Technical Report

Improving the Investment Climate in Emerging Nontraditional Coconut Products

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Preface

This report is the result of the technical assistance provided by the Economic Modernization through Efficient Reforms and Governance Enhancement (EMERGE) Activity, under contract with the CARANA Corporation, Nathan Associates, Inc., and The Peoples Group (TRG) to the United States for International Development, Manila, Philippines (USAID/Philippines) (Contract No. AFP-I-00-00-03-00020 Delivery Order 800). The EMERGE Activity is intended to contribute towards the Government of the Republic of the Philippines (GRP) Medium Term Philippine Development Plan (MTPDP) and USAID/Philippines' Strategic Objective 2, "Investment Climate Less Constrained by Corruption and Poor Governance." The purpose of the activity is to provide technical assistance to support economic policy reforms that will cause sustainable economic growth and enhance the competitiveness of the Philippine economy by augmenting the efforts of Philippine pro-reform partners and stakeholders.

This diagnostic study on emerging coconut products was prepared by a team composed of Simplicio Endaya; Study Team Leader; Pablito Villegas, Coconut Industry and Value Chain Specialist; Teresita Espino, Functional Food Products Specialist; Romulo Mesias, Industrial Products Specialist; and Ildefonso Tallada, Agricultural Products Specialist. They were assisted by their respective research assistants, namely: Lourdes Noveno, Elena Patambang, Ronnie Violanta, Arsenia Sapin, Jennifer Feliciano, and Gerard Feliciano. Final editing of the report was done by Ms. Sheila V. Siar.

On 21 April 2005, Board of Investments (BOI) Governor Consuelo S. Perez requested the EMERGE project to provide technical assistance to the BOI in the preparation of a diagnostic study on the investment climate of emerging nontraditional coconut-based products. The main objective was to identify the policy-related transaction costs and risks associated with investments in the industry and find out how these can be reduced in order to improve the investment climate. This approach is a departure from the traditional, costly investment promotion programs based on fiscal incentives.

The groups of coconut-based products identified in this diagnostic study (functional coconut food products – virgin coconut oil and its component by-products; industrial products – coconut shell charcoal and activated carbon, and cochin oil and coco methyl esther; and agro-industrial products – coir and coir products) have been named as emerging coconut products to distinguish them from the nontraditional product groups' classification.

The study team utilized the following methodologies and technical approaches in the conduct of this diagnostic study: review of literature; Porter's value chain analysis and clustering model; interviews and focus group discussions; field visits of projects and operations in emerging coconut products; study team coordination meetings and modeling of investments; and two consultative dialogues with stakeholders. The team is hopeful that through this diagnostic study on the emerging coconut products, the coconut industry will finally get the support it has long deserved for the benefit first and foremost of the small coconut farmers, many of whom are still mired in deep poverty.

The views expressed and opinions contained in this report are those of the authors and are not necessarily those of USAID, the GRP, EMERGE or the latter's parent organizations.

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CHAPTER 1

Improving the Investment Climate in Emerging Nontraditional Coconut-based Products: A Summary Report

Simplicio N. Endaya

Improving the Investment Climate in Emerging Nontraditional Coconut-based Products: A Summary Report

Simplicio N. Endaya

INTRODUCTION

The coconut industry is one of the important industries in the country, given the 25 million Filipinos, or one-third of the population, who are directly or indirectly dependent on the industry. This includes the 3.5 million coconut farmers (i.e., landowners, tenants, and hired workers) and their households. Over the years, these farmers have been producing mainly copra for a highly capital-intensive and specialized coconut oil industry that rendered uneconomical the use of 86% of the whole coconut for other high value added products demanded in different markets.

The diagnostic study on the emerging non-traditional coconut-based products examined the industry's investment climate. The main objective was to examine the policy-related transaction costs and risks associated with investments in the industry and find out how these can be reduced in order to improve the investment climate. This approach of improving the investment climate is a departure from the traditional, costly investment promotion programs based on fiscal incentives.

The study points out that the supply and value chain of the industry, from research and development, to sales and marketing, including its governance in terms of policies, support institutions, infrastructure, and allied industries, requires significant improvements to be able to attain the targets of the current six-year Medium Term Development Plan (MTDP) to increase growth, exports, and investments. In two consultative dialogues with the study team in February 2006 at the Board of Investments (BOI), the industry stakeholders agreed that no less than a concerted government-led effort is required to bring about these changes. Details of these dialogues are given in Annex A.

This summary report consolidates the findings of the five areas of the diagnostic study report, the details of which are contained in the succeeding chapters. Chapter 2 will discuss the economic contributions of the three emerging non-traditional coconut product groups, namely: (i) functional coconut food products (virgin coconut oil, protein isolate, skim milk, flour, feed concentrate, and coconut water); (ii) industrial coconut products (cochin oil and biodiesel; activated carbon and shell charcoal); and (iii) agricultural coconut products (coir, geotextile and coco peat).

Chapter 3 will examine the supply and value chain of the emerging coconut products, the bottlenecks and impediments to investments and industry growth, and policy recommendations to improve the investment climate.

Chapters 4, 5, and 6 will tackle each of the product groups by providing updates of the technologies and processes involved in the manufacture of the products; the economic production in stand-alone processing units; and the main issues in their respective supply and value chains. Each chapter was capped by recommendations to address the issues.

THE PHILIPPINE COCONUT INDUSTRY

The coconut industry, in the last 10 years, contributed a yearly average of 6% (almost PhP39 billion in 2004) to the gross value added in agriculture excluding fishery and forestry and about US$800 million in exports. These contributions come mostly from coconut oil (CNO) and dessicated coconut (DCN), both produced out of copra as feedstock.

Improvement of the industry's different value chain including provision of regulatory laws, incentives, infrastructure, business processes, and enforcement, had benefited mainly the millers and traders, but left out the many farmer suppliers of copra. Through the years, policies and incentives had favored the highly specialized, capital-intensive facilities for coconut oil production usually located far from the many smallholder feedstock suppliers. Cesar Villariba, administrator of the Philippine Coconut Authority (PCA) from 1971 to 1975, wrote that as early as the 1960s, the United Nations Food and Agriculture Organization (FAO) observed that the industry only benefited the traders and processors. At that time, the Board of Investment (BOI) was registering only large and specialized enterprises for fiscal incentives. Like other agencies of the government, the Board viewed coconut as a traditional sector under the turf of a specific agency, the Philippine Coconut Authority (PCA). Even the coconut levy, resorted to in recent years to raise funds to vertically integrate the industry and make the farmers active participants of the industry from production to the marketing of high-value coconut products, remained as an instrument of power wielders, millers, and traders, and, up to now, is still out of the reach of the coconut farmers, its intended beneficiaries.

As Chairman Oscar Santos of the Coconut Industry Reform Movement (COIR) noted, "there is some kind of system failure, with the Judiciary taking a long, long time resolving the country's biggest scam, the Executive unable to exercise enough political will to implement not just the intent and spirit but the very letter of the coco levy-related Presidential Decrees, and the Legislature failing to act on the measures brought before it to the end that justice is decisively done to the mandated beneficiaries."

With an average production of 750 kg of copra per hectare per year and the high transport cost from the farm to the mill, the smallholder supplier was forced to rely on the trader who could pay in advance, but in most cases, at a 30% discount, due to the poor quality of copra being produced because of the lack of drying facilities in the farm. This current scenario resulted in the uneconomical use of the rest of the coconut for other high-value products in the smallholders' areas of supply.

Given the disinterestedness of landlords and coconut landowners to invest for the further development of the industry, and the tension between the owners and the farmer

tenants in the sharing of the meager income, alternative methods of revenue generation like coconut tree logging has been resorted to by landowners and/or farmer tenants/workers. This was despite the law prohibiting the cutting of coconut trees without the approval of the PCA. Rather than wait for the PhP50 per tree payment of the Land Bank as mandated by the Comprehensive Agrarian Reform Program, or receive PhP10,000 per hectare per year income from copra, many have opted to cut their trees and sell them for quicker returns. With PhP500 per tree or PhP50,000 per hectare, the cutting of coconut trees has been viewed by many as a more practical alternative. This practice has become rampant throughout the country, with a rate of 2 million trees per year or about 20,000 hectares per year.

ESTIMATION OF THE POTENTIAL CONTRIBUTION OF INVESTMENTS IN EMERGING COCONUT PRODUCTS

Copra, as the PCA table of conversion for coconut would show, only accounts for 16% of the whole coconut and 53% of the fresh coconut meat. If only copra is produced, 84% of the whole coconut involving the shell, husks, and water parts are thrown away. In addition to this wasted 84%, 47% of the fresh coconut meat also dries up and disappear. Thus, only about 10% of the coconut is utilized when only copra is produced.

Some of the coconut parts, however, can be turned into high-value products. However, the production of these products remains in small quantities. For instance, the diagnostic study found that only 8% of the shell from coconuts turned into copra is recovered either in the form of charcoal or activated carbon, less than 1% of the husk is converted into coir and peat, and almost a negligible production of either vinegar or distilled water results from the use of the water of the coconut turned into copra.

The diagnostic study estimated the potential contribution of the investments in emerging coconut products by formulating a processing model on transforming the whole coconut into valuable products. Suited for small and medium enterprises (SME) for operation by farm households in the raw material sources, this model requires an input of only 5,000 whole coconuts a day. Basically, the idea of searching for technologies and using them to process the whole coconut right in the areas of production has long been proposed by the PCA. In 1974, then PCA Administrator Yniquez expressed support to this undertaking while Professors Banzon and Hagenmaier were among the early movers in technology development. The model proposed by this diagnostic study is a product of these efforts as well as the more than 30 years of research and industry experience of this study's specialists.

From the 5,000-nuts-per-day SME model, the diagnostic study developed a conversion table to include the emerging coconut products and supplement the current PCA table of conversion (Chapter 2, Endaya and Noveno). This conversion table on emerging coconut products includes the following: skim milk; protein isolate; virgin coconut oil (VCO); crude glycerine; coco methyl ester (CME); vinegar; distilled water; cochin oil; charcoal; activated carbon; coir; and peat. The table indicates that a whole coconut, in terms of weight, consists of 30% meat, 15% shell, 33% husk, and 22% water. The proportion of the emerging products from each of these parts are also identified.

The 5,000-nuts-per-day SME model shows that the whole coconut can be transformed into a number of different product lines for the functional foods market, cosmetics and feeds market, and industrial and agro-environmental markets. The types of product to be produced would vary depending on whether the meat portion would be turned into VCO, cochin oil, or CME, or into high-quality copra for the existing coconut oil mills. The production processes of the model will follow the patented Mesias' technologies on functional food production from fresh coconuts and activated carbon production from coconut shell, and Tallada's works on geotextile and organic plant media from coconut husks.

Based on the product flow of the 5,000-nuts-input-per-day model, at least nine products can be produced daily, as follows:

- 1,600 kilos of energy drink or skim milk, 360 liters of VCO, 350 kilos of protein isolate, 253 kilos of CME, and 32 kilos of glycerine from coconut meat;
- 130 kg of vinegar and 1,170 kilos of distilled water from coconut water;
- 117 kilos of activated carbon from coconut shell; and
- 1,000 sq. meters of geotextile and 200 bags of organic plant media from coconut husks.

The proposed 5,000-nuts-per-day processing model will require an investment of PhP20 million. The estimated returns include gross revenues of PhP52 million per year and employment for at least 200 people. In spite of the tax payment of 32%, the enterprise will still make a yearly net income of PhP9.6 million or an additional PhP6 per nut thereby increasing the value of coconut inputs by three times their current market price.

The total direct potential contributions of the model, in terms of income, employment, taxes, and alternative products from coconut can be estimated by multiplying the number of investments made by entrepreneurs all over the country. The indirect potential contributions involve the possible disposable income made available in the rural areas as derived from employment in the enterprise, the ancillary household industries resulting from the products in the model such as soap and aromatheraphy oils from VCO for the beauty market, the energy drinks from skim milk, the various cuisines from protein isolates that can be used as extenders of meat, and the geotextiles and organic plant media from coconut coir and peat production. The model also provides free heat for drying out of its activated carbon production, and village power for electricity requirements when the heat is made to turn steam turbines for power generation. The heat can also be used for pasteurization of skim milk, distilling of water, and drying of coconut fibers and peat on a 24/7 basis that need not be affected by the almost half year wet season weather. Agricultural, fishing, and seaweed villages can also make use of the free heat for their own production processes.

SUPPLY/VALUE CHAIN FRAMEWORK ON IMPROVING INVESTMENTS IN EMERGING COCONUT PRODUCTS

As indicated in the World Bank's Investment Climate Surveys of 719 surveyed firms in the Philippines in 2004 and the survey of the investment climate in the Philippines by the Asian Development Bank (ADB) in 2003, the Philippines did not perform well in the areas of starting a business with at least 11 procedures and 50 days to register particularly microenterprises and SMEs. It took an average of 380 days in enforcing a contract with at least 25 procedures. Constraints were noted in both the national and local governance particularly in the areas of macroeconomic instability (41%); corruption (34%); high cost and outages of electricity (33%); excessive tax rates (32%); uncertainties in economic policies (29%); and high incidence of crime, theft and civil disorder as well as poor tax administration (26%).

The diagnostic study indicates that the investment climate and business environment in emerging coconut-based industries is generally weak particularly in the areas of costly labor, power, interest and financial charges, tax rates, transport and handling charges, and registration and regulatory fees (Chapter 3, Villegas). The transaction and hidden costs of business registration and regulatory compliance jack up the cost of doing business. The investment climate is also constrained by policy uncertainties, graft and corruption, poor infrastructure (roads, ports, power), and law and order cum insurgency and terrorism problems in major coconut-producing areas.

The huge domestic and global markets still remain untapped. Market access opportunities and competitiveness potentials of the emerging coconut products exist in its health, wellness, beauty and nutrition; functional food; industrial and agricultural/environmental uses and versatile applications. The market and sales component of the value chain requires a stronger link with product development and logistics and distribution chain. The same is true with the supplier and services providing industries for raw material production, primary processing, and secondary/tertiary manufacturing subsectors. The support services from national and local government units, research and development and education/extension (training) and regulatory institutions, private sector professional and trade organizations, and financing institutions have to be liberated from technical and economic inefficiency, regulatory "capture," and economic rent-seeking behavior.

The overall SWOT (strengths, weaknesses, opportunities, threats) analysis showed a weak value chain that is still very vulnerable to uncertainties in macroeconomic fundamentals and external shocks (Chapter 3, Villegas). The connectivity and linkages between and among these component parts of the potentially potent coconut-based agro-industrial cluster are also very fragile. There are some strong components like few well-managed benchmark plantations (2-3 tons per hectare copra yield) and few Agrarian Reform Communities that received technical assistance from the Department of Agrarian Reform (DAR) and the Philippine Coconut Authority (PCA) as well as donor institutions. Product development appeared to be strong with globally competitive technological advances in VCO

and its component functional food products, biodiesel, geotextile, and rubberized coir breakthroughs, to mention a few.

The existence of an unhealthy investment climate in the coconut-based industries and the pervasive weaknesses and bottlenecks in the supply and value added chain consequently result in the prevalence of pervasive poverty and food insecurity in the coconut-producing areas where socioeconomic community welfare and peace and order condition continue to worsen.

Impediments to Investment and Industry Growth

The industry stakeholders need first to shed off their sectoral and traditional paradigm that has governed the industry for so long and spawned a structure that concentrated the benefits to a few and rendered the full recovery of the coconut uneconomical. Aside from changing this sectoral orientation that placed the coconut as a traditional crop/export similar to the treatment of logs and sugar exports, the government should consider emerging coconut products as a priority revenue stream in meeting the growth, export, and investment targets of the MTDP. Declaring them as a priority industry will provide the needed focus to set industry direction and execute institutional strengthening.

At present, the industry structure does not complement the needs of smallholder farm sources, with the current supply and value chain keeping the benefits out of the reach of a third of the Philippine population. The government (as well as international development institutions) tried to help the coconut farmers through the imposition of the coconut levy funds in 1973, in terms of price support and assistance to coconut farmers. But since then, the coconut farmers have yet to benefit from these funds as the courts still have not resolved the pending cases of ownership. A number of coconut farmers seeking their use have already died and yet the government has not yet determined the ownership of these coconut levy funds, which total no less than PhP55 billion based on current valuations of the San Miguel Corporation stock shares to which these funds were invested by coconut levy-created institutions. A compromise agreement between the government and the private claimants is under consideration by the present administration amid objections of concerned groups to the apparent graft and corruption.

The stability of coconut supply is threatened by the inability of the PCA to revive the 30% senile and nutrient-deficient coconut plantations in the country due to low budget for replanting and/or fertilization. The agrarian reform law, though still to be fully implemented, also instills uncertainty for further investments in coconut plantations. The restrictions on use and disposal of lands under the agrarian reform as well as the economics of current income and productivity of the plantations lead many farmers/landowners to cut the trees and sell them for higher and quicker returns. Cutting the trees provides an income of PhP500 per tree, 10 times the amount to be paid by the government in terms of bonds issued for land reform, or PhP50,000 per hectare compared to selling the land at a maximum price of PhP1,000 per hectare and PhP5,000 for the coconut trees.

Research and development (R&D) constraints

The constraints include the low budget of the PCA for R&D, the removal of industrial/commercial R&D from the PCA, the limited government incentive on the commercialization of R&D and utilization of mature technologies, and the uncoordinated, underfunded, and sectoral focus of R&D support institutions. Overall, the Philippines spends only one-fifth of 1% of its gross domestic product for R&D. The budget for coconut research is only 28% of the funding for sugarcane and even much lower than the budget for carabao research. Unless priority is given to support coconut R&D institutions ("the value-added shifter of the industry"), the comparative advantage of availability of raw materials for production of emerging coconut products cannot be turned into a competitive advantage for the industry.

A more deliberate direction in programs for R&D support institutions should be part of the roadmap for managing the industry. In this connection, there is a need for collaboration between the government and industry stakeholders—academe, scientists, private sector, and nongovernment organizations.

The production of functional food products from coconut is also constrained by the limited and unfocused R&D and extension on the health and nutritional aspects of coconut meat and water. For instance, while VCO has been found to be effective in fighting disease-causing lipid-coated organisms and in preventing coronary heart ailment, further clinical tests still have to be conducted to acquire food and drug agencies' acceptance and certification as a pharmaceutical product.

In addition, there is no specific R&D that will differentiate VCO from coconut oil (CNO), which is refined, bleached, and deodorized (RBD), and derived from copra. Unscrupulous products from RBD oils are also oftentimes passed as VCO. The shelf life study for VCO is still unfinished. In skim milk, the current R&D is inadequate for its large-scale utilization.

With the successes of India and Sri Lanka in exporting more than US$400 million per year of coir and peat products as a benchmark, the country's lack of an R&D institute that is focused on the development of coir and coir products is a significant constraint to investments.

If technologies are present, their usefulness is impeded by poor dissemination or the lack of it. In the consultative dialogues, the stakeholders stressed the lack of dissemination of technical findings that are just gathering dust in the shelves of government agencies. Homegrown technologies developed by private individuals and institutions actually abound but are not well disseminated and promoted due to lack of government support.

An example is the patented Filchar Manufacturing Corporation's activated carbon machine (called "carbo-activator"). With this machine, high-quality activated carbon can now be produced at much lower production and investment cost. Also available but not well disseminated is the technology for producing high-quality yet cheap cochin oil from fresh,

mature coconut processed within 24 hours. The processing cost with this technology is lower compared with the present method.

Other R&D constraints to investment include the problems of unsecured intellectual property rights and cases of R&D breakthroughs being stolen and commercialized by competitor countries as in the case of nata de coco and skim milk from coconut.

Product development constraints

Greater emphasis is given to coconut oil that has a lower value in the world market while very limited attention is provided to emerging coconut products. Product development and commercialization of technologies on emerging coconut products lack funding and techno-managerial support especially to private sector is nil.

In the market for functional food products, the government has already created the draft standards for VCO. The industry was given six months to comply with these standards. In a recent senate hearing, however, the Department of Science and Technology (DOST) and the Center for International Trade Expositions and Missions (CITEM) told the industry to disregard these standards and instead follow the Codex Alimentarius standards for VCO.

Basic product standards also need to be formulated for other functional food products such as skim milk and protein isolate from coconut milk, and flour from coconut meal. Another critical issue is the harmonization of the basic national product standards with international standards and processes such as the Codex Alimentarius, International Standards Organization (ISO), Good Manufacturing Practice (GMP), and Hazard Analysis and Critical Control Point (HACCP).

In addition, clinical studies on the efficacy of VCO as cure for specific human diseases need to be made to facilitate product development. The presence of low-quality VCO products and RBD oils passed as VCO in the market should be addressed. Regulatory agencies such as the Bureau of Food and Drugs (BFAD), Food Development Center (FDC), and the PCA lack the technology to detect low-quality and counterfeit products. The eroding public trust in government institutions involved in protecting the product development of emerging coconut products is another drawback.

Coconut meal/flour is still generally unacceptable to feed and food processors. Coconut water products like vinegar and *lambanog* have been found to have wide variations in quality vis-à-vis existing product standards.

At present, product test laboratories are concentrated in urban centers. These test laboratories should be accessible to ease product development. The testing fees are also unaffordable to SMEs. Directives of government entities on the fees to be paid and on the use of facilities deter the pursuit of product development by prospective producers. Prospective producers should also be assisted to learn from technologies and best practices of other countries.

Manufacturing constraints

The emerging coconut products have to compete with the existing copra production for the regular supply of high-quality mature nuts. Transport taxes, value added tax (VAT) on the finished products, and other government fees add to the increasing cost of fuel and other utilities required in manufacturing. The profitability of manufacturing is affected by the higher rates of VAT, corporate income taxes, and LGU levies. The application of the minimum wage law in the villages brings up the labor cost to the level of manufacturing in urban areas.

High investment cost for by-products on a stand-alone basis exists on such products as coconut flour and skim milk, and coconut water products. Access to equity and loan financing including grants for SMEs is limited. Development loans sourced from official development assistance (ODA) are passed on at a little less than the commercial rate but still far above the interest charged by ODA sources. Financing particularly by government banks are still based on collateral.

There is limited implementation of the Barangay Microbusiness Enterprise Act (Republic Act No. 9178) for emerging coconut products. The one-stop shops for registering SMEs in local government units (LGUs), Department of Trade and Industry (DTI), Securities and Exchange Commission (SEC), and PCA are not functional.

Additionally, the processes and equipment for economical processing of the whole coconut are lacking. Drying and heating facilities for production are absent in the farms. Introduction of machines in the farms is almost negligible. Machinery and equipment fabrication and supplier industries are weak. Adoption of mature/ commercial processing technologies remain slow.

There are no known incentives for setting up SMEs in the farms to be operated by the farm households. As early as the 1970s, the PCA already expressed support to the development of technologies that can bring the production process right in the farms. Unfortunately, the other arms of the government, in collaboration with the private sector, had been successful in rallying for continued incentives for the capital-intensive oil mills despite of the lack of the necessary raw materials to support an economical operation. More than 5 million metric tons (MT) in copra input capacity for these mills were approved to be set up with only less than half of their input requirement capable to be supplied by the more than 3 million hectares of coconut plantations in the country. This resulted in the current condition of lack of raw materials for most of these mills as they were also established far from the coconut sources. One is led to surmise that the business objective of those who pursued the setting up of these oil mills was only to secure profits from the overvaluation of equipment in the pre-operation stage of setting up with financial incentives.

The government should build the capacity of farmer groups to manage enterprises. The standardization of SME operations and the preparation of a manual of operations are important prerequisites for the prospective enterprises.

Logistics and distribution constraints

A major obstacle to investments is the limited and poor state of logistics (storage and distribution), roads, ports, and transport infrastructure resulting in uncompetitive transport, storage, and handling costs. Farm-to-market roads remain a problem in many areas resulting in high transport cost. There is no effective linkage between the coconut industry and the supplier and logistics services industries. Consolidation under standardized and varying quality of emerging coconut products is very difficult.

There is weak and underdeveloped distribution chain for both the domestic and foreign market. The roll-on roll-off combined trucking and shipping services are not fully utilized. Existing rail networks need improvement to service not only passengers but also cargoes.

During the consultative dialogues, at least 8 industry associations in the transport and distribution sector indicated the prevalence of corruption, extortion, and abuse that inflates the cost of doing business and brings about unprofitable operations. The market for logistics and transport infrastructure and services is highly protected and monopolized. The Distribution Industry Management Association of the Philippines brought forward the three Cs existing in transport and handling services: corruption, cartel, and capture of regulatory agencies by interest groups. In their evaluation of the logistics and transaction costs in sea and land transport, they concluded that a cartel is present. Hence, while cost of transport logistics is 8% of the total cost in some countries such as the United States, it is 30% in the Philippines.

Cargo handling is controlled by Asia Terminal Inc. and the International Container Terminal Services, Inc.; the Philippine Ports Authority (PPA) allows this cartel to prevail. A 10% rate for arrastre and cargo handling is collected by the PPA (PDA 57, Marcos time). The Maritime Industry Authority (MARINA) also allows the rates to be dictated by shipping line companies. The smooth operation of cargo vessels is also impeded by the maze of LGU ordinances on towing fees, fines, *tongs*, and penalties. The stakeholders are aware of the cabotage law and the need for its amendment to open up the shipping industry to competition. The Philippines has no antitrust law.

Sales and marketing constraints

There is limited market development and promotion of the different emerging coconut products. The marketing support provided by the commercial and agricultural attaches is limited by the wide span of problems brought to their attention by the government and the lack of support staff in their respective jurisdictional assignments.

There is inadequate supply of trained marketing and sales promotion personnel for dealing with the domestic and export markets. Product information is limited and oftentimes asymmetric. Statistics and R&D materials are lacking. As verbalized by the Coir Board of India, coir geotextiles do not have prescribed, internationally accepted standards. As such, end users are hesitant to accept the product as standard material for soil bioengineering

applications. This spells the need for marketing and promotion to increase product acceptability.

Concerted private sector support needs to be organized and funded so that the required marketing initiatives for the target market of each emerging coconut product can be acted upon. VCO, for example, is a relatively new product for which no historical list of buyers exists. Except for activated carbon, there are no traditional importers for emerging coconut products. In some cases like for geotextiles and organic plant media, protocols in the marketplace need to be established. Also, due to lack of information, potential customers are sometimes hesitant to try them out for fear that their use may introduce unidentifiable bacteria or result in soil contamination. Emission standards also have to be known for coco peat briquettes to determine if these can be used for cooking or for nonfood purposes.

The anticoconut oil propaganda remains prevalent in the markets. Discriminatory tariff and nontariff barriers are imposed by importing countries to protect their local industries. Customs and trade regulations are still major constraints in the conduct of business.

Another impediment is the high rate of rejection of coconut product exports. There is laxity in the enforcement of product quality standards and weeding out of counterfeit products in the market. A repetition of the "nata de coco" fiasco is deemed inevitable given the liberalized trade mandate under Executive Order 1016 (Withdrawing the Inspection, Commodity and Export Clearance Requirements on Philippine Exports) and the enforcement of product standards and nonscreening of counterfeit products.

INDUSTRY AND INVESTMENT POTENTIALS

The world demand for VCO is increasing due to its high lauric acid content and newfound applications in the cosmetic and nutraceutical industries. Out of only two foreign destinations in 2001 and 2002, the product is now being exported and gaining foothold in 16 foreign markets. The increasing popularity and demand for VCO was further dramatized by international experts like Prof. Jon Kabara, Dr. Bruce Fife, and Dr. Mary Enig who underscored its applications in pharmaceuticals, nutraceuticals, and cosmetics. The availability of information on the natural benefits and applications of VCO in the Internet has somehow countered the negative propaganda that all saturated fats are bad for the health. VCO is a saturated fat made up primarily of medium-chain triglyceride compared to other types of vegetable oils that are made up of long-chain fatty acids. Among the vegetable oils, coconut oil contains the least cholesterol. Because VCO is made from fresh coconut through natural process, without the use of chemicals, additives, or preservatives, it is called "virgin" due to its raw, pure, pristine, and unadulterated state. It thus earned for VCO the image as "healthiest oil in the world." As a functional food, VCO has been found to lower viral counts in HIV/AIDs patients and can also be used to reduce weight. Clinical studies have also established that it is effective for skin diseases (e.g., psoriasis, bed sore, acne) due to its antimicrobial and cleansing properties. This diagnostic study's expert on functional food also reported that the new set of rules by the US Food and Drug Administration on transfat

labeling for all manufactured goods sold in the US starting 2006 will likely have a positive effect on the demand for VCO as it has no transfatty acid unlike other vegetable oils.

Also gaining popularity in the world market is coir with its nontraditional applications. The demand behavior is pushed by the eco-friendly characteristic of the product. Many end users are beginning to realize the painful rewards of patronizing synthetic materials and their dangers to human and animal health. For instance, the automotive and upholstery industries have begun to recognize the environmental advantages of rubberized, molded coir products. New uses of coir as reinforcing material in composite products such as fiber boards and insulation boards have likewise come up.

A component product of coir production, coir dust is also finding sizeable markets in Europe and Canada. Commercial interest in its horticultural uses as substitute for peat moss was largely triggered by the "greening movements" that originated from these countries. The bulk of coco peat exports came from Sri Lanka; exports received by Korea and Japan were supplied by neighboring countries like the Philippines.

Meeting the desertification problems in Saudi Arabia and China would require volumes of erosion control nets or geotextile. With modern developments where population sites expand, subdivision areas are built as well as main highways, secondary road laterals, building constructions, river flood control projects, and other land developments such as parks and recreation areas, and golf courses; all these tremendous activities include natural ground terrain alterations that predispose huge areas to soil erosion. These areas can be found in China, Saudi Arabia, and other petroleum-rich countries. In Israel, coir nets go hand in hand with coco peat materials in desert greening. In China, the "live" dessert has moved toward cities, provinces, agricultural areas, and livestock pasture areas, at the rate of 2,460 sq. km. This is in addition to the existing affected areas of 2,622,000 sq. km or about 27.3% of the total territory of China. In Korea and Japan, high priorities are given to landscaping of public areas and highway sides that run thousands of kilometers. High demand for erosion control materials including organic plant media (coco peat) is also foreseen to grow each year. In Europe, Canada, and USA, there are demands for bristle fibers and coco peat.

Further still, the global coir industry could be facing international opportunity under the Clean Development Mechanism (CDM) of the Kyoto Protocol. Industrial countries that are heavy users of carbon dioxide (CO_2) -releasing operations agreed under the protocol to enter into emission trading with developing nations to meet their national commitment. The European Union and Japan, for example, committed to reduce 40 million tons of CO_2 emissions by 2010. Based on studies, the current market value for each ton of CO_2 reduced by the CDM project is worth US$5. Burning of coconut husks releases methane; projects preventing these releases could be qualified under the CDM.

The international concern for the environment increases the need for activated carbon. Activated carbon, manufactured from coconut shell, is considered superior to those that are typically obtained from other sources mainly because of its small macro pore structure that makes it more effective for absorbing gas/vapor and removing the color and odor of compounds. The market for coconut shell-activated carbon includes the gas mask

manufacturers, and the sugar, potable water, gas/vapor recovery, petroleum, and pharmaceutical industries. The biggest users of granular activated carbon are the gas absorption companies, water treatment companies, industrial chemical companies, and solvent recovery companies. The market for coconut shell charcoal is expected to increase as the use of the coconut shell-activated carbon increases. This is expected with the intensification of air and water pollution problems in industrialized countries.

A major local producer of activated carbon has launched a "big brother" program for shell charcoal to be delivered to their plant. There is a potential for the setting up of charcoal plants to utilize the excess 1,685,436 MT of coconut shells per year. A technology invented by Engineer Mesias is available for the production of coconut shell charcoal and coconut-shell activated carbon.

The recent tsunami in major coconut areas of Indonesia and Sri Lanka spell a three-year opportunity for transforming the coconut shell from the Philippines either into shell charcoal or activated carbon to fill up the void in supply resulting from the stoppage of operation of the tsunami-affected firms in Indonesia and Sri Lanka.

The market for cochin oil includes the manufacturers of cooking oil who further process it through refining, bleaching, and deodorizing (RBD) to fit the specifications of edible cooking oil. Its other users are the oleo chemical industries that produce fatty acids and fatty alcohols, and the cosmetic, soap, detergent, resin, plasticizer, and fuel industries. An efficient and profitable process using fresh nut will produce high-quality crude coconut oil without aflatoxin and nitrites that are carcinogenic. The process for producing cochin oil, including the equipment, has already been developed by Filchar Manufacturing Corporation.

Locally, the market of CME will be the various gasoline refineries of petroleum diesel. A bill is currently in the legislative branch of the government mandating the use of CME at a minimum of 1% blend by volume into all diesel engine fuels sold in the local market. A total of 2% blend by volume will be required within the two years from the effectivity of the law, which is expected to be passed soon. At 2%, the Philippines will need 140,000 MT of CME per year. But the bigger market of CME will be export. Most countries that require a higher percentage of CME in addition to their petroleum diesel, like Japan and the European countries, require at least 5% blend.

POLICY RECOMMENDATIONS AND ACTION PLAN

The recommendations are summarized in an Action Plan in Table 1.1. The table shows the list of recommendations for the main issues/constraints to investments identified in the study, the stakeholders that should take action, the lead agency, the target dates, and the needed resources.

A proposed action for consideration of the BOI is to designate emerging coconut products as a priority revenue stream for export and investment. As a priority undertaking, a NEDA Board resolution shall formalize the interagency setup of a business development

team with BOI as secretariat under the export development council. The business development team shall be composed of the industry stakeholders including representatives of farmer groups.

This diagnostic study recommends that the business development team take immediate action on the following.

1. Formulate a roadmap to guide the industry in tandem with the conduct of regional and national stakeholders summits to improve the investment climate in emerging coconut products and to call on national and local government units to act on the impediments to investments and reduce policy-related and transaction costs risks of doing business on emerging coconut products, as well seek recommendations on the use of the coconut levy funds if and when released.

2. Conduct investment forums to introduce available technologies, secure investments for SMEs, and provide assistance to farmer groups in setting up SMEs.

3. Create, through the Tariff Commission, in coordination with the Department of Finance, the tariff/product classifications of emerging coconut products for identification and differentiation.

4. Enforce, through the LGUs, Philippine National Police (PNP), and PCA, the law that prohibits the cutting of coconut trees (RA 8048, 1995)

5. Formulate and enforce, through PCA, BFAD, and FDC, the product standards for all emerging coconut products.

The business development team should also consider the following recommendations for immediate implementation:

1. Strengthen the PCA and build institutions for emerging coconut products
   - Build the capacity of farmer groups to operate enterprises for emerging coconut products
   - Draw up manpower development/training plan for industry marketing and sales
   - Review the Agricultural Rural Credit and Cooperative Farmer's Association law to include training programs on agricultural mechanization and equipment
   - Recommend representation of farmers and other stakeholders in the PCA Board
   - Encourage public and private investment in emerging coconut products R&D
   - Formulate capacity building program for R&D support institutions

2. Consolidate plans and programs for the coconut industry
   - Modernize the Philippine National Railway cargo train operation
   - Build farm-to-market roads in areas with coconut plantations
   - Review idle/foreclosed oil mill plants and study to dismantle them for distribution in 25 MT per day in areas all over the country that are planted to coconut

- Review the plan and implement a coconut-based Commodity Futures Exchange
- Monitor market developments and international negotiations

3. Assist SMEs in project preparation, marketing, and fund sourcing
   - Formulate/implement an export promotion program including the packaging of emerging coconut products
   - Study the opportunity of emission trading for husks and coco shell projects as per Kyoto Protocol

4. Through the stakeholders, monitor and act on the developments in Congress of proposed bills affecting the industry of emerging coconut products
   - Amend the cabotage law
   - Use CME for diesel-powered engines
   - Enact an antitrust law

Table 1.1 Improving the Investment Climate: Stakeholder's Action Plan 2006-2010

Issues/Areas of Concern	Proposed Actions	Stakeholders	Lead	Target Date	Resources Required
I. Declare emerging coconut products as priority					
A. Need for industry directions	1. Organize business development team under the umbrella of the Export Development Council	All industry	DTI	Immediately	NEDA Board proclamation and memorandum creating Business Development Team
	2. Formulation of road map for the emerging coconut industry	All industry	Development team	As soon as organized	Strategic plans of PCA, DOST TA Study
B. Institutional strengthening and capacity building	3. Strengthen PCA and build institutions for emerging products - e.g., coconut coir board	all industry	Development team	Within the year	Organizational study and assessment, Budget
	4. Recommend representation of farmers and other stakeholders in the PCA Board	All industry	Development team	As soon as possible	Organizational study and assessment
	5. Link government programs with PCA Agribusiness Centers and rationalize roles of support institutions	All industry	Development team	Immediately	PCA Agribusiness Center Program, Budget
II. Stability of supply of coconut					
A. Low PCA budget for replanting and fertilization	1. Fund PCA Program for planting/replanting and fertilization/intercropping	All industry	PCA/DBM	Every quarter	Budget of PhP1 billion yearly up to 2010

Issues/Areas of Concern	Proposed Actions	Stakeholders	Lead	Target Date	Resources Required
B. Senile trees and nutrient-deficient plantations (30% of total coconut areas)	2. Disseminate Department of Environment and Natural Resources (DENR) circular of November 2005 allowing coconut as a reforestation crop for government and idle lands	NGOs, LGUs, support institutions	DENR/PCA/DTI	Immediately	Investment forums, public information
C. Uncertainty in land ownership and tenure	3. Promote joint venture on planting in idle government lands	landowners, farmers	DENR, CIIF, private owners	Immediately	Management scheme by CIIF
D. Restrictions on land access/disposal under agrarian reform	4. Replant areas equivalent to input requirement of mills	millers, CIIF, farmers	Millers	Immediately	Mandate from PCA to millers
E. Indiscriminate logging of productive coconut trees for lumber and conversion of coconut land to other uses	5. Enforce RA 8048 of 1995 on coconut tree cutting regulation	All industry	PNP, LGUs	Immediately	Directive from DILG
F. Low productivity and income in coconut plantations (70% not intercropped)					
III. Use of the coconut levy for the farmers					
A. Unutilized coconut levy funds due to ownership claims/litigations	1. Monitor resolution of ownership of coconut levy	all industry	PCA, PCGG	Immediately	Court proceedings
	2. Recommend allocation on the use of the coconut levy	all industry	Development team	Immediately	Road map, investment plans

Issues/Areas of Concern	Proposed Actions	Stakeholders	Lead	Target Date	Resources Required
IV. R&D constraints to investments					
A. Low PCA budget for R&D	1. Formulate program for R&D support institutions	DOST, PCA	Development team	As soon as possible	Organizational study
B. Removal of industrial/commercial R&D from PCA	2. Fund R&D of support institutions	all industry	DOST, PCA,DBM, universities	As soon as possible	Organizational study
C. Limited government incentive on the commercialization R&D utilization of mature technologies	3. Share in royalty payments for contributing scientists	Universities, research institutions	Universities, research institutions	As soon as possible	Research institutions' policy directive
D. Uncoordinated and underfunded RD&E and sectoral focus of R&D support institutions					
E. Need for joint government-academe-industry-NGO private sector collaborative RD&E initiative	4. Launch convention or summit for the collaborative efforts (by region and then a national one involving all regions)	all industry	Development team	As soon as possible	Checklist of RD&E directions
	5. Draw program to allow access to R& D resources	All industry	PCA, DOST	Immediately	R&D resources
	6. Draw up program for consultations and extensions	All industry	PCA, DOST	Immediately	R&D resources
	7. Develop holistic and business-oriented technology transfer	all industry	R&D Institutions	Immediately	R&D resources

Issues/Areas of Concern	Proposed Actions	Stakeholders	Lead	Target Date	Resources Required
	8. Increase support for improving the technology for the conversion of VCO production wastes into high-value products	All industry	R&D Institutions, DBM	Immediately	R&D resources
F. Unsecured intellectual property rights (IPR) G. R&D breakthroughs being stolen and commercialized by competitor countries (e.g., nata de coco, coco milk etc)	9. Review and improve program on IPR	All industry	DTI	Immediately	IPR resources
H. Lack of R&D institute focused on coir and coir products	10. Conduct and broadcast relevant research and development for coir and coir products	All industry	DOST	Immediately	R&D studies
	11. Broadcast full utilization methodologies for coco coir dust or coco peat-based organic fertilizers	All industry	UPLB and other agricultural universities and colleges	Immediately	R&D studies
	12. Briquetting and charcoal production from coco peat materials	All industry	UPLB FPRDI	Immediately	R&D studies
	13. Use of geotextile and other coir materials to reinforce/strengthen mining canals, tunnels, and other discharge arteries	All industry	Bureau of Mines	Immediately	R&D studies
	14. Use of geotextile in fortifying fishpond levies and canal systems	All industry	BFAR	Immediately	R&D studies

Issues/Areas of Concern	Proposed Actions	Stakeholders	Lead	Target Date	Resources Required
	15. Use of geotextile in water impounding projects	All industry	Bureau of Soils and Water Management	Immediately	R&D studies
	16. Use of geotextile and other coir products in soil erosion problems in watershed and other reforestation areas	All industry	DENR	Immediately	R&D studies
I. Limited/unfocused R&D&E on health and nutrition aspects	17. R&D for improving current VCO production technology not only in terms of higher oil recovery but also in terms of finetuning the process to produce better quality products	R&D institutions	DOST, universities	Immediately	R&D studies
J. Virgin coconut oil (VCO) product development as cure for AIDS, SARS, and birdflu require clinical testings	18. Conduct of clinical trials of testimonials and actual cures resulting from VCO use	DOH, NGOs promoting alternative medicines	PGH	Immediately	Cases of cures resulting from VCO use
V. Product development constraints to investments					
A. Overemphasis on the low-valued coconut oil	1. Develop high value-added products needed by markets	All industry	DTI, PCA, DOST	Immediately	Product researches, standards
B. Inadequate technical and financial support to private sector-led product development and commercialization R&D	2. Provide guidance and testings for derivative food products from recovery products of VCO	All industry	DOST FNRI	Immediately	Nutrition deficiency guides, food product formulations

Issues/Areas of Concern	Proposed Actions	Stakeholders	Lead	Target Date	Resources Required
C. Lack of funding and techno-managerial support for new product development	3. Source development funds for commercialization of new technologies	Financial institutions	NGOs, private sector, TLRC	Immediately	Technology banks
D. Limited commercialization of emerging products					
E. Harmonization of product standards with HACCP, GMP, and Codex	4. Review standards and harmonize with international standards	All industry	DOST, PCA, BFAD	Immeditately	Existing standards
F. Absence of technology to detect counterfeit products	5. Source technology and funds for instruments 6. Develop product standards for emerging coconut products (skim milk, protein isolates, other functional food products)	PCA, BFAD, FDC All industry	BFAD BFAD, PCA, FDC	Immediately Immediately	RFP from suppliers Existing product standards
G. Eroding public trust and credibility of government institutions (DA/PCA, PCGG, IPO, DTI, DILG, PNP) H. Concentration of product tests laboratories in urban centers I. Access to finished results and proven best practices and commercialized products from other countries	7. Formulate and implement program with associations 8.Encourage schools/educational institutions with laboratories to offer testing services to industry processors	DOST, universities, research institutions DOST, universities, research institutions	DOST, NGOs Schools	Immediately Immediately	Research on program of other countries CHED, DepEd's roster of schools with laboratories

Issues/Areas of Concern	Proposed Actions	Stakeholders	Lead	Target Date	Resources Required
J. Testing fees unaffordable to SMEs	9. Review fee structure and terms of payment and consider allowing payment after completion of project sale	PCA, DOST, BFAD, research institutions	PCA, DOST, BFAD, research institutions	Immediately	Table of fees for product testing of PCA, DOST, BFAD and others
VI. Manufacturing constraints to investments					
A. Centralized capital-intensive imported technologies with big plant capacities	1. Review idle/foreclosed plants and study to dismantle them for distribution in 25 mt per day in the 2,000 islands of the country producing coconuts	CIIF, Land Bank, DBP, UCPB	Business development team	Immediately	Records of idle/foreclosed plants
B. Processing plants' locations far from coconut sources	2. Dissemination of information on available local technologies producing emerging coconut products which, at the same time, provide heat to dry copra and other farm products and also give off steam for other processes	DOST,PCA, DTI, research institutes, LGUs	Business development team	Immediately	Investment folios of the new technologies, technology banks
C. Lack of process and equipment for economical processing	3. Introduce technologies for small and medium social enterprises for CIIF and other operating oil mills	CIIF, private sector, LGUs	Business development team	Immediately	Available technologies for copra suppliers
D. Drying and heat for production lacking in farms	4. Establish small and medium social enterprises directed to functional foods and agri-environmental/industrial markets in plantation areas	Farmers, NGOs, Coops, Companies	AgriBiz centers	Immediately	Available technologies for copra suppliers

Issues/Areas of Concern	Proposed Actions	Stakeholders	Lead	Target Date	Required Resources
E. Slow adoption of mature and commercially viable processing technologies	5. "Big brother" arrangement between farmers and existing plants	CIIF, private sector, LGUs	Private sector proponents	Immediately	Oleochemical plants, activated carbon plants, CME distributors, oil mills
	6. Funding and implementation of the PCA Agribusiness Program	All industry	PCA/Land Bank/Coops/LGUs	Immediately	Farmers financing scheme
	7. Introduction of technologies to agrarian reform communities	DAR PCA, DOST	DAR, PCA, DOST, private sector	Immediately	Available technologies
F. Need to standardize micro/small/medium enterprises production	8. Formulate/implement program for integrators and consolidators	All industry	DT, PCA, private sector	Immediately	PCA Agribusiness Program implementation
G. Need to consolidate micro/small/medium enterprises production	9. Capacity building for farmer groups to operate enterprises	All industry	Business development team	Immediately	Training, seminars, conferences
H. Limited access to equity and loan finance including SME grants	10. Technical assistance in SME project preparation and marketing	PCA, DTI, DOST, proponents	Business development team	Immediately	Investment folios
I. Unaffordable capital investments for small entrepreneurs	11. Financing for consolidators	All industry	LandBank, CIIF, DBP	Immediately	Loan programs
J. Limited implementation of Barangay Microbusiness Enterprise Act on emerging coconut products business					

Issues/Areas of Concern	Proposed Actions	Stakeholders	Lead	Target Date	Required Resources
K. Nonfunctional one-stop shop at the LGU, DTI/SEC, and PCA levels for registering SMEs					
L. Negligible introduction of machines in the farms	12. Review Agricultural Credit Cooperative Financing Administration (ACCFA) law to include training programs on mechanization and equipment use	PCA, DOST	Business development team	Immediately	ACCFA law
M. Weak machinery and equipment fabrication and supplier industries	13. Continuous development of machines for coir extraction	MIRDC	MIRDC	Immediately	Machines developed
N. Higher rates of EVAT, corporate income taxes, and LGU levies					
O. High cost of labor due to mandated minimum wage					
VII. Logistics and distribution constraints to investments					
A. Limited logistics, transport, storage, and distribution infrastructure	1. Consolidate plans and programs for infrastructure development for the coconut industry	DPWH/DOTC/ LGUs	Business development team	Immediately	Transport master plans
B. Poor state of logistics, roads, ports and transport infrastructure that result in uncompetitive transport, storage, and handling costs	2. Philippine National Railways (PNR) operations as cargo train	All industry, DOTC/PNR	Business development team	Immediately	Study on using PNR for cargoes

Issues/Areas of Concern	Proposed Actions	Stakeholders	Lead	Target Date	Required Resources
C. Lack of effective linkage with supporting supplier and logistics services providing industries					
D. Severe difficulty in consolidating understandardized and quality-varying produce of SMEs E. Weak and underdeveloped distribution chain for both homegrown and export market					
F. Underutilized combined “roll-on-roll-off" trucking and shipping services G. Highly regulated, abused, and extorted trucking and hauling business resulting in high cost of doing business and unprofitable operation H. Protected and monopolized market for logistics and transport infrastructure and services	3. Amendment of the cabotage law 4. Advocate enactment of an antitrust law	All industry All industry	Business development team Business development team	Immediately Immediately	Cabotage law Other countries’ antitrust laws
I. Maze of LGU ordinances (towing fees, fines, tongs, penalties) and regulations (truck ban, color coding, anti-overloading regulations) that impede the smooth operation of cargo vessels	5. SME summit with concerned agencies to work on solutions	All industry	Business development team	As soon as possible	Position paper of association

Issues/Areas of Concern	Proposed Actions	Stakeholders	Lead	Target Date	Required Resources
J. Prevalence of corruption and extortion as alleged by at least 8 industry associations in the transport and distribution sector					
VIII. Sale and marketing constraints to investments					
A. Limited market development and promotion	1. Formulate/implement export promotion program including packaging of products	All industry	Business development team	Immediately	Market/product studies in target markets
B. Lack of sustained commercial attaché marketing support	2. Orient and train commercial attaches	DTI, PCA, DOST	DTI	Immediately	Private sector and farm operation visits
C. Limited and asymmetric information on products	3. Mobilize commercial attaches to obtain forward contracts to supply geotextile/organic plant media to China, Korea, and Japan	DTI, PCA, DOST	DTI	Immediately	Market/product studies
	4. Reactivate ASEAN Vegetable Oil Council (AVOC) to prevent destructive competition among suppliers	All industry	CIIF, private sector	As soon as possible	Records of the AVOC
	5. Study opportunity of emission trading for husks and coco shell products as per Kyoto Protocol	All industry	Business development team	Immediately	Kyoto Protocol processes for Clean Development Mechanism
	6. Monitor bills on use of CME for diesel-powered engines	All industry	Business development team	Continuing	Bills in Senate and Congress

Issues/Areas of Concern	Proposed Actions	Stakeholders	Lead	Target Date	Required Resources
	7. Get tariff classification of each emerging products for identification and differentiation with other products	Tariff Commission	Business development team	Immediately	Tariff classification
	8. Monitor market developments and international negotiations	Associations, NGOs	Business development team	Immediately	Multilateral and bilateral agreements
D. Need for a coconut-based Commodity Futures Market focusing on emerging coconut products and industry modernization	9. Plan for implementation of a coconut-based Commodity Futures Exchange	DTI, PCA, CIIF, Associations	Business development team	As soon as possible	Study on a Commodity Futures Exchange
E. Inadequate supply of specially trained marketing and sales promotion manpower for dealing with domestic and export market	10. Draw up manpower development/training plan for industry marketing and sales	Associations	Business development team	As soon as possible	Investments and export targets
F. High rates of export rejection on coco products caused by filth, 0.3%; unspecified process, 61.1%; labeling, 21.5%; additives, 13.5%; and microbiological hazards, 3.5%; of the total 311 cases reported	11. Require commodity clearance for nonregular shippers and random tests for regular shippers	All industry	PCA	Immediately	Product standards
G. Laxity in enforcement of product quality standards and weeding out of counterfeit products from the market	12. Assist in quality/environmental assurance, GMP, HACCP, organic systems installations and certifications	Millers, processors	DTI	Immediately	Product standards

Issues/Areas of Concern	Proposed Actions	Stakeholders	Lead	Target Date	Required Resources
H. Possible repeat of the "nata de coco" marketing fiasco in VCO	13. Enforce draft standards on VCO	All industry	PCA, BFAD	Immediately	Product standards
I. Anti-coconut oil campaign (coconut oil as a "health hazard") by soybean, corn, and canola lobby groups in the USA and EU	14. Disseminate scientific studies on monolaurin and coconuts	All industry	PCA	Immediately	Studies of Drs. Dayrit and Enig
J. Nonharmonization of liberalized trade under EO 1016 vis-à-vis product quality standards and non-screening of counterfeit products					
K. Discriminatory tariff and nontariff technical trade barriers to sanitary and phytosanitary measures imposed by importing countries	15. Collaborate on monitoring and positioning in world bodies involved in removing barriers to trade	All industry	Business development team	Immediately	DTI studies
L. Custom and trade regulations as major constraints (14-22 days clearing for imports and 8-15 days for exports)	16. Include in the agenda of proposed SME summit for concerned agencies	All industry	Business development team	As soon as possible	Position papers of associations
	17. Streamline Bureau of Customs	All industry	Bureau of Customs	As soon as possible	Position papers of associations

CHAPTER 2

Economic Contributions of Emerging Coconut Products

Simplicio L. Endaya and Ma. Lourdes L. Noveno

ABSTRACT

The country's coconut-based products continue to be dominated by copra and its use in coconut oil production that takes place in large copra mills situated far from the copra sources. Through the years, government policies and incentives have favored this highly capital-intensive and specialized coconut oil industry. But while the producers and traders flourish, the poor coconut farmers—these mills' source of raw materials—continue to suffer in abject poverty and are left at the mercy of traders who buy their produce at a discount due to the low quality of their copra as a result of their lack of drying facilities.

The Philippine Coconut Authority's table of conversion for coconut shows that if only copra is produced, 84% of the whole coconut that includes the shell, the husks, and the water parts is thrown away. In addition to this wasted 84%, 47% of the fresh coconut meat also dries up and disappears. In effect, only about 10% of the coconut is utilized when only copra is produced out of the whole coconut. Many researches have shown, however, that there are many ways by which the various parts of the coconut could be converted into high-value products. This chapter provides a general picture of the potential economic contributions of emerging nontraditional coconut-based products.

The conversion table on emerging coconut products developed by this study's specialists shows the different product lines that the whole coconut can create for the functional foods market, cosmetics and feeds market, and industrial and agro-environmental markets. Most of them are relatively new products in the market. Nevertheless, there are positive indications that their market potential will expand given their increasing acceptability and popularity either as food supplements, fuel additives or environment-friendly alternatives.

To demonstrate the potential economic contributions of investments in these emerging coconut products, the specialists formulated a processing model that will transform the whole coconut into high-value products led by VCO. Suited for small and medium enterprises (SME) for operation by farm households in the raw material sources, this model requires an input of only 5,000 whole coconuts per day.

The proposed model will require an investment of PhP20 million. The estimated returns include gross revenues of PhP52 million per year and employment for at least 200 people. In spite of the tax payment of 32%, the enterprise will still make a yearly net income of PhP9.6 million or an additional PhP6 per nut thereby increasing the value of coconut inputs by three times their current market price. The potential contribution of applying this model also involves the possible multiplier effect of the disposable income made available in the rural areas as derived from employment in the enterprise, and the ancillary household industries resulting from the emerging coconut products. The model also provides other benefits such as free heat for drying and village power or electricity.

EXECUTIVE SUMMARY

The Philippines has the world's widest geographical area planted to coconuts. Some 93 countries, mostly in the tropics, are producing this crop. The Philippines is second to Indonesia in terms of world production. In terms of yield, it ranks fourth (4.41 MT/ha), next to Vietnam that has the highest yield per hectare (7.01 MT), Indonesia (6.1 MT/ha), and India (5.00 MT/ha).

Over the years, the coconut industry contributed considerably to the Philippine economy. In 2004, it contributed about PhP38.78 billion to the country's gross value added. Of late, however, its share to the total gross value added of agriculture, excluding fishery and forestry, has exhibited a decreasing trend. Its share—about 10% in 1970—was reduced to half in 2004. But despite this dwindling performance, the sector still performed better than other traditional agricultural exports like banana and sugar.

Until now, the country's coconut-based products continue to be dominated by coconut oil, dessicated coconut, oleochemicals, and copra meal. Through the years, government policies and incentives have favored the highly capital-intensive and specialized coconut oil industry. But while the producers and traders flourish, the poor coconut farmers—these mills' source of raw materials—continue to suffer in abject poverty and are left at the mercy of traders who buy their produce at a discount due to the low quality of their copra as a result of their lack of drying facilities.

This current setup not only puts the coconut farmers at a disadvantage. To a large extent, the nonutilization of the other parts of the coconut also deprives the country of the revenues it could have earned from high-value products out of these parts. The Philippine Coconut Authority's table of conversion for coconut shows that if only copra is produced, 84% of the whole coconut that includes the shell, the husks, and the water parts is thrown away. In addition to this wasted 84%, 47% of the fresh coconut meat also dries up and disappears. In effect, only about 10% of the coconut is utilized when only copra is produced out of the whole coconut.

Many researches have shown, however, that there are many ways by which the various parts of the coconut could be converted into high-value products. For instance, the coconut meat could be made into virgin coconut oil (VCO), skim milk, protein isolate, coconut meal, flour, feeds or pulp, cochin oil, and biodiesel. Some of these products can be further turned into a host of other functional products, which can be used as inputs for the production of soap, aromatheraphy and other wellness oils, meat extenders, and high-protein spread.

From the husk, coir fiber can be produced and further turned into geotextile as well as peat, a major component for organic plant media fertilizers. Coir fiber is an input to a variety of other products such as brushes and brooms, ropes and yarns for nets and bags and mats, padding for mattresses, rugs, carpets, and needle felts. The peat can be turned into charcoal, composite boards (particle board and cement-bonded panels), moulded rubberized coir,

community pots for ornamentals, etc. The shell can be produced into charcoal and further turned into activated carbon. From the coconut water, other useful products can be produced such as beverages, vinegar, distilled water, and components for tissue culture work and enzyme production. A number of these nontraditional products were identified as emerging coconut products and thus, the focus of this diagnostic study. They include VCO, processed coir, activated carbon and shell charcoal, cochin oil, and coco-methyl ester (CME).

The indicative export prices of these products show that they fetch more attractive and more competitive prices than the traditional exportable coconut products. Based on their export values, VCO tops the list of nontraditional coconut product exports, followed by activated carbon and refined oil.

To demonstrate the potential economic contribution of investments in emerging coconut products, this diagnostic study formulated a processing model that will transform the whole coconut into high-value products led by VCO. This processing model underscored the conversion of the coconut parts into alternative uses other than the traditional products of coconut utilizing a sustainable small and medium enterprise (SME) model of 5,000 whole nuts input per day for operation by farm households right in the raw material sources.

From this processing model, this diagnostic study formulated a table of conversion for emerging coconut products. This table will supplement the current PCA table of conversion for coconut as it includes the emerging coconut products such as VCO, skim milk, protein isolate, crude glycerine, CME, vinegar, distilled water, cochin oil, charcoal, activated carbon, coir, and coco peat.

A single SME enterprise model in the villages will generate PhP52 million worth of revenues yearly and can provide employment for at least 200 people. The potential contribution also involves the possible multiplier effect of the disposable income made available in the rural areas as derived from employment in the enterprise, and the ancillary household industries resulting from the emerging coconut products. The model also provides other benefits such as free heat for drying and village power or electricity.

Except for activated carbon, most of the emerging coconut products highlighted in this study are relatively new products in the market. There are positive indications, however, that the market potential of VCO, cochin oil, CME, activated carbon, and shell charcoal will expand given their increasing acceptability and popularity as environment-friendly alternatives, as well as their health benefits as in the case of VCO. Improving the investment climate for enterprises is therefore necessary to capitalize on the economic contributions of these emerging coconut products.

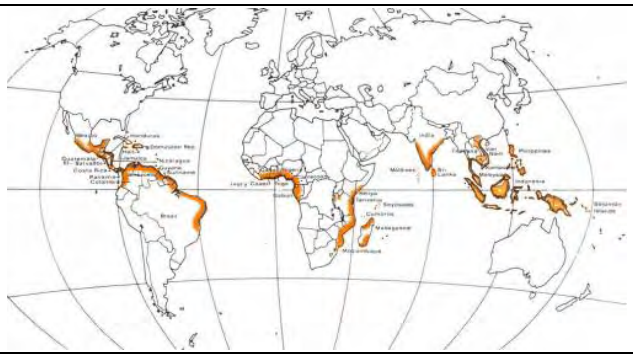
Economic Contributions of Emerging Coconut Products

Simplicio L. Endaya and Ma. Lourdes L. Noveno

THE PHILIPPINE COCONUT INDUSTRY

The Philippines has the world's widest geographical area planted to coconut. Some 93 countries, mostly in the tropics, are producing this crop (Figure 2.1). The Philippines is second to Indonesia in terms of world production. In terms of yield, it ranks fourth (4.41 MT/ha), next to Vietnam that has the highest yield per hectare (7.01 MT), Indonesia (6.1 MT/ha), and India (5.00 MT/ha) (Table 2.1).

Figure 2.1 Coconut-producing areas in the world



Source: Asian and Pacific Coconut Community.

Table 2.1 Major coconut-producing areas in the world: production and yield

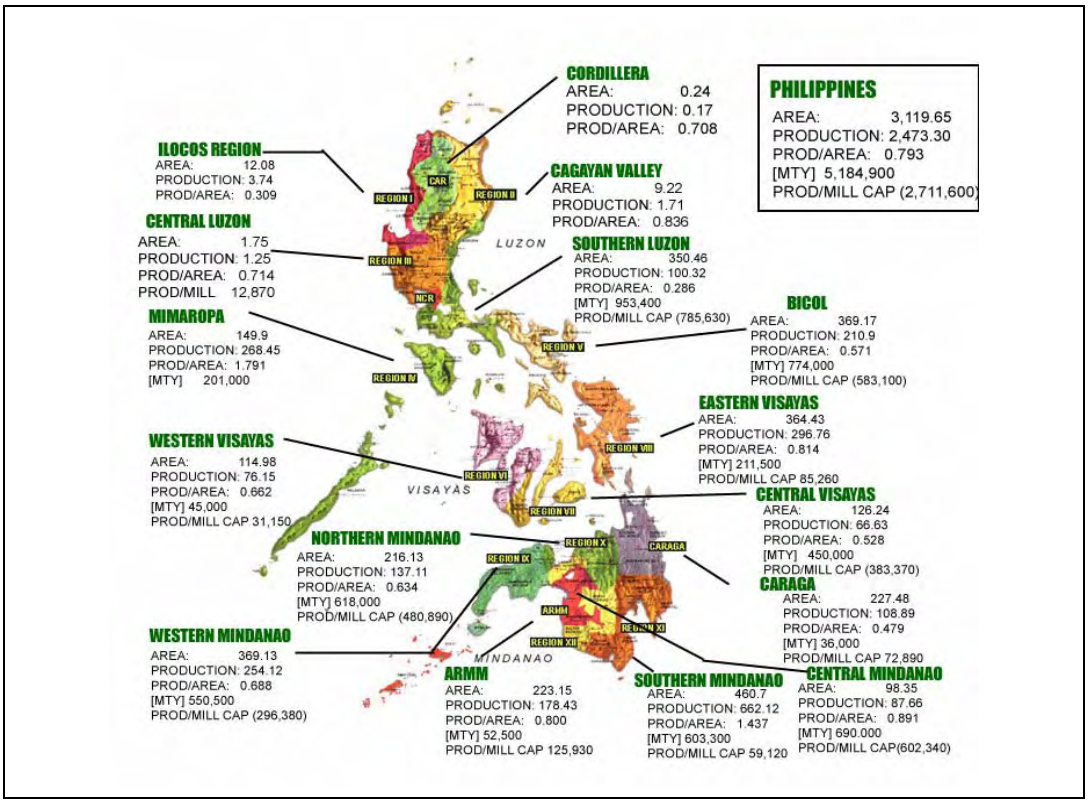
Country	Area Harvested		Production		Yield	
	In hectares	% of World	In hectares	% of World	In MT/hectare	Rank
India	1,900,000	17.59	9,500,000	17.36	5.00	3
Sri Lanka	447,000	4.14	1,950,000	3.56	4.36	5
Indonesia	2,660,000	24.62	16,289,000	29.76	6.12	2
Philippines	3,253,927	30.12	14,344,920	26.21	4.41	4
Thailand	337,000	3.12	1,450,000	2.65	4.30	6
Vietnam	132,800	1.23	930,600	1.70	7.01	1
Malaysia	179,000	1.66	710,000	1.30	3.97	7
World	10,803,438		54,736,517		5.07	

Source of basic data: Food and Agriculture Organization.
Estimated by the ICP-Coco Study Team.

Coconut (*Cocos nucifera* L.) is one of the best crops and considered the most suitable crop for a country like the Philippines that lies in the typhoon belt and has a marked dry and wet season. It provides energy (a functional food for the health, wellness, and beauty markets) and protection (fuel, heat, filter, control against pollution, soil erosion, and fertilizer). Some 3.5 million coconut farmers cultivate close to 3.4 million hectares, producing an average of 12 billion nuts per year, and are dependent on coconut for their livelihood.

The Philippine Coconut Authority (PCA) estimates a total of 1.6 million hectares of land planted to coconuts, of which 71% are 5 hectares and below, and only about 3% are more than 50 hectares. Mainly a smallholder crop, coconut occupies 27% of the country's total land devoted to agricultural use and produced in 68 out of 79 provinces situated in the countryside all over the archipelago. Major coconut-producing areas are Southern Mindanao, Southern Luzon, and Western Mindanao. Details on area and production are given in the figure below.

Figure 2.2 Coconut-producing areas in the Philippines and copra milling capacities (1997-2001)



Source: PCA 1997-2001 figures.

The PCA figured that about 1.1 million hectares of coconut plantations in the Philippines need rehabilitation. About 750,000 hectares are nutrient-deficient areas requiring fertilization and 400,000 hectares have senile and unproductive trees requiring replanting.

Coconut Industry's Capacity

Coconut processing in the Philippines remains predominantly specialized and takes place mainly in large copra mills situated far from the copra sources. Through the years, policies and incentives have favored these setups that require economies of scale both in production and logistics. There is heavy reliance on foreign technologies in the setup of these plants. At the PCA, the smallest known crushing plant for coconut oil has a capacity of 10,000 MT per day or the equivalent of about 50,000 nuts input per day. The smallholder sources of copra, who often lack drying facilities and shoulder the high cost of transport, are left to depend on the traders and millers. As shown in Figure 2.2, the situation has turned into an overcapacity for crushing copra with the shortage of raw materials. The crushing capacity of 5,000 MT of copra can only be supplied with a copra production of 2.3 million MT. Table 2.2 shows the manufacturing sector profile for 2004.

Table 2.2 Profile of the coconut manufacturing sector, 2004

Facility	Annual Capacity	Required Number of Whole Nuts Per Day *
73 oil mills	4.99 MMT	138 322 800
46 oil refineries	1.593 MMT	
10 DCN plants	132 709 MT	3 581 374
6 activated carbon plants	40 440 MT	
5 shell charcoal plants	48 018 MT	3 175 750
6 oleochemical plants	241 360 MT	
24 decorticators	16 189 MT of coir	671 196
	38 410 MT of cocopeat	457 975

Source: PCA Industry Situationer, 2005.
Using conversion table of United Coconut Association of the Philippines, Inc. at 300 days per year.

While coconut oil mills remain to be the largest market for coconut meat, coconut millers need to be provided with high-quality copra by the farmers. During the second consultative dialogue, Mr. Edmundo Lim pictured the coconut farmers' location as detrimental in the provision of high-quality copra. Access to the mills is difficult and costly since farmers are situated mostly far from the mills. Due to lack of drying facilities, these farmers can only produce low-quality copra out of sun drying, which in a day accumulates mold and develops aflatoxin in just after a week. The farm-gate prices of copra, therefore, are further discounted and it is estimated that about 30% of their produce is sold at a loss. These farmers are dependent on traders who discount copra prices substantially to cover the cost of transporting the copra to the processing plants. High costs and alienation of the farmers in the different value chain forces them to produce only copra in their farms, thereby limiting their potential income from the husks, shell, and water.

ECONOMIC CONTRIBUTIONS OF THE COCONUT INDUSTRY

Over the years, the coconut industry has contributed considerably to the Philippine economy. Of late, however, the share of coconut to the total gross value added of agriculture, excluding fishery and forestry, has exhibited a decreasing trend (Figure 2.3). Its share—about 10% in 1970—was only 5% in 2004. Despite dwindling performance, the sector still performed better compared to other traditional agricultural exports like banana and sugar (Table 2.3).

Figure 2.3. Coconut gross value added (GVA) and share to total agricultural value added (GVAA)

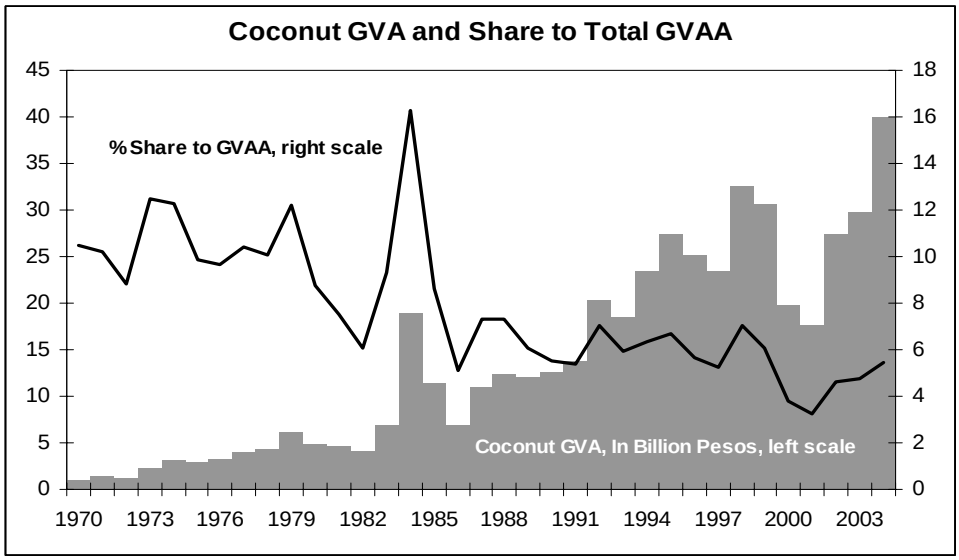


Table 2.3 Share to total agricultural gross value added (in %)

Period	Total Agricultural Industry (In Million Pesos)	Share of Traditional Agricultural Exports (%)		
		Coconut	Banana	Sugar
70-86	919,066	9.51	2.52	4.58
87-92	1,290,533	6.37	2.69	3.18
93-98	2,444,591	6.15	2.85	2.97
99-04	3,535,473	4.67	3.63	2.90

Sources of basic data: National Statistics Office and Bureau of Agricultural Statistics.
Estimated by the ICP-Coco Study Team.

In 2004, the coconut sector contributed about PhP38.78 billion to the country's gross value added. Coconut gross value added has declined from 1970 to 1990 but has again picked up beginning 2002 (Table 2.4).

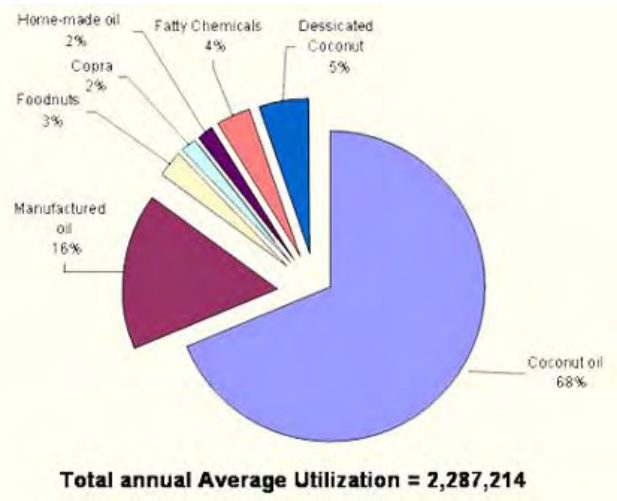
Table 2.4 Average growth rates in current gross value added (in %)

Period	Total Agricultural Industry	Traditional Agricultural Exports		
		Coconut	Banana	Sugarcane
70-86	17.01	14.61	22.01	10.07
87-92	14.00	10.25	17.16	21.09
93-98	7.79	8.19	5.85	4.59
99-04	7.29	8.94	8.71	6.92

Sources of basic data: Bureau of Agricultural Services and National Statistics Office.
Note: Growth rates are computed using regression.
Estimated by the ICP-Coco Study Team.

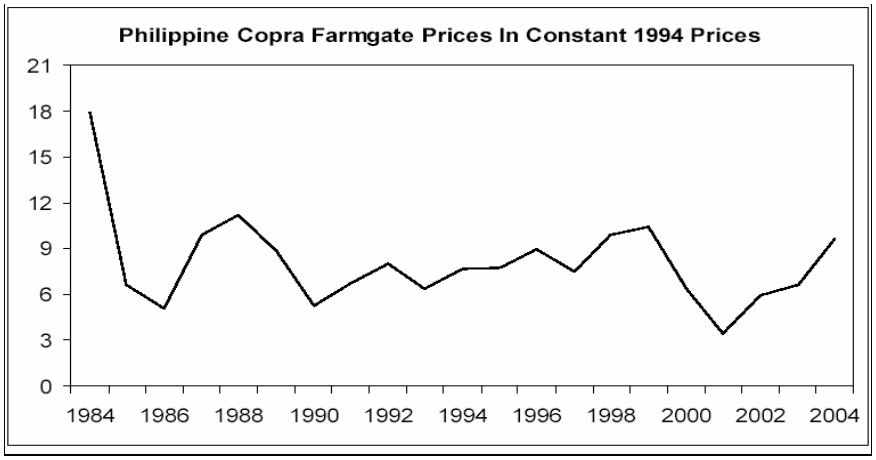
Data on total annual average coconut utilization from 1987 to 2001 in copra terms showed that the country's coconut-based products continue to be mainly coconut oil (CNO) comprising 84%, and the rest includes dessicated coconut (DCN), oleochemicals, and copra meal (Figure 2.4).

Figure 2.4 Total annual utilization in copra terms



While prices at the farm level have generally been rising in current terms over the last two decades by an average of 6.70% yearly, the corresponding values in constant terms (i.e., adjusted to inflation) have quite stagnated over the period after a sharp drop in 2001. Figure 2.5 shows the Philippine copra farm gate prices in constant 1994 prices of PhP18 per kilogram diving to half in 2004.

Figure 2.5 Copra farm gate prices (in constant 1994 prices)



Sources: Philippine Coconut Authority and United Coconut Association of the Philippines.

In terms of the prices received by coconut growers in the major coconut-producing countries, the Philippines gets only less than a third of the prices received by coconut growers in Indonesia (Table 2.5). Coconut growers in India receive the lowest price.

Table 2.5. Prices received by coconut growers in various countries (in US$ per MT)

Year	India	Indonesia	Philippines	Sri Lanka	Thailand
1991	394	143	97	166	102
1995	175	181	82	149	61
2000	125	321	75	166	80
2001	99	446	65	194	82
2002	84	458	108	182	78

Sources of basic data: Food and Agriculture Organization and Asian Development Bank.
Estimated by ICP-Coco Study Team.

Other Value Added Products from Coconut

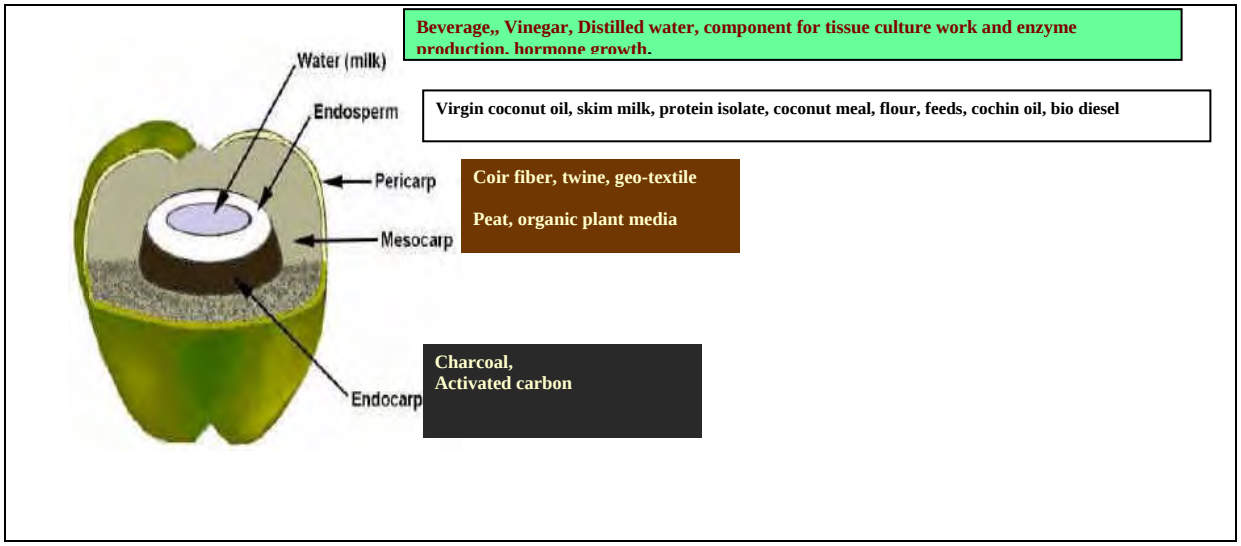
The PCA table of conversions for coconut shows that copra only accounts for 16% of the whole coconut and 53% of the fresh coconut meat. If only copra is produced, 84% of the whole coconut that includes the shell, the husks, and the water parts is thrown away. In addition to this wasted 84%, 47% of the fresh coconut meat also dries up and disappears.

Thus, in effect, only about 10% of the coconut is utilized when only copra is produced out of the whole coconut.

Researches of the Department of Science and Technology (DOST) showed that there are various alternative uses of the coconut meat other than copra. As shown in Figure 2.6, the meat can be turned into virgin coconut oil (VCO), skim milk, protein isolate, coconut meal, flour, feeds or pulp, cochin oil, and biodiesel. These products can be further turned into a host of other products that can be used as inputs for the production of soap, aromatheraphy and other wellness oils, meat extenders, high-protein spread, and coconut-based local culinary dishes. A by-product of bio-diesel or coco-methyl ester is glycerin, which is used as intermediate product for many other uses.

From the husk, coir fiber can be produced and further turned into geotextile as well as peat, a major component for organic plant media fertilizers. Coir fibers are also inputs to a variety of other products such as brushes and brooms, ropes and yarns for nets and bags and mats, padding for mattresses, rugs, carpets, and needle felts. The peat can be turned into charcoal, composite boards (particle board and cement-bonded panels), moulded rubberized coir, community pots for ornamentals, etc. The shell can be produced into charcoal and further turned into activated carbon. From the coconut water, other useful products can be produced such as beverages, vinegar, distilled water, and component for tissue culture work and enzyme production.

Figure 2.6 Coconut cross-section and alternative uses



Records indicate, however, that only some of the coconut parts are turned into valuable products. Based on the findings of this diagnostic study, only 8% of the shell from coconut turned into copra is recovered, either in the form of charcoal or activated carbon, and only less than 1% from the husk is turned into coir and peat. Almost a negligible percentage of the water coconut is made into either vinegar or distilled water.

Nontraditional and Emerging Coconut Products

The country's coconut-based products continue to be dominated by coconut oil, dessicated coconut, oleochemicals, and copra meal. Exports of these four traditional products reached about US$757.58 million in 2004 alone.

Nevertheless, eight nontraditional coconut products have been exported since 1995, namely, VCO, liquid coco milk, coco milk powder, coco water/juice, processed coir, coir and waste, activated carbon, and shell charcoal. From just a share of 2% in 1995, the share of these nontraditional coconut products grew to almost 6% of total exports of coconut products in 2004. Exports of these nontraditional coconut products were more than US$46 million in FOB value (Table 2.6).

Table 2.6 Exports of nontraditional coconut products, FOB in US$'000

Year	VCO	Liquid Coco Milk	Coco Milk Powder	Coco Water/ Juice	Coir (processed)	Coir & Waste	Activated Carbon	Shell Char-coal	Total, Non-traditional	Total Exports	Percent to Total Exports
1995		1,249.43	2,385.04	1,581.00	871.32	45	10,634	7,557	24,322.79	1,098,738.91	2.21%
1996		1,315.96	3,298.69	1,569.00	975.81	257	21,121	9,863	38,400.46	865,720.16	4.44%
1997		1,222.38	3,652.71	1,421.00	988.07	191	31,426	11,568	50,469.16	886,714.16	5.69%
1998		1,202.57	4,495.23	862.00	757.87	325	29,371	9,285	46,298.67	917,188.82	5.05%
1999		1,635.27	3,186.06	796.00	864.71	389	32,429	6,842	46,142.04	546,525.33	8.44%
2000		2,133.59	1,739.77	681.00	998.79	425	30,883	6,669	43,530.15	653,395.78	6.66%
2001	19.81	1,498.01	4,828.13	638.00	933.73	302	27,813	3,890	39,922.68	618,526.12	6.45%
2002	91.62	2,275.30	4,178.41	753.76	552.85	233.72	28,265	3,378	40,088.66	581,978.32	6.89%
2003	406.58	2,504.43	2,638.96	463.29	537.47	225.16	30,608	3,235	40,618.89	757,351.60	5.36%
2004	553.47	2,340.49	2,856.71	293.12	1,181.72	217.82	32,230	6,450	46,123.33	830,134.95	5,56%

Source: Philippine Coconut Authority.

Several nontraditional products were identified as emerging coconut products, thus the focus of this diagnostic study. These products are VCO and its by-products, processed coir, activated carbon and shell charcoal, and cochin oil and biodiesel.

Export receipts of some products such as VCO, processed coir, and activated carbon are increasing while those of shell charcoal exhibit a decreasing trend. This can be attributed to the growing use of shell charcoal in the local market either as activated carbon for plants or as fuel for industrial and household use.

Meanwhile, VCO export values rose from US$0.019 million in 2001 to US$0.55 million in 2004. The decline in the export receipts from shell charcoal was compensated by the high VCO export values, thus maintaining an average contribution of 85% of the nontraditional exports values. Meanwhile, over the same period, coir fiber export values increased by 35.62%, and activated carbon by a huge 203.08%.

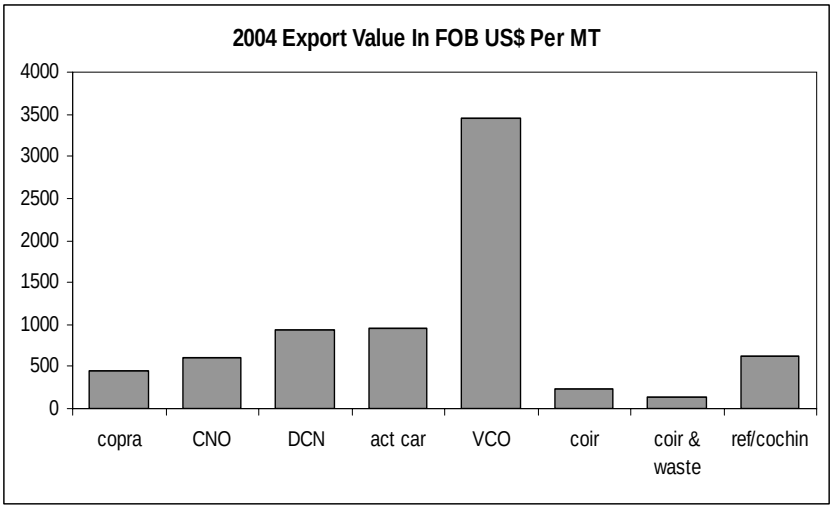
The indicative export prices of these products show that nontraditional products fetch more attractive and more competitive prices compared to traditional coconut exportable products (Table 2.7, Figure 2.7). Based on their export values, VCO tops the list of nontraditional coconut product exports with an export value of PhP175 per liter, followed by activated carbon at PhP53 per kilo, and refined oil at PhP35 per kilo.

Table 2.7 Indicative prices, 2004 (in PhP per MT)

Coconut Product	Indicative Price
Matured coconut at farmgate	3,590
Copra at farmgate	17,420
Copra at millgate	22,390
Copra, export value	24,809
CNO, export price	33,763
DCN, export price	52,588
Copra meal/cake pellet, export price	4,852
Crude oil, ave. export value	33,208
Activated carbon, export price	53,881
Shell charcoal, export price	12,169
VCO, ave. export value	175,626
Coir fiber, ave. export value	12,589
Liquid coco milk *, export value	67,042
Powdered coco milk *, export value	147,447
Coco water/juice *, export value/liter	42
Refined/Cochin oil, ave. export value	35,267

* Based on 2003 data.
Source of basic data: Philippine Coconut Authority.
Indicative prices estimated by the ICP-Coco Study Team

Figure 2.7 Indicative prices of 2004 coconut product exports



In terms of volume, a number of these emerging coconut products have improved their performance in the international market. From 1995 to 2004, export volumes for liquid coco milk, coco milk powder, processed coir, coir and waste, and activated carbon increased on a yearly average of 13.2%, 3.0%, 10.4%, 22.0%, and 9.7%, respectively. Meanwhile, exports of VCO, which only started in 2001, have increased tremendously by more than 350% yearly to 2004.

PROSPECTS OF EMERGING COCONUT-BASED INDUSTRIES

In finding a solution to the low recovery of coconut in a structure highly focused on copra and coconut oil, this diagnostic study determined the potential economic contributions of the investments in emerging coconut products. To do this, a processing model that transformed the whole coconut into other high-value products led by VCO was developed by this diagnostic study's specialists, namely, Dr. Teresita Espino, Mr. Ildefonso Tallada, and Engr. Romulo Mesias. This processing model underscored the conversion of the coconut parts into alternative uses other than the traditional products of coconut utilizing a sustainable small-and-medium-enterprise (SME) model of 5,000 nuts input per day for operation by farm households. This formulation followed the PCA recommendation in 1974, through Administrator Yniquez, Professors Banzon and Hagenmaier, to search for technologies to process the whole coconut right in the raw material sources.

Said SME processing model will transform the whole coconut into different product lines for the functional foods market, cosmetics and feeds market, and industrial and agro-environmental market. The types of products to be produced by the SME model would vary depending on whether the meat portion would be turned into VCO, cochin oil/coco methyl ester (CME) or biodiesel, or into high-quality copra for the existing coconut oil mills. The model will use the patented Messias processes for production of functional food products from fresh coconuts and activated carbon production from coconut shell. Tallada's works on

husks will be used for the production of coir and peat products for input to geotextile and organic plant media production by households.

From this processing model, this study established a conversion table that supplemented the PCA table of conversion for the industry to include the emerging coconut products such as skim milk, protein isolate, VCO, crude glycerine, coco methyl ester, vinegar, distilled water, cochin oil, charcoal, activated carbon, coir, and peat.

The emerging coconut products conversion table indicates that a whole coconut consists of 30% meat, 15% shell, 33% husk, and 22% water. VCO constitutes only 7% of the whole coconut as compared to cochin or white oil that is derived from 10% of the whole coconut (Table 2.8). An entrepreneur's decision on which product to produce will depend on his targeted market as well the product's prevailing market price.

Table 2.8 Table of conversion for emerging coconut products

Emerging Coconut Products Conversion Table
(In metric tons of 1,000 kilos of whole nut)

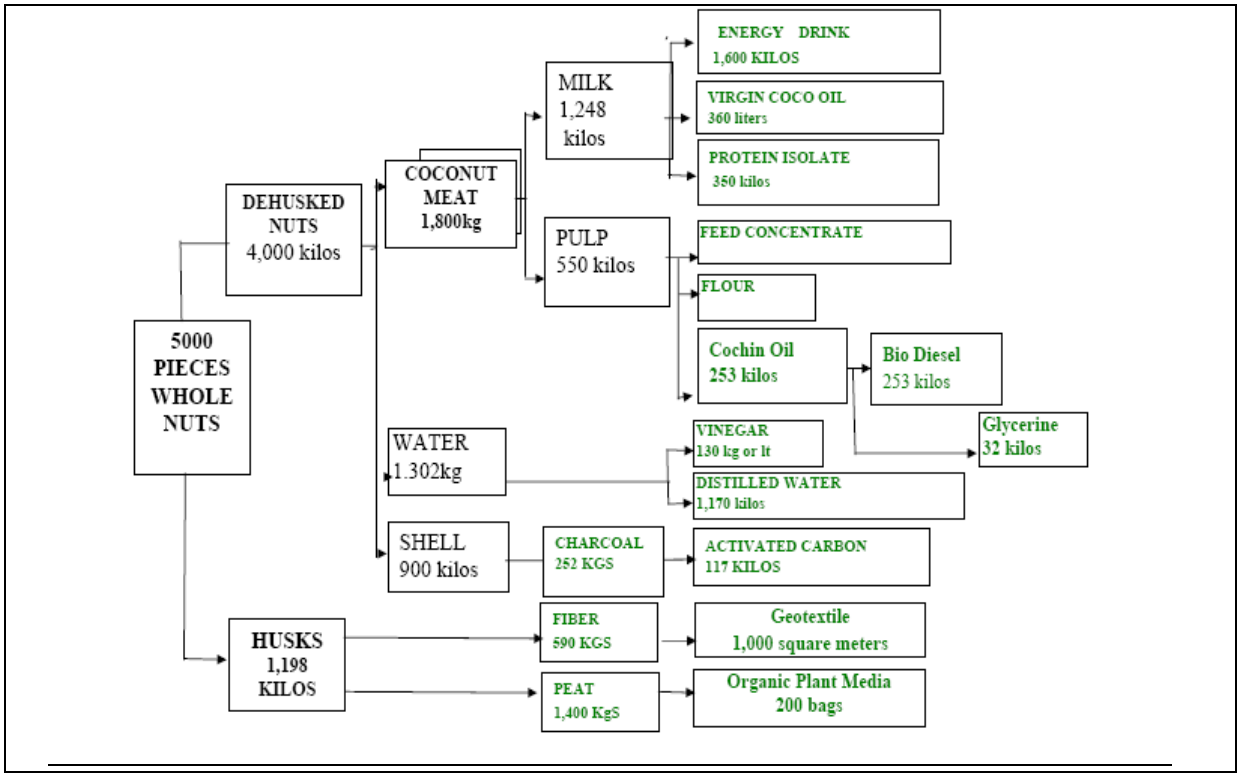
Coconut Products	Meat	Shell	Husk	Water
1 MT whole nut	0.3	0.15	0.333	0.217
Skim Milk	0.21			
Protein Isolate	0.13			
Virgin Coconut Oil	0.07			
Crude Glycerine	0.005			
Coco Methyl Ester	0.032			
Vinegar				0.239
Distilled Water				0.217
Cochin Oil	0.1			
Charcoal		0.42		
Activated Carbon		0.0195		
Coir			0.1	
Peat			0.233	

Sources of basic data: 1990 coconut statistics from the Philippine Coconut Authority and industry sector statistics from United Coconut Association of the Philippines.
Estimated by the ICP-Coco Study Team.

As can be gleaned from the product flow in Figure 2.8, all of the coconut parts are converted into different products. Based on computations, the VCO-led production model utilizing an input of 5,000 nuts per day can contribute at least nine products, namely:

- 1,600 kilos of energy drink or skim milk, 360 liters of VCO, 350 kilos of protein isolate, 253 kilos of CME, and 32 kilos of glycerine, from the coconut meat;
- 130 kg of vinegar and 1,170 kilos of distilled water, from the coconut water;
- 117 kilos of activated carbon, from the shell; and
- 1,000 square meters of geotextile and 200 bags of organic plant media from the husks.

Figure 2.8 Product flow chart for the 5,000 pieces whole coconuts per day processing plant



Source: Estimated by the ICP-Coco Study Team.

A single SME enterprise model in the villages is expected to generate PhP52 million worth of revenues yearly and can provide employment for at least 200 people. Notwithstanding a tax payment of 32% from the net income, the enterprise can still make a yearly net income of PhP9.6 million or an additional revenue of PhP6.00 per nut, thus increasing the value of coconut input by three times its current market price.

The direct potential contribution of the PhP20 million investment for a single 5,000-nuts-input-per-day model, in terms of income, employment, taxes, and alternative products for coconut, can be estimated by multiplying the contribution of each plant by the number of investments to be made by entrepreneurs all over the country.

The indirect potential contribution involves the possible multiplier effect of the disposable income made available in rural areas as derived from employment in the enterprise and the ancillary household industries resulting from the products (e.g., soap and aromatheraphy oils from VCO for the beauty market; energy drink from skim milk; various cuisines from protein isolates that can be used as meat extenders; and geotextiles and organic plant media from coconut coir and peat production).

In addition, the model provides other benefits such as free heat out of its activated carbon production for drying, and village power or electricity when the heat is made to turn steam turbines for power generation. For the model's own production processes, the heat can be used for pasteurization of skim milk, distilling of water, and drying of the coconut fibers and peat on a 24/7 basis that need not be affected by the almost half year wet season climate. Agricultural, fishing, and seaweed villages can also make use of the free heat for their production processes.

Estimated Foregone Export Revenues in 2004

Given the actual coconut production for 2004 and assuming that only 15% of this will be used to produce the emerging coconut products through the 5,000-nuts-input-per-day model, at least US$449 million export revenues are foregone (Table 2.9). In copra terms, the actual coconut production in 2004 is 2,377,000 MT or about 12,454,311,149 whole nuts. Assuming 15% of this or 1,869,146,672 whole nuts were used to produce emerging coconut products, there would be 1,246 modules of 5,000 nuts input per day operating at 300 days a year. Table 2.9 below shows the emerging products produced and exported. The products include VCO, cochin/CME, activated carbon, coir fiber, and coir peat. Other products in various stages of product and market development are to be included in the computation of foregone export revenues such as skim milk, protein isolate, flour, feed concentrate, vinegar, and distilled water, if these products were exported.

Increasing the utilization of the nuts for exports to 30% by converting these into emerging coconut products will increase total exports of coconut products to 70%.

Table 2.9 Computation of foregone revenues based on actual total coconut production in 2004

Emerging Products	Volume		Equivalent export receipts using 2004 values, FOB US$
VCO (given)	123,746,036	kg	387,812,319
Cochin oil/CME	94,528,221.62	kg	59,488,182
Activated carbon	43,714,632.13	kg	51,101,614
Coir fiber	186,814,667.23	kg	41,968,326
Coco peat	467,036,668.08	kg	62,826,113
Subtotal			603,196,554
15% of 2004 export receipts from traditional products			113,550,000
Others products that could have also been produced:			
Energy drink :	597,806,935.14	kg	
Protein isolate :	130,770,267.06	liters	
Feed concentrate :			
Flour :			
Vinegar :	535,784,465.62	kg	
Distilled water :	486,465,393.47	kg	
Exports of emerging coconut products, 2004			40,633,000
FOREGONE EXPORT REVENUES			**449,013,554**

Sources of basic data: Philippine Coconut Authority and United Coconut Association of the Philippines.
Estimated by the ICP-Coco Study Team.

Opportunities and Prospects of Emerging Coconut Products

VCO

From 2001, the VCO industry has improved its production performance using current technologies developed by the R&D institutions. Over a period of four years until 2004, production sharply swelled due to increased demand (Table 2.10).

Table 2.10 Monthly production and annual production of VCO (MT)

Year	Monthly Production	Annual Production
2001	1.9	23.0
2002	19.1	229.0
2003	831.8	9,982.0
2004	3,009.1	36,109.0
Total	3,861.9	46,343.0

Source: Philippine Coconut Authority.

In terms of production capacity and concentration of manufacturing plants, majority are in Luzon (83.8%). Only about 16.2% of total production are from Mindanao (16.1%) and Visayas (0.1%) (Table 2.11).

Table 2.11 Capability (MT/year) and share of VCO production of Luzon, Visayas, and Mindanao

	Regional Capability	Share (%)
Luzon	30,300.0	83.8
Visayas	30.0	0.1
Mindanao	5,820.0	16.1
Total	36,150.0	100.0

Source: Philippine Coconut Authority.

Opportunities for further expansion both in the local and international markets exist. Export of VCO has increased following the rise in demand after the manufacturers agreed to adopt production standards set by the government (Philippine Daily Inquirer 2005). The world demand for VCO is also increasing due to its high lauric acid content and newfound applications in the cosmetic and nutraceutical industries.

The increasing popularity and demand for VCO was further dramatized by international experts like Prof. Jon Kabara, Dr. Bruce Fife, and Dr. Mary Enig who underscored its use for nutraceutical, cosmetics, and other industrial applications. The availability of information on the natural benefits and applications of VCO in the Internet somehow countered the negative propaganda against the generalization that all saturated fats are bad for the health. The predominance of the medium-chain triglyceride in VCO compared to other types of vegetable oil has earned for VCO the image of healthiest oil in the world. As a functional food, VCO has been found to lower viral counts in HIV/AIDs patients and can also be used to reduce weight.

Clinical studies have also established that VCO is effective for skin diseases (e.g., psoriasis, bed sore, acne) due to its antimicrobial and cleansing properties. The team's expert on functional food also reported that the new set of rules by the US Food and Drug Administration on transfat labeling on all manufactured goods sold in the US starting 2006 will have a positive effect on the demand for VCO as it has no transfatty acid unlike other vegetable oils.

The United Coconut Associations of the Philippines reported that during the first half of 2005, 340 MT of VCO were shipped to foreign markets. This figure was 92% higher than the 177 MT exported for the whole duration of 2004 (Table 2.12). Of the total shipments, the United States took in 331 MT or about 97% of the export market. In 2004, the US imported about 170 MT or 96% of total shipments. Other markets that bought limited quantities are Singapore, Ireland, Saudi Arabia, Australia, Malaysia, Hong Kong, and Germany. Forecast for 2005 showed that at least 500 MT will be sold to markets abroad.

Out of only two foreign destinations in 2001 and 2002, VCO is now being exported and is gaining foothold in 16 foreign markets.

Table 2.12 Virgin coconut oil: annual export performance

Year	Volume (MT)	% Change	Value (FOB US$)	% Change	Unit Price ($/MT)
2001	1.80		19,810.00		11,005.56
2002	19.11	961.67	91,618.00	362.48	4,794.24
2003	102.83	438.10	406,580.00	343.78	3,953.90
2004	176.60	71.74	553,469.00	36.13	3,134.03

Source: Philippine Coconut Authority.

Coir products

With machines operating only at 45%, coir manufacturing in the Philippines according to PCA is quite small—only 5,114 MT in 2004—compared to the production of Sri Lanka and India. The domestic market is mostly the bed factories and upholstery shops (sala sets and Jeep assembly plants). The five-year average (2000-2004) showed only 17% utilization or 322 MT. A huge number of domestic manufacturers of vehicles, shops, and factories are still using the synthetic material styrofoam. A quite recent development is the growing awareness of the public sector to incorporate coco coir in their respective activities—for example, the Departmentof Agriculture for their nursery and grow-out requirements of seedling pots and organic plant media (to use coco peat based formulations); the Department of Natural Resources to use coir pots for reforestation nurseries; and the Department of Public Works and Highways to include coir geotextile, fascines, and other erosion control materials, whenever designs are prepared for highway constructions and/or rehabilitation.

The Philippines exports about 69% of its coir production. World demand has been growing over the past years as new nontraditional uses are being found. The demand behavior is pushed by the ecofriendly characteristic of the product. Many end-users are now beginning to realize the painful rewards of patronizing synthetic materials, i.e., their dangers on human and animal health. Erosion control mats and other geotextile applications (rolled erosion control mats, biologs or fascines) of coir are beginning to get noticed in the export market. The automotive and upholstery industries have begun to recognize the environmental advantages in the use of rubberized, moulded coir products. In addition, new uses of coco coir are coming up as reinforcing material in composite products fiberboards, insulation boards, and other similar applications

Export potential exists in China, Korea and Japan, Europe, Canada and the United States. Meeting the desertification problems in Saudi Arabia and China would require volumes of erosion control nets or geo-textile. With modern developments where population sites expand, subdivision areas are built, main highways, secondary road laterals, building constructions, and river flood control projects, other land developments such as parks and recreation areas, and golf courses; all these activities include natural ground terrain alterations that predispose huge areas to soil erosion. These areas are found in China, Saudi Arabia, and other petroleum-rich countries. In Israel, for example, coir nets go hand in hand with coco peat materials for desert greening.

In China, the "live" dessert is moving toward cities, provinces, agricultural areas, and livestock pasture areas, at the rate of 2,460 sq. km. This is in addition to the existing affected areas of 2,622,000 sq. km. or about 27.3% of the total territory of China. An equally huge addition is the erosion control requirements of high-activity areas in building constructions, and river flood control projects. In Korea and Japan, environmental consciousness is on the rise with seemingly no limits in budget allocation. Like China, these countries give high priorities to landscaping of public areas and highway sides that run thousands of kilometers. High demand for erosion control materials including organic plant media (coco peat) is foreseen to grow each year. In Europe, Canada, and USA, inquiries indicate a need for bristle fibers and coco peat.

A component product of coir production, coir dust is likewise getting a sizeable market share in Europe and Canada. Commercial interest in the horticultural uses of the material as substitute for peat moss was triggered by the "greening movements" that sprung from these countries. The bulk of coco peat exports came from Sri Lanka; exports received by Korea and Japan were supplied from neighboring countries like the Philippines.

Additionally, the global coir industry could be facing international opportunity under the Clean Development Mechanism (CDM) of the Kyoto Protocol. Industrial countries, which are heavy users of carbon dioxide-releasing operations, agreed under the protocol to enter into emission trading with developing nations to meet their national commitment (the European Union and Japan, for example, committed to reduce 40 million tons of CO2 emissions by 2010). Current understudy market value for each ton of carbon dioxide reduced by the CDM project is worth US$5. Burning of the coconut husks releases methane, and projects preventing these releases could be qualified under the CDM.

Premium activated carbon

The Philippines is a significant exporter of coconut shell-activated carbon. The encouraging performance achieved in Philippine exports of activated carbon (average of 31,345 MT in 1999-2003) clearly indicates its huge export potential (Table 2.13). With the world market growing at a rate of 11-12% per year and considering various sophisticated end-use applications of activated carbon in the gas market, solvent recovery, petroleum refining, and others, the international market is expected to grow fast.

Table 2.13 World exports of coconut shell-activated carbon by selected countries, in MT, 1999 -2003

Country	1999	2000	2001	2002	2003	Average
Philippines	32,344	31,344	29,585	30,833	32,620	31,345
Sri Lanka	14,380	16,201	15,591	18,038	16,000	16,042
Indonesia	11,283	10,205	12,104	11,553	12,409	11,511
Malaysia	11,889	12,784	14,433	19,893	18,861	15,572
Thailand	3,088	4,414	3,651	3,651	4,748	3,910

Source: Coconut Statistical Yearbook, Asian and Pacific Coconut Community.

The market for coconut shell-activated carbon includes gas mask manufacturers and the sugar, potable water, gas/vapor recovery, petroleum, and pharmaceutical industries. The biggest users of granular activated carbon are the gas absorption companies with 40%, the water treatment companies with 30%, the industrial chemical companies with 11%, the solvent recovery companies with 4%, and others with 15%. Locally, the markets for activated carbon include the food processing industry (softdrinks and sugar refining industries), edible oil industry, and monosodium glutamate manufacturing industry.

In 1975, the activated carbon production capacity in the Philippines is estimated to be only 3,260 MT per year. Today, the country has six activated carbon plants with an annual capacity of 40,440 MT.

The international concern for the environment increases the need for activated carbon. Activated carbon manufactured from coconut shell is considered superior to those obtained from other sources mainly because of its small macropore structure that makes it more effective for absorbing gas/vapor and removing the color and odor of compounds. Activated carbon is extensively used in refining and bleaching vegetable oils and chemical solutions; in water purification; in the recovery of solvents and other vapors, and recovery of gold; in gas masks for protection against toxic gases; and in filters for providing adequate protection against war gases/nuclear fallouts.

The recent tsunami in the major coconut areas of Indonesia and Sri Lanka, which resulted in the stoppage of operation of plants producing charcoal or activated carbon, spells a three-year opportunity for the Philippines to fill the void in supply.

Coconut shell charcoal

The market for coconut shell charcoal is expected to increase as the use of coconut shell-activated carbon increases. This increase is expected given the air and water pollution problems in industrialized countries. At present, there are new applications of the coconut shell-activated carbon developed by the military. The potential of coconut shell charcoal remains untapped as only 8% of the available coconut shell supply of the country is being utilized.

A major local producer of activated carbon has launched a “big brother” program for shell charcoal to be delivered to their plant. There is also a potential for setting up charcoal plants to utilize the excess 1,685,436 MT of coconut shells per year. A technology developed by Engr. R. Mesias is available for the production of both coconut shell charcoal and activated carbon.

Cochin oil

Cochin oil is a clear crude coconut oil whose free fatty acid content is less than 1% percent in terms of lauric acid. It is a very good material for making edible oil, cosmetics, industrial chemicals, and biodiesel. Cochin oil is manufactured from fresh nut by the hot air process as a main product, by the wet process as a by-product, or chemically from crude

coconut oil. Due to the high cost of fuel, there are no known manufacturers of cochin oil in the Philippines by the wet process. There is, however, a technology now existing that can provide the hot clean air for drying the grated meat for free. Product development of cochin oil has been completed by Engr. R. Mesias.

The market for the cochin oil includes the manufacturers of cooking oil who process it further by refining, bleaching and deodorizing it to fit the specifications of edible cooking oil. The other users of cochin oil are the oleo chemical industries that produce fatty acids and fatty alcohols, and the cosmetic, soap, detergent, resins, plasticizers, and fuel industries. An efficient and profitable process using fresh nuts will produce high-quality crude coconut oil without aflatoxin and nitrites that are carcinogenic. The process, including the equipment, is now available from Filchar Manufacturing Corporation.

Coco-methyl ester or biodiesel

Using coconut methyl ester (CME) or coco-biodiesel is better than using diesel fuel. Independent tests conducted by the US Department of Energy's National Renewable Energy Laboratory (NREL) with CME have consistently yielded the same results as diesel fuel, but with more positive results such as reduced smoke emission and increased fuel combustion (about 17% more mileage).

The same biodiesel is now used as primary raw material for the manufacture of coco fatty acids and coco fatty alcohols. The glycerin by-product is used in the manufacture of alkyd resins and other resins for the paint industry.

The Department of Energy (DOE) indicated that in 2004, the country‘s demand for diesel reached 5.4 billion liters a year. Given the increased mileage made possible by coco diesel, the country would need 4.86 billion liters of coco diesel each year. A bill is currently in the legislative branch mandating the use of CME at a minimum of 1% by volume for blending into all diesel engine fuels sold in the country. A total of 2% blend by volume will be required within two years from the effectivity of the law. At 2%, the Philippines will need 140,000 MT of CME each yea (Table 2.14).

The market of CME locally will be the different gasoline refineries of petroleum diesel. Transport cooperatives are taking a proactive role in the sourcing of biodiesel for their respective members.

But the bigger market for CME is export. The legal requirement for Europe is between 10 and 15% application; for Japan, 2%; for seven states in the United States, 1-2%; Korea, 2%; Thailand, 2%; and Malaysia, 1%.

Table 2.14 Philippine CME annual demand at different rates of incorporation

Percent requirement	CME Annual Demand	in '000 Metric Tons
1%	0.070 Billion liters	70,000 MT
2%	0.140 Billion liters	140,000 MT
3%	0.210 Billion liters	210,000 MT
4%	0.280 Billion liters	280,000 MT
5%	0.350 Billion liters	350,000 MT

Source: Department of Energy.

The DOE estimates at least 50 million liters of coco biodiesel production a year. More than half of these are produced by private manufacturers authorized by the DOE. Senbel Fine Chemicals, Inc. generates 25 million liters of coco diesel while RI Chemicals Corp. produces the other 10 million liters. Chemrez through it new plant can produce 60 million liters of coco biodiesel a year. Sustained production of coco biodiesel is envisioned to contribute to the government's target of achieving 60% energy self-sufficiency by 2010.

SUMMARY AND CONCLUSION

The economic contributions of the coconut industry mostly come from copra and its use in coconut oil production, and, in less significant quantities, from the conversion of the shells into charcoal or activated carbon, the husks into coir and peat, and the coconut water into vinegar or distilled water. Taken together, these coconut by-products add value to only about 10% of the coconut. The remaining 90% remain are put to waste, either burned or dumped into the environment, negatively affecting the soil, air, and water.

To solve the low recovery of coconut in a structure focused on copra and coconut oil, a processing model that transforms the whole coconut into high-value products led by VCO was developed by this diagnostic study, the details of which can be found in Chapters 4, 5, and 6. The highlight of this model is the conversion of the coconut parts into alternative uses other than the traditional products of coconut utilizing a sustainable small-and-medium-enterprise (SME) model of 5,000 nuts input per day for operation by farmer-households.

A single SME enterprise model in the villages is expected to generate PhP52 million worth of revenues yearly and can provide employment for at least 200 people. The potential contribution of applying this model also involves the possible multiplier effect of the disposable income made available in the rural areas as derived from employment in the enterprise, and the ancillary household industries resulting from the emerging coconut products. The model also provides other benefits such as free heat for drying and village power or electricity.

Except for activated carbon, most of the emerging coconut products are relatively new products with newly found uses in the market. There are positive indications, however, that the market potential of VCO, cochin oil, coco-methyl ester, activated carbon, and shell charcoal will expand given their increasing acceptability and popularity as environment-

friendly alternatives. Improving the investment climate for enterprises is therefore necessary to capitalize on the economic contributions of these emerging coconut products.

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CHAPTER 3

Investment Climate and Value Chain Analysis

Pablito M. Villegas

ABSTRACT

This chapter is a study of the investment climate and business environment of the emerging coconut-based industries. For these industries to realize their economic potential and contribute to investment and productivity growth, the government should ensure a healthy investment climate for them.

The overall picture of the investment climate in the Philippines provided by the World Bank's and Asian Development Bank's (ADB) investment climate surveys pointed to the higher cost of doing business in the Philippines relative to its neighboring countries. Many of the surveyed firms in the World Bank survey considered the country's labor regulations (e.g., wage fixing, hiring, and firing) as a major obstacle. More than half also reported paying bribes or incurring losses from crime and disorder. Other factors that put off investors were the unpredictable interpretation of policies, electrical or power outages, lack of confidence in courts upholding property rights, poor access to electricity, tax rates, and access to financing institutions. The country also did not perform well in the areas of starting a business given the lengthy procedures and period to register a business, particularly for micro-enterprises and small and medium enterprises.

These results confirmed the findings of the ADB survey in which most firms reported as the major to severe constraints the areas of macroeconomic instability; corruption; high cost and outages of electricity; excessive tax rates; uncertainties in economic policies; and high incidence of crime, theft, and civil disorder as well as poor tax administration. .

Seemingly, the availability of skilled and educated workforce was the only shining factor of the Philippines. Most of the surveyed firms were also appreciative of the improved telecommunication systems in the country in terms of access and rate.

Within the supply and value chain of the emerging coconut-based industries, the SWOT (strengths, weaknesses, opportunities, threats) analysis showed a weak value chain that is still very vulnerable to uncertainties in macroeconomic fundamentals and external shocks. The connectivity and linkages between and among these component parts of the potentially potent coconut-based agro-industrial cluster are also very fragile. There are some strong components like few well-managed benchmark plantations (2-3 tons per hectare copra yield) and few Agrarian Reform Communities that received technical assistance from DAR and PCA as well as donor institutions. Product development appeared strong with globally competitive technological advances in virgin coconut oil (VCO) and its component functional food, biodiesel, geotextile, and rubberized coir breakthroughs, to mention a few. What remains very problematic is the market development and sales promotion component, and its weak linkages to product development and logistics and distribution chain.

EXECUTIVE SUMMARY

Investment climate refers to the policy, institutional, and behavioral environment both present and expected that influences the returns and risks associated with investment. It is a set of location-specific factors shaping the opportunities and incentives for firms to invest productively, create jobs, and expand their business operations (World Bank 2003). According to the Asian Development Bank (ADB), the investment climate is largely affected, favorably or unfavorably, by macro fundamentals, infrastructure, as well as governance and institutions. These, in turn, lead (or not) to investment and productivity growth through private sector development and investment, and finally results in socioeconomic growth with equity and reduction of poverty and food insecurity. Value added is the value that an industry adds to its outputs by using technology, labor, material, and capital. Simply stated, it refers to the gross revenue less the intermediate costs of production.

As indicated in the World Bank's Investment Climate Surveys covering 2002 to 2004, the investment climate indicators included (but not limited) to: (a) policy uncertainty; (b) corruption; (c) courts or legal system; (d) crime and disorder; (e) regulation and tax administration; (f) finance and access to credit; (g) electricity; and (h) labor.

For 2004, the Philippines' only shining factor in the investment climate was in labor skills with only one out of 10 of the 719 surveyed firms (or less than 12%) reporting it as a major constraint. However, labor regulations (e.g., wage fixing, hiring, and firing) were major obstacles to one out of four firms. More than half (50.6%) of the surveyed firms reported paying bribes, with about 4 percent of sales going to it. These results were almost the same as those for Indonesia but higher than in China wherein 55 percent cases of bribery and extortion were reported but with less than 3 percent of sales going to bribery.

However, the Philippines did not perform very well in the areas of starting a business, which involved at least 11 procedures and 50 days to register a business, particularly micro-enterprises and small and medium enterprises. It took an average of 380 days to enforce a contract and at least 25 procedures. Worse, it took almost 6 years to resolve insolvency cases in the Philippines vis-à-vis 2.3 years in Malaysia, less than a year (10 months) in Singapore, and 2.4 years in high-income countries.

At the microlevel survey of the investment climate in the Philippines conducted by the ADB in 2003, the brighter spots were in the better access to competitive telecommunications system with less than 10 percent of the surveyed 716 firms reporting it as a major obstacle. This favorable business climate was followed by workers skills and education (10.8%) and the securing of licensing and permits (12.6 percent). The major to severe constraints were in the areas of macroeconomic instability (41%); corruption (34%); high cost and outages of electricity (33%), excessive tax rates (32%); uncertainties in economic policies (29%); and high incidence of crime, theft, and civil disorder as well as poor tax administration (26% each).

It appeared that the overall investment climate in China with its double-digit economic growth rate (over 10%) seemed to be much better than the Philippines, except in the availability of skilled and educated labor force, tax rates, and cost of financing. Bangladesh and Pakistan appeared to be worse off than the Philippines. While Indonesia's investment climate appeared to be almost at par with the Philippines, Indonesia seemed to be worse off in the areas of macroeconomic stability (50%), uncertainties in regulatory policies (45%), and corruption (37%).

The overall SWOT (strengths, weaknesses, opportunities, threats) analysis of the supply and value chain of emerging coconut products showed a weak value chain that is still very vulnerable to uncertainties in macroeconomic fundamentals and external shocks. The connectivity and linkages between and among these component parts of the potentially potent coconut-based agro-industrial cluster are also very fragile. There are some strong components like few well-managed benchmark plantations (2-3 tons per hectare copra yield) and few Agrarian Reform Communities that received technical assistance from DAR and PCA as well as donor institutions. Product development appeared strong with globally competitive technological advances in virgin coconut oil (VCO) and its component functional food, biodiesel, geotextile, and rubberized coir breakthroughs, to mention a few.

While the huge domestic and global markets are waiting to be tapped, what remains very problematic is the market development and sales promotion component, and its weak linkages to product development and logistics and distribution chain. The supplier and service provider industries for the raw material production, primary processing, and secondary/tertiary manufacturing subsectors require effective linkages and a favorable business climate that should be continuously strengthened. The support services—from the national and local government units, to the research and development and education/extension (training) and regulatory institutions, to the private sector professional and trade organizations, and up to the financing institutions—have to be liberated from technical and economic inefficiency, regulatory capture, and economic rent-seeking behaviors.

A quick analysis of the indicative gross values based on the average unit prices in 2000-2004 of traditional and emerging coconut products revealed that VCO (US$4,063.75 per metric ton), coco milk powder (US$2,722.48), liquid coco milk (US$1,276.12), and geotextile (US$952.38 per ton) were the most high valued coconut products in the global market. Imperatively, structural changes must happen in terms of veering away from the relatively low-valued coconut oil and copra and shifting more into high-valued emerging coconut products including oleo foods and oleo-chemicals. Any effort to liberate coconut farmers from the poverty cycle must involve and fully integrate them in the supply and value chain. Thus, the PCA and CIIF must consider decentralized and integrated high-value coco products processing at the village and community levels where farmers will have to be properly organized into Coconut Business Units with economies of scale in operation and access to social marketing, community organizing, and business management services, as well as technology, market, and finance.

Based on an indicative 5,000-nuts-per-day (6-ton capacity) business model developed by this diagnostic study, the daily gross revenue of an integrated emerging coconut products processing plant covering functional food products (VCO and its by-products), industrial (bio-diesel and activated carbon and its by-products), and agro-environmental (geotextile and organic plant media) products amounts to PhP158,213.36 with a net value added per day of PhP34,702.13 or PhP10.4 million annually in a 300-day operation. This was calculated under the "stand-alone processing operation" estimates of the technical specialists on the various coconut product groupings and therefore does not consider the potential cost savings or economies of scale of a fully integrated coconut processing operation. On a per nut basis, this results in an almost sevenfold (PhP6.94 per nut) increase in net value added or almost sixfold increase at PhP5.78 on a per kilo basis. The model could be progressively scaled up to twofold (10,000 nuts per day) to even tenfold (50,000 nuts per day) depending on access to raw materials and infrastructure market finance and business management capacity of coconut farmer organizations.

One of the goals of this diagnostic study is the indicative determination of the transaction, manufacturing, and logistics costs and its impact on the supply chain. Based on the results, labor and power costs were the highest amount paid by the producer as it comprised 55% of the total cost. This confirmed the survey conducted by the ADB and the World Bank that concluded that uncompetitively high labor and power costs as well as handling and transport costs were the major obstacles to investment in emerging coconut enterprises.

In summary, the investment climate and business environment in emerging coconut-based industries, just like in many agro-based enterprises, is generally weak particularly in the areas of costly labor, power, interest and financial charges, tax rates, transport and handling charges, and registration and regulatory fees. The transaction and hidden costs of business registration and regulatory compliance will even jack up the cost of doing business. The investment climate is also constrained by policy uncertainties, graft and corruption, poor infrastructure (roads, ports, power), and law and order cum insurgency and terrorism problems in major coconut-producing areas—all of which reduce the market access opportunities and competitiveness potentials of the emerging coconut products. A major threat in the industry is high competition of Philippine coconut oil and emerging products vis-à-vis Indonesia and the strong lobby against coconut oil and palm oil from other vegetable oil producers from the USA and EU (e.g., soybean, corn, rapeseed (canola) and sunflower oil lobbies) despite the fact that their oils are found to be having high transfatty acids resulting from the hydrogenation process that prevents their faster rancidity and quality deterioration. Coconut remains a strategic commodity bordering on "global health benefits" ("healthiest oil in earth"); solving energy crises (conversion of cochin and CNO into biodiesel alongside soybean oil in the USA); and, ensuring geopolitical balance (supply of strategic industrial raw material) and socioeconomic harmony (poverty reduction and terrorism control) in coconut-producing countries).

The government must have the political, legislative, and judicial will to curb corruption and foster competitiveness to improve the overall investment climate that will benefit the coconut-based industries. The government, through the DTI, PCA, DA, UCAP,

and CIIF must undertake a deliberate and focused shift to high-value products (VCO, coco milk, CME/CEE geotextile) that could possibly increase export value by at least 2-3 times (US$1.6 billion-US$2.4 billion). There is an urgent need to immediately formulate, by outsourcing consulting services, the coco-based Master Plans with Investment-Grade Feasibility Studies in four coconut strategic zones, namely: South Luzon-Bicol, Samar-Leyte, Davao-Caraga, and Moro Gulf–coconut-based business clusters. Such zones will be complemented by a network of decentralized pro-farmer Integrated Coconut Processing Plants (established initially in priority Coconut Farmers Agribusiness Centers or CFACs where strong farmers organizations and/or cooperatives exist) with the support services of PCA, DTI, and authentic nongovernment organizations like the National Confederation of Cooperatives (NATCCO) and Philippine Rural Reconstruction Movement (PRRM). The ASEAN Vegetable Oil Council (AVOC) has to be reactivated and/or an ASEAN Coconut and Lauric Oil (jointly with palm kernel oil) Promotion Board has to be created for closer agro-industrial cooperation and trade facilitation. These initiatives may further metamorphose into a Philippine-led coconut-based Commodity Futures Exchange where every aspects of the products and its quality attributes and specifications, packaging, containers, storage and distribution systems, are standardized, except the price of coco products.

In the final synthesis, the improvement of the overall investment climate, in terms of improving the productivity and the supply and value added chain (SVAC) and reducing the production, processing, distribution and transaction costs, risks, and barriers to competition, requires a drastic and radical departure from "heavy sectoral policy orientation." In order to transform the relative comparative advantage of emerging coconut products into competitive edge in the global market, it is imperative to have a progressive policy shift to agro-based industrial clustering (ABIC) and supply and value added chain (SVAC) paradigm at the macro and meso cluster levels, and decentralized coconut processing centers (DCPCs) at the micro and subcluster levels**.** The DCPCs will utilize the 5,000 nuts per day business model with a scaling opportunity to process 50,000 nuts as raw material for its daily operation. Such strategy will definitely operationalize and strengthen the multisectoral CFACs with priority project packaging and implementation in coconut areas with strong and functional cooperatives or operational coconut business units. In support of such DCPCs, CIIF/UCAP could firmly establish two centralized secondary to tertiary coconut processing zones in Luzon (Bauan, Batangas) and Mindanao (General Santos, Davao or Cagayan de Oro). Such coconut-based agro-industrial cluster facility will serve as the major strategic platform for linking up with the global supply chain and ensuring physical delivery of coconut products that will potentially be traded in the coconut-based Commodity Futures Exchange.

Investment Climate and Value Chain Analysis

Pablito M. Villegas

INTRODUCTION

More than 25 million Filipinos are directly or indirectly engaged in coconut-based industries. About 3.5 million coconut farmers consisting of landowners, tenants, and hired workers cultivate close to 3.4 million hectares, producing 12 billion nuts a year (45 nuts per tree). In the last 10 years, coconut-based industries contributed a yearly average of 6% to the gross value added (GVA) in agriculture, or about US$800 million in exports, 80% of which came from coconut oil and dessicated coconut, both produced out of copra as feedstock. Over the years, coconut farmers have been producing mainly copra for a highly capital-intensive and specialized coconut oil milling industry that rendered uneconomical the use of 86% of the whole coconut for other value-added products.

There are nontraditional products, however, that have been developed to diversify the utilization of coconut and produce high-value products. Eight nontraditional products have been exported since 1995, namely, virgin coconut oil (VCO), liquid coco milk, coco milk powder, coco water/juice, processed coir, coir and waste, activated carbon, and shell charcoal. While most of them are relatively new and some already exist in the market, statistics point to the growing foothold of these emerging coconut products in the international market, particularly VCO.

Being an important subsector of the Philippine economy, a healthy investment climate for the coconut industry will lead to investment and productivity growth and contribute to overall socioeconomic growth with equity with the reduction of poverty and food insecurity. Toward this end, it is but necessary to study the investment climate and business environment especially for the emerging coconut-based industries.

This investment climate study has the following objectives:

1. Provide a framework for, and an analysis on, improving the investment climate within the supply and value added chain for emerging coconut products;
2. Identify the opportunities and bottlenecks to investment and industry growth, focusing on those that affect the transaction and production-related costs, and governance and policy-related issues;
3. Formulate policy, strategy, and operational recommendations that will address the inadequacies of the coconut-based industries' investment climate; and
4. Present initial findings of the study during the first consultative (stakeholders) dialogue, and the final draft report during the second dialogue (Investors Forum).

THE VALUE ADDED AND VALUE CHAIN CONCEPT

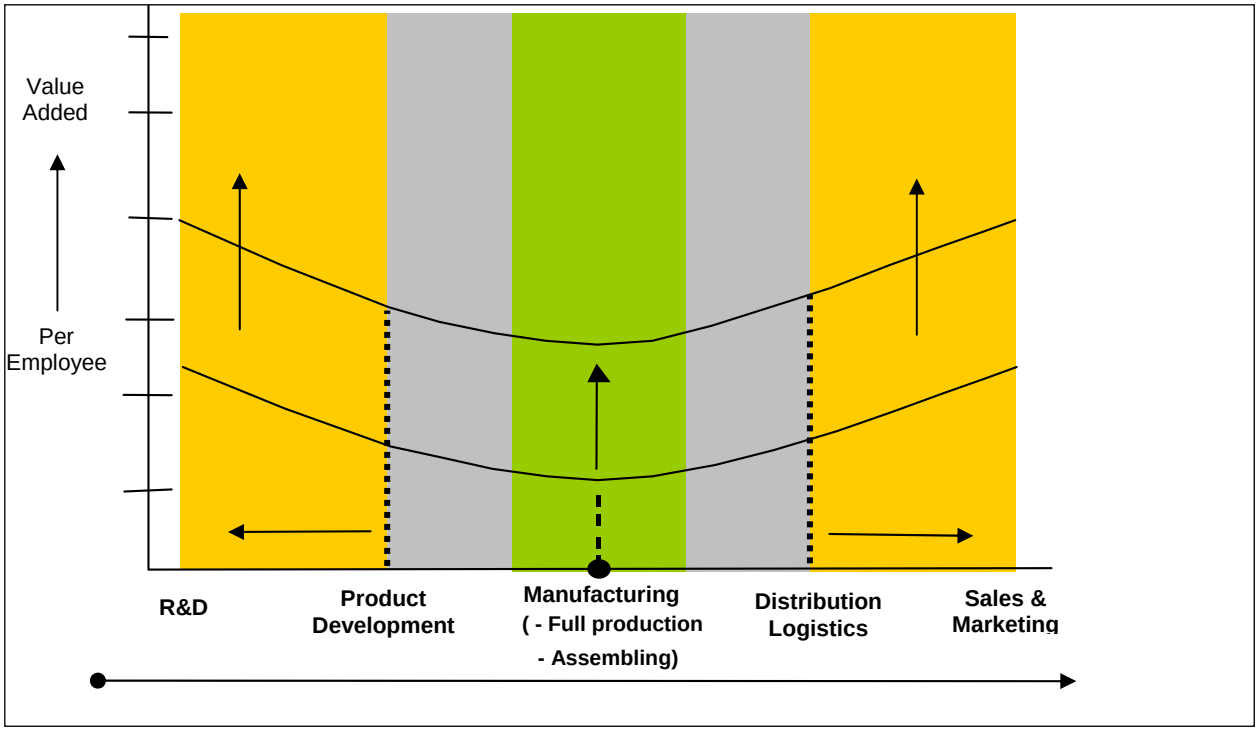
Definition

Value added is the value that a firm or an industry adds to its outputs by using technology, labor, material, and capital. It is the value of total outputs minus the value of inputs in terms of brought-in materials and services. Simply stated, value added refers to the gross revenue less the intermediate costs of production of a firm. It also involves the partitioning of firms' activities covering research and development, product development, processing and manufacturing, logistics, transport and distribution, and finally, sales and marketing functions that determine the optimum value added within the value chain system.

The Value Chain Framework

Within the value chain, opportunities for expanding value added activities means horizontal movement along the chain while the prospects for increasing productivity (value added per unit of inputs, like labor, land, capital, technology) means vertical upward movement or "lifting up the chain."

Figure 3.1 Supply and value added chain framework



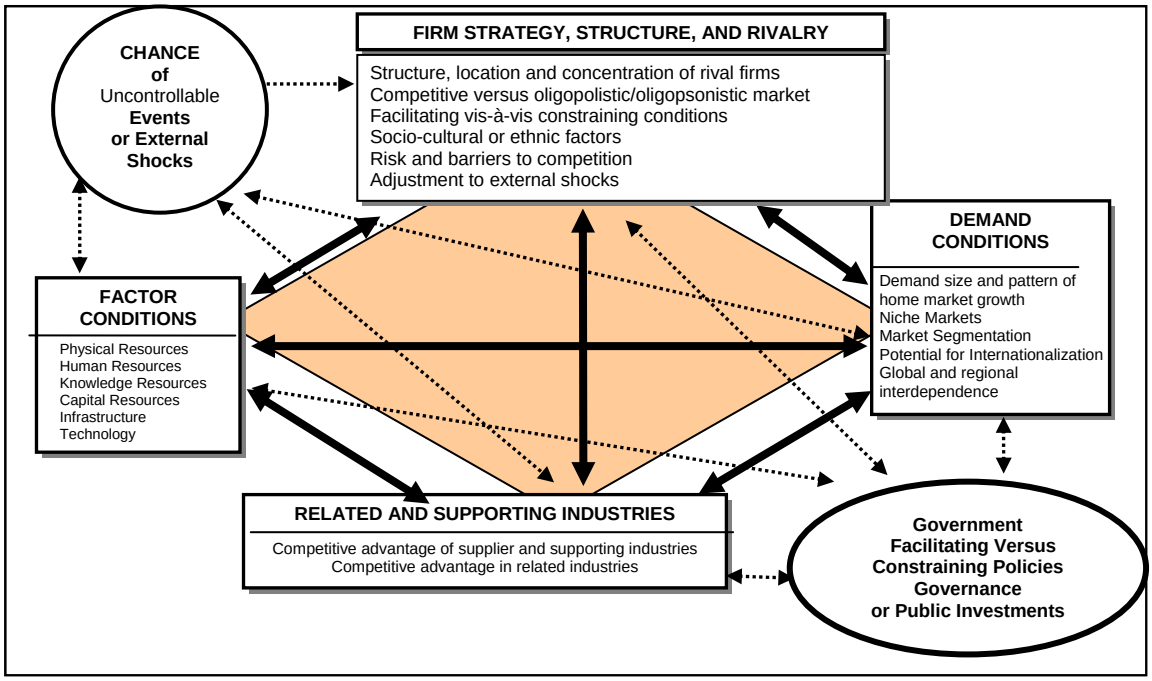
Source: Villegas et al. (2001).

DETERMINANTS OF NATIONAL COMPETITIVE ADVANTAGE AND INVESTMENT CLIMATE

In his model, Michael Porter argued that the national competitive advantage is well determined by a complete diamond system that impacts on the investment climate within the supply and value-added chain consisting of the following components (Figure 3.2):

- *Factor conditions (or economic foundation)* associated with macroeconomic fundamentals, infrastructure, technology, and relative comparative advantage in terms of physical, capital, human, and knowledge resources;
- *Demand conditions* relating to the size and pattern of home, global, and niche market opportunities;
- *Firm strategy, structure and rivalry* within the core industry system or focal industries consisting of raw materials, primary processing, and, finally, secondary or tertiary manufacturing;
- *Related and supporting industries* consisting of suppliers and service providers to the core industry system;
- *Role of government and institutions* could either be facilitating or constraining policies as well as effective or ineffective governance; and
- *Chance conditions* that refer to uncontrollable events (1990 Mount Pinatubo eruption, 2004 Tsunami disaster along Indian Ocean countries); external shocks (1997 Asian Financial Crisis), and technological breakthroughs (genetically modified organisms, biotechnology, HIV/AIDS cure or cancer drugs).

Figure 3.2 The complete diamond system: determinants of national competitive advantage and investment climate

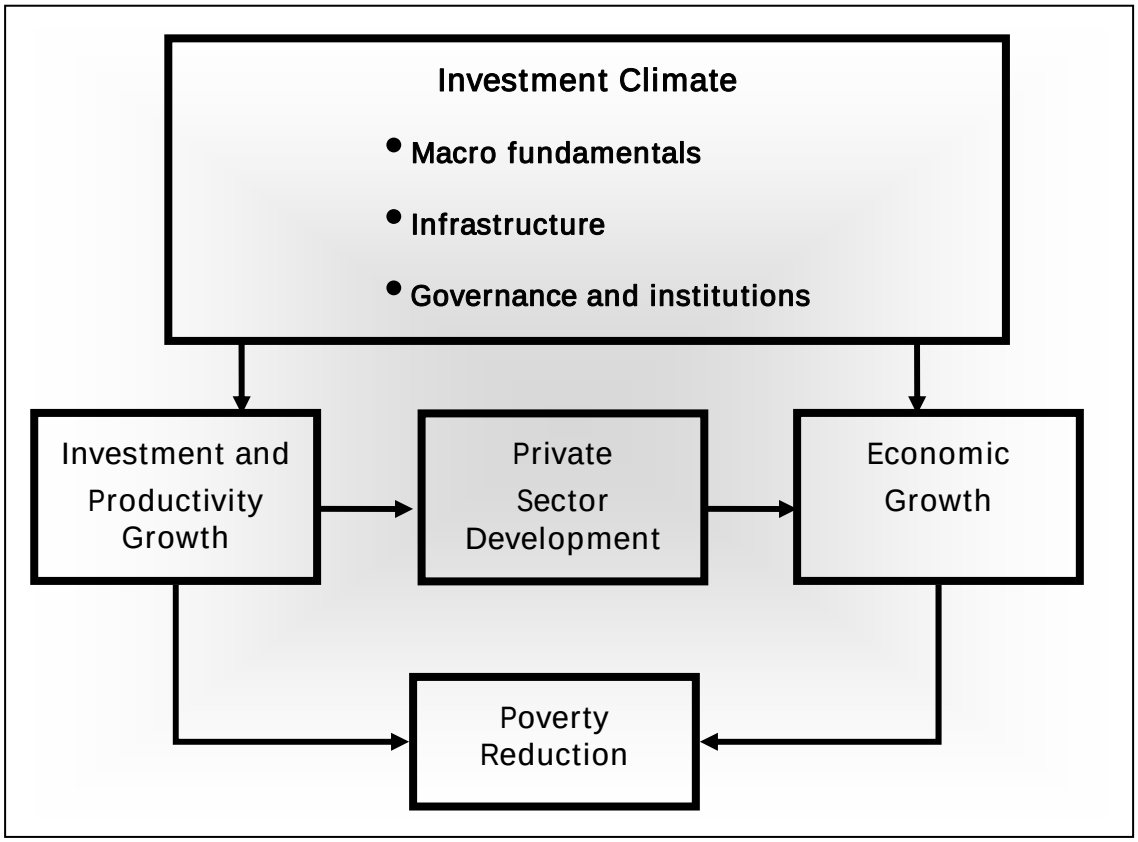


Source: Porter (1990).

The Asian Development Bank Investment Climate Paradigm

The interactions and linkages between and among the determinants or components of Porter's complete diamond system will largely influence the abovementioned investment climate environment. Thus, investment climate is basically the policy, institutional, and behavioral environment, both present and expected, that influences the returns and risks associated with investment (Stern 2002 as cited in ADB 2004). It is a set of location-specific factors shaping the opportunities and incentives for firms to invest productively, create jobs, and expand business operations (World Bank 2003). As advocated by the Asian Development Bank (ADB), the investment climate is largely affected, favorably or unfavorably, by macro fundamentals, infrastructure, as well as governance and institutions that in turn lead to (or not) investment and productivity growth through private sector development and investment and finally, resulting in socioeconomic growth with equity and reduction of poverty and food insecurity (Figure 3.3).

Figure 3.3 Investment climate vis-à-vis productivity growth and poverty reduction

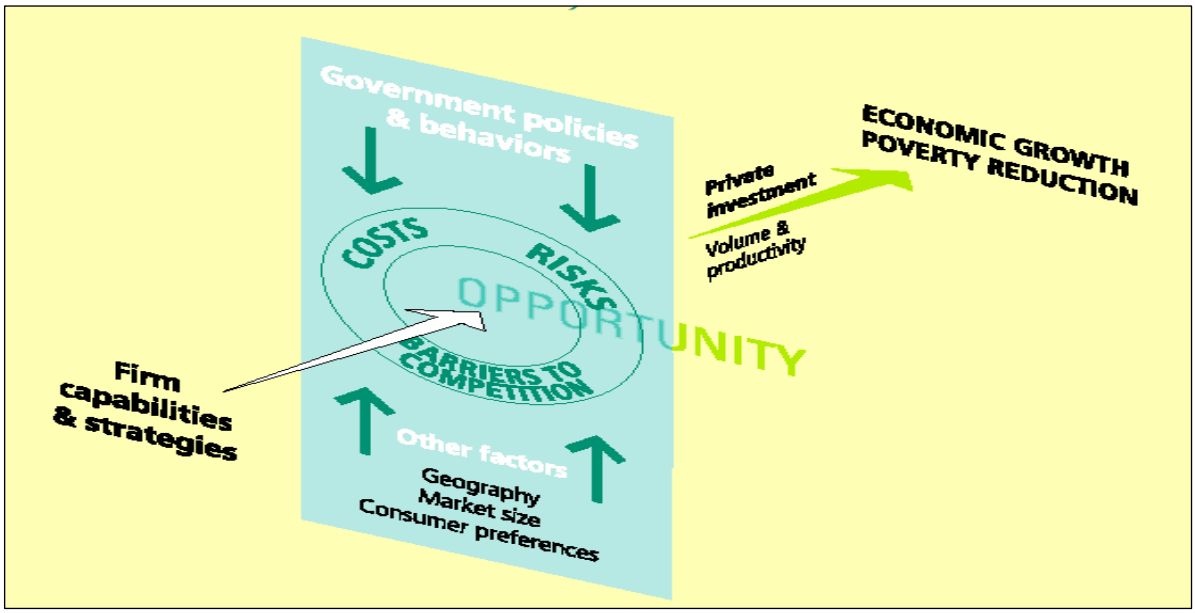


Source: ADB (2004).

The World Bank Investment Climate Model

Meanwhile, in the World Bank's Investment Climate Paradigm, firms or companies are the starting point of the framework with the horizontal plane representing the investment decision of firms (Figure 3.4). The firms come to a decision to explore product and market opportunities and overcome investment weaknesses and threats with different capabilities and strategies. The volume and productivity of the resulting private firms' investments contribute to economic growth and poverty reduction. A good investment climate embraces all firms, not just large or influential companies or entities, and serves society as a whole rather than just the firm.

Figure 3.4 World Bank's investment climate paradigm



Source: World Bank (2005).

The vertical plane represents the investment climate in terms of public policies and governance behaviors as well as geography (comparative advantage of location), market size (home, niche and global), and customer preferences. The government policies and behaviors heavily influence the investment decision of firms. There are major factors that shape opportunities and incentives for firms to invest, wherein the government will have either a strong or a weak influence depending on its first-order implications on costs, risks, and barriers to competition between and among firms. Table 3.1 presents some of these government policies and behaviors that affect the investment decisions of firms.

Table 3.1 Government policies and behaviors vis-à-vis investment decisions

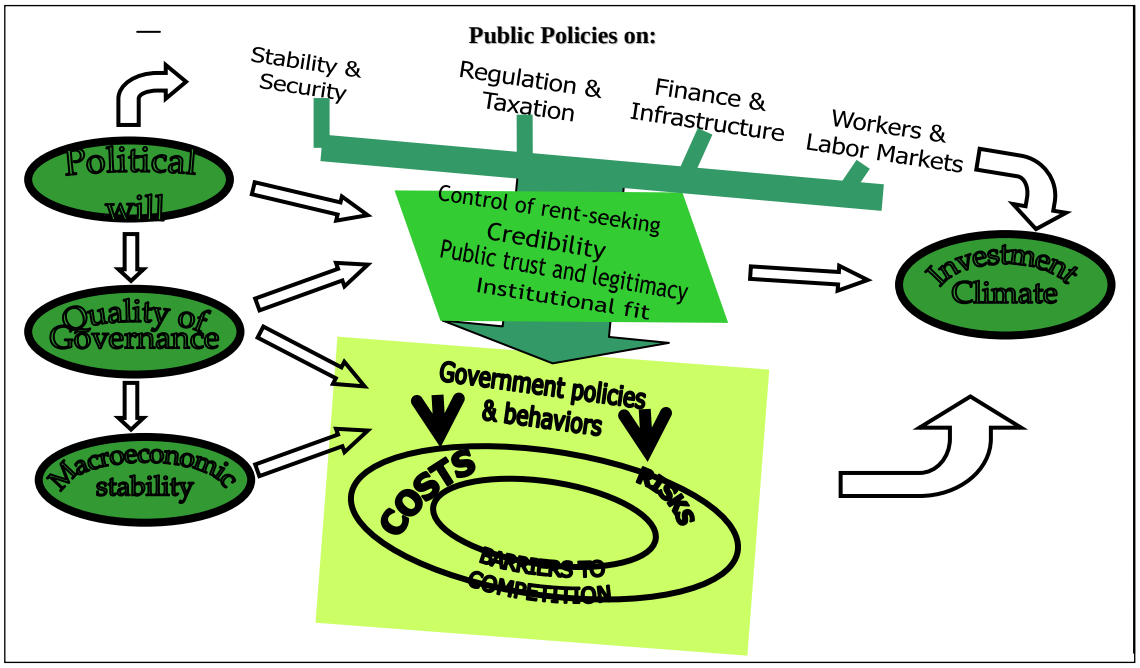
	Factors that shape opportunities and incentives for firms to invest	
	Government has strong influence	Government has less influence
Costs	• Corruption (bribery, extortion) • Taxes • Regulatory burdens, red tape • Infrastructure and finance costs	• Market-determined process of inputs • Distance to input and output market • Economies of scale and scope associated with particular technologies
Risks	• Policy predictability and credibility • Macroeconomic stability • Rights to property • Contract enforcement • Expropriation	• Consumer and competitor responses • Technological advances • External shocks • Natural disasters • Supplier reliability
Barriers to competition	• Regulatory barriers to entry and exit • Competition law and policy • Functioning finance and market • Infrastructure	• Market size and distance to input and output markets • Economies of scale and scope in particular activities

Source: *World Development Report 2005.*

Governance and Institutions vis-à-vis Investment Climate

Governance and institutions generally refer to the transparency and efficiency in regulations, taxation and legal system, strong and well-functioning infrastructure and financial system, labor market stability and flexibility, and skilled labor force (ADB 2OO4). The government influences the costs, risks, and barriers to competition of and among firms through formal policies on: (a) stability and security (incidence of crime, theft, peace and order and terrorism issues); (b) regulation and taxation; (c) finance and infrastructure; and (d) workers and labor markets (Figure 3.5). The quality and magnitude of investment climate are influenced by varying modalities of governance and the political will to: (a) control economic rent seeking activities; (b) instill credibility; (c) engender public trust on, and legitimacy of, government institutions; and, (d) secure institutional fit (capacity and commitment of institutions to perform its mandates). Indeed, the commitment and decisiveness of governments to tackle these four interrelated sources of policy failures is the surefire panacea for creating better and competitive investment climate.

Figure 3.5 Governance and institutions vis-à-vis the investment climate



Source: *World Development Report 2005.*

INVESTMENT CLIMATE INDICATORS: GLOBAL REALITIES AND BEST PRACTICES

As indicated in the World Bank's Investment Climate Surveys covering 2002 to 2004, the investment climate indicators included but not limited to: (a) policy uncertainty; (b) corruption; (c) courts or legal system; (d) crime and disorder; (e) regulation and tax administration; (f) finance and access to credit; (g) electricity; and (h) labor.

Highlights of World Bank's Investment Climate Survey

As confirmed by the World Bank's Investment Climate Surveys in 2004 (Table 3.2), the Philippines' only shining factor in the investment climate was labor skills with only less than 12% (only one out of 10) of the 719 surveyed firms reporting it as a major constraint. However, labor regulations (e.g., wage fixing, hiring and firing) were major obstacles to one out of four firms. More than half (50.6%) of the surveyed firms reported paying bribes, with about 4% of sales going to it. This was almost the same for Indonesia but higher in China with 55% cases of bribery and extortion but with less than 3% of sales going to bribery. Almost 4.2% of sales were also lost to crime and disorder in the Philippines with 27% of firms reporting losses from crime and almost 27% of firms reporting crime and disorder as a major obstacle and causing higher costs of doing business. The country also suffered from unpredictable interpretation of policies and regulations (49%), electrical or power outages (42%), lack of confidence in courts upholding property rights (34%), access to electricity (33%%), and tax rates as major constraints (30 percent). Almost 10 percent of sales were lost to power outages. Firms reporting power outages were more severe in India (69%) and

almost similar in Malaysia (41%). In terms of access to loans among the surveyed firms, Malaysia had the most access (57%), followed by China (52%) and India (51%), with the Philippines and Indonesia having only16 out of 100 firms with loans from financing institutions.

Table 3.2 Investment climate indicators: World Bank investment climate surveys

BASIC INFORMATION/ INDICATORS	COUNTRY				
	Philippines	China	India	Indonesia	Malaysia
Survey year	2003	2002/3	2003	2004	2003
Sample size	719	3,948	1,827	713	902
Policy Uncertainty					
Major constraint (%)	29.5	32.9	20.9	48.2	22.4
Unpredictable interpretation of regulations (%)	49.1	33.7	64.1	56.0	..
Corruption					
Major constraint (%)	35.2	27.3	37.4	41.5	14.5
Report bribes are paid (%)	50.6	55.0	..	50.9	..
Average Bribe % of sales	4.0	2.6	..	4.6	..
Courts					
Major constraint (%)	..	..	..	24.7	..
Lack confidence courts uphold property rights (%)	33.8	17.5	29.4	40.8	19.1
Crime					
Major constraint (%)	26.5	20.0	15.6	22.0	11.4
Report losses from crime	27.1	10.4	..	15.6	19.1
Average loss from crime % of sales	4.2	2.6	..	3.1	3.0
Regulation and tax administration					
Tax rates as major constraint (%)	30.4	36.8	27.9	29.5	21.7
Tax administration as major constraint (%)	25.1	26.7	26.4	23	13.3
Licensing as major constraint (%)	13.5	21.3	13.4	20.5	10.9
Management time dealing with officials (% management time)	11	19	15.3	14.6	10.2
Average days to clear customs (Days)	2.8	7.9	6.7	5.8	3.6
Finance					
Major constraint (%)	18.2	22.3	19.2	23	17.8
Small firms with a loan (%)	16.8	52	51.1	16.7	57.3
Electricity					
Major constraint (%)	33.4	29.7	28.9	22.3	14.8
Firms reporting outages (%)	41.6	38	69.2	33	40.6
Losses from outages (% of sales)	9.6	5	11.6	6.1	5.2
Labor					
Skills as major constraint (%)	11.9	30.7	12.5	18.9	25
Labor as regular major constraint (%)	24.7	20.7	16.7	25.9	14.5

Note: Data are based on enterprise surveys conducted by the World Bank and its partners in the year indicated. While the averages are reported, there are significant variations across firms. The data are not intended for the ranking of the countries

Source: *World Development Report 2005*.

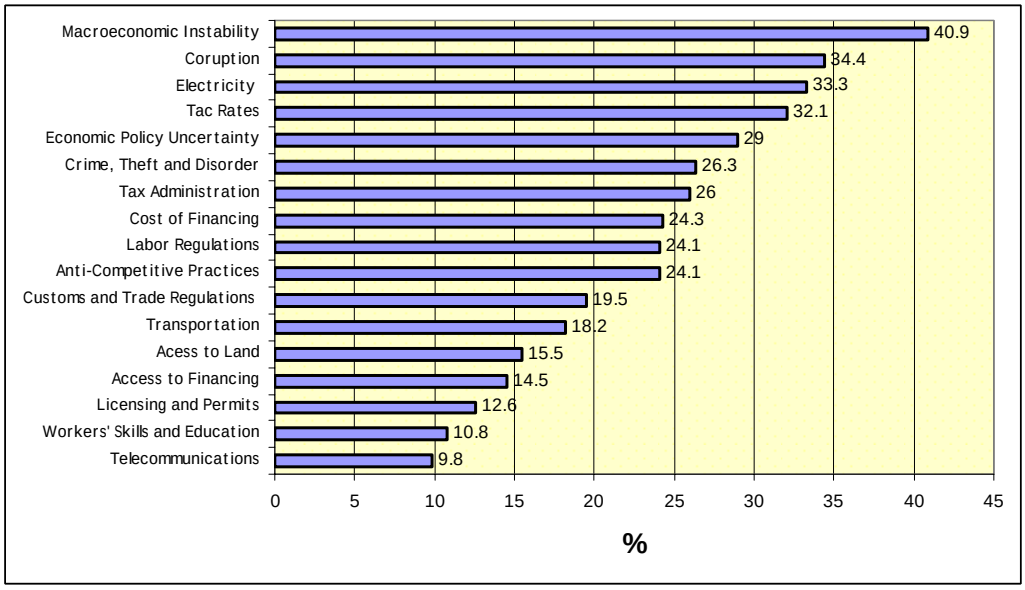
Expert Polls and Other Surveys on Investment Climate

In terms of expert polls and other surveys on investment climate indicators (Table 3.3), the Philippines performed relatively at par with Thailand and China in the intensity of local competition with an index of 5 vis-à-vis the high-income countries' 5.4 index and the middle-income countries' 4.8 index. The same was true with regards to investment profile, with the Philippines getting an index of 10 versus the high-income countries'11.4 and middle-income countries' global index of almost 9. However, the Philippines did not perform very well in the areas of starting a business that involved at least 11 procedures and 50 days to register a business, particularly micro-enterprises and SMEs. It took an average of 380 days to enforce a contract and at least 25 procedures. Worse, it took almost 6 years to resolve insolvency cases in the Philippines vis-à-vis 2.3 years in Malaysia, less than a year (10 months) in Singapore, and 2.4 years in high-income countries.

Micro-level Survey of Investment Climate in the Philippines

At the microlevel survey of the investment climate in the Philippines conducted by the ADB in 2003 (Figure 3.6), the brighter spot was in the better access to competitive telecommunications system, with only less than 10 of the surveyed firms reporting it as a major obstacle. This was followed by workers skills and education (10.8%) and the securing of licensing and permits (12.6%). The major or severe constraints were in the areas of macroeconomic instability (41%); corruption (34%); high cost and outages of electricity (33%); excessive tax rates (32%); uncertainties in economic policies (29%); and high incidence of crime, theft and civil disorder, as well as poor tax administration (26% each).

Figure 3.6 Microlevel view of the investment climate in the Philippines: share of firms rating constraints as major or severe



Source: ADB (2004).

Table 3.3 Investment climate indicators: expert polls and other surveys

BASIC INFORMATION/ INDICATORS	COUNTRIES							
	Philippines	China	Malaysia	Singapore	Thailand	World	Middle Income	High Income
World Bank' Doing Business Project								
Starting a business								
Days (Jan-04)	50.0	41.0	30.0	8.0	33.0	50.8	50.0	27.2
Procedures (Jan-04)	11.0	12.0	9.0	7.0	8.0	9.9	10.6	7.0
Enforcing a contract								
Days (Jan-04)	380.0	241.0	300.0	69.0	390.0	388.3	422.1	280.2
Procedures (Jan-04)	25.0	25.0	31.0	23.0	26.0	31.2	32.6	23.2
Registering property								
Days (Jan-04)	33.0	32.0	143.0	9.0	2.0	81.4	80.4	49.9
Procedures (Jan-04)	8.0	3.0	4.0	3.0	2.0	6.2	6.5	4.7
Resolving insolvency Years Jan-04	5.6	2.4	2.3	0.8	2.6	3.2	3.4	2.0
Investment Profile ICRG 2003	10.0	7.5	8.5	12.0	8.5	8.8	8.7	11.4
Intensity of local competition								
WEF index 2003/04	5.0	5.3	2.3	5.4	5.3	4.7	4.6	5.4
Transparency of gov't policymaking								
WEF index 2003/04	3.7	4.2	5.0	6.2	4.3	3.9	3.5	4.7
Regional disparties of bus. env.								
WEF index 2003/04	2.5	3.3	3.9	5.8	4.1	3.4	3.1	4.4

The aggregates are unweighted averages

ICRG – International Country Risk Guide

WEF – World Economic Forum

Source: *World Development Report 2005*.

Comparative International and National Perspectives on Investment Climate

Compared with other countries, the overall investment climate in China seemed to be much better than the Philippines, except in the availability of skilled and educated labor force, tax rates, and cost of financing. Generally, Bangladesh and Pakistan appeared to be worse off than the Philippines (Table 3.4). While Indonesia appeared to be almost the same as the Philippines, it appeared to be worse off in the areas of macroeconomic stability (50%), uncertainties in regulatory policies (45%), and corruption (37%).

Among the type of firms in the Philippines, business locators in the economic zones appeared to be highly worrisome about the customs and trade regulations (46 %); crime and theft and disorder (46%). Four out of 10 firms reported labor regulations, high cost of electricity, corruption, and macroeconomic stability as major or severe obstacles in doing business in the ecozones. The exporter firms also raised the same issues and concerns as the ecozone operators. The domestic or local businessmen seemed to have coped up with the relatively hostile business climate as the intensity of their constraints perception seemed to be relatively lower except in the areas of macroeconomic instability, corruption, excessive tax rates, and high cost of power where they were in congruence with the ecozone locators and exporters.

Table 3.4 Share of firms rating constraints to operation as major or very severe in the Philippines vis-à-vis international/Asian perspective and by type of firm, 2004

Indicator	International Comparison					Philippines					
						Ecozone		Exporter		Domestic	
	Bangladesh	China	Indonesia	Pakistan	Philippines	Yes	No	Yes	No	Yes	No
Telecommunications	24.4	16.5	9.1	9.2	9.8	23.2	9.0	17.5	7.3	8.6	19.8
Electricity	73.2	28.1	22.3	39.2	33.3	44.1	39.7	39.7	31.2	33.0	35.2
Transport	24.2	19.4	16.4	9.9	18.2	34.2	34.7	24.7	16.1	16.9	28.6
Access to land	27.5	16.3	13.0	20.4	15.5	24.7	15.0	15.4	15.6	15.3	17.2
Tax rates	35.4	34.1	29.5	45.6	32.1	28.4	32.3	32.8	31.9	32.8	26.4
Tax administration	49.8	23.7	23.0	46.0	26.0	33.8	25.5	31.5	24.2	26.1	25.1
Customs and trade regulations	41.9	21.1	13.5	54.5	19.5	46.1	17.9	36.7	13.9	17.0	39.7
Labor regulations	8.3	19.4	23.5	15.0	24.1	44.7	22.9	33.0	21.3	23.1	33.0
Skills and education of available workers	19.3	26.7	18.9	12.7	10.8	20.9	10.2	20.7	7.6	9.5	20.0
Business licensing and operating permits	16.5	15.9	17.5	14.5	12.6	17.5	12.3	15.0	11.8	12.4	14.0
Access to financing	41.5	24.1	17.5	37.5	14.5	15.7	14.4	12.2	15.2	14.9	11.4
Cost of financing	49.8	21.6	28.5	42.6	24.3	29.3	24.0	24.8	24.1	24.8	20.2

Regulatory policy uncertainty	44.4	28.0	48.3	40.1	29.0	35.7	28.6	33.9	27.5	28.6	32.4
Macroeconomic instability	38.6	26.0	50.1	34.4	40.0	43.7	39.8	40.9	39.8	40.6	35.8
Corruption	57.8	22.4	37.3	40.3	34.4	39.6	34.1	44.9	31.0	33.3	43.3
Crime, theft and disorder	39.2	15.7	22.0	21.5	26.3	46.0	25.1	35.4	23.4	25.5	33.2
Anticompetitive or informal practices	29.3	17.6	17.3	21.3	24.1	29.7	23.8	28.7	22.6	24.4	21.3

Source: ADB (2004).

STRENGTHS AND WEAKNESSES ANALYSIS ON THE SUPPLY AND VALUE ADDED CHAIN

The strengths and weaknesses analysis (SWA) are the first two segments of the Strengths, Weaknesses, Opportunities and Threats (SWOT) analyses that highlight the favorable factors as well as inadequacies in the investment climate given the strengths and constraints at the firm or institutional level, in the supply and value added chain. The SWA will focus on the firms' internal capabilities and weaknesses and assess their responses to varying product and market opportunities as well as their aversions to risks, costs, and barriers to competition. How do they respond to macroeconomic and sectoral policies affecting the stability and security of their business, regulation and taxation, finance and infrastructure, and labor and workers market? What is the quality of governance with respect to the presence of, and their vulnerability to, economic rent-seeking environment; in instilling credibility and securing fitness of institutions; and in engendering public trust on, and legitimacy of, government institutions? Such SWA will cover research and development and extension, product development, processing and manufacturing, logistic, transport and distribution, and sales and marketing.

Research and Development and Extension

In terms of research and development and extension services (R&D&E), there are plenty of highly trained manpower, both PhD and MS degree holders, in state universities and colleges, national government agencies (NGAs), and offices and agencies in the private sector. There are more than 382 highly trained research professionals, 76% of whom are from the University of the Philippines Los Baños (UPLB) (116), the Philippine Coconut Research and Development Foundation (PCRDF) (111), and the Philippine Coconut Authority (PCA) (63). There were also research initiatives on emerging coconut products coming from the Philippine Council for Agriculture, Forestry and Natural Resources Research and Development (PCARRD), Philippine Council for Industry and Energy Research and Development (PCIERD), PCA, PCRDF, and private business sectors. In Aragon's study (1998) reported by PCARRD, she cited more than 329 completed coconut researches from 1988 to 1998; most of these researches came from UPLB and more than half the number was done by PCA.

However, there has been limited government support to R&D. The average annual R&D expenditures for coconut, which had a 5.38% share in gross value added (GVA), was only PhP53 million from 1995 to 1997, compared to carabao that had only 0.77% share in GVA but with PhP136 million average annual R&D expenditures. Aside from funding, there is also a seriously uncoordinated sectoral focus (vis-à-vis clustering and value chain approach). There also exist weak coordination and linkages between PCA, PCARRD, PCIERD and PCRDF, weak commercialization of promising "laboratory-grade technologies" in terms of funding and expertise; and limited, unfocused, and seriously underfunded R&D on the industrial, environmental, health and nutrition aspects. PCA as the lead development and regulatory agency of the coconut industry has been handicapped by the removal of the industrial and commercial R&D functions. There is, however, a strong opinion from former executives of PCA that the agency has distinctive competence in agronomic and germplasm research and thus, they must continue to focus and aspire to excel in that area.

Because of these overall constraints in coconut R&D&E, no wonder the Asian Development Bank Survey (ADB 2004) reported that of the 716 firms, only one university and public research institution was the most important source of technology. Three universities were also ranked second most important source of technology. Surely, addressing the weaknesses in R&D priorities and focus will result in more technology generation and commercialization from universities and national public research institutions. The main issue relates to the fast conversion of "laboratory-grade" technologies to "investment and commercial grade" product innovations.

Product Development

In terms of emerging development of the product, there are available homegrown research technologies like the high-quality coconut functional foods (virgin coconut oil or VCO, skim milk, coco meal, coco flour), biodiesel or coco methyl esther (CME), activated carbon, geotextile, organic plant media (coco peat), as well as imported coir-based technologies. There is a high degree of complementarily, versatility, and multiplicity of mutually reinforcing and competitive coconut products. However, they are mostly being handled as stand-alone products rather than optimally complementing and value-adding products that have synergistic impact on enterprise profitability and viability.

Results of the experiment conducted by UP Mindanao (Soriano-Cruz M.A. et al. 2004) showed that the better method of biodiesel production is the two-stage transesterification process. A mean yield of 30.08–90.33% was obtained from the one-stage transesterification or alcoholysis, while 86.79–98.74% percent from the two-stage transesterification process at 65^0C.

On the other hand, there is limited promotion and commercialization of emerging coconut products with the alleged erosion of public trust and credibility of government institutions, such as the Department of Agriculture (DA)/PCA, Philippine Commission on

Good Governance (PCGG), Intellectual Property Office (IPO), Department of Trade and Industry (DTI), Department of Interior and Local Government (DILG), and the Philippine National Police (PNP). This is particularly true with respect to the perceived mishandling of coco levy funds, poor enforcement of product quality systems and intellectual property rights, existence of barriers to trade and competition, and worsening poverty and peace and order situation in the coconut-producing areas.

For VCO and functional food products, especially those for exports, there is a lack of harmonized product standards vis-à-vis the Hazard Analysis Critical Control Point (HACCP), Good Manufacturing Practices (GMP), International Standards Organization (ISO), and Codex Alimentarius, the product quality specifications being prescribed by the World Health Organization and Food and Agriculture Organization of the United Nations. The industry also lacks the technology that could detect counterfeit products to maintain its quality and remain competitive in the world market. In addition, 80-85% of the industry's total exports are in the form of coconut oil (CNO) and copra that are low valued and aflatoxin and poly-aromatic hydrocarbon (PAH) infected. In the latest record of PCA (2005), the volume of CNO that had been exported was 959,150,000 metric tons (MT) with an FOB value of US$577, 789,000 and for copra, 4,000 MT with an FOB value of US$17,000.

Manufacturing and Processing

In terms of product quality standards in the manufacturing subsector, there are accessible global practices in processing and manufacturing set under the HACCP, ISO, GMP, and Codex Alimentarius protocols. However, these national product standards are not fully harmonized with these globally mandated protocols. In line with these product quality standards, the coconut-based industries is blessed with a good supply of well-educated and highly trained chemists, nutritionists, engineers, technicians, and food/nonfood product technologists. They have the technical credentials to monitor the proper processing and manufacturing of emerging coco products, observe established quality systems protocols, and utilize support infrastructure for product testing and certification. There are also available locally fabricated processing machineries and equipment.

The manufacturing subsector suffers from the slow transfer and adoption of mature and "commerciable" processing technologies and the nonconversion of laboratory-grade technologies into bankable and market-oriented products.

Registration of coco SMEs is constrained by the nonfunctional and nondecentralized one-stop business registration shops at the DTI/SEC, DOH/BFAD, PCA, and LGU levels. The processing subsector is also handicapped by the high cost of labor (US$5-6 per day or PhP250-P300 per day) due to the mandated minimum wage law by the Regional Wage Board under Republic Act No. 6715 (Presidential Decree No. 442 - Labor Code of the Philippines). In contrast, Vietnam and China have very cheap labor cost (US$1.0 per day), along with Indonesia (US$3.0 per day) and Thailand (US$3.0 per

day). There has also been very limited implementation of the Barangay Microbusiness Enterprise Act (BSME Act) on emerging coconut products due to the limited access to technology, market and finance, and entrepreneurial constraints in the countryside.

Moreover, the dominance of micro ("kitchenomics approach) and small SME type of emerging coconut products is quite pervasive with small volume of outputs and diseconomies in processing, logistics, and distribution operation. There is very limited access to, and high cost of, capital loans with only 9% (8% for small and 17% for medium) of business finance coming from banks. Less than 2.5% of LandBank's total loan portfolio of over PhP115 B went to agriculture, agribusiness, and SME lending (PhP2.5 B).

Finally, the uncertainty in landownership and tenurial security and restrictions on access and disposal of land under the agrarian reform law discouraged manufacturing and processing investment in coconut-producing areas (resulting in reduction of collateral value and limitation of borrowing capacity for fixed and operating capital).

Logistics, Transport and Distribution

One of the strengths of the country's investment climate is the presence of a strong telecommunications infrastructure. This partly enables the emerging coconut products to be easily accessed and distributed into the domestic and international market. There exist an increasing and improving number of service providers in logistics, transport, and distribution chain management, including electronic commerce and procurement systems. The Strong Republic Nautical Highway offers an alternate route for efficient flow of agricultural products. Also, the logistics chain is blessed with the presence of specialized transport, handling and quality preservation technology with the presence of specialized retail, wholesale, and bulk handling containers, like the packaging and transport of the VCO using food-grade drums and hygiene containers.

Infrastructure has always been a problem in the Philippines. It slows down the transportation and access to product markets, especially in the rural areas where most of the coconut trees are located. Since most of the raw materials are concentrated in Southern Luzon, Mimaropa, Bicol, Eastern Visayas, Western and Southern Mindanao, the weak connectivity to processors and distributors was further complicated by the lack of effective linkage with supporting supplier and logistics services providers. Still on the distribution chain, transporting coconut products is adversely affected by Spanish colonization old *cabotage* law and its protocols (overseas shipping companies cannot handle domestic shipping services), that made local transportation cartels adopt oligopolistic pricing and control, resulting in high handling and transport cost. Worse, the Distribution Management Association of the Philippines (DMAP) reported the existence of corruption, cartel, and "regulatory capture" (connivance and conflict of interest among regulatory agencies e.g., Philippine Ports Authority (PPA), Maritime Industry Authority, etc.) in the transport industry. For example, the PPA gets 10 percent of whatever increase in port handling and stevedoring fees and charges. The "roll-on-roll-off" (RORO)

facilities were also considered underutilized or nonoptimized and uncoordinated and further complicated by the lack of backhaul load. The highly regulated, abused, extorted, and over-penalized trucking and hauling business also contributed to the high cost of doing business and unprofitable operation. Network of LGU ordinances, like towing fees, fines, *tongs*, penalties and regulations such as truck ban, color coding, and anti-overloading regulations impede the better and smoother operation of cargo vessels be it land, air, or water. Allegedly, corruption and extortion, as well as maze of molesting and costly rules and regulations had been raised by at least eight truckers and logistics and distribution industry associations. As published in the *Manila Bulletin* on January 15, 2006, the industry associations are the Alliance of Concerned Truck Owners and Organization (ACTOO), Integrated North Harbor Truckers Association (INHTA), United Truckers Association of the Philippines (UTAP), Unyon ng Truckers sa Pantalan (UTP), MIP Truck Operators Association (MIPTOA), Asosasyon ng mga Operators at Dispatchers sa Pantalan (AODP), Surplus Importers and Brokers Associations, Inc. (SIBA), and Fruit Importers and Brokers Association, Inc. (FIBA).

Sales and Marketing

With its 85 million population as of 2005, the Philippines has a huge homegrown and domestic market for emerging coconut products. The health and nutrition, energy, industrial and cultural, environmental, and nutra/pharmaceutical attributes of coconut-based products could be easily promoted nationally and globally given the easy access to tri-media such as broadcast, print, visual, and information (Internet) technology.

Export rates have grown significantly during the last 10 years (1995-2004) for products like coir (processed) (10.4%), coir and waste (28.4%), activated carbon (9.7%), and coconut milk (13.2%). VCO had the most significant growth rate of 368% from 2001 to 2004. These considerable improvements in market demand occurred despite the weak and uncoordinated global sales and promotion efforts.

Local demand for coco-biodiesel (coconut methyl esther or CME) will be boosted by Memorandum Circular No. 55 (February 9, 2004) of the Office of the President directing all agencies and instrumentalities of government to use 1% CME by volume in their diesel fuel requirements. Memorandum Circular No. 25 (September 2, 2003), on the other hand, prescribes the use of coco peat and other coconut husk materials in farming and horticulture as effective soil conditioner and water moisture conservator.

Despite the availability of technology and strengths of the potential market, limited knowledge and asymmetric information on the health, food, nutra/pharmaceutical, industrial, agricultural, and environmental values and huge benefits of coconut products remain a major obstacle to market development. This is further complicated by the inadequate supply of highly knowledgeable and especially trained marketing and sales promotion and manpower in the global and home market. As reported by de Leon et al. (2002), in the global trade involving coconut products, high rejection rates were caused by unspecified process (61% or 311 cases of export rejection; labeling, 21.5%; additives,

13.5%; microbial hazards, 3.5%; and filth, 0.3%). This could be partly explained by the nonharmonization of liberalized and export-oriented trade under Executive Order (EO) 1016 vis-à-vis compliance with product quality standards and nonscreening of counterfeit product. Due to the existence of counterfeit coco products (e.g., nata de coco, coconut pastries, VCO) and incidence of export rejection, there is an urgent need to revisit the intent and purposes of Executive Order (EO) 1016 vis-à-vis product quality systems compliance on globally established protocols. EO 1016 dated March 25, 1985 concerns with the withdrawal of the inspection, commodity and export clearance requirements on Philippines exports except those of garments, sugar, banned items for export (logs, copper and coffee to mention a few).

Close to 15% of food and processing firms considered customs and trade regulations as major or severe constraint (ADB Survey 2004) involving 14 to 22 days in customs clearing for imports and 8-15 days for export.

OPPORTUNITIES AND THREATS (OTA) ANALYSIS ON THE SUPPLY AND VALUE ADDED CHAIN

The second segment of the SWOT Analysis is the Opportunities and Threats Analysis (OTA). The analysis focuses on the existing opportunities that have to be tapped and threats that have to be addressed and overcome in the supply and value chain of the emerging coconut products. What are the considerations that the government and other institutions have to focus on to fully explore the potentials of the emerging coconut products? Are they aware of the external threats and impediments that have been confronting the industry? What are the opportunities for a better investment climate?

Research and Development and Extension

Great opportunities abound the R&D&E subsector with the existence of the PhP120 billion Coco Levy Fund that is available yet still inaccessible. According to CIIF executives, the liquid assets could easily come up to about PhP64 billion while the annual dividends amount to over PhP1.0 billion. The dividends and the principal could only be used for investments in R&D, credit assistance to coconut farmers, and as equity in decentralized integrated coconut-based industries, including provision of insurance coverage, scholarships and other social amelioration benefits and amenities to the coconut farmers and their families. Initiatives on R&D&E could be done through the joint government-academe-industry-NGO-private sector collaboration that must proceed beyond “sectoral turfing approaches” and focus on the germplasm and agronomic improvement and coconut replanting, including enhancement of the supply and value added chain. Pro-active R&D&E could effectively serve as a powerful value chain shifter that will capitalize on a very high commercial value of coco products as food, energy, industrial, agricultural, environmental, health, nutraceutical, pharmaceutical and oleo-chemical products.

However, with a high incidence of food insecurity and poverty, 90% of coconut farmers are still living below the poverty line resulting in peace and order and terrorism problems especially in the major coconut-producing areas. This brings to fore the need for a pro-poor R&D&E agenda that will address poverty issues in coconut- producing areas.

Given the R&D breakthroughs, intellectual property rights for these achievements are still unsecured resulting in dilution of incentive of inventors and scientists to innovate. Scientists and inventors are especially nonmotivated when these technological innovations are being stolen through intellectual piracy and commercialized by competitor countries. These have happened to the *macapuno* nut, nata de coco, and coco milk commercialization technologies. They also complained about high registration fees being charged by the Intellectual Property Office (IPO) and the longer time involved in securing patents and copyrights.

Product Development

The versatility and comparative advantage of coconut as "the tree of life" offers a wide multiplicity of food and nonfood uses. The multiuses of its parts offer great opportunities for varied utilization from the unopened bud, inflorescence, meat, water, husk, shell, trunk, leaves, petiole, rachis, roots, and bud. These can be classified as functional foods or feeds, industrial, agricultural and environmental uses. Access to advanced global technology will create new business opportunities in the value chain. Finished results of commercialization R&D and proven best practices and traded products from other countries may be locally tested and commercialized. VCO, for example, has high potentials as cures for HIV, AIDS, SARS, and bird flu. Another opportunity for the VCO is the US Food and Drugs Administration's (US FDA) warnings against, and full disclosure on, high levels of transfatty acids (TFA) contents of soybean, corn, and rapeseed (canola) oils. With these stringent ruling on proper TFA disclosure in food labels, new market opportunities in the US will definitely shift preference to coconut oils that have no TFA unless hydrogenated.

One of the major threats facing the industry is the declining volume and productivity of coconut coupled with limited replanting. This implies long-run inadequacy of raw materials for these emerging coconut products from more than 300 million coconut trees, of which about 25% (75.2 million) are senile and another 15- 20% are nutrient deficient (45-60 million trees) with very low level of productivity. Thus, the commercialization of newly developed or emerging coconut products must consider the planting or re-planting of coconuts (i.e., replacement of senile trees and balanced fertilization in nutrient-deficient areas) to ensure the long-term supply of raw materials for coconut processing.

Further compounding the threats include the increasing hectarage and better product productivity of selected elite clones in Indonesia, Malaysia, Thailand, Vietnam,

and India, and the higher public investment in R&D commercialization and new products developed by these competitor countries

Manufacturing and Processing

In terms of manufacturing and processing, great potentials exist for developing secondary and tertiary processing using VCO, cochin, coco fiber, and coco peat as intermediate raw materials. Joint agribusiness ventures with foreign direct investors could be forged to encourage them to invest into new primary processing and manufacturing technologies. Foreign direct investors (FDIs) could focus on the investment potentials of upstream and downstream industries in accordance with RA 7042, as amended by RA 8179 in 1996 (Foreign Investment Act of 1991). These FDIs could invest up to 100% in strategic enterprises (except for ventures that are in the negative list) with no restriction on export-oriented enterprises.

The major threats included:

- Increasing competition for cheaper priced processing and manufacturing machineries, equipment, spare parts, and supplies from China, Thailand, Taiwan and Korea;
- Weak machinery and equipment fabrication and supplier industries, particularly for downstream industries (secondary and tertiary processing);
- Higher rates of EVAT (12%), corporate income taxes (35%), and LGU levies (business permits, garbage fees, local realty taxes and fees). More than 35% of firms in the food processing business complained of very high tax rates;
- Recurrence of "nata de coco" product quality blunder arising from adulterated and counterfeit products;
- Poorly developed rural financial market (less than 17% of SMEs have access to loans);
- High incidence of power outages (brownouts) and high losses from outages (10% of sales, World Bank Investment Climate Survey; 8% of production, ADB Survey);
- Bottlenecks in water supply (7% losses in food processing industries);
- Low levels of gross domestic investment (19.3% of GDP in 2002) and declining net foreign direct investment (FDI) from 2.2% of GDP in 1993-96 to 1.4% (US$1.11 billion) in 2002 (ADB 2004) vis-à-vis Vietnam with 4% of GDP (US$1.4B)

Logistics, Transport and Distribution

Enormous opportunities abound in terms of lessening the high cost of logistics, transport, and distribution once the utilization of the nautical highway, RORO with backhaul provision, the Philippine National Railway (PNR), and other transport and cargo handling facilities are optimized. There is also a potential high return on FDI on this specific activity. Financing logistics, transport, storage, and distribution chain can

also be accessed through the Development Bank of the Philippines and the LandBank of the Philippines. Uses of emerging coco products like cochin oil for coco methyl esther (CME) or coco ethyl esther (CEE) as biodiesel and oil lubricants can also be potentially attractive investment opportunities particularly under the two-stage transesterification or alcoholysis method of biodiesel production.

However, there is a weak and underdeveloped logistics and distribution chain that threatens both homegrown and export markets. The poor state of logistics, roads, ports, and other transport infrastructure result in uncompetitive transport, storage, and handling costs. Only 20% of roads are paved, with very limited farm-to-market roads particularly in rolling, hilly, and mountainous coconut-producing areas. In the ADB investment climate survey, more than 55% of the firms reported that roads and infrastructure were poor. The high cost of power and energy in the Philippines remains a major stumbling block to investment. The industrial power rates in the country are quite high (8.09 US cents per kilowatt hour versus the 2.4 US cents in Thailand and Indonesia in July 2002). The Philippines also suffers from the high regulatory costs of doing business and prohibitive transaction costs like exorbitant port, handling and stevedoring charges, bunker fuel adjustments, transport tolls, *tongs*, and export processing fees. The presence of alleged "cartel, corruption and regulatory capture" within the sea transport and logistics chain has to be frontally addressed. The alleged oligopolists and oligopolistic pricing cartels need to be dismantled.

Sales and Marketing

With the liberalization of global and regional trade, trade protection and domestic subsidies have been slowly reduced, including the removal of tariff and nontariff barriers. There are huge emerging markets in China, South Asia (India, Pakistan and Bangladesh); Eastern Europe and Russia and its Commonwealth Independent States and even Brazil that have geopolitical balance implications. In terms of sourcing of coconut products as a strategic industrial or pharmaceutical raw material, for example, the ASEAN's Early Harvest Program with China will enable market access and entry of coco-based products to China at zero-tariffs. In these emerging markets, there will be also an increasing demand for emerging coco products as functional food supplements, nutraceuticals, pharmaceuticals, planting media, and erosion control. Substitution for petro-chemicals products (like biodiesel or CME or CEE fuel lubricants) is also a highly promising opportunity in light of sourcing prices of fossil-based fuels.

Some serious market obstacles or barriers to trade include (but are not limited to) the following:

- A major threat looming on the sales and marketing of these emerging coco products is the anti-coco oil as "health hazard" campaign by soybean, corn, and canola lobby groups in the USA and EU, respectively. There is an anemic and uncoordinated government-private sector effort on forging bilateral trade agreements on emerging coconut products and counteracting some tariff and nontariff technical barriers to trade (TBT) and stringent sanitary and phytosanitary

measures being imposed by importing countries (e.g., aflatoxin, alleged health hazards, PAH and export rejection, due to noncompliance with global standards and product protocols);

- Very limited public investments and funding for market development and government-private sector sales blitz and participation in global trade fairs and marketing/investment "road shows";
- Stiff competition with other vegetables oils (olive oil, palm oil, soybean oil, canola oil, and corn oil) with coconut oil being a minor vegetable oil (less than 3% of globally traded vegetable oil);
- Repetition of the "nata de coco" marketing fiasco due to malpractices in production and quality management; and
- Laxity in enforcement of product quality standards and nonweeding out of counterfeit products from the market (trade-off of EO 1016).

OVERALL SWOT ANALYSIS OF VALUE CHAIN OF EMERGING COCONUT PRODUCTS

Given the results of the SWA and OTA in the preceding sections, a summary presentation on the value chain approach to overall SWOT analysis is shown in Figure 3.7.

Generally, the supply and value added chain (SVAC) components, comprising of core industries, starting with the upstream or raw material industries (agricultural component) leading to primary processing and downstream secondary and tertiary manufacturing (industrial component), as well as the logistics, transport and distribution chain are considered generally weak with below par connectivity and linkages between and among these component parts of the potentially potent coconut-based agro-industrial cluster.

There are some strong components, however, like a few well-managed plantations (e.g., plantation service area of Filipinas Kao Company in Misamis Occidental) and some Agrarian Reform Communities (with copra yield of 2 to 4 tons per hectare) that received technical assistance from DAR and PCA and some donor institutions (World Bank, ADB, EU, UN and bilateral and agencies). The market component is also considered strong both in the domestic market with 85 million population and in the global export market with more than 6 billion people who will benefit from the wonders of coconut products (health and nutrition benefits, environmental, industrial, energy, pharmaceutical, and nutraceutical uses and impact). Product development is quite advanced with respect to primary processing technologies (functional foods, industrial goods, agricultural, and environmental products). Product development also includes some downstream processing such as soap/shampoo and wellness industry, animal feed, and geotextile, as well as the emerging oleo-food and oleo-chemical industries.

What remains very problematic is the market development and sales promotion component, and its weak linkages to product development and logistics and distribution chain. The supplier industries for the raw material production, primary processing, and

secondary/tertiary manufacturing subsectors require strengthening, including the support services from national and local government units, research and development and education/extension (training) institutions, private sector professional and trade organizations, and financing institution.

In the final analysis, the existence of an unhealthy investment climate in the coconut-based industries and the pervasive weaknesses and bottlenecks in the supply and value added chain consequently result in the prevalence of pervasive poverty and food insecurity in the coconut-producing areas where community welfare and peace and order situation are indeed worsening.

VALUE ADDED AND VALUE CHAIN ANALYSIS

Indicative Average Value Added of Coconut Product

A quick analysis of the indicative gross values based on the average unit prices in 2000-2004 of traditional and emerging coconut products revealed that VCO (US$4,063.75 per MT), coco milk powder (US$2,722.48), liquid coco milk (US$1,276.12), and geotextile (US$952.38 per ton) were the most high valued coco products in the global market. The value of VCO was almost 10 times greater than coconut oil (US$417.88) and 20 times greater than the value of copra (US$208.63). Imperatively, structural changes must take place in terms of veering away from the relatively low-valued coconut oil and copra and shifting the coconut processing more into high-value emerging coconut products, including oleo foods and oleo chemicals. As shown in Table 3.5 and Figure 3.7, the lowest valued coco products were coco water, copra meal (by-products), unhusked (US$31.62 per ton), and dehusked coconuts (US$119.05 per ton). This translates to only PhP1.66 per kilo of unhusked nut vis-à-vis PhP6.25 per kilo of dehusked or whole nuts mostly at the traders level vis-à-vis PhP213.35 per kilogram of VCO. No wonder, the coconut farmers, with an average income of PhP10,000 per hectare, are one of the poorest among the poor farmers, fishermen, and rural folk. The traders' margin is almost three times higher than the farmers' farm gate price mainly due to harvesting, dehusking and transport costs, and traders' surplus. Thus, any effort to liberate the coconut farmers from the poverty cycle must involve and fully integrate them in the supply and value chain. The PCA and CIIF must consider decentralized high-value coconut products processing at the village and community levels where farmers will have to be properly organized into Coconut Business Units (CBUs) with economies of scale in operation and access to social marketing, community organizing, and business management services as well as lucrative market, affordable finance, and technology.

Table 3.5 Indicative gross value added based on average unit price of selected coconut products, 2000-2004

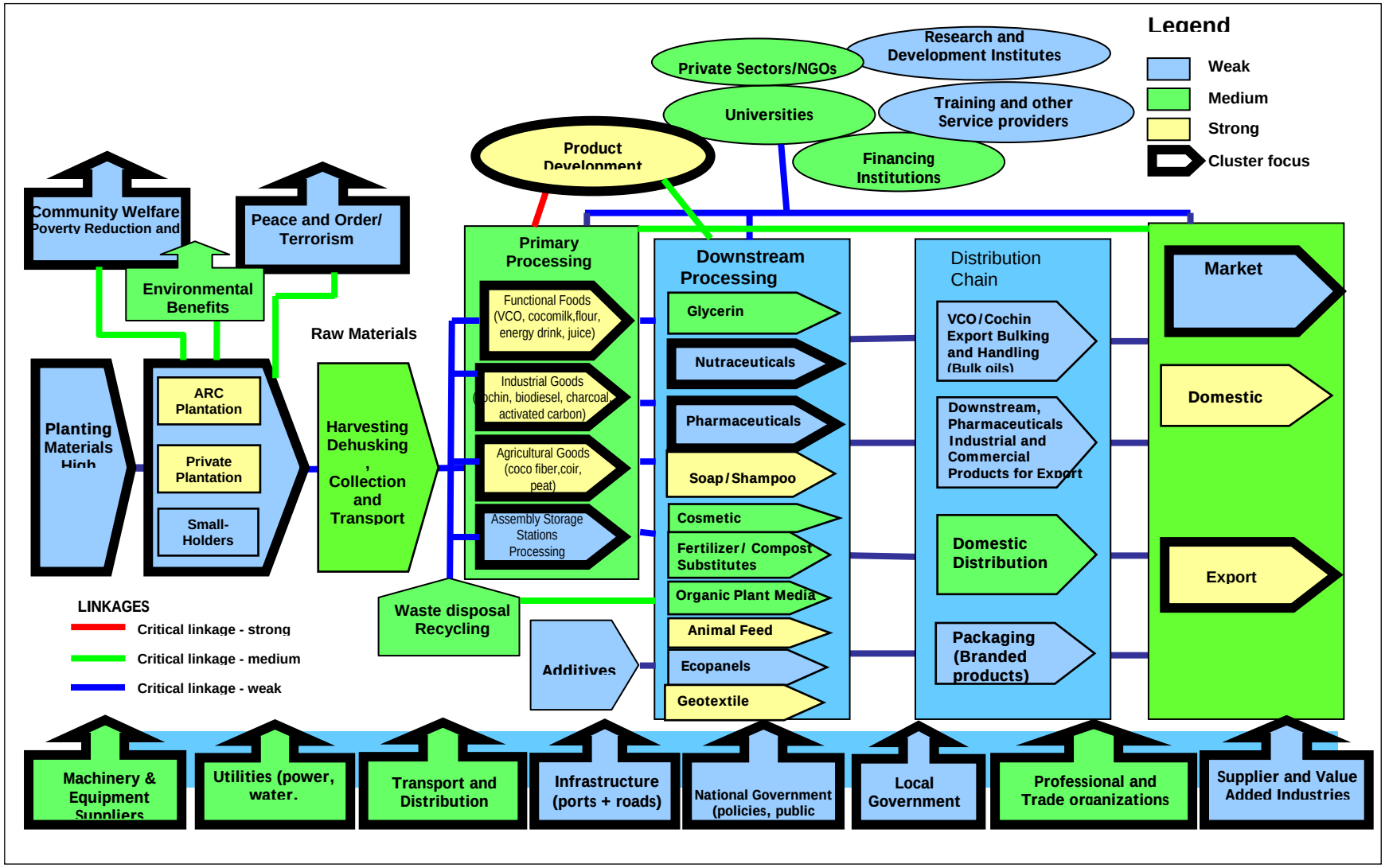
Product	Average Prices ($/MT) (2000-2004)	Average Prices (P/MT) (2000-2004)
Coconut Water*	0.79	41.48
Copra Meal	55.33	2,904.83
Unhusked Coconut	31.62	1,660.00
Dehusked Coconut	119.05	6,250.00
Coir and Waste*	160.78	8,440.95
Copra	208.63	10,953.08
Coco Shell Charcoal	214.87	11,280.68
Coco Shell Powder*	217.33	11,409.83
Coconut Oil	417.88	21,938.70
Coir Processed*	645.94	33,911.85
Nata de Coco	793.46	41,656.65
Desiccated Coconut	900.19	47,259.98
Activated Carbon	948.49	49,795.73
Geotextile	952.38	50,000.00
Liquid Coconut Milk*	1,276.12	66,996.30
Coconut Milk Powder*	2,722.48	142,930.20
Virgin Coconut Oil**	4,063.75	213,346.88

Source: Philippine Coconut Authority.

Indicative Gross and Net Value Added of Emerging Coconut Products

Based on a 5,000 nuts per day (6-ton capacity) business model developed by this diagnostic study, the daily gross revenue of an integrated, emerging coco products processing plant covering functional food and its by-products, industrial (bio-diesel and activated carbon and its by-products), agricultural and environmental products (geotextile and organic plant media) amounts to PhP158,213.36 with a net value added per day of PhP34,702.13 (Table 3.6). This translates to an annual net value added of about PhP10.4 million under a 300-day manufacturing operation. This was calculated under the "stand-alone processing operation" estimates of the technical specialists on the various coco product groupings. Therefore, this does not consider the potential cost savings or economies of scale of a fully integrated coconut processing operation. For the VCO and functional food category, the annual net value added sums up to about PhP4.4 million while that of bio-diesel and activated carbon adds up to more than PhP2 million. The net value added for geotextile and organic plant media amounts to almost PhP4 million. On a per nut basis, this results in an almost sevenfold (PhP6.94 per nut) increase in net value added or an almost sixfold increase at PhP5.78 on a per kilo basis.

Figure 3.7 Summary presentation on value chain approach to SWOT analysis of emerging coco products



Source: Author.

Table 3.6 Indicative gross and net value added of emerging coconut products based on a 5,000-nuts-per-day (6-ton) business model

Emerging coconut products	Volume (kg)	Price/kg (in pesos)	Gross revenue (in pesos)	Cost of production (in pesos)	Net value added (per day in pesos)	Net value added (per year in pesos)
Functional Foods						
VCO	306.36	276.00	84,555.36	74,943.71	9,611.65	2,883,495.15
Coconut Shell*	1,000.00	1.00	1,000.00	0.00	1,000.00	300,000.00
Coco Meal (wet) *	429.10	4.00	1,716.40	0.00	1,716.40	514,920.00
Protein Isolate	570.40	4.00	2,281.60	0.00	2,281.60	684,480.00
Subtotal			89,553.36		14,609.65	4,382,895.15
Industrial Group 1						
Biodiesel	140.00	60.00	8,400.00	7,201.55	1,198.45	359,535.00
Crude Glycerin	70.00	30.00	2,100.00	0.00	2,100.00	630,000.00
Feed Meal (dry)	330.00	7.00	2,310.00	0.00	2,310.00	693,000.00
Subtotal			12,810.00	7,201.55	5,608.45	1,682,535.00
Industrial Group 2						
Coconut Shell Activated Carbon	117.00	50.00	5,850.00	4,634.37	1,215.63	364,689.00
Agricultural and Environmental Group						
Geotextile	400.00	50.00	20,000.00	19,173.20	826.80	248,041.00
Organic Plant Media	200.00	150.00	30,000.00	17,558.40	12,441.60	3,732,479.00
Subtotal			50,000.00	36,731.60	13,268.40	3,980,520.00
TOTAL			158,213.36	123,511.23	34,702.13	10,410,639.15
Net Value Added per Kg (PhP)					5.78	
Net Value Added per Nut (PhP)					6.94	

* By-products of VCO production.
Source: Estimated by the ICP-Coco Study Team.

Indicative Transaction, Manufacturing and Logistics Costs and Its Impact on the Supply Chain

Based on a case firm survey, the costs were divided in accordance with the supply chain activities, such as product development, manufacturing and processing, logistics, transport and distribution, and sales and marketing. Under product development, it is subdivided into R&D cost, registration with DTI, PCA, and BFAD for the functional foods.

For manufacturing and processing, its costs are subdivided into SEC registration, energy and power cost, labor cost, business permit, barangay clearance, and DOH/BFAD license to operate. Included in the logistics, transport, and distribution chain are the transport, storage, quality preservation, handling, and extortion costs. On the sales and marketing side, promotional, inventory carrying, and extraordinary costs were also gathered.

Table 3.7 shows the summary of costs involved in the value chain, from the product development up to the sales and marketing of coco fiber and its by product, coco peat. In summary, labor and power costs were the highest amount paid by the producer as it comprised 55% of the total cost. The labor cost was PhP960.00 per ton of coco fiber and peat produced, and PhP900.00 per ton for energy/power cost. This confirmed the survey conducted by the ADB that concluded that labor and power costs were the major obstacles in investment. These were then followed by the handling and transport costs, which were PhP641.00 and PhP512.82 per ton, respectively, for coco fiber production. Storage cost was PhP128.21 per ton and quality preservation cost was PhP64.10 per ton. Under sales and marketing, promotional cost was PhP8.00 per ton, inventory carrying cost was PhP38.46 per ton, and spoilage rejection cost was PhP13.00 per ton.

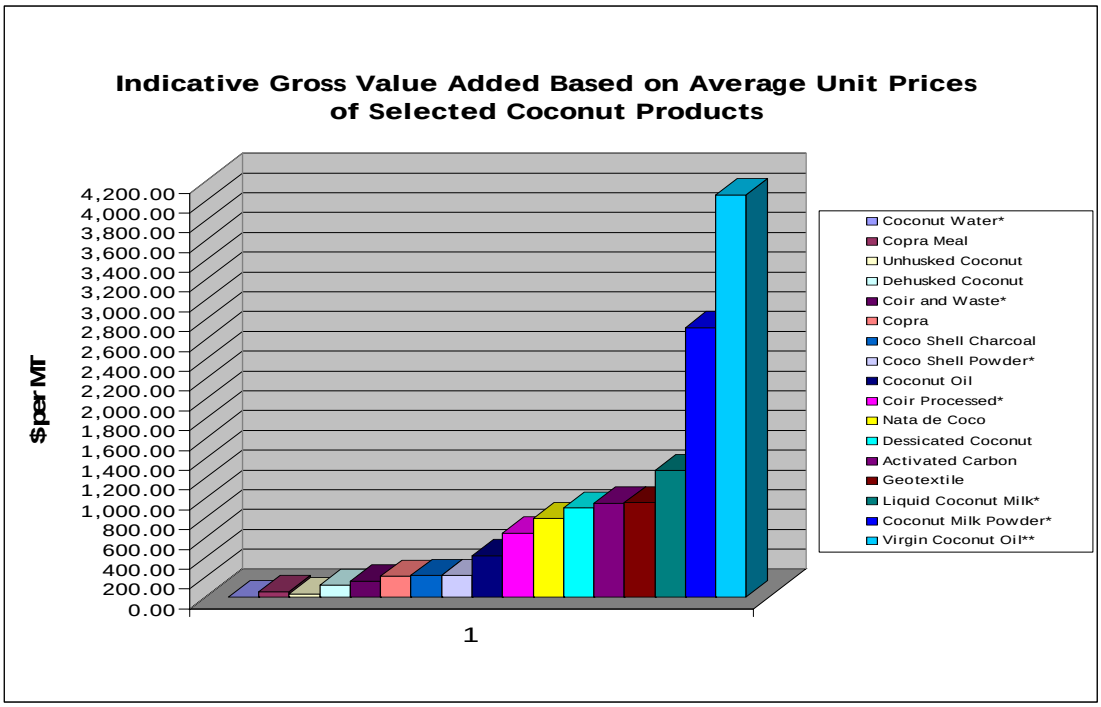
Table 3.7 Summary of manufacturing, logistics and transaction costs involved in coco fiber and peat production

Manufacturing, Logistics and Transaction Costs	Coco Fiber		Coco Peat	
	Cost per kg	Cost per mt	Cost per kg	Cost per mt
Product Development				
R&D Cost	0.02	21.37		
SEC/DTI Registration	0.01	2.14		
PCA Registration	0.00	1.07		
Manufacturing and Processing				
SEC Registration	0.09	85.47		
Energy Power Cost	0.90	900.00		
Labor Cost	0.96	960.00		
Business Permit	0.04	42.74		
Barangay Clearance	0.00	0.53		
Others				

Logistics, Transport and Distribution				
Transport Costs	0.51	512.82	0.05	46.62
Storage Costs	0.13	128.21	0.01	11.66
Quality Preservation	0.06	64.10	0.01	5.83
Handling Cost	0.64	641.03	0.01	7.00
Extortion Costs				
Sales and Marketing				
Promotional Costs	0.01	8.01	0.02	17.48
Inventory Carrying Cost	0.04	38.46	0.00	2.33
Spoilage or Rejection Cost	0.01	12.82	0.00	2.33

Source: Estimated by the ICP-Coco Study Team.

Figure 3.8. Indicative gross value added based on average unit prices of selected coconut products



Source: Philippine Coconut Authority.

On the other hand, Table 3.8 shows the summary of costs in VCO production of a case study export-oriented firm. About PhP450.98 per metric ton was spent on research and development. DTI registration cost PhP45.10 per metric ton, with PCA and BFAD registration both costing PhP90.20 per metric ton. On the manufacturing and processing activity, there was a huge investment in labor costs (PhP3,571.77 per metric ton). The

other major costs in doing business were energy/electricity costs (P2,381 per ton), transport cost (P1,251.20), USDA Certification (P1,183.82 per ton), and storage and communications/marketing expenses (P1,082.35 each).

Table 3.8 Summary of manufacturing, logistics and transaction costs involved in VCO production of a case study export-oriented firm

	Cost per liter	Cost per kg (in pesos)	Cost per mt (in pesos)
Product Development			
R&D Cost	0.49	0.45	450.98
DTI Registration	0.05	0.05	45.10
PCA Registration	0.10	0.09	90.20
BFAD	0.10	0.09	90.20
Manufacturing and Processing			
SEC Registration	0.01	0.01	6.76
DOH/BFAD License to Operate	0.01	0.01	9.02
Energy Power Cost	0.53	0.49	487.60
Labor Cost	3.88	3.57	3,571.76
Business Permit	0.01	0.01	5.41
Barangay Clearance	0.00	0.00	0.23
Logistics, Transport and Distribution			
Transport Costs	1.36	1.25	1,251.20
Storage Costs	1.18	1.08	1,082.35
Quality Preservation	0.32	0.30	297.65
Fuel Cost	2.59	2.38	2,381.18
Sales and Marketing			
Promotional Costs			
USDA Certification	1.29	1.18	1,183.82
Print and Media	1.18	1.08	1,082.35
Participation (CITEM)	0.10	0.09	90.20
PCA's Cocoweek	0.10	0.09	90.20

Source: Estimated by the ICP-Coco Study Team.

MAJOR FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

Overall Findings and Conclusions:

- Based on the ADB and World Bank's Surveys on Investment Climate in the World and in the Philippines, the following conclusions were highlighted:
  - (a) The country has weak macroeconomic fundamentals that continuously impede investment and productivity growth, including that within the coconut-based industries.
  - (b) The weak and severely inadequate infrastructure (roads, transport, power, ports) is a serious constraint to doing business.

(c) Corruption is considered a severe and major obstacle to investment.

(d) Business regulations and procedures are cumbersome and thus, must be made more transparent, simplified, and streamlined.

- The investment climate in emerging coconut-based industries, just like in many agro-based enterprises, is generally weak. This is evident in the costly labor, power, interest and financial charges, tax rates, transport and handling charges, and registration and regulatory fees particularly the hidden corruption (extortion, bribery) costs. The investment climate is also constrained by policy uncertainties, graft and corruption, poor infrastructure (roads, ports, power), and law and order cum insurgency and terrorism problems in major coconut-producing areas.

- Philippine coconut industry is mainly focused on production of crude coconut oil (CNO) and copra (80-85% of total export value of US$800 million) despite the market access opportunities and health, functional food, industrial, and agricultural/environmental and competitiveness potentials of emerging coconut products. Majority of the local companies fall short of their potentials for exports and global integration.

- A major threat in the industry is the high competition of Philippine coconut oil and emerging coconut products with those of Indonesia and the strong lobby against coconut oil and palm oil by other vegetable oil producers from the USA and EU particularly soybean, corn, rapeseed (canola), and sunflower oil producers, as these oils were found to have high transfatty acids (that contribute to obesity and health hazards) resulting from the hydrogenation process that prevents their faster rancidity. In contrast, VCO has no transfatty acid unless hydrogenated.

- Optimizing the vast potentials of coconut as food and health products (e.g., VCO, skim milk, coco flour, pharma and nutraceuticals, aflatoxin-safe and high-value feed ingredients) as well as the industrial, agricultural, and environmental uses of husks and shells could be done through high-profile product and market promotion and consumer education utilizing trimedia strategies and the Internet/cyberspace information technology. These initiatives will result in significant growth in demand for emerging coconut products.

- Coconut remains a strategic commodity bordering on “global health benefits” (“healthiest oil in earth”); solving energy crises (conversion of cochin and CNO into biodiesel alongside soybean oil in USA); and ensuring geo-political balance (supply of strategic industrial raw material) and harmony (poverty reduction and terrorism control) in coconut-producing countries.

Overall Recommendations

- The Government of the Philippines (GOP) particularly the offices of the President and Vice-President, Senate and House of Representatives, and the Supreme Court must have the political, legislative, and judicial will to curb corruption and foster competitiveness to improve the overall investment climate that will benefit the coconut-based industries;

- Major areas of reforms to improve investment climate must be geared in
  (a) reducing costs of doing business associated with graft and corruption, taxes and regulatory burdens, infrastructure and finance costs;
  (b) reducing business risks relating to policy uncertainties and ambivalence. Promoting stability in macro prices (interest, labor, exchange rate, inflation rate), protecting intellectual property rights and contract enforcement, as well as security of tenure on lands under the Comprehensive Agrarian Reform Program and real properties; and
  (c) removing barriers to competition (dismantling of oligopolies in trade, transport and cargo handling; functioning markets and finance and infrastructure);

- The GOP (thru DTI/PCA/DA/UCAP/CIIF) to undertake a deliberate veering away from coconut oil and copra production and to focus or shift to high value products (VCO, coco milk, CME/CEE geotextile) that could possibly increase export value by at least 2-3 times (US$1.6 billion to US$2.4 billion in the next 3-5 years);

- The GOP/DTI/CITEM/DFA and PCCI/UCAP/DOE to launch social marketing and information road shows focusing on the health benefits, energy impact, and geopolitical implications of supporting reciprocal and fair trade of emerging coconut products;

- The GOP and stakeholders (DA/PCA, DTI/BOI, UCAP/PCRDF/PCCI/CIIF) to zonify strategic coconut-producing areas and establish four (4) Agro-based Industrial Clustering (ABIC) Zones, namely:
  (a) South Luzon (including CALABARZON and MIMAROPA)– Bicol Zone
  (b) Samar-Leyte Zone
  (c) Davao-Caraga Zone
  (d) Moro Gulf Zone

- Immediately formulate, by outsourcing consulting services, the coco-based ABIC Master Plans with Investment-Grade Feasibility Studies. Such zones will be complemented by a network of decentralized pro-farmer Integrated Coconut Processing Plants (established initially in priority Coconut Farmers Agribusiness Centers (CFAC) where strong farmers' organizations and/or cooperatives exist. They require the pro-active support services of PCA, DTI, and authentic

nongovernment organizations like the National Confederation of Cooperatives (NATCCO) and the Philippine Rural Reconstruction Movement (PRRM);

- Stakeholders/GOP to form Coconut Trade Alliance with ASEAN and APCC in promoting emerging value-added coconut products focusing on the health benefits, energy potentials (biodiesel), and geo-political balance relationships with US, EU, China, and Russia;

- Reactivation of the ASEAN Vegetable Oil Council (AVOC) or creation of an ASEAN Coconut and Lauric Oil Promotion Board for closer agro-industrial cooperation and trade facilitation;

- Stakeholders and the GOP (DTI/CITEM/BOI and DFA) must have pro-active participation in global trade fairs, investment promotion, and product/market development and sales blitz road shows, and in forging bilateral agreements that will include coconut-emerging products as export winners;

- Adoption of mechanized and localized integrated coconut processing technology and manufacturing processes (5,000 nuts [6 ton] per day business model, covering 500-600 hectares of coconut lands per investment module) with a net value added of PhP10.4 million per year. Thus, 2,000 replication business units (covering 1-1.2 million hectares or roughly one-third of coconut lands) will generate at least PhP20.6 billion net value added (US$396 million) annually. Further modularization into a multiple of 2 to 10 times (10,000 to 50,000 nuts capacity per day) could be packaged depending on the availability of raw materials, access to markets and finance, and business management considerations.

Major Conclusions and Recommendations within the Value Chain

The specific findings/conclusions on the supply and value-added chain are summarized in the following matrices with the corresponding recommendations:

Major Findings/Conclusions	Recommendations
1. Research and Development and Extension	
• Coconut R&D&E is highly sectoral oriented, seriously fragmented, underfunded, uncoordinated, and not adopting the value-added chain and clustering approach to R&D&E • Commercialization R&D&E is seriously neglected, which leads to major research gap. • Undertake clinical research on VCO jointly with the Philippine College of Alternative Medicine (PCAM),	• Adopt R&D&E value-added chain and cluster paradigm as a superior approach to sectoral turfing with special emphasis on R&D for improving the investment climate within the supply chain. • Allocate at least 1% of average export value of US$ 800 million in the last 5 years (2001-2005) (US$8M or roughly PhP420M/year for coconut R&D&E (interest from and/or proceeds of coco levy fund and/or Agricultural Competitiveness

(UPLB/Biotech/UPCM/PGH)	Enhancement Fund or World Bank Loan) • Adoption of "focused commercialization R&D&E in the global and homegrown market • R&D&E focus on producing high-yielding clones (similar to oil palm) as inputs in replanting at least 1.3 million hectares (until 2010) using coco levy funds • R&D emphasis HIV-Aids, SARS, Avian Flu prevention and cure; new product and market development
2. Product Development	
• Emerging coco-products (functional foods, industrial, agricultural and environmental) are well-developed with high degree of versatility and complementarity but short of commercialization due to product and market information asymmetry and unfavorable and inequitable investment climate. • Enormous "laboratory-grade" technologies on emerging coco-products are not being commercialized due to neglect of commercialization R&D	• Refocus product development into high value added commodities (nutra and pharamaceutical, cosmetics, oleo foods, oleochemicals) • Fine tuning and adaptive R&D&E for existing laboratory-grade technologies and its conversion into mature and commerciable technologies. • Simultaneous market and product development initiatives and pro-active consumer-oriented information and knowledge dissemination campaign.
3. Manufacturing/Processing	
• "Kitchenomics" approach to functional food commercialization will hinder niche market development and global export penetration. • New and potentially competitive technologies on VCO, cochin, CME, geotextile, and activated carbon are available but hindered by poor access to, and high cost of, finance and unexplored markets.	• To ensure product quality and standardization, BFAD-registered and US FDA/Codex/HACCP-accredited firms may expand their operation through franchising or licensing of technology and processes. • DTI/BOI to provide social marketing and public investment support to globally oriented and trade-compliant firms
4. Logistics, Transport and Distribution	
• Coconut, being bulky and low valued raw material, is too vulnerable to diseconomies of scale in transport, logistics provision, and distribution • High competitiveness potentials of cochin and VCO by-products as	• Decentralized and integrated coco-processing centers in major coconut-producing areas (500-600 hectares per module of 5,00 nuts daily) with raw material sourcing radius of not more than 5-10 kilometers to dramatically reduce

biodiesel substitute for costly fossil oils. • High cost of energy power (including regulatory costs and prohibitive transaction costs in the logistics chain) will render emerging coco products uncompetitive in the home and global market	transport, logistics, handling, and distribution costs. • Optimize use of nautical highway: RORO with backhaul provision and utilization/upgrading of PNR system. • Optimize use of cochin and coconut shells into biofuels/biodiesel for reducing power cost and better still, in generating and operating power plants and coco processing facility.
5. Sales and Marketing	
• Emerging markets in China, South Asia, Russia, CIS, and Brazil are huge with economic and geopolitical implications • Lackluster national and local government support in market development and promotion of emerging coco products in home and global markets. • Shifting demand for soybean as biodiesel and for corn (USA) and sugar beets (EU) as ethanol, as cheaper bioenergy substitutes for costly fossil fuels will improve demand for VCO as healthy oils rich in medium-chained fatty acids (MCFA) particularly lauric acid and monolauric acid. • Coco products' global prices and supplies are determined in USA (Chicago, New York) and EU markets (Rotterdam) with the Philippines and coconut exporters as price takers.	• Optimize public investment and competitive budgets in market development and promotion (DTI/CITEM) • Gear up participation in global trade fairs and coco products investment/marketing road shows (DTI/CITEM/BOI) • Bilateral coco-based trade agreement with USA, China, Russia and CIS, South Asia (India, Pakistan, Bangladesh) Middle East, and Brazil • The Philippines, through ASEAN, APCC, and APEC, spearhead the setting up of coconut-based commodity futures market where all aspects of the commodity trade (products, health/logistics chain market) are standardized except the price. Immediately operationalize DA/FRLD studies on Commodity Futures Market Operation with coconut as the vanguard product.

OVERALL SYNTHESIS AND SOLUTIONS FRAMEWORK

In the final synthesis, the improvement of the overall investment climate must be geared toward improving the productivity and the supply and value added chain (SVAC) of coconut-based enterprises and reducing the production, processing, distribution and transaction costs, risks and barriers to competition. Such initiatives require a drastic and radical departure from "heavy sectoral policy orientation" in coconut development. Imperatively, this calls for a progressive policy shift to agro-based industrial clustering (ABIC) and supply and value added chain (SVAC) paradigm and decentralized coconut processing centers (DCPCs) in major coconut-producing areas. The DCPCs will operate at varying capacity models (5,000, 10,000, 20,000 and 50,000-nuts-per-day capacity) depending on the supply of raw materials and relative economies of scale in operation, including financial capacity and ability to access market, credit, and business management services. Such strategy will definitely operationalize and strengthen the multisectoral Coconut Farmers Agribusiness Centers with priority project packaging and implementation in coconut areas with strong and functional cooperatives or operational business units.

Corollarily, another clustering strategy is to establish coconut export processing zones in strategic manufacturing and bulk handling centers in Luzon and Mindanao. The CIIF export processing facility in Bauan, Batangas could be one of the ideal locations of such agro-industrial manufacturing and export handling center. In addition, an additional coconut export bulk handling and processing zone could be located in Davao, General Santos or Cagayan de Oro or Polioc Bay in Muslim Mindanao.

Agro-Based Industrial and Business Clustering Models

Coconut-based Agribusiness Clustering is defined as the "agglomeration of inter-linked or related business or economic activities comprising industries, suppliers, critical supporting services and requisite policy and infrastructure institutions that are interdependent and characterized by high degree of linkages and connectivity. The concept of Business Clustering will entail the process of restructuring and modernizing via reorganizing, realigning and upgrading the technological and operational efficiency and innovative capacity of coconut-based agro-industries as significant "growth-driver" and socio-economic segment in the national economy and security. The Agro-based Industrial Clustering (ABIC) initiatives will also entail the formulation of strategic development goals and business rationalization options to streamline and integrate the structure; improve the conduct and performance of the core industry system (raw material production, primary processing and secondary/tertiary processing); its policy framework and supporting supplier-related or services industries at the macro (economic foundation or factor conditions), meso (the existence, conduct, and performance of the ABIs and coconut-based business clusters) and micro (structure, strategy, and rivalry of firms) levels in a demand–led and market-oriented national and global economy (Figure 9: The Agro-based Industrial Cluster Framework). The process will include improvements of investment climate in coco-based industries through policy and institutional reforms,

improvements in incentive structure and human resources development of the coconut-based business clusters. In contrast with the traditional "sectoral" or "turfing" development approach, the ABIC paradigm is indeed highly multisectoral and multidisciplinary as well as focused on overall viability, profitability and sustainability of the various coconut business units within the sub-cluster and cluster levels.

The ABIC core industries consist of the focal industries (primary processing), supporting raw material industries (upstream or backward linkages) and the secondary and tertiary industries (downstream or forward linkages). Forward linkages are between the focal or core industry and its downstream industries whereas backward linkages are those between the focal or core industry and its upstream supply input and raw material production industries. These upstream industries constitute the agricultural component of the cluster. Thus, the core ABIC system is composed of primary processing as the focal industry, the raw material industries as the upstream industries (backward linkages) and secondary/tertiary processing as downstream industries. The latter two sub-systems constitute the manufacturing or industrial component of the ABIC. Each subsystem has separate and distinct supply and value added chain (SVAC) activities. The value added and value chain is the residual value that an industry adds to inputs by using labor, materials and capital. It is represented by the value of total output less the value of inputs measured in terms of brought in materials and services. It also involves the partitioning of firms' activities (from R&D&E to product development processing, logistics and distribution and finally, sales and marketing) in order to determine the optimum value added within the value chain system.

The core industries are, to a great extent, driven by strong home demand and a strong export market or emerging market foothold. The core industry system is further driven or influenced by a strongly evolving economic foundation (factor or framework conditions) consisting of: (a) technology and R & D capability; (b) natural endowments (land, water and environment); (c) physical infrastructure (energy, transport, communication); (d) human resources development; (e) policy and business environment; and (g) capital resources, financing and incentive.

The supplier industries consist of the key suppliers of main raw material, primary processing, secondary/tertiary manufacturing industries and machinery and equipment inputs and services system. The related and allied industries (service providers) consist of the services providing sector ranging from finance and banks, education and training, R & D, transportation and communication, marketing and distribution (including export and import services), machinery repair and maintenance, and other critical business support services (e.g. management, accounting, auditing, and consulting services).

The presence of or inadequacies in the macro economic fundamentals (factor conditions), market demand core industry system, supplier industries and related services providing industries will determine the level of investment climate and relative exposure to costs risks and barriers to competition.

Coconut-based Agro-Industrial Clustering Model

Within the context of the ABIC model and based on the summary presentation of the SWOT on the coconut supply and value chain, a coconut-based agro-industrial clustering and services model has been designed (see Figure 3.10) as basis for future master planning and for the formulation of investment grade feasibility studies and business plans that will be spearheaded by BOI/DTI with the possible follow-up technical assistance of this USAID/EMERGE project. Consequently, at the firm or business sector level, the pilot testing and showcase commercialization of the 5,000-nuts-per-day (6-ton-per- day) model in 500-600 hectares of coconut land need immediate funding support possibly under a follow-up project. Such model could further be upscaled and modularized into a multiple of 2 to 10 (10,000 to 50,000 nuts per day) depending on the availability of raw materials and absorptive management capacity of the proponent farmers' organizations or coconut cooperative business units.

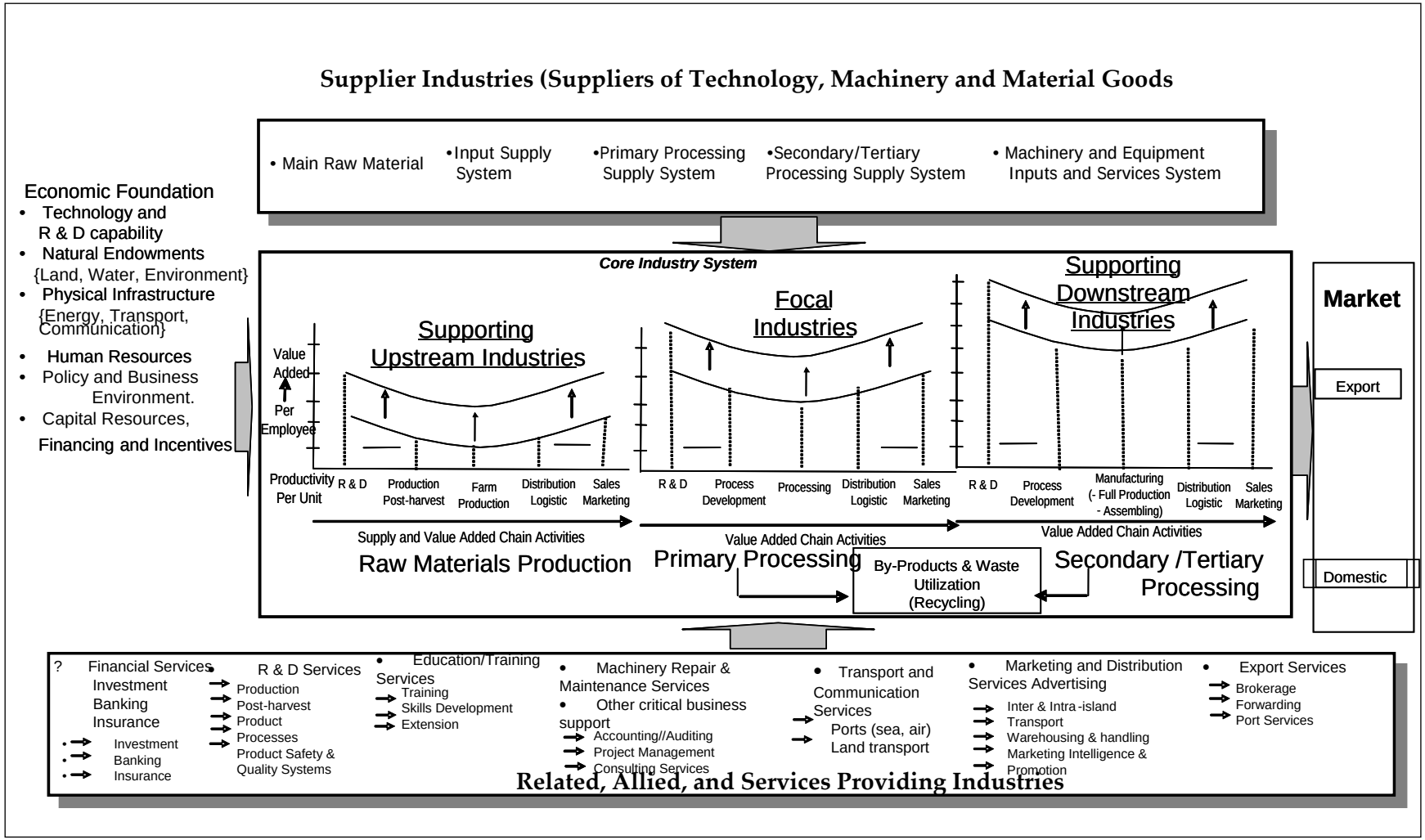
CONCLUDING NOTES

Finally, how can the government realize the elusive but not impossible goal of: (a) improving the investment climate on emerging coconut products; and (b) achieving product and market competitiveness in the home and global market? To achieve this, this study recommends strict adherence to the formula, QCD + I = Competitive Investment Climate, from the firms' decisionmaking point of view. It means:

- Quality and Quantity Criteria (compliance with Codex, GMP, HACCP protocols; coconut replanting and emerging coconut product technologies)
- Cost Effectiveness (reducing costs, risks, and barriers to competition)
- Delivery (just-in-time distribution to competitive markets)
- Innovations (continuing product and market development)

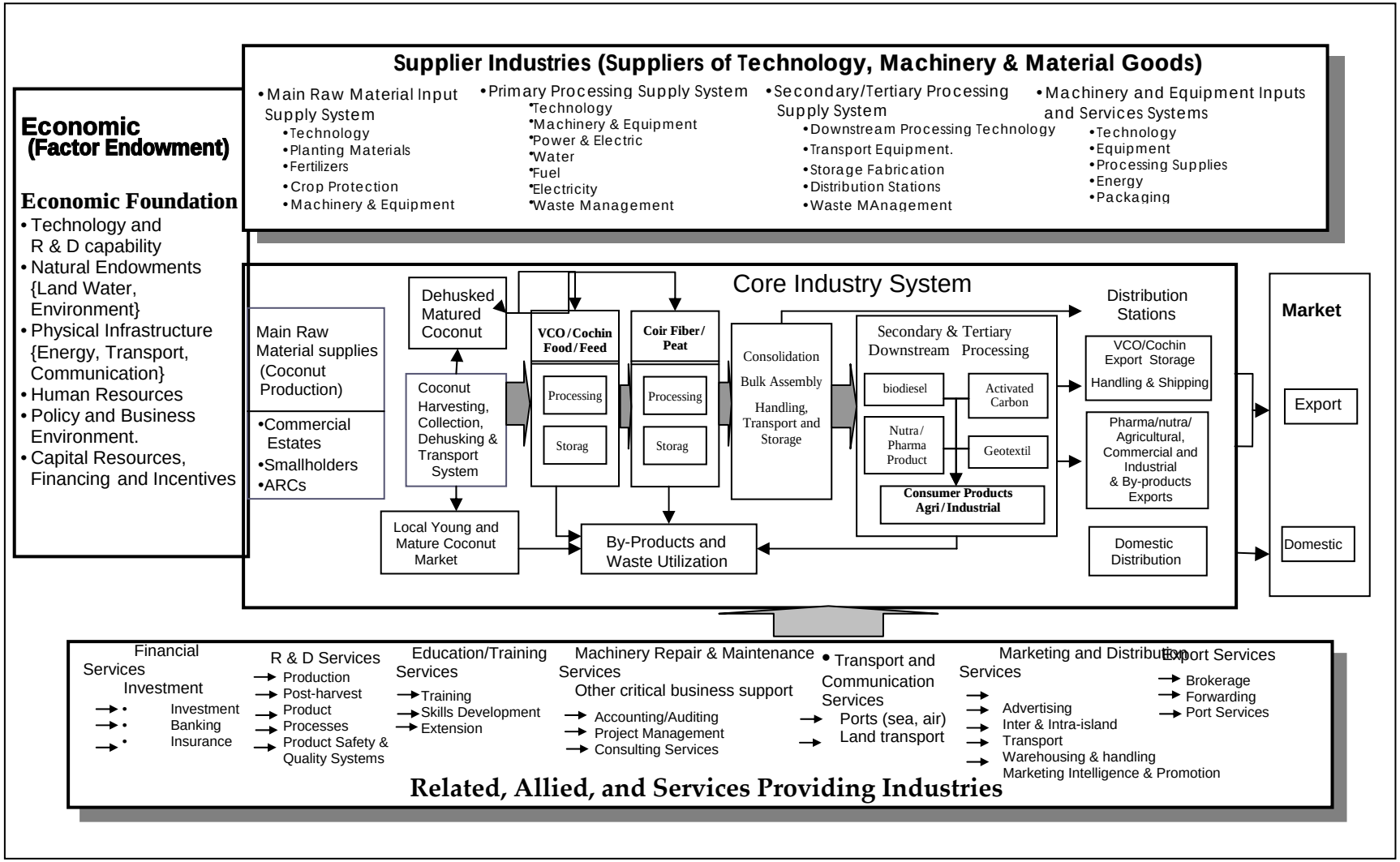
There are no shortcuts. Coconut-based firms and industry associations must overcome the obstacles and hindrances of a hostile or unfavorable investment climate and help create a conducive, coconut agro-based industrial cluster business environment. The final question is: will the government beat the odds that constrain the improvement of the investment climate? Or will the stakeholders and investors wait in vain?

Figure 3.9 The agro-based industry cluster (ABIC) framework



Source: Author.

Figure 3.10 Coconut-based agro-industrial clustering and services cluster model



Source: Author.

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CHAPTER 4

Product Development, Challenges and Prospects: Functional Coconut Food Products

Teresita M. Espino, Ph.D.

ABSTRACT

This chapter focuses on the economic challenges and prospects of emerging functional food products from coconut led by virgin coconut oil (VCO) and its component food products. The world demand for coconut oil specifically VCO is rapidly increasing due to its superior health benefits and newfound applications in the cosmetics and nutraceutical industries. This is predicted to intensify further as manufacturers adopt the new Philippine National Standards for VCO.

The analysis of the supply and value chain of VCO and its component food products yielded a number of internal problems and external threats that must be addressed to strengthen their competitiveness in the world market. These include: the low budget support for improving the processing technologies of nontraditional, value-added, coco-based products; the low- quality VCO products and counterfeit ones in the form of RBD oils passed as VCO, and the lack of a technology to detect low-quality and counterfeit products; the research and development initiatives of other countries that can lead to a substitution trend for coconut oil, improved plant breeding, and genetically altered oil crops; the uncontrolled cutting of coconut trees and the large numbers of coconut trees that are already senile and unproductive, which can significantly reduce the supply of raw materials; the multilayer marketing system that are detrimental to small farmers; the increasing cost of transportation and distribution; the inadequate marketing assistance to local producers to promote their products both locally and internationally and widen the current market and penetrate new markets for VCO and its high-value by-products; the threat posed by other major producers of coconut like India and Indonesia; and the impediments to doing business efficiently and competitively found in the results of the investment climate surveys of the World Bank and the Asian Development Bank.

Attractive windows of opportunities are present in processing VCO using the 5,000-nuts-per-day business model recommended by this diagnostic study's specialists. The investment cost of producing VCO using the process developed by UPLB-BIOTECH is around PhP11.6 million. With the current wholesale price of PhP300.00 per liter or PhP276.00 per kg, a profit margin of 21.2% and net profit after taxes of around PhP5.26 million can be attained each year. For a period of five years, the average return on investment is 38.27%. The net present value of returns after considering a hurdle rate (or opportunity cost of capital) of 18% is PhP2,116,536.71. This clearly shows that investing in VCO production is a sustainable and highly profitable business venture.

EXECUTIVE SUMMARY

The Philippines supplies 65% of the world requirement for coconut oil. But the market for coconut oil is only part of the larger market for fats and oil. The Philippine coconut oil must compete with palm and palm kernel oil, soybean oil, sunflower oil, rapeseed oil, and even animal fats and petroleum-based products. Out of the 17 vegetable oils and fats traded in the world market, coconut oil accounts for only 4.34% during the year 2000.

Coconut oil is the most important major product from coconut that is obtained either by the dry or the wet process. A major portion of coconut oil is obtained from copra, considered a dry process, or it can be obtained from the production of dessicated coconut, which is dried to a least 100^0C. The wet process involves the use of freshly grated coconut meat in the production of the so-called "virgin coconut oil" or VCO.

VCO is the naturally processed, chemical-free, and additive-free product from fresh coconut meat that has not undergone any heat above 40^oC and chemical processing after extraction. It has the natural scent of coconut, colorless to pale yellow, and contains natural vitamin E. In its purest form, VCO does not undergo hydrogenation and therefore does not contain transfatty acids that cause heart disease. It is not also subjected to chemical refining, bleaching, and deodorizing (RBD).

With the increasing popularity of VCO as the "healthiest oil in the world" and its newfound applications in the cosmetic and nutraceutical industries, the world demand for VCO is rapidly increasing. This is predicted to intensify further as manufacturers adopt production standards (Philippine Dairy Inquirer 2005).

The United Coconut Association of the Philippines reported that during the first half of 2005, about 340 MT of VCO were shipped to foreign markets. This figure was 92% higher than the 177 MT exported for the whole duration of 2004. Out of the total shipment, the US took in 331 MT or about 97% of the export market. In 2004, the US imported about 170 MT or 96% of total shipments. Other markets that bought limited quantities are Singapore, Ireland, Saudi Arabia, Australia, Malaysia, Hongkong, and Germany. Forecast for 2005 showed that at least 500 MT will be sold to markets abroad.

The Bureau of Food and Drugs (BFAD) of the Department of Health (DOH), in coordination with other government regulatory agencies, e.g., Philippine Coconut Authority (PCA) and Bureau of Agriculture and Fisheries Product Standards (BAFPS) of the Department of Agriculture (DA), has approved the Philippine National Standards for VCO. Their strict implementation and monitoring of compliance with these standards is very important to maintain the quality standard of VCO products for them to remain competitive in the world market. Filipinos who are involved in VCO production should comply with these standards to avoid a case similar to the "nata de coco" fiasco. Otherwise, other coconut- and VCO-producing countries such as Indonesia, India, Thailand, and those in the Pacific region could overtake the Philippines in the world market.

Other high-value, functional coconut food products can be derived from the by-products of VCO production such as coconut water, skim milk/protein concentrate, coconut meal, and coconut shell, which can increase the incomes of producers and eliminate pollution in the environment. The coconut water wastes from VCO production can be material inputs for the production of high value added products such as nata de coco; therapeutic drink; refreshment drink; vinegar; sparkling wine, and coconut champagne; components for tissue culture media for plants (e.g., banana, orchids); fermentation media for enzyme production; growth regulator; substrate for biogas generation; and coconut water concentrates.

Coconut meal is made from fresh coconut meat and contains 14% coconut oil and 58% total dietary fiber. It is similar to copra meal except that it may be used not only as feed but also as food. Unlike copra meal that is generally unfit for human consumption, coconut meal when spray-dried will retain its white color suitable as food when made into coconut flour. Coconut flour is a natural high-quality ingredient and an excellent source of dietary fiber. Coconut milk contains good quality proteins including water-soluble carbohydrates and sugars originally present in fresh coconut meat. Coconut protein concentrates can be used in a number of food preparations.

The analysis of the supply and value chain of VCO and its component food products yielded a number of internal problems and external threats that must be addressed to strengthen their competitiveness in the world market. Foremost is the budget support for the coconut industry that is highly focused on the production side. There is an urgent need to shift the focus to improving the processing technologies for nontraditional, value-added, coco-based products. Although a significant number of Filipinos are dependent on coconut for their livelihood, public funding for research activities on development of new technologies that can give added value to coconut is very minimal. Low-quality VCO products and counterfeit ones in the form of RBD oils passed as VCO will affect authentic ones, thus the need for a technology that can detect low-quality and counterfeit products.

Relatedly, the industry is threatened by research and development initiatives from other countries, which will lead to a substitution trend for coconut oil, improved plant breeding, and genetically altered oil crops.

The regular supply of coconut raw materials may be affected by the uncontrolled cutting of coconut trees and the fact that 75 million trees are already senile and unproductive. The inability of farmers to adopt new farming technologies and superior breeds of coconuts may affect the future supply of material inputs.

The multilayer marketing system also affects the prices of coconut inputs. Although VCO producers are buying at PhP5.00 per nut, coconut farmers are receiving only PhP2.00 to PhP2.50 for each nut from traders. Around PhP0.50 of this cost goes to labor expenses in harvesting and bringing the nuts to the local buyers. This problem is compounded by the increasing cost of transportation. The passage of the expanded value added tax law further jacks up the cost of doing business in the industry.

Local producers need additional capital and/or the assistance of the government to promote the products both locally and internationally in order to widen the current market and penetrate new ones for VCO and its high-value by-products.

Other major producers of coconut like India and Indonesia may likely produce VCO and compete in the local and international market. The profitability of the VCO industry will attract foreign competitors. Under such scenario, competition will be very stiff. It will be a cut-throat business and only firms or industries with competitive advantage will be left to operate in the global market.

The country's VCO industry may be affected by several major impediments to doing business efficiently and competitively. Based on the report of the World Bank (2002), the Philippines has several weak spots compared to other competing countries that incidentally are also major producers of coconut products. Compared to its competitors such as India, Sri Lanka, and Indonesia, the Philippines has the worst investment scenario in the following areas: crime, theft and disorder; anticompetitive practices; access to land; tax rates; customs and trade regulations; electrical outages; water supply failure; lowest new investment from banks; highest time to claim imports from customers (9.09 days); highest unofficial payments for firms to get things done (1.91% of sales); firms are expected to give gifts in meetings with tax inspectors; highest value of gift expected to secure government contracts (2.2%) of contract); dispute resolution (9.54 weeks); security and protection costs (3.98% of sales); losses due to crime (1.24% of sales); lesser number of firms using technology licensed from foreign companies as compared to Indonesia; lesser ISO certification ownership compared to Indonesia; lesser number of firms undertaking innovation compared to Indonesia; and lowest capacity utilization.

Attractive windows of opportunities are present in processing VCO. Using the 5,000-nuts-per-day business model recommended by this diagnostic study's specialists, it will be a sustainable and highly profitable business venture. Aside from giving added benefits to farmers in terms of buying the coconuts at higher prices, high-quality and value-added products such as high-grade coconut flour, coconut meal, vinegar and coco-beverages may also be produced. Establishing the processing plants in strategic coconut-producing regions will result in job creation, giving higher value to coconut and generating highly demanded products, which will catalyze the establishment of enterprises and accelerate development in the rural areas.

The investment cost of producing VCO using the process developed by UPLB-BIOTECH is around PhP11.6 million—a huge cost for small and medium enterprises and thus could be a significant barrier for them to enter the VCO industry. However, with the current wholesale price of PhP300.00 per liter or PhP276.00 per kg, a profit margin of 21.2% and net profit after taxes of around PhP5.26 million can be attained each year. For a period of five years, the average return on investment is 38.27%. The net present value of returns after considering a hurdle rate (or opportunity cost of capital) of 18% is PhP2,116,536.71. The financial analysis also shows that all the investment could be recovered within 1.5 years. This only indicates that investing in VCO production is a highly profitable business venture.

Product Development, Challenges and Prospects: Functional Coconut Food Products

Teresita M. Espino, Ph.D.

INTRODUCTION

The Philippines accounts for 26% of the total world production of coconuts and currently ranks third in the world next to Indonesia and India. Around 3 million hectares are devoted to coconut in many provinces producing around 14.3 MT metric tons (BAS, 2004). The top three producing regions are Davao (Region XI), Eastern Visayas (Region VIII), and Southern Tagalog (Region IV).

About 80% of the local coconut production goes to the export market while the remaining 20% goes to the domestic market. Around 90% of the total production is processed into oil. The remaining 10% is processed into desiccated coconut and canned/tetrapak coconut milk or consumed as fresh nut or "buko."

Coconut oil (RBD), virgin coconut oil, desiccated coconut, fresh coconut, and copra are the primary products of coconut. The by-products include copra/coconut meal, activated carbon, charcoal, and coconut coir, and dust. Coconut end-products include detergent soaps, shampoo, cosmetics, nutraceuticals, margarine, cooking oil, confectionery, vinegar, and nata de coco. Coconut intermediaries include oleo chemicals such as fatty acids and fatty alcohols.

According to the Philippine Coconut Authority (PCA), products derived from coconuts earned an average of US$760 million in exports. Compared to 2003, exports of coconut products grew by 18.89% in 2004. The European countries and the United States are the key markets for coconut products while Japan is the major destination of charcoal and activated carbon from coconut shell.

The Philippines supplies 65% of the world requirement for coconut oil. However, the market for coconut oil is only part of the larger market for fats and oil. The Philippine coconut oil must compete with palm and palm kernel oil, soybean oil, sunflower oil, rapeseed oil, and even animal fats and petroleum-based products. Out of the 17 vegetable oils and fats traded in the world market, coconut oil accounts for only 4.34% in 2000.

Nevertheless, the world demand for coconut oil (CNO) and/or virgin coconut oil (VCO) is rapidly increasing due to their high lauric acid content and newfound applications in the cosmetic and nutraceutical industries.

The demand for VCO as export commodity increases as manufacturers adopt production standards (Philippine Dairy Inquirer 2005). The United Coconut Association of the Philippines reported that during the first half of 2005, 340 MT of VCO were shipped to

foreign markets. This figure was 92% higher than the 177 MT exported for the whole duration of 2004. Out of the total shipments, the United States (US) took in 331 MT or about 97% of the export market. In 2004, the US imported about 170 MT or 96% of total shipments. Other markets that bought limited quantities are Singapore, Ireland, Saudi Arabia, Australia, Malaysia, Hong Kong, and Germany. Forecast for 2005 showed that at least 500 MT will be sold to markets abroad.

REVIEW OF RELATED LITERATURE

Virgin Coconut Oil

Virgin coconut oil (VCO) can provide instant energy to the body. According to experts, the medium-chain (C_8 –C_{12}) fats in VCO are similar to the fats in mother's milk that gives babies immunity from diseases. The medium-chain fatty acids (MCFAs) have antiviral, antimicrobial, antifungal, and antiprotozoal properties. It is reported that lauric acid (C_{12}) and its monoglyceride commonly called "monolaurin" have a very wide range of antimicrobial properties. The biomolecule, C_{12}, is mentioned as the most potent against lipid-coated microorganisms that are not normally cured by ordinary antibiotics. Among the vegetable oils traded in the world, coconut oil is the richest source of MCFA (64%) and lauric acid (48-53%) (Enig 2005).

Production of VCO

Coconut oil is the most important major product from coconut. Data showed that export of coconut oil went up by 17.8% to US$277.60 M in 2004 from US$235.67 M in 2003 (Foreign Trade Statistics of the Philippines 2004). A major portion of the coconut oil exported is obtained from copra, which is an example of the "dry process" of coconut oil production.

The other method is the "wet process." The most common procedure is the so-called traditional or kitchen method. Several variants of the "wet process" were previously introduced to improve oil yield and produce the protein-rich meal/skim milk for human and animal consumption. Table 4.1 presents the different "wet process" modifications as reported by Banzon et al. (1990).

Table 4.1 Summary of different "wet methods" for coconut oil production

Type of process	Date	Description of process
1. Lava process	1937	Grating of coconut meat and extraction of cream or "gata" with roller press, centrifugation of "gata" to separate protein solid, water and oil. Spray drying of skim milk to produce milk powder.

2. Gonzales process	1948	Fractionation of coconut milk in a settling tank to obtain the aqueous protein from the cream
3. Robledano-Luzuriaga	1940	Expression of milk at 50°C and fractionation in a settling tank to produce skim milk cream and deodolified protein. Frozen cream is thawed and filtered to produce skim milk and oil.
4. Modified Robledano-Luzuriaga Process	1948	*Drying of the meat and pressing using expeller to produce oil and cake. The protein isolate is obtained after filtration of the skim milk.
5. Cruz-Bernardo Process	1949	Hot water extraction of ground meat, pressing of the meat and heating of cream at 70°C in a settling tank to produce "water" and cream. Oil is obtained from the frozen cream by evaporation of the water.
6. Birosel (physics-mechanical) Process	1955	Coconut milk is placed in a separator to get the crude cream; cooled to 5-10°C and churned to separate the solid fat. Oil and protein are separated after heating the solid fat.
7. Diokno Process	1960	Comminuted coconut meat is subjected alternately to pressure and vacuum to rupture the cells and release the constituents.
8. Central Food Technological Research Institute Process (Mysore India)		Grinding of the kernel and mixing with heptane until the material is free from moisture and oil. The meal is powdered and can be used in edible formulation. The process claims that 80% of the protein is H_2O extractable.
9. Kraus-Moffer (KM) Process and CFTRI/KM		The coconut is steamed and the kernel is passed through a cutter, rollers, and then pressed in a screw press. The milk is centrifuged to separate oil from water ("aqueous") layer. In the modified CFTRI/KM process, coconut steaming is omitted resulting in improved oil and protein recoveries.

10. Tropical Product Institute Process		Slurry of disintegrated coconut meat is filtered/screened to remove the fiber and centrifuged after adjusting the pH to its isoelectric point. Products obtained are oil, proteins, water solubles, and a fourth phase which is an emulsion containing substantial quantity of oil and protein.
11. Sanchez Process	1965	This is supposed to be a cold process that separates the oil from protein with the use of the "Sanso" reagent invented by Mr. Sanchez. The milk is stored in a stainless steel tank.
12. Nambear-Apacible	1974	Did not describe the process but claimed 100% recovery of oil, soluble proteins, and sugars and flour from the kernel.
13. Hagenmaier Process	1977	The coconut meat is sliced, dried, and expelled producing the oil. The oil is collected in a settling tank, filtered and deodorized.

Source: Banzon et al. (1990).

Out of the 13 "wet process" methods described in Table 4.1, methods 1, 2, and 7 did not use direct heating. Methods 3, 4, 5, 6, 9, and 11 applied heat. Methods 8 and 12 used chemicals (e.g., heptane and Sanso reagent, respectively) and method 10 utilized the isoelectric point of coconut proteins. Method 13 did not describe the procedure used.

Other studies were conducted to increase yield and quality of coconut oil by the wet process. The method of Banzon and Resurreccion (1979) involved solvent extraction of grated coconut endosperm with a household grater and dried in a laboratory force-draft oven at 40°C. The dried meal was extracted with ethyl ether in a Goldfish extractor.

Del Rosario (1973) showed that cellulase treatment of fresh and desiccated coconut meat reduced the fibrous content by 17% and 62%, respectively, and significantly increased the extractability of oil and protein. McGlone et al. (1986) extracted coconut oil through the enzymatic action of mixed enzymes on diluted coconut paste resulting in an 80% yield of good quality oil that has not undergone any purification step. Extraction of coconut oil from freshly grated coconut meat using commercial gamanase was also done by Pham et al. (1998). Che Man et al. (1996) used a mixture of enzymes at pH 7.0 that yielded 73.8% of oil. This technique for recovering oil from fresh coconut meat with enzymes considerably improved both the yield and the quality of oil compared to the traditional wet process.

Based on the standards approved by the Philippine Bureau of Food and Drugs, Department of Health (BFAD-DOH) for VCO, no heat should be applied to the process. However, only a few producers use the cold process. Separation of the oil from the aqueous layer containing proteins for the cold process includes centrifugation, fermentation, and enzyme treatment.

Figure 4.1 presents the schematic diagram of the different cold processes being used for VCO production. Method A uses natural fermentation and the oil is separated either by centrifugation, decantation, or use of separatory funnel. For method B, the principle involved in the addition of lactic acid bacteria (LAB) in the fermentation process of coconut milk is the production of enzymes by the LAB that catalyze hydrolysis of the components (e.g., proteins, carbohydrates) and, at the same time, break the emulsion between the oil and the aqueous layers. LAB also lowers the pH level of the mixture resulting in the precipitation of the proteins. Hence, separation of the oil from the "water portion" is facilitated either by centrifugation, decantation, or use of separatory funnel. For method C, the oil in coconut milk is separated by centrifugation and the collected oil is subjected to vacuum evaporation to remove the water.

Instead of using fermentative microorganisms to produce the enzymes, the technology developed at UPLB-BIOTECH (method D) utilizes very minimal amount of enzyme mixture to separate the oil from the water portion. The enzymes were obtained from generally regarded as safe (GRAS) or food grade microorganisms. Toxicological studies were conducted on each enzyme to alleviate the fear of the public. Each was found to be nontoxic and safe to human beings and animals. The finished product, VCO, also does not contain any of the enzymes since they are not oil soluble. Oil separation is done by centrifugation.

Other processes for coconut oil production with fresh coconut meat as starting material involved the use of heat as described in Figure 4.2. In method A, coconut milk, the major product, is extracted from fresh meat by an expeller, and the by-product, coconut meal, is then dried at a certain temperature to remove the moisture. The oil is obtained from the dried meal with the use of an expeller, which the manufacturer calls "virgin coconut oil."

Freshly grated meat is heated to a minimum of 100°C to produce a major product, dessicated coconut (DCN). Excess oil is removed from the DCN by the use of an expeller (method B). In the case of method C, the traditional method is used wherein the coconut milk obtained from extraction of freshly grated coconut meat is cooked until "latik" is formed. The oil is separated from the solid portion by filtration. In method D, the coconut milk extracted from freshly grated meat is allowed to stand in a jacketed container up to 90°C. After incubation, the oil is separated by centrifugation.

Different VCO producers who apply heat have maintained that their processes do not alter the quality of their product. However, if the standards approved by BFAD will be followed, which strictly specifies no application of heat, then the product cannot be called "virgin" coconut oil.

Figure 4.1 Schematic diagram of the different cold processing methods for virgin coconut oil production

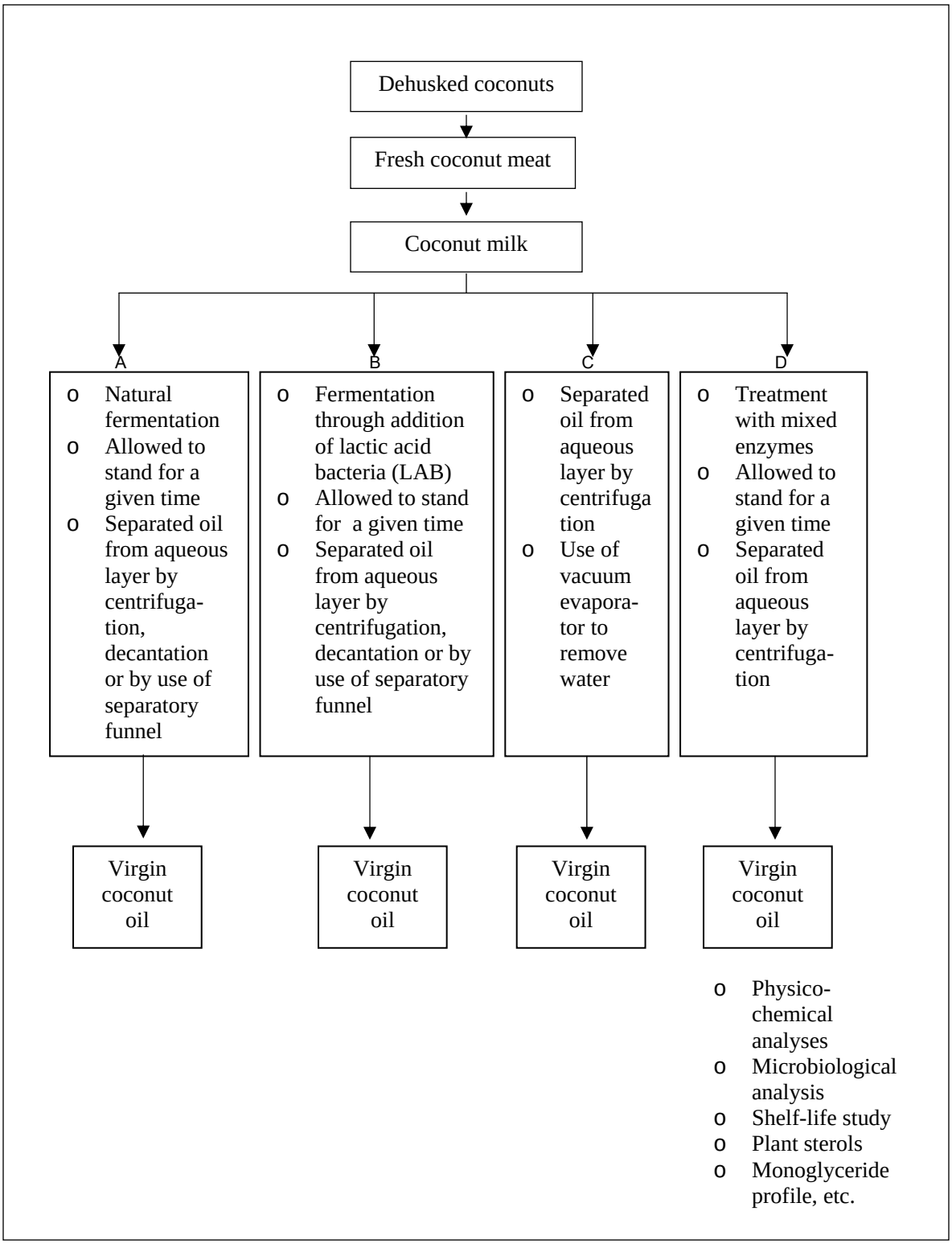
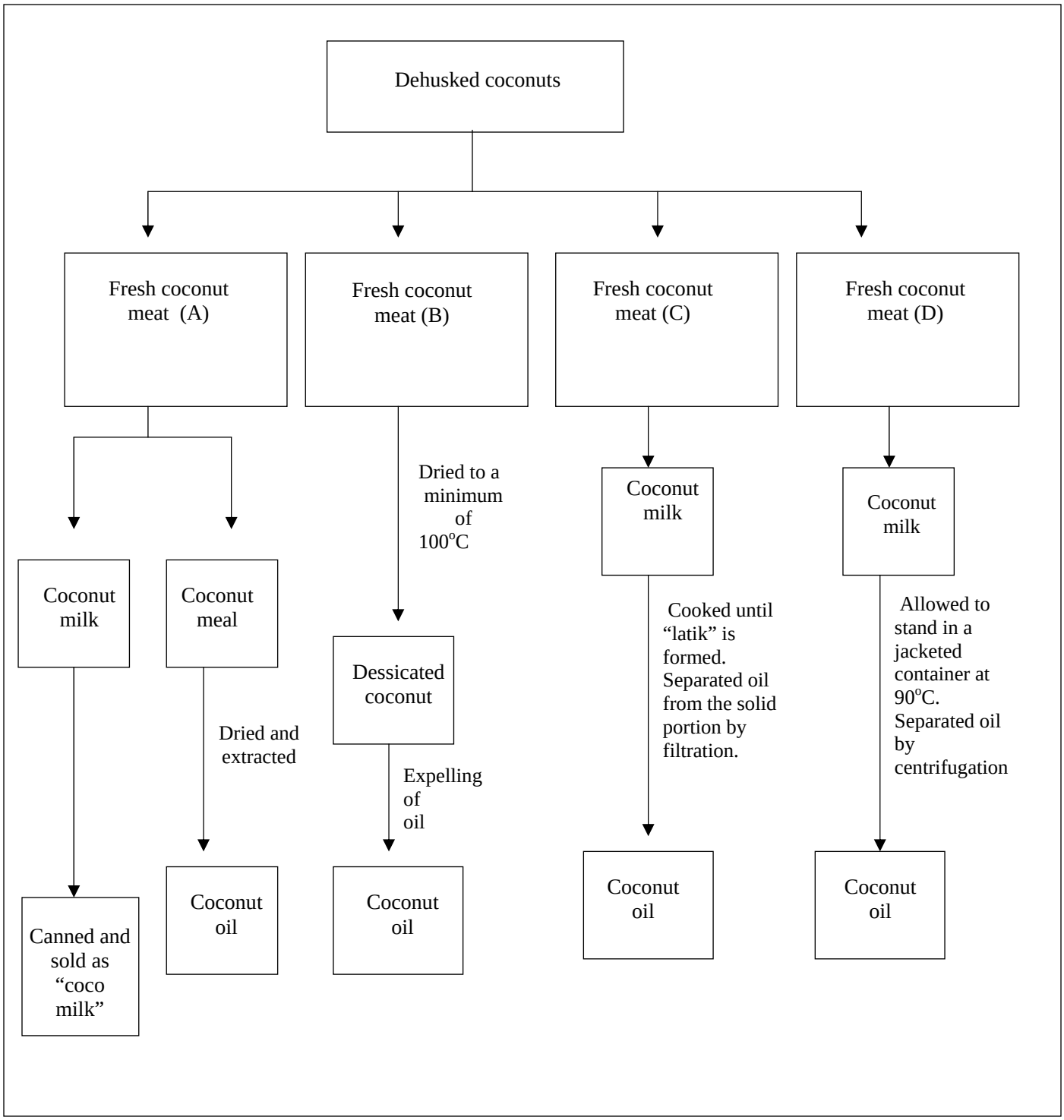


Figure 4.2 Schematic diagram of the different processes for coconut oil production using heat



Various studies (physico-chemical analyses, microbiological analyses, plant sterols, monoglyceride content, etc.) are now being conducted at UPLB-BIOTECH to differentiate the oils obtained from the different processes that yield refined, bleached, and deodorized (RBD) oil (e.g., Minola, Baguio Oil, etc.)

In an earlier study, Herradura (1988) determined the α-tocopherol content known as vitamin E of coconut oil from germinating and mature coconuts. Tocopherols serve as antioxidants that prevent peroxidation of unsaturated fatty acids of a given oil thus increasing its shelf life. Results of said study showed that oil from mature coconut (10 months old) had higher tocopherol contents in the upper and bottom portion, i.e., 19.7170 mg/ml and 28.9150 mg/ml, respectively. Meanwhile, those from oil of germinating coconut had lower tocopherol contents, i.e., 13.5580 mg/ml in the upper portion and 21.6504 mg/ml in the bottom portion.

These tocopherol values coincided with the stability study in which the upper and bottom portions of oil from 10-month-old mature nut that had higher tocopherol contents were found to be more stable giving 150.7 and 196.5 hours, respectively.

On the other hand, the upper and bottom portions of the oil from germinating coconut were only stable for 92.0 hours and 110.5 hours, respectively. Manalac (1967) reported that at each stage of processing, about 14.4% of tocopherol is lost in storage, deodorization, and alkali refining.

Currently, studies on the effects of different processing methods and coconut varieties on tocopherols and β-sitosterol of oils are being conducted by Espino and her group at UPLB-BIOTECH. In a study conducted by Santiago (2005) on the effects of different processing methods and coconut varieties on cholesterol and stigmasterol contents of coconut oil, data showed that higher percentage of cholesterol-like substance based on the total sterol content was obtained from the wet process that was without heat and enzyme for varieties Malaya red dwarf x Tagnanan tall (22.44%), Laguna tall (19.72%), and Malaya red dwarf x Baybay tall (14.63%), in decreasing order. The wet process that was without heat and with enzyme gave the lowest content of cholesterol-like substance based on the total sterol content for all varieties used with Laguna tall (2.03%), Malaya red dwarf x Baybay tall (9.20%), and Malaya red dwarf x Tagnanan tall (10.22%), in increasing order. For the kitchen method that involved heating until “latik” was formed, data showed that heating resulted in the decrease of the cholesterol-like content based on the total sterol content as compared to the wet process that was without heat and enzyme in decreasing order (Laguna tall, 15.42%; Malaya red dwarf x Tagnanan tall, 11.55%; and Malaya red dwarf x Baybay tall, 11.06%).

Qualitative determination by thin layer chromatography showed that stigmasterol was present in Laguna tall, Malaya red dwarf x Baybay tall, and Malaya red dwarf x Tagnanan tall. Based on the intensity of the colored spots obtained after thin layer chromatography (TLC), it seemed that heating affected the concentration of stigmasterol. Quantitative determination of the said sterol should be done to assess the effects of different processing methods and coconut varieties.

Results from these studies will be very useful in determining which components of the real VCO contribute to its health benefits besides the lauric acid that has a very wide range of antimicrobial properties.

Physico-chemical properties of coconut oils produced at UPLB-BIOTECH without and with enzyme were compared with those of the standard coconut oil (AOAC) (Table 4.2). Results of the analyses showed that those oils without and with enzyme treatment were comparable to the standard oil. However, in terms of free fatty acid (FFA) value expressed as lauric acid, further refinement of the UPLB-BIOTECH technology (cold process) resulted in the decrease of FFA expressed as percent lauric acid that now ranges from 0.10 to less than 0.20%, conforming with the standard set by BFAD-DOH. Any production run of VCO that exceeds the FFA maximum limit (0.2%) is discarded.

Table 4.2 Comparison of the physico-chemical properties of coconut oils without and with enzyme treatment with standard coconut oil (AOAC 1995)

Properties	Control[1]	Enzyme-treated coconut oil[2]	AOAC standard
Color	Colorless	Colorless	Colorless to brownish yellow
Specific gravity at 25°C	0.919	0.919	0.917-0.919
Free fatty acid value[3]	0.246	0.389	0.01-1.00
Saponification value	253	253	250-264
Iodine value[4]	9.81	9.57	7.50-10.50
Refractive index at 20°C	1.455[5]	1.455[5]	1.448-1.449[6]
Moisture	0.100	0.100	0.100
Viscosity	0.447	0.469	--

[1]No enzyme added.

[2]The coconut oil was obtained through an enzyme-catalyzed centrifuge process developed by the group of Dr. T.M. Espino of UPLB-BIOTECH. The process did not utilize any form of heat treatment.

[3]Expressed as % lauric acid. Values have been reduced to less than 0.2% after further optimization studies.

[4]Hanus method

[5]Analyzed at the Industrial Technology Development Institute (ITDI), DOST, Taguig, Metro Manila.

[6]Determined at 40°C. Analysis for peroxide value and tocopherol (vitamin E) contents will be done.

The fatty acid composition of the UPLB-BIOTECH-produced coconut oil (without and with enzyme) is presented in Table 4.3. Fatty acids of coconut oil are categorized as medium-chain triglycerides (MCT) that include caproic acid (C_6), caprylic acid (C_8), capric acid (C_{10}), and lauric acid (C_{12}); long-chain triglycerides (LCT) such as C_{14} (myristic acid), C_{16} (palmitic acid), and C_{18} (stearic acid); and unsaturated triglycerides consisting of $C_{18:1}$ (oleic acid) and $C_{18:2}$ (linoleic acid).

Table 4.3 Fatty acid composition of the UPLB-BIOTECH-produced coconut oil

Fatty Acid[1]	Concentration (%)[2]	
	Control[3]	Enzyme treated
Medium-chain fatty acid		
$C_{8:0}$ (caprylic)	5.45	5.59
$C_{10:0}$ (capric)	3.04	3.09
$C_{12:0}$ (lauric)	48.15	48.72
Long-chain fatty acid		
$C_{14:0}$ (myristic)	20.05	21.01
$C_{16:0}$ (palmitic)	9.80	10.44
$C_{18:0}$ (stearic)	1.18	2.85
Unsaturated fatty acid		
$C_{18:1}$ (oleic)	6.55	6.47
$C_{18:2}$ (linoleic	0.14	Trace

[1]Gas chromatographic analysis using flame ionization detector.

[2]Percent (%) relative concentration is based on the percent (%) peak area

[3]Without enzyme treatment.

To protect the quality of the so-called "virgin coconut oil," a series of public consultations to develop a set of standards for VCO was conducted by regulatory agencies of the government such as the Philippine Coconut Authority (PCA)and the Bureau of Agriculture and Fisheries Product Standards (BAFPS) of the Department of Agriculture (DA), the Center for International Trade and Expositions Mission (CITEM) of the Department of Trade and Industry (DTI), and DOH-BFAD, with technical personnel from the academe, VCO producers, and other nongovernment organizations involved in the coconut industry. Table 4.4 presents the draft of the Philippine National Standards for VCO. All VCO producers were given a six-month moratorium by BFAD-DOH to conform to the standards being refined by the Bureau. Appendix 4.1 gives the checklist of requirements for registration of VCO as well as the Philippine National Standard for VCO.

The regulatory agencies mandated by the Philippine government to implement the approved standards should have the political will to implement them. Their strict implementation and monitoring of compliance is very important to ensure the quality of Philippine VCO in order to maintain its competitiveness in the world market. Filipinos who are involved in VCO production should comply with these standards to avoid a case similar

to the “nata de coco” fiasco. Otherwise, other coconut- and VCO-producing countries such as Indonesia, India, Thailand and those in the Pacific region could overtake the Philippines in the world market.

Table 4.4 Draft of the Philippine National Standards for virgin coconut oil

Color, odor and taste	Colorless oil, sediment free, with natural fresh coconut scent, free from odors or tastes indicating alteration
Free fatty acid (% as lauric acid)	0.2% maximum
Moisture and volatile content	0.2% maximum
Food additives	None permitted
Peroxide value	3 meq/kg oil

- The term “virgin” does not address the actual production method.
- The term “premium and extra virgin” is borrowed from the olive oil industry and is just another attempt to make this oil sound somehow superior to others.

The VCO produced at UPLB-BIOTECH strictly follows the standards set by BFAD. Table 4.5 compares the properties of the UPLB-BIOTECH VCO with those prescribed by CODEX Alimentarius and adopted by BFAD.

Table 4.5 Physico-chemical properties of the UPLB-BIOTECH VCO as approved by BFAD

Properties	CODEX	UPLB-BIOTECH VCO
Color	Colorless or light yellow, clear oil	Colorless to pale yellow, clear oil
Odor and taste	Free from foreign and rancid odor and taste	Natural scent of coconut
% moisture	<0.2	0.09
% free fatty acid (as lauric)	Max 0.2	0.13
Peroxide value, meq peroxide oxygen/kg oil	≤ 10	0.33
Relative density (40°C/water @20°C)	0.908 – 0.921	0.919
Saponification value (mg KOH/g oil)	248 – 265	254.19
Iodine value (g iodine/100 g oil)	6.3 – 10.6	9.86
Iron (Fe)(mg/L)	5.0	0.77 ± 0.01
Copper (Cu)(mg/L)	0.4	ND*

Lead (Pb)(mg/L)	0.1	ND*
Arsenic (As)(mg/L)	0.1	ND*
Fatty acid composition Medium-chain fatty acid $C_{6:0}$ $C_{8:0}$ $C_{10:0}$ $C_{12:0}$	 ND – 0.7 4.6– 10.0 5.0 – 8.0 45.1 – 53.2	 0.39 6.01 5.36 47.83
Long-chain fatty acid $C_{14:0}$ $C_{16:0}$ $C_{18:0}$	 16.8 – 21.0 7.5 – 10.2 2.0 – 4.0	 19.56 9.88 3.01
Unsaturated fatty acid $C_{18:1}$ $C_{18:2}$	 5.0 – 10.0 1.0 – 2.5	 6.70 1.26
Total plate count CFU/ml	< 100	< 1
E. coli CFU/ml	< 1	< 1
Salmonella spp. CFU/ml	< 1	< 1
Yeast and molds CFU/ml	< 10	< 1

*ND – nondetectable (MDL Cu: 0.025 mg/L; Pb 0.05 mg/L, As 0.10 mg/L.

Coconut Meal/Coconut Flour

Coconut meal or coconut residue or "sapal" is the by-product obtained after the milk has been extracted from freshly grated coconut meat during the wet process of VCO production. Copra meal, on the other hand, is the by-product obtained after the oil has been extracted from copra. Coconut meal is similar to copra meal except that it may be used not only as feed but also as food. Unlike copra meal that is generally unfit for human consumption, coconut meal when spray-dried will retain its white color suitable as food when made into coconut flour.

Coconut flour, on the other hand, is the name commonly applied to the food grade product made from dried, deoiled, and finally ground coconut meal (Banzon et al. 1988). It is high in fiber, digestible carbohydrates, and a good source of protein.

VCO producers see exports escalating three to five times this year from 200,000 liters last year due to the high demand worldwide (Campos 2004). As demand continues to build up, VCO production will increase and so is the volume of coconut by-products that are good sources of raw materials for the development of new coconut-based products.

Copra meal

Copra meal has long been used as feed ingredient. Early studies showed that the maximum inclusion level of copra meal in broiler diets was 15%. The use of copra meal as feed is limited due to its fiber or nonstarch polysaccharide (NSP) content and its low levels of

essential amino acids (Ranit 1966). The amino acid composition of copra meal indicates a major deficiency in lysine and the sulfur-containing amino acids (methionine and cystine) relative to the requirements of poultry and swine (Querubin et al. 1989). Siriwathananukul (1986) investigated amino acid supplementation of high copra meal diets for growing finishing pigs while Colapo and Sacristan (2000) used 40% copra meal with lysine and methionine supplementation in broilers. Both obtained improvement in feed conversion ratio.

The major components of the nonstarch polysaccharides in copra meal are mannans and galactomannans that interfere with nutrient availability. Addition of NSP-degrading enzymes such as mannanase was identified to reverse the negative effect in broilers and swine (Padilla 1998; Romano 1999). Atinyao et al. (2000) studied the growth performance of pigs given copra meal diets with or without NSP-degrading enzymes and found an improvement in feed—a gain ratio at 30% copra meal with enzyme supplementation. Zamora et al. (1996) reported positive results in the growth performance of broilers fed with mannanase-treated copra meal.

Coconut meal

The nutritional value of coconut meal, a by-product of oil extraction by the wet process, has been studied as a feed supplement for cattle, chickens, and pigs.

Granfield (1912) in his studies reported that dairy cows fed with coconut cake produced a butter of good quality, possessing better keeping properties than butter from cows fed with linseed or cottonseed cakes. Brouwer (1930) and Schmidt and Vogel (1932) recorded an increase in the total butterfat from dairy cows fed with coconut meat. The butter produced from the milk fat was satisfactory. A study conducted by Ewing and Spence (1918) on feeding dairy cows with coconut meal and cottonseed meal showed that there was not much difference between feeding cottonseed meal, coconut meal, or a mixture of the two except that there was an increase of around 0.2% more in butterfat from dairy cows fed with coconut meal. They also pointed out that coconut meal was not as palatable as cottonseed meal, the former often became rancid on storage. This was verified by the experiments conducted by Joachim (1924, 1930) on the value of coconut cake as feeding stuff. He reported that coconut cakes became rancid and unpalatable when allowed to become warm and moist. Crawford (1940) also emphasized that the method of oil extraction had an effect on the suitability of coconut meal as a feed supplement for many classes of livestock. He reported that the presence of a large amount of oil in the coconut meal made it unsuitable for feeding in large amounts; the coconut meal became rancid and moldly when exposed to dampness during storage.

Meanwhile, Johns et al. (1919) found that the globulin from coconut meal protein produced almost a normal rate of growth in rats. Derecho (1922) reported that copra meal alone or when supplemented with highly purified food caused constipation in guinea pigs. Afalla (1938) used fresh coconut meat as feed for growing and fattening pigs instead of coconut meal. He concluded that 2 parts of coconut meat in place of 1 part corn increased the weight by 82%. Mondonedo and Realeza (1938) also reported that for growing and

fattening hogs, cracked coconut meat had a feeding value equal to corn, and grated coconut meat was 6% more efficient than corn for weight. A similar study was undertaken by Fronda and Doles in 1940 using chicks as experimental animal. They reported that feeding fresh grated coconut meat to chicks resulted in death due to diarrhea. Feathering of chicks was also hampered in lots where coconut meat was used. However, coconut meat imparted a smooth glossy appearance to the feathers of the adult birds.

In protein metabolism studies on rats, Smuts and Malan (1938) showed that the average biological value of the coconut meal protein was 69% and the true digestibility of coconut meal was 89%. Krishnamurthy et al. (1958) investigated the nutritive value of coconut meal and a low-cost protein food containing coconut and peanut meals and Bengal gram. They found that the protein efficiency ratio (PER) at 8 weeks for coconut protein-fed rats at 105 level of the protein intake was 2.04 as compared to 2.29 for rats fed with skim milk powder protein. The PER for a low-cost protein food containing coconut flour, peanut flour, and roasted Bengal gram flour was 1.72. In 1960, Tasker et al. undertook a similar study and reported that coconut meal at 12.5% level in a poor rice diet increased rat growth rate. Two protein-fortified foods with low fat peanut flour, coconut meal, and Bengal gram flour at 48.25:25 and 38:40:20 ratios, supplemented to poor rice diet, also caused a marked increase in growth. Bhatia and Swaminathan (1963) also prepared a protein food containing coconut meal fortified with calcium salts, vitamins A and D, thiamine, and riboflavin. This food was also seasoned with 3 parts of seasoning premix and 3 parts of common salts. The PER efficiency ratio at 4 weeks was 1.87 for growth of rats fed with coconut protein at 10% level in the diet. Salon and Payumo (1968) developed a high-protein food consisting of 60% mungbean flour, 35% coconut flour, and 5% nonfat dry milk. Growth studies on rats were conducted by Abdon et al. (1968) on their preparation. The high-protein food preparation gave a PER of 2.32, which was comparable to high-protein food supplements developed in other countries.

The importance of coconut meal as a food supplement depends almost entirely on the quality of coconut proteins. Johns and Jones (1920) in their analysis of some of the amino acids from coconut globulin by the butanol extraction method obtained glutamic acid, aspartic acid, alanine, and serine from the aqueous solution, while leucine, valine anhydride, and proline were isolated from the butyl alcohol fractions. Other amino acids of the coconut globulin determined after hydrolysis were glycine, phenylalanine, tyrosine, cystine, arginine, histidine, and lysine. The tryptophan and cystine of coconut globulin analyzed by Jones et al. (1924) showed the former to be 1.25% of the proteins while the latter was 1.52%.

Lyman et al (1956) determined the following amino acids from coconut meal by microbiological assay: arginine, 10.4; histidine, 1.8; isoleucine, 3.4; leucine, 5.4; lysine, 2.2; methionine, 1.5; phenylalanine, 5.1; threonine, 3.0; tryptophan, 0.99; and valine, 5.1. The amount of each amino acid was based on 16 grams of nitrogen.

In 1959, Matos and Frydman hydrolyzed the albumin, globulin, and prolamine fractions of coconut protein by HCl-HCOOH. They separated the amino acids by two-dimensional chromatography and identified them by the ninhydrin reaction. The albumin fraction contained aspartic and glutamic acids, alanine, serine, threonine, valine, leucine,

isoleucine, methionine, cystine and proline. The globulin fraction also had the basic amino acids, lysine, and arginine, in addition to those in the albumin, except proline and hydroxyproline. The prolamine fraction contained aspartic and glutamic acids, serine, threonine, alanine, valine, proline, and hydroxyproline. A comparative study on the essential amino acids of the proteins of coconut meal, peanut flour, and Bengal gram flour conducted by Tasker et al. (1960) showed that coconut meal proteins were uniformly rich in all essential amino acids while proteins of peanut and Bengal gram flour were deficient in methionine, lysine, tryptophan, and threonine.

Krishnamurthy et al. as cited by Bhatia and Swaminathan (1963) did a quantitative analysis of amino acids present in coconut meal. The amino acids (as g/16 g N) were arginine, 9.9; histidine, 2.2; lysine, 4.2; tryptophan, 1.1; phenylalanine, 5.1; methionine, 1.2; cystine, 1.4; threonine, 3.1; leucine, 7.5; isoleucine, 4.8; and valine, 4.0.

An investigation on the quality of coconut proteins conducted by Concepcion et al. (1958) showed that coconut proteins gave comparable results as the diet containing 12% case in growth studies as well as in the evaluation of protein efficiency and utilization. In their determination of the 12 constituent amino acids using the microbiological method, they obtained several amino acids (calculated as g/16.0 gm of nitrogen) in both the water- and the oil-soluble protein fractions (Table 6).

Tryptophan was found to be the limiting amino acid in both protein fractions using the microbiological method. However, it was found to be a good source of lysine.

Table 4.6 Amino acid analyses of water- and oil-soluble protein fractions of coconut

Amino acids	Fraction 1 (Water soluble)	Fraction 2 (Oil soluble)
Arginine	21.5	17.3
Cystine	0.8	0.7
Histidine	3.6	4.2
Isoleucine	12.6	7.7
Leucine	19.1	11.9
Lysine	9.9	8.4
Methionine	5.2	5.2
Phenylalanine	13.7	11.3
Threonine	8.5	7.8
Tryptophan	0.7	0.6
Tyrosine	2.6	2.4
Valine	16.8	10.7

Source: Concepcion et al. (1958).

In a study of the amino acid composition of the coconut endosperm using paper chromatography, Takeuchi (1961) reported the following amino acids present: alanine, arginine, aspartic and glutamic acids, glycine, hydroxyproline, isoleucine, leucine, lysine, serine, valine, and methionine. Phung Le Anh and Lugay (1967) employed ascending paper chromatography on the analysis of the amino acids on coconut proteins. They identified tryptophan, tyrosine, phenylalanine, leucine, glycine, and threonine qualitatively. Amino acids determined qualitatively and quantitatively (grams of amino acid/16 grams of nitrogen) were: glutamic acid, 20.532; proline, 16.9; isoleucine, 10.491; lysine, 7.219; arginine, 6.659; valine, 6.12; aspartic acid, 5.637; cystine, 4.758; histidine, 0.772; and methionine, 0.645.

Recently, Laurente (2005) used coconut meal from VCO production in broiler diets and reported that 5% coconut meal was the optimum inclusion rate. Higher level of coconut meal depressed growth performance of broilers.

Coconut flour

The Food and Nutrition Research Institute (FNRI) of the Department of Science and Technology (DOST), together with the PCA, developed a technology for converting coconut meal or "sapal" into high-value coconut flour and also pioneered the research on the nutritional and health benefits of coconut flour. Masa (2005) reported that coconut meal can be turned into high-protein and high-fiber coconut flour. The flour from coconut meal is low in fat and energy, and contains high amount of dietary fiber. The high-protein coconut flour can be used as substitute for wheat flour in a number of popular breads and cakes, while the high-fiber coconut flour can be used as an additive in breads, cookies, or snack food preparations to provide dietary fiber. Dietary fiber has been shown to play an important role in the prevention of colon cancer and atherosclerosis, and in the control and proper management of diabetes mellitus and obesity (http://www.fnri.dost.gov.ph/wp/coconut2.htm). Hence, it is very important that processing of coconut meal must meet the requirements of BFAD to ensure that only high-quality processed coconut meal is produced.

Various investigators have studied the physico-chemical properties of coconut flour (Banzon et al. 1988). Due its high-fiber content, coconut flour has limited blending ability with other flours. The ratio of coconut flour to wheat flour may not go beyond 1:9 or at most 1:4. When coconut flour is present in as little as 10-12% combination with wheat flour, a grainy or sandy mouthfeel is detected in baked goods. Samson et al. (1971) reported that white coconut flour or brown flour has good nutritional value. Miranda (1969) noted that coconut flour compares favorably with high-quality plant proteins like sesame and peanut flours.

Coconut Skim Milk/Coconut Protein

Coconut milk is defined as the liquid portion obtained after extraction of freshly grated meat with or without addition of water. In the Philippines, the milk is popularly known as "kakang gata" if no water is added in the first extraction. The milk is usually added as an ingredient in a number of dishes and desserts especially in coconut-producing countries of the Asia-Pacific region.

Figure 4.3 presents the schematic diagram of the traditional extraction process for coconut milk as described by Gonzalez (1990). Extraction of freshly grated meat by hand pressing is commonly used to produce enough milk in small scale. The traditional process of manual extraction is very inefficient and results in low yield of oil. Production of coconut milk in large scale uses an expeller or hydraulic press.

In the commercial production of VCO through the wet process, separation of the oil from other constituents of coconut milk could be facilitated by centrifugation and fermentation or addition of specific enzymes, or a combination of centrifugation and fermentation or centrifugation and addition of specific enzymes. Continuing studies conducted by Espino and her group on VCO production by the cold process showed higher oil recovery with the enzyme-mediated treatment as compared to the control. The liquid portion after oil separation is the so-called "skim milk."

Coconut skim milk is a very important by-product in the commercial production of VCO. It contains good-quality proteins including water-soluble carbohydrates and sugars originally present in fresh coconut meat. According to Banzon et al. (1990), its chemical composition depends upon the amount of liquid used for the extraction of the grated coconut meat. With a 1:1 ratio of meat to water, the skim milk typically contains 90% moisture, 2.7% protein, and 0.6% fat. Comparison of nutrients derived from coconut skim milk and cow's milk is shown in Table 4.7. Although cow's milk was shown to be more nutritious than coconut skim milk in terms of protein, calcium, phosphorous, and vitamin A, coconut skim milk could be a cheap alternative source of nutrients for malnourished people in poor countries where cow's milk is not available or very expensive. The carbohydrate, iron, niacin, and ascorbic acid contents of coconut skim milk were also comparable and even higher than those of cow's milk.

In 1980, Escuesta used mungbean protein isolate in combination with coconut milk and coconut milk with nonfat dry milk (NFDM) to determine the stability of evaporated-type and sweetened condensed-type beverage products. Instead of using mungbean isolate, coconut skim milk could be used as an alternative protein source in the preparation of coconut skim milk beverages. Analysis of coconut skim milk showed that it contains 90% moisture, 2.7% protein, and 0.6% fat using a 1:1 ratio of meat to water (Gonzales, 1990). In another study, Hagenmaier (1980) showed that the coconut milk produced without the addition of water, heated to 73°C, and passed through a three-way centrifuge contained 85.8% moisture, 35% protein (dry basis), 9% minerals (dry basis), and carbohydrates in the form of sucrose (55% dry basis). In terms of the nutritional quality of the proteins in coconut skim milk, Table 4.8 shows that both skim milk and protein sediment have good essential amino acid balance.

Figure 4.3 Traditional extraction process for coconut milk from freshly grated meat (Gonzalez 1990)

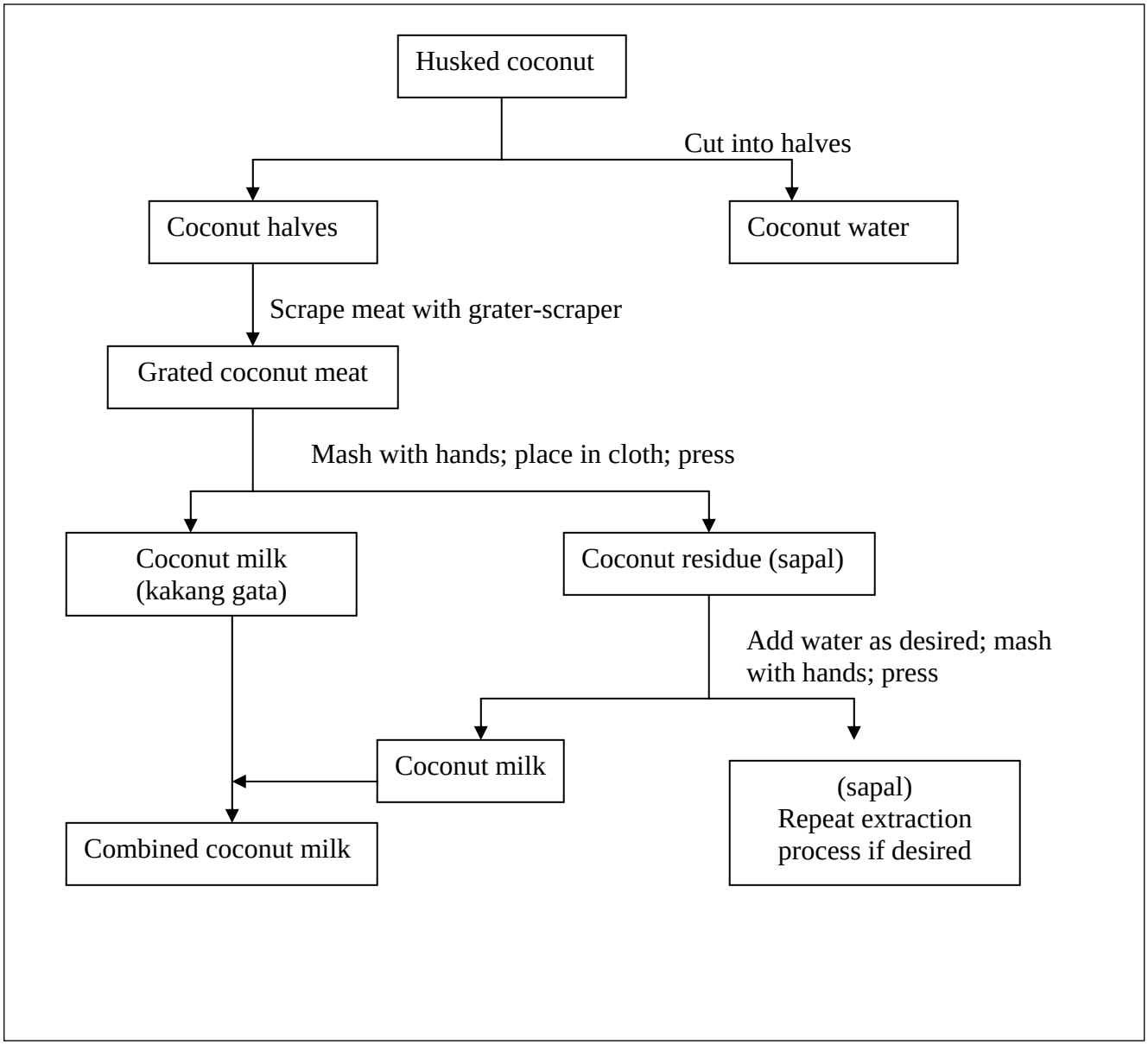


Table 4.7 Comparison of nutrients derived from coconut skim milk and cow's milk

Nutrients	Coconut skim milk	Cow's milk
Food energy, cal	27.0	65.0
Protein, g	1.6	3.5
Fat, g	0.4	3.5
Carbohydrates, g	4.5	4.9
Calcium, mg	26.0	118.0
Phosphorous, mg	36.0	93.0
Iron, mg	0.7	Trace
Thiamine, mg	0.01	0.03
Riboflavin, mg	0.01	0.17
Niacin, mg	0.4	0.1
Ascorbic acid, mg	2.0	1.0
Vitamin A, I.U.	-	140.0

Sources: For skim milk: Salon et al. (1969); for cow's milk: Watt et al. (1963).

Table 4.8 Amino acids in the coconut skim milk and the protein sediment from the cream separator

	Amino Acid Content (g/100 g Protein)[a]	
	Skim milk	Protein sediment
Essential		
Isoleucine	2.5	3.7
Leucine	5.1	6.4
Lysine	4.1	3.0
Phenylalanine	3.6	4.0
Tyrosine	2.1	2.8
Cysteine/cystine	1.8	1.7
Methionine	1.2	2.2
Threonine	2.4	3.3
Tryptophan	0.9	1.1
Valine	4.1	5.3

Source: Hagenmaier (1980) as cited by Banzon et al. (1990).

[a]Equivalent to g/16 g nitrogen.

The composition, nutritional value, and functional properties of the protein concentrates that largely determine their suitability for food and nonfood applications have thus been the subject of numerous researches.

For example, Melo (1969), through solubility tests, established that the protein they prepared consisted of 67% globulins, 21% glutelins, 7% albumins, and 5% prolamines. These values are close to those reported by Purwoamidjojo (1982), namely, globulins, 49.79 to 61.6%; glutelins, 9.16 to 11.31%; albumins, 13.56 to 15.92%; and prolamines, 1.35 to 1.93%. A comparison of the essential amino acid content of coconut protein concentrate with the FAO/WHO (1973) scoring pattern (Table 4.9) shows that, except for the sulfur amino acids methionine and cysteine, of which only traces are present, coconut protein concentrates/isolates provide most of the amino acids essential for good health (Gonzales and Tanchuco 1977). Concepcion et al. (1958) also reported that tryptophan may be another amino acid limiting in coconut protein concentrate/ isolate.

The proximate composition of coconut protein concentrates/isolates has also been studied. Gonzales et al. (1969) produced concentrate from aqueous extract of coconut meat by acid precipitation, heat coagulation, and direct drying of the extract using a drum dryer. Acid precipitation results in a higher protein content, but only at the expense of organoleptic quality. Direct drying produces a highly acceptable extract but of relatively low protein content.

Gonzales and Tanchuco (1977) likewise prepared protein concentrate from coconut skim milk by heat coagulation, drying of the protein coagulum at 60-70°C, and solvent-extraction of the dried product to remove residual oil.

Table 4.9 Comparison of essential amino acid pattern of coconut protein concentrates/isolates to FAO/WHO amino acid scoring pattern

Essential amino acid	Coconut Protein Isolate (g/16 gN)	FAO/WHO Pattern 1973
Isoleucine	4.06	4.0
Leucine	7.60	7.0
Lysine	4.06	5.5
Methionine + Cysteine	Traces	3.5
Phenylalanine + Tyrosine	6.30	6.0
Threonine	4.90	4.0
Valine	6.30	5.0

Source: FAO/WHO (1973).

Storage of the product for 6 months packed in 0.002 milliliter polyethylene bags, at ambient conditions (30° ± 2°C), refrigerated (4°C), and frozen (0°C) indicates very slight changes in its physicochemical and organoleptic properties (titratable acidity, thiobarbituric

acid values, odor, color, taste, and general acceptability). The low moisture and fat contents, as well as proper packaging of the product, contribute to its good keeping quality.

Dilute neutral salts, alkali, and acid solutions are proven to be effective solvents for the extraction of vegetable proteins. Dilute salt solutions increase the dielectric properties of proteins and cause dissociation of protein molecules from the other constituents of the cells to render them more soluble (Melo 1969). Dilute alkalies, on the other hand, increase the solubility of acidic proteins, while dilute acids promote solubility of basic proteins.

Melo (1969) compared the efficiency of protein extraction using salt, acid, and alkali solutions from defatted coconut flour prepared from comminuted coconut meat dried at 40°C and 100°C. Dilute sodium hydroxide solution proved to be a more efficient solvent than the salt and acid solutions (Table 4.10). This indicated that coconuts contain a number of acid-sensitive proteins, which precipitated at pH 3.4 to 3.5 (Sison et al. 1969).

The use of elevated temperatures in the drying of coconut meat for flour production adversely affected the solubility of coconut proteins (Table 4.10). This observation was collaborated by Sison et al. (1969), who obtained a higher yield of protein from defatted coconut flour dried at 60°C compared with that dried at 90°C. This effect is attributed to the denaturation of proteins brought about by heating of the coconut meat, resulting in reduced solubility. Purwoamidjojo (1982) likewise reported that stability of coconut milk from desiccated coconut decreased with the increase in drying temperature due to the denaturation of proteins.

On the other hand, four different methods for the isolation of proteins from coconut skim milk were tested by Buccat et al. (1973), namely, heat coagulation, isoelectric precipitation, combined isoelectric precipitation and heat coagulation, and coprecipitation with calcium salts. Higher protein yield was obtained by heat coagulation than by pH precipitation, and combining the two techniques resulted in an even higher yield.

Buccat et al. also collected the sludge that accumulates after centrifuging the coconut milk extract. The material is oily and contains about 50-55% protein. After washing with water, drying, and defatting with normal hexane, the resulting product is a white powder containing 74% protein.

Table 4.10 Extraction of coconut proteins from defatted coconut flour dried at 40°C and 100°C

Extractants	Percent protein extracted	
	A (Dried at 100°C)	B (Dried at 40°C)
Water	35.6	-
0.50M NaCl	51.7	-
1.0 M NaCl	68.7	78.5
1.0 M NaOH	79.5	83.7
0.25 M NaOH	72.0	80.5
0.10 M NaOH	70.9	80.5
0.05 M NaOH	69.5	78.8
1.0 M NH_4OH	60.2	66.8
1.0 M CH_3COOH	32.0	42.1
1.0 M HCl	25.0	24.9

Source: Melo (1969).

Hagenmaier (1980) has also done extensive work on the recovery of proteins from coconut skim milk by heat coagulation and/or acidification followed by solid-liquid separation to remove the low protein liquid phase or whey. Heating the skim milk, which originally contained 4.7% protein, to a temperature of 98°C without acidification gave whey containing 2.3% protein (Table 4.11). Acidification to pH 4.6 after heating neither significantly increased protein recovery nor reduced the protein content of the whey. Acidification without heating, on the other hand, has several disadvantages (Hagenmaier 1980). First, the coagulated protein sediment is very viscous and must be diluted with water before spray drying. Second, the protein develops a dark color when neutralized with alkali to remove the acid taste. Finally, the use of acids entails additional expense. Furthermore, heating and/or acidification have proved to be inefficient methods of protein recovery, as one-third of the protein available still remains in the whey.

The use of $CaCl_2$ or sodium hexametaphosphate to aid protein precipitation was also tested by Hagenmaier (1980). A slight decrease in the protein content of the whey was observed, but the taste of the product was adversely affected.

Final processing of the coagulated proteins may be done by spray drying or drum drying. The latter proved to be the more economically advantageous option.

Table 4.11 Protein content of whey after protein coagulation at different values of pH and temperature

Temperature(^oC)	Protein content of the whey		
	pH[a]	% Dry basis	% Wet basis
98	5.8 3.2 4.7	20 22 19	2.3 2.5 2.1
94	5.7 5.1 4.6	21 22 21	2.5 2.6 2.2
90	5.8 4.5	26 19	2.5 2.1
60	4.7	23	2.3

Source: Hagenmaier (1980).

[a]pH 5.7 to 5.8 is the naturally occurring unadjusted value.

While heat coagulation and isoelectric precipitation cause alteration in the chemical structure of the proteins, Hagenmaier (1980) used a purely physical separation process to produce coconut protein concentrates. The process is ultrafiltration, where separation is due to the varying rates of diffusion of different molecular species through a semi-permeable membrane. Hagenmaier (1980) concentrated coconut skim milk by ultrafiltration to produce a protein-rich solution. Spray drying the solution results in a white powder, neither as hygroscopic nor as flavorful as dried coconut skim milk, but still retaining some of the fresh coconut flavor. Sediment from coconut cream may also be added before drying.

Several studies have already been conducted on the utilization of coconut skim milk powder as ingredient for beverages (Salon and Maniquiz, 1969; Hagenmaier, 1983; Gonzales et al., 1983; Solidium and Genato, 1987) and bakery products (de Leon, 1976). Since the wet process for coconut oil production was not successfully pushed through in the 1980s, Hagenmaier (1980) reported that the prospect of using dried coconut skim milk then was not economically viable as substitute for wheat flour.

As demand for VCO increases, production of coconut skim milk also increases. Hence, there is a need to process the skim milk immediately in order to prevent microbial growth. The most effective means to process the skim milk is to spray dry the product and use it in powdered form.

Coconut Water

The country produces big volumes of coconut water as a by-product of dessicated coconut, copra manufacture, and recently, from VCO production. A fully mature nut contains about 250 g of water while the less mature nut contains considerably more (Banzon

1988). The PCA reported that one metric ton of coconut water is obtained from 3.115 metric tons of husked nuts, suggesting a huge resource for high-value products. Unless a comprehensive and efficient method for the utilization of this by-product is developed, coconut water will just go to waste and cause environmental problems.

The chemical composition of coconut water varies with the age of the nut (Anzaldo et al., 1985). Total reducing sugar and protein contents increase as coconut matures. However, total sugar content reaches a peak of 2.9% on the ninth month, and then declines. This explains why coconut water from young nuts is substantially sweeter than that from mature nut. The sugars include simple sugars such as glucose, fructose, and sucrose, and sugar alcohols, mainly sorbitol. Sison and Genato (1977) reported the average proximate analysis of coconut water from mature nuts generated in a coconut dessicating factory (Table 4.12).

Coconut water is an excellent source of nutritious and healthful drink. It contains proteins, fats, sugars, vitamins, and amino acids (PCA 1979). Mamaril et al. (1988), Serrano et al. (1967), and Sierra and Velasco (1976) reported on the unusual growth-promoting factor of coconut water on plant and microbial cells. In terms of mineral contents, coconut water is relatively high in potassium and low in sodium content (Anzaldo 1985).

The abovementioned characteristics indicated the potential of coconut water as raw material for value-added products such as vinegar and coconut water beverages. It may also be used in the manufacture of nata de coco, wine ("lambanog"), alcohol, yeast, and food jelly.

Table 4.12 Proximate analysis of coconut water from mature nuts

Nutrient Parameter	Level (%)
Sugars (levulose & dextrose)	2.60
Protein	0.55
Oil	0.74
Total solids	4.71
Chlorides	0.17
Ash	0.46
Specific gravity	1.02
pH	5.60

Source: Sison and Genato (1977).

Vinegar

The most common application of coconut water is in vinegar production. As cited by Opeña (1988), the Development Bank of the Philippines' industry profile for coconut states that vinegar production requires minimal attention even during preparation until harvest, not labor intensive, and has a low level of capitalization. A researcher from UPLB found that the

earnings from vinegar (from coco water or coco sap) are bigger than the earnings from copra or fresh coconut alone. On a per hectare basis, earnings from vinegar total to about PhP8,705 while copra earns PhP5,093 and fresh coconut PhP5,445 for the farmer.

Vinegar is a sour-tasting condiment and preservative prepared by two successive microbial processes, the first being an alcoholic fermentation effected by yeasts and the second an oxidation of alcohol by *Acetobacter,* a genus of aerobic bacteria.

The United States Food and Drug Administration (USFDA) requires that any product called "vinegar" contains at least 4% acidity. This requirement ensures the minimum strength of the vinegar sold at the retail level. There are currently no standards of identity for vinegar in the US. However, the FDA has established "Compliance Policy Guides" that must be followed regarding labeling of vinegars (http://www.versatilevinegar.org/todaysvinegar.html). The same thing should be adapted in the country. Proper representation of the vinegar products in the labels must be followed (e.g., coconut vinegar or cane vinegar and others).

Coconut vinegar belongs to a category of vinegar products called specialty vinegars. Specialty vinegars are those formulated to provide a special or unusual taste when added to various food preparations thus making them a favorite in the gourmet market.

From thousands of years ago up to the present, people continue to use vinegar in a variety of ways. Vinegar is one flexible product because of its versatile use in everyday life—from the kitchen to the bathroom and beyond. It is used primarily as a key ingredient in cooking. Vinegar also adds flavor and zip to salad dressings, sauces, marinades, ketchup, pickles, tomato products, and more. In Japan, some people considered vinegar as health food particularly those made from fruits. Drinking vinegar thus became a fad in Japan. Others use vinegar as an alternative to commercial household cleaners that are harmful (http://www.versatilevinegar.org/latestnews.html).

Opeña (1988) reported that vinegar exports showed an increasing trend from 1975 to 1977 and a slight decline in 1978 owing to the damage brought about by the typhoon "Kading." Moreover, although there are no documented export figures for vinegar for the years following 1978, it has been noted that local demand for vinegar increases at a rate of 3% annually.

Coconut water beverages

Studies on the use of coconut water have also been conducted by several researchers. Del Rosario and Rubico (1979) formulated coconut water beverage from mature nuts and del Rosario cultivated yeasts in coconut water (as cited by Opeña 1988). Gonzales et al. (1983) have also developed processes for the production of non-carbonated and carbonated coconut water beverages utilizing water from mature nuts. Coconut water from "buko" (young green coconut) may also be used.

In the process of Gonzales (1983), the pH of coconut water is adjusted with food grade acid, and total solids with refined sugar. Sodium benzoate is added as preservative. The solution is pasteurized, passed through a centrifuge to give a nonoily solution, and repasteurized further. Repasteurization may be done through a high temperature short time (HTST) heating unit, in which case the addition of preservative is not necessary. Also, the pH and total solids content need not be adjusted, and this results in a natural coconut water drink.

For noncarbonated coconut water beverage, the hot repasteurized coconut water is packed aseptically in beverage bottles, tin cans, laminated pouches, or tetra briks. For carbonated beverages, the repasteurized coconut water is cooled, carbonated, and packed aseptically in suitable sterile containers. The volume of carbon dioxide dissolved in coconut water beverage is 2.1–3.2%, which is the range obtained from commercial cola and uncola type of soft drinks.

Noncarbonated and carbonated coconut water beverages possess the characteristic flavor of coconut water, but this is slightly masked by the acid-sweetish taste imparted by the different additives. Both products are highly acceptable and preferred to other artificial fruit drinks (Gonzales et al. 1983).

Coconut growth hormone

Cocogro is a commercialized product, a mixture of plant growth hormones from coconut water developed by Mamaril et al. (1989). It can be applied to orchids, flowering plants, and ornamentals. Cocogro enhances seed germination, induces bud formation and early flowering, and promotes plant growth and development as growth promoter in tissue culture media.

DESCRIPTION OF PRODUCTS

Virgin Coconut Oil

Virgin coconut oil (VCO) is the naturally processed, chemical-free, and additive-free product from fresh coconut meat that has not undergone any heat above 40°C and chemical processing after extraction. It has the natural scent of coconut, colorless to pale yellow, and contains natural vitamin E. Pure VCO is not subjected to chemical refining, bleaching, and deodorizing (RBD) as well as hydrogenation. Hydrogenation of fats and oils results in the production of transfatty acids that cause heart disease. Therefore, VCO is free from transfatty acids. Its competitive characteristics and applications are as follows:

<u>Product characteristics</u>

- Retains vitamin content, especially Vitamin E, an antioxidant
- Richest source of medium chain triglycerides (MCT) among vegetable oils

- Rich in lauric acid, a fatty acid naturally found in mothers milk that helps develop and strengthen the immune system of newborn babies
- Has antiviral, antimicrobial, antiprotozoal, and antifungal activity
- Has anticancer activity
- Cholesterol, chemical, and additive free
- Has low peroxide value, which makes it less prone to rancidity
- Loaded with antioxidant properties that strengthen the immune system
- Does not contain aflatoxin and polyaromatic hydrocarbon (PAH)
- Retains the aromatic scent and taste of fresh coconut

Product applications

- Strengthens the immune system due to its high lauric acid content
- Helps prevent bacterial, viral, and fungal infections
- Protects the body from degenerative diseases
- High-energy food supplement
- Eases constipation
- Reduces the risk of cancer
- Helps control diabetes
- Helps eliminate gall bladder and kidney stones
- Reduces the risk of atherosclerosis and heart disease
- Improves digestion and nutrient absorption
- Keeps skin soft and smooth
- Effective remedy for skin ailments like psoriasis, eczema, skin rashes, pimples, and other skin disorders
- Good carrier oil for aromatherapy

Industry scope

- Nutraceuticals
- Cosmetics

In VCO production by the wet process, other high-value by-products can be obtained (Figure 4.4). These by-products can be utilized as raw materials for other high-value, environment-friendly products, thus can increase the incomes of producers and prevent environmental pollution.

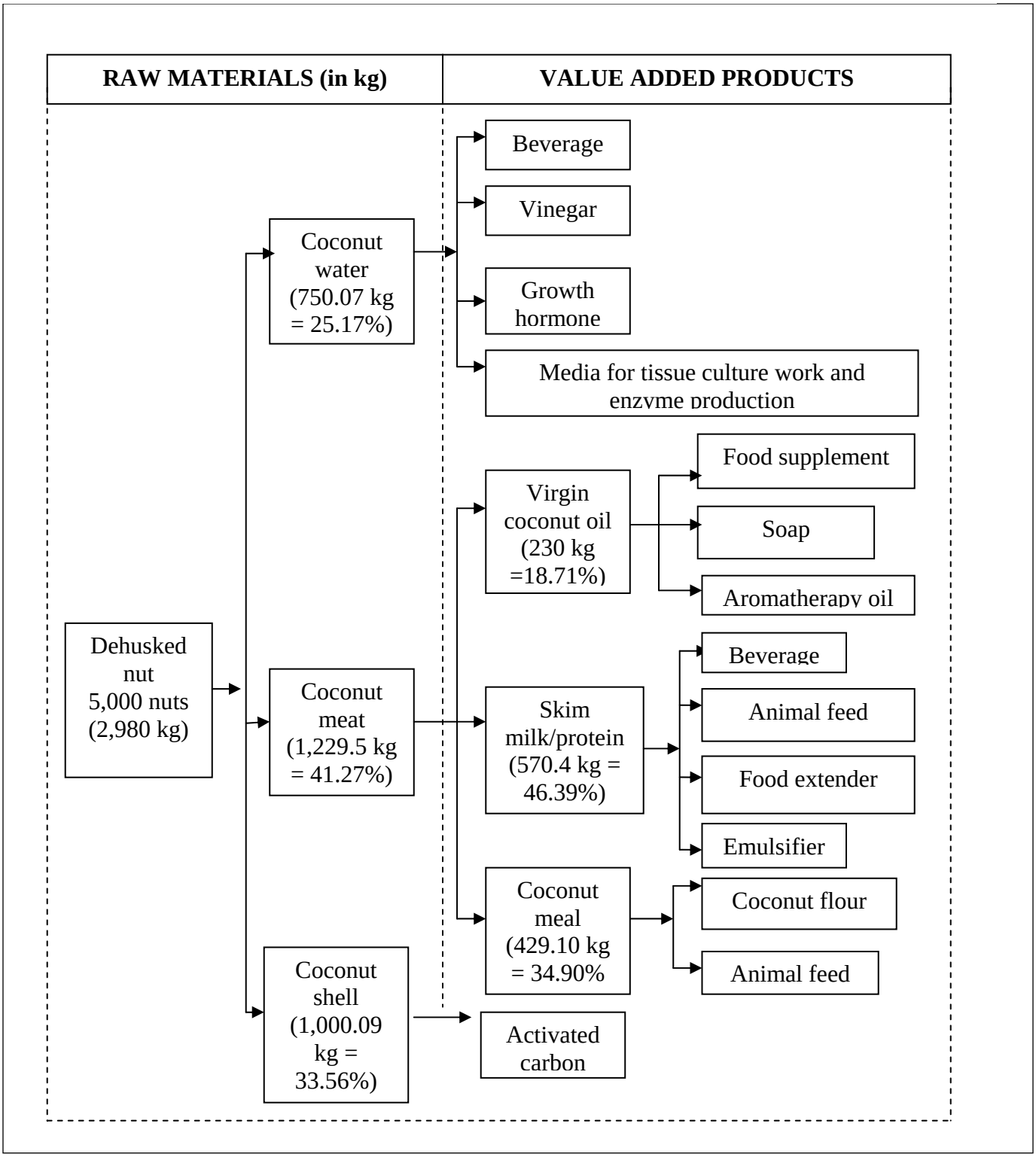
Coconut Water

Coconut water can be a competitive substitute for currently available beverages that have lower food values and prepared using imported materials. Large quantities of coconut water are collected with biological oxygen demand of 40 grams per liter. If left unused, its nutritional value will just go to waste and contribute to environmental pollution (Banzon et al. 1990).

The coconut water wastes from VCO production can be material inputs for the production of the following value-added products:

- Nata de coco production
- Therapeutic drink
- Refreshment drink
- Vinegar
- Sparkling wine
- Coconut champagne
- Components for tissue culture media for plants (e.g., banana, orchids)
- Fermentation media for enzyme production
- Growth regulator
- Biogas generation
- Coconut water concentrates

Figure 4.4 Schematic diagram on the utilization of freshly grated coconut for production of VCO and other by-products. Data were based on actual production runs at UPLB using Laguna Tall variety with an average weight of 0.596 kg per nut



Coconut Meal

Coconut meal is white in color. Its composition is shown in Table 4.13. It has a higher fiber content but lower protein content relative to copra meal (Laurente 2005) as shown in Table 4.14 (The Philippine Recommends for Livestock Feed Formulation 2000).

Coconut flour from coconut meal is white to cream in color similar to wheat flour. It is high in dietary fiber, digestible (carbohydrates), contains no gluten, and a good alternative to wheat (http://www.wildernessfamilynaturals.com/book-cooking-coconut. htm). It is ideal for making cookies, cakes, and other baked products. Coconut flour can replace all-purpose flour to as much as 38% (http://www.fnri.dost.gov. ph/wp/coconut2. htm).

Table 4.13 Proximate analysis of coconut meal

Component	%
Moisture	2.12
Crude ash	1.52
Crude protein	6.29
Crude fat	16.25
Crude fiber	12.92
Nitrogen – free extract	60.90

Source: Laurente (2005).

Table 4.14 Typical composition of copra meal

Component	%
Dry matter (%)	94.00
Moisture (%)	6.00
Crude protein (%)	20.00
Fat (%)	9.00
Fiber (%)	11.00
Ash (%)	6.50
Ca (%)	0.15
Total P (%)	0.60
Available P (%)	0.08
Lysine (%)	0.50
Methionine (%)	0.30

Methionine + Cystine (%)	0.60
Arginine (%)	2.20
Threonine (%)	0.64
Tryptophan (%)	0.16
Metabolizable energy, poutry (Kcal/kg)	1800
Metabolizable energy, swine (Kcal/kg)	2850

Source: The Philippine Recommends for Livestock Feed Formulation 2000.

Coconut flour is the ground solid residue/flakes obtained after immediate extraction of oil from dried comminuted coconut meat or coconut milk residue that is processed under sanitary conditions. Three types of flour can be made from coconut:

1. Full-protein, medium-fat coconut flour with testa;
2. Full-protein, medium-fat coconut flour without testa; and
3. Low-fat, high-fiber coconut residue flour.

Coconut flour is made from fresh coconut meat and contains 14% coconut oil and 58% total dietary fiber. It is a natural high-quality ingredient used as an excellent source of dietary fiber. Foods rich in dietary fiber can help in maintaining weight and in controlling diabetes. Dietary fiber slows down the release of glucose thus the body requires less insulin to utilize glucose and transport it into the cell where it is converted into energy. Foods rich in soluble dietary fiber are low glycemic index foods. In contrast, foods without dietary fiber allow fast release of glucose creating a need for more insulin. In the absence of enough insulin needed to utilize the glucose, the glucose stays in the blood and can cause high blood glucose and/or hyperglycemia. The excess glucose can also be stored in the body and may increase weight.

The smell of coconut flour is dependent upon the processing. The coconut smell becomes stronger as more coconut oil is left in the flour after processing. The granulation is dependent upon the degree of grinding and milling to which the flour has been subjected. It usually varies from 30 to 200 mesh. The vitamin and mineral contents of coconut flour is shown in Table 4.15 (Abdon 1967). Coconut flour has good nutritive value and contains no known substances at toxic levels as some oilseed flours do (Table 4.16).

Table 4.15 Vitamin and mineral content of coconut flour

Vitamin/mineral	Mg/100g
Thiamine	0.09
Niacin	2.30
Riboflavin	0.08
Calcium	70.00
Phosphorus	470
Iron	8.10

Source: Abdon (1967).

Table 4.16 Analysis of coconut flour

Component	%
Protein	12-15
Carbohydrates	55-60
Minerals	3-4
Fiber	9-10
Moisture	2-5

Source: Nambiar and Apacible (1976) as cited by Banzon et al. (1990).

Coconut Protein

Protein concentrates from vegetable sources have been used as intermediates in the preparation of high-protein food products. They contain almost pure proteins with minimal amounts of moisture and minerals. These are prepared by extracting the vegetable material, usually cereal germs, legumes, or oilseed meals, with a solution of acid, alkali, or salt, then coagulating and precipitating the proteins from the solution by heating and/or acidification. Coconut protein concentrates have been successfully prepared by this method and used in a number of food preparations.

VALUE CHAIN ANALYSIS

Internal Environment Analysis

Tables 4.17, 4.18, 4.19, and 4.20 present the summaries of the Strengths, Weaknesses, Opportunities, and Threats (SWOT) analysis for VCO, coconut meal, skim milk/protein concentrate, and coconut water, respectively. A detailed discussion is given below.

Strengths

Research and Development (R&D)

- *Established protocol and infrastructure for product quality monitoring*. Through extensive researches conducted, efficient production processes and monitoring agencies such as the Bureau of Agriculture and Fisheries Product Standards, PCA, DA, BFAD, and DOH are already in place to regulate the manufacturing of VCO.

- *Availability of efficient technology*. There are several technologies for the production of VCO. According to experts, the wet process is so far the best process to produce high-quality VCO.

  The technologies currently adopted by VCO processors for commercialization are presented in Figures 4.1 (cold process) and 4.2 (heat process).

Product development

- *Developed high-quality VCO and by-products.* High-quality VCO and other products like soap, coco flour, and coco meal as animal feed can be produced using the technologies developed by the public and private sectors. In fact, some firms are already in the early stages of commercialization of some products.

  In terms of composition, VCO, just like coconut oil, has comparative advantage over other vegetable oils (Table 4.21) because of its medium-chain fatty acids that include C_6, C_8, C_{10}, and C_{12}. Highly unsaturated plant oils (e.g., corn oil, soybean oil) are hydrogenated to make them stable, but in the process, they produce trans fats that cause heart disease (Dayrit 2005).

- *Clinical studies were already conducted on VCO*. Clinical trials for topical applications were already conducted by Dr. Vermen Verallo-Rowell (2005), a well-known dermatologist. After several trials using the UPLB-BIOTECH-produced VCO, it was found to be effective for skin diseases such as psoriasis, exzema, bed sore, and acne due to its antimicrobial and cleansing properties as described in her book, *Rx: Coconuts! (The Perfect Health Nut).*

  Clinical studies were also conducted by Dr. Jader-Onate (http://www.laureece.com/dr_onate.htm) on about 500 patients using VCO to prevent and cure various illnesses. It was found to be effective on a significant number of patients (50) with diabetes. The experiments on VCO for treating HIV-positive patients also yielded good results.

Table 4.17 SWOT analysis on virgin coconut oil

	Strengths	Weaknesses	Opportunities	Threats
Research, Development and Extension	o Established protocol and infrastructure for product quality monitoring o Efficient technology o Available technical human resource	o No R and D yet to differentiate VCO from RBD oil. o Unfinished shelf life study o No clinical trials for human and animal o Low public spending on coco-research (only 28% of research funding for sugar cane). Phil. spends only 0.2% of GDP on science and technology program o Research on new technologies highly dependent on public funding	o Efficient technology (cold process) o Extended small and medium enterprises (SMEs)	o Unscrupulous products o Multinational producers o Biotechnology research in competing vegetable oils and fats (modification in fat structures) (Manicad, 1995) o Industrial production of fats and fatty acids through microorganisms
Product Development	o Developed high-quality VCO and by-products o Clinical trials for topical applications conducted by a well-known dermatologist	o Low quality of other VCO products o Lack of clinical studies on testimonials as cure for specific human diseases	o High-quality VCO through biotechnology process o Developed by-products (i.e., soap, aromatherapy oils) o Reduction on dependence on copra-based products	o Proliferation of low-quality and adulterated VCO o Entry of foreign products
Manufacturing/ Processing	o Higher yield o Availability of supplier of raw material inputs and machinery	o Regular supply of high-quality matured nuts o VAT on finished products, transport taxes, and miscellaneous fees o Increasing cost of fuel and other utilities	o Available scale-up manufacturing process for commercialization	o Entry of multinational/big competitors o Increasing costs of raw materials and packaging materials
Logistics, Transportation, and Distribution	o Availability of transportation	o Supply of raw materials may decrease due to uncontrolled cutting of trees and the 75 million trees that are already unproductive o Poor infrastructure and handling from the source of raw materials to processors and consumers o VAT on transportation	o Availability of transportation: Roll-on-Roll-off (RORO), land transportation	o High cost of transportation (fuel) maintenance o Unreliable courier service
Sales and Marketing	o Higher profit o Testimonies of consumers o Product efficiency	o Excessive profit margin by middle men	o High product and quick recovery of investments o Available marketers/ distributors o Strengthening Philippine trade relations with the Asia-Pacific countries will open up new markets for VCO o Better chances for VCO exports to the US due to new set of rules by the US Food and Drug Administration on transfat labeling for all manufactured goods sold in the US starting year 2006. VCO has low saturated fat—only around 0.05% to 0.1% transfat or free fatty	o Entry of imported products from Indonesia, Srilanka and other coco-growing Asia-Pacific countries o Increasing presence of vegetable oils in the world market

			acids (Business World 2005) o Increasing popularity and demand for VCO as food supplement and for cosmetic application	

Table 4.18 SWOT analysis on cocomeal/flour

	Strengths	Weaknesses	Opportunities	Threats
Research, Development and Extension	o Established protocol and infrastructure for product quality monitoring o Efficient technology o Available technical human resource	o Lack of knowledge of VCO producers on by-products utilization o Lack of exhaustive R&D for upgrading nutritional value o Lack of dissemination of available technology	o Efficient technology (DOST) o Enzyme treatment to improve digestibility	o Entry of foreign competitors (Indonesia, Sri Lanka, etc.)
Product Development	o Developed high-quality coco-meal based-products o Sensory product evaluation conducted by DOST on humans o Available experts to conduct feeding trials for swine and poultry	o Inadequate product acceptance by the food and feed processors	o Good source of dietary fiber for humans o Good source of energy and protein for animals o High-quality product	o Entry of foreign produced products
Manufacturing/ Processing	o Available technology for manufacturing food and feed products o Available supplies of raw material inputs and machinery	o Unreliable supply of raw materials – fragmented VCO producers o Small-scale production o High investment cost	o With scale-up manufacturing process o Available UPLB-BIOTECH enzyme and process	o Entry of multinational/big competitors o Increasing costs of raw materials, packaging materials
Logistics, Transportation and Distribution	o Availability of transportation – Roll-on Roll-off (RORO), land transportation	o Lack of proper handling of raw materials by VCO producers o Lack of interested investors	o Roll-on Roll-off (RORO), land transportation	o High cost of transportation (fuel) and maintenance o Unreliable courier service
Sales and Marketing	o Higher profit o Product efficiency	o Lack of product promotion o Excessive profit margin by middlemen	o High product and quick recovery of investments o Available marketers/ distributors	o Entry of imported products from Indonesia, Sri Lanka and coco-growing Asia-Pacific countries

Table 4.19 SWOT analysis on coconut proteins/skim milk

	Strengths	Weaknesses	Opportunities	Threats
Research, Development and Extension	o Availability of researches on nutritional and functional properties of coconut proteins o Development of high-quality vegetable protein	o Inadequate R&D for large-scale utilization of this by-product	o Value-added products for food and feeds o R&D for the utilization of coconut proteins for human and animals	o Possibility of available R&D in other coconut-producing countries
Product Development	o Development of aflatoxin-free protein substitute for animals o Development of coconut protein-based products	o Proliferation of low-cost protein sources	o Development of high-quality, low-cost coconut protein-based products to replace expensive animal protein-based food products	o Entry of similar products developed from other countries
Manufacturing/ Processing	o Availability of an efficient manufacturing process for coconut protein extraction o Availability of raw materials particularly the protein concentrate from VCO production	o Lack of equipment for large scale manufacturer o High investment cost	o Scale-up manufacturing process for coconut proteins o Establishment of processing plants for coconut protein-based food products	o Entry of multinational/big competitors o Increasing costs of raw materials
Logistics, Transportation and Distribution	o Land transportation and courier services	o Unreliable transportation and courier services	o Emergence of marketing and distribution companies	o Increasing cost of fuel and maintenance
Sales and Marketing	o Effectiveness of the products that will alleviate malnutrition especially in children	o Low consumer acceptance o Absence of product advertisements	o High demand for new protein sources with the increasing cost of soybeans	o Entry of imported similar low-cost products from other coconut-producing countries

Table 4.20 SWOT analysis on coconut water

	Strengths	Weaknesses	Opportunities	Threats
Research, Development and Extension	o Established commercial scale technologies on utilization of coconut water for plant growth hormone, vinegar, and coconut juice	o Lack of investor to pursue other R&D	o More R&D on the utilization of this coconut by-product in the development of other high-value products	o Availability of a more comprehensive R&D program for the utilization of coconut water from other coconut-producing countries
Product Development	o Utilization of coco water as component medium for enzyme production o Development of different products	o Lack of improved standards, e.g., nata de coco and coco-beverages o Wide variation in the quality of some products like vinegar and lambanog	o Setting up of standards for product quality monitoring	o Entry of similar products developed from other countries

	from coconut water, vinegar, coconut juice, and alcoholic beverages such as lambanog			
Manufacturing/ Processing	o Availability of technologies for manufacturing/ processing of the high-value products o Availability of raw materials particularly coconut water from VCO production	o Antiquated facilities for manufacturing/processing o Lack of modernized manufacturing/processing plants for scale-up operations	o Scale-up manufacturing process will generate employment and will be profitable	o Entry of multinational corporations capable of manufacturing products more efficiently thus lowering product cost
Logistics, Transportation and Distribution	o Availability of different means of transportation and courier services	o Appropriate means of transporting the coconut water raw materials to the processing plants	o Creation of marketing and distribution firms	o Increasing cost of fuel and maintenance
Sales and Marketing	o Effectiveness of the products specifically for Cocogroe, vinegar, and coconut juice o High quality of the different food products	o Low consumer acceptance o Poor product promotion o Inferior product presentation including packaging	o High demand for food products produced by natural methods	o Entry of imported similar low-cost products from other coconut-producing countries

Table 4.21 Fatty acid composition of vegetable oils as determined by GC

Fatty acid	Coconut oil	Cottonseed oil	Grapeseed oil	Maize oil	Palm oil	Palm kernel oil	Rapeseed oil	Soybean oil	Sunflowerseed oil
$C_{6:0}$	ND-0.6	ND	ND	ND	ND	ND-0.8	ND	ND	ND
$C_{8:0}$	**4.6-10.0**	ND	ND	ND	ND	**2.4-6.2**	ND	ND	ND
$C_{10:0}$	**5.5-8.0**	ND	ND	ND	ND	**2.6-5.0**	ND	ND	ND
$C_{12:0}$	**45.1-50.3**	ND-0.2	ND-0.5	ND-0.3	ND-0.5	**45.0-55.0**	ND	ND-0.1	ND-0.1
$C_{14:0}$	**16.8-21.0**	**0.6-1.0**	ND-0.3	ND-0.3	**0.5-2.0**	**14.0-18.0**	ND-0.2	ND-0.2	ND-0.2
$C_{16:0}$	**7.5-10.2**	**21.4-26.4**	**5.5-11.0**	**8.6-16.5**	**39.3-47.5**	**6.5-10.0**	**1.5-6.0**	**8.0-13.5**	**5.0-7.6**
$C_{16:1}$	ND	ND-1.2	ND-1.2	ND-0.5	ND-0.6	ND-0.2	ND-3.0	ND-0.2	ND-0.3
$C_{17:0}$	ND	ND-0.1	ND-0.2	ND-0.1	ND-0.2	ND	ND-0.1	ND-0.1	ND-0.2
$C_{17:1}$	ND	ND-0.1	ND-0.1	ND-0.1	ND	ND	ND-0.1	ND-0.1	ND-0.1
$C_{18:0}$	**2.0-4.0**	**2.1-3.3**	**3.0-6.5**	ND-3.3	**3.5-6.0**	**1.0-3.0**	**0.5-3.1**	**2.0-5.4**	**2.7-6.5**
$C_{18:1}$	**5.0-10.0**	**14.7-21.7**	**12.0-28.0**	**20.0-42.2**	**36.0-44.0**	**12.0-19.0**	**8.0-60.0**	**17.7-28.0**	**14.0-39.4**
$C_{18:2}$	**1.0-2.5**	**46.7-58.2**	**58.0-78.0**	**34.0-65.6**	**9.0-12.0**	**1.0-3.5**	**11.0-23.0**	**49.8-59.0**	**48.3-74.0**
$C_{18:3}$	ND-0.2	ND-0.4	ND-1.0	ND-2.0	ND-0.5	ND-0.2	5.0-13.0	5.0-11.0	ND-0.3
$C_{20:0}$	ND-0.2	0.2-0.5	ND-1.0	0.3-1.0	ND-1.0	ND-0.2	ND-3.0	0.1-0.6	0.1-0.5
$C_{20:1}$	ND-0.2	ND-0.1	ND-0.3	0.2-0.6	ND-0.4	ND-0.2	3.0-15.0	ND-0.5	ND-0.3
$C_{20:2}$	ND	ND-0.1	ND	ND-0.1	ND	ND	ND-1.0	ND-0.1	ND
$C_{22:0}$	ND	ND-0.6	ND-0.5	ND-0.5	ND-0.2	ND-0.2	ND-2.0	ND-0.7	0.3-1.5
$C_{22:1}$	ND	ND-0.3	ND-0.3	ND-0.3	ND	ND	>2.0-60.0	ND-0.3	ND-0.3
$C_{22:2}$	ND	ND-0.1	ND	ND	ND	ND	ND-2.0	ND	ND-0.3
$C_{24:0}$	ND	ND-0.1	ND-0.2	ND-0.5	ND	ND	ND-2.0	ND-0.5	ND-0.5
$C_{24:1}$	ND	ND	ND	ND	ND	ND	ND-3.0	ND	ND

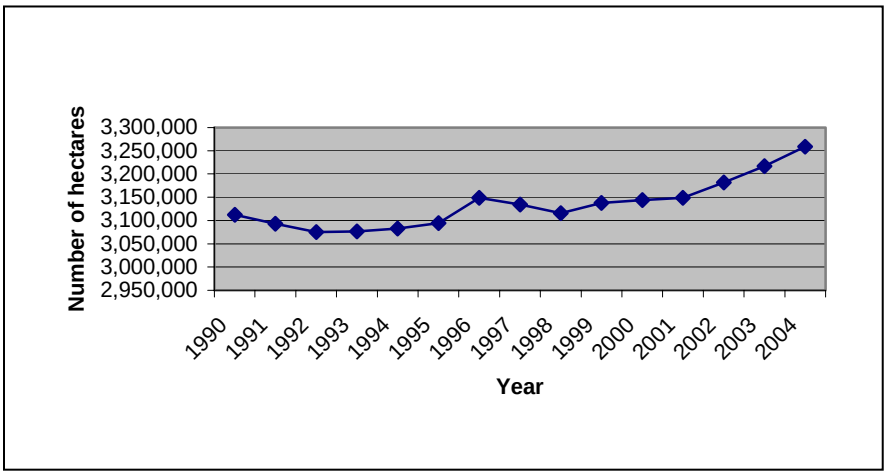
ND = not determined

Manufacturing/Processing

- *Efficient and profitable production processes are now available to prospective investors*. A case model presented in Appendix 4.2 showed that producing VCO is a good business with higher oil recovery than the dry process of extracting coconut oil.

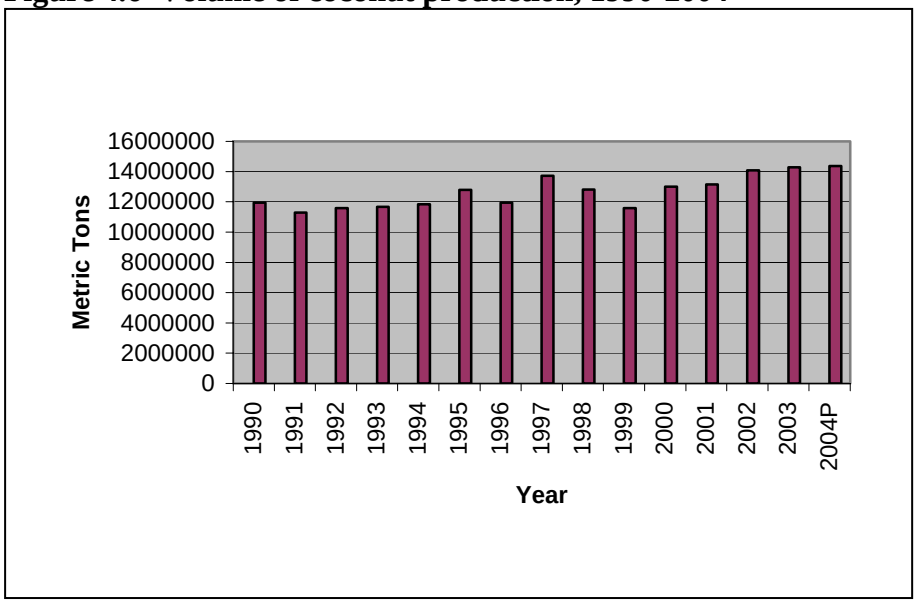
- *Availability of raw materials*. The raw materials for VCO production are widely available. Since freshly harvested nuts are needed, it is advisable to establish the manufacturing plants near the coconut-producing areas such as the Southern Tagalog provinces (Region IV), Davao area (Region XII), Eastern Visayas (Region VIII), and the Bicol Region (Region V). Although cutting of coconut trees is rampant these days due to increasing demand for coco-lumber and increasing price of coconut trees (PhP400.00–PhP600.00 in the Laguna area), there has been an increase in the land area planted to coconut and in the volume of production during the last five years (1999-2004) (Figures 4.5 and 4.6). By 2006, annual production is targeted to reach 14.3 million MT (Table 4.22, and Figure 4.7).

Figure 4.5 Coconut hectarage, 1990-2004



Source: Bureau of Agricultural Statistics 2005.

Figure 4.6 Volume of coconut production, 1990-2004



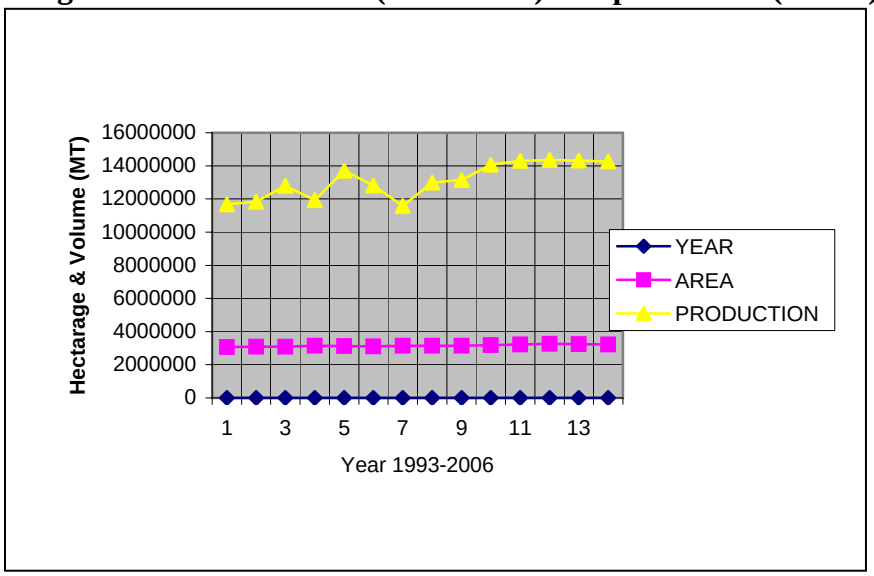
Source: Bureau of Agricultural Statistics 2005.

Table 4.22 Projected coconut area and production volume, 1993-2006

Year	Area	Production (MT)
1993	3,076,238	11,669,480
1994	3,082,727	11,837,160
1995	3,094,504	12,790,840
1996	3,149,037	11,936,720
1997	3,134,417	13,707,837
1998	3,115,829	12,806,429
1999	3,127,881	11,589,010
2000	3,143,909	12,994,654
2001	3,148,651	13,146,052
2002	3,181,670	16,068,495
2003	3,216,528	14,294,203
2004	3,258,576	14,366,184
2005	3,237,552	14,330,194
2006	3,224,000	14,264,500

Source of 1993-2004 Data (Bureau of Agricultural Statistics); 2004-2005 are projected data.

Figure 4.7 Coconut area (in hectares) and production (in MT)



Source: Bureau of Agricultural Statistics 2005.

- *Increasing capacity to produce VCO.* There was a marked increase in production performance of the VCO industry beginning 2001 owing to technologies developed by the R&D institutions. From 2001 to 2004, production sharply swelled because of increased demand for the product (Table 4.23).

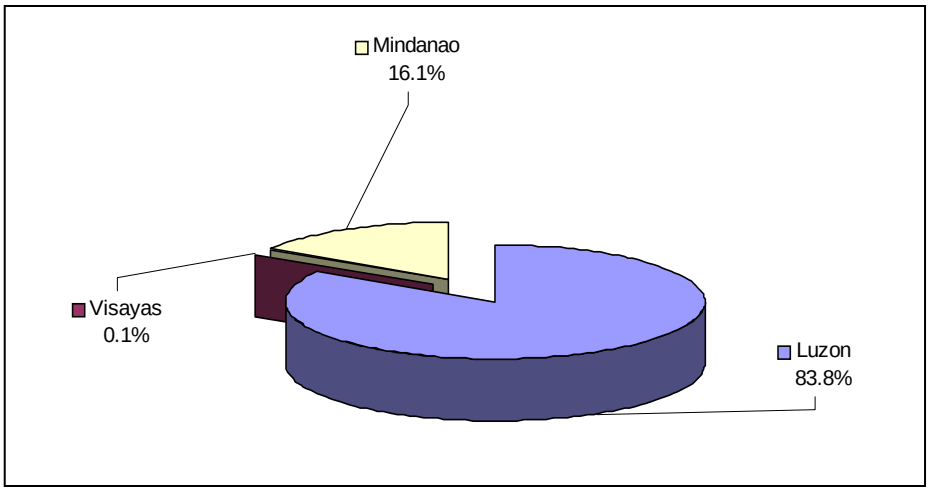
Table 4.23 Monthly and annual production of VCO

Year	Monthly Production (MT)	Annual Production (MT)
2001	1.9	23.0
2002	19.1	229.0
2003	831.8	9,982.0
2004	3,009.1	36,109.0
Total	3,861.9	46,343.0

Source: Philippine Coconut Authority

In terms of production capacity and concentration of manufacturing plants, majority are in Luzon (83.8%). Only about 16.2% of the total production are from Mindanao (16.1%) and the Visayas (0.1%) as shown in Figure 4.8 and Table 4.24.

Figure 4.8 Production and share of VCO



Source: Bureau of Agricultural Statistics 2005.

Table 4.24 Capability (MT/year) and share of VCO production in Luzon, Visayas, and Mindanao

	Regional Capability	Share
Luzon	30,300.0	83.80%
Visayas	30.0	0.10%
Mindanao	5,820.0	16.10%
Total	36,150.0	100.0%

Source: Philippine Coconut Authority.

- *Value-added products from VCO production.* A wide array of value-added products can be produced from the by-products of VCO production. The coconut water can be processed into beverage, vinegar, and foliar fertilizer, while the coconut skim milk can be used as beverage, emulsifier, and protein extender in a number of "poor man's" food, and as animal feed. Activated carbon can be produced from coco shell. These products can be a source of additional income from VCO production.

- *Production of VCO is profitable.* An investment study on VCO production using the UPLB-BIOTECH process was conducted (Appendix 4.2). The investment cost is around PhP11.6 million. Given the current wholesale price of PhP300.00 per liter or PhP276.00 per kg, a profit margin of 21.2% can be attained each year. For a period of five years, the average return on investment is 38.27%. The net present value of returns after considering a hurdle rate (or opportunity cost of capital) of 18% is PhP2,116,536.71. This clearly shows that investing in VCO production is a sustainable and highly profitable business venture.

Sales and marketing

- *Capability of the industry to meet the demand of local and foreign markets.* The opportunity for further expansion both in the local and international markets is a real possibility. Export of VCO increases as demand shoots up following manufacturers' adoption of production standards (Appendix 4.1) set by the government (Philippine Daily Inquirer 2005). The United Coconut Associations of the Philippines reported that during the first half of 2005, 340 MT of VCO were shipped to foreign markets. This figure was 92% higher than the 177 MT exported for the whole duration of 2004. Out of the total shipment, the US took in 331 MT or about 97% of the export market. In 2004, about 170 MT or 96% of the total shipments were imported by the US. Other markets that bought limited quantities were Singapore, Ireland, Saudi Arabia, Australia, Malaysia, Hong Kong, and Germany. Forecast for 2005 showed that at least 500 MT will be sold to markets abroad.

Weaknesses

Research and development

- *Absence of technology to detect counterfeit products*. Counterfeit VCO products may enter the market because it is possible that RBD oils or those produced using the heat process are sold. However, research studies are being conducted at UPLB-BIOTECH to distinguish between RBD oils and those oils obtained from freshly grated meat subjected either by cold or by heat process.

- *Lack of government financial support*. Budget support for the coconut industry is more focused on the production of coconut. There is an urgent need to focus on improving the processing technology of nontraditional, value-added coco-based products. Although a significant number of Filipinos especially the small farmers are dependent on coconuts, public funding for research activities on the development of new technologies is very minimal.

Product development

- *Limited product development.* Due to limited financial resources, researches on product development cannot be actively pursued.

Manufacturing/Processing

- *Supply of raw materials may decrease*. Regular supply of raw materials may be affected due to the uncontrolled cutting of coconut trees and the fact that 75 million trees are already senile and unproductive. The inability of farmers to adopt new farming technologies and plant more superior breeds of coconuts may affect the future supply of material inputs.

- *High price of coconut.* The multilayered marketing system affects the prices of coconut inputs. Although VCO producers buy the nuts at PhP5.00 per piece, coconut farmers receive only PhP2.00 to PhP2.50 per nut from the traders. Around PhP0.50 of this cost also goes to labor expenses in harvesting and bringing the nuts to the local buyers. This shows that among the actors in the coconut industry, the coconut farmers are the most disadvantaged.

- *High cost of investment.* The investment cost of using new technologies like the UPLB-BIOTECH technology is around PhP11.6 million. This high cost may be prohibitive to small entrepreneurs and could be one barrier to entry. Nevertheless, the financial analysis has shown that the investment cost can be recovered in just 1.5 years (Appendix 4.2).

Sales and marketing

- *Limited promotion of VCO*. According to Figueroa (2005), local producers still need additional capital to promote VCO both locally and internationally. However, due to lack of funds, promotion on the positive health effects of VCO has not been actively pursued by the concerned government agencies. There is also a need to widen the current market as well as penetrate new ones.

Logistics, transport and distribution

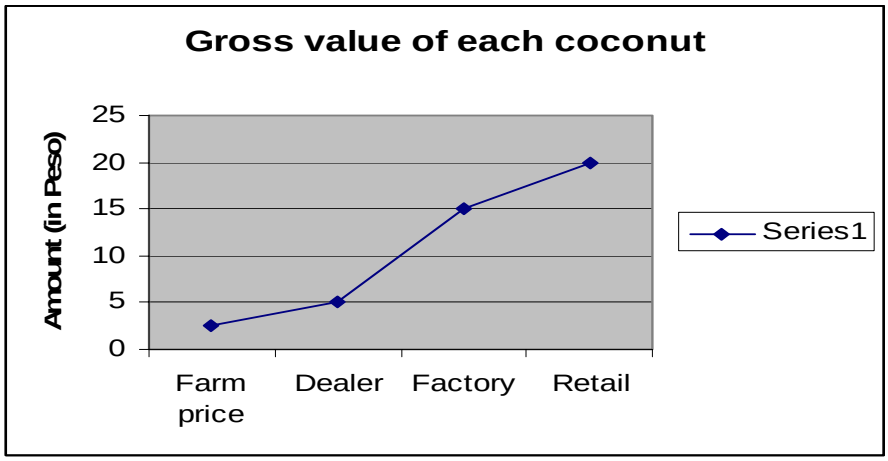
- *High cost of transportation and distribution.* The passage of the Expanded Value Added Tax (E-VAT) law further increased the cost of doing business in the coconut industry. It triggered increases in the cost of raw materials, fuel, and transportation. Decrease in net income from VCO production could hamper the modernization of plants and factories necessary to achieve and maintain the highest quality standards of coconut products.

External Environment Analysis

Opportunities

- *Opportunity to add value to coconuts.* Production of VCO will increase the gross value of each coconut. From the coconut farmer who sells each nut at PhP2.50, the gross value of each nut will increase to PhP15.00 if it is processed into VCO and to PhP20.00 per coconut if it is traded locally or exported to foreign countries at the price of PhP400.00 per liter (Figure 4.9).

Figure 4.9 Value added for each coconut if processed into VCO



Source: Author's estimates.

- *Opportunity to develop other high-value products*. High-value products from by-products of VCO production could be developed. These products are the following:

By-product	High-value product
Coconut shell	o Activated carbon
Coconut meal	o Coconut flour o Animal feed o Food extender
Skim milk/Protein	o Beverage o Emulsifier o Food extender o Animal feed
Coconut water	o Beverage o Vinegar o Nata de coco production o Media for tissue culture of plants and enzyme production o Growth hormone

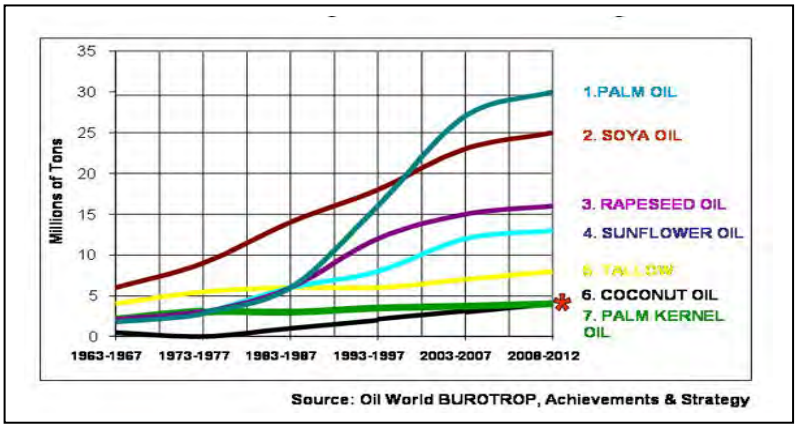
- *Increasing demand for organic products*. Coconut trees in the Philippines are mostly organically produced. Since the trees are not treated with pesticides or insecticides, VCO and its by-products can be marketed as organic products. The increasing demand for organic products is enhanced by the growing awareness of consumers on the benefits of healthy and environment-friendly products.

- *Attractive opportunity to diversify coconut products*. Production of VCO offers an opportunity to diversify and improve the competitiveness of coconut products. Coconut oil extraction is mainly done using the dry method or the copra expeller system. The copra drying method in the Philippines is generally very backward. Copra is either sun dried or smoked, resulting in the presence of toxic substances, such as mycotoxins and polyaromatic hydrocarbons that are carcinogenic. Traditional copra production in the Philippines is labor intensive, expensive, and unsanitary.

  The oil extracted from copra requires drastic refining, bleaching, and deodorizing. For industries importing coconut oil, the reprocessing adds to the cost of the already expensive coconut oil. In fact, the Philippine coconut oil is of such low quality that it sells at a discount of 2% in the world market. This situation is estimated to cost the country about US$52 million a year in reduced export prices and physical losses (Manicad 1993).

  The Philippines needs to diversify and widen the market for coconut products because it currently exports only less than 3% of the world's traded supply. The market for coconut oil is only part of a larger market for fats and oil. This is because coconut oil must compete with palm and palm kernel oil, soybean oil, and even animal fats (Figure 4.10). In addition to its industrial use in detergents, it must also compete with petroleum-based products.

Figure 4.10 Oils and fats production



Source: Oil World BUROTHROP, Achievements and Strategy

- *Competitiveness of VCO in the international market.* It is expected that there will be better chances for Philippine VCO exports to the US with the new set of rules by the US FDA requiring transfat labeling on all manufactured goods sold in the US starting 2006. VCO has low unsaturated fat and has not undergone any hydrogenation so it does not have any transfat.

- *Strengthening Philippine trade relations with countries in the Asia-Pacific.* The current trade relations will open up new markets for VCO. Export data showed that

other than the US, the country is making headway on developing its niche in the Asia-Pacific market.

- *Increasing export of VCO.* Out of only two foreign destinations in 2001 and 2002, the product is now being exported and gaining foothold in 16 foreign markets (Table 4.25).

The increasing popularity of and demand for VCO due to its nutraceutical, cosmetic, and other industrial applications was further highlighted by international experts like Prof. Jon Kabara, Dr. Bruce Fife, and Dr. Mary Enig.

Table 4.25 Annual export performance of virgin coconut oil

Year	Volume (in Mt)	% Change	Value (FOB US $)	% Change	Unit Price ($/MT)
2001	1.80		19,810.00		11,005.56
2002	19.11	961.67	91,618.00	362.48	4,794.24
2003	102.83	438.10	406,580.00	343.78	3,953.90
2004	176.60	71.74	553,469.00	36.13	3,134.03

Source: Philippiine Coconut Authority

Threats

- *Current trend in biotechnology research.* Biotechnology research in terms of increased yield through plant breeding indicates a substitution trend for coconut oil. For palm oil, Malaysia's tie-up with Unilever aims to develop clones that will give higher yields and have increased disease resistance. Although this research is besieged with many problems, it is vigorously being pursued. There is a strong competition between palm kernel oil and coconut oil due to their high lauric acid content. But the main advantage of palm kernel oil over coconut oil is that palm oil gives the highest yield per unit area among all vegetable oil crops. Depending on the demand, an increase in the yield of palm oil may further depress world market prices.

Organisms such as yeast, fungi, algae, and bacteria could be genetically altered to produce a variety of edible oils comparable to vegetable oils. However, the research on this has not yet gone far enough given that the cost is too prohibitive for commercial application. Thus, the threat to coconut oil is still low.

Current advances in biotechnology are now in the areas of producing genetically modified plants and/or modifying fat structures to develop specialty oils that will directly compete with coconut oil. The techno-economic interest of the biotechnology industries depends on the commercial profitability of biotechnology products over traditional oil crops, as well as consumer acceptance, and the (inter)national policies on agriculture and trade. These, combined with the efficiency

of domestic coconut production, will determine the impact of biotechnology on coconut oil substitution.

The substitution trend also occurs in biotechnology research on the modification of fat structures. For example, for soya bean, scientists at Iowa State University, USA, have discovered the gene that codes for *acetyl-CoA carboxylase* (ACC), a key enzyme in the biosynthetic pathways of fatty acids. They aim to manipulate the ACC gene to induce soya beans to increase yields, as well as to modify the fatty acid composition to resemble short-chain fatty acids found in coconut and palm oil. Similarly, extensive research is being carried out on the genetic modification of fatty acid composition of rapeseed by public and private sectors in Canada as well as in Europe and Australia. One of the objectives is to induce rapeseed to produce a high proportion of lauric acid. Commercial production is still years away. Not only foreign companies are researching the possibilities of tailoring oils and fats; UPLB-BIOTECH is also conducting research on the tailoring of fatty acids using enzymatic techniques. Enzymes that can remove or attach specific fatty acids at specific places are being identified. This research, however, is only in its early stage (Manicad 1993).

If a commercial assessment is made, coconut production in the Philippines will show itself to be uncompetitive and unreliable in terms of supply. Policy decisions taken by the Philippine government mainly address farm productivity and not the structural impediments such as the failing land reform, tax policies, and price distortions. In such a context, the coconut sector will have great difficulties to survive. Unless immediate and effective agronomical and institutional reforms are undertaken, Philippine coconut production and trade could collapse in the future under the pressure of substitution (Manicad 1993).

The development of cuphea as an alternative crop of US farmers may threaten the market of VCO, crude coconut oil, and cochin oil. Procter and Gamble, the Cincinnati-based soap giant, has been involved in promoting research on the oil from cuphea (soyatech.com, 2003). Just like coconut, cuphea is also rich in lauric acid, which is a prime ingredient in detergents and shampoos. Although the research on cuphea in the US is still ongoing, it is expected to threaten the coconut and palm oil industries within the next 3 to 5 years.

- *Entry of foreign competitors*. Other major producers of coconut like India and Indonesia may likely produce VCO and compete in the local and international markets. The profitability of the VCO industry will attract foreign competitors. Under this scenario, the competition will become very stiff. It will be a cut-throat business and only firms with competitive advantage will be left to operate in the global market.

- *Risks and uncertainty in the investment climate.* The Philippine VCO industry may be affected by several major impediments to doing business efficiently and competitively. Based on the report of the World Bank (2002), the Philippines has several weak spots relative to other competing countries that are also major producers

of coconut products. Compared to India, Sri Lanka, and Indonesia, it has the worst investment scenario (Table 4.26) in the following areas:

1. Crime, theft and disorder
2. Anticompetitive practices
3. Access to land
4. Tax rates
5. Customs and trade regulations
6. Electrical outages
7. Water supply failures
8. Lowest new investment from banks
9. Highest time to claim imports from customs (9.09 days)
10. Highest unofficial payments for firms to get things done (1.91% of sales)
11. Firms are expected to give gifts in meetings with tax inspectors
12. Highest value of gift expected to secure government contract (2.2% of contract)
13. Dispute resolution time (9.54 weeks)
14. Security and protection costs (3.98% of sales)
15. Losses due to crime (1.24% of sales)
16. Lesser number of firms using technology licensed from foreign companies as compared to Indonesia.
17. Lesser ISO certification ownership compared to Indonesia.
18. Lesser number of firms undertaking innovation compared to Indonesia.
19. Lowest capacity utilization.

Table 4.26 Comparative snapshot of business environment (India, Sri Lanka, Indonesia, and Philippines)

A. Firms' perceptions

Percentage of firms identifying indicator as a major or very severe obstacle to business.

Indicator	India	Sri Lanka	Indonesia	Philippines
Economic and regulatory policy uncertainty (%)	20.94	34	48.25	29.51
Macroeconomic instability (%)	16.13	29.78	50.07	38.37
Corruption (%)	37.42	16.89	41.51	35.17
Crime, theft and disorder (%)	15.63	14	22.02	26.45
Anti-competitive practices (%)	17.49	20	17.25	24.27
Legal system (%)	..	..	24.68	..
Telecom (%)	5.33	14	9.12	11.34
Electricity (%)	28.92	41.33	22.3	33.43
Transportation (%)	12.4	22	16.41	18.31
Access to land (%)	9.09	8.22	13.04	14.83
Tax rates (%)	27.89	19.11	29.45	30.38
Tax administration (%)	26.39	12.47	23	25.15
Customs and trade regulations (%)	14.01	14.67	15.71	21.66
Labor regulations (%)	16.69	25.56	25.95	24.71
Skills and education of workers (%)	12.47	21.33	18.93	11.92
Business licensing and permits (%)	13.41	7.11	20.48	13.52
Access to financing (%)	18.3	15.11	17.53	13.52
Cost of financing (%)	20.21	25.78	28.47	22.97

B. Infrastructure and services

Indicator	India	Sri Lanka	Indonesia	Philippines
Delay in obtaining an electrical connection (days)	81.59	64.84	14.61	8.16
Electrical outages (days)	..	..	4.4	5.99
Value lost to electrical outages (% of sales)	8.95	..	4.23	7.13
Delay in obtaining a water connection (days)	..	11.97	2.93	9.91
Water supply failures (days)	..	..	4.42	5.68
Value lost to water supply failures (% of sales)	86.68	62.54	26.59	13.21
Water supply coming from public sources (%)	..	15.91	1.81	1.88
Delay in obtaining a telephone connection (days)	..	..	2.64	..
Telephone outages (days)	63.6	75.11	39.1	36.58
Value lost to telephone outages (% of sales)	62.07	68.22	49.93	48.76
Firms that share/own a generator (%)	35.9	29.33	24.33	24.42

Firms using e-mail to interact with clients/suppliers	..	19.36	13.13	..
Firms using the Web to interact with clients/suppliers (%)	..	..	26.95	52.09

C. Finance

Indicator	India	Sri Lanka	Indonesia	Philippines
New investment from internal funds (%)	..	50.02	41.89	57.96
New investment from banks (%)	..	15.3	16.34	13.29
Firms with an overdraft facility (%)	57.51	60.48	19.83	31.42
Collateral needed for a loan (% of loan)	101.39	106.37	116.32	61.33
Days to clear a check	11.1	5.31	14.28	..
Days to clear a domestic wire	7.53	2.71	10.84	2.15

D. Government policies and services

Indicator	India	Sri Lanka	Indonesia	Philippines
Consistency of officials' interpretations of regulations	35.89	71.11	44.04	50.88
Time to claim imports from customs (days)	7.11	4.12	5.78	9.09
Optimal employment level compared to current level (%)	90.72	103.59	96.83	95.69
Senior management time spent dealing with requirements of regulations (%)	14.41	3.84	5.47	8.83
Sales amount reported by a typical firm for tax purposes (%)	..	92.44	73.14	78.2
Unofficial payments for firms to get things done (% of sales)	..	0.2	1.76	1.91
Gifts requested by government officials	62.98	5.14	5.61	5.88
Time firms spent in meetings with tax officials (days)	..	5.07	1.97	3.91
Firms expected to give gifts in meetings with tax inspectors (%)	..	2.74	11.22	27.55
Value of gift expected to secure government contract (% of contract)	..	0.22	0.75	2.2

E. Conflict resolution and crime

Indicator	India	Sri Lanka	Indonesia	Philippines
Confidence in the judiciary system (%)	70.63	68.83	59.19	66.22
Dispute resolution time (weeks)	..	6.04	3.91	9.54
Security and protection costs (% of sales)	..	1.16	1.8	3.98
Losses due to crime (% of sales)	..	0.88	0.49	1.24

F. Capacity and innovation

Indicator	India	Sri Lanka	Indonesia	Philippines
Firms using technology licensed from foreign companies (%)	..	..	18.43	16.59
ISO certification ownership (%)	..	..	22.13	15.79
Firms undertaking innovation (%)	..	..	73.92	73.15
Average capacity utilization (%)	78.34	77.26	73.25	68.87

G. Labor relations

Indicator	India	Sri Lanka	Indonesia	Philippines
Females in senior management (%)	..	..	..	..
Firms offering formal training (%)	..	32.55	23.83	21.74
Permanent skilled workers receiving training (%)	..	..	..	26.59
Workforce that is unionized (%)	62.2	25.81	42.86	12.09
Production days lost to strikes, etc	..	2.19	1.14	0.78

Source: Investment Climate Survey World Bank, 2002.

RECOMMENDATIONS

The growth and development of the coconut industry can be further enhanced through the following strategic recommendations:

R&D and Extension

- *Encourage public and private investments in coconut R&D.* The government, including the private sector, must give priority to coconut because a large chunk of Filipinos are dependent on this commodity and there are numerous attractive business opportunities in the coconut industry.

- *Conduct further R&D on improving the current VCO production technology.* The current technology for VCO production must be continuously improved to attain manufacturing efficiency, not only in terms of higher oil recovery but also in terms of finetuning the

process to produce better quality products. The industry can improve its competitive advantage by producing only the best quality VCO and improving production quantities.

- *Increase the support for improving the technology for converting VCO production wastes into high-value products.* The paper showed that there are plenty of business opportunities out of production wastes of VCO by processing them into functional foods, animal feeds, and highly demanded inputs for the pharmaceutical, nutraceutical, and cosmetic industries. Although the technologies are available, there is still a need for financial support to pilot test the processes in large-scale setups.

- *Develop holistic and business-oriented technology transfer mechanism.* There is a gap between the technology generators and the business community in terms of communicating and transferring the technologies. To develop more techno-driven enterprises and create more jobs, more interfacing should take place between these two sectors. Technology generators like the inventors and R&D institutions must be provided with assistance or support in all aspects, from the protection of intellectual properties to the pilot testing of emerging technologies, while the business community especially the small entrepreneurs should be assisted in business planning and financing, and in putting up their business.

For this set of recommendations, the relevant implementing agencies include the Department of Budget and Management, Legislative Branch (Congress and Senate), Philippine Coconut Authority (PCA), R&D institutions, Department of Science and Technology (DOST), Department of Trade and Industry (DTI), local government units (LGUs), private organizations, and the business sector.

Product Development

- *Develop the product standards for emerging coconut products.* The standards for new coconut products such as the high-quality functional food products derived from VCO processing (e.g., coconut flour, beverages, skim milk, and protein concentrates) must be established. This is to prepare for the marketing of these products and to ensure their competitiveness when introduced in the world market.

For this recommendation, the implementing agencies will include the Bureau of Food and Drugs (BFAD) and the Philippine Coconut Authority (PCA).

Logistics, Transportation and Distribution

- *Improve the delivery of support services.* Obstacles like crime, theft, disorder, corruption, poor infrastructure, and electrical and water outages increase the business cost and deter investments. There is a need to eradicate these obstacles to improve the investment climate, enhance the growth of the industry, and create more jobs for the marginalized sector of society.

- *Streamline the Bureau of Customs.* This is needed to improve the delivery of services, prevent delays in shipment, and reduce unnecessary shipping costs.

  For this set of recommendations, the relevant implementing agencies include the Philippine National Police (PNP), LGUs, the Bureau of Customs, and utility companies.

Manufacturing, Sales and Marketing

- *Develop the VCO industry and its ancillary industries*. This paper showed that there are attractive business opportunities from producing value-added products out of coconut. Developing the VCO industry is a good strategy for creating jobs and increasing incomes in the countryside. The country should go into industries where it has a competitive advantage and should go beyond its role of a mere supplier of copra and crude coconut oil that are price takers and purchased at a discount in the world oil market.

- *Empower and improve the quality of life of coconut farmers*. It is about time that the marginalized sector of society particularly those who depend so much on the "tree of life" be given the opportunity to go out of the recurring cycle of poverty. The quality of life in the coconut-growing areas could be improved by:

  a. *Organizing and clustering the coconut producers as input suppliers of the VCO processors.* Development of the VCO industry offers an opportunity for coconut producers to enjoy a fair market price for their harvest. However due to small landholdings and fragmented production or harvesting of nuts, the supply of raw materials for VCO processing might become a problem. To counteract this threat, the farmers must be organized to supply the regular volume of nuts needed by the VCO processors. The presence of a VCO manufacturing firm in a coconut-producing area will also motivate farmers to take a second look on their farms. Since VCO firms require premium nuts and offer higher buying price for premium quality nuts, it will encourage farmers to improve their production. It will likewise discourage coconut logging but will encourage replanting and increasing of production areas.

  b. *Establishing integrated VCO and by-product manufacturing plants in strategic coconut-producing provinces.* Coconut farmers if properly organized and empowered will have the option to become entrepreneurs or processors themselves of coconut products like VCO, coconut flour, vinegar, high-grade charcoal, and coco-beverages, with the synergistic support of the public and the business community in terms of providing the right technology, financial assistance, market linkages, and the like.

- *Strengthen the financing mechanisms to support enterprise development.* Financing windows must be accessible to investors who need the capital to establish the manufacturing firms for emerging coconut products.

- *Encourage foreign and local investment through easier access to land ownership*. The coconut industry needs investment to industrialize and develop the processing industries, which will contribute to job creation and poverty alleviation. Allowing foreign investors to invest in the country will mean easier access to foreign markets. Our competitors are much more attractive now because multinational firms have more access to land, which will be their valuable asset to support their business interests.

For this set of recommendations, the relevant implementing agencies include the Senate, Congress, DTI, financing institutions, PCA, LGUs, and the private sector.

Appendix 4.1

CHECKLIST OF REQUIREMENTS FOR REGISTRATION OF
Virgin Coconut Oil (VCO)

1. Letter of Application from manufacturer/exporter or distributor addressed to the Director of BFAD (notarized)
2. Valid License to Operate (LTO). This must be revalidated for the current year. VCO must be listed as one of the products being manufactured,
3. Product Information: a. Finished product specification as per BFAD standards in terms of physico-chemical properties
4. One (1) sample of the product in commercial presentation. For initial/new product application, a proposed artwork of the label may be submitted.
5. Labels and labeling materials used in the product (to be attached in the documents). Follow the labeling requirements of the PNS for Virgin Coconut Oil and Bureau Circular No. 2 s. 1999.
6. Certificate of analysis of the finished product. Indicate the analytical method used. Submit the test results on complete Fatty Acid Composition and properties of VCO as per BFAD. Analysis may be conducted by recognized laboratories of BFAD (Bureau Circular No. 06 s. 2005)
7. Flow diagram of the method of manufacture, packaging, and quality control.
8. A certification of suitability of packaging material for food use must be submitted.
9. Estimated shelf life, parameters used, and methods for determining shelf life.
10. Registration Fee of PhP2,000 valid for two (2) years upon approval.
11. Previous Certificate of Product Registration (CPR) for Renewal Only.

NOTE:
*Secure requirements in a folder and place inside a clear expandable envelope. Attach a yellow tag for coding of locally manufactured products.
* Submit at the PAICS (Room 101) only a complete set of documentary requirements <u>every Monday</u> only.

Foreword

The development of Philippine National Standard for Virgin Coconut Oil was initially undertaken by the Center for International Trade Expositions and Missions (CITEM) of the Department of Trade and Industry (DTI) in view of the increasing demand of commodity for domestic and export markets. After which, an interim technical committee spearheaded by the Philippine Coconut authority (PCA) was created.

In close coordination with the members of the interim committee of PCA, the Bureau of Agriculture and Fisheries Product Standards (BAFPS) Sub-Committee on Crops created through Special Order No. 411 convened series of technical reviews and public consultation on the draft standard for virgin coconut oil.

BAFPS deemed it necessary to adopt a standard providing common understanding on the definition of virgin coconut oil, essential composition and quality factors, labeling and methods of analysis and sampling.

Provisions of the standard may be revised upon recommendations of stakeholders as long as these are supported by published scientific studies.

1. Scope

This standard applies to virgin coconut oil in a state for human consumption.

2. References

The titles of the standards publications referred to in this standard are listed on the inside back cover.

3. Definitions

For the purpose of this standard, the following definitions apply:

3.1 General

3.1.1 Free fatty acids (FFA)
A specified fatty acid liberated by hydrolysis from naturally occurring fats

3.1.2 Glyceride
An ester formed by the combination of glycerol and fatty acid. Glycerides occur naturally in oils and fats.

3.1.3 Iodine number
Measure of the degree of unsaturation of oils and fats

3.1.4 Virgin Coconut Oil (VCO)
Oil obtained from the fresh, mature kernel of the coconut by mechanical or natural means, with or without the use of heat, without undergoing chemical refining, bleaching or deodorizing, and which does not lead to the alteration of the nature of the oil. Virgin coconut oil is an oil, which is suitable for consumption without the need for further processing.

Virgin coconut oil (VCO) consists mainly of medium chain triglycerides, which are resistant to peroxidation. The saturated fatty acids in VCO are distinct from animal fats, the latter consisting mainly of long chain saturated fatty acids.

4. Essential Composition and Quality Factors

4.1 Identity characteristics

4.1.1 Gas liquid chromatography (GLC) ranges of fatty acid composition[1] shall be in accordance with Table 1.

Table 1. Gas liquid chromatography range of fatty acid composition.

Common Name	Composition	(%)
Caproic acid	C 6:0	ND-0.7
Caprylic acid	C 6:8	4.6 – 10.0
Capric acid	C 10:0	5.0 – 8.0
Lauric acid	C 12:0	45.1 – 53.2
Myristic acid	C 14:0	16.8 – 21
Palmitic acid	C 16:0	7.5 – 10.2
Palmitoleic acid	C 16:1	ND
Stearic acid	C 18:0	2.0 – 4.0
Oleic acid	C 18:1	5.0 – 10.0
Linoleic acid	C 18:2	1.0 – 2.5
Linoleic acid	C 18:3	ND – 0.2
	C 24:1	ND

NOTE: ND means non-detectable

4.2 Quality characteristics

4.2.1 Color, odor and taste
Virgin coconut oil shall be colorless, sediment free, with natural fresh coconut scent and free from rancid odors or tastes

4.2.2 Virgin coconut oil shall conform to the requirements specified in Table 2.

Table 2. Virgin coconut oil property requirements

Properties	Specification
Moisture and volatile content, %, max	0.20
Free fatty acids (expressed as lauric acid), %, max.	0.20
Peroxide value, meq/kg oil, max.	3.0
Food additives	None permitted
Contaminants Matter volatile at 105°C, %, max.	0.20

Heavy metal, mg/kg, max.	
Iron (Fe)	5.0
Copper (Cu)	0.40
Lead (Pb)	0.10
Arsenic (As)	0.10

5. Hygiene

It is recommended that the product covered by the provisions of this standard shall be in accordance with the appropriate Sections of the General Principle of Food Hygiene recommended by the Codex Alimentarius Commission (CAC/RCP 1-1969, Rev. 3 – 1997).

6. Labelling

The label of each package shall have the following information:

1. Name of product: "Virgin coconut oil"
2. Brand name or trade name
3. Net content
4. Lot identification
5. Name and address of the manufacturer and/or packer, or distributor
6. The phrase "Product of the Philippines"
7. Type of Process
8. Date manufactured and "Best Before"
9. BFAD registration number and bar code (optional)

7. Methods of analysis and sampling

7.1 Determination of fatty acid composition. According to IUPAC 2.301, 2.302 and 2.304 or ISO 5508:1999 and ISO 5509:1999.

7.2 Determination of iodine value. According to IUPAC 2.205/1, W ijs method or ISO 3961:1996, Hanus Method, AOAC 920.158. Results are expressed as % m/m absorbed iodine.

8. Compliance and specification

When found to comply with the requirements specified in this Philippine Standard Specification, the lot, the batch, or the consignment from which the samples have been drawn, shall be deemed to comply with this Philippine National Standard Specification and shall be provided with the Philippine Standard (PS) mark.

Appendix 4.2

INVESTMENT FOLIO: FUNCTIONAL FOOD GROUP (Investment Model 1)

1. Project Description: Production of Virgin Coconut Oil (Stand Alone - 5,000 Nuts Model)

   The products will be produced through an efficient cold processing method and the application of the latest trend in biotechnology. VCO will be produced and production wastes such as coco shell, coco meal, and protein concentrates will be sold to processors.

2. Product Description: High-quality virgin coconut oil (VCO) is produced from fresh coconut meat (noncopra) without heat and chemicals. The product does not pass through the refining, bleaching, and deodorizing (RBD) processes. It does not contain aflatoxins and polyaromatic hydrocarbons (PAHs) that are carcinogenic. It is rich in lauric acid and medium-chain fatty acids that are converted to energy and easily digested by the body.

3. Production and Sales Schedule (volume and value) Average Selling Price per Unit

3.1. Annual Production

Product	Annual Production (kg)				
	Year 1	Year 2	Year 3	Year 4	Year 5
VCO	74,127.52	74,127.52	74,127.52	74,127.52	74,127.52
Coco shell	322,176.00	322,176.00	322,176.00	322,176.00	322,176.00
Protein concentrate	183,793.47	183,793.47	183,793.47	183,793.47	183,793.47
Coconut meal (Sapal)	138,271.01	138,271.01	138,271.01	138,271.01	138,271.01
TOTAL	718,368.00	718,368.00	718,368.00	718,368.00	718,368.00

3.2. Prices per Product in PhP/kg

Product	Price per kg				
	Year 1	Year 2	Year 3	Year 4	Year 5
VCO	276.00	276.00	276.00	276.00	276.00
Coco shell	1.00	1.00	1.00	1.00	1.00
Protein concentrate	2.00	2.00	2.00	2.00	2.00
Coconut meal (Sapal)	3.00	3.00	3.00	3.00	3.00

3.3. Annual Sales per Product

Product	Annual sales (PhP)				
	Year 1	Year 2	Year 3	Year 4	Year 5
VCO	20,459,196.40	20,459,196.40	20,459,196.40	20,459,196.40	20,459,196.40
Coco shell	322,176.00	322,176.00	322,176.00	322,176.00	322,176.00
Protein Concentrate	367,586.94	367,586.94	367,586.94	367,586.94	367,586.94
Coconut Meal (Sapal)	414,813.02	414,813.02	414,813.02	414,813.02	414,813.02
TOTAL	21,563,772.36	21,563,772.36	21,563,772.36	21,563,772.36	21,563,772.36

4. Employment Generation

	No. of employees	Annual payroll
Direct	18	2,347,160.00
Indirect[1,2,3]	50	3,409,525.08
Selling and administrative	2	158,640.00
Total	70	5,915,325.08

Note:

[1] Indirect = Informal sellers with average average profit margins of 25% mark-ups.

[2] 50% of production will be marketed by informal sellers or dealers.

[3] Computation: PhP276.00 x 33.33% x 50% x 74,127.52 kg

5. Target Markets: Functional food market, cosmetic, and pharmaceutical laboratories.

6. Technology: UPLB-BIOTECH VCO Production Technology

6.1. Raw Materials (5,000 nuts/production run)

Materials	Volume per run	Unit	Cost/unit	Cost/run
Coconut, in kg	4,000.0	kg	5.50	22,000.00
Water	10.0	cu. meter	20.00	200.00
Enzyme	825.4	grams	2.50	2,063.50
Bottles	308.9	liters	15.40	4,756.44
Labels	333.3	pcs	1.00	333.33
Total				29,353.28

6.2. Raw Materials per Year

Materials	Volume per year	Unit	Cost/unit	Cost per year
Coconut, in kg	960,000.0	kg	5.50	5,280,000.00
Water	6,000.0	cu. Meter	20.00	120,000.00
Enzyme	198,096.0	grams	2.50	495,240.00
Bottles	74,126.4	kg	15.40	1,141,546.56
Labels	80,000.0	pcs	1.00	80,000.00
Total				7,116,786.56

Assumptions:

1. Weight of dehusked nut = 0.8 kg and grated coconut = 0.4127 kg/nut
2. Enzymes = 5000 x.4127 x 0.4 g/kg
3. Production runs per month = 20
4. Production runs per year = 240

6.3. Property, Plant and Equipment (PPE)

PPE	Quantity/unit	Unit cost	Total cost
Land	200 m^2	200.00	40,000.00
Building 100 m	100	5,000.00	500,000.00
Top loading balance	1	39,000.00	39,000.00
Graters (double blades)	7	20,000.00	140,000.00
Expellers	2	320,000.00	640,000.00
Separator, Westfalia Oil Purifier	2	2,500,000.00	5,000,000.00
Vaccum pump	2	30,000.00	60,000.00
Filtration set-up	2	20,000.00	40,000.00
Boiler	1	480,000.00	480,000.00
Deionizer	1	20,000.00	20,000.00
Laboratory tables	4	5,000.00	20,000.00
Plastic containers (200 L)	100	550.00	55,000.00
Delivery van	1	500,000.00	500,000.00
Office equipment - computer	1	35,000.00	35,000.00
Office equipment - printer	1	25,000.00	25,000.00
Office equipment - tables	4	5,000.00	20,000.00
Total			7,614,000.00

6.4. Depreciation Schedule

Item	Total Cost	Useful life	Depreciation expense				
			Year 1	Year 2	Year 3	Year 4	Year 5
Building	500,000.00	15	33,333.33	33,333.33	33,333.33	33,333.33	33,333.33
Top loading balance	39,000.00	10	3,900.00	3,900.00	3,900.00	3,900.00	3,900.00
Graters (double blades)	140,000.00	10	14,000.00	14,000.00	14,000.00	14,000.00	14,000.00
Expellers	640,000.00	10	64,000.00	64,000.00	64,000.00	64,000.00	64,000.00
Separator, Westfalia Oil Purifier	5,000,000.00	10	500,000.00	500,000.00	500,000.00	500,000.00	500,000.00
Vaccum pump	60,000.00	10	6,000.00	6,000.00	6,000.00	6,000.00	6,000.00
Filtration set-up	40,000.00	10	4,000.00	4,000.00	4,000.00	4,000.00	4,000.00
Boiler	480,000.00	10	48,000.00	48,000.00	48,000.00	48,000.00	48,000.00
Deionizer	20,000.00	10	2,000.00	2,000.00	2,000.00	2,000.00	2,000.00
Laboratory tables	20,000.00	10	2,000.00	2,000.00	2,000.00	2,000.00	2,000.00
Plastic containers (200 L)	55,000.00	5	11,000.00	11,000.00	11,000.00	11,000.00	11,000.00
Delivery van	500,000.00	10	50,000.00	50,000.00	50,000.00	50,000.00	50,000.00
Office equipment - computer	35,000.00	10	3,500.00	3,500.00	3,500.00	3,500.00	3,500.00
Office equipment - printer	25,000.00	10	2,500.00	2,500.00	2,500.00	2,500.00	2,500.00
Office equipment - tables	20,000.00	10	2,000.00	2,000.00	2,000.00	2,000.00	2,000.00
Total	7,574,000.00		746,233.33	746,233.33	746,233.33	746,233.33	746,233.33

7. Timetable

Activity	Period (month)							
	1	2	3	4	5	6	7	9
Feasibility study								
Project approval & documentation								
Land acquisition Building construction/improvement								
Equipment delivery & installation								
Plant commissioning & testing								
Recruitment & training								
Marketing								

Raw material preparation & sourcing		
Commercial operation		

7.1 Loan Amortization Schedule @ 16% INTEREST RATE

Year	Principal	Interest	Loan amortization	Loan balance
0				7,614,000.00
1	1,522,800.00	1,218,240.00	2,741,040.00	6,091,200.00
2	1,522,800.00	974,592.00	2,497,392.00	4,568,400.00
3	1,522,800.00	730,944.00	2,253,744.00	3,045,600.00
4	1,522,800.00	487,296.00	2,010,096.00	1,522,800.00
5	1,522,800.00	243,648.00	1,766,448.00	0.00

7.2 Working Capital and Other Project Costs

	Per production run	40 Production runs
Salaries and wages	10,440.83	417,633.33
Supplies and materials	29,653.28	1,186,131.09
Utilities	1,000.00	40,000.00
Marketing and administrative Expenses (20%)	6,849.02	410,941.11
Pre-operating expenses		1,037,068.00
Loan repayment	11,421.00	685,260.00
TOTAL	47,943.13	3,777,033.53

7. Project Location: UPLB Science Park

8. Justification for Pioneer Status: (Not applicable)

10. Project Cost

Nature	Amount (In Pesos)	Bank loan	Equity capital
Asset requirements:			
Fixed assets:			
Land site	40,000.00	40,000.00	0
Building	500,000.00	500,000.00	0
Plant machinery and equipment	6,494,000.00	6,494,000.00	0
Transport equipment	500,000.00	500,000.00	0
Office equipment	80,000.00	80,000.00	
Total cost of fixed assets	7,614,000.00	7,614,000.00	0

Working capital and other project costs			
Working capital	3,777,033.53	0.00	3,777,033.53
Total working capital	3,777,033.53	0.00	3,777,033.53
Total project cost	11,391,033.53	7,614,000.00	3,777,033.53

11. Projected Income Statement

Particulars	YEAR				
	Year 1	Year 2	Year 3	Year 4	Year 5
Gross sales-VCO (kg)[1]	74,127.52	74,127.52	74,127.52	74,127.52	74,127.52
Less: Sales return and allowances[2]	3,706.38	3,706.38	3,706.38	3,706.38	3,706.38
Net sales (kg)	70,421.15	70,421.15	70,421.15	70,421.15	70,421.15
x Selling price/kg	276.00	276.00	276.00	276.00	276.00
Net sales-VCO	19,436,236.58	19,436,236.58	19,436,236.58	19,436,236.58	19,436,236.58
Add: Sales from other sources					
Coco shell	322,176.00	322,176.00	322,176.00	322,176.00	322,176.00
Protein concentrate	367,586.94	367,586.94	367,586.94	367,586.94	367,586.94
Coconut meal	414,813.02	414,813.02	414,813.02	414,813.02	414,813.02
Sub-total	1,104,575.96	1,104,575.96	1,104,575.96	1,104,575.96	1,104,575.96
Gross Sales	20,540,812.54	20,540,812.54	20,540,812.54	20,540,812.54	20,540,812.54
Less: VAT (12%)	2,464,897.51	2,464,897.51	2,464,897.51	2,464,897.51	2,464,897.51
Gross income	18,075,915.04	18,075,915.04	18,075,915.04	18,075,915.04	18,075,915.04
Less: Expenditures					
Depreciation cost	746,233.33	746,233.33	746,233.33	746,233.33	746,233.33
Production and marketing cost (Sch.5)	11,506,350.99	11,800,729.37	11,800,729.37	11,800,729.37	11,800,729.37
Loan amortization	2,741,040.00	2,497,392.00	2,253,744.00	2,010,096.00	1,766,448.00
Royalty	583,087.10	583,087.10	583,087.10	583,087.10	583,087.10
Amortization of pre-operating expenses	207,413.60	207,413.60	207,413.60	207,413.60	207,413.60
Total Expenditures	15,784,125.02	15,834,855.40	15,591,207.40	15,347,559.40	15,103,911.40
Net profit before income tax	4,756,687.53	4,705,957.15	4,949,605.15	5,193,253.15	5,436,901.15
Less: Provision for income taxes (32%)	1,522,140.01	1,505,906.29	1,583,873.65	1,661,841.01	1,739,808.37
Net profit income after tax	3,234,547.52	3,200,050.86	3,365,731.50	3,531,412.14	3,697,092.78

12. Cash Flow Statement

Item	Pre-Operation	Year 1	2	3	4	5
Estimated cash receipt						
Bank loan	7,614,000.00					
Equity contribution	3,777,033.53					
From Operation:						
Net profit after tax		3,234,547.52	3,200,050.86	3,365,731.50	3,531,412.14	3,697,092.78
Add back:						
Depreciation		746,233.33	746,233.33	746,233.33	746,233.33	746,233.33
Amortization of Pre-op.exp.		207,413.60	207,413.60	207,413.60	207,413.60	207,413.60
Total cash receipt from operation	0.00	4,188,194.45	4,153,697.79	4,319,378.43	4,485,059.07	4,650,739.71
Total estimated cash receipts	11,391,033.53	4,188,194.45	4,153,697.79	4,319,378.43	4,485,059.07	4,650,739.71
Estimated cash disbursements						
Capital expenditures						
Land	40,000.00					
Building	500,000.00					
Machinery and equipment	6,494,000.00					
Transport equipment	500,000.00					
Office equipment	80,000.00					
Organizational and pre-op. exp.	1,037,068.00					
Total capital expenditures	8,651,068.00	0	0	0	0	0
Total estimated disbursements	8,651,068.00	0.00	0.00	0.00	0.00	0.00
Net cash inflow (outflow)	2,739,965.53	4,188,194.45	4,153,697.79	4,319,378.43	4,485,059.07	4,650,739.71
Cash balance, beginning		2,739,965.53	6,928,159.99	11,081,857.78	15,401,236.21	19,886,295.29
Cash balance, end	2,739,965.53	6,928,159.99	11,081,857.78	15,401,236.21	19,886,295.29	24,537,035.00

Profitability

Net present value (NPV) method						
Initial investment/ Net income	11,391,033.53	4,188,194.45	4,153,697.79	4,319,378.43	4,485,059.07	4,650,739.71
Hurdle rate(18%)		0.85	0.72	0.61	0.52	0.44
Present values	-11,391,033.53	3,549,317.33	2,983,121.08	2,628,907.07	2,313,343.58	2,032,881.19
NPV	2,116,536.71					

Total investment	11,391,033.53
Selling price	276.00
Break-even point (in kg)	94,315.17
Contribution margin per kg	120.78
Profit margin (%)	21.22
Break-even period	1.5 years
Average net income/year	4,359,413.89
Average return of investment/year (%)	38.27

Investment Models for VCO Processing (5 years)

Particulars	Model 1 (Products: VCO, coco shell, protein concentrates & coco meal)	Model 2 (Products: VCO, coco shell & flour)
A.Capital Requirements		
1. Property, plant and equipment	7,614,000.00	7,849,000.00
2. Pre-operating expenses	1,037,068.00	1,037,068.00
3. Working capital	2,739,965.53	2,739,965.53
Total	11,391,033.53	11,626,033.53
B. Profitability		
Sales	102,704,062.72	109,638,006.88
Less: Expenditures		
Production and marketing cost	58,709,268.45	58,709,268.45
Loan repayment	11,268,720.00	11,616,520.00
VAT	12,324,487.53	13,156,560.83
Royalty	2,915,435.49	2,915,435.49
Provision for income tax	8,013,569.32	10,083,535.45
Total expenditures	93,231,480.78	96,481,320.21
Net income	9,472,581.94	13,156,686.67
Return of investment (%)	83.16	113.17
Payback period	1.5 years	1.5 years

INVESTMENT FOLIO: FUNCTIONAL FOOD GROUP (Investment Model 2)

1. Project Description: Production of Virgin Coconut Oil (Stand Alone - 5,000 Nuts Model)
   The products will be produced through an efficient cold processing method and the application of the latest trend in biotechnology.

2. Product Description: High-quality virgin coconut oil (VCO) is produced from fresh coconut meat (noncopra) without heat and chemicals. The product does not pass through the refining, bleaching, and deodorizing (RBD) processes. It does not contain aflatoxins and polyaromatic hydrocarbons (PAHs) that are carcinogenic. It is rich in lauric acid and medium chain fatty acids, which are converted to energy and easily digested by the body.
   VCO will be produced and production wastes such as coco meal and protein will be processed into high-protein and high-fiber coco flour.

3. Production and Sales Schedule (volume and value) Average Selling Price per Unit

3.1. Annual Production

Product	Annual production (kg)				
	Year 1	Year 2	Year 3	Year 4	Year 5
VCO	74,127.52	74,127.52	74,127.52	74,127.52	74,127.52
Coco shell (kg)	322,176.00	322,176.00	322,176.00	322,176.00	322,176.00
Coco flour-high protein and fiber (kg)	86,767.55	86,767.55	86,767.55	86,767.55	86,767.55
Total	483,071.07	483,071.07	483,071.07	483,071.07	483,071.07

3.2. Prices per Product in PhP/kg

Product	Price per kg				
	Year 1	Year 2	Year 3	Year 4	Year 5
VCO	276.00	276.00	276.00	276.00	276.00
Coco shell	1.00	1.00	1.00	1.00	1.00
Coco flour (high protein & fiber)	25.00	25.00	25.00	25.00	25.00

3.3. Annual Sales per Product

Product	Annual sales (PhP)				
	Year 1	Year 2	Year 3	Year 4	Year 5
VCO	20,459,196.40	20,459,196.40	20,459,196.40	20,459,196.40	20,459,196.40
Coco shell	322,176.00	322,176.00	322,176.00	322,176.00	322,176.00
Coco flour (high protein and fiber)	2,169,188.79	2,169,188.79	2,169,188.79	2,169,188.79	2,169,188.79
Total	22,950,561.20	22,950,561.20	22,950,561.20	22,950,561.20	22,950,561.20

4. Employment Generation

	No. of employees	Annual payroll
Direct	18	2,347,160.00
Indirect[1,2,3]	50	3,409,525.08
Selling and administrative	2	158,640.00
Total	70	5,915,325.08

Note:

[1] Indirect = Informal sellers with average profit margins of 25% mark-ups.
[2] 50% of production will be marketed by informal sellers or dealers.
[3] Computation: PhP276.00 x 33.33% x 50% x 74,127.52 kg

5. Target Markets: Functional food, cosmetic and pharmaceutical industries.

6. Technology: UPLB-BIOTECH VCO Production Technology

6.1 Raw Materials (5,000 nuts/production run)

	Volume per run	Unit	Cost/unit	Cost/run
Coconut, in kg	4,000.0	Kg	5.50	22,000.00
Water	25.0	cu. Meter	20.00	500.00
Enzyme	825.4	Grams	2.50	2,063.50
Bottles	308.9	Liters	15.40	4,756.44
Labels	333.3	Pcs	1.00	333.33
Total				29,653.28

6.2 Raw Materials per Year

Materials	Volume per year	Unit	Cost/unit	Cost per year
Coconut, in kg	960,000.0	kg	5.50	5,280,000.00
Water	6,000.0	cu. Meter	20.00	120,000.00
Enzyme	198,096.0	grams	2.50	495,240.00
Bottles	74,126.4	kg	15.40	1,141,546.56
Labels	80,000.0	pcs	1.00	80,000.00
Total				7,116,786.56

Assumptions:

1. Weight of dehusked nut = 0.8 kg and grated coconut = 0.4127 kg/nut
2. Enzymes = 5000 x.4127 x 0.4 g/kg
3. Production runs per month = 20
4. Production runs per year = 240

6.3 Property, Plant and Equipment (PPE)

PPE	Quantity/unit	Unit cost	Total cost
Land	200 m^2	200.00	40,000.00
Building 100 m	100	5,000.00	500,000.00
Top loading balance	1	39,000.00	39,000.00
Graters (double blades)	7	20,000.00	140,000.00
Expellers	2	320,000.00	640,000.00
Separator, Westfalia Oil Purifier	2	2,500,000.00	5,000,000.00
Vaccum pump	2	30,000.00	60,000.00
Filtration set-up	2	20,000.00	40,000.00
Boiler	1	480,000.00	480,000.00
Deionizer	1	20,000.00	20,000.00
Pulverizer	1	45,000.00	45,000.00
Dryer	1	190,000.00	190,000.00
Laboratory tables	4	5,000.00	20,000.00
Plastic containers (200 L)	100	550.00	55,000.00
Delivery van	1	500,000.00	500,000.00
Office equipment - computer	1	35,000.00	35,000.00
Office equipment - printer	1	25,000.00	25,000.00
Office equipment - tables	4	5,000.00	20,000.00
Total			7,849,000.00

6.4 Depreciation Schedule

Item	Total cost	Useful life	Depreciation expense				
			Year 1	Year 2	Year 3	Year 4	Year 5
Building	500,000.00	15	33,333.33	33,333.33	33,333.33	33,333.33	33,333.33
Top loading balance	39,000.00	10	3,900.00	3,900.00	3,900.00	3,900.00	3,900.00
Graters (double blades)	140,000.00	10	14,000.00	14,000.00	14,000.00	14,000.00	14,000.00
Expellers	640,000.00	10	64,000.00	64,000.00	64,000.00	64,000.00	64,000.00
Separator, Westfalia Oil Purifier	5,000,000.00	10	500,000.00	500,000.00	500,000.00	500,000.00	500,000.00
Vaccum pump	60,000.00	10	6,000.00	6,000.00	6,000.00	6,000.00	6,000.00
Filtration set-up	40,000.00	10	4,000.00	4,000.00	4,000.00	4,000.00	4,000.00
Boiler	480,000.00	10	48,000.00	48,000.00	48,000.00	48,000.00	48,000.00
Deionizer	20,000.00	10	2,000.00	2,000.00	2,000.00	2,000.00	2,000.00
Pulverizer	45,000.00	10	4,500.00	4,500.00	4,500.00	4,500.00	4,500.00
Dryer	190,000.00	10	19,000.00	19,000.00	19,000.00	19,000.00	19,000.00
Laboratory tables	20,000.00	10	2,000.00	2,000.00	2,000.00	2,000.00	2,000.00
Plastic containers (200 L)	55,000.00	5	11,000.00	11,000.00	11,000.00	11,000.00	11,000.00
Delivery van	500,000.00	10	50,000.00	50,000.00	50,000.00	50,000.00	50,000.00
Office equipment - computer	35,000.00	10	3,500.00	3,500.00	3,500.00	3,500.00	3,500.00
Office equipment – printer	25,000.00	10	2,500.00	2,500.00	2,500.00	2,500.00	2,500.00
Office equipment – tables	20,000.00	10	2,000.00	2,000.00	2,000.00	2,000.00	2,000.00
Total	7,809,000.00		769,733.33	769,733.33	769,733.33	769,733.33	769,733.33

7. Timetable

Activity	Period (month)							
	1	2	3	4	5	6	7	9
Feasibility study								
Project approval and documentation								
Land acquisition								
Building construction/ improvement								
Equipment delivery and installation								
Plant commissioning and testing								
Recruitment and training								
Marketing								
Raw material preparation and sourcing								

7.1. Loan Amortization Schedule @ 16% INTEREST RATE

Year	Principal	Interest	Loan amortization	Loan balance
0				7,849,000.00
1	1,569,800.00	1,255,840.00	2,825,640.00	6,279,200.00
2	1,569,800.00	1,004,672.00	2,574,472.00	4,709,400.00
3	1,569,800.00	753,504.00	2,323,304.00	3,139,600.00
4	1,569,800.00	502,336.00	2,072,136.00	1,569,800.00
5	1,569,800.00	251,168.00	1,820,968.00	0.00

7.2. Working Capital and Other Project Costs

	Per production run	40 Production runs
Salaries and wages	10,440.83	417,633.33
Supplies and materials	29,653.28	1,186,131.09
Utilities	1,000.00	40,000.00
Marketing and administrative expenses (20%)	6,849.02	410,941.11
Pre-operating expenses		1,037,068.00
Loan repayment	11,773.50	706,410.00
Total	47,943.13	3,798,183.53

8. Project Location: UPLB Science Park

9. Justification for Pioneer Status: (Not applicable)

10. Project Cost

Nature	Amount (In pesos)	Bank loan	Equity capital
Asset requirements:			
Fixed assets:			
Land site	40,000.00	40,000.00	0
Building	500,000.00	500,000.00	0
Plant machinery and equipment	6,729,000.00	6,729,000.00	0
Transport equipment	500,000.00	500,000.00	0
Office equipment	80,000.00	80,000.00	
Total cost of fixed assets	7,849,000.00	7,849,000.00	0
Working capital and other project costs			
Working capital	3,798,183.53	0.00	3,798,183.53
Total working capital	3,798,183.53	0.00	3,798,183.53
Total project cost	11,647,183.53	7,849,000.00	3,798,183.53

11. Project Income Statement

Particulars	YEAR				
	Year 1	Year 2	Year 3	Year 4	Year 5
Gross sales-VCO (kg)[1]	74,127.52	74,127.52	74,127.52	74,127.52	74,127.52
Less: Sales return and allowances[2]	3,706.38	3,706.38	3,706.38	3,706.38	3,706.38
Net sales (kg)	70,421.15	70,421.15	70,421.15	70,421.15	70,421.15
x selling price/kg	276.00	276.00	276.00	276.00	276.00
Net sales-VCO	19,436,236.58	19,436,236.58	19,436,236.58	19,436,236.58	19,436,236.58
Add: Sales from other sources					
Coco shell	322,176.00	322,176.00	322,176.00	322,176.00	322,176.00
Coco flour (high protein and fiber)	2,169,188.79	2,169,188.79	2,169,188.79	2,169,188.79	2,169,188.79
Sub-total	2,491,364.79	2,491,364.79	2,491,364.79	2,491,364.79	2,491,364.79
Gross sales	21,927,601.38	21,927,601.38	21,927,601.38	21,927,601.38	21,927,601.38
Less: VAT (12%)	2,631,312.17	2,631,312.17	2,631,312.17	2,631,312.17	2,631,312.17
Gross income	19,296,289.21	19,296,289.21	19,296,289.21	19,296,289.21	19,296,289.21
Less: Expenditures					
Depreciation cost	769,733.33	769,733.33	769,733.33	769,733.33	769,733.33
Production and marketing cost (Sch.5)	11,506,350.99	11,800,729.37	11,800,729.37	11,800,729.37	11,800,729.37
Loan amortization	2,825,640.00	2,574,472.00	2,323,304.00	2,072,136.00	1,820,968.00
Royalty	583,087.10	583,087.10	583,087.10	583,087.10	583,087.10
Amortization of pre-operating expenses	207,413.60	207,413.60	207,413.60	207,413.60	207,413.60
Total expenditures	15,892,225.02	15,935,435.40	15,684,267.40	15,433,099.40	15,181,931.40
Net Profit before Income Tax	6,035,376.36	5,992,165.98	6,243,333.98	6,494,501.98	6,745,669.98
Less: Provision for income taxes (32%)	1,931,320.43	1,917,493.11	1,997,866.87	2,078,240.63	2,158,614.39
Net profit income after Tax	4,104,055.92	4,074,672.87	4,245,467.11	4,416,261.35	4,587,055.59

12. Cash Flow Statement

Item	Pre-operating	Year				
		1	2	3	4	5
Estimated cash receipt						
Bank loan	7,849,000.00					
Equity contribution	3,798,183.53					
From operation:						
Net profit after tax		4,104,055.92	4,074,672.87	4,245,467.11	4,416,261.35	4,587,055.59
Add back:						
Depreciation		769,733.33	769,733.33	769,733.33	769,733.33	769,733.33
Amortization of pre-op.exp.		207,413.60	207,413.60	207,413.60	207,413.60	207,413.60
Total cash receipt from operation	0.00	5,081,202.86	5,051,819.80	5,222,614.04	5,393,408.28	5,564,202.52
Total estimated cash receipts	11,647,183.53	5,081,202.86	5,051,819.80	5,222,614.04	5,393,408.28	5,564,202.52
Estimated cash disbursements						
Capital expenditures						
Land	40,000.00					
Building	500,000.00					
Machinery and equipment	6,729,000.00					
Transport equipment	500,000.00					
Office equipment	80,000.00					
Organizational and pre-op. exp.	1,037,068.00					
Total capital expenditures	8,886,068.00	0	0	0	0	0
Total estimated disbursements	8,886,068.00	0.00	0.00	0.00	0.00	0.00
Net cash inflow (outflow)	2,761,115.53	5,081,202.86	5,051,819.80	5,222,614.04	5,393,408.28	5,564,202.52
Bash balance, beginning		2,761,115.53	7,842,318.39	12,894,138.19	18,116,752.23	23,510,160.51
Cash balance, end	2,761,115.53	7,842,318.39	12,894,138.19	18,116,752.23	23,510,160.51	29,074,363.03

Profitability

Net present value (NPV) method						
Initial investment/net income	11,647,183.53	5,081,202.86	5,051,819.80	5,222,614.04	5,393,408.28	5,564,202.52
Hurdle rate (18%)		0.85	0.72	0.61	0.52	0.44
Present values	-11,647,183.53	4,306,104.12	3,628,138.32	3,178,644.14	2,781,859.99	2,432,164.20
NPV	4,679,727.24					

Total investment	11,647,183.53
Selling price	276.00
Break-even point (in kg)	96,436.03
Contribution margin per kg	120.78
Profit margin (%)	24.00
Break-even period	1.5 years
Average net income/year	5,262,649.50
Average return of investment/year (%)	45.18

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CHAPTER 5

Product Development, Challenges and Prospects: Industrial Coconut Products

Romulo R. Mesias

ABSTRACT

This chapter focuses on the economic challenges and prospects of emerging industrial products from coconut such as coconut shell charcoal and activate carbon, and cochin oil and coco-methyl ester (CME). The Philippines is already a top exporter of coconut-shell activated carbon. As for shell charcoal, cochin oil and CME, their market potential remains strong given their increasing popularity as environment-friendly alternatives to polluting synthetic materials.

The investment analysis conducted by this diagnostic study shows that it is profitable to invest on these products. One hundred modules of the proposed system for charcoal production, which will cost P500,000 or only P5,000 per module, will bring in a hefty net profit of P2.8 million per year, with a payback period of less than 2 years only. One module of the proposed activated carbon plant, which will have a capacity of 4 MT shell charcoal per day, will require a capital investment of P7 million. Net profit after taxes will be P1.7 million per year and the business will achieve its breakeven point in less than 4 years. For cochin oil, the proposed processing model amounting to P3.6 million will earn a net profit of P2.2 million per year, with a payback period of only a little more than 1 year. For CME, a net profit of 8.3 million per year can be expected from an investment of P2.8 million for two modules, with a payback period of less than two years.

But everything depends on how well the country deals with the impediments to investments in these emerging industrial coconut products. The most serious of these impediments include the limited number or total lack of farm-to-market roads, the worsening peace-and-order situation, the insufficient budget for research on coconut processing technologies, and the inadequate technology transfer.

Without farm-to-market roads, investors will not bother investing in the industry. They will not be able to bring inputs to the farms or get the goods to the market. It will not matter how much raw materials there is or how cheap the labor is if the goods will simply rot in the farms for lack of roads. The farmers themselves are not motivated to raise output due to the hardship involved in bringing their product to the market. Their profits are also reduced by the high cost of transportation. Coconut traders also control the trading process and can manipulate prices to their advantage, leaving the poor farmers at their mercy.

The worsening peace and order situation in the country is another barrier to investments. Communists are running loose in many coconut-growing areas, charging people “revolutionary taxes.” If a person refuses to pay up, he may get killed or his plant may be razed to the ground or he can suffer both consequences. Either way, this is exactly the kind of situation that makes investors stay away.

The limited budget for research on coconut processing technologies is also a hindrance to investments. If technologies are present, these are not well disseminated to their intended users. Various research institutions like the Department of Science and Technology (DOST) have technologies that are gathering dust and cobwebs in their steel filing cabinets.

EXECUTIVE SUMMARY

Approximately 25 million Filipinos (or one-third of the population) depend on the coconut industry for their livelihood while an estimated 3.1 million hectares or 27% of total agricultural land is planted to coconut. An annual average of 2.3 million metric tons (MT), in copra terms, was produced over the past 10 years. This is equivalent to PhP35 billion per year in output value and about US$800 million per year in export earnings. Despite this, however, the industry has remained a classic social irony, as the country's 3.5 million coconut farmers are still mired in abject poverty. This is happening even as foreign and domestic interest groups continue to make a milking cow of the industry.

There are four emerging coconut products for industrial use that have high economic potential as well as environmental application. These are coconut shell charcoal, activated carbon, cochin oil, and coco methyl ester (CME) or biodiesel.

Research and development has greatly improved the processing technologies for these products. The process of making coconut shell in the past has been very crude. Over the years, significant improvements have been realized with the introduction of the modified drum method. Ditto with activated carbon production. The old rudimentary process has not only been lengthy; the resulting product has high ash content. The new method of producing carbon involves the use of the carbo-activator, which reduces the processing time. The activated carbon produced also has a very low ash content of 2%, lower than the standard requirement of 5%. Cochin oil can be produced from fresh, mature nuts: (i) as a main product of the hot air process; (ii) as a by-product of the wet process; or (iii) chemically from crude coconut oil. The production of CME or biodiesel involves a new process called transesterification, which is currently the only process used for making biodiesel.

The Philippines is already a top exporter of coconut-shell activated carbon. As for shell charcoal, cochin oil and CME, their market potential remains strong given their increasing popularity as environment-friendly alternatives to polluting synthetic materials.

Shell charcoal's current main application is in the manufacture of activated carbon and as fuel, especially now that liquefied petroleum gas (LPG) is becoming very expensive. As a nation with 2.3 million MT of unutilized coconut shells, it is high time that Filipinos use this idle resource for the production of activated carbon and earn more dollars in the process or use them as fuel for the needs of domestic households.

Yet out of the 2.3 million MT of coconut shells produced in the country, only 8% is actually converted to activated carbon or coconut shell charcoal. This is despite of the big market for activated carbon. Activated carbon made from coconut shell is considered superior to those obtained from other sources mainly because of its small macropore structure. This structure makes it more effective in absorbing gas or vapor and in removing the color and odor of compounds.

Shell activated carbon is used in gas masks for military and industrial applications because of its ability to absorb certain poisonous gases. Another application is in the industrial recovery of vapors. A very important continuous process for close fractionation for light-hydrocabon recovery from gas streams has been developed. This hypersorption process uses a moving bed of activated shell charcoal, which has a high absorptive capacity and a more abrasion-resistant area than other carbons.

The water purification industry also needs a great deal of activated carbon for removing poisonous materials in potable water while the pharmaceutical industry uses it in some medical formulations. Industrialized countries also need it for their antipollution campaigns.

Cochin oil is a very good raw material for cooking oil, cosmetics, industrial chemicals, and the best oil for making biodiesel. It is produced as a main product using the wet process or as a by-product in the production of coconut virgin oil. It is aflatoxin and nitrite free; therefore, it is not carcinogenic. The raw material for producing cochin oil is widely available but nowadays, nobody in the Philippines produces cochin oil using the wet process due to the high cost of fuel. However, a technology has been developed in the Philippines that can provide the hot, clean air for drying the grated meat for free.

Cochin oil's main competitor is crude coconut oil from copra, which is usually dark in color, has high free fatty acid content as well as aflatoxin and carcinogenic nitrites. This oil may also come in a more expensive RDB (refined, deodorized, and bleached) version.

Biodiesel or CME is now being eyed to replace petroleum diesel when petroleum deposits dry up. At present, CME is used as an additive to petroleum diesel to reduce emission and increase mileage. In 2004, the country's demand for diesel reached 5.4 billion liters a year. This demand shows no signs of weakening. With world oil prices fluctuating in response to conflict in the Middle East and other geopolitical concerns, it becomes even more important to explore alternatives to petroleum. For the Philippines, CME is one such alternative. Various tests have consistently shown that CME performs as well diesel, but with less emissions and with increased fuel combustion. If the Philippines is to seriously develop CME as an alternative fuel source, it would have to produce 4.86 billion liters of CME yearly. Right now, CME is being used as the main raw material for fatty acids and fatty alcohols. The glycerin by-product is used in the manufacture of alkyd resins and other resins for the paint industry.

A bill mandating the blending of CME with all diesel engine fuels sold in the country is pending in the legislative branch. The initial volume required for blending is 1%. Within two years of the law's effectivity, the required volume blended will be raised to 2%. At 2%, the Philippines will need 140,000 MT of CME each year. This output is expected to be absorbed by the different refineries of petroleum diesel and transport cooperatives acting on behalf of their members. The bigger market for CME, however, is still overseas. Potential markets include Europe where the legal requirement for blending is between 10 and 15%; Japan, 2%; seven states in the United States, 1% to 2%; Korea, 2%; Thailand, 2%; and Malaysia, 1%.

Additionally, the production of CME will help further diversify the coconut and improve its competitiveness. Because of the different by-products CME produces, the cost of producing of CME is reduced. Instead of having CME carry all the costs, the latter is distributed among the by-products and CME.

An example is crude glycerin, which is a by-product of CME manufacture. In raw form, glycerin can be used as raw material for resins. In its refined form, it is used in the manufacture of cosmetics, cigarettes, explosives, and many other products.

The investment analysis conducted by this diagnostic study shows that it is profitable to invest on these products. One hundred modules of the proposed system for charcoal production, which will cost P500,000 or only P5,000 per module, will bring in a hefty net profit of P2.8 million per year, with a payback period of less than 2 years only. One module of the proposed activated carbon plant, which will have a capacity of 4 MT shell charcoal per day, will require a capital investment of P7 million. Net profit after taxes will be P1.7 million per year and the business will achieve its breakeven point in less than 4 years. For cochin oil, the proposed processing model amounting to P3.6 million will earn a net profit of P2.2 million per year, with a payback period of only a little more than 1 year. For CME, a net profit of 8.3 million per year can be expected from an investment of P2.8 million for two modules, with a payback period of less than two years.

Everything depends, however, on how well the country deals with the impediments to investments in these emerging industrial coconut products. The most serious of these impediments are the limited number or total lack of farm-to-market roads, the worsening peace-and-order situation, the insufficient budget for research on coconut processing technologies, and the inadequate technology transfer.

Without farm-to-market roads, investors will not bother investing in the industry. They will not be able to bring inputs to the farms or get the goods to the market. It will not matter how much raw materials there is or how cheap the labor is if the goods will simply rot in the farms for lack of roads. The farmers themselves are not motivated to raise output due to the hardship involved in bringing their product to the market. Their profits are also reduced due to the high cost of transportation. Coconut traders also control the trading process and can manipulate prices to their advantage, leaving the poor farmers at their mercy.

The worsening peace and order situation in the country is another barrier to investment. Communists are running loose in many coconut-growing areas, charging people “revolutionary taxes.” If a person refuses to pay up, he may get killed or his plant may be razed to the ground or he can suffer both consequences. Either way, this is exactly the kind of situation that makes investors stay away.

The limited budget for research on coconut processing technologies is also a hindrance to investments. If technologies are present, these are not well disseminated to their intended users. Various research institutions like the Department of Science and Technology (DOST) have technologies that are gathering dust and cobwebs in their steel filing cabinets.

Nevertheless, the industry has a number of positive factors going for it such as the availability of, and access to, abundant raw materials; new technology; technical expertise; and a more-than-adequate labor pool.

The raw materials needed to produce these emerging products are coconut shells, of which the Philippines has an excess of 1,685,436 MT lying around unused. In fact, estimates peg the industry's utilization rate of coconut shells at only 8%, so the potential of the coconut shell as an industrial raw material has remained mostly untapped and unrealized.

The industry can encourage upstream processing of coir fiber and geotextiles and downstream integration for cochin oil production and then biodiesel. For small enterprises, the downstream integration would include copra, coir, geotextiles, and coco peat drying. For medium-scale enterprises, the upstream integration is activated carbon production.

New technologies or equipment that will allow manufacturers to produce premium-quality activated carbon and shell charcoal at lower cost are already available and simply waiting for producers to try them out so they can see for themselves the touted benefits.

Among these benefits are the facts that these technologies use abundant and locally available raw materials; that they use by-products as inputs to the process, further reducing production costs; and that they are locally made thereby eliminating the need to import capital goods or pay royalties to foreign entities.

Another possible benefit to using these new technologies is that they lend themselves well to the setting up of smaller processing plants that farmers can easily operate. If such plants are established in the provinces, these can generate much-needed employment and perhaps help reduce migration to congested urban areas.

Of manpower and technical expertise, the industry also has enough to enable it to compete globally. What it lacks, though, and what it desperately needs, is funding—for R&D and product development, for promotion of these products in local and foreign markets, and for improvement of farm-to-market roads as well as storage and transportation facilities. Farmers need, but lack access to, low-cost funds that will enable them to acquire inputs or perhaps even make use of new technologies.

Product Development, Challenges and Prospects: Industrial Coconut Products

Romulo R. Mesias

INTRODUCTION

The coconut industry is a giant in Philippine agriculture. Approximately 25 million Filipinos (or one-third of the population) depend on the industry for their livelihood while an estimated 3.1 million hectares or 27% of total agricultural land is planted to coconut. An annual average of 2.3 million metric tons (MT), in copra terms, was produced over the past 10 years. This is equivalent to PhP35 billion per year in output value and about US$800 million per year in export earnings. Despite this, however, the industry has remained a classic social irony, as the country's 3.5 million coconut farmers are still mired in abject poverty. This is happening even as foreign and domestic interest groups continue to make a milking cow of the industry.

The objective of this diagnostic study is to investigate the role of emerging industrial coconut products, such as shell charcoal and activated carbon, cochin oil, and coconut methyl ester (CME), in improving the life of poor coconut farmers in particular, and in promoting the growth of the coconut industry in general. Analysis will be made on how investments move within the industry. If there is timidity in the inflow of investments, what could be the cause? How can it be solved and who can solve it—the government, the private sector, or the farmers themselves?

DESCRIPTION OF PRODUCTS

Shell charcoal

Coconut shell is a by-product of the copra-making process. Although it has undergone development over the past five years as an export product, its potential as an industrial raw material has remained largely untapped and unrealized. This is despite the fact that the utilization rate of the available coconut shell supply has grown by 8%.

However, the market for coconut shell charcoal is expected to increase as the use of coconut shell activated carbon intensifies. Environmental degradation, air and water pollution specifically, has become such a serious problem in many industrialized countries. Given the environmental benefits from using coconut shell-activated carbon, this growing international concern for the environment offers bright prospects for coconut shell charcoal. The Philippines, as one of the top producers of coconut products, should take advantage of this golden opportunity by developing the local coconut charcoal industry to support the producers of shell activated carbon.

Coconut shell charcoal is metallic black in color. It is produced using any of the following methods: pit, drum, modified drum, or a charcoal-making machine. The first two methods produce low-quality charcoal while the last two produce premium-quality shell charcoal. The Filipino-invented charcoal-making machine, in particular, produces an extremely high-quality shell charcoal suitable for activated carbon production. The standards for shell charcoal are as follows:

Table 5.1 Specifications for different grade charcoal

	Metallurgical Grade A	Commercial Grade A	Commercial Grade B
Fixed Carbon	80% max.	75% max.	65% max.
Ash	3% max.	3% max.	3% max.
Moisture Volatile	10% max.	10% max.	10% max.
Combustible Matter	10% max.	10% max.	20% max.
Sieve Analysis	Not >5% shall pass a ¼-inch mesh sieve	Not >5% shall pass a ¼-inch mesh sieve	Not >5% shall pass a ¼-inch mesh sieve

Source: Philippine Coconut Authority.

Activated carbon

Activated carbon made from coconut shell is considered superior to those obtained from other sources mainly because of its small macropore structure. This structure makes it more effective in absorbing gas or vapor and in removing the color and odor of compounds.

Shell activated carbon is used in gas masks for military and industrial applications because of its ability to absorb certain poisonous gases. Another application is in the industrial recovery of vapors. Billions of pounds of such vapors with a value of several hundred million dollars are recovered yearly. Shell activated carbon can absorb practically any organic solvent at about 38°C and release it when heated to 177°C.

With regard to vapor recovery, a very important continuous process for close fractionation for light-hydrocabon recovery from gas streams has been developed. This hypersorption process uses a moving bed of activated shell charcoal, which has a high absorptive capacity and a more abrasion-resistant area than other carbons.

In the Philippines, the raw material for activated carbon is charcoal made from coconut shells (or shell charcoal). Activated carbon from shell charcoal has certain outstanding natural properties and for some specific purposes, it is superior to other amorphous carbons. It has greater resistance to abrasion, higher capacity for adsorption, and higher ash purity. Coco-based activated carbon is especially superior for gas adsorption due to its small macropore structure. It is classified as a high-priced activated carbon.

Cochin oil

Cochin oil is a clear crude coconut oil with free fatty acid content of less than 1% in terms of lauric acid. It is a very good raw material for edible/cooking oil, cosmetics (e.g., soap), industrial chemicals (e.g., free fatty alcohols and acids), and biodiesel or CME.

Cochin oil is produced as a main product or as a by-product in coconut processing. Raw materials are widely available, but nowadays, nobody in the Philippines produces cochin oil using the wet process due to the high cost of fuel. However, a technology has been developed in the Philippines that can provide the hot, clean air for drying the grated meat for free.

Cochin oil's main competitor is crude coconut oil from copra, which is usually dark in color, has high free fatty acid content as well as aflatoxin and carcinogenic nitrites. This oil may also come in a more expensive RDB (refined, deodorized, and bleached) version. Crude coconut oil (from copra), however, is not considered a strong threat because of its low quality.

Filchar Manufacturing Corp. has completed product development work on cochin oil, aided in part by the availability of free heat provided by a carbo-activator, which was invented by Engr. R. Mesias, this paper's author.

Coco methyl ester

Coco methyl ester (CME) or biodiesel is a product of a chemical reaction between coconut oil and methanol or ethyl alcohol. An acid or a base catalyzes this reaction through a chemical process known as transesterification.

Coco diesel, which is how biodiesel or CME is known on the global market, is being eyed to replace diesel when the earth's natural crude oil deposits are finally used up. But even as crude oil deposits have yet to be exhausted, CME has already become a primary raw material for various coco fatty acids and fatty alcohols. In the transportation industry, it is now being used as an additive to reduce emissions in diesel-powered vehicles. There are currently only five companies in the Philippines producing CME, making it an untapped resource and a potential export product if sufficient volumes can be produced.

The Philippines has an abundant supply of raw materials for CME. However, if parties interested in producing CME will source their crude oil from oil mills, they will have to compete with manufacturers of cooking oil. It is recommended that any party interested in venturing into the manufacture of CME produce their cochin oil directly from coconut.

CME applications include free fatty acids and fatty alcohols as well as an additive to, or a total substitute for, petroleum diesel. As an additive to petroleum diesel, CME reduces emissions and increases mileage per liter by 17%.

MANUFACTURING PROCESS

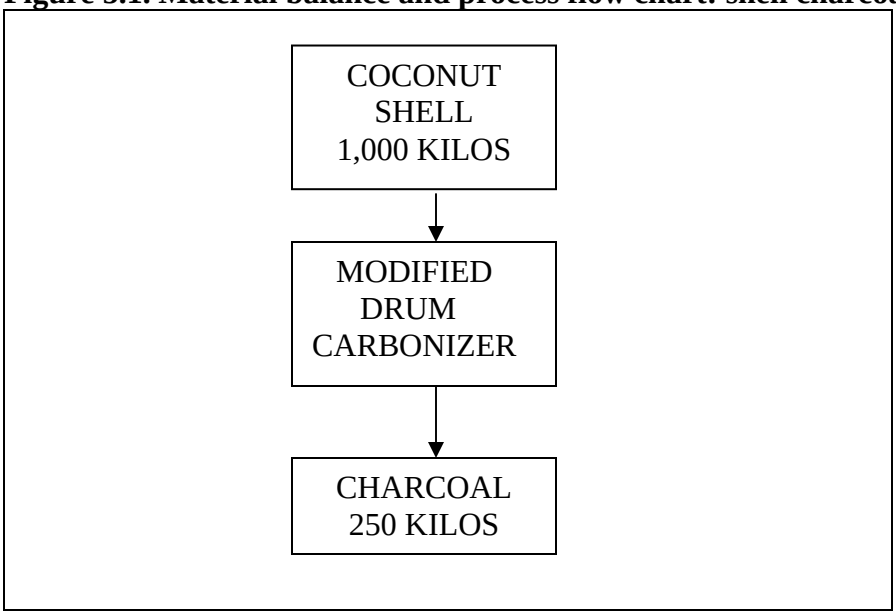
Coconut shell charcoal

Charcoal making in the past was very crude. In the pit method, makers bore holes into the ground in which they burned coconut shells. As the holes filled to the top with charcoal, these were covered with banana bark and then with wet jute bags after which they were covered with soil. The charcoal produced using this method is usually contaminated with soil.

The second method of making charcoal is the drum method where kerosene-soaked coconut husks are placed inside a drum and then burned. Coconut shell is gradually added until the drum is filled to the brim with charcoal. To contain the flame, the drum's opening is sealed in the same manner done in the pit method. Charcoal produced using this method has no contaminant, but the quality is uneven. The charcoal in the bottom portion of the drum is usually thin while that on the top portion is only half charred.

A third method, the modified drum method, produces clean, uniformly charred, and uniformly thick charcoal. The steps involved are as follows: (1) clean the inside of the drum; (2) place four to five pieces of kerosene-soaked coconut husks at the bottom of the drum; (3) burn the husks and place the coconut shells over them, taking care not to snuff out the flame; (4) as the shells burn, continue adding more shells until the drum is filled to the brim with charcoal; (5) when the flame goes out, sprinkle just enough water on top of the charcoal to douse the embers; (6) lay the drum on its side when the embers on top are doused and then sprinkle enough water on the newly exposed embers to douse these, too; (7) allow the charcoal cool and dry and then place it in 20- to 30-kilo bags; (8) store these bags in cool, dry place.

Figure 5.1. Material balance and process flow chart: shell charcoal



Source: Author

Activated carbon

Activated carbon is produced from shell charcoal made using the pit or drum method. The quality, therefore, of the finished activated carbon depends very much on the quality of the shell charcoal used. The charcoal is first ground and classified. The ground charcoal caught between the 4-gauge and 50-gauge mesh wire is placed in the activating kiln where it is heated to 900°C and then subjected to live steam.

In this process, the pores of the charcoal are increased when the naturally present hydrocarbon is removed. Heating the charcoal from room temperature to 900°C produces ash. To produce activated carbon that would meet the standard of 5% ash content, the activated carbon must first be washed with an acid and then with plain water to lower the ash content. The material is then ground classified using different gauge mesh wires after which it is packed in multiwalled paper bags.

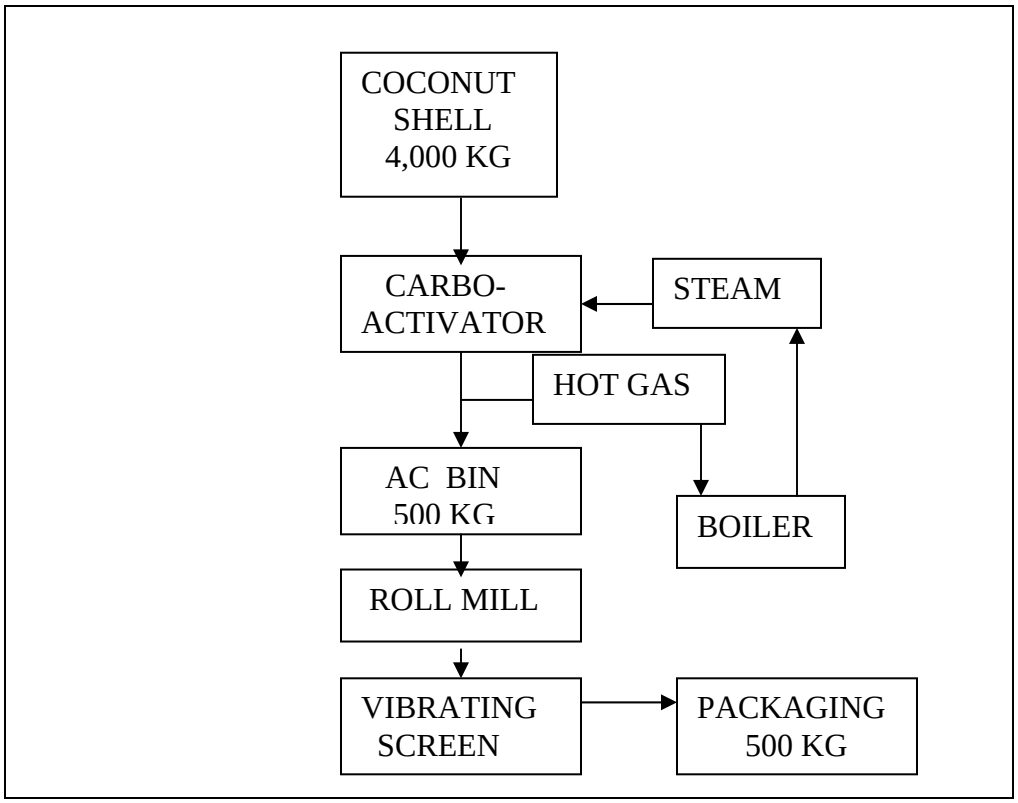
In this diagnostic study, a machine that will carbonize and then activate the coconut shell directly from the shell was introduced. This method offers many advantages. It produces activated carbon of uniform quality. It also protects the carbon against contamination with foreign substances like clay or sand. It results in very low ash content of 2% since the charcoal is not reheated to 900°C before activation. Finally, it produces its own superheated steam for activation using the combustible gases of the carbonization and activation processes.

Activation is a physical change where the surface of the carbon is tremendously increased by the removal of hydrocarbons from the carbon surface. Several methods can be used for this process. The most widely employed is the treatment of the carbonaceous material with oxidizing gases such as air, steam, or carbon dioxide. The oxidizing gas used in this study is superheated steam.

The vertical retort is first ignited on the top and coconut shell is placed on the feed chute. As the coconut shell burns, the whole bed moves down by gravity allowing combustible gases to exit and be ignited on peripheral burners. The red-hot coconut shell charcoal descends to the activation zone where it meets the superheated steam, starting the activation process. From this zone, the activated carbon goes down to the cooling zone and then to the screw discharge conveyor. From here, the activated carbon is fed to the roller mill that reduces its size. It then goes to the vibrating screen where it is classified into different mesh sizes. The classified activated carbon is packed in 25-kilo multiwalled paper bags. Alternatively, polypropylene (PP) bags with polyethylene (PE) liners can also be used. The final product is then stored for shipment.

While the technology for making activated carbon has not changed much over the years—charcoal is still the base material—it remains well guarded. The equipment used in the process is so expensive that only a select few can afford to set up processing plants. In this sense, technology is being used as a means of preserving cartel-like conditions in the coconut processing industry.

Figure 5.2. Process flow chart and material balance: activated carbon



Source: Author.

Table 5.2 Standard specifications for coco shell activated carbon

Characteristics	Low Density	High Density
Apparent density at room temperature (g/ml)	0.44-0.48	0.52-0.56
Hardness number (% minimum)	92	92
Iodine value (mg/g minimum)	1,200	700
Moisture (% maximum)	3	3
Ash (% maximum)	4	4
CCl4 (% minimum)	60	40
Benzene (% minimum)	36	23

Source: PCA Administrative Order No.03m series of 1981.

Cochin oil

There are three ways by which cochin oil can be produced from fresh, mature nuts: (1) as a main product of the hot air process; (2) as a by-product of the wet process; or (3) chemically from crude coconut oil.

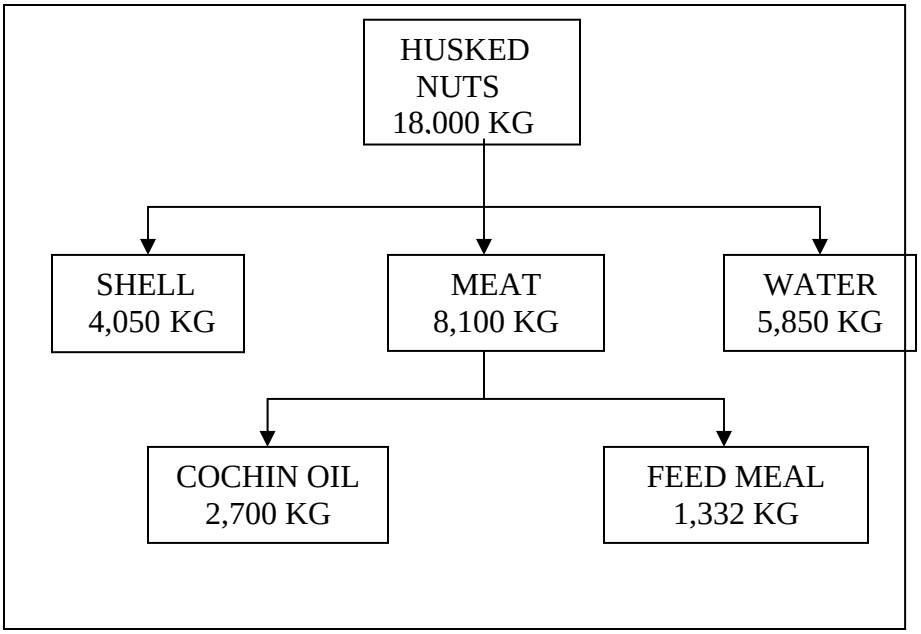
In the hot air process, the husked nuts are broken in halves after which the meat is separated from the shell by grating. The grated meat is fed to a hot-, clean-air dryer, which is typically a rotary dryer. The meat is dried to 6% moisture content and, while still hot, is ejected to the expeller where 60% to 62% of the oil is extracted from the dried meat. The oil then goes through a plate-and-frame filter press after which it is stored in a steel tank as cochin oil.

As a by-product of the wet process, cochin oil comes from the pulp from which the coconut milk has been pressed, as in the production of virgin coconut oil (VCO). The pulp, which still contains 30% oil, is dried in a rotary dryer to 6% ercent moisture content and then fed to the expeller while still hot to extract the cochin oil. The cochin oil is filtered in a plate-and-frame filter press and then stored.

The chemically made cochin oil comes from copra. The oil from copra is filtered and treated with sodium hydroxide to reduce the free fatty acid content. The quality of the cochin oil is ultimately dependent on the quality of the copra. Local and foreign manufacturers use this process.

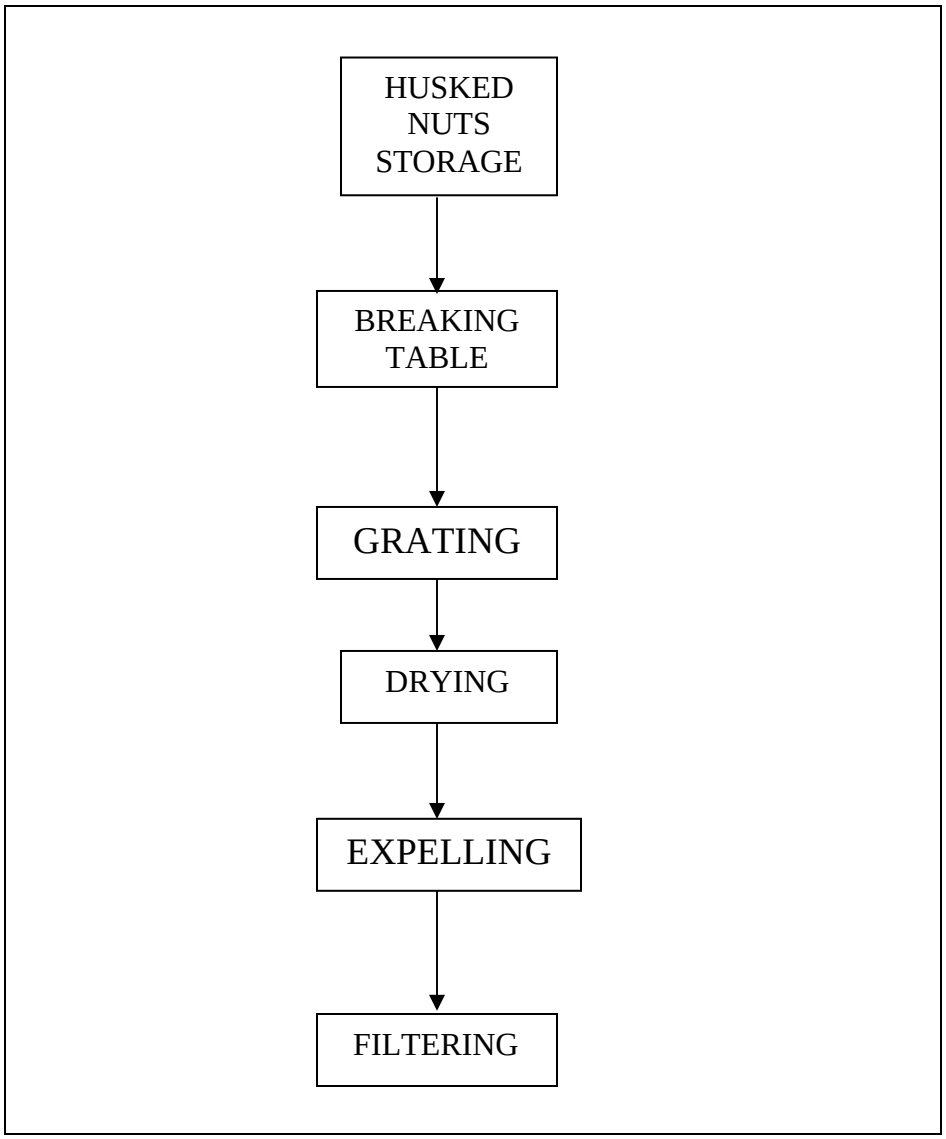
The hot-air and the wet processes will greatly change the quality of the cochin oil because of the use of fresh, mature nuts as raw material. The wet process will significantly affect the price of cochin oil because here, it is a by-product of VCO, which in itself is a high-value product.

Figure 5.3 Raw material and product balance: cochin oil



Source: Author.

Figure 5.4 Process flow chart: cochin oil



Source: Author.

The standard specifications for cochin oil are as follows:

Table 5.3 Standard specifications for cochin oil

Characteristics	Value
Free fatty acid, max. (lauric)	0.07%
Color, max.	1.0 R & 10.0Y

Source: Philippine Coconut Authority.

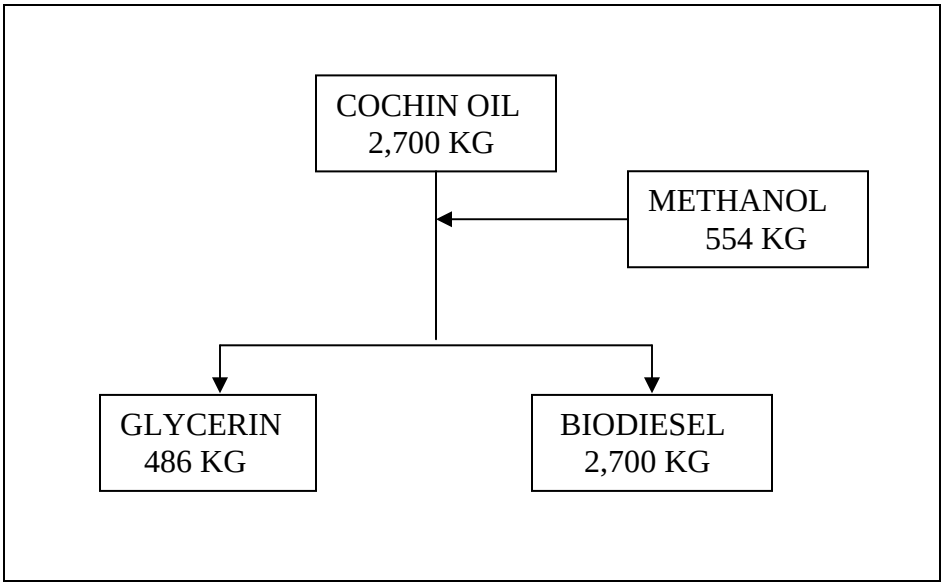
Coconut methyl ester (CME) or biodiesel

The production of CME or biodiesel involves a new process called transesterification, which is currently the only process used for making biodiesel.

Cochin oil or crude coconut oil is ejected to an ester reactor. The temperature of the oil in the reactor is raised to, and maintained at, 60°C. The alcohol and the catalyst are added to the oil at a rate that lets the alcohol react with the oil before it is stirred to the top. This reaction is usually completed within 2 to 3 hours of adding the alcohol.

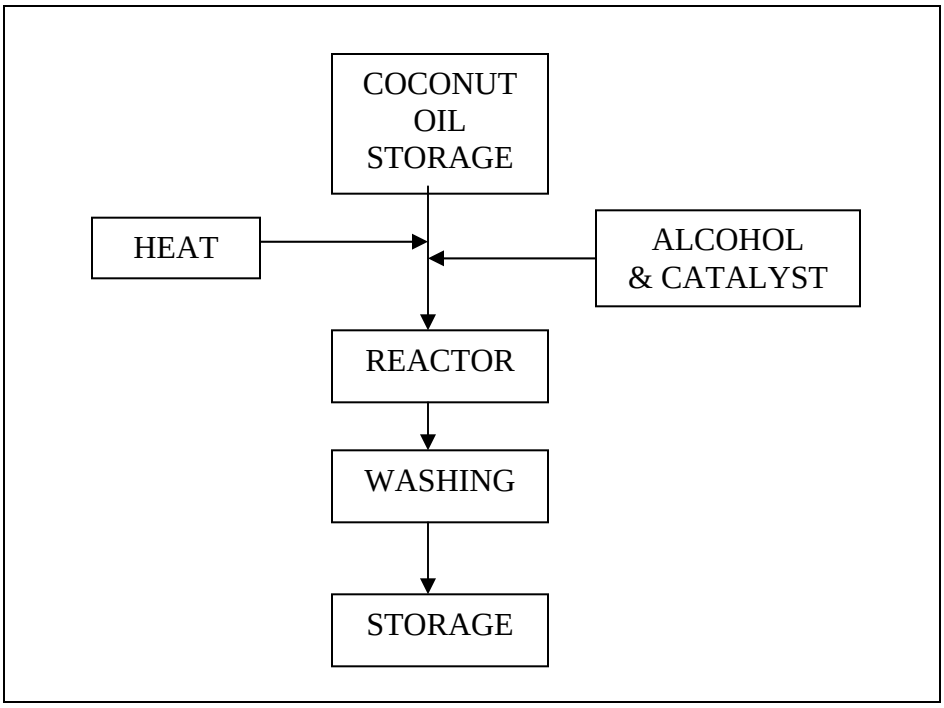
The mixture is cooled to room temperature and allowed to stand for three hours. After this, the crude glycerin is decanted and the biodiesel is washed with water and allowed to stand again for another two hours. At the end of two hours, the wash water is drained, and the biodiesel is discharged and stored. The glycerin is sold in crude form to refineries or resin manufacturers.

Figure 5.5 Material and product balance: CME or biodiesel



Source: Author.

Figure 5.6 Process flow chart: CME or biodiesel



Source: Author.

The local standard for CME is as follows:

Table 5.4. Philippine national standard for coconut methyl ester (chemical and physical requirements – PBS 2020 and DOE 002-2003)

Property	CME Limit
Flashpoint, Pensky Martens °C, min.	100
Water & sediments, %vol. max.	0.05
Kinematic viscocity at 40°C, mm^2/s	2.0-4.5
Sulfated ash, % mass max.	0.02
Sulfur at mass max.	0.05
Cooper strip corrosion, 3 hrs at 50°C, max	No.3
Cetane number, min.	42
Cloud point, °C, max	Report
Carbon residue, 100% sample, % mass, max.	0.05
Acid number, mg KOH/g, max.	0.5
Free glycerin, % mass, max	0.02
Total glycerin, % mass, max.	0.24
Phosphorus, % max, max	0.001
Distillation AET 90% recovered °C, max	360

Source: DOE's Technical Committee on Petroleum Products and Additives.

INDUSTRY PROFILE

Shell charcoal and activated carbon

From 1999 to 2003, the country exported an average volume of 22,000 MT of charcoal worth US$4.9 million. (Table 5.5). From 1994 to 2003, the average volume of charcoal exports was 30,000 MT with a value of US$7.2 million. The dollar values are on free-on-board (FOB) basis.

Table 5.5 Annual export performance of shell charcoal

Average	Volume (MT)	Value (FOB, US$)
1999-2003	22,000	4,875,000.00
1994-2003	30,000	7,184,000.00

Source: Philippine Coconut Authority.

Currently, only 8% of the country's available coconut shell supply is being used. The market for shell charcoal is expected to increase as the use of coconut- shell activated carbon increases. This increase is expected due to the problems industrialized countries are having with air and water pollution. The military has also developed new applications for coconut-shell activated carbon.

Production of activated carbon in the Philippines started in 1975 with an estimated capacity of 3,260 MT. Today, there are six with an aggregate annual capacity of 40,440 MT producing activated carbon in the Philippines. Of this amount, 77.5% is exported while the balance is (9,099 MT) used locally.

Table 5.6 shows selected Asian countries' world exports of coconut-shell activated carbon from 1999 to 2003. It is evident from the data that the Philippines is a top exporter of this product. The total average export volume for that five-year period was 78,380 MT. The Philippines exported (on average) US$7.2 million worth of activated carbon from 1994 to 2003.

Table 5.6 World exports of coconut-shell activated carbon by selected countries, in MT, Year 1999 -2003

Country	1999	2000	2001	2002	2003	Average
Philippines	32,344	31,344	29,585	30,833	32,620	31,345
Sri Lanka	14,380	16,201	15,591	18,038	16,000	16,042
Indonesia	11,283	10,205	12,104	11,553	12,409	11,511
Malaysia	11,889	12,784	14,433	19,893	18,861	15,572
Thailand	3,088	4,414	3,651	3,651	4,748	3,910

Source: *Coconut Statistical Yearbook*, Asia and Pacific Coconut Community.

As has been previously stated, demand for activated carbon is expected to grow in the coming years as environmental concerns worsen. Coconut-shell activated carbon has characteristics (e.g., small macropore structure) that make it an effective agent for absorbing gas/vapor and removing the color and odor of compounds.

Aside from military- and industrial-use gas masks, activated carbon's many applications include air filters, water purification, gas and solvent recovery, metal recovery, petroleum refining, and chemical bleaching.

The market for coconut-shell activated carbon is growing at a healthy rate of 11% to12% per year with the following industries as end users: sugar, gas masks, potable water, gas/vapor recovery, petroleum, and pharmaceutical.

Gas absorption companies are by far the biggest users of granular activated carbon with 40% of world output going to them. Water treatment companies absorb 30% of output; industrial chemical companies, 11%; solvent recovery companies, 4%; and other industries, 15%.

Cochin oil and biodiesel

Data from the Philippine Coconut Authority (PCA) show that the Philippines has 46 oil refineries with a total rated capacity of 1,593,000 MT per year. In contrast, the UCAP industry kit data indicate that there are 48 oil refineries with a rated capacity of 1,603,200 MT per year. Industry export figures are not very specific and are mostly expressed in copra or CNO (crude coconut oil terms).

The market for cochin oil consists primarily of manufacturers of cooking oil who further refine, bleach, and deodorize the oil to fit the specifications of edible cooking oil. The other users are the oleochemical industries that produce fatty acids and fatty alcohols as well as the cosmetic, soap, detergent, resin, plasticizer, and fuel industries.

In 2004, the Philippines exported 1,774,000 MT of cochin oil in copra terms while local consumption reached 444,000 MT in copra terms. The Philippines' coconut oil (CNO) export is equivalent to 64% of world coconut oil production.

Data obtained from the Department of Energy (DOE) show that in 2004, the country's demand for diesel reached 5.4 billion liters a year. This demand shows no signs of weakening. With world oil prices fluctuating in response to conflict in the Middle East and other geopolitical concerns, it becomes even more important to explore alternatives to petroleum.

For the Philippines, CME is one such alternative. Various and independent tests conducted by the US Department of Energy's National Renewable Energy Laboratory (NREL) have consistently shown that CME performs as well diesel, but with less emissions

and with increased fuel combustion. The latter translates to approximately 17% more mileage.

If the Philippines is to seriously develop CME as an alternative fuel source, it would have to produce 4.86 billion liters of CME yearly. Right now, CME is being used as the main raw material for fatty acids and fatty alcohols. The glycerin by-product is used in the manufacture of alkyd resins and other resins for the paint industry.

A bill mandating the blending of CME with all diesel engine fuels sold in the country is pending in the legislative branch. The initial volume required for blending is 1%. Within two years of the law's effectivity, the required volume blended will be raised to 2%. At 2%, the Philippines will need 140,000 MT of CME each year (Table 5.7). This output is expected to be absorbed by the different refineries of petroleum diesel and transport cooperatives acting on behalf of their members.

The bigger market for CME, however, is still overseas. Potential markets include Europe where the legal requirement for blending is between 10 and 15%; Japan, 2%; seven states in the United States, 1% to 2%; Korea, 2%; Thailand, 2%; and Malaysia, 1%.

Table 5.7. Philippine CME annual demand at different rates of incorporation

Percent requirement	CME Annual Demand	in '000 Metric Tons
1%	0.070 Billion liters	70,000 MT
2%	0.140 Billion liters	140,000 MT
3%	0.210 Billion liters	210,000 MT
4%	0.280 Billion liters	280,000 MT
5%	0.350 Billion liters	350,000 MT

Source: Department of Energy.

Current local production of CME, according to DOE estimates, is at least 50 million liters every year. More than half of this amount is produced by DOE-authorized private enterprises. PCA records show that the list of CME manufacturers includes Senbel Fine Chemical Company, D&L/Chemrez Industries Incorporated, RI Chemical Corporation, and Pilipinas Kao, Incorporated. The PCA, however, has no data on the actual plant capacities of these manufacturers.

INVESTMENT OUTLOOK

To demonstrate the investment potential of the four emerging coconut products, this diagnostic study prepared technical and financial feasibilities for each product (Appendices 5.1 to 5.4).

For charcoal production, 100 modules of the proposed system will cost around P500,000 or only P5,000 per module. Of the total investment, a hefty net profit of P2.8 million per year can be expected from 100 modules, with a payback period of less than 2 years only.

Meanwhile, one module of the proposed activated carbon plant, which will have a capacity of 4 MT shell charcoal per day, will require a capital investment of P7 million. Analysis, however, shows that it will be a profitable venture. Net profit after taxes will be P1.7 million per year and the business will achieve its breakeven point in less than 4 years.

For cochin oil, the proposed processing model amounting to P3.6 million will earn a net profit of P2.2 million per year, with a payback period of only a little more than 1 year.

Profitable returns from biodiesel production can be expected by local producers as the feasibility study shows. With an investment of P2.8 million for two modules, a net profit of 8.3 million per year can be expected, with payback period of less than two years.

VALUE CHAIN ANALYSIS

Coconut shell charcoal and activated carbon

Internal environment analysis

Strengths

1. **Research, Development and Extension (RD&E)**

- Both the government and private sector have proactively carried out some RD&E initiatives in the areas of coconut-shell charcoal and shell activated carbon. For example, the PCA has used the Roque Carbonizer in Alaminos, Laguna for R&D work on coconut-shell charcoal.

  Filchar Manufacturing Corporation, a private company, has developed a new technology for coconut-shell charcoal production and is now ready to disseminate said technology, which is based on a patented carbonizing machine that burns the carbonization gases. It has also developed and patented a machine that can be used to manufacture activated carbon using coconut shell as raw material.

  The Pacific Activated Carbon Corporation is currently improving some of its processes for the production of activated carbon.

2. **Product Development**

- Quality is one of the most important factors to become globally successful. The new technologies that have been developed, such as those by Filchar, will enable local manufacturers to produce premium-quality charcoal and activated carbon at lower cost.

- Private sector steps in to do product-development activities since the government sector is unable to due to the high cost of equipment.

3. Manufacturing and Processing

- New manufacturing and processing technologies and equipment that will produce high-quality products at low cost are available.

- There is an abundance of raw materials, which will keep the industry competitive for the next 5 to 10 years. The Philippines produces an excess of 1,685,436 MT of coconut shell every year and is currently using only 8% of the available supply coconut shells. This also precludes keen competition from breaking out among local manufacturers because there is enough raw materials for everyone.

- The industry does not need to import capital goods and inputs because everything is locally available.

- The labor force and technical expertise needed to compete internationally are available locally.

4. Logistics, Transport and Distribution

- The industry has access to logistics, storage, transport, and distribution services and facilities, and more companies that will cater to these needs are being formed.

5. Sales and Marketing

- Market demand for coconut-shell charcoal is big. Local activated carbon plants have established buying stations just to fill their requirements.

- High-quality and lower cost will boost manufacturers' chances in the domestic and export markets.

Weaknesses

1. Research, Development and Extension (RD&E)

- The budget for coconut-production and -processing technologies is low, which, in turn, limits support for RD&E.

- There is also limited private-sector funding for RD&E.

- PCA is not involved in perfecting new technology.

2. **Product Development**

- Both the government and private sectors have limited funds for product development. The private sector is also generally cautious about funding product development initiatives.

3. **Manufacturing and Processing**

- There is a lack of farm-to-market roads.
- Farmers do not have access to low-cost funds.
- Fly-by-night producers produce charcoal contaminated with sand and trash.
- The cost of capital investment is high.
- Raw materials may decrease due to the cutting down of trees and the absence of replanting initiatives.
- Traders inflate the cost of coconut shells.

4. **Logistics, Transport and Distribution**

- High cost of fuel affects transportation and distribution costs.
- EVAT will further increase product cost.
- There are few distribution channels.
- Farm-to-market roads are limited.

5. **Sales and Marketing**

- High cost of sales and marketing
- Marketing and related costs are expected to further increase.
- Some producers have questionable reputation.
- There is limited promotion for activated carbon.

External environment analysis

Opportunities

1. **Manufacturing and Processing**
   - More charcoal plants can be set up to use the excess 1,685,436 MT of coconut shells.
   - There are new technologies and processes that are locally available for manufacturers to use. These technologies and processes can make products competitive in terms of price and quality.
   - The industry can encourage upstream processing of coir fiber and geotextiles and downstream integration for cochin oil production and then biodiesel.
   - For small enterprises, the downstream integration is copra, coir, geotextiles, and coco peat drying. For medium-scale enterprises, the upstream integration is activated-carbon production.
2. **Sales and Marketing**
   - The market for activated carbon is expected to grow bigger because of air and water pollution.

Threats

1. **Manufacturing and Processing**
   - Competition from low-cost charcoal and coal
   - Development of synthetic materials as substitute
   - Substitution with substandard materials
   - Copying of our new technology by other coconut-growing countries

<u>Cochin oil and biodiesel</u>

Internal environment analysis

Strengths

1. **Research, Development and Extension (RD&E)**
   - Concerned government bodies have taken steps to support, standardize, and systematize oversight of the industry. For example, the DOE is now in charge of

certifying the quality of CME. The PCA has established standards for monitoring product quality and has written specifications for cochin oil.

The PCA and PNOC made an RD&E initiative on CME as a diesel additive. In May 2001, the PCA-DA launched the Biodiesel Development Project with the issuance of DA Special Order no. 176, series of 2001. PCA set up a coconut biodiesel pump station at its Quezon City compound to promote the use of coconut biodiesel as well as conduct scientific validation testing and various R&D activities. The emissions of 15 PCA vehicles filled with 1% CME blend were tested and found to have been reduced by about 15%.

R&D results on CME thru the initiatives of PCA and the Philippine National Oil Company (PNOC) are to be implemented to support the Clean Air Act. Petroleum companies are waiting for the approval by Congress of the legislation requiring the addition of CME to all petroleum diesel products sold in the country.

- Private companies are also doing their own R&D on cochin oil.

2. Product Development

- The cosmetics industry is now using high-quality cochin oil for its products.

- New technologies developed by local inventors assure manufacturers of high-quality products and low processing costs as these technologies do not require the use of expensive chemical inputs and no royalties need be paid to foreigners for their use or purchase.

3. Manufacturing and Processing

- New and locally fabricated technology (machinery + processes) as well as raw materials and other capital goods and inputs are widely available. Fresh, mature coconuts are all over the country eliminating the need to import anything. The use of new technologies would also reduce production costs because these were designed to make use of by-products traditionally considered as waste to provide fuel for the operation.

- By using new technologies, smaller plants can be set up in the countryside to generate employment there. Farmers will be able to run these smaller plants.

- The labor force and technical expertise needed to become internationally competitive are available locally.

4. Logistics, Transport and Distribution

- Oil mills' handling facilities and storage tanks for CNO can be used.

- The various oil companies have their own storage, handling, and transportation facilities, which are distributed nationwide. With support from these facilities, CME can be produced all over the country since it requires smaller production facilities.

- The Roll-On-Roll-Off (RORO) land and sea transportation network will facilitate the transportation and distribution of raw materials and finished products. Cochin oil, for instance, can be transported using RORO facilities.

5. Sales and Marketing

- The existence of product standards will facilitate the selling of the product since substandard materials can easily be identified and rejected.

- The high quality of cochin oil will eventually increase demand. Cochin oil is an ideal and versatile input to other products. It can also be sold at a price lower than RBD oils' price.

- As the international community works to clean up and repair damage to the environment from pollution and other destructive activities and practices, demand for CME is projected to increase locally and globally. The high cost of fuel is also expected to boost demand as more people switch to petroleum diesel.

Weaknesses

1. Research, Development and Extension (RD&E)

- Research on coconut technologies is dependent on public funds. Unfortunately, research and development (R&D) is a very expensive and uncertain venture. Hence, there are very few private companies willing to fund R&D.

- The government has a limited budget for coconut production and processing technology. The PCA has a grandiose plan for coconut tree planting but the government has no funds.

2. **Product Development**

- There is very little research on product development due limited funds. Without funds, no product development is possible. And without product development, no country can go global.

3. **Manufacturing and Processing**

- Traders inflate the prices of nuts. Coconut traders control the trading process and can manipulate prices to their advantage.

- The cost of fuel is high. In manufacturing and processing operations, fuel is a very important raw material. It is used to run machines, dry materials, and provide light. If the cost of fuel is high, it will greatly affect the cost of the end product.

4. **Logistics, Transport and Distribution**

- The value-added tax and higher fuel costs will increase transportation and distribution costs. This situation is similar to the effect of high fuel costs on manufacturing and processing operations. The vehicles used in transporting the goods use the high-priced fuel and therefore will charge higher freight cost.

- There are limited logistics, transport, and distribution facilities.

- There are very limited farm-to-market roads; most of time, there is none at all.

5. **Sales and Marketing**

- Limited promotion of cochin oil

- Competition from other substandard oils

- Low budget for the promotion of CME

- Lack of trained sales and marketing personnel

Opportunities

- The production of cochin oil will create a distinct product for use of cooking-oil refineries, the oleochemical industries, and the biodiesel industry.

- The production of cochin oil using the fresh nut process will produce high-quality crude coconut oil without aflatoxin and carcinogenic nitrites. Flour and feed meal are other by-products that can command a higher price because of the absence of aflatoxin and nitrites.

- The production of CME will help further diversify the coconut and improve its competitiveness. Because of the different by-products CME produces, the cost of producing of CME is reduced. Instead of having CME carry all the costs, the latter is distributed among the by-products and CME.

- Crude glycerin, which is a by-product of CME manufacture, will open new product lines for the coconut industry. In raw form, glycerin can be used as raw material for resins. In its refined form, it is used in the manufacture of cosmetics, cigarettes, explosives, and many other products.

Threats

- Raw materials supply may decrease due to the cutting of coconut trees and lack of budget for tree planting. Coconut plantations are also subject to land reform. This fact may have something to do with the rampant tree cutting.

- Competition from substandard and cheap oils

- A new and cheaper raw material may be discovered. Biotechnology may further increase the yield of this new material.

CONCLUSIONS AND RECOMMENDATIONS

This paper discussed four emerging industrial coconut products, namely: coconut-shell charcoal, activated carbon, cochin oil, and CME.

While the present structure of the industry is still focused on traditional products such as copra and coconut oil, the four products cited above have shown promise not only as export products but also as valuable inputs or end products for local market. A common thread running through all four is the fact that they can be used in the effort to arrest environmental degradation, especially air and water pollution.

The Philippines is already a top exporter of coconut-shell activated carbon. As for shell charcoal, cochin oil and CME, their market potential remains strong given their increasing popularity as environment-friendly alternatives to polluting synthetic materials.

Based on this diagnostic study's analysis of the four products' applications and potentials as well as the industry's value chain, the industry has a number of positive factors

going for it such as the availability of, and access to, abundant raw materials; new technology; technical expertise; and a more-than-adequate labor pool.

The raw materials needed to produce these emerging products are coconut shells, of which the Philippines has an excess of 1,685,436 MT lying around unused. In fact, estimates peg the industry's utilization rate of coconut shells at only 8%, so the potential of the coconut shell as an industrial raw material has remained mostly untapped and unrealized.

New technologies or equipment that will allow manufacturers to produce premium-quality activated carbon and shell charcoal at lower cost are already available and simply waiting for producers to try them out so they can see for themselves the touted benefits.

Among these benefits are the facts that these technologies use abundant and locally available raw materials; that they use by-products as inputs to the process, further reducing production costs; and that they are locally made thereby eliminating the need to import capital goods or pay royalties to foreign entities.

Another possible benefit to using these new technologies is that they lend themselves well to the setting up of smaller processing plants that farmers can easily operate. If such plants are established in the provinces, these can generate much-needed employment and perhaps help reduce migration to congested urban areas.

Of manpower and technical expertise, the industry also has enough to enable it to compete globally. What the industry lacks, though, and what it desperately needs, is funding. Funding is needed for R&D and product development; for the promotion of these products in local and foreign markets; for the improvement of farm-to-market roads as well as storage and transportation facilities. Farmers need, but lack access to, low-cost funds that will enable them to acquire inputs or perhaps even make use of new technologies.

The high cost of fuel is another serious problem. Fuel is a critical input to the manufacturing process. Therefore, high fuel costs raise production costs and ultimately, the final price of the product.

This study recommends the following courses of action:

1. The government must make available to coconut farmers, through its lending institutions, a soft loan facility with low interest rates. The poor coconut farmers have no source of capital. Thus, they cannot use even the low-capital project modules, which this study recommends. The coconut farmers need the government's help so that they can participate in the production of the emerging products of the coconut industry.

2. The government must build the needed farm-to-market roads so that supplies can reach the farms and finished products can reach the market.

3. The government must give a mandate to the PCA to establish the needed product standards and become a one-stop clearinghouse for all coconut products. The PCA must consolidate all the product standards and be the enforcing body. It is confusing for coconut producers to have multiple enforcing agencies. The way the situation stands right now, there are so many government agencies that would like to have a say in the quality and quantity of the coconut products.

4. The farmers' cooperatives sell their products by themselves. Thus, they become easy prey to seasoned buyers' groups (mostly from abroad) when it comes to pricing their products and other terms of the transaction. The private sector involved in this industry must therefore form a national marketing organization that will allow coconut farmers to market their products and avoid another "nata de coco" fiasco.

5. The PCA must insist on getting their budget for coconut-tree planting and R&D. Without this budget, the coconut industry might one day find itself short of raw materials it needs to produce new products from the coconut.

Appendix 5.1

FINANCIAL PREFEASIBILITY STUDY: COCONUT SHELL CHARCOAL

I. Assumptions

- Basic Data

Basic Data	Quantity
Charcoal/MT Shell	250 kilos

- System Data

System Data	Quantity
Total Capacity/System	25 kilos
Number of Module/System	100
Days/cycle	1
Number of modified drum	100

- Production Data

Production Data	Quantity
Charcoal	2500 kilos

- Operational Data

Operational Data	Quantity
Number of shifts	1
Working days/month	25
Months/year	12

- Interest rate

Interest rate	10%
Grace period	0
Loan term, year	10

II. Prices

Charcoal	12.00/kilo
Shell	1.00/kilo
PP-Bag	10.00/pc.

III. Capital Investment

	Size	Cost	Amount
1. Land	500 sq. m.	P200/sqm.	100,000.00
2. Building	100 sq. m.	P1,000/sqm.	100,000.00
3. Site Development			50,000.00
4. Office equipment			100,000.00
5. Pre-operating expense			15,000.00
6. Machineries & Equipment			
1 platform scale			30,000.00
100 Modified Drums			100,000.00
10 shovel			2,000.00
1 water pump			2,000.00
50 meter hose with nozzle			1,000.00
Total			135,000.00
Total Capital Investment			500,000.00

7. Financing		
Owner	30%	150,000.00
Loan	70%	350,000.00

IV. Manufacturing Cost

Raw Materials:				
Shell (10% allowance)				3,300,000.00
PP-Bag				30,000.00
Direct Labor	Quantity	Per day	Working days/year	Total
Operator	10	200.00	300	600,000.00
Helper	2	150.00	300	90,000.00
Factory Overhead				
SSS, Medicare, 13th month				126,500.00
Depreciation				
Factory	10 years			10,000.00
Equipment				55,200.00
Repair and Maintenance				6,750.00

Total Manufacturing Cost	4,218,450.00

V. Cost of Goods Sold

Total manufacturing Cost	4,218,450.00
Add: finished goods inventory beginning 7 days	-
Less: finished goods inventory end 7days	98,431.00
Total Cost of Goods Sold	4,120,019.00

VI. Selling and Administrative Expenses

Salaries and wages:	Per month	Total
Manager	20,000.00	240,000.00
Cashier/clerk	10,000.00	120,000.00
Accountant	15,000.00	180,000.00
SSS, Medicare 13th month		99,000.00
Depreciation (office equipment)		10,000.00
Financial charges:		
Principal payment	35,000.00	
Interest payment	35,000.00	70,000.00
Total Operating Cost		**719,000.00**

VII. Projected Sales

	Volume, kg	Value, peso
Charcoal	750,000	9,000,000.00

VIII. Projected Income Statement

Sales	9,000,000.00
Less: cost of goods sold	4,120,019.00
Gross profit	4,879,981.00
Less: operating expenses	649,000.00
Profit before financial charges	4,230,981.00
Less: financial charges	70,000.00
Profit before taxes	4,160,981.00
Less: provision for income tax	1,331,513.92
Net Profit	2,829,467.08

IX. Profitability Analyses

Return On Investment (ROI)	707.4%
Payback Period (months)	1.7

Appendix 5.2

TECHINICAL AND FINANCIAL PREFEASIBILITY STUDY: ACTIVATED CARBON

I. Assumptions

- Basic Data

Basic Data	Quantity
Activated Carbon/MT of Shell	130 kilos

- System Data

System Data	Quantity
Total Capacity/System	4 MT Shell
Number of Module/System	1
Days/cycle	1
Number of Carbo-Activator	1

- Production Data

Production Data	Quantity
Activated Carbon	500 kilos

- Operational Data

Operational Data	Quantity
Number of shifts	3
Working days/month	25
Months/year	12

- Interest rate

Interest rate	10%
Grace period	0
Loan term, year	10

II. Prices

Coconut Shell	1.00/kilo
Activated Carbon	60.00/kilo

III. Capital Investment

	Size	Cost	Amount
1. Land	2,000 sqm.	P200/sqm.	400,000.00
2. Building	500 sqm.	P2,000/sqm.	1,000,000.00
3. Site Development			200,000.00
4. Office equipment			500,000.00
5. Pre-operating expense			38,500.00
6. Machineries & Equipment			
1 platform scale			30,000.00
1 production bin			100,000.00
1 boiler			1,000,000.00
1 carbo-activator			3,000,000.00
1 roll mill			300,000.00
1 vibrating screen			200,000.00
Total			4,630,000.00
7. 5% installation cost			231,500.00
Total Capital Investment			7,000,000.00

8. Financing		
Owner	30%	2,100,000.00
Loan	70%	4,900,000.00

IV. Manufacturing Cost

Raw Material: Coconut Shell				1,200,000.00
Direct Labor	QTY	Per day	Working days/year	Total
Operator	4	300.00	300	360,000.00
Helper	8	200.00	300	480,000.00
Utility Man	2	150.00	300	90,000.00
Warehouseman	1	350.00	300	105,000.00
Quality Control	1	350.00	300	105,000.00
Factory Overhead				
SSS, Medicare, 13th month				209,000.00
Power				1,879,164.00
Depreciation				
Factory	20 years			50,000.00

Machinery	10 years		463,000.00
Repair and Maintenance			281,500.00
Total Manufacturing Cost			5,222,664.00

V. Cost of Goods Sold

Total manufacturing Cost	5,222,664.00
Add: finished goods inventory beginning 7 days	-
Less: finished goods inventory end 7days	121,862.00
Total Cost of Goods Sold	5,100,802.00

VI. Selling and Administrative Expenses

Salaries and wages:	Per month	Total
Gen. Manager	20,000.00	240,000.00
Cashier/clerk	10,000.00	120,000.00
Accountant	15,000.00	180,000.00
SSS, Medicare 13th month		99,000.00
Depreciation (office equipment)		50,000.00
Financial charges:		
Principal payment	490,000.00	
Interest payment	490,000.00	980,000.00
Total Operating Cost		1,669,000.00

VII. Projected Sales

	Volume, kg	Value, peso
Activated Carbon	156,000	9,360,000.00

VIII. Projected Income Statement

Sales	9,360,000.00
Less: cost of goods sold	5,100,802.00
Gross profit	4,259,198.00
Less: operating expenses	689,000.00
Profit before financial charges	3,570,198.00
Less: financial charges	980,000.00
Profit before taxes	2,590,198.00
Less: provision for income tax	882,863.00
Net Profit	**1,707,335.00**

IX. Profitability Analyses

Return On Investment (ROI)	26.02%
Payback Period (years)	3.84

Appendix 5.3

TECHNICAL AND FINANCIAL PREFEASIBILITY STUDY: COCHIN OIL

I. Assumptions

- Basic data

Basic Data	Quantity
Cochin Oil/MT Husked Nuts	150 kilos
Feed Meal/MT Husked Nuts	74 kilos
Wt. Shell/MT Husked Nuts	225 kilos

- System Data

System Data	Quantity
Total Capacity/System	18 MTD Husked Nuts
Number of Module/System	1
Days/cycle	1
Number of 1.5 MT Expellers/Day	1

- Production Data

Production Data	Quantity
Dried Meat	4.5MTD
Cochin Oil	2.7MTD
Feed Meal	1.8MTD
Shell	4.0MTD

- Operational Data

Operational Data	Quantity
Number of shifts	3
Working days/month	25
Months/year	12

- Interest rate 10%

Interest rate	18%
Grace period, year	0
Loan term, year	10

II. Prices

Dehusked nut	4.00/kg
Cochin oil	35.00/kg
Feed Meal	7.00/kg
Shell	1.00/kg

III. Capital Investment

	Size	Cost	Amount
1. Land	2,000 sqm.	P200/sqm.	400,000.00
2. Building	1,000 sqm.	P1,000/sqm.	1,000,000.00
3. Site Development			200,000.00
4. Office equipment			100,000.00
5. Pre-operating expense			81,400.00
6. Machineries & Equipment			
1 platform scale			30,000.00
2 breaking table			2,000.00
5 graters			100,000.00
1 dryer			1,000,000.00
1 expeller			500,000.00
filter press			100,000.00
Total			1,732,000.00
7. 5% installation cost			86,600.00
Total Capital Investment		3,600,000.00	3,600,000.00

8. Financing		
Owner	30%	1,080,000.00
Loan	70%	2,520,000.00

V. Manufacturing Cost

Raw Materials: Nuts (10% Allowance)	23,760,000.00

Direct Labor	Quantity	Per day	Working days/year	Total
Operators	15	150.00	300	675,000.00
Helpers	30	120.00	300	1,080,000.00
Utility Men	3	150.00	300	135,000.00
Foreman	3	250.00	300	225,000.00
Warehouseman	3	200.00	300	180,000.00

Factory Overhead	
SSS, Medicare, 13th month	420,750.00
Power	2,232,832.00
Depreciation	
Factory	50,000.00
Machinery	173,200.00
Repair and Maintenance	86,600.00

Total Manufacturing Cost	29,018,382.00

VI. Cost of Good Sold

Total manufacturing Cost	29,018,382.00
Add: finished goods inventory beginning 7 days	-
Less: finished goods inventory end 7days	694,400.00
Total Cost of Goods Sold	28,323,982.00

VI. Selling and Administrative Expenses

Salaries and wages:	Per month	Total
Gen. Manager	20,000.00	240,000.00
Cashier/clerk	10,000.00	120,000.00
Accountant	15,000.00	180,000.00
SSS, Medicare 13th month	99,000.00	99,000.00
Depreciation (office equipment)	10,000.00	10,000.00
Financial charges:		
Principal payment	252,000.00	
Interest payment	252,000.00	504,000.00
Repair and maintenance	5,000.00	5,000.00
Total Operating Cost		1,158,000.00

VII. Projected Sales

	Volume, kg	Value, peso
Cochin Oil	810,000	28,350,000.00
Feed Meal	399,600	2,797,200.00
Shell	1,215,000	1,215,000.00
Total Sales		32,362,200.00

VIII. Projected Income Statement

Sales	32,362,200.00
Less: cost of goods sold	28,323,982.00
Gross profit	4,038,218.00
Less: operating expenses	654,000.00
Profit before financial charges	3,384,218.00
Less: financial charges	504,000.00
Profit before taxes	2,880,218.00
Less: provision for income tax	684,352.00
Net Profit	2,195,866.00

IX. Profitability Analyses

Return On Investment (ROI)	68.62%
Payback Period (years)	1.46

Appendix 5.4

TECHNICAL AND FINANCIAL PREFISIBILITY STUDY: CME

I. Assumptions

- Basic Data

Basic Data	Quantity
Bio-diesel/MT Cochin Oil	1000 kilos
Crude Glycerin/MT Cochin Oil	180 kilos

- System Data

System Data	Quantity
Total Capacity/System	1.35MT Cochin Oil
Number of Module/System	2
Days/cycle	1
Number of Reactor/Day	2

- Production Data

Production Data	Quantity
Bio-diesel	2.7MT
Crude Glycerin	486 kilos

- Operational Data

Operational Data	Quantity
Number of shifts	1
Working days/month	25
Months/year	12

- Interest

Interest rate	10%
Grace period, year	0
Loan term, year	10

II. Prices

Cochin oil	35.00/kg
Methyl Alcohol	32.00/kg
Sodium Hydroxide Liquid	10.00/kg
Biodiesel	60.00/kg
Crude Glycerin	30.00/kg
Steel drums	500.00/pc

III. Capital Investment

	Size	Cost	Amount
1. Land	1,000 sqm.	P200/sqm.	200,000.00
2. Building	500 sqm.	P1,000/sqm.	500,000.00
3. Site Development			100,000.00
4. Office equipment			100,000.00
5. Pre-operating expense			83,500.00
6. Machineries & Equipment			
1 platform scale			30,000.00
2 storage tank			1,000,000.00
2 reactor			500,000.00
2 thermal heater			200,000.00
Total			1,730,000.00
7. 5% installation cost			86,500.00
Total Capital Investment			2,800,000.00

8. Financing		
Owner	30%	840,000.00
Loan	70%	1,960,000.00

IV. Manufacturing Cost

Raw Materials:				
Cochin Oil (10.0% allowance)				31,185,000.00
Caustic Soda, liq. (10% allowance)				46,200.00
Methanol (10% allowance)				5,702,400.00
Steel drums				2,732,586.00

Direct Labor	Quantity	Per day	Working days/year	Total
Reactor Operator	2	300.00	300	180,000.00
Utility Man	1	150.00	300	45,000.00
Warehouseman	1	200.00	300	60,000.00
Foreman	1	250.00	300	75,000.00

Factory Overhead			
SSS, Medicare, 13th month			66,000.00
Power & Water			214,776.00
Depreciation			
Factory	20 years		25,000.00
Machinery	10 years		181,650.00
Repair and Maintenance			111,500.00

Total Manufacturing Cost	40,625,112.00

V. Cost of Goods Sold

Total manufacturing Cost	40,625,112.00
Add: finished goods inventory beginning 7 days	-
Less: finished goods inventory end 7days	947,919.00
Total Cost of Goods Sold	39,677,193.00

VI. Selling and Administrative Expenses

Salaries and wages:	per month	**Total**
Gen. Manager	20,000.00	240,000.00
Cashier/clerk	10,000.00	120,000.00
Accountant	15,000.00	180,000.00
SSS, Medicare 13th month		99,000.00
Depreciation (office equipment)		10,000.00
Financial charges:		
Principal payment	196,000.00	
Interest payment	196,000.00	392,000.00
Repair and maintenance		-
Total Operating Expense		1,041,000.00

VII. Projected Sales

	Volume, kg	**Value, peso**
Bio-diesel	810,000	48,600,000.00
Crude Glycerin	145,800	4,374,000.00
Total Sales		52,974,000.00

VIII. Projected Income Statement

Sales	52,974,000.00
Less: cost of goods sold	39,677,193.00
Gross profit	13,296,807.00
Less: operating expenses	649,000.00
Profit before financial charges	12,647,807.00
Less: financial charges	392,200.00
Profit before taxes	12,255,607.00
Less: provision for income tax	3,921,794.00
Net Profit	8,333,813.00

IX. Profitability Analyses

Return On Investment (ROI)	320.50%
Payback Period	3.74 months

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CHAPTER 6

Product Development, Challenges and Prospects: Agro-Industrial Coconut Products

Ildefonso A. Tallada

ABSTRACT

This chapter focuses on the economic challenges and prospects of emerging agro-industrial products from coconut. The world production of coir temporarily slowed down beginning mid-2002 up to 2003 due to the entry of biodegradable and traditional synthetic materials in the market. The market, however, remained strong, posting an average growth of 9.7% from 1999 to 2003. This growth is expected to be sustained in the future as research and development brings in more new product applications for coir and coir products for agriculture, the environment, and the construction industry.

The Philippines is currently the second top coconut producer in the world next to Indonesia. Data derived from the Asian and Pacific Coconut Community's 2003 Coconut Statistics Yearbook show that the Philippines' yearly output of 13.7 billion nuts, when converted to coir, can produce 27.4 million sq km of coir geotextiles and 3,425 million tons of coco peat. Erosion-control geotextiles and coco peat blocks are the best products to invest in based on the demand in the local and export markets. In the local scene, government agencies led by the Department of Public Works and Highways (DPWH) have begun to promote the use of coir products. The department has required the use of geotextiles and other erosion-control materials in all its road construction and road rehabilitation projects.

Based on the proposed model of this diagnostic study, small modules capable of processing up to 5,000 husks daily would need an investment of PhP5.5 million per module while large ones that can process up to 25,000 husks per day would require PhP36.5 million per module. For a period of five years, the average return on investment from a small module is 40.47%. A net income worth PhP2.2 million can be expected each year, showing the rosy business potential of the proposed model.

The Philippine coir industry can become a major supplier of coir and coir products to the world market, but a number of impediments need to be addressed in order to make the investment climate more favorable. For example, coir producers have to contend with the chronic shortage of funds and high interest rates, which effectively limit plant improvements and product development. There are problems with the availability of husks for processing due to poor plant locations and few feeder roads. High transportation costs and availability of transportation facilities are likewise a concern along with government policies that make it difficult for coir producers to get a fair break as far as getting their raw materials and products from farm to plant is concerned. The domestic market is also weak as end users prefer synthetic alternatives to coir like polyurethane foam. This, too, will require a great deal of work and sustained information drives to overcome.

Research results are also not properly communicated to end users, thus the latter have no idea what technologies and facilities are already in existence and ready for them to use.

EXECUTIVE SUMMARY

The demand for coir has been growing over the years due to the product's environment-friendly characteristics and the fact that it lends itself well to nontraditional uses. Top coconut producers like India and Sri Lanka are riding this wave of opportunity by supporting and using research and development (R&D) and technology. The Philippines, which ranks second in the world in terms of production, but fourth in terms of yield, can get a bigger slice of the pie than it has right now depending on how it deals with certain restraining factors.

There are approximately 12 million hectares of coconut farms all over the world, of which 83% or 10.5 million hectares are located in the countries included in the Asian and Pacific Coconut Community (APCC). Six of APCC's member countries—India, Indonesia, Malaysia, the Philippines, Sri Lanka, and Thailand—produce an average of 447,000 tons of coco coir. The top producers are India and Sri Lanka, whose combined production of 412,000 MT makes up 92% of total world supply. Thailand supplies 15,400 tons or 3.4%; the Philippines, 900 tons or 0.2%; and Indonesia, 200 tons or 0.04%.

The Philippines is currently exporting coir fiber to Europe, the United States, Canada, and other countries. The biggest markets for coir in Europe are Germany, the United Kingdom, the Netherlands, and Yugoslavia. The country's potential markets include China, Japan, Korea, Pakistan, and Australia.

Total value of world exports in 2003 was approximately US$91.47 million. Of this amount, $74.3 million came from India; $14 million from Sri Lanka, $2.6 million from Thailand; $0.50 million from the Philippines; and $0.07 million from Indonesia. Leading producers see steady growth for the coir market with the latest figures available pegging annual growth at a healthy 9.7%.

Geotextiles for erosion control, coco peat for use in horticulture, and other coir products with applications in the construction industry (e.g., insulation materials, building boards, reinforcement for other fiber composite materials) are generally considered to be attractive choices for investments.

The Clean Development Mechanism (CDM) of the Kyoto Protocol offers significant international opportunities for the coir industry. Under the CDM, industrial countries that are heavy users of carbon dioxide-releasing operations can enter into emission-trading investment projects with developing nations to meet their commitment to reducing their own emissions. The European Union and Japan, for example, committed to reduce 40 million tons of CO_2 emissions by 2010. The current understudy market value for each ton of carbon dioxide reduced by CDM projects is worth US$5.

By investing in environment-friendly projects in developing countries, industrialized nations can earn Certified Emission Reductions (CERs). Philippine commercial attachés in foreign countries can be tasked to look for foreign investors in China, the European Union

(EU), and Japan that are willing to channel investments in large husk-processing plants. In return, they will have a guaranteed supply of coir geotextiles and coco peat for their environmental projects, and they will also gain a huge quantity of CERs as a result of their investments. This is reason enough for the Philippines to try and make the investment climate for the coir industry favorable.

However, before the Philippines can capture a bigger share of the world market, the government and the players in the coir industry need to get their act together and address certain impediments. Foremost of these barriers is the chronic shortage of funds and the high interest rates that prevent coir producers from implementing improvements to their plants, production processes, or undertaking product development. Funding should be made available at terms conducive to expansion. One possible source is the PhP3.65-billion Coconut Industry Investment Fund (CIIF).

Producers are also hobbled by the scarcity of husks for processing due to poor plant locations and few feeder roads. This is compounded by the high cost of transporting husks from farms to processing plants and the unavailability of transportation means when they are needed. Producers likewise complain of government policies such as the Cabotage Law, which further inflates the costs of transporting materials and goods from one point to another. One way this situation could be remedied and could have been avoided is by establishing plants based on existing road networks.

The Philippine Coconut Authority (PCA) has come out with a study showing that there are certain coconut-growing areas capable of supporting more plants than are currently located there based on these areas' current nut production and the actual number of existing plants.

There is also a need to boost demand in the domestic market as end users still prefer synthetic alternatives to coir like polyurethane foam. Necessarily, this will require a great deal of work and sustained information/education drives.

As far as product development is concerned, research results are still not properly communicated to end users as a result of which the latter have no idea what technologies and facilities are already in existence and ready for them to use. To address this, a specific body should be tasked with disseminating or publicizing technical findings to the general public.

Focus should also be given to other high-value coir-based products, such as rubberized molded coir, composite materials, and coir for industrial filters and water purification.

On the export side, it has already been established that there are potential export markets for the country's coir products. However, the country's commercial trade attachés need to help by promoting coir in their countries of assignments and providing useful information to businessmen who may be interested in sourcing their coir requirements from the Philippines.

Product Development, Challenges and Prospects: Agro-Industrial Coconut Products

Ildefonso A. Tallada

INTRODUCTION

The current structure of coconut-processing in the Philippines is highly focused on copra and coconut oil. Studies, however, estimate that converting even 50% of coconut husks into coir could raise local output of coir and coir products to 700,000 metric tons (MT). The latter is seven times the current world demand of approximately 100,000 MT per year and with an annual growth rate of 10%.

In recent years, more coconut products have been found useful in reducing today's environmental problems associated with the construction of roads in mountainous or forested areas. While roads facilitate transport of goods to and from a place, they also lead to deforestation. Without forests, there is little to keep the soil in place. The deadly results are floods, landslides, and creeping desertification, all of which threaten lives and livelihoods. One way of addressing the problem is through the use of coir geotextiles in combination with biologs and organic plant media (OPM) made from coco peat. The use of these environment-friendly coconut materials will help "re-green" landscapes rendered barren by industrial and other development activities. The Asian and Pacific Coconut Community (APCC), of which the Philippines is a member, can help in the gigantic task of restoring nature back to its healthy state.

A careful analysis of the above situation and issues is needed to obtain sound basis for investment decisions that could transform the Philippines into a top producer of coir and coir products. This paper aims to: (i) establish the impediments that hold down coir and coir products in their present status; and (ii) formulate carefully structured business plans that would bring the performance of these products on par with that of other APCC members and to a level that would substantially address the problems of the local coir industry.

This report includes (1) a discussion of the manufacturing process; (2) an industry profile; (3) an investment outlook; (4) a value chain analysis; and (5) conclusions and recommendations.

MANUFACTURING PROCESS

Production Process

Members of the Indian Coir Board who visited the Philippines about five years ago said that in India, the processing of coconut husks used to be done by women and children

who pounded the husks over large river stones using wooden mallets. When the husks had been sufficiently softened, they washed these in the river to separate the peat from the coco fiber. This laborious and time-consuming process resulted in high-quality coco fibers, but its net effect was low volume output per day. It was only when the demand for coir increased that the Indians started using mechanical decorticators, fiber cleaners, twiners, and weaving looms.

Local coconut farmers also passed through the same low-tech stage of processing, but were quicker to switch to mechanized operations. Scientists, engineers, and other people involved in the coconut industry studied the characteristic properties of coconut husks, after which they designed, manufactured, tested, and improved appropriate processing machines.

The production process starts with the mature husks being dropped into the receiving hopper of the decorticating machine at the rate of one husk every 5 seconds. Fiber comes out of the vent at the distal end of the deco body while coco peat drops through the cagelike belly.

The tangled coir passes through the carding machine, which brushes off any remaining peat. Twiners initially make the single-ply rope and, using the twiner wheels' counterspinning motion, produce 11-m double-ply twine hanks.

These hanks are then set on the weaving loom, 40 pieces weft and 40 pieces warp. The up-and-down motion of the beam locks the weft/warp on preset spacing (2 cm, 1.5 cm, or 1 cm), which is determined by the scheduled geotextile mesh.

Coco peat is collected from the down-belly, sieved, and mixed with the other ingredients that make up the organic media formulation (e.g., carbonized rice hull, shredded leaves of grasses or trees, animal manure, and inert ingredients such as river delta soil or silt). An inoculant (biological activator) is added during mixing to hasten the decomposition process. The homogenized mixture is placed in polyethlene (PE) bags and set aside for a curing period of at least 15 days. After maturation, the OPM is placed in commercial polybags, ready for sale.

Product Description and Uses

The coconut husk-derived products discussed below are deemed to have attractive market potential and, as such, were selected to become the focus of this investment proposal.

Coir

Coir is a fibrous material extracted from coconut husks. The 14-to-20-cm bristles or stiff fibers come from the outer (back) portion of the husk while the comparatively softer strands of 10-to-14-cm fiber typically used for mattresses come from the inner (concaved) side.

The Fiber Development Authority (FIDA) passed Administrative Order No. 2-05, which stipulates the rules and regulations governing the determination and description of the official standard of commercial coir grades.

Coir is facing stiff competition from polyurethane (PU) foam due to the malleability or ease with which PU foam can be adapted for use in mattresses, car seats, and as upholstery material—all traditional applications for coir. Fortunately, PU foam has certain disadvantages such as nonbiodegradability and fragility (i.e., it disintegrates into powder after several years of use). Moreover, PU foam does not allow free air circulation—an important consideration for bed mattresses for health reasons—while coir does.

Table 6.1 Description and uses of commercial coir grades

Letter Designation	Name of Grades	Descriptions	Uses
CH-1	Coir Good	Highest coir grade; well cleaned with little or no pulp present in the bristles	Used in brush industries and as blenders for bed mattresses
CH-2	Coir Fair	Fairly clean bristles; defibering process not properly done, so fiber strands are still stuck together with considerable pulp still present; characterized by long fiber strands extracted from husks using defibering machines	
CH-3	Coir Mixed	Fairly clean; a mixture of stiff bristles and softer, mattress-use fibers; generally crumpled and tangled	As stuffing for bed mattresses, such as those made by the Salem and Sheraton bed factories; for erosion-control materials, such as geotextiles, fascines, coir twine, stitched pads, etc.
CH-4	Coir Mattress	Short, crumpled fiber strands with an average length of not less than 6.35 cm; the fiber is	Generally used for bed mattresses; soil mulch for vegetables, fruit trees, and

Letter Designation	Name of Grades	Descriptions	Uses
		"mellow textured," with a certain degree of softness preferred by mattress factories	ornamental trees; as plant liners for hanging baskets
CH-W	Coir Waste	Fibers less than 6.35 cm in length and/or with partially defibered portion of the husk	

Source: Based on author's own data gathering from currently prevailing transactions, local or foreign.

Coco Peat

Peat is the corklike material that keeps the nut in shape and binds the fibers together. Its many pore spaces make coconuts buoyant, an important characteristic for seed dispersal.

Peat also contains small amounts of major plant food (nitrogen, phosphorus, and potassium). Its high water-holding capacity makes it an ideal water reservoir for plants during dry weather and a steady source of water for plants newly transferred to the field.

Table 6.2 Specifications and uses of coco peat

Form	Specifications/Description	Uses
Plain, sieved coir	Packed in polybags	
Coir dust		A component of composite boards used in construction work; insulating material; filter for heavy metals in water-purification set-ups
Pelleted coir	Machine-extruded in pellet form	
Peat brick	Compressed peat in ratios of 3:1 or 5:1; 20 cm in length, 10 cm in width, and 5 cm in thickness	Peat is generally used as a potting mix for flowering plants as well as in vegetable gardens and greenhouses; as plant starters for tree species and orchard stocks intended for replanting/transplanting
Coco peat block	Hydraulically compressed peat; 30 cm in length, 30 cm in width, and 15 to 30 cm in thickness	

Source: Based on author's own data gathering from currently prevailing transactions, local or foreign.

In OPM formulations, peat functions as timed-release mechanism, holding together the nutrients contributed by the other mix ingredients and then slowly releasing these nutrients over time. This characteristic helps extend the availability of nutrient supply for the continued nourishment of growing plants.

Geotextiles

This high-value product from coir is used for the control of soil erosion and mitigation of desertification. Geotextiles are woven nets made of coir twine. These nets are placed on top of erosion-prone soils to prevent the soil particles from being carried away by water or wind. In the Philippines, geotextiles are woven using handlooms; other countries with more advanced coir-production technologies use motorized, automatic looms.

Among the emerging coconut products, geotextiles have the greatest market potential due to the increasing volume of land-development activities, such as the construction of subdivisions and gated communities, roads, parks, golf courses, and other recreation areas. All of these require developers to alter natural ground terrain, thereby predisposing huge areas to soil erosion.

The mitigation of desertification in China, Saudi Arabia, and other oil-producing countries also presents another potential for geotextiles. In Israel, for example, coir nets are used together with coco peat materials for desert-greening activities.

Table 6.3 Specifications of geotextiles

Product Type	Mass (g/sqm)	Mesh Size (cm)	Length (m)
CG 400	400	2.5 x 2.0	20 to 40
CG 700	700	1.5 x 1.5	20 to 40
CG 900	900	1.0 x 1.0	20 to 40

Source: Based on author's own data gathering from currently prevailing transactions, local or foreign.

Biologs or Fascines

Measuring 20 cm to 40 cm in diameter and 4 m to 6 m in length, biologs or fascines resemble oversized sausages. They are made by hydraulically compacting woven coir twine (CH-3 or coir mix grade) into tubular sleeves. Sometimes, polypropylene (PP) twine is used in place of coir twine.

Demand for this material is also expected to rise along with that for geotextiles in connection with projects involving control of erosion and desertification. Commonly used in tandem for erosion-control purposes, biologs and geotextiles are laid across erosion-prone slopes to block and maintain a constant flow of slow-moving water.

Table 6.4 Specifications of biologs/fascines

Diameter (cm)	Length (cm)
20	4 to 6
30	4 to 6
40	4 to 6

Source: Based on author's own data gathering from currently prevailing transactions, local or foreign.

Stitched Pads

Coir, sufficiently cleaned of peat and other extraneous dirt, is arranged using a mechanical contraption to form mats 1.7-cm to 1.9-cm thick. The fiber strands are locked in place with the aid of stitching needles. These needles are arranged in rows and designed to pass through the mat layers as they move up and down, carried by the motion of the mounting bar.

In the future, development efforts may directed toward other product lines with equally important agricultural and industrial uses, such as rubberized molded coir, needle-felted coir, cement-bonded coir boards, and plain coir boards.

Issues with the Manufacturing Process

There is room for improvement in current manufacturing practices, but these improvements are constrained by the following factors:

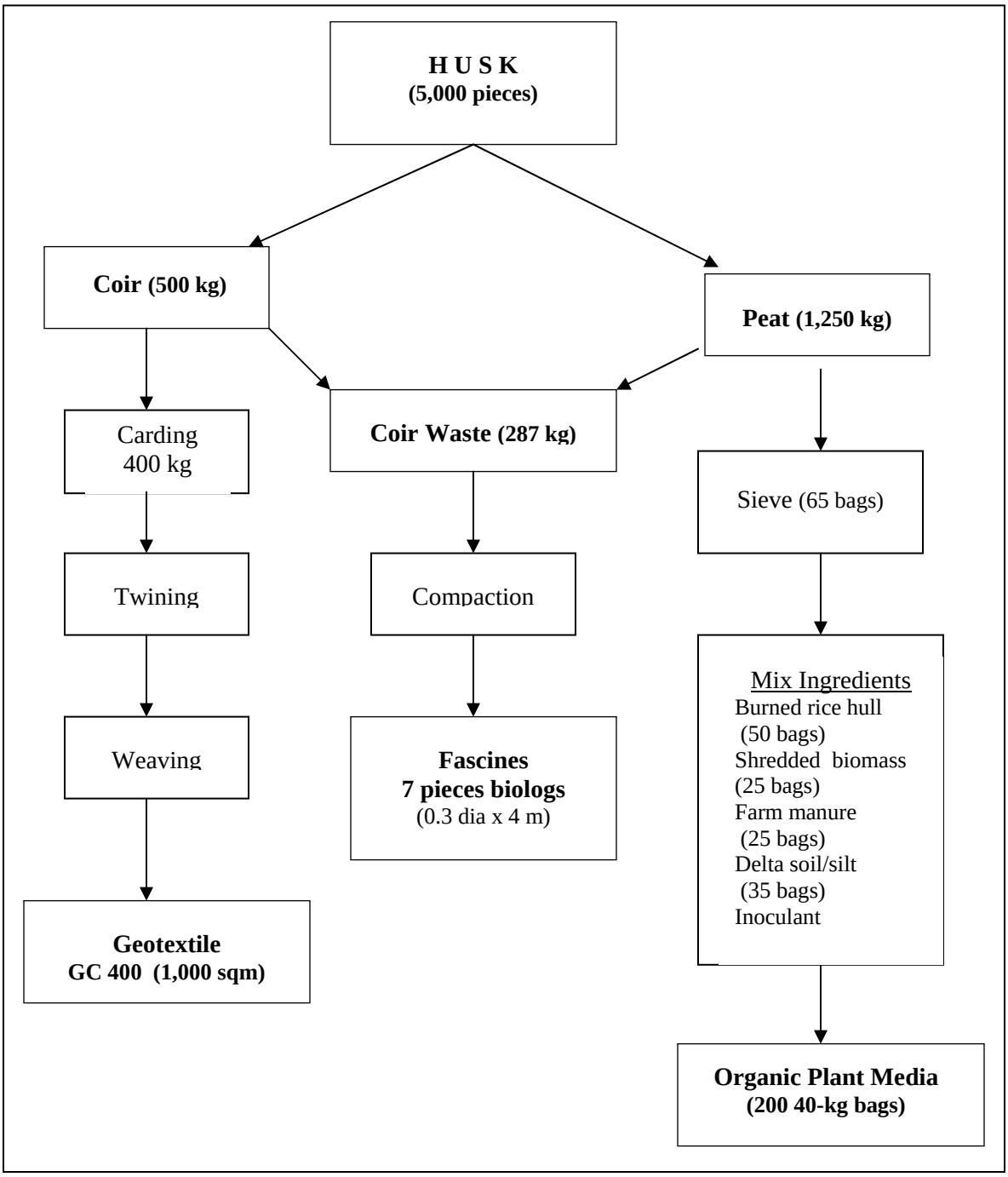
1. The local coir market is sluggish, pushing producers to sell to domestic outlets at very low prices. The returns on the producers' investment are so small they have nothing left to plough back into the business. Thus, they cannot undertake improvements in their production facilities. On the export side, the price of coir is mostly speculative, with the possible exception of the Soriano Fiber Industries.

2. Producers have little access to market information that could motivate them to improve the productivity of their processes and the quality of their products.

3. A large portion of revenues is allocated for the payment of the high interest rates charged by lending institutions on loans.

   The cost of fabricating world-class machines is high.

Figure 6.1 Process flow chart and material balance: coconut husks



Source: Author.

Issues Affecting Product Development

The raw material for the emerging products discussed in this paper is coconut husk. Considering the fact that husks are abundant in all of the coconut-producing areas of the country—prodigious amounts end up as farm waste—there should be no problem in obtaining them for processing into coir, coir products, peat, geotextiles, biologs, and OPM.

While thousands of hectares of land in eight out of twelve regions nationwide are planted to coconut, there appears to be some difficulty in getting husks to processing plants due to the following factors:

1. Many coconut-growing areas are characterized by mountainous, rugged terrain and few feeder roads, which make husks very difficult to gather

2. Some coconut-growing areas are located at the midpoints of transport terminals. The scarcity of transport facilities (hauling trucks) in these areas increases costs. Truckers usually charge much higher rates than they normally would for areas closer to transport hubs.

3. Some coconut-growing areas are in relatively developed regions with many factories, universities, recreation facilities, and income sources other than farming. Thus, the locals in these places consider farming as a last resort for income generation and cannot be bothered to gather husks and deliver these to processing plants.

INDUSTRY PROFILE

World Situation

Production trends

Coconut coir constitutes a vital economic activity in some coconut-producing countries of the world, such as India and Sri Lanka, and plays an important role in rural employment and development.). Aside from India and Sri Lanka, the other world producers of coir are Thailand, the Philippines, Malaysia, and Indonesia.

The total value of coir exports in 2003 was approximately US$91.47 million (Asian and Pacific Coconut Community Yearbook 2003). Of this amount, India and Sri Lanka contributed the biggest volume at US$88.3 billion ($74.3 million came from India and $14 million from Sri Lanka) while $2.6 million came from Thailand; $0.50 million from the Philippines; and $0.07 million from Indonesia. Leading producers see steady growth for the coir market with the latest figures available pegging annual growth at a healthy 9.7%.

World production in 2003 was 419,000, down by 49,800 MT compared to 2002 production. Together, India and Sri Lanka contributed 411,840 MT or 92.2% of total world supply in 2003. The 11.9% drop in world production in 2003 was due to the close

competition between coir and traditional, biodegradable synthetics as well as with other organic fibers (e.g., sisal and henequen). This reduction is deemed to be temporary, and the industry is projected to be heading toward much bigger growth in the coming years.

As of now, applications are mostly in the field of environment restoration. Manufacturing capacities are steady, and R&D is continuous, especially in the areas of product quality, production equipment, coir-based composites, building boards, and insulation materials.

Market trends and potentials

The response of the market toward coir is very encouraging and runs contrary to actual production. The five-year (1999 to 2003) export average was 99,800 MT. The industry is growing at the rate of 9.8% or 9,700 MT annually.

The environment-friendly nature of coir and coir products is one of the major reasons for increasing demand. It also helps that these products are ideal for nontraditional applications, such as erosion control. In fact, erosion-control mats and other geotextile applications, such as biologs or fascines, are big in the export market. Perhaps consumers are also beginning to realize the dangers synthetic materials pose to the health of the humans and animals as well as to the environment.

Relatedly, the Clean Development Mechanism (CDM) of the Kyoto Protocol offers significant international opportunities for the coir industry. Under the CDM, firms in industrialized countries can earn Certified Emission Reductions (CERs) by investing in environment-friendly projects in developing countries. China is set to become the biggest market in the world because of its heavy reliance on coal for energy.

CDM is an early introductory measure to limit carbon dioxide emissions. The European Community (EC) and Japan have committed to reduce 40 million tons of carbon dioxide emissions by year 2010.

Other potential export markets waiting to be tapped are the following countries:

- *China*. According to the Sino-Malaysia Science and Technology Cooperation Project, “live” desert is moving towards cities, provinces, agricultural areas, and livestock pasture areas in China at the rate of 2,460 sq km per year. A total of 2.6 million sq km or 27.3% of China’s total territory is already affected by desertification. China also has numerous building construction and flood-control projects that are in need of erosion-control measures.

- *Korea and Japan*. These countries allocate funds for environment-related projects. Like China, they give high priority to the landscaping of public areas and highway shoulders that run thousands of kilometers. It is projected that there will be high demand for erosion-control materials and OPM (coco peat) in these countries.

- *Europe, Canada, and the United States*. There have been inquiries for bristle fibers and coco peat from these countries. While these inquiries were coursed through nonofficial channels during private discussions about coir potentials, the information received has been confirmed by the activities of the International Erosion Control Association (IECA).

The automotive and upholstery industries also recognize the eco-friendliness of rubberized, molded coir products. In addition, new uses of coco coir are being developed all the time (e.g., as reinforcing material in composite products such as fiber boards and insulation boards).

Coir dust, a component product of coir production, is finding large markets in Europe and Canada. Commercial interest in the horticultural applications of the material as a substitute for peat moss was triggered due to the "greening movements" that developed in these countries. The bulk of coco peat exports to Europe and Canada come from Sri Lanka while Korea and Japan source from neighboring countries like the Philippines.

Research and Development (R&D)

Much information on coir and its uses is yet to be discovered through science and technology. The following topics are now either subject to testing, pilot-scale verification, or further evaluation:

- *Decortication technology of coco coir*. Production of high-output machines that aim for 26% to 30% recovery of fiber from a dry-processing operation. In terms of cleaning capacity, 80% of skin and dust should be removed.

- *Softening, bleaching, drying, and printing for coir mats, mattings, and rugs.* These studies would result to enhanced product acceptability.

- *Mechanical drying of fiber*. Majority of small manufacturing plants still rely on solar drying. While drying costs using this method seem very low, the unpredictable weather hikes the actual cost of drying to a level much higher than programmed.

- *Coir as reinforcement fiber for composite materials, building and packaging materials, and thermal insulation materials.* Human imagination is the limit in developing high-performance bio-based composites.

As a sign of their confidence in the expansion of the coir market, the top world producers of coir continuously conduct research and ensure steady production. One factor that is fuelling the bullish attitude towards coir is the attitude that the environment needs to be protected from further harm. Industry giants see the potential of coir as a suitable material for environment-related efforts.

Philippine Situation

An economic survey conducted some time ago in Philippine rural areas indicated that the coconut-growing provinces are the most depressed areas of the country. There appears to be a positive correlation between the presence of coconut-growing areas and the level of poverty in a given province. Table 6.5 lists the major coconut-growing provinces and their ranking in poverty incidence, magnitude of poverty, and the minimum basic needs index (MBN).

Table 6.5 Major coconut-producing regions and poverty indicators

Province	Coconut land Area (ha)	1994 Incidence	Ranking Magnitude	MBN
Quezon	263,310	27	6	31
Zamboanga Sur	199,710	42	10	6
Davao Oriental	157,080	9	33	21
Zamboanga N.	154,200	8	12	8
Leyte	144,900	49	8	24

Sources: *Philippine Human Development Report 1997* and *Philippine Statistical Yearbook 1999*.

To explain the relationship between coconut growing and poverty, one would have to go back to the Spanish colonial period. During that time, coconut coir was used as caulking material for the building and repair of Spanish galleons. Coir rope, an alternative to ropes made of Manila hemp, was also used to anchor ships at bay.

The Manila Refining Company was established to produce crude coco oil. The bulk of the company's output was exported together with copra meal although a small part was reserved for local use as cooking oil.

Global demand for coconut oil increased soon enough, and the product became a key ingredient in cosmetic and pharmaceutical products as well as in other industries. Oil-pressing plants mushroomed and spread from highly urbanized areas to rural locations. After this, factories processing desiccated coconut were also put up due to the increasing popularity of the use of coconut meat in the bakery and confectionery industries.

Pioneers in coconut processing, especially in the oil-milling and desiccated-coconut sectors dominated the coconut industry. These industries established firm footholds and secured their niche in the processing and marketing of coconut-derived products, which is an export-oriented industry. These pioneers implemented protectionist measures to maintain their domination and keep new players out.

The Philippines remained as the top coconut producer in the world for many decades, which enabled 90 pioneer oil-milling and coconut-processing companies to generate an average income of US$700 to US$900 million annually.

But while the multinational owners of oil mills raked in profits, the more-than-30-million Filipinos who depended solely on coconuts for their subsistence remained mired in poverty, a situation that continues up to today.

On average, a farmer earns approximately PhP25,000 to PhP35,000 per hectare per year from copra production (Copra is the main raw material in coconut-oil extraction). However, a coconut-farming family is usually large, with the number of children ranging from 6 to 12. Home is a one-room shanty with neither electricity nor running water. The latter is taken from shallow, open wells.

To augment income, the head of the family usually takes on whatever odd jobs may come along. Even at a young age, the children help out with various farm chores like weeding, fertilizing, and harvesting. Very few of them finish elementary school; even less reach high school. This practically condemns them to a life of farming since they are unable to obtain employment in factories within easy reach of transportation facilities.

Husk processing, however, is now turning out to be a viable economic activity given the emergence of coir and coir products as environment-friendly alternatives to synthetic materials.

Thus, the coconut-producing provinces of the country (more than 60 in all) are in an ideal position to take advantage of a renewable resource that, up to now, usually ends up as farm waste. The fact is, in up to 95% of coconut farms, farmers burn husks to avoid stockpiles that may end up as breeding grounds and hiding places for snakes, scorpions, and other poisonous creatures.

The Philippines is currently the second top coconut producer worldwide next to Indonesia. Data derived from the APCC's 2003 Coconut Statistics Yearbook show that the Philippines' yearly output of 13.7 billion nuts, when converted to coir, can produce 27.4 million sq km of coir geotextiles and 3,425 million tons of coco peat.

Tapping even 25% of this market potential can bring in additional revenues of US$455 million per year to the coconut industry. With farmers carrying out production tasks, a huge number of coconut-farming families can reap the benefits of this emerging industry.

Capacities and locations

A survey made by the PCA of the number of coir manufacturers nationwide yielded the results presented in Table 6.6.

Table 6.6 Number of coir manufacturers, September 2005

Province	Number of coir-making establishments
Laguna	5
Quezon	9
Batangas	1
Bicol	2
Aklan	1
Samar/Leyte	2
Misamis Oriental	1
Davao	9
Saranggani	3
General Santos	2
Maguindanao	1
Negros Oriental	1
TOTAL	37

Source: Philippine Coconut Authority (PCA).

The capacities of these plants were estimated as follows:

2 plants in Laguna at 3,500 kg/day	= 7,000 kg
2 plants in Quezon at 3,500 kg/day	= 7,000 kg
Rest of the plants, average of 700 kg/day	= 23,100 kg
TOTAL	= 37,100 kg
Per year (in MT)	= 11,130 kg
Annual Production, 2004 (in MT)	= 5,114 kg

Note: Machines are operating at only 45.9% capacity.

As Table 6.6 shows, there are about 37 coconut-husk processing plants listed with the PCA. Majority of these produce coir and peat as their main products. Seven or eight of them produce high-value geotextiles and stitched coir pads.

The milling capacities of these plants range from 400 kg of coir output per day to about 3,000 kg per day. Seven of the processors can produce 3,000 kg or more of coir per day. Many of these coir producers sell their output to bed makers, jeepney and car factories, and upholstery shops. In 2003, six of these processors exported 1,056 tons of coir.

In the estimation of plant capacity under Table 6.6, it was mentioned that the 37 plants were operating at only 45.9% capacity. This undercapacity is due to several reasons:

- Many of these plants established their factories without consulting the PCA or other experts who could advise them about suitable plant locations. This resulted in the establishment of plants in locations with husk-availability problems; hence, there is stiff competition for raw materials (husks).

- Factors affecting the market situation were not given due importance in the establishment of the factories. For example, the domestic market for coir is currently unfavorable, and needs considerable information drive ("pushing"). On the other hand, international markets are still in the early stages of development. Large inventories of finished products remain unsold in producers' warehouses.

- Cost factors continue to spiral upwards, leaving very small margins of profit, if any, to the manufacturer. These cost factors are diesel fuel, electricity, labor, hauling of products, and interest rates. Many coir-processing plants have limited working capital; thus, the "cost of money" does not provide any leeway for larger allocation of funds.

With the interplay of these factors, processing plants suffer erratic production, and a number have ceased operations.

Institutions involved in the Philippine coir industry

The following are the government agencies, private associations and companies involved in the local coir industry.

a. Government Agencies

- The Philippine Coconut Authority (PCA) is mandated to carry out coconut-related research and development (R&D), production development, manufacturing and processing, and sales and marketing.
- The Fiber Development Authority (FDA) is in charge of product standardization and the monitoring of the performance of fibers in local and foreign markets.
- The Department of Trade and Industry-Bureau of Trade and Promotions (DTI-BTP) takes care of product marketing, promotion, and information dissemination in the world market.

b. Private Associations

- The Coconut Coir Industry Association of the Philippines is a business association of coir producers.
- The Small Coconut Farmers' Organization is a PCA-sponsored farmers' group.
- The United Coconut Association of the Philippines (UCAP) is a business association of oil millers.
- The Coconut Farmers' Cooperatives and Associations is an umbrella group of:
  - Agrarian reform beneficiaries/agrarian reform communities
  - Bacong Small Coconut Farmers Development Cooperative
  - PITAD Foundation, Inc.
  - Jaro Leyte Multi-Purpose Livelihood Cooperative
  - Others

c. Private Companies

- Coco Technologies, Inc. in Camalig, Albay (Bicol region)

- Soriano Fiber Industries in San Pablo City, Laguna (Southern Tagalog and Bicol regions)
- Lacto Asia Phils. in Sariaya, Quezon (Southern Tagalog region)
- Yellowbar Coircraft in Sariaya Quezon (Southern Tagalog region)
- Pontmaine Resources Inc. in Davao (Mindanao)
- Others

Basically, the constraints hampering coir producers' domestic marketing efforts may be classified into direct costs, availability of transportation, and government policies that indirectly affect costs.

- The costs involved in moving products from the factories to consumption points (e.g., Manila, Quezon City) eat up a substantial portion of potential income. In many instances, the income of truckers is higher than the income of coir producers. For example:

  - The cost of trucking one 40-foot container van of coir products from Bicol to the port of Manila is PhP27,000.
  - It costs PhP8,500 to haul 4,500 tons of coco coir from Quezon to the Salem bed factory in Valenzuela, Bulacan using one Isuzu forward truck.
  - The ocean freight charge from Davao to Manila of one 40-foot container van is Php 28,000, exclusive of handling and other port charges.

- It takes time to make arrangements for the use of hauling trucks and boat bottoms, which translates into a transportation-availability problem.

- Some government policies indirectly affect the cost of marketing these products. For example:

  - A FIDA regulation on exporting baled coir stipulates that product origin and other data should be printed on a piece of cloth, which should be fastened securely on the straps or bands of each bale. Switching to plain paper can reduce the additional cost incurred with the use of cloth.
  - The Cabotage Law protects the high charges levied by shipping companies on coir and other agricultural products transported from the provinces to Manila. Substantial savings can be generated if empty vans or vessels that ply the same route would be allowed to charge shippers low, backload freight rates.

Distribution system

There is room for improvement in the distribution of processing plants, which should have been established based on existing road networks to ease the movement of products and services. Data in Table 6.7 show that some representative locations could support more husk-processing factories than are extant in those areas, considering the area's current nut production and the present number of processing plants established there.

Table 6.7 Representative areas capable of supporting more husk-processing factories than are currently established

Representative Area	No. of Factories Available Husk Supply can Support*	Actual Existing Factories
Laguna	17	5
Quezon	166	9
Samar/Leyte	302	2
Davao	58	9
Saranggani	58	3

Source: Philippine Coconut Authority.
*Note: Computed using nut production of 6 million nuts, average quantity of nut input per factory per year (PCA 2003).

Among the areas where this exercise was done, the Leyte/Samar region has the highest capacity to support more husk-processing factories (302 factories against the existing two) followed by Quezon and Saranggani provinces, in that order.

Markets

Domestic market

The bulk of coir output is exported with the portion left for the domestic market being absorbed mostly by bed factories and upholstery shops (i.e., for *sala* sets and jeepney assembly plants). Table 6.6 shows that at least 17% of the five-year average of total coir production is sold locally, which translates to an average of 322 MT out of a total output of 1,872 MT. This rate could be higher if not for the huge number of local shops and manufacturers still using PU foam.

The industry's overall performance in terms of local sales and exports from 2000 to 2004 is presented in Table 6.8.

Table 6.8 Market performance, 2000-2004

Year	Coir Production (MT)	Domestic Sales (MT)	Percent	Export Sales (MT)	Percent
2000	1158	686	59	299	26
2001	1007	471	46	266	26
2002	814	210	26	239	29
2003	1267	119	9	1051	83
2004	5116	123	2	4617	90
Average	1872	322		1294	

Source: FIDA Statistics.

Data in Table 6.8 further show that the percentage of coir production exported has steadily increased since 2000. In 2004, almost all coir output (90%) was exported, leaving a miniscule 2% (123 MT) for domestic sales. This is in stark contrast to the year 2000 when more than half of coir production (59% or 686 MT) went to domestic sales. The overall trend is of a steady increase in exports and a substantial decrease in the volume of output sold locally.

Of the three major island groups, coir producers in Luzon appear to have better access to the local market than producers in the Visayas and Mindanao. In fact, there are reportedly sizeable inventories of coir in Mindanao.

Recently, various government departments issued circulars regarding the use of coco coir in their activities. This development makes the government part of the coco coir industry's domestic market.

The Department of Agriculture (DA), for example, issued Memorandum Circular No. 25 and Administrative Orders No. 43 and 11.

- *Memorandum Circular No. 25* directs all national and local government agencies, bureaus, and other instrumentalities, including agricultural institutions and councils, to use coco peat or coir dust and coconut fiber materials for soil conditioning and erosion control.
- *Administrative Order No. 43* encourages the use of containers or receptacles (for "plantable" seedlings) made from indigenous organic materials like coconut husk, coconut coir, coco peat, or other plant fibers.
- *Administrative Order No. 11* recommends the sustained use of coco peat or coir dust as a complementary soil amendment (conditioner) for improved crop yields during "normal" times and as a drought-mitigating measure during El Niño years.

The Department of Natural Resources (DENR) also issued a circular regarding the use of coir pots for reforestation nurseries.

Meanwhile, the Department of Public Works and Highways (DPWH) issued Memorandum Circular No. 25, ordering the incorporation/inclusion of geotextile in the designs made by the Department for construction of roads and highways. At present, imported synthetic erosion control materials are used to stabilize highway shoulders and eroding sections of roads. The use of locally made geonets can push the demand, of which a mere 10% estimate translates to about 500 MT geotextile per 1,000 km per year.

The demand for geotextile is expected to shoot up with the intensification of subdivision projects all over the country, the construction of golf courses, and government and private sector projects on soil stabilization of river banks, strengthening and fortification of dikes of fishponds, and water impounding projects for crop irrigation systems.

Export market

Of the average coir output of 1,872 MT from 2000 to 2004, 69% or 1,294 MT was exported. Six of the 37 coir producers have the financial capacity to export as well as strong connections to foreign buyers. Three of these producers are located in Laguna, one in Bicol, and two in Davao. The Department of Trade and Industry (DTI) extends considerable support to these six export performers.

In addition, Lacto Asia, a private company in Sariaya, Quezon, is focusing on the production of coco peat for solid waste management projects. Rubberized, molded coco coir products are another potential export item.

As previously discussed, the coir industry stands to benefit from the international opportunities created by the Clean Development Mechanism (CDM) of the Kyoto Protocol. Industrial countries, which are heavy users of carbon dioxide-releasing operations, agreed under the protocol to enter into emission trading with developing nations to meet their national commitment.

Actually, CDM is already being implemented in Laguna where small-scale reforestation projects in areas that supply water to Laguna Lake will earn verified emission reductions (VERs) that can be sold to World Bank Carbon Funds. Similarly, representations could be made with the Department of Natural Resources (DENR) on controlling the excessive burning of coconut husks, which emits carbon dioxide during the combustion process.

Following the same idea, Philippine commercial attachés in foreign countries can be tasked to look for foreign investors in China, the European Union (EU), and Japan to channel investments on large husk-processing plants (100,000 husks per day). The plan could be favorably received by these three countries because of a two-fold advantage: (1) guaranteed supply of coir geotextiles and coco peat for their environmental projects; and (2) the huge quantities of CERs they would gain as a result of their investments.

Data from the *APCC Yearbook* (Table 6.9) show the following coir products that were India's and Sri Lanka's top exports for 2003.

Table 6.9 Top coir product exports from India and Sri Lanka, 2003

Country	Coir Product	Volume (MT)	Value (US$ million)
India	Coir yarn	12,948	7.25
	Coir matting	4,786	6.33
	Coir mat	49,643	58.16
	Coir rug and carpet	1,203	1.76
	Coir rope	310	2.25
	Rubberized coir	499	5.57

Sri Lanka	Mattress fiber	23,793	4.2
	Bristle fiber	3,196	1.5
	Coir yarn	1,224	0.7
	Twisted fiber	19,291	5.0
	Coir twine	3,446	2.6
	Fiber dust	17,210	3.26

Source: *APCC Yearbook 2003*.

In comparison, Philippines coir products with potential export demand are geotextiles, fascine, coir twine, compressed coco peat (in block or brick form), OPM, and stitched pads. Potential markets that are being eyed include China, Korea, Japan, Europe, Canada, and the United States. With China, for example, geotextiles, fascines, coco peat, and OPM will be in great demand considering its desertification and soil-erosion problems.

INVESTMENT OUTLOOK

To illustrate the investment potential of coir and coir products, the study estimated the potential contribution of a 5,000 husks per day module. An estimated 286 coconut farm households are envisioned to benefit from each 5,000 husk per day stand-alone module herein proposed. The investment cost of one unit of the small module amounts to PhP5.5 million. For a period of five years, the average return on investment is computed at 40.47%. A net income of PhP2.2 million can be expected each year, showing the proposed business' rosy potential (see Appendix 6.1 for details of the financial profile for the small module).

Funding should be made available on terms conducive to expansion as the project will need substantial capitalization. One hundred (100) units of the small module will require PhP550 million while 100 units of the large module (25,000 husks per day per module) will require PhP3.65 billion.

Sectors that should show genuine concern—the government and Filipino investors with funding capability—must aggressively and seriously pursue the husk-processing potential that could bring in more dollar revenues to the country.

Well-planned and bold strides should be taken to develop the domestic and export markets, a move that should encourage investors to "place their bets" on the project.

VALUE CHAIN ANALYSIS

Internal environmental analysis

Strengths

1. Research and Development (R&D)

- R&D facilities are available in several locations: MIRDC, PTRI, FIDA, UPLB, FORPRIDECOM, PCA, and a number of private coir-manufacturing entities.

  The government agencies listed above have laboratory facilities equipped to evaluate processing machines, conduct tests on strength of coir and coir products, and run tests to determine the suitability of production equipment. Private entities, on the other hand, have their own means of testing the capacities and characteristics of their products.

- Technical data established by other coir-producing countries can be sourced through the Internet, which has proven itself to be a boon in terms of enabling researchers/scientists to "compare notes" with their fellow researchers and other specialists in the same field. For example, data and findings from India's and Sri Lanka's coir research are available online, giving researchers everywhere the opportunity to review these findings.

- Technical personnel knowledgeable on product qualities, potential for use, and applications can be tapped for extension and product information dissemination activities. Graduates of technical schools, colleges, and universities are usually available for contractual or permanent work assignments to do the research task.

2. Product Development

- A number coir manufacturers and government entities keep themselves abreast of developments while actively looking for opportunities to obtain capital.

  Members of the Coconut Coir Industry Association of the Philippines, Inc. (CCIAPI) actively monitor information on product developments in India and Sri Lanka as well as relevant information from major export markets like the United States, Canada, Europe, and Korea.

- Some fabricators test innovative ideas using combinations of new machine parts and low-cost scrap materials. Shops like GLM Metals, Ortega's Machine Shop, and Yellow Bell Fibercraft are open to fabricating new designs for husk-processing machines, including field-testing these designs.

3. Manufacturing and Processing

- Local producers are capable of learning and using advanced foreign technologies.

  If funds were not an issue and producers were given creative space, the capacity of these producers for innovation would blossom.

4. Logistics, Transport and Distribution

- There are functional roads and highways in major transportation routes and railway systems in place to serve the needs of the coir industry.

- There are communication facilities in operating centers.

- Facilities that supply critical inputs (e.g., power lines, fuel-supply depots, etc.) are present in many coconut-production areas.

5. Sales and Marketing

- Government mechanisms are in place locally and abroad to support the coir industry's marketing efforts. Commercial attachés, for example, can be trained to promote Philippine coir in their respective places of assignments.

- There are immediate and direct applications for these products, which have a ready market in countries with desertification problems like China and Saudi Arabia. The local coir industry can build linkages with these countries.

- The coir industry can and should take full advantage of local, state-of-the-art communications facilities.

Weaknesses

1. Research and Development

- Both government and private entities have very limited funds, hampering continuity of R&D and extension work. This is a very common problem especially in Third World countries.

- Very few technically oriented persons are aware of the existence of R&D facilities. As a result, important data and findings languish unused on bookshelves. The underutilization of these facilities could be due to researchers' lack of funds for extra expenses or the lack of publicity about the availability/existence of these facilities.

- The current low prices of coir products in the local and foreign markets dampen the interest and commitment of technical personnel to work for product improvements.

- R&D findings are often left unannounced or remain unused on bookshelves. It is up to the industrious person to spend hours researching and adding to his own information bank.

- There is no specific body that takes charge of disseminating technical findings with any semblance of regularity or frequency. Thus, parties that should benefit from the results of R&D are unable to make full use of the findings. Also, the country's financial situation is such that proper facilities for learning and technology transfer are low on the list of priorities.

2. Product Development

- There are government directives and policies related to the charging of fees for the use of facilities, which prevent people from pursuing product-development initiatives. It may be difficult to comprehend the phenomenon of government entities that are mandated to carry out activities to help the industry levying fees on proponents of ideas for studying and testing proposed improvements in the manufacturing processes.

- There is no fund allocation for product development. One has to scrounge around for R&D funds and contend with high interest rates at the same time; there are absolutely no incentives offered.

3. Manufacturing and Processing

- The cost of fabricating world-class machines is high.

- The lack of capital stymies progress in manufacturing and processing. Finding sufficient funds to finance improvements in the business is an elusive dream. Moreover, a large portion of the revenues goes to the payment of the high interest rates charged by lending institutions on loans.

- There is a shortage of the right kind of machines and equipment, a direct result of scarce resources.

- Producers have little access to market information that could motivate them to improve the productivity of their processes and the quality of their products.

- The local coir market is sluggish, pushing producers to sell to domestic outlets at very low prices. As a result, the returns on producers' investments are so small they have

nothing left to plough back into their business. Thus, they cannot undertake improvements in their production facilities.

4. Logistics, Transport and Distribution

- There is a lack of feeder roads from the source of raw materials to the main highways. Many coconut-growing areas are characterized by mountainous and rugged terrain, which make husks very difficult to gather.

- No concerted effort is being made to look at the problem of the high cost of delivering raw materials to processing plants. The scarcity of transport facilities (hauling trucks) in the coconut-growing areas increases costs.

5. Sales and Marketing

- The country's "listening posts" overseas are not properly oriented on the potentials of available products. This is a great disadvantage in the drive to develop foreign markets for these products. There must be good reason for foreign trade attachés' inability to gather the kind of information that will be useful to individuals interested in the local coir industry.

- There is a need to further prod and strengthen markets like the DA, the DENR, and the DPWH to take serious and positive action on official directives to use coir and coir products in their various activities and projects. This should be part of a concerted effort to patronize the country's products.

External environmental analysis

Opportunities

1. Research and Development

- The Philippines has an annual production volume of 12 billion husks; less than 1% of this is converted to coir. That translates to a tremendous volume of untapped raw materials.

- Private entities could take advantage of existing government facilities to seal R&D gaps. There are laboratories and mechanical shops in government agencies and universities that may be used for research purposes.

- Test findings made by foreign countries for orientation and dissemination. India and Sri Lanka are inviting other coconut-producing countries to exchange information. A healthy exchange of information could deepen everyone's information banks.

2. Product Development

- Many countries are concerned with the need to restore the environment. Aware of the destruction man's activities have wrought on nature, international organizations like the International Erosion Control Association (IECA) ceaselessly conduct campaigns and seminars on environmental topics/concerns.

- There is an increasing aversion to synthetic products and a clear trend toward the use of organic materials. Many high-profile organizations and movements are raising awareness on the consequences of the use of synthetic products and the dangers of pollutants.

3. Manufacturing and Processing

- Trade fairs, especially those that cater to foreign markets, are an ideal showcase for well-crafted products. These fairs provide an opportunity to show products to a bigger audience. Information obtained through the Internet and through printed materials indicates that Filipinos are on par with other countries in terms of design.

- The demand for excellent products is constant as is the need for R&D. The market seeks new products and designs year after year.

- Products that have built up a steady demand leads to a higher volume of production.

4. Logistics, Transport, and Distribution

- Limited road connections impel designers to fabricate self-mobile machines, a clear case of the environment dictating the form of the machine. The local situation pushes engineers and other technical people to adapt designs and operations to circumstances on the ground and in the field.

- Review production planning with preference to moving high-value products.

- Bigger volumes can be offered to the market if several producers pool their output.

5. Sales and Marketing

- The high cost of synthetic materials eats up a huge portion of budgets. Meetings with DPWH personnel revealed the high cost of investments incurred in using synthetic erosion-control materials.

- There is a desire and a burgeoning movement to go back to the old ways to reverse the damage done to the environment. While it may take a long time to achieve significant gains out of this, the first steps have already been taken.

Threats

1. Research and Development

- The coir industry will stagnate unless R&D and extension are given due priority. No industry can exist or survive without giving importance to R&D.

- The Philippines will lag behind foreign countries like India and Sri Lanka unless technical information is properly disseminated and used to improve the quality and marketability of its own coir products.

2. Product Development

- The choice between industrial progress and environmental protection is difficult one. Many sectors, especially those in business, choose monetary benefits even if their projects or activities harm the environment.

- Many synthetic products can be produced at lower cost than organic products. Again, there is the choice between what is cheap and easy on one hand and what could possibly cost a little more but will be more rewarding for the health and the environment on the other.

- Synthetic products meld well with today's busy lifestyles. Consumers prefer the "instant," which, unfortunately, relies heavily on synthetic materials.

3. Manufacturing and Processing

- The lack of appropriate machines will pull the industry down. Ill-equipped manufacturing operations spell trouble.

- There are few technically trained personnel and the manpower bench remains shallow. There is no effort to train second-tier replacements should the first tier leave or retire. Also, there is little attention from the government while from the private sector, there are only a few "enthusiasts" who are actively involved in husk processing. This situation needs to be addressed.

4. Logistics, Transport, and Distribution

- There are foreign investors willing to invest capital in solutions to the coir industry's logistics problem. If foreign investors come in and take advantage of the huge potential of the coir industry, local producers could be eased out. Already, a number of foreign-invested entities are operating within the country while other foreign groups waiting in the wings have signified their intention to establish husk-processing factories.

5. Sales and Marketing

- Consumers are deeply enamored with synthetics. A complete turn-around to natural materials will take a great deal of time. Perhaps it will take even more than a generation to get people to make the right choice between low-cost but environmentally harmful synthetics and relatively higher-priced but eco-friendly natural materials. This, however, is not a reason to not do something about the situation.

CONCLUSIONS AND RECOMMENDATIONS

The indicated course of action that would bring Philippines' coir situation on par with India's and Sri Lanka's will take, at best, three years considering the speed at which the country takes action. The following measures should be considered:

1. Establish 10% coir volume size of operation from the production potentials of current sources of coir.

   The plan will generate 30,690 MT of geotextiles; 95,900 MT of peat; and 22,060 MT of fascines with total annual revenues expected to reach US$ 55.2 million. Expansion of additional factories shall be made as experience is earned and as more orders for the products are obtained.

2. Mobilize the country's commercial attachés to obtain forward contracts to supply geotextiles and OPM to China, Korea, and Japan.

3. Designate the Philippine Coconut Authority (PCA) to be the main lead agency of the government in the development of local coir industry. Implement all these with funds obtained from the CIIF.

4. Simultaneously work to establish a privately formed and managed Philippine Coconut Coir Board, with clear directions on tasks focused on R&D and on market promotions and development.

5. Focus should be made to produce other high-value products, such as rubberized molded coir, composite materials, coir for industrial filters and water purification.

Despite the encouraging trend in exports and the support shown by some government agencies for the coco coir industry, there is still a need to build up local demand for coco coir products. Toward this end, the following steps are recommended:

1. A concentrated campaign should be conducted to encourage upholstery shops and bed manufacturers to switch from synthetic to natural fibers, following the trends in some foreign markets.

2. Educate the public on coir and coir products, including the health benefits derived from the use of these products. This information campaign should include a call to patronize local products like coir and its derivative products.

3. Conduct product symposia to address the concerns of various government agencies regarding the use of coir and coir products in their respective fields.

Appendix 6.1

INVESTMENT FOLIO (STAND ALONE: 5,000 HUSKS PER DAY MODEL)
Production of Coco Coir Geotextile and Organic Plant Media (OPM)

Raw Material Source:

a. Coconut plantation-bearing trees (has) – 800
b. Quantity of coconut husks per year, whole pieces – 1,500,000 (500 husks per day x 300 days/year)

Products, Quantity per Year

a. Coco coir geotextile (sq.m) – 300,000
b. Organic plan media (OPM; in bags of 40 kg each) – 60,000

Financial Profile

1. Investment

a) Fixed capital	2,390,000
b) Operating capital	2,537,760
c) Pre-operating capital	500,000
Total	5,427,760

2. Operating expense 2,524,742

3. Manufacturing expense 9,244,738

4. Cost of goods manufactured 11,769,480

5. Sales revenue

	Quantity	Unit Price	Total
5.1. Coir geotextile	300,000	20	6,000,000
5.2. OPM, bag	60,000	150	9,000,000
Total			15,000,000

6. Gross margin 3,230,520

7. Less: 32% Tax 1,033,767

8. Net income 2,196,753

9. Return on investment 40.47

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ANNEX A

The Coconut Stakeholders' Consultative Dialogues

The Coconut Stakeholders' Consultative Dialogues

By the invitation of Department of Trade and Industry (DTI) Secretary Peter Favila, two consultative dialogues with stakeholders of the coconut industry from the government, private institutions including farmers' representatives, nongovernment organizations, and producers/manufacturers were held at the BOI Building on 7 February 2006 and 14 February 2006.

Senior Undersecretary Tomas Aquino opened the first consultative dialogue and BOI Executive Director for Industry Development Group Raul Angeles opened the second consultative dialogue.

The stakeholder participants in the consultative dialogues included Mr. Danilo Coronacion, President/CEO of the Coconut Industry Investment Fund (CIIF) Oil Mills Group; Former Senator Bobby Tanada, President of the Philippine Rural Reconstruction Movement (PRRM); Mr. Edgardo Amistad, President of the CIIF Coco Finance; PCA Deputy Director Arturo Liquete; Undersecretary of Foreign Affairs Edsel Custodio; former BOI Governor Conrado Sanchez; BOI American Desk representative Robert Blume; former Resident Representative of the United Nations Development Program Bayani Aguirre; and former CIIF Board Director Edmundo Lim, a private company President. Representatives of private companies, government agencies, and nongovernment and private sector organizations such as the United Coconut Association of the Philippines, National Confederation of Cooperatives, Small and Medium Enterprises, Distributors Management Association, Inventors Association, and Angelo King Institute also participated in the dialogues

Statements of the Department of Trade and Industry (DTI) Officials

Senior Undersecretary Tomas Aquino stressed the importance of having a market-driven roadmap for the industry and a concerted stakeholders' effort for the development of the emerging coconut products.

BOI Executive Director Raul Angeles appealed to the industry stakeholders to close ranks as global competition demands a concerted and systematic effort. The stakeholders need only to harness the comparative advantage the country has in coconut into competitive advantage. A focused capability building for entrepreneurship could impact considerably in attaining the country's development goals. He suggested that the stakeholders in the consultative dialogue consider the creation of an Emerging Coconut Products Business Development Team that will draw up a roadmap and coordinate the execution of short-term and long-term action plans. The business development team can be included in the current national clustering efforts under the export development council.

After the opening statements of the DTI officials, the study team and the stakeholders exchanged views on the presentation of findings of the study team, and the issues brought forward by the stakeholders. The conclusions and recommendations on the improvement of

the investment climate for the emerging coconut products are drawn from these exchanges of views between the stakeholders and the study team.

The Study Team Presentations

In the first consultative dialogue, Mr. Simplicio Endaya, this diagnostic study's team leader, provided a situationer on the coconut industry. He highlighted the need to make the industry responsive to the demands of the different markets that can be served by coconut products. At the same time, he called the stakeholders' attention to restructure the industry by making the climate for investment favorable for SMEs that can be operated by farmers and their households right in the farms.

Meanwhile, Mr. Pablito Villegas, the value chain specialist, discussed the framework and analysis used by the study team in assessing the value chain of the industry. With an elaborated review of literature on the World Bank and Asian Development Bank's comparative surveys of the investment climate, particularly on the Philippines, he then presented the transaction costs in each of the industry's value chain as researched by the study team experts and the resulting value added on a per nut equivalent. The findings on the value chain as well as its linkages were explained using a graphical presentation of the results of the team's assessment.

Dr. Teresita Espino, the functional food products specialist, explained the uses, technical specifications, and the different processes of production of virgin coconut oil (VCO), skim milk, protein isolate, coconut meal, flour, vinegar, feeds, and growth hormones. Dr. Espino presented the problems of the industry in the current standard used for VCO where the consumers cannot distinguish the retention of the natural characteristics inherent in coconut for the product to be considered virgin. A strict enforcement of a modified standards that would delineate the production processes could prevent what could be a developing market fiasco ala 'nata de coco" in VCO. She ended her presentation with indicative investments for VCO using the patented University of the Philippines Los Baños-National Institute of Molecular Biology and Biotechnology (UPLB-BIOTECH) VCO technology for SMEs.

Mr. Ildefonso Tallada, the agricultural/environmental products specialists showed statistics and specific desertification projects to stress the potential markets in coir and peat products such as geotextile and organic plant media. He showed the products currently produced, the availability of technology and machines designed for small operations, and the supply of raw materials that are mostly thrown away or burned as waste. He then estimated the possible export revenues even if only a portion of these wastes are converted to products for the markets. Indicative investments options for SME operations capped the presentation.

Engr. Romulo Mesias, the industrial products specialists made two presentations: one on cochin oil and bio-diesel, and another on charcoal and activated carbon. In both presentations, he described the products' uses, their specifications, processes, and material balance. He also estimated the possible effect on raw material availability for the coconut oil industry given the differences in the requirements set for mandating the use of biodiesel as an

additive to regular fuel. He cited that the Philippines still has to pass a law setting a 2% requirement for diesel fuel in line with the Clean Air Act. Neighboring countries like Korea Malaysia already require a 2% biodiesel mix while Europe and most developed countries are now doubling their requirement to 5%. An executive order though was passed in 2005 requiring a 1% mix to government's 16,000 vehicles. An indicative stand-alone investment model for cochin oil production was used in the determination of the possible impact in income and profitability. In the charcoal and activated carbon presentation, the potentials of the shell charcoal were shown if it were converted into activated carbon. Higher quality activated carbon is produced out of coconut shell and priced with a premium in the world market. A video of the patented activator machine was presented during the first consultative dialogue.

In the second consultative dialogue, Mr. Endaya summarized the findings of the three months' work on review of literature, interviews and focus group discussions with the industry players, participatory rapid appraisal, field visits of ongoing and prospective projects in emerging coconut products, and study team coordination meetings and modeling activities. The constraints to policy, administration, and operation for a better investment climate were enumerated and became the consultative dialogue's guide to draw out the recommendations of the study team and various stakeholders. Alternative integrated processing models for different input capacities were also presented for the various target markets.

The Dialogues

The stakeholders expressed gladness that the "neglected" coconut sector is finally given attention and asked that action be taken instead of further talks on the improvement of investments and exports to attain the targets of the MTDP.

Stability of supply of coconut to the oil processors

The emerging coconut products will further lessen the supply of raw material to the coconut oil processing industry that is already operating at less than 50% its rated capacity. With VCO, 500 MT have been drawn out of the dessicated coconut supply for fresh nuts. The production of biodiesel could deduct another 70,000 to 350,000 MT of copra equivalent. Production of coconut has not grown for reason that about 1.1 million hectares of coconut plantations need rehabilitation; of this 750,000 hectares are nutrient- deficient areas requiring fertilization and 400,000 hectares with senile and unproductive trees requiring replanting.

Uncertainty in land ownership and tenure and restrictions on access and disposal of land under agrarian reform

Other than the low income derived from copra, the study team listed the pending land reform implementation as one of the constraints to investments in the coconut areas. Rather than wait for the PhP50 per tree payment of the Land Bank as per the Comprehensive Agrarian Reform Program, or receive PhP10,000 per hectare per year as income from copra, landowners and/or farmer tenants/workers are better off cutting the coconut trees and collect

PhP500 per tree or about PhP50,000 per hectare. The cutting of coconut trees has been going on at a rate of 2 million trees per year or about 20,000 hectares per year.

A landlord/farmer/management scheme has been recommended to address the dampening effect of the land reform act. In the scheme, a joint venture is formed by the CIIF Oil Mills Group and the landowners and farmers of the coconut land. The coconut tree, which is considered as a resource, as well as the land will be managed by the CIIF with the farmers providing the required labor for intercropping and other projects that can be feasible for the area.

The government targets 1.3 million hectares for rehabilitation in the next 5 years. This target includes about 200,000 hectares for palm oil production, which is expected to cover for palm oil imports of about 400,000 MT a year.

The Department of Environment and Natural Resources (DENR) through a circular in November 2005 allowed coconut as a reforestation crop for government and idle lands. Joint ventures with DENR for plantation estate have been opened to the private sector for a consideration of 3% of net income to DENR.

Replanting will be mandated and tied up with the equivalent area of the input requirement of processing plants. The processing plants may, however, opt to donate equivalent seed nuts for PCA distribution. For the CIIF oil mills, which crush about 879,000 MT or 30-35% of total copra supply, this means replanting 900,000 hectares in 5 years.

The CIIF has committed PhP100 million for this year for replanting plus PhP200 million for intercropping. The CIIF Finance, the investment arm of the United Coconut Planters Bank (UCPB), on the other hand, carries a portfolio of PhP300 million to PhP400 million for financing projects.

The CIIF gets a yearly dividend of PhP1.05 billion from the San Miguel Corporation (SMC)-traded bloc shares. The Office of the Solicitor General, however, provided the opinion that the government should stop drawing down the amount until the ongoing litigations clear the issue of ownership of the coconut levy funds.

The use of the coconut levy for the farmers

The governing presidential decree on the use of the coconut levy for the farmers sets four purposes:

- Research and development for high-breed replanting (this is the *bugsuk* project of Mr. Cojuangco where the hybrid variety, a tall and dwarf combination of foreign origin, did not adapt well with Philippine planting conditions). The variety was geared for operation on a corporate basis running counter to the smallholder units of plantation ownership averaging at 1.5 to 8 hectares only.
- Credit assistance to farmers through the UCPB;
- Socio-economic program such as the Coco Life insurance and scholarships; and

- The balance or excess are for investments in operating companies such as the CIIF oil mills.

The coco levy could help address the long-term need of coconut farmers for investments in emerging coconut products. Any restructuring of the industry would have to be led by institutions (like UCPB, CIIF) that were created by the coconut levy.

Former Congressman Oscar Santos, Chairman of the Coconut Industry Reform Movement, wrote (*BusinessWorld* Internet Edition, THIS WEEK, 12 January 2004) of "a systems failure (in the coconut levy for the farmers), with the Judiciary taking a long, long time resolving the country's biggest scam (benefiting the power wielders not the farmers), the Executive unable to exercise enough political will to implement not just the intent and spirit but the very letter of the coco levy-related Presidential Decrees, and the Legislature failing to act on the measures brought before it to the end that justice is decisively done to the mandated beneficiaries."

Mr. Danilo Coronacion, president of the CIIF mills and former administrator of the PCA pointed that the amount of the coconut levy whose question of ownership is under litigation is not the benchmark valuation of PhP130 billion. It is the current traded value of the SMC share of PhP55 billion. This current valuation of PhP55 billion is expected to be reduced in the next three years considering that 48% of SMC's revenues as of the latest update come from Australia.

The resolution of the ownership issue has been slow. On 1 September 2001, however, the Supreme Court ruled that the coconut levy is prima facie public fund and the Sandigang Bayan was supposed to resolve the ownership issue in 6 months' time. In July 2003, a partial decision was made that the UCPB is owned by the government on behalf of the coconut farmers. In May 2004, the court declared that the CIIF SMC shares are owned by the government in trust for the small coconut farmers and a writ of execution for this decision can be made. Mr. Cojuangco questioned the declaration and moved for the trial to proceed as there are 8 cases on the coconut levy pending before the courts for more than 20 years as follows.

1. Civil Case No. 0033-A Re: Anomalous purchase and use of the FUB, now UCPB
2. Civil Case No. 0033-B Re: Creation of companies out of coco levy funds
3. Civil Case No. 0033-C Re: Creation and operation of Bugsuk Project and award of PhP988 million damages to Agricultural Investors, Inc.
4. Civil Case No. 0033-D Re: Disadvantageous purchases and settlement of the accounts of oil mills out of coco levy fund
5. Civil Case No. 0003-E Re: Unlawful disbursements and dissipation of coco levy funds
6. Civil Case No. 0033-F Re: Acquisition of San Miguel Corp.
7. Civil Case No. 0033-G Re: Acquisition of Pepsi Cola
8. Civil Case No. 0033-H Re: Behest loans and contracts

The resolve by the government to settle the issue of ownership either by continuing litigation or settlement was affirmed by the current PCCG chairman when he said he is resigning his post should the issue remain unresolved by the end of 2006.

The idea that farmers and stakeholders should have seats in the PCA Board was brought out in the dialogue. They should be given voice in the formation of policies and guidelines concerning the coconut industry.

Research and development and extension (R&D&E) constraints to investments

- Uncoordinated and underfunded R&D&E and sectoral focus of R&D support institutions
- Limited government incentive on the commercialization R&D utilization of mature technologies

Dr. Espino recommended incentives such as share on the royalties to be derived from the use of patents for scientists who help secure these patents for universities and institutions. The programs for R&D need to be funded more and directed to prevent efforts on recycled activities that often have no value added.

- Lack of R&D institute focused on coir

Mr. Tallada recommended that the DOST should conduct relevant research and development for coir and coir products, such as the manufacture of insulation/sound proofing use of coir (already developed abroad), rubberized moulded coir, composite materials, filtration products for air, oil, and water, as well as the utilization of peat to filter/remove toxic metals (as in battery manufacturing industries).

The University of the Philippine Los Baños (UPLB) and other agricultural universities and colleges should conduct and broadcast full utilization methodologies for coco coir dust or coco peat-based organic fertilizers. The UPLB Forest Products Research and Industry Development Institute should do the same for briquetting and charcoal production from coco peat materials. So with the Bureau of Mines on the use of geotextile and other coir materials to reinforce/strengthen mining sum levies, canals, and other discharge arteries; the Bureau of Fisheries and Aquatic Resources on the use of geotextile in fortifying fishpond levies and canal systems; the Bureau of Soils and Water Management on the use of Geotextiles in water impounding projects; and the whole Department of Environment and Natural Resources (DENR) on the use of geotextile and other coir products in soil erosion problems in watershed and other reforestation areas.

- Low PCA budget for R&D
- Low PCA budget for coconut tree planting

Financing the distribution of seedling is lacking. The PhP3.50 to PhP4.50 per seedling becomes PhP30 per seedling when delivered.

- Removal of industrial/commercial R&D functions from PCA

Mr. Coronacion called for support to PCA agronomic or germplasm core competency in R&D. He underscored the significance of a PCA focusing on its core competency and giving up product and market development of emerging coconut products to others.

- Limited and unfocused RD&E on the health and nutrition aspects of coconut
- VCO product development as cure for AIDS, SARS, and bird flu require clinical testings

The study team recommended that the DOH, through the Philippine General Hospital, should spearhead the conduct of clinical trials of testimonials and actual cures resulting from the use of VCO. The clinical trials, which would take years to undertake, will establish the use of the product as a drug in various food and drug institutions worldwide. Applications of VCO to obesity and HIV/AIDS as well as newly known diseases such as SARS, bird flu, and the like require clinical trials more than the many testimonials abounding in the market for acceptability of VCO not only as a food supplement but also as a cure that can be prescribed.

- Need for joint government-academe-industry-NGO-private-sector collaborative R&D&E initiative

The need of the private sector or prospective investors to know or have access to existing R&D resources, as well as scientists to consult with, "live", was noted in the consultative dialogue. A program has to be provided by the government stakeholders on this.

- Unsecured intellectual property rights on emerging coconut technologies (resulting in dilution of incentive to innovate)
- R&D breakthroughs being stolen and commercialized by competitor countries (e.g. nata de coco, coco milk, etc.)

Product development constraints to investments

- Overemphasis on low-valued coconut oil (crude and RBD)

Product development needs to be directed into high value added commodities (nutra and pharmaceutical, cosmetics, oleo foods, oleochemicals).

The United Coconut Association of the Philippines representative brought to the attention of the study team the need for classifying cochin oil out of fresh coconut as distinct from the chemically processed cochin oil out of manufactured (RBD) oil that the industry currently produces.

- Limited commercialization of emerging products

Production from ancillary industries deriving input from the emerging coconut products and normally operated by micro enterprises should also be provided the necessary

product development and commercialization guidance and testings. The DOST Food and Nutrition Research Institute (FNRI) outputs should be disseminated in the rural areas where statistics on nutrition deficiency are highest. Protein isolates and coconut meal can be turned into hamburgers and hotdog patties sans the animal fats that affect human health. Cochin oil out of pulps are just the right materials for the production of special health soaps. High-value products from VCO such as monoglycerides are in various stages of product development and require market acceptance and testings.

- Incomplete harmonization of product national processing standards with HACCP, GMP and Codex

Further product development and commercialization including adoption of industry standards are required. This is the case in producing functional food products out of the coconut meat such as skim milk and protein isolate.

- Inadequate technical and financial support to private sector-led product development and commercialization R&D
- Lack of funding and techno-managerial support for new product development
- Absence of technology to detect counterfeit products
- Eroding public trust and credibility of government institutions (DA/PCA, PCGG, IPO, DTI, DILG, PNP)
- Access to finished results and proven best practices and commercialized products from other countries
- Fees for testings for product development of support institutions a hurdle for farm-level operations

Manufacturing constraints to investments

- Micro and small enterprises production provide small volume outputs and diseconomies in production, logistics, and distribution operation

Mr. Edmundo Lim explained that an industry-wide effort by CIIF, UCPB, and organized farmers has made possible the PhP300 million CIIF integrated processing center right in the CIIF oil mills called the Niyog Tulungan Center (NTC). Under the NTC concept, a center becomes a whole nut buying station, drying facility sourced from charcoal making which renders drying for free, first stage fiber production, charcoal making, organic use of peat, and production of copra meal, water, fertilizer and feeds. It becomes a community store, internet cafes, small centers servicing 2,000 hectares to produce the required 50,000 nuts per day input of the CIIF oil mill. He sounded the benefits of continuing the stopped NTC considering the income and employment effects right in the farm areas and the integrative role of CIIF that has the program already in place including the funds required for its operationalization.

Mr. Coronacion expressed support for the NTC integration concept that is expected to uplift the coconut farmers and, at the same time, assure the CIIF mills of copra input. But he explained that the technical difficulties in the Mulanay experience provided the reason for the

Cabinet to instruct CIIF to stop the implementation of the NTC and instead required the CIIF to focus more on farm development rather than processing to allow the private sector to improve downstream processing.

The study team's models of onsite processing by the farmers offer a range of options. These options are a high-quality copra-led product lines setup, a biodiesel-led product lines setup, and a VCO-led product lines setup. These setups are integrated with production facilities in charcoal and/or activated carbon, in husks products such as geotextile and organic plant media, and in water products such as vinegar and distilled water. The investment scenarios for these models including its profitability were provided to the stakeholders. The PCA, through a licensing agreement with the patent holders of the technologies, may very well integrate the program for dissemination to organized farmer groups through the DA Agribiz Centers set up all over the country.

A major producer of coconut coir and peat among the stakeholders pointed that the 5,000 husk per day requirement is too small for economic operation by the farmer. The main problem is the absence of drying facilities. Meanwhile, the PhP5million investment recommended for the stand-alone 5,000-nuts-per-day model for coir and peat production is probably too large a capitalization for a single farmer. The small decorticators are diesel fed, and very expensive to operate. The small decorticators funded by some congressmen are not operating because of high cost of operation.

PCA Deputy Administrator Art Liquete indicated that PCA's thrust is to help the small coconut farmers. In this regard, PCA will be fielding decorticating machines with input of 1,000 husks per day to give farmers additional source of income. Numerous coconut plantations are located in "deep" areas that husks could only be most natural to be decorticated by small machine setups.

The demand for CME currently exceeds the supply considering the imports by one of the considered major producers. Both Congress and the Senate are expected to finalize the bill requiring CME addition in diesel fuel to support the Clean Air Act and generate savings in fuel consumption from the extra mileage with the use of CME.

Several big investments in terms of expansion and new investments, as modeled in the past, are up for consideration. But models to allow investments in smaller manufacturing plants with economies of scale and more dispersed locations for easy access to high volume (e.g., 1,000 value nuts) also need to be considered.

Mr. Alvin Manalang, Director of Management Services of PRRM, on behalf of their President, Mr. Bobby Tañada, announced that they will help organize farmer communities, as proponents for the investment models of the study team.

Engr. Ronald Talion, a member of The Filipino Inventors Association, offered to help farmers in the setting up of cost-effective processing plants with the use of technologies developed by its members on energy and fuel.

- Slow adoption of mature and “commerciable” processing technologies

The market problem posed by pricing RBD as cochin oil by Indonesian suppliers in the US market can be addressed by the technology of Engr. R. Mesias that processes cochin oil out of fresh coconut meat. The existing technology for cochin oil is not commercially adopted by the entrepreneurs of the industry due to the high cost of petroleum fuel. The technology relies on the use of chemicals and drying the meat to 6% that require high capital investments and production costs that are uncompetitive for fresh or wet processing. These technology flaws as well as economies of investments (scale, location, farmers and investments structuring, infrastructure, bulk handling, prospective buyers, linkages with existing plants etc.) need to be addressed. An estimate of the potential savings for oleochemical producers should be demonstrated for the use of cochin oil compared with the current RBD coconut oil input, where the cost of refining, bleaching and deodorizing unduly add up to the cost of production. The same assessment should be made on the use of cochin oil instead of diesel with coco methyl ester (CME) as biodiesel.

The industry can supply real cochin oil instead of RBD in response to the Indonesian RBD that is priced as cochin oil in the US market. The product standard for the cochin oil was set up by the PCA.

- Limited access to equity and loan finance including SME grants
- Unaffordable capital investments for small entrepreneurs
- Limited implementation of the Barangay Microbusiness Enterprise Act for emerging coconut products enterprises

Financing particularly by government banks are still based on collateral. Development loans sourced from official development assistance (ODA) are passed on at a little less than the commercial rate but still far above the interest charged by ODA sources.

Mr. Ed Amistad, President of Coco Finance, indicated that the 5,000-husk-per-day model is a representative model for farmer groups that the Coco Finance Inc. will finance. The management feasibility, however, must be well studied and properly built-in in the feasibility study.

- Concentration of product testing laboratories in urban centers
- Nonfunctional one-stop shops at the LGU, DTI/SEC, and PCA levels for registering SMEs

A small producers’ export processing zone for coconut locators could also be offered for investors. The CIIF facility in Bauan, Batangas can start this processing zone. In fact, there is already a move to transfer the CIIF San Pablo plant to this facility.

There is a need for treating coconut at par with other priority commodities particularly as a special window for PEZA. A shorter procedure for BOI registration for the emerging coconut products enterprises should also be devised.

- Negligible introduction of machines in the farms
- Weak machinery and equipment fabrication and supplier industries

The DOST Metal Industry Research and Development Corporation (MIRDC) should be directed to continuously develop the most effective machines for extraction and utilization of coir (e.g., decorticators, twiners, rope makers, laminated coir boards, automatic weaving looms, high-density balers, high-density peat compactors, etc.).

- Higher rates of EVAT, corporate income taxes, and LGU levies
- High cost of labor due to mandated minimum wage

Logistics and distribution constraints to investments

- Limited logistics, transport, storage, and distribution infrastructure
- Poor state of logistics, roads, ports, and transport infrastructure that result in uncompetitive transport, storage, and handling costs
- Lack of effective linkage with supporting supplier and logistics services providing industries
- Severe difficulty of consolidation under standardized and varying quality of products of SMEs
- Weak and underdeveloped distribution chain for both homegrown and export market
- Underutilized "roll-on-roll-off" (RORO) combined trucking and shipping services

There are two existing transport facilities that need to be optimized, namely, the Philippine Nautical Highways using RORO without backhauls and the use of the Philippine National Railways for cargo transport.

A feasibility study has to be made in establishing a central facility for processing and logistics in Mindanao for Brunei, Indonesia, Malaysia, and the Philippines similar to the tank farm in Edgewater, New Jersey, or the Vegetable Farm in Rotterdam. A better utilization of the crushing and ports capacities in the Philippines could result in such a central facility.

- Highly regulated, abused and extorted trucking and hauling business resulting in high cost of doing business and unprofitable operation
- Protected and monopolized market for logistics and transport infrastructure and services

The Distribution Industry Management Association of the Philippines brought forward the three (3) Cs existing in transport and handling services namely, corruption, cartel, and capture of regulatory agencies by the regulated parties. The representative of the Distribution Industry Management Association of the Philippines cited that in their evaluation of the logistics and transaction costs for shipping line and land transport, a cartel operates within the industry. While cost of transport logistics is 8% of total cost in some countries such as the US, it is 30% in the Philippines. In cargo handling, it is controlled by Asia Terminal Inc. and International Container Terminal Services, Inc (ITSI). The Philippine

Ports Authority (PPA) allows this cartel to prevail. A 10% rate for arrastre and cargo handling is collected by the PPA (PDA 57, Marcos time). The Maritime Industry Authority (MARINA) also allows rates dictated by shipping line companies. The Philippines has no antitrust law.

The CIIF president challenged the stakeholders to have the cabotage law amended to open up the shipping industry to competition. The PRRM representative indicated the farmers' awareness of this issue and the preparations they are making for demonstrations in the senate and congress for the repeal of the law.

- Maze of LGU ordinances (towing fees, fines, *tongs*, penalties) and regulations (truck ban, color coding, anti-overloading regulations) that impede the smooth operation of cargo vessels
- Prevalence of corruption and extortion as alleged by at least 8 industry associations in the transport and distribution sector

Moratorium on government fees has also been submitted for coir products (FIDA, PPA, CUSTOMS) until completion of a review of these government fees. These fees are currently at par with abaca, which is a high-value fiber. Position papers on this were submitted to DA and DTI and the Office of Senator Magsaysay. Follow up with the offices concerned should be one of the first agenda items of the emerging coconut products business development team.

Sales and marketing constraints to investments

- Limited market development and promotion

More aggressive export promotion needs to be undertaken in the emerging Asia-Pacific market. Korea has lately become an active buyer. Australia and New Zealand import a lot of VCO.

- Lack of sustained commercial attaché marketing support

All trade and commercial attaché must undergo product orientation and training on the emerging coconut products including: (a) full knowledge of the characteristic properties of these products; b) specific types of products suited for specific markets; (c) marketing strategies for these products; and (d) market intelligence on competing countries, especially price trends.

- Limited and asymmetric information on products

The concerned stakeholders should launch social marketing and information road shows focusing on the health benefits, energy impact, and protective benefits of the emerging coconut products.

Ms. Girlie Sarmiento, the CITEM representative, enjoined the stakeholders to concur with global market requirements such as organic certification and took note of the different trade fairs and shows the DTI is arranging for the industry. She further announced the opportunity of 100,000 MT of VCO relayed to her by a buyer in the US.

Undersecretary Edsel Custodio of the Department of Foreign Affairs mentioned that in a recent roadshow on information and communication technology in Saudi Arabia, a special interest on the use of coconut for dissertification control was expressed. The only thing holding the Saudi Arabian government back is the ban on coconut due to a finding in the past on the *cadang-cadang* disease that could negatively affect its palm industry. Nevertheless, the government of Saudi Arabia will send a delegation this year to validate the eradication of the disease.

The Coconut Coir Association representative suggested that the study team should be careful in stressing geotextile as the direction of the industry because current prices are low with Sri Lanka's price as leader quoting only at US$951 per MT, as of May 2005 (Cocommunity Journal, APCC). There is local demand for coco peat that runs to several thousand tons per day.

Other private sector representatives also cautioned the direction for recommending geotextile. Rubberized coir has much higher value than geotextile.

- Inadequate supply of specially trained marketing and sales promotion manpower for dealing with domestic and export market

With reference to Presidential Memorandum Circular No. 25 issued on 2 September 2002 (Directing all National and Local Government Agencies, Bureaus and other Instrumentalities, including Agricultural Institutions and Councils to use Coco Peat or Coir Dust and Coconut Fiber materials for Soil Conditioning and Erosion Control), it is recommended that the DA, DPWH, all national and local government bureaus and their instrumentalities to discontinue the importation of synthetic fertilizers and synthetic geotextile materials and instead use coconut materials and products like coco peat, coir twine, geotextile, needle-felted pads, biologs, wattles, and gabions.

The Indonesians are aggressively selling RDB oil in the US market as cochin oil. This price cutting could snipe the RBD market of Philippine suppliers and may affect the differential in price and the already thin margin of RBDs. Some kind of a Coconut Promotions Board of supplying countries similar to OPEC could be organized with suppliers to stabilize the market.

- Nonharmonization of liberalized trade under EO1016 vis-à-vis product quality standards and nonscreening of counterfeit products
- Discriminatory tariff and nontariff technical trade barriers to sanitary and phytosanitary measures imposed by importing countries.

- Custom and trade regulations as major constraints (14 to 22 days clearing for imports and 8 to 15 days for exports)
- Need for a coco-based Commodity Futures Market focusing on emerging coconut products and industry modernization

The ASEAN Vegetable Oil Council (AVOC) has to be reactivated and/or an ASEAN Coconut and Lauric Oil (jointly with palm kernel oil) Promotion Board has to be created for closer agro-industrial cooperation and trade facilitation. These initiatives may further metamorphose into a Philippine-led coconut-based Commodity Futures Exchange where every aspects of the products and its quality attributes and specifications, packaging, containers, storage and distribution systems are standardized, except the price of the coconut products.

- Laxity in enforcement of product quality standards and weeding out of counterfeit products from the market
- Repetition of the "nata de coco" marketing fiasco

Dr. Teresita Espino stressed the importance of a technical perspective particularly in the production process to prevent a repeat of the "nata de coco" market debacle.

Grading should be done for the different kinds of VCO produced in the market to guide the consumers on the processes particularly the distinction in quality of the first pass and enzymatic no heat extraction directly from fresh coconut meat. Some products pass as VCO yet extracted using heat and on second pass out of the pulp or coconut meal.

- High rates of export rejection on coconut products caused by filth, 0.3%; unspecified process, 61.1%; labeling, 21.5%; additives, 13.5%; and microbiological hazards, 3.5%; of the total 311 cases reported
- Anticoco oil campaign by soybean, corn, and canola lobby groups in the USA and EU

The study team recommended that VCO shipments' precondition for a certificate of product registration (CPR) be issued by only one agency, i.e., BFAD-DOH. Said agency should exercise strict enforcement of standards to weed out counterfeit and mislabeled products.

About the Authors

Simplicio L. Endaya, prior to his recent migration in the USA, was the senior adviser of the Governor of the Board of Investment, where he provided advisory services on investment including project development and management. Prior to that, he was the managing director with a rank of Assistant Secretary for presidential flagships under the Office of the President, where he was in charge of formulating policies for monitoring and implementation of problematic official development assistance (ODA) projects. He was also a consultant of the United Nations Conference on Trade and Development/General Agreement on Tariffs and Trade (UNCTAD/GATT), United Nations Centre for Human Settlements (UNCHS), and Asian Development Bank (ADB). His specialization as a consultant includes project development and management, and identification of industry sectors with export potentials and suitable for promotion of joint ventures.

Mr. Endaya received his Bachelor of Science in Economics from the University of the Philippines and has earned graduate units in Economics and Business Administration from the same university.

Mr. Endaya was selected to lead the team because of his familiarity with how the Board of Investment works, his strong motivation to make an alternative strategy of promoting investments using nontraditional coconut processing activities, and a capacity to work effectively with the rest of the team, particularly Mr. Villegas and Engr. Mecias.

Pablito M. Villegas has had more than 35 years of professional, managerial, and technical services in agricultural, fishery, forestry, and resource development policy and planning; corporate, cooperative, sectoral, and cluster-based and firm/enterprise-focused strategic planning and program and project formulation; development banking and rural finance; project packaging and management; institutional development and support services management (research, extension, and training); agro-industrial development and agri-business management; agrarian reform, agricultural marketing, and cooperatives development; sustainable agriculture, farming systems, and rural development; food security and nutrition policy and planning; agricultural governance and civil service reforms; and poverty reduction and agricultural modernization. He is also an international consultant (ADB, World Bank, Food and Agriculture Organization of the United Nations, United Nations Development Programme) who has had various assignments in many developing countries such as People's Republic of China, Sri Lanka, Nepal, Kingdom of Tonga, Papua New Guinea, Laos, Cambodia, Thailand, Namibia, Malawi, Zimbabwe, Uganda, Cook Islands, Western Samoa, Solomon Islands, Vanuatu, Indonesia, Myanmar, and the Philippines. His global experiences and assignments are concerned mostly with agricultural and rural development, agro-based industrial clustering, rural financial systems, and management and field implementation of agribusiness and agro-industrial projects geared toward food security, sustainable rural development, and poverty alleviation.

Mr. Villegas received his Master of Science in Agricultural Economics from the University of Georgia, USA.

Teresita M. Espino is currently a Professor at the Molecular Biology Laboratory of the National Institute of Molecular Biology and Biotechnology at the University of the Philippines, Los Baños (UPLB-BIOTECH). She is a multi-awarded scientist and researcher. The most notable of her awards are the Gawad Saka Awardee for 1995-1996 as Outstanding Agricultural Scientist given by the Department of Agriculture, and the 2004 Outstanding Microbiologist given by the Philippine Society for Microbiology. Her major research areas involve (1) the isolation, purification and characterization of cellulases and ligninases from fungi; (2) enzymatic and microbial saccharification of lignocellulosic materials; (3) microbial production of food enzymes; (4) bioprocessing of ramie; (5) applications of antibodies for diagnosis of selected plant viral, fungal, and bacterial diseases; and (6) studies on the food and other industrial applications of pectinases, lipases, proteases, and amylases. On the latter, she is well-known for her research work on the utilization of coconut oil as substrate for lipolytic enzyme hydrolysis that produces high-value products such as fatty acids and glycerol that have unlimited industrial production (e.g., pharmaceuticals, cosmetics, food flavor, etc). She has extensive publication in the above areas, either as books, chapters in books, monographs, and articles in local and international journals. She has presented her research works and papers in scientific meetings, both local and international. The relevance and quality of her research work is manifested by the number of national and international research grants awarded to her.

Dr. Espino is a sought-out resource person on the utilization of coconut oil. She declined several offers to do related work in other countries.

She received her Ph.D. in Food Science from the North Carolina State University, USA.

Ildefonso A. Tallada is an agriculturist by profession, with specialization in coconut husk processing, bioengineering, and plantation management. He is currently involved in bioengineering practice, its field applications on slope application on high constructions, installation of coco fiber geo-textiles, coco coir biologs, coir erosion control mats, and the final re-vegetation of eroding slopes. He has established a field production module of coconut husk processing plant at Calauag, Quezon. He has undertaken studies on activated carbon production and granulated coco shell charcoal, and has compiled data on the potential markets and commercial production of coconut coir, coco peat, twine, and geo-textile. He was also involved in the preparation of the integrated coconut processing project for coconut areas from Laguna to Bicol. He was a member of the Philippine delegation to the Province of Hainan, China, which prepared the preliminary investigation of the soil erosion and desertification problem of Hainan, and the potential introduction of coir erosion nets and geo-textiles to the China market.

Mr. Tallada also serves in various capacities in several organizations: (i) member of the Board of Directors of the Coconut Coir Industry Association of the Philippines; (ii) member of the Board of Directors of the Virgin Coconut Producers and Traders Association, Inc; and (iii) member of the International Erosion Control Association. He received his Bachelor of Science in Agriculture from the University of the Philippines at Los Baños, Laguna.

Romulo R. Mesias is a chemical engineer by profession, with extensive research work on coconut products since 1974 up to the present. Some of his research work include the manufacture of activated carbon direct from coconut shell; soap making from coconut oil by the modified cold process; manufacture of methyl ester and ethyl ester, and glycerin from coconut oil; coconut milk processing by the UHR process; manufacture of wall boards from coconut husk; manufacture of coco peat pellets; integrated coconut processing; and production of virgin coconut oil, skim milk, and high-protein sandwich spread from coconut milk. Some of his inventions have been granted Philippine patents such as the furnace for producing charcoal from carbonaceous materials; process for producing edible cooking oil from fresh coconut milk; apparatus for producing activated carbon form carbonaceous materials; and processed volcanic cinders for pesticide carrier.

Engr. Mesias is currently the president of Greca Soap Processor, a position he has occupied since 2001. In the past, he has occupied various positions in private companies either as plant manager, president, chief executive officer, president or chairman of the board. He is a member of the Philippine Inventors Society, Inc.