AGRICULTURAL TRANSFORMATION & FOOD SECURITY 2040

ASEAN Region with a Focus on Vietnam, Indonesia, and Philippines

Philippines Country Report

January 2013

CENTENNIAL GROUP INTERNATIONAL
policy and strategic advisors

Cover Photo Credit:

Farmer, Indonesia: Flickr photo available at http://www.flickr.com/photos/jedavillabali/5014188760/sizes/l/in/photostream/

Tractor, Vietnam: Flickr photo available at http://www.flickr.com/photos/feserc/3307001230/

Market, Philippines: Flickr photo available at www.flickr.com/photos/squeezyboy/2579543345/

Agricultural Transformation & Food Security 2040

ASEAN Region with a Focus on Vietnam, Indonesia, and Philippines

Philippines Country Report

Table of Contents

List of Figures, Tables, and Boxes

Figures

Chapter 2

Chapter 3

Chapter 4

Chapter 6

Chapter 8

Abbreviations

AERR	ASEAN Emergency Rice Reserve
AFTA	ASEAN Free Trade Area
AMIS	Agricultural Market Information System
AMPLE	Agriculture Multi-Market Model for Policy Evaluation
APTERR	ASEAN Plus Three Emergency Rice Reserve
ASEAN	Association of Southeast Asian Nations
ATIGA	ASEAN Trade in Goods Agreement
BULOG	Bureau of Logistics
EAERR	East Asia Emergency Rice Reserve
FAO	Food and Agriculture Organization of the United Nations
FAOSTAT	Food and Agriculture Organization of the United Nations Statistics
FDI	Foreign Direct Investment
GDP	Gross Domestic Product
GHG	Greenhouse Gases
IEFR	International Emergency Food Reserve
IFPRI	International Food Policy Research Institute
IMPACT	International Model for Policy Analysis of Agricultural Commodities and Trade
IPCC	Intergovernmental Panel on Climate Change
KKP-E	Kredit Ketahanan Pangan dan Energi
KPEN-RP	Kredit Pengembangan Energi Nabati & Revitalisasi Perkebunan
KUPS	Kredit Usaha Pembibitan Sapi
KUR	Kredit Usaha Rakyat
PPP	Private-public Sector Partnership
TFP	Total Factor Productivity
VIP	Vietnam, Indonesia, Philippines
WDI	World Development Indicators
WTO	World Trade Organization

Executive Summary

This study focuses on agricultural transformation and food security through 2040 in the Philippines, as part of a broader study on selected countries in the ASEAN region. The objective has been to generate analyses and suggestions that will contribute to planning and consensus building among Philippine stakeholders and development partners towards an overall Vision and supporting strategies that take advantage of opportunities to optimize agriculture sector performance, raise rural incomes, and meet the expected increases in the demand for food over the next several decades.

The study presents the elements of what such a Vision for agricultural transformation and food security might look like in the Philippines by 2040. The Vision is optimistic and assumes that sector reforms and investments are carried out forcefully and early in the period, in the context of sustained, strong overall growth. The last 30 years have not, on average, been particularly impressive for the Philippines in terms of economic growth, which has affected achievements in poverty reduction, however the study posits that the country may now be shifting into a higher growth trajectory, with prospects to move into the ranks of the world's 20 largest economies by 2040. The pace at which convergence takes place will largely determine whether this potential materializes and how broadly the benefits are shared. At the level of the economy, this will be driven largely by productivity change and innovation, adherence to sound macro fundamentals, good governance, an improved investment climate, openness to trade, and a development strategy that ensures broad-based participation in the benefits of growth and therefore substantial improvements in average well-being, expansion of the domestic consumption component of the economy, and movement of a large share of the population into the middle class. Achieving and sustaining convergence will involve inter-related reforms and investments across all sectors of the economy. This study focuses on the drivers at the level of the agriculture sector.

The study begins with an analysis of past agriculture performance, and identifies and discusses a subset of exogenous, policy, institutional and investment issues that are likely to determine the trajectory along which the sector will move over the next three decades, i.e. whether agricultural transformation is sufficiently robust for the optimistic Vision to materialize by 2040. It then explores food security challenges that the Philippines will face as a result of demographic pressures and rising incomes, and analyzes particular issues for the country's main staple crop, rice; livestock and poultry; fisheries; tree crops, horticulture and sugar; livestock and poultry, and fisheries.

Main findings

Agriculture is considerably more important to the Philippine economy than the classic breakdown of GDP by industrial shares would suggest, because these figures capture only the production phase of the value chains. This study estimates that, if manufacturing and service sector activity which is directly dependent on the existence of domestic agriculture and fisheries production is taken into account (i.e., the 'multiplier effect), then the contribution of agriculture and fisheries to the Philippines GDP is probably more on the order of 35–40%, rather than 12% of GDP (2010). Similarly, the share of manufacturing and service sector jobs in the rural non-farm economy and in small towns, together with the agricultural production activities on which they depend directly, may be closer to 45–50% (rather than the 33% normally identified as 'agricultural employment' in labor force surveys).

Long-term sector performance over the last three decades has been fairly weak: following strong growth in the 1970s,

agriculture experienced a sharp slowdown in the 1980s, modest recovery in the 1990s, and continued modest recovery with growth accelerating in some crops and commodities over the past decade. Overall diversification of GVA and agricultural trade have been quite limited, with a small number of products and markets continuing to dominate.

At the same time, there are important strengths: although the Philippines has had a growing net negative agricultural trade balance over the past 15 years, it still obtains most of its food domestically (and is currently making a renewed effort to increase production of its main staple crop, rice). Yields for most major crops are low by East Asian and global standards, but there have been some significant improvements over the last decade, and national averages mask great internal variation: for example, average dry season yields for both irrigated and rain fed palay exceed 5.1 tons/ha in Central Luzon—easily comparable with strong performers elsewhere in Asia—but they are less than half that in the Central Visayas region. The Philippines has been a leader in introducing genetically improved maize, and its average yellow corn yields of 5.4 tons/ha in Central Luzon and 5.2 in Ilocos are on a par with those of China and Thailand, but yields also fall well below those levels in some other regions.

Agriculture in the Philippines today has two faces

One face is modernizing more rapidly due to a relatively high level of adoption of new knowledge and technologies generated from agricultural research, an important part by the private sector. These farms are typified by the fruit export crops where the Philippines is a major player in international trade; fully irrigated and intensively operated rice fields; some hog and poultry farms under contract growing arrangements; parts of the aquaculture, yellow corn and sugar industries; the tuna industry; medium sized root crop farmers; and a small but growing number of salad vegetable and cut-flower producers. There are still serious value chain issues to tackle in each of these subsectors, but generally they employ newer technologies and have better access to transport, telecommunications, market, and financial services.

The other face is modernizing very slowly, and in some cases losing ground. These farms are characterized by their low adoption of modern methods of agriculture production and processing. Many are operated by tenants, sharecroppers, or owners who have insecure tenure or face major legal restrictions in the use of their land. They are often located in difficult areas where access to markets and financial services is made complicated by the absence of all-weather roads, and poor transport and telecommunication facilities. These generally small, multi-commodity farms comprise a substantial part of the country's agricultural landscape, typified by artisanal fishing in municipal waters; upland and rain fed rice farmers, and irrigated farmers in those communal or national systems that are operating with low efficiency; white corn producers; backyard hog and poultry raisers; and small root crop producers. They also include some farmers of minor tropical fruits, the tenanted coconut farms, and some sugar estates and many small sugarcane farms. Poverty in the Philippines is concentrated in rural areas, where 36.7% of the farm population and 41.4% of fishers are below the national poverty line (26.5%). These rates have a great deal to do with the issues that confront this 'other face' of agriculture.

Challenges over the coming decades

Over the next few decades, agriculture in the Philippines will confront several challenges—among these, the country's burgeoning population will require greater food supplies. The scope for expansion of farmland has narrowed, except in some areas suitable for tree crops and agro-forestry, but less so for production of foods regularly consumed by the majority of Filipinos. The profile of production constraints may be altered by climate change and water scarcity in some locations. Although the Philippines continues to obtain most of its food domestically, consumption of the more prominent food items has mostly been increasing. In particular, per capita consumption of rice is high and growing, compared to levels and trends in other developing countries in Asia. How would agriculture evolve over the next few decades in the face of these and other challenges? This study attempts to answer the question, both through qualitative analysis of issues and quantitative support from

several modeling instruments. The latter should not be seen as forecasts per se, but rather as projections of market movements, determined by supply-demand fundamentals. Compared to back-of-the envelope exercises, they offer a more systematic means of imposing internal consistency of assumptions. A series of 'high case-low case' assumptions were explored—others may well want to use the models to test alternative assumptions and questions.

Data constraints complicate the analysis of historical food patterns in the Philippines. Despite considerable effort, resources and professionalism by the National Statistical Office (NSO), Food and Nutrition Research Institute (FNRI) and the Department of Agriculture (DA), differences in methodology, definitions, timing and coverage of the various survey instruments they employ result in some gaps and apparent inconsistencies that complicate the analysis of food patterns. This study drew on data from all three, and also commissioned a special analysis of some aspects of the Family Income and Expenditure (FIES) household surveys that had not previously been done, in an effort to better understand past consumption patterns (particularly rice), as a basis for making forward projections.

Expenditure patterns with regard to food do appear to have changed slowly over the past 50 years, but have held fairly steady during the last decade. The share of total household expenditures on food decreased from about 54% in the early 1960s to 43% by 2003, but since then has remained in the 41–43% range. There is about a 10 percentage point difference between the share of total expenditure on food by urban (lower) and rural (higher) households, and this has held for most of the 50 years, with only occasional widening or narrowing of the difference in some survey years. For the latest survey (2009), 39.5% and 48.7% of expenditures by urban and rural households, respectively, were on food. One important change is that Filipinos have more than doubled the share of expenditures on food eaten outside the home (rather than at home), and this is true in both urban and rural areas. There is no reliable data on the composition of this food.

The greatest change in food consumption has been in the cereals category, with expenditures decreasing by 11–13% (mainly during 1965–2000), led by a 6–8% percentage point decrease in rice expenditures, about 4 percentage points on maize, and a very slight reduction on other grains. The second greatest decrease concerns fish, for which the share of expenditures declined steadily in all survey years and is now 5 percentage points lower than in the mid-1960s. Expenditures on meats have increased 4–5 percentage points, with the biggest growth in prepared (v. fresh meats).

This does not mean Filipinos are eating less rice, rather, the average quantity per capita has increased. The study developed empirical estimates of Engel curves for rice consumption, using the FIES datasets for 2000, 2006, and 2009. Results showed that rice remains a 'normal' good in economic terms and will likely continue to do so under both high and low GDP growth scenarios through 2040, for all but some higher income households. Our analysis suggests that the quantity of rice consumed per capita will rise slightly throughout the period (although the share of total household expenditures on rice will decrease, as incomes rise), after which it will begin to stabilize and move into the 'inferior' goods category.

This poses some major challenges for the Government, as it seeks to think through food security strategies for the next few decades. The Philippines is currently making a major effort to achieve self-sufficiency in rice production by 2013. After examining the gap in recent years and at the present time, the study accepts that the Philippines may possibly achieve rice self-sufficiency in the near term—whether in 2013 or a later year will depend a lot on the vagaries of weather and unforeseeable natural disasters, which are a factor in the Philippines that can always affect the best plans. At the same time, considering the long-term implications of population growth, our findings on the likely increase in per capita rice consumption throughout the period, and limits on water and land availability, the study explores the implications of sustaining the self-sufficiency strategy through 2040.

As trade in rice shifts over the long-term from current quantitative controls to tariffication and gradual liberalization exposing producers to greater competition, productivity growth will be critical. As mentioned above, average

yields in parts of Central Luzon are comparable to those of countries from which potential imports would likely come, and they can be raised further to the 6.5–7 ton level, even considering the impacts of climate change and water scarcity in parts of that region. Other parts of the country face bigger productivity issues, but can also substantially improve yields with proper support, including improved seeds, increased application of nutrients, irrigation, better access to all-weather infrastructure and telecommunications, reliable rural financial services and risk mitigation instruments. These, in turn, will require the combined efforts of a strong, well-funded and well-coordinated agricultural research and technology generation system, and an effective combination of public and private extension services.

Productivity improvements will be needed not only at production, but in all phases of the rice value chain—and this is true as well for other crops and commodities, where reduction of post-harvest/post-slaughter/post-capture costs will be essential for improving producer incomes while keeping consumer prices down. Other changes will be needed to reflect the growing share of Philippine consumers who will be purchasing their foods in supermarkets, as well as changes in expectations for quality and standards by both national consumers and those in the Philippines' main export markets

The issue of land policy constraints also arises in the vast majority of value chain analyses carried out for different crops in the Philippines. The objectives of restructuring societal relations, achieving a significant asset transfer and raising rural incomes were central to the design of the current agrarian reform program. While implementation has achieved some of these goals, the results are uneven. Some 25 years later, the inability of many agrarian reform beneficiaries (ARBs) to use land as they may chose, in terms of selling, leasing, or putting it up as collateral, and of those who are interested in operating farms of more than 5 ha to do so, appears to be inhibiting rather than improving the well-being of many ARBs and the agriculture sector more generally. Uncertainties surrounding the implementation of the program have depressed incentives to invest and willingness of the financial sector to engage more fully in agriculture—and therefore have retarded the rate of productivity improvement. Whatever the past merits of these restrictions, they need to be re-examined in the light of contemporary conditions and structural, demographic and technological changes of the coming decades.

Demand for both livestock and poultry products will increase, but Philippine producers will also face stiff competition in capturing part of that growth, as domestic production costs are above those in the main exporting countries (e.g. Thailand, Brazil). The ruminant sector has changed drastically over the last 25 years due to land reform; the poultry sector through large-scale local and foreign investment; the pig sector is still fragmented and mainly centered in backyards. As retail prices for pork and poultry are above world prices, technical and real smuggling occur. On the (very) positive side, per capita consumption of livestock and poultry are still relatively low in the Philippines compared with a number of other middle income countries, and the population growth rate is high—so there is a large and growing domestic market, if local producers can increase their competitiveness through application of latest technologies and by reorganizing to take advantage of specialization and economies of scale. As 60–70% of livestock producer costs are driven by feed prices, this will also depend on the ability of the domestic maize sector to accelerate the pace of yield improvements it has realized over the last decade, or lose market share. Change will largely be private sector-driven. If pork and poultry costs are reduced sufficiently and quality standards met, the Philippines could also export to nearby markets, as it is free from HPAI and FMD.

Population growth and rising incomes will increase local demand for sugar, as will domestic biofuels/ethanol targets (for which sugar is the main feedstock)—the question will be whether this demand is met through robust local production or increasing sugar imports in the post-2015 trade liberalization period. The Philippines risks losing some of the area under sugar production as trade reform advances, with possible conversion to lower value crops and loss of employment, depending largely on how the land reform process is managed in the next couple of years. Productivity of smaller sugar farmers is presently lower on average

than rates achieved by the plantations, and therefore it will be extremely important to avoid parcelization of sugar lands subject to expropriation by keeping them organized as large management units. There are initiatives underway to encourage smallholder block planting, but the scale on which this is happening is not commensurate with the challenge.

Finally, the Philippines has considerable potential for tree crop development that will require private investment on a scale that will likely materialize also only after land-related issues are resolved. As much of the potential is centered in Mindanao, political resolution of conflict issues is also critical (after which tree crops and other higher value agriculture development can play an important role in sustaining peace). Opportunities exist to scale up rubber, oil palm, coffee and cocoa much above the current rate of growth, with much of the expansion in currently degraded forestlands, with important environmental benefits. Should this potential materialize, the Philippines would still be a relatively small player in regional and global markets for these commodities, but export, income and employment benefits would be significant. There is also scope to intensify coconut yields through fertilization and replanting, embark on major intercropping (especially cocoa) and engage actively in the development of new coconut products. This study strongly recommends an ambitious program in this regard, inasmuch as the majority of the poorest rural households are involved in coconuts; the potential rural poverty reduction benefits are therefore large; and this is one commodity for which financing should not be an issue if decisions are made about strategic use of the 'coconut levy' funds.

Some quantitative assumptions and forecasts of the optimistic Vision

To analyze the possible high and low case quantitative scenarios for agriculture in the period through 2040, the study used the Centennial Global Growth Model to set economic parameters—what might the incomes and consumption look like under sustained high growth for the next several decades, what might it look like if slower growth prevailed, and how does this affect the agriculture sector? Within these two economic scenarios, the Agriculture Multi-Market Model for Policy Evaluation (AMPLE) was used for crop and commodity forecasts. AMPLE had been earlier applied for assessing productivity growth in the Philippines; for this study, the model was updated, revised to improve some aspects, and applied over an extended time horizon (2009–40). It offers a systematic framework for testing assumptions and generating projections on production, area (for crops), consumption, imports, exports and prices.

The optimistic Vision scenario assumes the Philippines would realize sustained average GDP growth of about 5.9% p.a. throughout the period, with overall TFP in the range to propel the country into the ranks of middle class converging economies. Real agricultural GDP growth would average about 3.5% or better, also with higher TFP rates (varying by crop/commodity). Because of the differential between overall and sector GDP growth, agriculture's share would fall to about 5% of GDP by 2040, but due to its multiplier effects, agriculture would continue to drive a greater 10–15% of the national economy.

The scenario analysis indicates that it will be feasible for the Philippines to meet the growing demand for food and other agricultural products, which will be stimulated both by population growth and rising purchasing power of households.

While some food items become more expensive (e.g., swine and some fish products), others enjoy enough supply growth so that their affordability improves, including among micronutrient sources (fruits and vegetables). However, this hinges critically on the rate of productivity growth; at slower rates, more exceptions to improved affordability of food can be expected.

Per capita consumption of most food items would also rise gently, with the significant exception of fish products, where simply arresting the long-term decline in consumption will be a very positive achievement. Under the lower case scenario, however, fish consumption continues to decline, with negative impacts on the incomes of extremely poor fisher households and on consumer nutrition more generally.

The long-term structure of production underscores the increasing prominence of livestock and poultry products in the sector; fisheries would be dominated by aquaculture owing to stagnant productivity growth in capture systems.

Among crops, the structure of production would evolve, but with slower growth (the more pessimistic scenario) the changes fall short of transformation. Sharper structural changes are observed for the optimistic scenario of faster income growth, with a decline in the relative area shares of some traditional crops, particularly rice and corn, and important increases in tree crops and non-traditional and higher value food crops and exports.

How would the optimistic Vision look? Some structural, policy and institutional highlights

Food consumption patterns would continue to change, though more gradually than in some other Southeast Asian economies. In particular, rice would remain an important component of the diet, with per capita consumption increasing slightly through 2040, before it stabilizes and begins to decrease, though the share in household expenditures would decline as incomes rise. Though the Philippines will pursue self-sufficiency in the near-term, the longer-term policy approach would move towards a mixed domestic production cum trade strategy, eventually importing about 25% of requirements for food and other uses, entirely through the private sector. As the share of household expenditures on rice decreases, consumers' ability to withstand occasional short-term price spikes would improve, but the Government would keep in place a strong safety net for families at the low end of the income distribution. If needed, the Government would manage greater volatility through instruments such as variable tariffs, rather than seeking to itself provide rice physically to local markets. The Government may consider participation in an ASEAN regional stock arrangement, but would also ensure a domestic stock for emergencies, stored mostly by the private sector and producers.

While aggregate agricultural employment would decline, the trend would be accompanied by an important shift to higher paying jobs, particularly in tree crops and higher value agriculture. The rural-urban wage differential for unskilled workers would narrow; labor scarcity would nonetheless emerge as an issue in selected areas, though less serious than in neighboring countries because of the Philippines relatively higher population growth rate. Gender gaps in agricultural earnings and working conditions would have been eliminated.

Strong institutions would emerge to manage and enforce food quality standards, protect the interests of Filipino consumers and facilitate penetration of export markets.

The land reform process would have been completed, and land markets freed to operate among willing participants. Land consolidation and farm mechanization would become important in some areas, and land leases would be common. Small farms would continue to dominate, but there would be widespread diversification in terms of modes of operation: small farms, centralized management, contract farming, joint ventures, etc. Group titles would have been transferred to individuals in the lowlands; ownership of degraded uplands would be transferred to the community-based organizations that now lease them, under appropriate land use regimes; investors would be permitted to operate nucleus estates within such schemes. Restrictions on foreign ownership of land would have been eliminated, again within appropriate land use requirements.

The contraction in private lending to agriculture would be reversed; and private equities, banks and financial institutions such as insurance companies and pension funds would be active in agricultural downstream and agribusiness project finance. The public sector would continue to play an important role in ensuring access to rural financial services for smallholders, but mainly through regulation, guarantees, insurance and other risk management instruments. GFI roles would have been streamlined and consolidated, but there would still be at least one public bank.

There would be good physical and communications connectivity across islands and the countryside. The national and communal irrigation systems would be working well, managed by irrigator associations and producing cropping intensities of 1.7–2.0, including rotation with horticulture

crops; a streamlined NIA would provide state of the art technical advice and just-in-time interventions as needed, especially in response to disasters.

Sustained investment of about 1% of GDP in agriculture research and technology development would be underpinning higher sector TFP rates; the role of the private sector would have increased; and the environment for agricultural innovation based on biotechnology would be friendlier. The private sector would be the dominant provider of extension services, and widespread internet connectivity would facilitate direct two-way messaging and technology advice between producers, generators and managers of knowledge.

A better educated population would place more emphasis on qualifications and experience in electing leaders, holding government more accountable for results. In that context the civil service would have been remodeled towards meritocracy. Investments in monitoring, evaluation and data collection systems would have paid off, and the Philippines would have the capacity at both the national and subnational-government levels to formulate realistic short/medium/long term plans for agriculture, measure results and make course corrections in a timely and transparent manner.

Achieving the Vision will involve a myriad of inter-related reforms and investments in the coming years, but strategic choices in ten areas will be especially important: (i) concluding the land reform process and modernizing land markets; (ii) adjusting for weaknesses in the Local Government Code in the areas of agricultural extension, communal irrigation, water resources, fisheries, and the rules governing fiscal transfers to LGUs; (iii) fast-tracking the institutional rationalization process at the national government level; (iv) opening to foreign investment and trade; (v) adapting to climate change and climate variability—the 'new normal'; (vi) placing poverty reduction and income growth at the center of food security policy, and relying on social safety nets to handle occasional market failures; (vii) placing total factor productivity growth at the center of agricultural transformation policy, with attention to the entire value chain; (viii) shifting the focus from agricultural credit to financial services and risk management; (ix) modernizing water resource management; (x) raising public and private capital formation in all phases of the value chains. These are elaborated in Chapter 9.

This study is part of a broader review of agricultural transformation and food security prospects through 2040 in the ASEAN region, with a focus on Vietnam, Indonesia, and the Philippines (VIP countries). Specific objectives of the ASEAN study are to:

1. Review trends in agricultural over the past 30 years in Vietnam, the Philippines, and Indonesia, with particular emphasis on food security policies.

2. Generate analyses and suggestions that will contribute to consensus building among ASEAN countries and development partners on agricultural transformation and food security strategies in the region; and

3. Outline a vision for agriculture in VIP countries in 2040 and related strategies to take advantage of opportunities to improve agriculture sector performance, reduce rural poverty, and meet the expected increased food demand through that period.

Within the above mandate, this volume focuses specifically on agricultural transformation and food security issues in the Philippines. The Philippines' agriculture sector has many characteristics in common with other ASEAN countries: sector contribution to GDP growth is declining, but a significant share of the population is still employed in farming and fishing; a majority of the poor live in rural areas and, of these, the largest proportion is engaged directly in agriculture; non-farm activities are growing in importance as the primary pathway out of rural poverty; value added is dominated by the crops subsector, and rice in particular; and important shares of manufacturing and services are dependent on agriculture and therefore the sector's low and declining share of GDP belies its true importance to the national economy.

Chapter 1. Introduction

This study is part of a broader review of agricultural transformation and food security prospects through 2040 in the ASEAN region, with a focus on Vietnam, Indonesia, and the Philippines (VIP countries). Specific objectives of the ASEAN study are to:

1. Review trends in agricultural over the past 30 years in Vietnam, the Philippines, and Indonesia, with particular emphasis on food security policies.

2. Generate analyses and suggestions that will contribute to consensus building among ASEAN countries and development partners on agricultural transformation and food security strategies in the region; and

3. Outline a vision for agriculture in VIP countries in 2040 and related strategies to take advantage of opportunities to improve agriculture sector performance, reduce rural poverty, and meet the expected increased food demand through that period.

Within the above mandate, this volume focuses specifically on agricultural transformation and food security issues in the Philippines. The Philippines' agriculture sector has many characteristics in common with other ASEAN countries: sector contribution to GDP growth is declining, but a significant share of the population is still employed in farming and fishing; a majority of the poor live in rural areas and, of these, the largest proportion is engaged directly in agriculture; non-farm activities are growing in importance as the primary pathway out of rural poverty; value added is dominated by the crops subsector, and rice in particular; and important shares of manufacturing and services are dependent on agriculture and therefore the sector's low and declining share of GDP belies its true importance to the national economy.

At the same time, several features distinguish the Philippines. The country's already large population is growing faster than that of most neighbors, with the result that the Philippines is moving up in the ranks of the world's most populous countries, currently in 12th place and likely to be in 9th by 2040.[1] The absolute share of the population in urban areas and the rate of urbanization are both higher than regional averages. Despite a growing middle class, rice consumption continues to rise, even though domestic retail prices have been increasing and exceed world market levels. The rates of forest and marine coastal resource degradation have been more rapid than elsewhere in East Asia, and the Philippines is classified among the 10 most vulnerable countries globally to both natural disasters and climate change impacts. Overall GDP growth rates, agriculture sector performance, and productivity of rice and other key crops have lagged below regional averages for most of the past several decades, with Philippines having recently become one the world's largest importers of rice. Agricultural export growth and public and private investment are well below regional averages. The approach to fiscal decentralization to LGUs may be exacerbating rather than helping to close differences in agricultural performance and rural poverty.

Population pressures and weak domestic agricultural performance, combined with uncertainties about the global market's ability to meet the Philippines' heavy import requirements at affordable prices, have fueled policy makers' anxiety over food security and the pursuit of self-sufficiency in rice. This objective has dominated public expenditure decisions, reducing the volume of investment available for core services and other agricultural subsectors, including some with higher value added potential. Other issues emphasized in relevant literature concern the institutional

1 Based on United Nations Population Division medium variant demographic projections.

fragmentation and overlapping mandates among sector institutions, and between national and sub-national governments; business climate, logistics and behind-borders trade constraints; insufficient financial intermediation and financial services (including financial risk management instruments) for agriculture, particularly for small farmers; an incomplete land reform process, uncertainty about its future, and related disincentives for investment; water investment, management and regulatory issues affecting irrigation efficiency; serious transport bottlenecks; and a general need to shift policy attention and investment efforts from a traditionally heavy focus on production to other stages in the agricultural value chain, both for the Philippines' main subsectors and newer high value agriculture and fisheries activities.

While climate, geography and natural resource endowments certainly account for some of the Philippines' agricultural performance 'story' over the past three decades, policy choices and institutions have played an even greater role in driving outcomes. The study explores the long-term challenges and opportunities for agricultural transformation in the Philippines over the next three decades, with an emphasis on strategies that can help to maximize the sector's contribution to national poverty reduction and food security objectives.

The Philippines country study is organized according to the following structure

The Executive Summary above synthesizes main findings (for the Philippines; regional findings and recommendations are included in a sparate Overview volume).

The study focuses on opportunities for agricultural transformation and ensuring food security in the Philippines over the next 30 years and therefore, to set the stage, Chapter 2 looks retrospectively at trends over the past 30 years with respect to agriculture sector performance, rural incomes and poverty.

Chapter 3 discusses a set of cross-cutting issues that will have an influence in the years ahead across agricultural sub-sectors, including demographic patterns; macro-economic performance; total factor productivity and innovation; governance and the investment climate; land reform and land markets; rural financial services and risk management; natural disasters, climate change and climate variability; water balances and irrigation; and public sector institutions decentralization and implementation capacity. The study does not attempt to cover all agricultural sub-sectors, but rather focuses on those with broader strategic implications for sector growth, incomes, poverty reduction and/or food security.

Chapter 4 looks at the main food security issues facing the Philippines. It analyzes production and consumption patterns in the Philippines' main staple crop, rice, presenting findings of a special analysis made of the Philippines household surveys to further understanding of consumption patterns and elasticities across rural and urban income groups and implications for demand over the next three decades.

Chapter 5 analyzes the Philippines' significant potential for development of tree crops and other high value agriculture, horticulture, and issues faced by the sugar sector in the near term.

Chapters 6 and 7 deal with the livestock and fisheries subsectors, respectively.

The concluding chapters integrate the implications of the Vision for agricultural transformation and food security through 2040, from different perspectives. Chapter 8 presents quantitative scenarios[2] of high and low case performance. The Centennial Group's Global Growth Model was adapted for this study to illustrate some of the implications of higher and lower growth in GDP and total factor productivity on consumption patterns and other outcomes relevant to the rural sector. Those parameters are then used as inputs to the Philippines specific Agriculture Multi-Market Model for Policy Evaluation (AMPLE) that was updated and fine-tuned for purposes of this study.

2 Throughout the study there are various references to scenarios, variously described as high and low case, optimistic and pessimistic. The optimistic or high scenarios are understood to be synonymous with the Vision.

Finally, Chapter 9 offers a more qualitative exposition of the Vision of the Philippines agriculture sector by 2040, exploring the institutional and policy choices that will have been needed to bring that about.

Chapter 2. The Philippines Agriculture Sector: Structure, Trends, and Performance, 1980–Present

Direct and Multiplier Effects of Agriculture on the Philippine Economy

In general, the last period of rapid growth of Philippine agriculture was the 1970s. Since then, as has happened in many countries, the relative economic importance of the sector has decreased steadily, to only about 13% of GDP in 2011 (Table 2.1).[1]

Table 2.1: Share of GDP by industrial origin (%)

Sector/Year	1970	1980	1990	2000	2010	2011
Agriculture	29	25	22	14	12	13
Industry	32	39	34	34	33	30
Services	39	36	44	52	55	57

Source: World Development Indicators.

However, this understates the importance of agriculture and fisheries to the Philippine economy, because the figures capture only the production phase of the value chains. If the share of manufacturing (e.g. food and beverage industries) and service sector activity that is directly dependent on the existence of domestic agriculture and fisheries production is taken into account, then a different picture emerges. Cross-country studies show that modern agribusiness (including—besides the production activities reflected in standard GDP data—input supply, farming, processing and marketing, logistics, distribution and support services) has important multipliers. In its 2008 World Development Report on Agriculture, the World Bank estimated the magnitude of these multipliers for several countries. In Thailand, while agriculture accounted for only 11% of GDP, agribusiness was estimated to contribute about 43%; in Malaysia, results were 13% and 36%, respectively; and in leading agribusiness countries in Latin America, 10% and 30% (World Bank, 2008). Applying similar methodology to supply and utilization data drawn from the Philippines national accounts (2010), this study estimates that the share of modern agribusiness (as defined above) in the Philippines is probably on the order of some 35–40 percent of GDP (Table 2.2).

Table 2.2: Agriculture, agribusiness, and multipliers

country	agriculture as % of GDP (A)	agribusiness as % of GDP (B)	multiplier (B/A)
Indonesia	20	33	1.6
Malaysia	13	36	2.8
Thailand	11	43	3.9
Argentina	5.6	32.2	5.8
Brazil	7.5	26.6	3.6
Chile	8.5	32.1	3.8
Costa Rica	12.8	32.5	2.5
Philippines	12.3	35–40	2.8–3.33

Source: Thor all countries except Philippines: World Bank, World Development Report (2008); Philippines multiplier estimated by Centennial using 2010 national accounts data.

Similarly, the share of jobs that are dependent on the existence of a healthy domestic agriculture sector and the non-farm rural economy linked to it is probably closer to 45–50% than to the 33% figure normally identified as agricultural employment.

1 In 2008, the Philippines revised its national accounts, shifting the base year from 1985 to 2000 (see Technical Paper on the Major Revisions on the Philippine System of National Accounts: Implementation of the 2008 System of National Accounts (TP20120412-ESO-1), April 13, 2012. This had an impact on the shares of GDP by industrial origin, lowering that of agriculture, forestry and fisheries, relative to industry and services, and within manufacturing, the share of the food and beverage industry (by differing amounts, depending on the period and distance from the 2000 base year). For that reason, caution needs to be exercised in comparing literature and analyses carried out at different times. The old PSNA series from 1946 is being linked with the new series. Where possible, this study uses the new series and the World Development Indicators, although for some long-term trend and/or crop specific information, the 1985 constant price series is used because information based on the new price series is not yet available in the detail needed. However, despite differences in absolute amounts, the direction of change is generally similar.

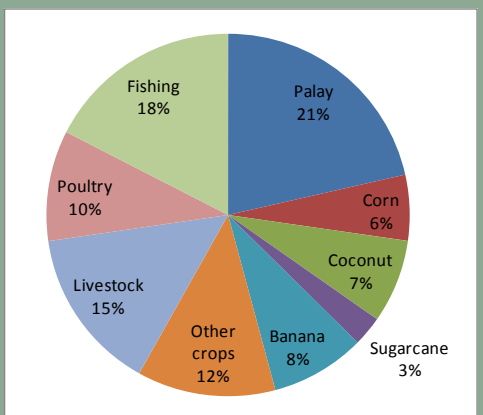
Following a period of strong agricultural growth in the 1970s, the sector experienced a sharp slowdown or even decline in the 1980s, modest recovery in the 1990s, and continued modest recovery with growth accelerating somewhat in the past decade (Table 2.3). The significant exception is fisheries, which enjoyed its highest growth so far in the past decade, due to the rapid expansion of aquaculture, particularly seaweeds. Over half of agricultural output is obtained from crops; the traditional crops, namely palay (palay rice), corn, coconut, and sugarcane, account for nearly 65% of crop value added. The share of poultry and livestock is about a quarter of GVA, while fishing accounts for just under a fifth (Figure 2.1).

TABLE 2.3: PRODUCTION GROWTH RATES

	1970s	1980s	1990s	2000s
palay	4.2	2.6	3.9	2.5
corn	5.2	3.5	0.1	3.9
coconut	7.3	–4.6	0.6	1.9
sugarcane	4	–1.6	3.9	0.5
banana	13.8	–3.5	5.4	6.4
other crops	8.9	1.5	1.1	1.2
livestock	0.8	5.9	3.9	1.8
poulty	10.5	6.5	5.5	3
fishery	4.1	3.9	1.9	5.7
total	5.4	2.1	2.4	3

Source: BAS.

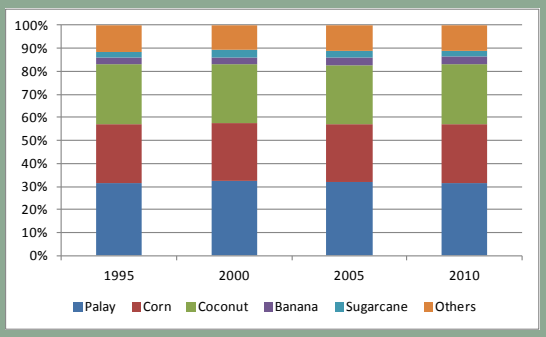
FIGURE 2.1: SHARE OF AGRICULTURE PRODUCTION



Source: BAS.

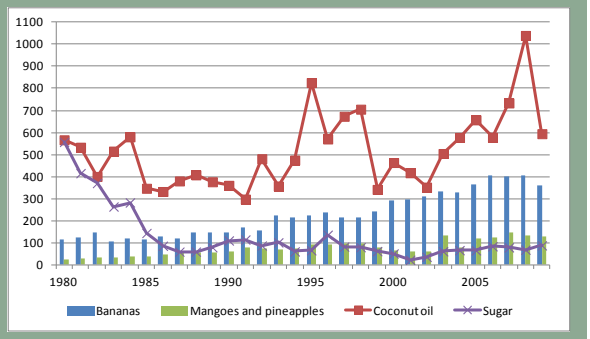
Traditional crops also account for the bulk of area harvested (Figure 2.2). Contrary to diversification trends in other countries, the relative importance of the traditional crops has not decreased over time (Briones and Galang, 2012). Nevertheless, some non-traditional crops, especially banana, mango, and other fruits, and non-traditional fisheries (aquaculture) that have exhibited the most dynamic export performance (Figure 2.3).

FIGURE 2.2: SHARES IN TOTAL AREA HARVESTED OF THE MAJOR CROPS, 1995–2010 (%)



Source: BAS.

FIGURE 2.3: VALUE OF EXPORTS OF TOP EXPORTED CROPS, 1980–2010



Source: BAS.

There has been relatively little change in the basic structure of GVA during the past four decades. The crops subsector continues to dominate, at about three-fifths of total GVA. Rice remains the most important crop, with GVA oscillating in the 15–17% range. Despite the common perception of fisheries as a fast-growing subsector, its overall share of

Table 2.4: Gross value added as a share of total agriculture and fisheries, 1980–2010 (%)

sector/ subsector	1969–1970	1979–1980	1989–1990	1999–2000	2009–2010
crops	62	64.1	58.3	59.4	60.4
palay	15	12	16	15.8	16.7
corn	4.8	5.1	7.5	4.5	5.2
coconut	9.6	10.5	5.8	4.9	4.9
sugar	6.3	4.7	3.2	2.8	2.5
bananas	2.3	2.6	2.2	3.5	6.5
other crops	24.1	29.2	23.6	27.9	24..6
livestock & poultry	21.3	13.5	19.1	21.4	20.1
livestock	16.8	8.4	12.4	13.5	12.6
poultry	4.5	5.1	6.7	7.9	7.5
fisheries	16.6	17.4	18.2	14.6	14.9
ag services	--	4.9	4.4	4.5	4.6

Source: World Bank (2010). Philippines Discussion Notes: Challenges and Options for 2010.

GVA actually decreased slightly over the past 40 years and there has been little aggregate change in the last 10 years (although within fisheries, seaweed-based aquaculture has increased at the expense other categories). The aggregate contribution of livestock and poultry remained fairly stable, with the relative shares of poultry increasing and livestock decreasing. It is important to note that these (mostly minor) long-term changes in overall structure occurred within the context of a sector that itself is contributing a decreasing share to overall GVA in the Philippines.

There are, however, significant differences in the relative economic importance of the various subsectors and crops/activities among the Philippines' three regions. For example, 57% of rice is produced in Luzon; 56% of corn and 59% of coconuts in Mindanao; and 65% of sugar in the Visayas. Luzon accounts for most inland fishing (66%), while marine and aquaculture are more significant in both Luzon and Mindanao. Nonetheless, as with national aggregates noted above, regional production and value added patterns have not changed significantly over the past several decades.

A small number of products and markets account for most of the Philippines' agricultural trade. Approximately two-thirds of the total value of agricultural exports (2008–10 average) came from six activities: coconuts 31% (oil, 26%; and desiccated coconut, 5%), tuna 9.7%, fresh banana 9.6%, pineapples 6.8%, tobacco 6% (manufactured 3.6%, unmanuf.2.4%), and seaweeds 3.4%. Except for seaweed, more than half the value of each of these main exports goes to three countries or less, mainly outside of Southeast Asia:

Table 2.5: Principal Philippine exports and destination countries, 2008–10

export	principal destination
coconut	Netherlands (39%), United States (32%)
tuna	United States (25%), Germany (13%), United Kingdom (11%)
banana	Japan (53%)
pineapple	United States (54%)
tobacco	Korea (36%), Thailand (27%)
seaweeds	United States (17%), Germany (9%), Belgium (8%), Spain (7%), France (7%)

Source: BAS.

Rice has accounted for an average 22% of the total value of agricultural imports during the past three years, followed by wheat (9.8%), dairy products (7.6%), soybean oil and cake (6.3%), and fertilizer (4%). Half or more of the value of each of these imports is sourced from only two countries:

Table 2.6: Origin of imports

import	principal origin
rice	Vietnam (74%), Thailand (19%)
wheat	United States (54%), Canada (15%)
dairy	New Zealand (42%), United States (24%)
soy products	United States (50%), Argentina (46%)
fertilizer	China (31%), Japan (18%)

Source: BAS.

The Philippines' net agriculture and fisheries trade balance has been negative over the past decade (averaging -$3.3 billion during 2008–2010). The largest negative trade balance is with the ASEAN region, owing to high rice imports, mainly from Vietnam,[2] and very low exports to member

2 The Philippines is importing much less rice in 2012, as it finishes drawing down excess stocks that it acquired over the past several years.

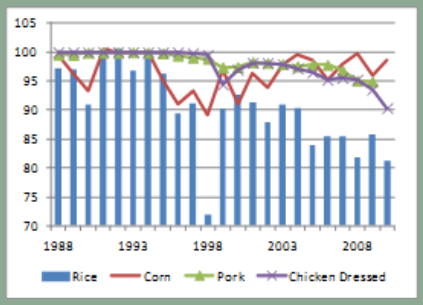
countries. The Philippines also runs a small negative trade balance with the European Union, Australia and the United States, and a small positive balance with Japan.

Table 2.7: Agricultural trade balance, 1995–2010

year	exports (USD, F.O.B.)	imports (USD, C.I.F.)	trade balance (USD, %)	
1995	2,499	2,619	–120	–5
2000	1,982	3,106	–1,123	–57
2005	2,691	3,986	–1,295	–48
2010	4,101	3,298	–3,298	–80

Source: BAS.

Figure 2.4: Self-sufficiency ratios of major food items, Philippines 1990–2010 (%)



Source: BAS.

The Philippines shifted its position from net food exporter to net food importer in the late 1980s. Nevertheless the country continues to obtain most of its food domestically. Consumption of the most prominent food items has mostly been increasing (fish products being a notable exception). In particular, consumption of rice is high and appears to still be growing, compared to levels and trends in other developing countries in Asia. Figure 2.4 presents the food self-sufficiency ratio (SSR)[3] for major food items. The SSR in rice has fallen markedly since the early 1980s, now at below 85%, despite various efforts to shore up self-sufficiency in the country's main staple product. The current government has adopted 2013 as its target year, and this study explores the implication of this and other strategic food security issues.

Yields, particularly (though not exclusively) for the Philippines' main food crops are low by international standards. The yield per ha of palay/rice averaged 3.62 mt in 2010, ranging from 3.99 mt for irrigated and 2.81 mt for rain fed production. Overall palay yields did rise steadily during 2000–07 (from about 3.2 mt to just over 3.8 mt), but then declined in 2008–09 and appear to have stabilized and then increased slightly in 2010–11. It is important to note, though, that yields vary considerably across regions: the average for all palay (wet and dry season) ranged from 4.3 mt/ha in Central Luzon and 4.2 mt in Davao, to 2.7 mt in Central Visayas. There is also great variation between farmers who have adopted SRI (system of rice intensification) and those who have not.

The maize average area harvested is about evenly divided between white corn (52%, mainly for human consumption) and yellow (48%, mainly livestock) (2008–10). The share of yellow corn has been increasing and presently accounts for some two-thirds of the volume of production. There is a marked differential in average yields: white corn, 1.64; yellow corn, 3.64. Both are low in comparison with international averages (for example, China's yellow corn yields are 5 mt/ha), and survive largely due to high tariff protection. As with palay, however, there is very great variation across regions: for yellow corn, from yields averaging 5.4 in Central Luzon and 5.2 in Ilocos (i.e. fully competitive with China and Thailand), to under 3.0 in the Visayas, Bicol, Davao and Calabarzon.

With only a very few examples (e.g. pineapples), productivity and value chain assessments routinely find that yields of other Philippine crops are also below regional and/or international levels. This may partly be explained by the fact that the Philippines has a relatively low proportion of cropland under irrigation compared with other Asian, East and Southeast Asian countries; and also uses relatively less fertilizer per ha of arable land than the regional average (Table 2.8). About half of irrigated lands are part of the national irrigation system, 36% are communal systems, and 14% is private. In terms of geographic distribution, 66% of irrigated lands are in Luzon, 11% in the Visayas, and 23%

3 SSR = production/(production + imports – exports).

in Mindanao (see further discussion of water resources and irrigation in Chapter 4).

In very broad terms, agriculture in the Philippines today has two faces

Table 2.8: Irrigation and fertilizer use in Philippines and comparator regions/countries

region/country	irrigated area, 2008 (% cropland)	fertilizer use, 2007 (kg/ha arable land)
Asia	41	176
East Asia	52	331
Southeast Asia	22	162
Philippines	15	141
Indonesia	18	170
Thailand	34	117
Vietnam	49	425

Source: FAO.

One face is modernizing more rapidly due to a relatively high level of adoption of new knowledge and technologies generated from agricultural research, an important part by the private sector. This is the agriculture of some small, but mainly medium to larger farms with better productivity, generally located in more favorable environments. These farms are typified by export fruits (Cavendish bananas, pineapples, mango farms); fully irrigated and intensively operated rice fields; some hog and poultry farms under contract growing arrangements; parts of the aquaculture industry, especially tilapia and milkfish; parts of the yellow corn industry; parts of the sugar industry; the tuna industry; medium sized root crop farmers; and a small but growing number of salad vegetable and cut-flower producers. There are serious value chain issues for each of these subsectors, but generally they have better access to transport, telecommunications, market, and financial services. Despite the greater dynamism of these 'modernizing' farms, however, efficiency is mixed: some are clearly competitive by any international standards, but many produce yields that, while improving, are still below regional and global standards and are profitable mainly because of trade protection.

The other face is modernizing very slowly and is characterized by a low level of adoption of modern methods of agriculture production and processing. These are the generally small, multi-commodity farms that comprise a substantial part of the agricultural landscape of the country. Their productivity is low; many are operated by tenants, sharecroppers or producers with very insecure tenure; they are often located in difficult areas where access to the market and financial services is made complicated by the absence of all-weather roads and poor transportation and telecommunication facilities. These farms essentially compose the "agriculture of the poor" typified by artisanal fishing in municipal waters, upland and rain fed rice farmers, irrigated rice farmers in communal or national systems with low operating efficiency, white corn producers, backyard hog and poultry raisers, and small root crop producers. They also include farmers of minor tropical fruits (jackfruit, avocado, guava, etc.), the tenanted coconut farms and some sugar estates and farms. Yields on non-modernizing farms are extremely low by international standards, and in some cases appear even to be stagnating.

The agriculture sector and Philippine society in 2040 will be shaped by the mega forces of population growth, climate change, technology and globalization. The pace of change in agriculture sector growth, employment and trade (and therefore rural poverty reduction and food security) will largely be driven by the pace of productivity and technological change across the two 'faces' of agriculture described above.

The share of public expenditures allocated to agriculture has been low, and concentrated on domestic food crops, particularly rice. From the early 1980s through 1995, government expenditures on agriculture averaged only about 3.2% of GVA in agriculture; this increased to about 4.5% from 1996–2005; and to 8.2% from 2006–2011 (David, 2009; BAS). The increase in recent years largely reflects increasing expenditures associated with the rice self-sufficiency program and rice imports, although a variety of other activities have also benefited to some degree.

Most of the land designated as suitable for agriculture (9.7 million ha, or 33% of the country's total land area of 29.5

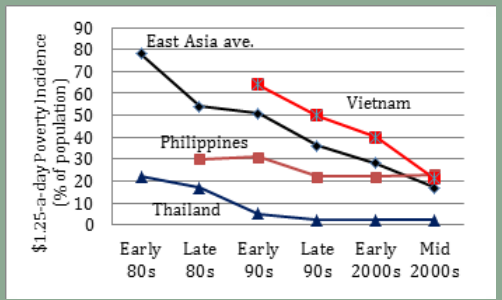
million ha is classified for agriculture) is already under some form of production. However, a very significant share of the 19.1 million ha classified as forests (64.5% of total land area) consists of degraded forest areas that would be suitable for tree crop development, of the kind that neighboring countries have enjoyed. There are also large areas on coconut farms that are well suited for intercropping that is not presently taking place. From that perspective, the 'agricultural frontier' for annual crops has virtually been exhausted in the Philippines, but is not as tight for selected kinds of development, in particular tree crops (discussed more fully in Chapter 6).

Income Distribution and Poverty

Poverty reduction in the Philippines has occurred more slowly than elsewhere in East Asia. This is partly attributable to the Philippines' high rate of population growth, relatively slow economic growth by regional standards, and persistently high-income inequality, which reduces the income elasticity of poverty. According to World Bank Development Indicators, the Philippines had the most unequal income distribution among East Asian middle-income countries during 2002–08 (Gini coefficient of 44, compared with 39 in Indonesia and Vietnam, and a regional average of 41).

Poverty in the Philippines is concentrated in rural areas. Whether measured by the Philippines national poverty line, or cross-country indicators such as $1.25/day, the country's poverty rate is now about one-third lower than it was in the mid-1990s. However, an estimated 36.7% of farmers and 41.4% of fishers are below the national poverty line as measured in the Philippines Income and Expenditure Surveys (FIES). Over the last decade progress appears to have stagnated, with roughly the same proportion of Philippine farm households (37%) in poverty in 2009, as had been in 2003. For fisher families, the situation appears to have deteriorated, with 41% below the poverty line in 2009, compared with 35% in 2003. There was also a slight 1–2% worsening of urban poverty over this period. From a gender standpoint, women do not appear any poorer than men, with the exception of female heads of household. However, children have a higher poverty rate than the national average—a reflection of larger family sizes in rural areas where poverty is more acute—and it too has worsened during the last decade. The Philippines' Gini coefficient of inequality worsened steadily from 1985 to 2000, then began to improve slightly in recent years but is still above the 1985 level.

Figure 2.5: Evolution of poverty in the Philippines and other East Asian countries



Source: World Bank, Development Data Platform.
Note: the evolution in East Asia is strongly influenced by China, which weighs heavily in the regional average.

It is difficult to escape the conclusion that, although some policies, investments and agricultural development programs in the Philippines may have benefited some segments, in the aggregate they have not served the rural population well. The situation has been complicated by slow growth in manufacturing and other non-agricultural activities, which resulted in a lower volume of rural labor being drawn out of agriculture than might have been possible with higher growth in other sectors. In spite of this, many areas have experienced fairly heavy out migration and the resulting remittances from overseas have provided a de facto safety net for many poor urban and rural households.

Finally, there are significant differences in spatial distribution of poverty across regions, LGUs and islands (OECD 2009, World Bank 2010 and 2011; FIES 2000, 2003, 2006). Rather than helping to narrow differences in poverty levels, the approach to fiscal decentralization in the Philippines may be exacerbating inter-LGU inequality and reinforcing lower agricultural growth patterns in poorer areas. The current system of formula-based transfers does not allow for

equalizing differences in revenue raising capacities of the LGUs. Since only better off LGUs have own-tax and non-tax resources on a scale sufficient to undertake larger projects, this makes it extremely difficult for poorer LGUs to overcome critical infrastructure bottlenecks to higher agriculture and non-farm growth (Balisacan et al 2008; Llantos 2009).

Table 2.9: Measures of poverty and inequality in the Philippines, 1985–2009

year*/ poverty indicator	1985	1988	1991	1994	1997	2000	2003	2006	2009
% below $2/day	61.9	56.9	55.4	52.6	43.8	44.8	43.8	45	41.5
% below $1.25/day	34.9	30.5	30.7	28.1	21.6	22.5	22	22.6	18.4
% below nat'l poverty line				40.6	36.8		24.9	26.4	26.5
% urban pop. below nat'l poverty line				28	21.5		11.1	12.5	12.8
% rural pop. below nat'l poverty line				53.1	50.7				
% farmers below nat'l poverty line							37	37.2	36.7
% fisher-men below nat'l poverty line							35	41.4	41.4
% women below nat'l poverty line							24	25.1	25.1
% children below nat'l poverty line							32.7	34.8	35.1
Gini coefficient	41	40.6	43.8	42.9	46.2	46.1	44.5	44	43

Source: National Statistical Office; World Bank
Note: These are the years when the household survey (FIES) was conducted and therefore in which the national poverty lines are measured.

Main Takeaways

The importance of agriculture and fisheries to the Philippine economy has been declining, but is considerably greater than standard GDP estimates suggest, because these capture only the production phase of value chains. Taking into account various multiplier effects, agriculture probably 'drives' about one-quarter of GDP at this time, i.e. well above the 12–13% figure frequently cited.

The structure of the sector has been fairly static for several decades, growth rates have recovered somewhat from the lows of the 1980s but are still weak; the relative contributions of various crops to GVA has changed remarkably little (with a few notable exceptions), and contrary to trends in 'diversifying' economies, the share of traditional crops has actually increased in the Philippines. Trade patterns have also shown little dynamism.

Yields are low across both 'modernizing' and non-modernizing sectors; some important subsectors are ill-prepared to withstand global competition or to take advantage of attractive nearby export markets. Raising productivity levels across the board in agriculture will be essential for long-term growth, poverty reduction and food supply. The agricultural frontier for annual crops is largely exhausted, though some important opportunities exist for tree crop development on degraded forestlands and significant intercropping on the large land area presently devoted to coconuts.

The incidence of poverty in the Philippines has decreased since 1980, but the rate of improvement appears to be stalling, or at least slowing significantly.[4] This calls for serious reflection on the strategic directions that are being pursued in the agriculture sector, as three-fourths of those below the national poverty line live in rural areas and the majority are either directly engaged in agriculture or in related non-farm rural economic activities.

4 Changes in recently years in national accounts and in definition of the national poverty line complicate cross-year comparisons. However, whether poverty reduction has increased or decreased by a percentage point, it seems clear that it has slowed significantly.

Chapter 3. Cross-Cutting Issues for Agriculture Sector Performance Through 2040

Demographic Considerations

The Philippines has a large population that is still growing rapidly. During the second half of the last century, the total population quadrupled from 18.4 million (1950) to 77.3 m (2000). By 2010 it had reached 93.3 million, making Philippines the 12th most populous country in the world. Projections for 2040 suggest a further increase to 141.7 million inhabitants. In relative terms, the Philippines will have moved from being the world's 25th most populous country in the mid-20th century, to 9th by the mid-21st century (and 3rd in East Asia, after China and Indonesia). For the Government, this translates into a need to feed 52% more people in 2040, than today.

Urbanization is taking place somewhat more rapidly in the Philippines than in most of Southeast Asia, but the rural population is also growing fast in absolute terms because of the country's relatively higher fertility rates. Some 49% of Filipinos now live in urban areas, compared with 30% in Vietnam, 44% in Indonesia and a Southeast Asia regional average of 42%. However in absolute terms the rural population is still expanding more quickly in the Philippines than elsewhere in the region, at 1.5% p.a., compared with only 0.3% in Vietnam, 0.7% in Indonesia, and a regional average

Table 3.1: Actual and projected population of the Philippines, 1980–2040

	actual			forecast			
	1980	1990	2000	2010	2020	2030	2040
total ('000)	47,064	61,628	77,310	93,261	109,742	126,321	141,670
urban ('000)	17,640	29,945	37,101	45,370 (48.6)	56,623 (51.6)	71,145 (56.3)	86.513 (61.1)
(%)	–37.5	–48.6	–48	47,891	53,119	55,176	55,162
rural ('000)	29,424	31,683	40,209	–51.4	–48.4	–43.7	–38.9
(%)	–62.5	–51.4	–52				
density (per sq km)	157	205	258	311	366	421	472
median age (yrs)	18	19.1	20.4	22.2	24.5	27.1	29.8
0–14 yrs (%)	43.3	41.2	38.5	35.4	31.5	28.7	25.8
15–64 yrs (%)	53.5	55.7	58.3	60.9	63.6	64.5	65.6
65+ yrs (%)	3.2	3.1	3.2	3.6	4.9	6.7	8.5
dependency ratio (%)	87	79	72	64	57	55	52
(child)	–81	–74	–66	–58	–50	–45	–39
(old age)	–6	–6	–5	–6	–8	–10	–13
female (%)	49.4	49.5	49.6	49.8	49.9	50	50.03
male (%)	50.6	50.5	50.4	50.2	50.1	50	49.97

Source: UN Population Divison.

of 0.6%. In 2040 the absolute size of the Philippines' rural population is likely to stabilize and begin slowly to decrease, but before then it will grow by 15% compared with 2010, or nearly double the size it was in 1980. Roughly one-third of rural inhabitants in the Philippines are engaged in non-farm activities, considerably higher than the regional average of 21%.

Due to the relatively high population growth rate, the Philippines will continue to have a fairly young population (by East Asian standards) for the next several decades and this has important implications for the rural labor force. The median age will still be just under 30 years by 2040; while the median age in rural areas will likely be higher (as younger family members move to towns and cities), a significant share of rural households will still have family members young enough to engage in more physically demanding agricultural pursuits than tends to be the case for many regional neighbors whose populations are aging more rapidly. This will present a competitive advantage for the Philippines over the next several decades, as these neighbors face more rapidly rising rural wages and labor constraints.

Finally, the age distribution of the population will also have important food security implications. Two countries with the same population, but different age distributions, will face a different structure of demand for food. For example, the quantities of the staple cereal consumed per capita/year are lower for both younger (under 14) and older (over 65) household members. In the Philippines with its relatively younger age distribution, by 2040 some 65% of the population will still be in the 15–64 age bracket (i.e. with higher consumption requirements per capita).

Macroeconomic Management

The last 30 years have not, on average, been particularly impressive for the Philippines in terms of economic growth and poverty reduction. However, the country may be shifting into a higher growth trajectory, with prospects to move into the ranks of the world's 20 largest economies by 2040. The pace at which convergence takes place will largely determine whether this potential materializes and how broadly the benefits are shared.

During 1980–2010, GDP growth in the Philippines averaged 3.1% (1.7% during 1980–90; 2.9% 1990–2000; and 4.8% 2000–10. Despite the initiation of some important reforms, growing governance problems reflected in economic mismanagement characterized the final years of the Marcos regime in the early 1980s. The successor government of Corazon Aquino struggled with a macro-economy in disarray and numerous structural challenges. Building sufficient consensus to tackle these proved difficult, though some progress was made in stabilizing the economy; on the structural front, a comprehensive agrarian reform was launched and relationships between the central and local governments restructured, both of which have played a major role in the patterns of growth and poverty reduction in the years since.

The next administration of Fidel Ramos was able to undertake a more ambitious and comprehensive set of structural reforms that placed order and discipline on the macro-economic front, liberalized the trade regime, strengthened the financial sector and generally moved the Philippines onto a somewhat stronger growth path. The pace of poverty reduction began to accelerate, however, the Asian financial crisis of 1998 and its aftermath eroded some of the gains expected from the reforms; others would require a longer-time frame of sustained support to materialize. The next two governments did pursue the macro-economic stabilization agenda and tackled a few important structural reforms. However, governance—both capacity and accountability dimensions—deteriorated and sluggish foreign and domestic investment clearly reflected the private sector's limited confidence in the Philippines. Economic performance did nonetheless strengthen somewhat during the past decade. GDP growth averaged 4.5%, below the achievements of several regional neighbors but stronger than in the previous two decades. However, much of this growth was driven by extremely heavy remittances from Filipinos who had migrated abroad to find more remunerative employment than the opportunities at home, on the one hand, and by a surge in business process outsourcing (BPO) activity in recent

years, mainly by U.S. companies seeking to reduce costs of operation, for which the English-speaking Philippines environment and wage structure are attractive. At the same time, manufacturing activity declined steadily, a shrinking agricultural sector lost numerous opportunities that nearby countries with comparable agro-climatic conditions were successful in capturing, and poverty reduction stagnated.

Why, then, does this study conclude that the Philippines may now be shifting into a higher growth trajectory? Near term risks are significant, including the European debt crisis, slowdown in China and the Philippines' ever-present high vulnerability to weather-related natural disasters. At the same time, some reform efforts of earlier administrations are beginning to produce results (e.g., in maritime transport, the financial sector, and social safety nets). The current government has embraced goals of strengthening governance to a degree unprecedented in Philippine history and, while this is not by itself sufficient to bring about growth, it is triggering a surge in confidence by the private sector that may result in rising investments. This is reflected, for example, in recent decisions by ratings agencies to upgrade the Philippines' long-term credit rating. Ratings were also influenced by the Philippines quite strong growth in the first semester of 2012, which reflected a recovery in net exports, government spending and private consumption. Core inflation appears to be manageable, exchange rate policy is sound, and the Philippines has developed a strong track record in external debt management. External risks include the economic slowdown in Western Europe and the United States, as well as developments within East Asia, especially, though not exclusively, in China.

If there is a domestic Achilles heel for the Philippines, from the standpoint of macroeconomic management, it is the country's relatively low tax and revenue to GDP ratio. This constrains the ability to make sustained investment in public infrastructure and services on a scale, and over a long enough period, that would more comfortably raise Total Factor Productivity (see below), and create a more conducive environment for private sector-led growth. By way of comparison, over the past decade, total central government primary spending as a share of GDP averaged about 13% in the Philippines, 15% in Thailand, 16% in Indonesia, 23% in Malaysia and 26% in Vietnam. Both central government capital spending and net lending, and gross fixed capital formation as shares of GDP, were well below rates in these other countries.

Total Factor Productivity and Innovation

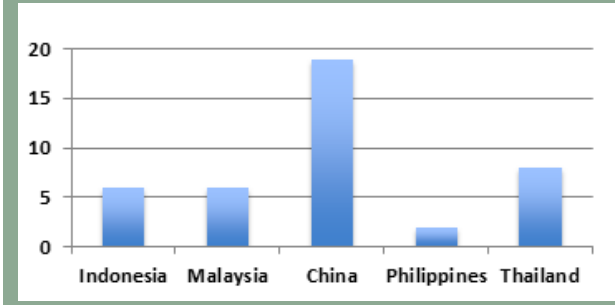
Achieving this needs to be elevated as an objective, on a par with strengthening governance—these are not alternatives, but mutually supportive aims, and neither is likely to succeed alone. This is especially true of the agriculture and agribusiness sector, where lagging productivity and returns to land and labor are acute, drive widespread rural poverty and have negative impacts on the overall economy through the sector's often overlooked multiplier effects.

Philippines moved from being one of Asia's most advanced developing economies in 1960, with twice the per capita GDP of Thailand and ahead of Indonesia, Malaysia and China at that time, to lagging behind such countries by the early 21st century. Figure 3.1 shows the number of times that per capita GDP increased over the period 1960–2010.

The main reasons underlying this differential have been the relatively lower rate of physical capital accumulation and of total factor productivity (TFP) growth in the Philippines—linked, in turn, to a relatively low public investment base and weak private investment climate, particularly during the last 30 years.

Numerous studies have identified the importance of the share of TFP in driving high GDP growth, and in distinguishing 'converging' from 'non-converging' economies. While convergers often owe much of their growth to productivity improvement, many non-convergers (including the Philippines for many years) owe more of their growth to labor expansion and often score poorly on comparative indicators of entrepreneurship and innovation (Kohli et al, 2011). TFP growth in the Philippines during 1980–2010 averaged only about 0.4%, placing it squarely within the ranks of non-converging Asian economies during that period (Table 3.2).

Figure 3.1: Number of times per capita GDP increased, 1960–2010



Source: World Economic Indicators.

However, there has been a gradual rise in TFP growth in the Philippines during 2000–2010 (2.3%); this is encouraging and needs to be intensified and sustained. This rate is similar to the level achieved by Asia's 'convergers' during the 1980s, but they then went on to raise TFP growth to above 3% and in some cases higher. The ingredients for achieving this certainly include sound macro fundamentals and strengthening of governance (with a strong emphasis on the capacity aspects of governance), but they also require significant investments in human capital, public infrastructure, research and innovation. For the agriculture sector, this study argues that building on trends of the last decade and continuing to raise TFP further is both feasible and essential for broad-based growth and poverty reduction. Doing so will require, inter alia, (i) prudent management of the final phase of the agrarian reform, and rapid modernization of the regulatory framework and institutions essential for a well-functioning land market with secure property rights; (ii) much greater efficiency in water management; (iii) reform of restrictions on foreign investment that limit capital and technology flow into the sector, and increasing openness to trade; (iv) expanding access to rural financial services: (v) development of a sound risk framework that helps individual households, investors, the financial sector, the government and the economy manage short-term disruptions that are natural to the sector; (vi) addressing critical infrastructure, communications and trade logistic gaps, in some cases through investment, in others through legal and regulatory reform; (vii) decisive reform of some particularly dysfunctional institutional arrangements in the agriculture sector at both the national and sub-national government levels, and development of strong newer institutions for certification, standards and food safety to protect Philippine consumers and take maximum advantage of trade opportunities in the coming decades; (viii) development of a long-term agricultural transformation and food security strategy that goes beyond the lifetime of individual government administrations; (ix) at least a doubling of resource allocations for agricultural research, innovation and technology transfer, and for the data systems that will be essential for planning, monitoring and evaluation; and (x) sustaining the current emphasis on anti-corruption dimensions of governance reform, while broadening the attention to capacity building and professionalization of core sector institutions to meet the challenges of the 21st century, matched by a commensurate strengthening of corporate social responsibility within the private sector.

Table 3.2: Estimated TFP growth (%)

Philippines	
1980–1990	–1.3
1990–2000	0.1
2000–2010	2.3
1980–2010	0.4
Asia comparators (1980–2010)	
convergers	3
non-convergers	0.2
high-income	0.9
Asia average	2.2

Source: Kohli et al, eds. (2011). Asia 2050: Realizing the Asian Century.

Agricultural Services across Value Chains

Agricultural Research and Technology Generation

Agricultural Research and Technology Generation in the Philippines[1] has a long history, dating to 1901 when the

1 See Annex 7 for further details on Agriculture Research and Technology Development in the Philippines.

insular Bureau of Agriculture was created under the Department of Interior. Subsequent developments can be divided into three periods: Pre-Green Revolution (1901–1965), Green Revolution (1966–1981), and Post-Green Revolution (1982–present).

Currently, the Philippines has three partially overlapping research systems involved in agriculture and fisheries, which have evolved over the last century:

- The Department of Science & Technology (DOST) system through the Philippine Council for Agriculture, Aquatic, & Resources Research & Development (PCAARRD) was established during the Green Revolution period to provide better coordination in planning and implementing agriculture research. The key players include one national university of agriculture (University of the Philippines at Los Baños), three zonal universities of agriculture, and 14 regional R&D consortia composed of state colleges/universities (SCUs) and regional agencies engaged in agriculture and fisheries research.

- The Department of Agriculture (DA) system, coordinated by the Bureau of Agriculture Research (BAR), was organized during the post Green Revolution period (1982 onwards). BAR was established in 1996 during the Cory Aquino administration, in response to criticism that PCAARRD was not fully responding to DA priorities and needs. The system consists of four bureaus directly under the Office of the Secretary (OSEC) of DA, 14 Regional Integrated Agriculture Research Centers (RIARC) and 10 attached agencies and corporations such as the Philippine Carabao Center (PCC), the Philippine Rice Research Institute (PhilRice), and the Philippine Coconut Authority (PCA). The majority of agencies performing R&D suffer from poor facilities, lack of staff, deteriorating staff quality, and low budgets; most of them also perform regulatory functions.

- The Department of the Environment and Natural Resources (DENR) system is overseen by the Ecosystems' Research and Development Bureau (ERDB), established in 1986, that coordinates the Research Divisions in all regional DENR offices.

Each system sets its own priorities and obtains an annual appropriation from the Department of Budget and Management (DBM) to implement its programs. Accountability is hazy; and accomplishments are generally measured by activities conducted rather than outcomes and impacts. External Program Management Review (EPMR) is almost unknown. Interdepartmental coordination and integrated planning are limited, although there has been attempt to operationalize this through the "Convergence Zone Initiative."

During the Green Revolution Period (1966–81), the International Rice Research Institute (IRRI), as part of the International Agriculture research Institute (IARC) and later

Table 3.3: R&D investment in agriculture and fisheries as % GVA, 2002–09

source/year	2002	2003	2005	2007	2009
public sector	0.35	0.31	0.32	0.36	0.53
government agencies	0.22	0.22	0.22	0.13	0.18
public higher education	0.13	0.09	0.10	0.23	0.35
private sector	0.03	0.03	0.03	0.02	0.08
private non-profit	0.02	0.01	0.02	0.02	0.06
private higher education	0.00	0.02	0.01	0.00	0.02
total	0.38	0.34	0.35	0.38	0.61

Source: DOST, NEDA.

as part of the Consultative Group in Agriculture Research (CGIAR), was established in the country and developed semi-dwarfed, high yielding rice varieties. The Philippines not only became self-sufficient in rice for the first time in its history, but also a minor exporter to neighboring countries in 1977–78. During this period, the Philippines out-performed ASEAN neighbors in terms of growth in gross value added (GVA) and agriculture exports. Robust agricultural growth was made possible by strong public sector investment in the provision of public goods. At the same time, the private sector became more active in providing support services (e.g., fertilizers and seeds, including research and development). Increasingly, the private sector took over services initiated by the government, when the market became commercial (such as the development of new vegetable varieties and hog and poultry breeds). Criticisms of the Green Revolution program have centered on the negative effects of heavy pesticide and fertilizer use on the environments and the health of the farmers, and the differential economic benefits to input suppliers and better-off farmers in highly favorable environments.

The Post-Green Revolution Period, 1982 Onwards. Unlike during the Green Revolution, the Philippines' agriculture performance during the post-Green period has been erratic and generally weaker than in ASEAN neighbors, particularly Indonesia, Thailand and Vietnam. Productivity growth slowed in the crop sector, particularly rice, corn, sugar, and coconut. In contrast, the animal industry sector (hogs, broilers, and chicken eggs) and the aquaculture industry (especially tilapia) have performed better. Advances in technology—improved breeds, better nutrition, and cultural and management practices—generally came from the private sector. One notable exception was sex-reversed tilapia, which resulted from the collaboration between World Fish Centre and the Bureau of Fisheries and Aquatic Resources (BFAR).

Impact of Investment in Agricultural Research and Development (R&D). Selected impacts of R&D in the Philippines can be seen both on the country's competitive export crops and major commodities central to the diet of the Filipinos. The development of new technologies from the private sector have been responsible for the growth of important export crops (pineapple, asparagus, bananas), as well as cut-flowers, salad vegetables, yellow corn, broiler, and the hog industry. On the other hand, advances in technologies developed by the public sector have been responsible for the development of modern, high yielding varieties of rice that allowed the country to raise yields and improve self-sufficiency (Box A7.1), and the development of Genetically Improved Farmed Tilapia (GIFT) that triggered the phenomenal growth of the tilapia industry in the Philippines, with production tripling during the last ten years, 2001 to 2011 (Box 2, Annex 7). Rice and tilapia illustrate the impact that public research in agriculture has had in the Philippines. The two cases demonstrate the impacts on productivity and output that can occur when adequate funding is available for agricultural R&D and attention is paid to dissemination of results. The two cases also involved strong partnership between the international research centers of the CGIAR and national research agencies of the Philippines, including both the Department of Agriculture and the State Universities of Agriculture.

Recent Trends in Investment in Agricultural Research and Development (R&D) Investment. The Philippines Agricultural and Fisheries Modernization Act (AFMA) of 1997 mandated that the Government should invest at least 1% of agricultural GVA in research and development of the sector. Notwithstanding the kinds of impacts mentioned above, however, data shows that actual expenditures have been well below that amount through much of the last decade: even when budget allocations increased substantially in 2009, the result was still only about 0.53% of GVA. When private sector investments are included, total R&D investment reached only about 0.61% of GVA in the year (2009) of the highest allocations. Within the public sector, since 2007 roles of higher education and public agencies have reversed earlier patterns, with universities and colleges accounting for about two-thirds of R&D, and government agencies the balance.

Also, the budgetary situation now appears to be changing, for the better. The budgets of all three research systems have been increased substantially in 2012 and/or will be in 2013 (Annex 7).

Opportunities and Challenges Going Forward. Advances in genetic engineering, genomics, and molecular biology have made it possible to develop new crop varieties that pack more nutrients, protect themselves from pests, fix nitrogen, and adapt to both biotec and abiotec stresses. At the same time, advances in biotechnology have led to the development of bio-fertilizers and bio-pesticides to reduce applications of inorganic counterparts. Herein lies the challenge for Philippine agriculture research and extension, both public and private.

The Philippines was the first country in the ASEAN region to implement a regulatory system for transgenic crops, which started in 1990. The area planted to biotech maize increased to 600,000 hectares in 2011, accounting for 48% of the total area for yellow corn. Reports show that small resource-poor farmers, growing on average 2 hectares, account for about 40% of total users.[2] Despite the success in the introduction of transgenic yellow corn, however, public perceptions of transgenic food have been largely negative, making public research quite challenging. Research by the UPLB on Bt eggplant to control fruit borer, delayed ripening of papayas, and papaya ring-spot virus have has met with some opposition, though such technologies would potentially be quite important for small farmers, if they reach commercialization stage.

Private sector research has propelled the banana and pineapple industries into a leading export role for the Philippines. But private research invariably focuses on commercial crops such as transgenic yellow corn for feeds and hybrid rice. Public research has played an important role in areas central to the livelihood of the poor (e.g., rice, tilapia), although efforts in other areas (e.g. sweet potato, white corn, and tropical fruits for the domestic market) have lagged behind.

There is also an increasing demand for new products based on traditional crops, e.g., coconut water and tropical fruits such as avocado and papaya for neutraceuticals, but growth in these areas has been hobbled by low productivity and product quality. Public research investment in coconut and non-traditional crops with high export potential, that are central to the livelihoods of the poor, has been low and erratic.

The lack of a national strategic direction cutting across all three main research systems (DOST, DA and DENR), fragmented planning and implementation, and low public investment in research over the past decade have certainly contributed to lagging productivity levels in various subsectors. Recent significant increases in the 2011 and 2012 research budgets of the three research systems both BAR and PCAARRD are likely to yield less than optimal results unless efficiency and governance issues are effectively addressed. In addition, new knowledge and technologies generated from research are not immediately made available to the farmers and other agricultural producers due to weak research-extension linkages that are currently more ad hoc than institutional in character.

The key strategic requirements to strengthen the Philippines' agriculture research systems that should underlie a "Straight Path Strategy", following President Aquino's call for a more efficient, graft free government, should include (i) a higher level of systems integration with clearly defined accountability for outcomes; (ii) a significant increase in public funding combined with a more predictable, participatory and transparent system of research prioritization; (iii) substantial upgrading of the physical and human infrastructure for research; (iv) development of more dynamic public-private sector partnerships in agriculture research; and institutionalized research-extension linkages.

Agricultural Extension and Technology Transfer

Some productivity issues relate to agricultural research and the need to expand and adapt knowledge, but in the case of the Philippines, very often constraints relate to weaknesses in the ability to deliver new technology and knowledge to farmers.

After passage of the 1991 Local Government Code, several national services were decentralized to the local level, including: (i) agricultural extension, (ii) social forestry, (iii) environmental management and pollution control, (iv)

2 There has also been some increase in the use of hybrid rice on well-irrigated farms.

primary health and hospital care, (v) social welfare services, (vi) repair and maintenance of infrastructure, (vii) water supply, (viii) communal irrigation, and (ix) land use planning. For agricultural extension, this involved the transfer of over 17,000 DA staff (over 60% of staff at the time), who were part of the national extension services, to provincial and municipal agriculture extension services. The transfer was hasty and without adequate consideration of the administrative and financial capacity of local government units (LGUs) to effectively manage and finance the devolved services. Responses across LGUs were highly variable. LGUs belonging to 4th to 5th class had the most problems; deterioration of services was probably most significant in these LGUs. And it is in these poor LGUs that quality extension services would arguably have significant impact on food security and poverty alleviation.

The Philippine Congress has recognized the problems of agriculture extension in the country. The Agriculture & Fisheries Modernization Act of 1997 (AFMA) tried to address the issue by defining the functions of the national and local governments, the private sector and civil society in the provision of agriculture extension. It affirms the principle of public-private partnerships, decentralization, and the role of the national government based on the principle of 'New Public Management.' Unfortunately, governance issues at the DA during previous administrations have prevented the implementation of reforms in extension services. Since 2004,, there have been attempts to pass a National Agriculture Extension Act to address the issues of financing and accountability, but these have not succeeded. Consequently, serious problems of extension continue to affect the LGUs, especially those in the 4th to 5th economic classes.

As always, despite a chaotic setting, there have been examples of excellence in technology transfer. The results from rice and tilapia research (described in Boxes A7.1 and A7.2 on agricultural research) would not have had the impact they did if it had not been for the dedicated work of numerous extension agents over a number of years. There have also been cases where private research and technology transfer have underpinned impressive advances in other crops (e.g., the main fruit export crops, and introduction of Bt yellow corn). Overall, however, agricultural extension is an extremely weak link in the Philippines' efforts to raise yields and profitability across many crops and commodities.

Moving forward. There is an urgent need to develop a national Extension Policy, engaging a wide range of stakeholders, including research institutes, state colleges and universities, the private sector, civil society, as well as the LGUs and communities—to ensure that the outcome does reflect the various concerns and experiences:

It will be important to set out clear roles across the different levels of government, with (i) policy generation and oversight at the central level; (ii) staff recruitment and training at the provincial level, drawing upon the staff from the regional field offices of the national government agencies (NGAs) and appropriate technical institutions in supporting the training; and (iii) implementation through a demand driven approach at the village and community levels.

In pursuing this structure, and drawing upon the above principles, the Regional Offices of the NGAs will need to develop a structured program for providing training and support to the LGUs. Importantly, NGAs need to commit to pursuing programs that are funded from national level budgets in partnership with LGUs, and not as parallel initiatives.

Consideration should be given to merging the provincial and municipal extension services into one service, managed administratively and with technical supervision at a provincial level, but with most extension agents based in the municipalities.

More importantly, reform in the delivery of technical services will require the adoption of a multi provider model, with increased reliance on farmer/producer organizations, and a much greater role for non-governmental provision of agricultural services, by drawing in the state colleges and universities, agribusiness, NGOs, farmer organizations and other private sector providers.

Partnerships should be promoted for transfer of technologies to farmers by private plantations, seed and agricultural

companies, and animal production and food processing firms.

Increase farmer participation in defining needs, problems, opportunities and priorities for extension programs and in "on-farm" evaluation of new technologies.

In that context, it would be worth piloting initiatives to put farmer communities in the drivers' seat, by providing grants to directly to enable them to procure technical services from the source they select, as has been done quite successfully in other countries (e.g. Northeast Brazil).

Finally, the adoption of new technologies and crop-management techniques can be improved through the provision of internet connectivity, and the utilization of the internet by extension workers and farmers to access agricultural technology information should be encouraged. IRRI and PhilRice have been piloting the use of cell phones to provide site specific technical advice to rice farmers on nutrient applications—the initiative is still in the infancy stage but holds great promise. The Philippines is already a leader among developing countries in piloting the use of mobile cell phones for payments in rural areas (see Annex 6 footnote 94).

Taking a Value Chains Approach

Raising agricultural gross value added (GVA), rather than the volume of agricultural production, is essential for creating the space to raise rural incomes. Certainly the two are related, but prioritizing value over volume often leads to different investment decisions. Essentially this calls for a shift from a traditional supply chain approach to agricultural development (focus on constraints to expanding production), to a value chain approach (concentration on where maximum value is added, from production to wholesale and retail levels) in analysis, strategic planning, program design, monitoring and evaluation. Faced with competing choices of whether to upgrade several kms of road, line canals in an irrigation command area, change the technology used to dry rice or produce copra, modernize processing or cold storage facilities, improve market information services, fast track land titling efforts, invest in export promotion, etc., the weight needs to be placed on where the greatest value is likely to be added (i.e., which raises GVA the most) if the goal is to maximize rural incomes. Public sector agencies traditionally think of the production phase of value chains, because this is where they are most easily able to act, while post-harvest phases are often partly or entirely in the domain of the private sector.

In the Philippines, analysis of farmgate-wholesale price relationships suggests that significant costs to producers and consumers have their origin in the post-harvest phases of crop and commodity value chains. One study by the Philippines Institute of Development Studies (PIDS) found post-harvest losses of 15–50% for fruits and vegetables, 15% for rice; and 5% for corn (Briones 2009). Another confirmed the heavy losses to horticulture, on the same scale (Digal, 2007), due to inadequate collection centers/packing houses, disinfection facilities, cold storage facilities and vans, and labs for analysis of pesticides and chemical contaminant. There are also estimates of significant gains to be made from raising the palay: rice conversion rate by modernizing mills and/or by simply encouraging consumers to shift a larger part of consumption from white to brown rice (thereby improving the conversion rate from about 65% to 85%). Table 3.4 shows the rate of rejection of the European Union and United States, of Philippine products by major food group, suggesting another area in the respective value chains (food safety, standards and certification) that may be a candidate for greater attention, viewed through a value chain lens.

Finally, as the Philippines prepares for eventual liberalization of rice imports, it is worth remembering the experience of the maize sector in the initial transition from quantitative controls to tariffication during the mid-1990s. The price competitiveness analysis at the respective wholesale markets in the production areas (mainly in Mindanao) showed domestic corn to be highly competitive with imported corn both at the in-quota and out-quota tariff rates (Chupungco, 2003). However, after adding marketing and distribution cost up to Manila (where most feed processors were concentrated) from the respective production areas, domestic corn was found to be either marginally or not competitive

at all with imported corn at the Manila wholesale market at the in-quota tariff rates. In other words, farmers themselves were competitive in producing the corn in Mindanao, but lost the ground vis-à-vis importers when high transport costs to get to the feed mills were added—suggesting that post-harvest transport and/or relocation of mills may have deserved greater attention.

Table 3.4: Relative rejection rate for imports to the EU and the US for Philippines, 2002–08

food category	European Union	United States
overall rejection rate	medium	medium
fish and fishery products	none	medium
fruits and vegetables	medium	low
nuts and seeds	low	low
herbs and spices	none	high

Source: UNIDO—Meeting Standards, Winning Markets—Trade Standards Compliance Report 2010.

Setting priorities for agricultural services, both research and extension, needs to take place within a value chains framework of analysis. This is also important in guiding the national budget allocation process for agriculture and fisheries more generally.

Governance and the Investment Climate for Private Sector Development

The business environment in the Philippines has not been as attractive as in some other East and Southeast Asian countries, although this is beginning to change. This has been reflected in much lower private investment levels, although some cross-country benchmarking exercises have rated the Philippines' investment climate as gradually improving. The Philippines has a fairly open trade policy regime (with some important exceptions in the agriculture sector), as measured by tariff trade restrictiveness indicators (Tariff-TRI), and it faces relatively open markets for its exports (MA-TTRI). In both cases, the country compares reasonably well with regional averages. The World Bank's Logistics Performance Index (LPI) score for the Philippines in 2010 also placed the country above the averages for East Asia and Indonesia, and near those of Malaysia and Thailand: Philippines 3.14 (44th rank); East Asia regional average, 2.65; Indonesia 2.76; Malaysia 3.44; and Thailand 3.29. In 2011, Fitch upgraded the Philippines credit rating to a notch just under investment grade; Standard & Poor followed suit in July 2012, and Moody's in October 2012—all three with stable outlook. These decisions were positively influenced by the current Philippine leadership's determined anti-corruption campaign and commitment to improve the environment for private investment. The Global Competitiveness Report 2012–13 has just ranked Philippines 65th out of 142 countries, up 22 percentage points during the past 24 months (Vietnam 75, Indonesia 46, Thailand 39, Malaysia 21). On the other hand, in Doing Business 2013,[3] the Philippines is ranked 138th out of 185 economies (Indonesia 128, Vietnam 99, Thailand 18, Malaysia 12, regional average for East Asia & Pacific 86). In these various benchmarking exercises, absolute ranking is less important than relative position, and in that regard the Philippines often places near the bottom, or last, among middle and lower middle-income countries in East Asia.

Cross-cutting Constraints. The main cross cutting constraints that emerge from the sources mentioned above and various value chain analyses over the past five years, and that will need to be tackled aggressively, include significant barriers to market entry and exit of firms, weak investor protection, limited access to financing and a fragmented collateral system that undermines confidence in the ability to collect debts, serious infrastructure quality and gaps (farm to market roads, post-harvest infrastructure, ports and inter-island shipping), perceptions of weak public sector institutions and other governance issues;[4] the depressing

3 The Doing Business 2013 Report is about to come out on October 1, 2012; it is likely that the Philippines overall score will improve. The World Bank's Doing Business team also carried out two sub-national assessments at the city level for the Philippines (2008 and 2011, covering 20 and 25 cities respectively), focusing on issues related to ease of starting a business. Of the 25 cities reviewed in 2011, 18 were in the Luzon region, 4 in the Visayas and 3 in Mindanao. Interestingly enough, Mindanao did extremely well, with its cities ranked 1st, 2nd and 6th. Performance was more uneven across the Visayas and Luzon, with some cities doing quite well and others less so (although the 5 worst ranked cities for ease of starting a business were all in Luzon).

4 High concentration and price cost ratios suggest the presence of monopoly rents in many sectors (Discussion Note 6 for World Bank 2010).

impact on land and credit markets of CARP and the uncertainties regarding its future; and under-investment in core institutions and services (especially agricultural research, extension and market information—by both the public and private sectors). The Philippines also caps foreign equity ownership in most sectors at 40% (Foreign Investment Negative List) with even lower ceilings in capital-intensive sectors (e.g. air transport), and does not allow foreigners to own land.

In a macroeconomic setting that is stable, but likely to be constrained for some time by a very low tax to GDP ratio, selectivity and efficiency in public investments will be critical, as well as maximizing opportunities for public-private partnerships and risk-sharing.

Land Reform and Land Markets

The Comprehensive Agrarian Reform Program (CARP) is not yet completed. CARP was launched in 1988 by the administration of President Corazon Aquino, to address extreme inequality in land ownership5 by redistributing 9.77 million ha in 10 years. It built on and enhanced the land reform activities initiated in 1972 by the Marcos administration. CARP coverage was subsequently contracted to 8.2; and the program has been extended twice through 2008, and then for a third time through June 30, 2014 (now renamed Comprehensive Agrarian Reform Program Extension with Reforms, CARPER, under RA 9700). For historical information on land reform in the Philippines, see Binswanger-Mkhize et al (eds) 2009; World Bank 2010; and Department of Agrarian Reform website: www.dar.gov.ph). CARP/CARPER has had social justice, productivity/income and 'beneficiary development' (poverty reduction) objectives. Land reform per se was to be achieved through a combination of redistribution of public and private lands, leasehold reform and stock distribution for some large commercial farms. Beneficiary development would result both from transfer of land assets and comprehensive agricultural infrastructure and support services. The Departments of Agrarian Reform (DAR) and Environment and Natural Resources (DENR) are the primary implementing agencies, though many other institutions are involved at national and sub-national levels, primarily in supporting CARP/CARPER's beneficiary development objectives. The Land Bank of the Philippines (LBP) is the financial intermediary for CARP, and the Land Registration Authority (LRA) is responsible for land titling.

Mixed achievements. DAR reports that from 1972–2011, some 4.385 million ha were redistributed to about 2.556 million beneficiaries (DAR, 2012). For its part, DENR had transferred approximately 2.3 million ha between 1988–2005. While these are important achievements, they fall short of targets, implementation has taken considerably longer than envisaged, and much of what was done can be characterized as the 'easier' part of the land reform challenge. Specifically, more than three-fourths of lands distributed through 2011 were either government-owned lands or lands distributed under voluntary modes of acquisition (as opposed to compulsory acquisition/expropriation); most of the private lands transferred have been from among the smaller properties in the Philippines, and the majority of the land transferred by DAR is held under certificates collective ownership (CLOAs) and by DENR under other communal arrangements. Agrarian reform beneficiaries (ARBs) can receive up to 3 ha only, and land ownership is capped at 5ha. Finally, there are strong restrictions on the rights of ARBs to sub-divide, sell and/or lease lands transferred to them. While CARP has reduced poverty among many agrarian reform beneficiaries, only about 30% of these have received comprehensive support services and the program's impact on overall rural poverty levels has been assessed as low; achievements have been greatest in areas where the shift from small-scale subsistence to commercial farming was easiest because of favorable natural resources and proximity to peri-urban centers (World Bank 2010).

Challenges. The volume of land to be redistributed from January 1, 2012 through mid-2014 is approximately 962,000 ha. DAR estimates that with optimal budget and staffing arrangements, only about two-thirds of this may be feasible—and that, in turn, would require an unprecedented pace of implementation. The challenge is more than the figures on total area may suggest, because 90% of what

5 Gini coefficient of land ownership distribution in 1988 estimated at 0.64 (Putzel 1992, reported in Borras 2007 and Binswanger-Mkhize et al 2009).

remain to be distributed are private lands, 60% are likely to require some form of compulsory acquisition, and 39% are relatively large properties in the Philippine context (over 24 ha). About 32% are coconut plantations, 22% rice lands, 15% sugar plantations, and 15% corn lands. In addition, between 170,000–400,000 ha of communally held properties need to be subdivided and this also is a time consuming and complex task. Finally, DAR faces two serious staffing issues. The first concerns skill mix: while some 5,635 of its staff at central and sub-national levels are no longer needed, DAR management estimates that it would require about 2,750 new staff in a range of skill areas to complete CARPER; resources have not been provided to make such retrenchment and selective re-staffing possible and there are now only about 20 months remaining. Second, staff morale is understandably low given the uncertainties surrounding DAR's future after CARPER ends, and this makes it difficult to raise efficiency to the extent that will be needed necessary to achieve much higher land distribution targets in the final period of the program.[6]

Land issues were raised as being among the top sector development constraints by most officials interviewed for this study and by all private sector representatives, and they figure prominently in most value chain studies. There is considerable uncertainty on the ground about (i) whether CARPER will actually close in mid-2014 and some successor phase agreed, or not; (ii) which private lands will actually be affected in the final phase of CARPER, since institutional capacity and budgetary resources are not sufficient to tackle all eligible lands before mid-2014; (iii) whether all, or only some, lands held under certificates of communal ownership (CLOAs) will be sub-divided, how that process will be managed and how long it will take; (iv) whether ownership of lands under DENR jurisdiction that are being managed communally may eventually be transferred; and (v) whether and when the legal and regulatory restrictions on what ARBs can do with their lands may be lifted, so that willing parties can sell/buy, lease, use as collateral, subdivide and/or merge to form larger working farm units. These matters have affected many ARBs' willingness and ability to undertake productivity improvements on their lands or dispose of them legally if they wish to shift into non-farm occupations, and they have dampened incentives to invest in agriculture generally and thereby contributed to the contraction in private financing discussed in the next section on rural financial service—if not addressed clearly and decisively, they will continue to do so. Accelerating agricultural transformation, raising productivity, generating employment in downstream activities related to agriculture, reducing poverty and improving nutrition and food security, on a scale commensurate with the Philippines' potential, will require a modern, well functioning land market and improved property rights.

Rural Financial Services and Risk Management

Overview. Improving access to formal rural financial services is essential to raise productivity in all phases of the agriculture value chains, including post-production off-farm activities, processing, logistics, marketing and export services. Achieving this on the scale needed to maximize the sector's growth potential is not likely, however, unless the private sector steps up substantially its volume of lending for agriculture, and the public sector takes important policy and institutional measures to put in place a sound risk management framework that mitigates issues faced at the individual farmer, investor, banking system and government levels.[7]

The Philippines financial system is primarily bank-based rather than capital market-based. The banking system is sound, though small relative to GDP: total assets are about US$150 billion, or 74% of GDP (World Bank, 2012). Among banking groups, universal and commercial banks account

6 There appears to be a consensus on a possible future reconfiguration of DA, DAR and DENR roles (DA would be transformed into a Department of Agriculture and Rural Development/DARD and would assume beneficiary support/extension activities currently performed by DAR and DENR; DAR would be transformed into a Department of Land Reform and Management (DLRM) responsible for agrarian justice and remaining land redistribution/land administration activities; and DENR would focus on its environment and natural resource management mandate.

7 Annex 6 provides details on the main financial institutions (other than commercial banks) that have operations in agriculture and agribusiness, as (i) wholesale or retail lenders (Land Bank and Development Bank of the Philippines, LBP and DBP, two government owned universal banks; some 617 rural banks, RBs, including 40 cooperative banks; and a mix of cooperatives, microfinance institutions, MFIs, and non-governmental organizations, NGOs); or that provide (ii) risk management services (Philippines Crop Insurance Corporation, PCIC; the Quedancor guarantee agency, currently in bankruptcy; and the Agriculture Guarantee Fund Pool, AGFP). It also summarizes the evolution of rural finance policies in the Philippines since the early 1980s, and the reform efforts that moved the system from one characterized by heavy government involvement through commodity-based directed credit lines and other subsidies, to the current more market-driven policy framework.

for 88.3% of total assets, of which the five largest account for almost 50% of assets. Although the country has a long agricultural credit history, agriculture presently receives only 2.5% (and agricultural production under 1%) of total banking sector credit. This is mainly short-term credit; and the volume has been decreasing in constant terms over the past decade, due mainly to a significant contraction in commercial bank lending for agriculture. The availability of equity financing and other services (insurance and other risk management products, savings and investments options, etc.) in rural areas is also quite limited. Access is particularly difficult for small farmers and fishers, small processors and those engaged in certain crop types.

Government agricultural credit programs. Since 1996, most government efforts to expand access to agricultural credit have been channeled through the following two programs.

- The Agricultural Competitiveness Enhancement Fund (ACEF) was created under the Agricultural Tariffication Act of 199 using the proceeds of the in-quota minimum access volume (MAV) importations for nine years, later extended to 2015 (because it did not actually begin operating until 2000). The objective was to provide grants, loans and scholarships to enhance global competiveness. ACEF is jointly administered by the Department of Agriculture (DA) and Congressional Oversight Committee on Agriculture and Fisheries Modernization (COCAFM); LBP is the financial conduit. ACEF implementation was suspended in January 2011 due to a number of governance and efficiency issues (COA 2010 and 2011), but is scheduled to re-open in late 2012. During 2000–2010, ACEF extended only P8.17 billion of loans (71%) and grants (29%); repayment rates were low, including a P1 billion to the Quedancor guarantee agency.

- Agro-Industry Modernization Credit Finance Program (AMCFP).The Agriculture and Fisheries Modernization Act of 1997 (AFMA) aims to transform agriculture into a productive and competitive sector able to meet the challenges of globalization. AFMA mandated the adoption of market-based interest rates for public agriculture credit, with greater role for the private sector and government financial institutions (GFIs) in the provision of financial services. AMCFP was created to help implement AFMA; it is an umbrella program, overseen by the Agricultural Credit Policy Council (ACPC), an attached agency of DA. GFIs serve as wholesalers and qualified private banks and other organizations as retailers. AMCFP is funded by proceeds from the terminated directed agricultural credit programs, but was also supposed to receive budgetary appropriations of some P1.7–2.0 billion annually for seven years, which did not happen. AMCFP supports several interesting microfinance and other credit sub-programs but, like ACEF, the aggregate volume of its combined activities is small: as of end 2011, AMCFP had generated only P3.2 billion in loans (USD 77 million equivalent at current exchange rate) to some 115,915 farmer and fishers over more than a decade.

Agri-Agra credit policy.The Government has also tried the strategy of requiring all financial institutions to allocate a minimum share of loanable funds to agriculture. The Agri-Agra Reform Credit Act of 2009 (Republic Act 10000) signed in February 2010 is the amended version of Presidential Decree 717 or the "original" Agri-Agra Law of 1975. It requires banks to allocate 25% of their loanable funds to agricultural and agrarian reform credit. "Erring" banks pay an amount equal to 0.5% of the non-compliance amount. Ten percent of penalties go to BSP; the remaining 90% form part of the credit guarantee and insurance funds of the AGFP and the PCIC.

Agricultural credit performance and issues. Lending for agriculture is low in the Philippines by any measure—as a share of total new lending, total loans outstanding, agricultural GVA, or the estimated demand for short and long-term financing. This extremely low level of financing, on the one hand, and low sector productivity, on the other, help to explain the country's sluggish agricultural growth rates.

Loans granted for agriculture. The share of agricultural loans to total loans granted by banks during 2001–2010

TABLE 3.5: TOTAL BANK LOANS GRANTED TO AGRICULTURE, 2001–2010 (IN CONSTANT[1/] AND CURRENT P BILLION)

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
					(constant prices)					
total lending	6,639	13,057	13,520	13,381	9,195	12,675	12,312	13,573	15,455	15,100
total lending to agriculture	390	297	298	385	367	219	272	299	379	376
of which, for agri. production	117	112	117	136	84	68	108	125	142	144
					(current prices)					
total lending	7,090	14,363	15,386	16,137	11,936	17,480	17,459	21,038	24,727	25,081
total to agriculture	417	327	340	464	476	302	386	463	606	625
of which, for agri. production	125	123	133	164	109	93	154	193	228	240
					(%)					
share agri loans to total	5.88	2.28	2.21	2.87	3.99	1.73	2.21	2.2	2.45	2.49
share loans for agri. production to total loans	1.77	0.86	0.87	1.02	0.91	0.53	0.88	0.92	0.92	0.96

Source: ACPC and BSP.
1/ Constant 2000 prices, using GDP deflator.

TABLE 3.6: TOTAL LOANS OUTSTANDING TO AGRICULTURE BY TYPE OF FINANCIAL INSTITUTION (CURRENT P/BILLIONS AND % TOTAL OUTSTANDING AFF LOANS)

financial institution	2000 Pbns (%AFF)	2010 Pbns (%AFF)
government banks	19.844 (7.0)	57.730 (19.5)
DBP (Development Bank of Philippines)	7.864 (2.8)	14.559 (4.9)
LBP (Land Bank of Philippines)	11.980 (4.2)	43.171 (14.5)
private banks	263.143 (93.0)	238.999 (808.5)
PKBs (private commercial banks)	236.382 (83.5)	1660.462 (54.1)
TBs (thrift banks)	8.460 (3.0)	38.302 (12.9)
PDBs (private development banks)	2.907 (1.0)	2.761 (0.9)
SMBs (savings and mortgage banks)	4.532 (1.6)	34.225 (11.5)
SSLAs (stock savings and loan associations)	1.022 (0.4)	1.316 (0.4)
RBs (rural banks)	18.301 (6.5)	40.234 (13.6)
all banks: total AFF loans outstanding (current P billions)	282.987 (100)	296.729 (100)
all banks: total loans outstanding [memo item: GDP deflator]	1,904.693 (100)	3,119.836 (158)
ratio of AFF outstanding to all loans outstanding	14.9%	9.5%

Source: BSP and ACPC.

averaged only 2.9%; the share of lending for agricultural production was just under 1%. The abovementioned government initiatives, and many others during the past decades to improve access to rural financial services (Annex 6), have not made a significant impact, although they may have contributed to the success of specific activities. Table 3.5 shows the volume in constant and current terms of loans granted to agriculture overall, and to agricultural production in particular, as a share of total lending by formal financial institutions over the last 10 years.

In constant terms, the volume of all bank lending increased by 227% over the decade from 2001 to 2010, but lending for agriculture stagnated (actually decreased slightly). As can be seen by comparing Table 3.5 (total of volume of loans granted), and Table 3.6 (total volume of loans outstanding), much of the lending would have been short term.[8]

Loans outstanding. Table 3.6 shows the distribution of all loans outstanding, and loans outstanding for all agricultural purposes (AFF) by category of financial institution. The share of AFF in total loans outstanding has been declining quite significantly over the past decade in real terms. [Figures are in current prices, but the GDP deflator is provided below the total loans outstanding line.] Private commercial lending to agriculture, in particular, has experienced a huge contraction. Although DBP, LBP, some thrift banks and rural banks have picked up part of the slack, in the aggregate their volume was too small to offset the impact of the decrease in commercial bank lending.

Estimated demand for credit. It is not unusual for the share of bank lending to agriculture to decrease in a country, as the sector's relative share of GDP decreases, but 2.5% of loans granted for all agricultural purposes in 2010, compared with a 12.3% sector share of GDP is very low. Comparable figures for Indonesia for the same year are as follows: agriculture accounts for about 7.5% of total credit and 15.3% of GDP. In 2010, the ACPC estimated that banks financed only about 30% of the total credit required for selected DA priority commodities (palay, corn, coconut, sugarcane and fisheries, among others).

Formal and informal institutions. According to ACPC surveys, the proportion of borrowing farmers has been on the increase, but surveys also reveal that farmers still borrow more from informal sources (50% v. 43%). Informal lenders, not regulated by the BSP or any regulatory body, include input suppliers, millers, traders, friends and relatives, and landowners. They typically charge high interest rates (as much as 50% per annum) in exchange for little or no documents and/or collateral. The ACPC has established a target to increase to 85% the proportion of borrowing farmers and fishers who are serviced by formal institutions. This would require credit outreach to an additional 800,000 farmers and fishing households, which is not likely to materialize unless private commercial banks were to substantially increase lending.

Credit information. The limited access to credit by small farmers and fishers, despite the banking sector's reported good liquidity, has been attributed to: (i) the lack of track record among farmers; (ii) lack of knowledge on accessing formal or bank financing, particularly putting together the required documents; (iii) lack of acceptable collateral (often linked to agrarian reform and/or land titling issues); delayed release of loans; and (iv) large documentary requirements that formal lending institutions require from farmers. The limited availability of credit information on prospective borrowers, and the absence of a nationwide movable collateral registry, contribute to banks' reluctance to lend. Table 3.7 compares the depth of credit information coverage in the Philippines with other countries and regions. The Philippines overall score is about average by world, middle income and East Asia standards, but low compared with Southeast Asian neighbors.

Compliance withAgri-Agra requirements.Banks assert that they find it very difficult to comply with these affirmative action policies (especially with the 10% agrarian reform beneficiaries provision) due to perceived high risk and low bankable demand from the agriculture sector, although,

8 For example, in 2010: P25,081 billions granted and only P3,120 outstanding. This would happen if most loans are short-term, as they would be granted and paid back within the same year (often the case with agricultural production and microfinance loans) and therefore not show up in end-year outstanding statements. For example, a loan of three months' duration could show up four times in loans granted, but only once or not at all in end-year outstanding statements.

as a result of the 2010 amendment, recently some banks have started to make special efforts. Among the banks, RBs had the highest compliance rate because their clientele is concentrated in agricultural areas. The under compliance of other banks may have been due partly to location, which is mostly in urban centers, making them less accessible to agricultural borrowers.

ACEF and AMCFP Outreach, 2011. The aggregate impact of these two programs is very small. ACEF implementation was suspended in January 2011 and will not resume until late 2012, but even when this happens, the aggregate impact will be small given its limited resources. Loans under AMCFP represent only about 0.1% of the total loans granted to agriculture by the banking sector in that year, distributed among various subprograms.

Way forward in the long run. Agriculture will not grow to anywhere near potential in the Philippines unless there is a significant increase in the availability of rural finance.

The government would likely get more mileage out of current efforts if the number of fragmented and small financing initiatives were consolidated into a more substantial wholesale fund to provide long-term finance to the banking system. Such a fund would need to be properly sized in relation to demand, and should be co-financed by financial institutions, transparently administered, with clear monitorable performance indicators, and fully regulated by BSP. However, even with such a program in place, overall volume would still be small in relation to needs. The government's main focus will have to be on addressing those issues that are at the core of private sector reluctance to lend.

TABLE 3.7: DEPTH OF CREDIT INFORMATION COVERAGE BY PRIVATE AND PUBLIC BUREAUS

indicator/country group	private credit bureau coverage (% adults)	public credit bureau coverage (% adults)	credit depth of information
world	25.5	8.5	3.2
high income	53	7.5	4.2
middle-income	10.2	6.7	2.8
low income	0.8	1.0	1.3
East Asia	29.7	8.8	2.7
Philippines	7.4	0[1/]	3
Indonesia	0	31.8	4
Vietnam	0	29.8	5
Singapore	53.8	0	5
Malaysia	83.4	49.4	6
Thailand	41.7	0	5

Source: World Development Indicators.
Note: The Credit Depth of Information Index "measures rules and practices affecting the coverage, scope, and accessibility of credit information available through either a public credit registry or a private credit bureau."
1/ Legislation to establish a nationwide credit information system was approved several years ago, but has not yet been implemented for a variety of reasons.

The roles of the various GFIs should also be reviewed and consolidated over time (including the ACPC, Land Bank, DBP, PCIC, PCFC and others), to improve effectiveness, efficiency and service delivery. The Government should consider: (i) closing the PCFC and transferring its functions to Land Bank, which is already handling some similar activities; (ii) restructuring the PCIC and incentivizing the private sector to undertake many of its functions; (iii) over the longer-term, consolidating the functions of DBP and Land Bank into one development bank, when the financial sector is well developed and commercial banks are more active in SME lending; and (iv) revising the role of the ACPC to become a policy and oversight body without the loan rediscounting function (given very low impact of this activity), which could be handled by Land Bank. In this context, the Government could consider abolishing the Agri-Agra Credit policy, as the banking sector enhances its outreach to agriculture.

The rural bank system needs to be upgraded, including sound capital requirements, policies, operating procedures, and institutional capacity, with the possibility of encouraging FDI to bring capital and know-how. RBs should be encouraged to mobilize savings, open branches and modernize their governance, management and technology systems. Some of this is being pursued, but there are also still restrictions on opening branches outside their areas, rediscounting could require co-financing from own funds through savings mobilization, training of bank directors and managers, etc. The BSP's current RB consolidation program should be expedited. Some best practices experiences that may be applicable include factoring, leasing, informal lending techniques, group guarantees, collateral substitutes

and micro-insurance to address the problems of imperfect information, high transaction costs and the risks inherent to an agriculture setting. Group guarantees are quite common in many countries, thru savings and loan associations (Moldova, India, Bangladesh Grameen Bank, some in Latin American countries. Factoring/leasing are also being used increasingly (e.g., Turkey, India), and more loan processing and management systems automation and simplified loan applications are widely popular.

The Cooperatives and MFI systems also need to be strengthened, with sound capital, policies, operating procedures and institutional capacity building. This should include development and enforcement of national standards for the establishment and supervision of cooperatives (both credit and non-credit coops), and extension of the Philippines' regulatory framework for MFIs, to cover most of the sector. While there may not be a strong case for having prudential regulations cover some sections of NGOs, observance of performance standards would foster greater financial discipline and enhance their credibility before donors and patrons.

Problems related to the agrarian reform program need to be addressed, including: (i) enabling farmers to fully own, use, mortgage and market their land assets freely; and (ii) developing a robust, transparent and easily accessible nationwide electronic land registry system to enable quick and low cost access to land records by farmers and lenders alike.

Given its vulnerability to natural disasters and climate events, the Philippines needs to put in place a state-of-the-art crop insurance program (and continue to develop safety net arrangements for households affected by such disasters). The Government should encourage private sector participation (including FDI) in this area, with suitable insurance and re-insurance product capabilities. However, precisely because of the country's relatively high vulnerability, the private sector alone will find it very costly and unprofitable to provide such coverage on its own. Therefore, the Government will have to share some of the risk/burden in particular for smallholders and vulnerable groups.

A robust and sustainable credit guarantee system is also necessary, operated on market-based principles (preferably owned and operated by the banking system) to provide credit risk protection at a reasonable cost. Here again, the Government may have to share some of the costs in the case of smallholders and vulnerable groups.

Nationwide credit information and collateral registry systems (both for fixed and movable assets) need to be developed, with comprehensive data on current and prospective borrowers, including farmers and fishers. This would provide nationwide coverage for all types of borrowers and collateral national-wide collateral. Timely availability of good quality information should help to reduce transaction costs for lenders, thereby enhancing their interest to serve this important market.

Although the discussion in this Section has centered on credit and related risk instruments, equity financing is also scarce in the Philippines and will be essential for development of some subsectors, especially tree crops, biotechnology/new product development, processing and other downstream activities. Making the foreign investment regime more user friendly, in particular addressing restrictions on the share of foreign investment in business undertakings, and land ownership, will be important to attract longer-term equity financing (as well as technology and skills) on the scale needed to maximize agriculture's potential contributions to the growth, employment, energy, environmental sustainability, food security and rural poverty reduction.

Natural Disasters, Climate Change and Climate Variability[9]

The Philippines is considered one of the most natural disaster-prone countries in the world, highly vulnerable to storms, typhoons, floods, droughts, earthquakes, volcanic eruptions and landslides. Some 60% of the total land area and about three-fourths of the population are classified as exposed to multiple hazards, placing the Philippines in 8th place in the World Bank's Natural Disaster Hotspot list. Just

9 These subjects are covered jointly because they have in common the issues of typhoons 'extreme weather events' (IPCC terminology), that are treated both in the literature on natural disasters and on climate change.

over one-third of the natural disasters in Southeast Asia since 1980 have occurred in the Philippines.

The Philippines National Disaster Coordinating Council and donors (ADB, World Bank, UNDP) have estimated losses to the economy for various periods over the last three decades from direct damages due to natural disasters. Results have averaged from 0.7–1% of GDP, with some years exceeding this range by a significant margin. Weather related disasters have been particularly severe: over the past two decades the Philippines has recorded the most extreme typhoons and longer episodes of drought. Damages and loss from typhoons in 2009 alone were estimated at 2.7% of GDP, placing the impact on a par with that of the tsunami in Aceh[10] in terms of absolute cost, and with Cyclone Sidr in Bangladesh in terms of share of GDP.[11] Of the costs associated with the 2009 typhoons in the Philippines, some 19% of losses and damages were directly in agriculture, of which 87% of the immediate losses were to rice and 89% of damages were to irrigation assets (World Bank 2010). In 2011, typhoons were a contributing factor—though by no means the only one—to the Philippines' low estimated GDP growth of only 3.7% (IMF 2011).

Climate change and climate variability projections at the global level and in the Philippines. Climate Change has been occurring at a faster rate for the last century and is projected to accelerate further in the next thirty years. Despite uncertainties in long term climate projections, there is scientific consensus that mean surface temperature at the global level will increase by about 1°C by 2050 and could, according to the IPCC 4th Assessment Report, increase by 2–4°C by 2100, depending upon the pace of economic, social and technology changes, in the absence of urgent global efforts to reduce greenhouse gases (GHG).[12]

The Philippines Atmospheric, Geophysical and Astronomical Services Administration (PAGASA) has done a first round of downscaling these projections to the provincial level for the Philippines, with grids of 25 sq km. Further downscaling to smaller grids is planned, as well as doubling the number of weather monitoring stations to 140. Below are the results of PAGASA's current modeling effort for the Philippines, which needs to be extended to cover a wider range of models/scenarios. It should be noted that PAGASA has had access to software for only one of the several major climate models available at this time.

Table 3.8: Natural disaster events in Southeast Asia, 1980–2012

location/period	SE Asia (no.)	Philippines (no.)	Philippines share of SE Asia
1980–1989	212	87	41%
1990–1999	330	107	32%
2000–2009	516	145	20%
2010–2012[1/]	105	53	50%
1980–2011	1,165	392	34%

Source: CRED, International Disaster Database (CRED is the Center for Research on the Epidemiology of Disasters. Its database EM-DAT (www.embat.be-Universite Catholique Louvain – Brussels – Belgium) was last accessed for this study on September 7, 2012).
1/ As of September 7, 2012; see footnote 12.

Results of these various models do vary, and it is important that PAGASA have access to several of them as soon as possible, so that it is able to explore deepen its analysis of possible outcomes:

- Surface Temperature. Over the last 60 years, surface temperature has increased by 0.65°C above the 1971–2000 values; and the minimum and maximum temperatures have increased by 0.36°C and 1°C respectively. The mean temperature in all areas of the Philippines is expected to rise by 0.9–1.1°C by 2020, and by 1.8–2.2°C by 2050, compared with the 1971–2000 baseline. The warming is projected to be most severe in Mindanao.

- Precipitation. Since 1960, mean annual rainfall and the number of rainy days have increased and the country has experienced greater variability in the onset of the rainy season. PASAGA projects a reduction of rainfall in most of the provinces during

10 Damages and loss in Aceh from the 2005 East Asia tsunami are estimated at $4.4 billion, equivalent to 1.6% of Indonesia's GDP in that year (World Bank 2010).
11 Damages and loss for 2007 Cyclone Sidr are estimated to have cost Bangladesh 2.8% of GDP in that year (World Bank 2010).
12 The IPCC 5th Assessment Report (AR5) is presently scheduled for distribution to governments in late 2013.

the summer season, making the dry season drier, while rainfall increases are likely in most of Luzon and the Visayas during the southwest monsoon, making these seasons wetter. There is generally a decreasing trend projected for most parts of Mindanao. Thus, there is the likelihood of more droughts as well as floods (PAGASA 2011, World Bank 2010).

- Sea Level Rise. Studies on rising sea levels in major coastal cities show a slight upward trend. The Manila area has exhibited a particularly strong increase in mean sea levels, probably due to a combination of local subsidence as well as a rise in sea levels (Hulme and Sheard 1999). A sea level rise of 70 cm is projected for 2100 (IPCC 2007).

- Extreme Climate Events. The Philippines, particularly its Central Visayas region, on average, is frequented by 20 tropical cyclones each year, with nine on average making landfall. This number has increased in recent decades by four; there is also evidence that the intensity of these storms i increasing (PAGASA 2011).

At the global level, food supplies are not likely to be threatened by a modest temperature rise of 1°C, given the longer growing season anticipated in the higher latitudes. Climate variables affect yield potential of crops and livestock, but not always adversely. In the temperate mid to high latitude zones where the bulk of world food is grown, longer growing seasons lead to an increase in the yield potential of most crops till about a 3°C rise. On the other hand in the low latitudes, even a 1°C rise leads to significant loss of yield potential. Thus, overall global supplies of food are not likely to be affected at least to 2050, but food security in many countries, including VIP countries, would be secured only through increased reliance on trade.

The Philippine agriculture sector is already witnessing the impacts of accelerating climate change (CC), and the associated threats are generally well recognized. The Government has started to integrate CC themes into overall sector and economic policy-making. The platform for doing this is provided by the Climate Change Commission (CCC) and its Strategic Framework issues in 2010 and its subsequent Philippines CC Action Plan. This platform is slowly being built upon. Early work has been done in downscaling IPCC modeling into Philippine specific projections of climate variables. However, there is a need to conduct in-depth vulnerability and impact analysis of these emerging threats on key subsectors and crops, and these are underway.

The Government aims to develop a differentiated and phased response strategy to various CC threats, since the impacts on Philippines food security are likely to be varied in terms of severity, probability, immediacy and irreversibility. It is safe for now to be guided by the IPCC (2007) conclusion that CC will likely depress agricultural yields by about 10–15% by 2050, hence a commensurate increase in productivity will be needed to offset this impact. Philippines does face a special challenge in terms of cyclones, whose frequency and intensity are expected to increase with sea temperature change, and its archipelagic geography also heightens risks associated with sea level rise. A clear methodology needs to be developed for prioritizing among a host of planned hard, soft and autonomous adaptation actions that Philippines can pursue. It is commendable that sector and regional vulnerability assessments affecting food security, using a common framework, are scheduled to be accomplished by end-2012. They should then be subjected to a systematic analysis to make optimal choices taking into account the severity, immediacy and probability of various climate threats.

The likely impacts of climate change on crops in the Philippines are currently being assessed through sector vulnerability assessments that are expected by the Climate Change Commission to be completed in 2012. From published scientific literature, some of these would be as follows:

Experiments conducted in the Philippines by the International Rice Research Institute (IRRI) have shown that rice yields could decrease 10% for every 1°C increase in minimum temperature. Another study predicted that an increase in temperature of +2°C (at 330 ppm CO2 concentration) would reduce rice yields by 22%. (Escano and Buendia, 1994).

Sea level rise will undoubtedly affect coastal agriculture and fisheries. Estimates of likely agricultural land affected by sea level rise are currently being developed. Philippine coastal fishing and aquaculture could suffer, requiring operators to raise dikes to protect current production. There has already been a significant loss of mangroves in the Philippines (from 417,000 ha in 1967 to less than 100,000 now (3/), due to the establishment of fish ponds. This loss allows more sediment flows to reach coral reefs, in turn negatively impacting them and the marine fisheries dependent upon healthy coral reefs face an uncertain future.

Extreme weather events, such as cyclones, are likely to be affected by a slow rise in sea surface temperature, but specific predictions are not yet available. The loss of coastal mangroves has reduced the natural protection against cyclones.

Philippines Department of Agriculture, using Geographic Information System (GIS), has estimated that approximately 10.2 M hectares, or 34% of the country's total area, would be affected by either floods, drought or an extreme weather event, but it provides neither a time line nor the modeling basis for this seemingly worst case scenario.

The overall impact of CC on the agriculture sector will likely intensify in the second half of the 21st century. While Philippine specific analysis is not currently available, it is generally estimated (IPCC 2007) that improvements from accelerated R&D investments, resulting in a 10–15% increase in crop productivity by 2050, would overcome most negative climate change impacts. In view of the fact that rice yields in the Philippine have tripled in the last 50 years, raising productivity by 10–15 % over the next 40 years does not seem an insurmountable challenge. However this needs to be considered in the following context: Philippines will also need to achieve significant productivity increases to meet demand for food due to relatively high population growth and shrinking agricultural land area over the next several decades.

Social consequences of climate change will be negative. During El Niño years, many farmers had to totally give up rain fed rice farming due to water shortages. About a half of the Philippine land area and 80% of the population are considered vulnerable to natural disasters. With nearly one third of households judged to be below the poverty line, families exposed to climate risk are unlikely to withstand additional stress successfully on their own. Provision of accessible crop and livestock insurance instruments and strengthening of social safety nets would be needed.

Some adaptation responses can be autonomous, with individuals and firms taking steps to adjust to long-term changes on their own, but these cannot be left to the private sector alone. Planned public sector responses will be essential when, because of scale, public nature and need for simultaneous action, poverty impact and social vulnerability, the responses cannot be left to private initiative. These public responses in turn can be "soft", such as policy and institutional measures, or "hard" i.e. investment actions such as building of river/sea dykes. In various sectors the response menu would be as follows.

Crops: Increased investment in agricultural R&D would strengthen adaptation through development of suitable crop varieties to deal with water and temperature stress and saline intrusion, improved crop and livestock management techniques including better soil nutrition, changes in planting times and irrigation methods. Improved integration of the Philippine food market with the global market to cushion fluctuations in domestic production and enhance price stability would form a part of the adaptation response.

Irrigation infrastructure such as dams, particularly in Luzon region, where rainfall is expected to intensify, may need to be "climate-proofed" and dikes on rivers to protect low lying areas would need to be raised in order to protect against increasing cyclones and higher tides. Design standards for construction of future dikes will also need to be revised. The extent and timing of such climate proofing would depend upon an assessment of the immediacy, severity and probability of the threats of increased surges that accompany cyclones.

Fishery and Livestock: Aqua culture will certainly be challenged by CC as ponds are threatened by erosion, and controlling salinity becomes more challenging as dry season

fresh water flows are reduced and saline intrusion increases. It is speculated that increase in habitat due to floods will be balanced by a reduction in dry season habitat but both will call for adaptation in catfish and shrimp farming operations, without necessarily a loss in total production. Autonomous adaptation through upgrading of ponds and changes in water/salinity management practices and use of new salinity tolerant species are foreseen.

Sea Level and sea temperature rise: Adaptation strategies against sea level and temperature rise range from achieving coastal protection through restoring mangroves, creating dunes and raising heights of dikes (which can be very expensive), all the way to temporary or total evacuation in the most threatened and critical locations and offering effective social protection services to displaced populations. The choice of a specific adaptation measure would again depend upon the severity, immediacy, and probability of such events.

Extreme Events: Adaptation measures are not specific to agriculture and include soft measures such as improved construction standards, better land use planning, early warning systems, well established evacuation procedures, social protection measures and insurance systems to cover losses. Assured and prompt access to food stocks, medicines and alternate shelter forms a major part of the agenda. Philippines is piloting work on undertaking detailed local level integrated cyclone and disaster risk mitigation planning, e.g. in the province of Albay, based on which a larger national response strategy can be developed.

No reliable estimates of the cost of adaptation are available for the Philippines. Attempts made to estimate the potential costs of adaptation still have serious limitations in methodology and thus are seen as indicative only. One study focusing on four countries of SE Asia (Vietnam, Indonesia, Philippines and Thailand) concluded that the costs would be about 0.2 % of GDP to 2020, mainly for R and D and construction of dykes (ADB 2009). Another study concluded that for all developing countries, cost of adaptation in agriculture, excluding those for dykes and embankments, would be about $7 B per year to 2030 or about 0.12% of the combined GDP of developing countries.

Combined with knowledge about adaptive cost, scope for cost recovery and social impact as well as institutional capacity to pursue a proposed response, it would be possible to develop an optimal response menu to allocate resources for climate action. Such a system would be a blend of:

1. Using a cost-benefit approach: build climate resilience for the country and individual farmers and firms through co-benefits of robust economic and rural income growth;

2. Avoiding key vulnerabilities: act quickly in the most cost effective way where impacts, probabilities, immediacy and irreversibility are all high;

3. Promoting autonomous actions, within a cost benefit framework, to deal with high probability and immediate threats that have market impacts. These minimize public costs and spread the burden of adaptation;

4. Buying an insurance policy through pursuit of soft measures for high impact, low probability and long term threats; and,

5. Pursuing a sequential decisions approach to buy time for more information for low impact and low probability/long term threats.

With little progress to date in reducing global Green House Gas (GHG) emissions since Kyoto , the world may well be on the way to substantial warming of over 4°C by 2100. The totality of climate actions now underway will not suffice to prevent a 2°C rise by 2100. While the Kyoto commitments called for a reduction of GHGs by 5.2% below 1990 level by 2012, emissions globally have increased by 36% to date. Even the softer Copenhagen 2009 agreements which would have limited global emissions to 44 Gtons CO2e by 2020 are already showing a slippage of 5 Gtons. In the energy sector, which accounts for 26% of global GHG emissions, half of the new coal plants which have come up in the last decade do not meet latest efficiency standards and none pursues carbon capture. Pace of improving energy efficiency of buildings, a win-win proposition, has been tardy

worldwide. The one bright spot is renewable power—solar, hydro, wind and geothermal—which has been growing at 27% annually and keeping pace with aspirations. In the transport sector, which accounts for 13% of GHG emissions, vehicle efficiency has been growing at just 1.7% annually, compared to a need of 2.7%. (11/). In the forestry sector, which accounts for 17% % of global emissions largely from reduction in tree cover, despite pilot efforts to promote re-forestation and stop deforestation for example in Indonesia, overall trends are not encouraging. In the agriculture sector, including livestock, which accounts for 14% of GHG emissions, there has been virtually no attention to mitigation.

With a 3°C or higher rise, prospects for food production become unfavorable even in the high latitude regions and disastrous in the low latitudes. In the higher latitude regions, all major crops including pasture are projected to show decline in yields of 16–29%. In the lower latitudes, yield declines are of the order of 20–40%. Even if an allowance is made for not yet fully researched carbon fertilization effect countered by increased prevalence of pest and disease and increased loss of agricultural land to sea level rise, the situation once temperature rise exceeds 3°C will be very difficult to manage. The fate of Philippine agriculture in the period beyond 2050 will be significantly affected by what the world does in the intervening decades to control GHG emissions. Philippines itself contributes very little (0.5%) to global GHG emissions but managing this will nonetheless be important. Land use change and forestry issues account for nearly half of the GHG emissions originating in the Philippines.

National policy-making is at the level of the President, who chairs the Climate Change Commission, which provides a high level forum. Its secretariat rightly seeks to mobilize the energy and initiative of sector and local government agencies, seeing its role as a facilitator and in monitoring and evaluation. CCC's national framework intends to place greater importance on adaptation, though the analytical work on mitigation seems to be more advanced. The framework recognizes the overlap between the two. Plans of further action to flesh out the seven pillars of the National Framework Strategy, of which food security is the first, requires in-depth work in sectors and in the regions, which has been launched. Technical capacity is being developed for improved modeling and better impact assessment mainly through a series of loosely coordinated donor supported 1–3 years' projects. Philippines aims to have world class CC monitoring and analysis capacity, which depends upon the pool of scientific talent as well as access to high-speed computation hardware much higher than PAGASA's current capacity, which takes a month to run one 100-year simulation.

The available indigenous scientific talent pool is spread over many institutions and is called upon to offer its expert service through task forces, leaving room for more structured approaches, perhaps mirroring the IPPC framework of formal working groups. Given the heavy emphasis on decentralization in the Philippines, there is an attempt to replicate the climate change planning process as well as architecture at the four different local government (LGU) levels. It is doubtful that adequate capacity exists to effectively support all four LGU levels, and it is far from certain that all functions have to be done at all four levels. Much greater selectivity in the role of various LGUs in CC planning, execution and monitoring will be needed. There is also room to enhance the effectiveness of the harnessing of the national scientific talent both into the national policy making effort as well into sector and local government level program delivery efforts. Clearer role definitions among various institutions engaged in gathering, analysis, dissemination and actual use of CC data are needed. There is also a need for improved mechanisms for engagement between LGUS and key sectors strategically in Manila as well as operationally in the delivery of technical support and advice to affected people. Of particular importance is the process of analysis and making inter sector trade-offs when using natural resources, such as coastal areas and water. Integrated management of coastal areas and water resources through river basins will be needed to implement the future adaptation programs and appropriate institutional arrangements cutting across sector and local government units, need to be thought through now.

Water Balances and Irrigation

Over the past decade the Philippines has continued to expand the share of its land area under agriculture by about 0.3% annually; the share of land under agriculture in East Asia and the Pacific has also expanded, but at a slower rate (0.1%); and Southeast Asia generally has lost land under agriculture by an average 0.5% annually. However this area expansion has been accompanied by only modest investments in the country's irrigation system: the share of agricultural land equipped for irrigation in the Philippines was about 14.7% in 2009, some two-thirds the average for Southeast Asia and less than half the average for East Asia & Pacific.

Despite some $600 million of Investments over the past two decades by the public sector to increase the area under National Irrigation Systems (NIS) area by about 120,000 ha, the gains were offset by an even greater loss of nearly 185,000 ha of irrigated lands in the Communal Irrigation Systems (CIS). The net loss was compensated only by the expansion of about 65,000 ha of private irrigation—with the end result, however, that there has been no change in total irrigated land area in the Philippines for some two decades. This would appear to be one of the main causes of chronically lower yields for most crops compared with regional and global averages.

A comprehensive inventory conducted by NIA in 2010 (the first such exercise in about a decade) arrived at a 'firmed up service area' similar to the above total, but with a slightly different distribution among the NIS (737,768 ha), CIS (615,135 ha) and private systems (202,138 ha). However, it is important to note that this same inventory also found that 21% of the total estimated irrigation service area is 'non-operational,[13] including 13% of the NIS areas, 32% of the CIS and 15% of private irrigation. Table 3.10 summarizes the inventory findings on the share of the irrigated area in each of the three systems that is effectively operational:

Under the 1991 Local Government Code, responsibility for oversight and support to the CIS was decentralized to LGUs, most of which did not have the technical or financial capacity to discharge these functions, nor have most of them developed such capacity in the intervening years. NIA provides occasional support, but this is ad hoc and beyond its regular mandate. If the estimates above are accurate, only some 58% of the area under communal systems in 1990 was still in good operational status in 2010, and many communal irrigator associations are in default on their loan obligations (in the CIS, irrigators are responsible both for repaying the capital costs of initial investment in their systems, and for regular O&M).

Table 3.9: Area under irrigation by kind of system, 1990–2011

year/ system	national ha/% total	communal ha/% total	private ha/% total	total ha
1990	663,209/ (42.4)	750,671/ (47.9)	152,128/ (9.7)	1,566,008
1995	651,812/ (49.9)	474,289/ (36.3)	180,909/ (13.8)	1,307,010
2000	685,812/ (50.4)	501,442/ (36.8)	174,200/ (12.8)	1,361,454
2005	695,774/ (49.2)	543,262/ (38.4)	174,200/ (12.3)	1,413,236
2010	767,006/ (49.7)	558,333/ (36.2)	217,329/ (14.1)	1,542,668
2011	783,457/ (50.0)	565,805/ (36.1)	217,329/ (13.9)	1,566,591
change ha 1990–2011 %	NIS +120,248 +18%	CIS –184,866 –25%	Private +65,201 +43%	Total +585 no change

Source: Donor project documents and NIA data, including Draft Inventory 2010.

13 The NIA Inventory identifies the total service area (A), from which converted areas (B) and permanently non-restorable areas (C) are subtracted to arrive at a 'firmed up service area' or FUSA (D). The FUSA is then disaggregated into 'operational'(E) and 'non-operational' (F) service areas. The non-operational areas (F) are understood to be those that are not capable of supplying reliable irrigation services to irrigators (whether because of design, maintenance or water availability issues), but that could be restored if these problems are addressed (unlike the permanently non-restorable areas in (C). See: NIA Inventory of National Communal & Private Irrigation System Summary by Region as of December 31, 2010, dated December 7, 2011.

Donors channeled substantial resources to develop the CIS in the late 1980s and 1990s, but have since been focusing more financial and technical support to upgrade NIA's capacity to manage the NIS, including a systematic transfer of operations and maintenance responsibilities to Irrigator Associations. Despite top NIA management commitment to this approach, however, there are reservations within NIA about the feasibility of having IAs assume significant O&M responsibilities, given the dismal results of the similar strategy (of irrigator-led management) in the CIS. Field staff cite farmer capacity to pay constraints, the limited progress in rural poverty reduction over the past decade, deterioration in average farm worker wages and in returns to investment across the main irrigated crops (palay)—these reservations appear to be shared by the majority of IAs, which are reluctant to assume more than very limited roles (Stages 1 or 2 of NIA's four-stage plan for progressive transfer of responsibilities to IAs). The Government has allocated a significant share of the current Rice Self Sufficiency Program resources for irrigation investment by NIA, mostly for rehabilitation. Even if the several main projects are fully implemented, however, over the next several decades the Philippines is still likely to have one of the smaller ratios of irrigated-to-total crop land in Southeast Asia. Total irrigation capacity could even decline, if the decline in the share of operational communal systems is not arrested.

Finally, financial resources and organizational capacity are not the only constraints facing irrigation in the Philippines. The country is estimated to have the second lowest availability of water per inhabitant in the region (5,302 m^3, Aquastat Database, FAO 2010), and this ratio will change (for the worse) as population continues to expand at a faster pace than in neighboring countries. At the same time, there is no up-to-date knowledge base on water balances in most parts of the Philippines (the exceptions being Metro Manila and Metro Cebu) that would provide a reasonable basis for judging where the 'tipping points' may be going forward. The most recent National Water Resources Master Plan (NWRMP, 1998) was itself prepared on the basis of water resource information from 1980. Since the Philippines has not had in place an effective system to measure rainfall, stream flows and groundwater, opinions about changes in the interim since 1980 tend to be based on very partial information.

The 1998 NWRMP projected that water stress would emerge in nine locations by 2025—almost all of these were already experiencing problems by 2010, and this has led to shortfalls in the release of water to various irrigation command systems at different times in recent years. When water scarcities emerge, agriculture/irrigation often absorbs most of the shortfall (industrial uses and potable water for human consumption tend to receive higher priority). In addition, several multipurpose dams and reservoirs generate hydroelectric power and, although this does not result in a net loss of water, energy and irrigation needs do sometimes involve competing management choices, with irrigation again frequently having the lower priority. Considering that (i) only 15% of cropland in the Philippines is presently irrigated; (ii) the water directed to irrigate this relatively small share of cropland already accounts for nearly four-fifths of all water use in the country; (iii) some of the irrigation command areas have been facing periodic shortages of water; (iv) the country has relatively low availability of water per capita, with a rapidly growing and urbanizing population; and (v) climate change will bring some degree of warming and therefore greater evapotranspiration of water resources over the coming decades, it is not at all clear how feasible it will be to expand irrigation very significantly in the Philippines. NIA and other government agencies frequently cite the country's total potentially irrigable land area as being about twice the currently irrigated area, based on a definition related to land slope. If updated water resource information were included in the equation, however, the potentially irrigable area would likely be much smaller.

Table 3.10: Irrigated area in good operational condition, by type of system (2010)

type of system	ha
National Irrigation Systems (NIS)	658,524
Communal Irrigation Systems (CIS)	433,581
Private Irrigation System	164,800
total	1,256,915

Source: NIA Draft Inventory, December 2010.

There is an urgent need to update the 1980 water balance information for all regions of the Philippines, and to use the results (with forecasts of the impact of climate change factored in), as a sound basis for long-term planning of water resource investments, management and water allocation decisions, within a river basin framework. There is also a need for a comprehensive and up-to-date dam safety baseline (which presently exists for only a few dams) and to improve the monitoring of water pollution (the Philippine Environment Monitor estimates that 37% of water pollution is caused by agricultural wastes, but the database used for such analyses is weak).

Finally, water resource and irrigation planning have been seriously hampered by the absence of up to date information on water balances, and by the multiplicity of agencies at the national and sub-national levels with overlapping mandates, insufficient data and data sharing, and weak coordination arrangements. The National Water Resources Board (NWRB), established in the 1980s, lacks the legal and regulatory authority, budget and human resources to effectively plan and administer water resource allocations. A 1995 study financed by JICA and executed by the World Bank included detailed recommendations to strengthen policy formulation, data collection and processing, national and basin planning and real-time management. Very few of the recommendations have been followed up. In 2011, the current administration convened a high-level working group under the Secretary of Public Works to prepare a new National Water Resources Management Plan, including institutional and financial recommendations for its implementation, with assistance from the ADB. The working group has resurrected and updated many of the recommendations of the 1995 study, some of which can be implemented through regulatory action and others will require legislation; Congress has initiated hearings. Interim recommendations of the working group include the establishment of a National Water Resources Management Council with regional (and eventually river-basin based) offices at the sub-national level, as well as an independent economic regulatory body. Proposals are under review and pushback from a wide array of institutions with vested interest is evident. It would be unfortunate to lose another opportunity to undertake clear reforms in an area that is absolutely central to the Philippines' future well-being (including, but certainly not limited to, the country's agricultural sector).

Public Sector Institutions and Implementation Capacity

This Section is not an exhaustive review of all sector institutional issues; rather, it brings together in one place matters, most of which are discussed elsewhere in the study, on two subjects relevant to long-term agricultural transformation and food security in the Philippines: (i) the impact of selected decentralization policies on the Philippines; and (ii) the impact of the failure, to date, of not having completed rationalization plans for all key departments and agencies, on implementation capacity and the risks this poses at a time when budget allocations are being increased for most of these entities.

Decentralization. Some aspects of decentralization have not served the agriculture sector well in the Philippines. In other respects, decentralization has clearly been beneficial, and this study in no way suggests reversing the process. However, insofar as agricultural transformation and rural poverty reduction are concerned, the Local Government Code of 1991 has five major defects that need to be addressed, whether through reform of the Code itself or the associated regulations.

Decentralization of agricultural extension is not working and this is seriously limiting technology/knowledge transfer to farmers. There is no country that manages an efficient extension system with such a degree of atomization as exists in the Philippines; while re-centralization to the national level would not make sense, there is clearly a need to restructure the extension system, with much greater responsibilities along provincial lines. The original decentralization essentially created 75 provincial and more than 1,350 municipal agriculture extension services, from one national extension service. Many LGUs face issues of insufficient technical and financial capacity, and there are no structured arrangements to backstop them in delivering technical services.

Decentralized oversight of communal irrigation by LGUs is also not working. Latest estimates suggest that the Philippines has lost some 185,000 ha of communal irrigation capacity since the 1980s (i.e., more than the aggregate of new publicly financed irrigation). Most LGUs lack the technical and financial capacity to backstop irrigation O&M and, when needed, rehabilitation. The communal systems currently represent 35% of the installed irrigation capacity of the Philippines—a resource than cannot continue to be squandered through mismanagement. Combining the communal with the national irrigation systems, under NIA management, in the context of gradual strengthening and transfer to irrigator associations, is important to ensure that yields for key crops improve as suggested in this study.

Decentralization of decision-making over water resource management to administrative units based on population and similar factors does not make sense in the case of water resources. The Philippines needs both to strengthen technical and coordination capacity at the national level, and reconfigure water resource management along river basin lines at the subnational level.

For similar reasons, the fisheries sector does not lend itself to management at the lowest level of local government, as many resource issues cut across administrative unit boundaries. If the Philippines is to arrest the trend of declining output and consumption of some segments of fisheries resources, it will be essential to reconfigure formal responsibilities at the level of provinces or groups of provinces.

The resource transfer rules of the Local Government Code do not include compensatory provisions for differences in income, and this makes it extremely difficult for poorer LGUs to make certain kinds of investments, especially more costly infrastructure undertakings. The Government has attempted to address this problem through establishment of other funding mechanisms (for example, the fund for good governance), but the scale of financing is very small and to some extent discretionary. While such supplementary 'bonus' arrangements may serve certain goals, it would be important for the Philippines to review options to incorporate transparent redistributive provisions into the rules governing fiscal transfers to LGUs.

Planning. [Note: This section will integrate all major recommendations throughout the report on actions needed to strengthen planning. These include the need for longer-term planning (going beyond the six-year plans that NEDA produces to coincide with individual presidential mandates); agriculture sector modeling; climate change modeling; updating water balance knowledge; preparing an up-to-date dam safety baseline; strengthening technical aspects of the FIES household surveys (in particular regarding the need to track the composition by major category of food eaten outside the home and for entertainment); rationalizing the work by FIES-FNRI-BAS; regular use of satellite imagery and other GIS techniques to update land use data; credit information and collateral registry services; common strategic framework for the three main agriculture R&D systems of PCAARRD, BAR and DENR-ERBD; and others.]

Institutional Rationalization Process. National government agencies have been mandated since 2004 to implement 'rationalization' plans, but few in the agriculture sector have done so14 (the same is also true of many other sectors). Absent a plan approved by the Department of Budget Management (DBM), an agency is not able to reorganize or recruit new staff; while some relief is possible through short-term contracting, this generally makes it impossible for agencies to attract experienced professionals in critical ongoing or new skill areas. After eight years of such administrative restrictions, many agencies in the agriculture sector are operating on the basis of ad hoc and severely dysfunctional institutional arrangements and staffing complements. By way of illustration, Annex 7 provides details on the staffing impact on the Department of Agriculture (DA).

DBM has made very substantial progress in some areas of its responsibility, particularly regarding oversight and timely release of budgets. However, progress on the institutional rationalization program has been quite poor, for a variety of reasons, and this is seriously undermining the effectiveness of public expenditures at a time when the agriculture sector budget is being increased and rural poverty reduction requires redoubling of efforts to overcome the apparent stagnation in progress. Given severe personnel shortages

14 Notable exceptions include PCAARRD and NIA.

(not only aggregate numbers but, more important, specific managerial and skill constraints) it is likely that DA and some key sector agencies may experience 'burn rate' problems in using increased budget envelopes. It would be unfortunate if this were to result in a decrease in future allocations on the grounds that they cannot be absorbed—when the issue is the failure to act in a timely manner on core institutional reforms and capacity building.

Some sector agencies consider that DBM is moving slowly because of reluctance to allocation resources for redundancies, on the scale that would be needed if the rationalization proposals were adopted. Others suggest that DBM itself lacks the sector expertise to evaluate the proposals quickly and efficiently. Clearly, for the agriculture sector, DBM needs to fast track the institutional rationalization process. It may be useful to ground this in a quick review of how the process has functioned to date, to identify possible improvements. If technical skills are a constraint, other agencies (NEDA, PCAARD, SEARCA, UPLB, etc.) could be asked for temporary support. If budget resources for redundancies are an issue, rationalization plans could include phases that would at least permit interim reorganizations and some new hiring of critical skills.

Chapter 4. Food Security in the Philippines

Food Expenditure and Consumption Patterns

Data sources. The Philippines uses four main instruments to track food consumption patterns:

1. Supply and Utilization Accounts (SUA) prepared by the Bureau of Agricultural Statistics (BAS) of the Department of Agriculture (DA), using a production-based 'disappearance' methodology developed by the FAO to measure quantities of food products available for consumption in a country, based on domestic production and imports;

2. Food Supply Analyses (FSA) also prepared by BAS to estimate the volume and income elasticities of demand for key agricultural commodities;

3. National Nutrition Surveys (NNS) conducted by the Food and Nutrition Research Institute (FNRI) of the Department of Science and Technology (DOST) to measure food consumption patterns, nutritional content, and related health implications; and

4. Family Income and Expenditure Surveys (FIES) carried out by the National Statistical Office (NSO) to measure changes in income and poverty levels using consumption-based household surveys similar to those conducted by many countries.

The SUA are prepared annually; FSAs in 1995, 2001 and 2010; the NNS every couple of years beginning in 1978, with the most recent 7th NNS findings issued in 2008; and the FIES that have been carried out at roughly three-year intervals since 1957, with the latest completed in 2009 and a new 2012 survey currently underway. Considerable effort, resources and professionalism are evident in these four instruments. However, differences in methodology, definitions, timing and coverage result in gaps and apparent inconsistencies that undermine their collective usefulness for planning, monitoring and evaluating impacts of public policies.

The Government has relied on the SUA as its principal source of information on quantities of rice consumed by Philippine households, though essentially the SUA generate data on rice available for human consumption, stocks and other uses; it does not purport to explain what households actually consume. The statistical sample frame is based on the 2002 Agricultural Census;[1] production results for farms in the sample are aggregated by the total area assumed to be under production based on the Census, but these assumptions are not cross-checked with satellite imagery;[2] and the surveys do not pick up consumption of smuggled products (only domestic production and official imports), which varies yearly depending on differences between retail prices in the Philippines and global/regional prices.[3] The SUA do provide consumption estimates for subnational geographic units, but do not disaggregate results by income cohort.

The NNS produces estimates based on one day's consumption by households in the sample, which are then grossed up to an annualized estimate. Results are influenced by the timing of the survey, as food habits vary across seasons. Less detail is provided on sub-national units (below the regional level) and on differences across income cohorts, but NNS does report nutrition (based on consumption) across age and gender, with a particular focus on children.

1 A new Agriculture and Fisheries Census is planned for 2013.
2 IRRI and PhilRice are carrying out such an exercise for the Philippines, as part of a multi-country exercise led by IRRI to refine data on areas under rice production using satellite imagery and GIS techniques.
3 Unofficial estimates for rice the volume of rice smuggled into the Philippines in 2011 by BAS and NFA staff range from 400–600 MMT (4–6% of the SUA figure for net rice available for food consumption). Data is based on a comparison of official information from neighboring countries on quantities of rice shipped from their ports and headed to the Philippines, v. official Philippines import data).

The FIES data are gathered using a structured questionnaire to include information on family income and level of consumption by type of expenditure (cash and non-cash imputed). They also include data on family size, employment, age, education, and housing. The composition of expenditure categories has evolved, with more non-food items and greater detail on food incorporated over time. The FIES is conducted nationwide using a stratified two-stage cluster sampling scheme with rural and urban classification of each province as principal domains and the administrative regions as the sampling domains (Ericta and Fabian, 2009). The Population Census is used as the sampling frame.

FIES permits considerable disaggregation by both subnational unit and income cohort. However, NSO does not process the quantities data, among other reasons because it has yet to develop a matrix of equivalencies (defining bundles, packages, egg units, etc. in terms of grams or kilograms) that would make the results comparable across years, food groups and countries. Fortunately, as rice and other cereals are reported in kilos to begin with, the FIES provides an excellent database that could be used to measure actual consumption quantities; unlike the NNS, it is carried out in two different months using semestral recall methods, which reduces distortions related to seasonality, and it does disaggregate by income cohort. Unlike the SUA, it measures all rice that households report as having actually eaten at home (regardless of whether it originated as legal or smuggled food), rather than what may be available for consumption in the locality. However, while the FIES tracks expenditures on food eaten outside the home, it does not do a good job of disaggregating the kinds of food consumed outside the home, which is increasing as a share of both rural and urban expenditures. Thus we are not able to track quantities of rice eaten outside the home.

Share of food in total household expenditures.After having declined slowly by about 10 percentage points over the 40 years from the early 1960s to 2000, the food share of total household expenditures in the Philippines has held steady in the 41–43% range for nearly a decade. Both urban and rural areas experienced similar patterns through 2000, although at different levels: food accounts for 38–40% of expenditures by urban households, and 49–51% for rural households. Urban households now spend about 7% of total expenditures on food eaten outside the home; rural households spend 4.2% of total expenditures (Table 4.1).

TABLE 4.1: FOOD EXPENDITURES AS A SHARE OF TOTAL EXPENDITURES, 1961–2009

	food share of total expenditures (%)			food eaten at home/ total exp (%)			food eaten ouside home/ total exp (%)		
year	national	urban	rural	national	urban	rural	national	urban	rural
1961	53.8	48.4	59.5	51.6	45.4	58.0	2.2	3.0	1.5
1971	53.7	47.0	59.3	51.0	43.3	57.5	2.7	3.7	1.8
1985	51.9	46.3	58.8	48.8	42.3	56.8	3.1	4.0	2.0
1991	48.6	45.0	55.7	44.7	40.4	53.4	3.9	4.6	2.3
2000	43.6	39.9	51.5	38.6	34.3	48.0	5.0	5.6	3.5
2003	43.1	na	na	37.7	na	na	5.4	na	na
2006	41.4	38.3	47.6	35.6	31.5	43.7	5.8	6.8	3.9
2009	42.6	39.5	48.7	37.2	32.5	44.5	5.7	7.0	4.2

Source: Centennial calculations based on FIES records and survey report.

The second greatest decreasing trend concerns fish, for which the share of expenditures has declined steadily in all survey years, and is now about 5 percentage points lower than in the mid-1960s.

Expenditures on meats have increased 4–5 percentage points, with the biggest growth in prepared (v. fresh) meats, followed by some increase in the share of poultry (meat only, the expenditure share of eggs has decreased) and very little change in swine and other livestock combined. In 1965 the average family spent nearly twice as much on fish as on meat; today expenditures for meat are slightly greater than those for fish.

Distribution of expenditures across food groups. While Table 4.1 tracks what share of total expenditures households have allocated to food over time, Table 4.2 shows how they have distributed those expenditures across food categories. As changes in the food patterns have occurred very slowly, the analysis looks back over the last five decades. Table 4.2 summarizes changes between 1965 and both 2006

TABLE 4.2: DISTRIBUTION OF FOOD EXPENDITURES BY ALL HOUSEHOLDS (URBAN AND RURAL) IN THE PHILIPPINES, 1965–2009[1/]

year/food category	1965	1971	1985	1991	2000	2003	2006	2009	2006–1965	2009–1965
cereals	39.3	36.3	35.7	29.8	27.3	25.7	26.3	28.2	–13.0	–11.1
rice	27.1			22.0		17.8	18.8	21.0	–8.3	–6.1
maize	5.6			2.3		1.7	1.4	1.2	–4.2	–4.4
other	6.6			5.5		6.2	6.1	6.0	–0.5	–0.6
roots, tubers, fruits, veg.	9.3	1.02	10.2	11.1	11.5	11.2	10.3	10.0	+1.0	+0.7
roots and tubers	1.8		2.3	1.9	1.4	1.3	1.2	1.2	–0.6	–0.6
fruits and veg.	7.5		7.9	9.3	10.0	9.9	9.1	8.8	+1.6	+1.3
dairy and eggs	6.0	4.8	6.8	7.2	6.9	7.5	7.3	7.2	+1.3	+1.2
dairy	3.6			4.8		5.4	5.2	5.2	+1.6	+1.6
eggs	2.4			2.4		2.1	2.1	2.0	–0.3	–0.4
meat	9.7	13.2	13.1	14.6	16.1	15.6	14.8	13.7	+5.1	+4.0
poultry fresh	2.3					4.2	4.1	4.0	+1.8	+1.7
swine fresh	6.5					5.3	5.3	4.9	0	–0.6
other fresh						1.6	1.2	1.0		
prepared meats	0.9					4.5	4.2	3.8	+3.3	+2.7
fish	17.4	16.6	15.2	14.6	13.1	12.8	12.3	12.1	–5.1	–5.3
other	12.8	13.8	12.9	14.6	13.8	14.6	14.9	14.8	+2.1	+2.0
outside home	5.4	5.0	6.0	8.0	11.5	12.6	14.1	14.2	+8.7	+8.8
totals	100	100	100	100	100	100	100	100	--	--

Source: Centennial calculations based on FIES records.
Note: The FIES were begun in 1957, but Centennial was unable to locate a copy of the first survey. The analysis therefore starts with 1961 in Table 4.1 (because that FIES provided a rural:urban breakdown but did not disaggregate cereals)and 1965 in Table 2 (because that FIES did disaggregate cereals into rice, corn, etc., although it does not provide a rural:urban breakdown). For the 1965 survey, however, beef and swine are included as one total and therefore Table 4.2 groups the two meats.

and 2009, as it is possible that 2009 was an atypical year because of the 2008 spike in global food prices. In either case, several clear patterns emerge.

Although households are spending a steadily increasing share on food eaten outside the home (at the workplace, kiosks and restaurants, schools, etc.), FIES does not capture the distribution of these expenditures across major food groups.[4] This gap in understanding an important component of expenditures needs to be addressed in future FIES. With increasing urbanization, and changes in lifestyle in rural areas as well, the share of food consumed outside the home will only increase.

THE DEMAND FOR RICE

Rice is a crucial source of calories and energy for most Filipinos, accounts for approximately 9% of total expenditures by urban households and more than 13% by rural households (2009), and is an important source of income for millions of farmers and workers in allied industries. Thus policies affecting the rice sector are at the crux of key issues of economic development, poverty reduction and food security for the country. A clear understanding of both long-term and current trends in food expenditures and consumption, across geographic areas, income levels and

4 There is an additional category of relevant expenditures not included under the main food category in the FIES, namely food and non-alcoholic beverages for entertainment purposes (equivalent to 2% of total household expenditures in 2009). It does not disaggregate the kinds of food consumed at such occasions.

age cohorts, and the factors that drive changes in these patterns, is essential for the design of sound food security policy and programs. This study aims to advance the understanding of what will happen to rice consumption as the Philippine economy develops over the next three decades.

We begin with a summary of the results of several analyses carried out for this study, two using the Philippines Family Income and Expenditure (FIES) household survey to determine what light it might shed on the question of the quantities of rice actually consumed in the Philippines, and a third drawing mainly on BAS and FNRI data.

The FIES does collect data on quantities, but normally processes and reports only expenditures. Centennial therefore commissioned a team of consultants from Purdue and North Carolina State Universities in the U.S., and the University of the Philippines at Los Banos to carry out a quantities analysis (referred to below as Centennial–Balagtas et al). IRRI cooperated by allowing the team to use the FIES databases that it had acquired for 2000, 2003, 2006 and 2009; NSO staff were very generous with their time in providing unpublished sections of older FIES reports to the team and answering various methodological queries. The team used the FIES data on rural and urban expenditures by income cohort to estimate Engels curves for rice, on the basis of which it developed forecasts of rice demand through 2040 (national, urban and rural) under optimistic and pessimistic GDP scenarios.

Centennial carried out a second, less detailed analysis of food consumption patterns (referred to below as Centennial-Kohli), using a common methodology applied to all three focus countries (Philippines, Indonesia and Vietnam)[5] Finally, future trends in rice consumption were also examined closely in the context of an econometric exercise to forecast overall performance of the Philippine agriculture sector through 2040 using a country-specific multi-market sector model (see Chapter IX, referred to here as Centennial-Briones). Results of all three analyses showed per capita rice consumption rising through 2040, with relatively little difference between the optimistic and pessimistic GDP scenarios. Centennial-Balagtas et al. developed rural, urban and national forecasts; Centennial-Kohli and Centennial-Briones prepared only national forecasts. The structure of the FIES database would also make it possible to analyze patterns at the sub-national level and across age cohorts, in future research.

Influence of prices on food expenditures. The study analyzed the extent to which changes in food consumption in the last decade (FIES 2000, 2003, 2006 and 2009) have been the result of consumer responses to shifts in relative prices, actual changes in quantities consumed, or a combination of the two, with a focus on cereals given their prominent role in national food security policy.

The increased demand for rice may partly reflect the fact that rice prices have risen more slowly than have those of corn and other cereals (Table 4.3).

TABLE 4.3: CHANGES IN CONSUMER PRICE INDEX FOR MAIN FOOD GROUPS, 1990–2010 (2000=100)

food group/ year	1990	2000	2005	2006	2007	2008	2009	2010
all items	44.9	100.0	129.8	137.9	141.8	155.0	160.0	166.0
all food	49.6	100.0	123.9	130.7	135.9	153.3	162.4	167.4
cereals and cereal preparations	49.8	100.0	119.9	125.1	129.6	162.4	174.4	176.8
rice	48.7	100.0	115.2	119.5	123.6	159.7	171.6	173.5
fruits and veg.	42.9	100.0	116.6	126.9	130.6	145.9	154.5	155.3
dairy products	54.5	100.0	143.1	151.7	160.0	180.5	191.8	195.1
eggs	58.9	100.0	119.0	125.7	132.4	143.4	153.1	157.3
meat	55.5	100.0	128.9	132.0	135.4	147.5	155.5	161.9
fish	42.7	100.0	126.9	133.5	137.9	150.4	159.6	164.5

Source: BAS.

Between 2000 and 2006 (the last FIES before the 2008 global spike in food prices), the price of rice in the Philippines rose less quickly than prices of other cereals and of all foods, and food prices in turn increased less than did the overall CPI. By 2009 (first FIES after the increase), the price of food had risen slightly more than the overall CPI, and cereals prices rose more sharply than did other categories

5 Centennial-Kohli used the base year estimate of per capita consumption developed by Centennial-Balagtas et al.

of food (Table 4.3). Rice was still relatively cheaper than other cereals, and it appears that consumers responded accordingly by shifting their cereals expenditures towards rice (Table 4.4).

TABLE 4.4: EXPENDITURE SHARES FOR CEREALS, 2000–09 (%)

	2000	2006	2009
rice	70.47	71.64	74.29
rural	–73.28	–73.7	–77.18
urban	–67.83	–68.68	–71.46
corn	6.65	5.35	4.35
rural	–10.92	–8.62	–7.12
urban	–2.63	–2.2	–1.64
other	22.88	23.01	21.36
rural	–15.8	–16.68	–15.7
urban	–29.55	–29.12	–26.9
all cereals	100	100	100

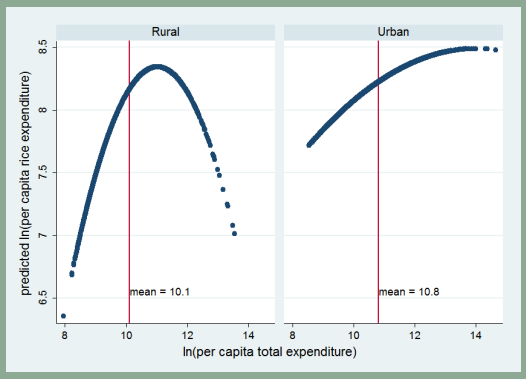
Source: Centennial-Balagtas et al calculations from FIES data.

With regard to quantities, BAS published estimates of national average per capita consumption of 103 kg in 2000 and 107 kg in 2003 that were quite similar to those derived from the Centennial analysis of the FIES database. However, in 2006, the FIES-derived quantities estimate remained basically unchanged at 105 kg, while BAS reported a dramatic rise to 118 kg/per capita in the same year. A change of this magnitude in such a short period is surprising, as there were no obvious price developments to drive such a change and, absent a crisis, consumption habits normally shift gradually.

Centennial-Balagtas et al: Modeling the future: Engels curves for rice. An Engel curve describes how consumer expenditure for a good relates to total expenditure or income. They determine expenditure elasticity, and thus whether a good is 'normal' (expenditure rising with total expenditure) or 'inferior' (expenditure falling with total expenditure). Centennial-Balagtas et al developed empirical estimates of Engel curves for rice in the Philippines, using the FIES datasets for 2000, 2006 and 2009. Details of the econometric model are provided in Annex 3.

Key model results are, first, that rice will remain a 'normal' good in the Philippines through 2040 for all but very high income households, nder both optimistic and pessimistic GDP growth scenarios.Second, as total incomes and expenditures rise, rice expenditures will represent a declining share of total expenditures, but the absolute quantity of consumption per capita will not decrease over this period. Third, rice expenditure is more responsive to total expenditure in rural areas than in urban areas: in 2009 the expenditure elasticity in rural areas was 0.39, compared with 0.18 in urban areas. The quadratic terms in the Engel curve specification allow the expenditure elasticity to change as total expenditure changes. Figure 4.1 illustrates the estimated Engel curves for rural and urban households. For urban households, rice expenditure becomes less responsive to total expenditure as total expenditure rises, and the expenditure elasticity (the slope of the Engel curve) approaches zero but remains positive throughout the range of the data. For rural households, the Engel curve eventually slopes downward, meaning that above a certain threshold, total rice expenditure begins to decline with additional total expenditure. That threshold occurs at a value of log rice expenditure of approximately 11.1. Thus, given the 2009 mean log rice expenditure of 10.1, total expenditure would have to rise by 100% before the threshold is met.

FIGURE 4.1: ESTIMATED ENGEL CURVES FOR HOUSEHOLD RICE EXPENDITURE IN THE PHILIPPINES



Source: Centennial Group.
Note: Predicted values are computed at estimated population

The key finding, that rice remains a normal good over a large range of incomes, is somewhat surprising, given the

experience of some other countries in East Asia. However, it is broadly consistent with previous analyses of rice consumption in the Philippines (among others, Balisacan et al.; Ito et al.; Timmer et al.), and with the observed patterns published by BAS (though not necessarily the same absolute quantities). To the extent that some households might shift away from rice at higher incomes, we would expect to observe this behavior more in urban areas than in rural areas. It is important to note that, because the Engel Curves depicted in Figure 1 are point estimates, they are less precise at the extremes of the data. That is, there is somewhat less confidence in the estimated Engel curves at higher and lower incomes where there are relatively fewer observations. However, the estimates are most precise near the means of the data. Thus the analysis placed greater emphasis on the estimates of expenditure elasticity of rice consumption evaluated at mean income, and these estimates were used to forecast mean response of rice consumption to income growth.

Finally, Balagtas et al estimated an analogous model for rice consumption (not expenditure) for 2006, where the log of per capita rice consumption replaced the log of per capita rice expenditure as the dependent variable in the regression, and the right-hand side of the model remained unchanged. Results were qualitatively and quantitatively similar to the expenditure results, thus predicted percentage changes in rice expenditure can be interpreted as equivalent percentage changes in consumption.

Forecasts of rice expenditure and consumption through 2040. Two major factors will influence rice consumption in the Philippines in the coming decades, economic growth and population growth. To forecast the impact of economic growth, Balagtas et al applied estimates of changes in total consumption to the estimated Engel curve for 2009. The optimistic and pessimistic GDP estimates derive from the Centennial Group Global Growth Model. The 2009 FIES data was used to estimate an econometric relationship between income (GDP) and total expenditure. The result showed a propensity to consume additional income of 0.84 in rural areas and 0.44 in urban areas. That is to say, 84% of additional household income in rural areas is spent, compared with 44% in urban areas. The remaining portions of additional income are saved. Combining the estimated propensities to spend with the projected GDP growth yielded an implied annual growth of total expenditure in rural and urban areas. The key parameter values used in the rice consumption forecasts are summarized in Annex 3.

In the pessimistic economic growth scenario, per capita rice consumption rises by 14.6% among rural households and 5.3% among urban households, for a countrywide average increase of 8.1%. That is, national average per capita consumption of rice rises from 105.3 kg to 113.8 kg.[6] Meanwhile, the expenditure share of rice falls from 13.5% to 9.2% in rural areas (–32%), from 6.6% to 5.1% (–22.5%) in urban households, and from 8.9% to 6.2% (–31%) nationally.

In the optimistic economic growth scenario, per capita rice consumption rises by 17% among rural households and 12.2% among urban households. The national average per capita consumption rises from 105.3 kg to 119.3 kg. Meanwhile, the expenditure share of rice falls from 13.5% to 5.1% in rural areas (–62.5%) in rural households, from 6.6% to 3.5% (–56.8%) in urban households, and from 8.9% to 4% (–55.7%) nationally.

Applying FAO's estimate of rural and urban population growth in the Philippines (Table 4.1), Balagtas et al made the further assumption that the population elasticity of rice consumption is 1.0, i.e., that each percentage point increase in population causes an equal percentage point increase in aggregate rice consumption. Thus, the FAO forecasts imply a 6.2% increase in aggregate rice consumption in rural Philippines, and a 97.8% increase in aggregate rice consumption in urban Philippines, as a result of population growth alone. To put these changes in context, in 2006 average per capita consumption was 105.9 kg in rural households and 104.1 kg in urban households. The projected increases due to GDP growth would raise per capita consumption to between 110–125kg for rural households,

6 Centennial recognizes that there are different views about the current level of per capita consumption; this analysis uses quantities derived from the FIES database (105.3 kg). However, even if alternative base year quantities are used in the formulas, the direction of change would be the same, i.e. some level of decrease in share of expenditures but increase in average per capita consumption of rice through 2040, reflecting the fact that rice is likely to remain a 'normal' rather than 'inferior' good.

and to between 112–119kg for urban households, depending on which (optimistic or pessimistic) growth scenario is used.

Centennial-Kohli 2040 consumption forecast. In parallel with the above analysis, Kohli developed 2040 forecasts of per capita demand for rice, using a slightly different methodology that was applied to all three VIP (Vietnam, Indonesia and the Philippines) country studies. The methodology uses the income distribution patterns for the Philippines from FIES, but does not disaggregate rural and urban consumption. The results were similar to those of Balagtas et al with respect to consumption trends, although absolute quantities were lower: per capita rice consumption increased to 108.5 kg under the pessimistic GDP scenario, and 109.0 kg under the optimistic scenario.

Centennial-Briones 2040 forecast. Briones arrived at results closer to those of Balagtas et al: 117.9 kg and 116.7kg, respectively, under the optimistic and pessimistic GDP scenarios (at the national level; like Kohli, Briones did not disaggregate urban and rural forecasts).

In summary, all three analyses (Balagtas et al, Kohli and Briones) conclude that: (i) rice will still be a 'normal' good in the Philippines through 2040; (ii) consumption per capita will increase gradually, with relatively little difference between the optimistic and pessimistic GDP scenarios; and (iii) although consumption per capita will rise, the share of rice in total household expenditures will decrease. This means that the Philippines will be consuming increasing quantities of rice through 2040, due both to population increase and income related consumption trends.

Implications of Alternative Supply Strategies

This Section explores the implications of trying to meet per capita demand for rice through domestic production, i.e. maintaining the current official policy of rice self-sufficiency, or shifting to a longer-term strategy of reliance on a combination of domestic production and trade (imports).

Costs of Rice Self-Sufficiency Policies to Date. Various researchers have explored the costs of pursuing rice self-sufficiency in the Philippines. A study done with USAID financing (AGILE 2000) based on data for the 1995–98 period estimated higher losses, including those from (i) foregone tariff revenues (estimated at an average of PhP3.72 billion annually), on the grounds that if rice imports had been liberalized and subject to import taxes, tariff revenues would have accrued to the government; and (ii) regarding consumers, PhP10.91 billion of losses due to the excess of the actual price of rice in the local market over what would have been the equilibrium price under an integrated rice marketing system and tariffs only regime.

The World Bank (2007) also analyzed the welfare costs of the Philippines official rice policy, focusing on consumer

Box 4.1: Domestic production as a share of total 2010 palay requirements

Food consumption @ 105.3kg/cap x 93.3m	-	9.825 MMT milled rice
Other uses (@ 12% food cons.)	-	1.179 MMT milled rice
Emergency stock replenishment @ 1 MMT	-	1.000 MMT milled rice
Sub-total milled rice required	-	12,004 MMT milled rice
Total unmilled palay equivalent (65% palay:rice conversion rate required to meet demand for food, other uses and stocks)	-	18,468 MMT milled rice
Less actual 2010 palay production	-	15,846 MMT milled rice
Gap between actual comestic production and supply needed	-	2,622 MMT (16.5%)

Source: Centennial calculations, BAS data.

loss due to implicit trade protection, producer gains due to the same policies of restricting imports, and public spending by the government on the program (including costs associated with NFA operations). The losses to consumers during 2000–05 averaged PhP 72 billion, part of which was 'gained' by producers (these gains averaged PhP 16.8 billion p.a.). After making a few adjustments on other minor items, the World Bank concluded that net losses (welfare costs) averaged PhP 56 billion annually. A study by Philippine researchers (unpublished) updated this analysis for 2006–09, and found that net losses averaged PhP 84 billion p.a. (US$1.8 billion). At an average 10.6 million tons of rice produced locally during those years, the cost to society for each kilo was about PhP 7.89.[7]

Proponents of domestic rice self-sufficiency and associated trade protection often argue that the higher retail prices born by consumers are justified because (i) the policy avoids volatility in food prices that would be even more difficult for poor households to manage,[8] and/or (ii) it is essential to protect incomes and employment of poor producers who would otherwise be driven deeper into poverty, i.e. a social contract rationale. On the first point, certainly the Philippines has experienced less volatility in food prices over the past two decades than have many countries, however the question is whether this was a achieved in the most efficient way possible and, even if the strategy served a purpose in the past, whether it will continue to do so in the future. The second point, regarding producers and consumers, overlooks the fact that many producers are also consumers who themselves have to buy rice in the market for at least part of the year. Netting out the gains and losses to the same farm community is a complex task; more important, the question is whether the strategy employed is more cost-effective than alternatives (e.g. conditional cash transfers) and the whether it distorts incentives in a way that keeps farmers in rice production rather than helping them to shift to higher value crops.

Even if justified by some criteria in the past, as circumstances change—demographics, climate, growth opportunities and constraints—it is appropriate to recalibrate agricultural policies (Dorward, Fan et al, 2004). In that spirit, rather than dwell on defining more precisely what have been the costs of past policies, this study focuses on the future implications of alternative rice supply strategies.

Volume of Demand for Rice Going Forward. This analysis uses the FIES per capita consumption estimate of 105.3 kg/per capita (Centennial-Balagtas et al) for the base-year (2010) value. Readers who may prefer to use the BAS 112.8kg/cap (2010 estimate), or a different base estimate, could easily adjust the results by the corresponding difference.

We began by looking retrospectively at what would have been the implications of supplying that 2010 base demand figure entirely through domestic production, to determine how far the Philippines was from being able to achieve this at that time. We then estimate the volumes that would be required by 2040 using the Balagtas et al and Kohli forecasts described above. Finally, the analysis includes a third forecast using the AMPLE model that was employed for all other crop and commodity forecasts in the study (referred to as Centennial-Briones, Chapter 9).

How close was the Philippines to being self-sufficient in 2010? Total 2010 palay production fell short by about 17%, of what would have been required to achieve 100% self-sufficiency in 2010.

To supply all rice requirements, including emergency stocks, through domestic production, in 2010 the Philippines would have had to produce 17% more palay than it did, i.e. 18,470 MMT needed—15.846 MMT actually produced. Alternatively, if all demand for food and other uses had been met through domestic production, and the Philippines had imported only a minimal emergency stock, it would have had to produce 7% more. If it had sourced an emergency stock 50:50 between domestic production and imports, it

7 An unpublished DRC (domestic resource cost) analysis done for the World Bank and FAO estimated that in 2009 rice in the Philippines cost PHP2.60/kg over what would have paid had the rice been sourced by the world's most efficient producer (Gergeley 2010), but given the purpose this did not include some of the items in the analysis cited in para. 5. 22.

8 For an alternative viewpoint, namely that lowering average prices is more important for the rural poor than is avoiding volatility, see: http://www.foreignaffairs.com/articles/67981/christopher-b-barrett-and-marc-f-bellemare/why-food-price-volatility-doesnt-matter (Foreign Affairs, July 2011).

would have needed to harvest 12% more palay. In sum, depending on assumptions, the Philippines would have had to produce somewhere between 1.1 and 2.6 MMT more than it did—roughly equivalent to the output of another 305,000 to 722,000 ha (harvested) palay at the prevailing (2010) cropping intensities and average yield of 3.6MT/ha.

Yields have been improving, the government is making significant investments and, therefore, depending on assumptions about the emergency stock and developments with respect to weather-related disasters, closing this demand-supply gap may be possible for the Philippines over the next few years.We therefore looked forward to explore the implications of sustaining the approach over the longer-term. To estimate requirements in 2040, we used the results of the three modeling exercises to establish a range for per capita demand in 2040, and assumed that the UN medium variant population forecast would materialize and that the size of the emergency stock increases at roughly the rate of population growth (forecasts for livestock and poultry, fisheries and other crops are discussed in Chapters 6, 7 and 8, and 9):

What are the implications of the heavy demand for rice over the next three decades?

Using the several models/approaches to forecasting future demand for rice discussed above, we estimate the volume to range between 29 and 31.5 MMT (palay, 2040) (Table 5.5). If higher estimates of base year consumption were used, the 2040 figures could also be commensurately higher.To produce 80–100% more rice without major area expansion, it would be necessary to increase the combined average yield of both irrigated and rain fed rice to over 6 MT/ha. Bearing in mind that climate change may depress rice yields by about 10% over the period through 2040, this means that in order to realize 6–6.5 MT/ha, productivity enhancing measures would need to be taken on a scale that would have been sufficient to generate average yields of 7 MT/ha, but for the depressing effects of climate change on yields. While in principle such yields could be obtained in irrigated areas and some parts of the country that are already producing over 5 MT/ha, there is little evidence that they could be achieved on a sustained basis throughout the entire country, especially in upland and mainly rain fed farming areas.

Raising average yields to 6–6.5 MT/ha would require a major increase in the use of certified seeds, mainstreaming of SRI techniques where possible, and significant investment in irrigation rehabilitation and some expansion(accompanied by measures to address the deterioration in communal irrigation systems discussed elsewhere, and to accelerate transfer of operational responsibility to irrigator associations, IMT). At an estimated $5,000/ha for new irrigation and $2,500–$3,000/ha for rehabilitation of existing command areas that are not in good operational status, however, this would cost $3–5 billion of investment at constant prices for irrigation investments alone—to produce a crop that would likely cost consumers more on average than may be the case with a better trade/domestic production supply mix, on the one hand. On the other, that crop would also depend on (aging) producers being willing to remain heavily committed to a fairly low value and physically demanding commodity. The cost of committing that volume of investment to palay/rice production would also necessarily come at the expense of other investments that could potentially contribute more to agricultural transformation, poverty reduction and food security.

An alternative may be for the Philippines to shift gradually to a long-term strategy that relies on both trade and domestic production, for example in a 25:75 ratio, and perhaps backed up by a regional stocking agreement with regional countries (but always maintaining an emergency stock in country). This would minimize—but not eliminate—risks of price spikes, weather and other natural disasters. However, as the share of rice in total household expenditures decreases, to less than 9% in the pessimistic GDP scenario and less than 5% in an optimistic scenario, consumers' ability to withstand higher prices will improve: an unexpected 30% increase in rice prices (as occurred in 2008) is considerably easier for consumers to manage for a short time when normal expenditures on rice areequivalent to only 5% of total household expenditures, than was the case in the past, when the share of expenditures on food

TABLE 4.5: FORECASTS OF PER CAPITA AND TOTAL PALAY NEEDED FOR FOOD CONSUMPTION, OTHER USES AND EMERGENCY STOCKS, 2040

forecasting model	Balagtas et al	Briones	Kohli
population (UN medium variant, millions)	141.7	141.7	141.7
rice food consumption (kg/capita) optimistic GDP scenario pessimistic GDP scenario	 119.3 113.8	 117.9 116.7	 109.0 108.5
demand for food consumption (MMT) optimistic GDP scenario pessimistic GDP scenario	 16.905 16.125	 16.705 16.535	 15.430 15.345
demand for other uses (eqv. 12% of food uses, MMT[1/]) optimistic GDP scenario pessimistic GDP scenario	 2.030 1.935	 2.005 1.985	 1.850 1.840
emergency stock replenishment (MMT)	1.500	1.500	1.500
sub-total milled rice for all uses (MMT) optimistic GDP scenario pessimistic GDP scenario	 20.435 19.560	 20.210 20.020	 18.780 18.685
total volume palay needed @ 65% palay: milled rice conversion optimistic GDP scenario pessimistic GDP scenario	 31.440 30.090	 31.090 30.800	 28.890 28.745
total incremental palay needed over 2010 production optimistic GDP scenario pessimistic GDP scenario	 15.595 14.245	 14.955 15.245	 13.045 12.900

Source: Centennial estimates.

generally, and rice in particular, was higher. Impacts will, of course, be greater for the extreme poor, but the Philippines has now put in place a good social safety net program (conditional cash transfer strategy) that could be refined and strengthened to serve in cushioning the impact of food price shocks on families at the low end of the income distribution. If stronger measures were needed, the government could also consider an instrument like varying the tariff rate (at the stage when it has moved quotas to tariffication), rather than trying to physically import and deliver rice to local markets itself. In most years, consumers could be expected to benefit from domestic retail prices of rice that are more in line with (generally lower) international prices. With improving productivity, many producers would be able to withstand competition, especially if they are able not only to raise rice output per ha, but also to supplement income by investments in, say, high value horticulture during part of the year.

Even with greater reliance on trade, demand over the next three decades is going to be sufficiently large that it could keep current rice farmers in the Philippines fully involved, provided productivity continues to improve—although this may not be the best strategy for raising rural incomes and food security. Rather than concentrating heavily on targeted programs linked to production targets, the Government may be better advised to set productivity/profitability goals for paddy, and in parallel direct more of its investment strategy towards crop neutral infrastructure, on the one hand, and technical and financial services to help farmers shift into alternative agriculture, downstream or non-farm activities. Older farmers also need to be able to sell or lease their land to others interested in working larger areas; for those in the Mindanao region, there would also be more remunerative employment if the Government were to undertake a major tree crops expansion program, along the lines in Chapter 6.

The complexity of assisting producers through such a transformation should not be underestimated, and change would need to be introduced gradually, but there are examples and lessons to draw on from other countries that have taken bold decisions along these lines and succeeded in their implementation (e.g., Malaysia's decision to diversify away from excessive dependence on rubber, Thailand's decision to expand smallholder rubber, Mexico's decision to support farmers in the transition to greater competition under NAFTA, etc.).

An alternative may be for the Philippines to shift gradually to a long-term strategy that relies on both trade and domestic production, for example in a 25:75 ratio, and perhaps backed up by a regional stocking agreement with regional countries (but always maintaining an emergency stock in country). This would minimize—but not eliminate—risks of price spikes, weather and other natural disasters. However, as the share of rice in total household expenditures decreases, to less than 9% in the pessimistic GDP scenario and less than 5% in an optimistic scenario, consumers' ability to withstand higher prices will improve: an unexpected 30% increase in rice prices (as occurred in 2008) is considerably easier for consumers to manage for a short time when normal expenditures on rice areequivalent to only 5% of total household expenditures, than was the case in the past, when the share of expenditures on food generally, and rice in particular, was higher. Impacts will, of course, be greater for the extreme poor, but the Philippines has now put in place a good social safety net program (conditional cash transfer strategy) that could be refined and strengthened to serve in cushioning the impact of food price shocks on families at the low end of the income distribution. If stronger measures were needed, the government could also consider an instrument like varying the tariff rate (at the stage when it has moved quotas to tariffication), rather than trying to physically import and deliver rice to local markets itself. In most years, consumers could be expected to benefit from domestic retail prices of rice that are more in line with (generally lower) international prices. With improving productivity, many producers would be able to withstand competition, especially if they are able not only to raise rice output per ha, but also to supplement income by investments in, say, high value horticulture during part of the year.

Even with greater reliance on trade, demand over the next three decades is going to be sufficiently large that it could keep current rice farmers in the Philippines fully involved, provided productivity continues to improve—although this may not be the best strategy for raising rural incomes and food security. Rather than concentrating heavily on targeted programs linked to production targets, the Government may be better advised to set productivity/profitability goals for paddy, and in parallel direct more of its investment strategy towards crop neutral infrastructure, on the one hand, and technical and financial services to help farmers shift into alternative agriculture, downstream or non-farm activities. Older farmers also need to be able to sell or lease their land to others interested in working larger areas; for those in the Mindanao region, there would also be more remunerative employment if the Government were to undertake a major tree crops expansion program, along the lines in Chapter 6.

The complexity of assisting producers through such a transformation should not be underestimated, and change would need to be introduced gradually, but there are examples and lessons to draw on from other countries that have taken bold decisions along these lines and succeeded in their implementation (e.g., Malaysia's decision to diversify away from excessive dependence on rubber, Thailand's decision to expand smallholder rubber, Mexico's decision to support farmers in the transition to greater competition under NAFTA, etc.).

Are there any 'game changers' that could alter this perspective? Yes, at least three …

Many things could influence the above analysis at the margin (e.g., the unmilled palay:milled rice conversion rate could be improved, through upgrading post-harvest practices, shifting more consumption to brown v. white rice, etc.), although these are unlikely to affect the basic conclusion. However, there are three potential 'game changers' that could produce major adjustments:

Demographics- if Philippines changes the demographic trajectory it seems to be on, i.e. if it moves towards the UN lower variant population projection (women's education, health, safety nets being among the critical factors that would drive such a shift, and certainly this has happened in other countries), this will not only have a major impact on food consumption patterns but will also affect water balances, land availability, etc.

Climate Change—if the impact of CC on crop yields is 5–10%, or more, than the assumed negative impact by 2040, this would dramatically affect the Philippines' domestic production capacity and probably shift the balance even

more towards trade. As such developments would also other producers, price impacts might hasten the stage at which rice ceases to be a 'normal' good.

Biotechnology—if there is a biotech breakthrough in rice production, on the scale of the Green Revolution (e.g. if IRRI succeeds in developing C-4 rice by changing the plant's photosynthesis mechanism and as a result breaks the current yield barrier in such a way that one can obtain 30–50% more palay per ha, and if there is good uptake of new technology by farmers, the Philippines may be able to comfortably meet its own consumption requirements for rice for an extended period.

These are not changes that can either be foreseen or relied on with any degree of certainty and, even if they were to materialize, the impacts could operate in different directions (e.g., reduced population growth but more serious climate change). In the circumstances, this study accepts that the Philippines may achieve rice self-sufficiency in the near term, depending on the vagaries of weather and unforeseeable natural disasters to which the country is prone and that can upset even the best plans. However, it does explore the feasibility of continuing to do so for a sustained period of time, considering the long-term implications of high population growth, our analysis of the likely increase in per capita demand for rice over the next few decades, and limits on land and water availability.

Chapter 5. Tree Crops, Horticulture, and Sugarcane

Crops other than rice and corn occupy about 5.5 million ha,[1] or 56% of the reported farm land area of 9.7 million ha (Table 5.1), over a third of total agricultural GVA, probably from 40–50% of agricultural employment (including self-employment), and 60–70% of the value of exports. The area occupied by these crops has increased at an average rate of about 0.9% p.a. over the past few decades. Presently about two-thirds is coconut, part of which is intercropped.[2] Growth in physical output has averaged about 2% p.a. since 1980, an increase with respect to the productivity of land of only about 1% p.a. For the most part, the Philippines has not succeeded in expanding tree crops and other high value agriculture on nearly the scale that some neighboring countries with similar agro-ecological conditions have enjoyed. Main positive changes have been the spectacular growth of bananas and the recent startup of a new crop for the Philippines—oil palm.

This section does not deal exhaustively with all of the non-rice and corn crops, but rather focuses on those that have particular development potential (selected tree crops and high value horticulture), and with the sugar sector because it faces special challenges related to commitments under the ongoing AFTA trade liberalization process.

Table 5.1: Area planted to other crops*, 2001

crop	planted area (ha)	%
total farmland	5,811,356	100
≥ 100,000 ha	5,291,961	91.06
coconut	3,575,944	61.53
banana	449,443	7.73
sugarcane	354,878	6.11
cassava	217,622	3.74
mango	189,437	3.26
rubber	138,710	3.21
abaca	135,090	2.32
coffee	121,399	2.09
sweet potato	109,438	1.88
≤ 99,999 ha	519,395	8.94
other—fruits	225,713	3.88
other—vegetables	180,782	3.11
other—nuts	57.395	0.99
other—tree crops	34,506	0.94
other—flowers	999	0.02

Source: BAS.
* "other" = all crops except rice and maize.

Tree Crops

Tree crops are well suited to the Philippines from an agro-ecological standpoint, and their further development would be economically attractive.3 While the Philippines has in some senses missed the first round of tree crop expansion in Southeast Asia (excepting coconuts), there is very good potential to participate now—it is not too late, and for the next couple of decades the Philippines will have an increasing competitive advantage vis-à-vis some other countries that are already experiencing labor shortages/rising rural wages constraints, which will become increasingly acute for them. With respect to the Philippines' traditional tree crop, coconuts, there is scope for a very significant program that, if well managed and on an ambitious enough scale, could well be a legacy program that the current government could leave for future generations.

Employment and value added per ha would be higher than for non-irrigated upland crops (e.g., cereals, pulses or oilseeds), with the exception of coconuts, for which inter-cropping will be needed to produce similar results. Provided they do not encroach into primary forest areas, tree crops would also have

1 The difference between the 5.8 million ha of planted area in Table 6.1, and the estimate of 5.5 million ha of land occupied, is due to double cropping and/or crops under coconut trees.
2 There is no firm data on the proportion of coconuts intercropped , but it is doubtful that area intercropped to the extent of 100% land cover would be more than about 10%.
3 See for example Tree Crops for Rural Development (World Bank 1999) and Quantitative Assessment for Comparative Advantage of Major Crops in the Philippines (FAO/WB 2010).

positive environmental impacts with respect to carbon absorption, compared to annual crops. The most compelling case for ambitious tree crops development would be in areas of degraded forest lands in Mindanao that lie outside the Philippines' typhoon belt, although there would also be a sound justification for selective planting elsewhere on lands now used for rain fed annual crops, or inter-planted under coconuts.

Land Availability for Tree Crops Development

Land area. Statistics from the Forest Management Bureau (FMB) of the Department of Environment and Natural Resources (DENR) indicate that of the 15.8 million ha of public land designated as forestland/timberland, or forest zone, less than half[4] (6.4 million ha) actually had forest cover in 2003 (Table 5.2). Since then, the government is reported to have supported reforestation of 175,000 ha. However, in parallel, it is likely that there has also been deforestation since 2003—possibly of similar orders of magnitude to replanting. Overall, a conservative estimate is that at present there are more than 9 million ha of forestland without forest cover that could be considered for tree crop planting.

Of the land without forest cover, about 5 million ha is classified as 'wooded grassland', 1.1 million ha as 'open grassland', and the balance of just over 3 million ha is 'cultivated' to some extent, largely by the 6 million families who inhabit these areas. Of the total 15.8 million ha of 'forest zone', about 40% (6.1 million ha). The amount of actual forest cover in Mindanao within the forest zone in 2003 was only 1.9 million ha. By deduction, therefore, there are just over 4 million has in Mindanao that are designated as forest zone, but do not have forest cover. Some of this land may be in protected forest areas and thus unsuitable for tree crop planting, under ancestral domain titles, etc. For purposes of developing 2040 scenarios, this study has made some assumptions, but it would clearly be important to have more updated information as part of detailed design. That said, the study proposals lie comfortably within even the most conservative assumptions on land available for tree crops development.

Table 5.2: Distribution of public forest lands by region, (million ha)

category of land/region	Luzon[1/]	Visayas[2/]	Mindanao[3/]	Total
total forestland (not A & D)	7.49	2.25	6.07	15.81
with forest cover	3.77	0.75	1.91	6.43
without forest cover	3.72	1.50	4.16	9.38

Source: DENR.
1/ includes CAR, NCR and regions 1–5.
2/ includes regions 6, 7 & 8.
3/ includes regions 9–13 and ARMM.

Presently, under the National Greening Program (2011–16)[5] led by DENR and involving more than a dozen other agencies, it is planned to plant trees on some 1.5 million ha of the forest zone (i.e., more than ten times the average during 2003–10). Many details need to be developed, but the outline of the program clarifies that (i) there are substantial tracts of land in the 'forest zone' which, from a technical standpoint, could be planted to tree crops and (ii) DENR is comfortable with planting a substantial proportion of these areas to rubber, coffee, cacao or fruit trees although they have reservations about oil palm, except on 'open grassland'.

Investment characteristics and financing mechanisms. Since the development of tree crops requires a long gestation period before any significant income generation, potential investors (whether large or small) need to be (i) confident in their entitlement to use the land for the period of the whole crop cycle (7–30 years depending on crop), and (ii) in a position to finance the relatively long period before the cash flow from the crop itself breaks even. Table 5.3 gives an overview of the investment parameters of the different tree crops.

4 Total forest cover in 2003 was estimated at 7.168 million ha, of which only 6.432 million ha was classified as "with forest" cover within forestlands. Most of the balance is forest on alienable and disposable(A& D land

5 This program was initiated through Executive Order No. 26 signed on February 24, 2011. Guidelines were issued on March 8, 2011 and the program was launched on May 13, 2011.

TABLE 5.3: SUMMARY DEVELOPMENT PARAMETERS OF MAIN TREE CROPS

	coconuts local talls	rubber	oil palm	robusta coffee	cacao under coconuts	mango	banana (cavan dish)
development period (yrs)	6	6	3	2–3	3	7	1
typical investment cost during establishment, excl. processing (USD/ha)	1,000/1,500	2,000/3,500	2,200/3,000	1,400/2,000	800/1,200	2,000/4,000	5,000/8,000
first yr in which annual cash flow breaks even	7	7	4	3	3–4	8	2
typical crop life cycle (yrs)	30+ years	30	25	10	15	30	7

Source: Centennial.

While corporate plantations and wealthy landowners may be prepared for such long time horizons, smallholders need mechanisms to finance planting and provide income until tree crops generate positive cash flow. Other countries in the region have adopted different approaches, including rubber-replanting grants in Thailand, FELDA/FELCRA land development schemes in Malaysia for rubber and oil palm, and long-term credit in Vietnam for coffee and rubber. The grant experience from Thailand in particular has been successful, as was Malaysia's land development approach.6 In the Philippines, there is some experience of smallholder tree crop new planting in the oil palm sector in recent years. In that case, initial development costs, including the cost of the farmer's own labor, were financed on long-term credit partly by Land Bank (LBP) through a farmers' cooperative and partly by the processing mill.

SCENARIOS FOR TREE CROP DEVELOPMENT

Two scenarios for tree crop development through 2040 are presented here, to illustrate differences in the impact of each on the economy as a whole with respect to land use, labor absorption/job creation, contribution to exports, contribution to GVA and demand for investment resources two broad scenarios are considered. The characteristics of the scenarios are summarized below, followed by a discussion of issues and opportunities that individual crops face.

Scenario 1. This is the more pessimistic scenario. It assumes some Government support for tree crop development, but long delays in tackling critical institutional and legal issues related to land markets, foreign investment and the roles of LGUs. CARPER comes to an end as planned, but the legislation and regulations governing the property sizes remain in effects, creating uncertainty, particularly among those who would be subject to land reform if the resources were available. Funding for PCA, DA, DAR, DENR etc. remains at about the present level in real terms, and there is neither significant improvement nor deterioration in the peace and order situation.

Scenario 2. There is strong government support for tree crop development, Investment friendly legislation is put in place in land markets, restrictions on foreign investment are eased, private sector investment in agricultural tree crops is encouraged as part of the reforestation effort, funding for the key rural development convergence agencies is increased, including releasing the coconut levy resources to more directly benefit coconut production. The peace and order situation improves, thus facilitating investment in what were traditionally good rubber areas. These developments elicit a strong private sector response, including some international investors. Civil society welcomes and facilitates opportunities to improve incomes of upland farmers in degraded forestlands and indigenous populations.

6 Both Thailand and Malaysia collect a cess to finance rubber replanting, or new planting (one-time grant) of oil palm. In effect, this financing comes from farmers, who pay in advance through the export cess.

Coconuts

The Philippines is a major producer and exporter of coconuts and coconut products. Over 3 million farmers (40% of all farmers) own coconut trees. Growth in area and number of trees over the past 20 years has averaged about 0.6–0.7% p.a. The main product at farm level is copra, which is processed into coconut oil with a copra meal by-product. National average production of copra equivalent is about 0.8 tons/ha overall, or just under one ton per ha based on the mature stand only.[7] A typical smallholder with one ha of mature coconuts and average yields would earn an income of about PhP 24,000 (USD 550) at 2010 prices; the annual gross income per ha coconuts at the farm level has varied significantly in real terms. Labor requirements for one ha of coconuts, including harvest and copra making, would be about 30–50 person days per year, some of which is traditionally by hired landless workers. Even with well-managed[8] higher yielding coconuts, labor requirements would normally be less than 70 person days/year. Not surprisingly, households depending heavily on coconuts are among the poorest and most underemployed in the Philippines.

The global market for other coconut products (besides copra, e.g. desiccated coconut, coconut water, coconut cream, high specification charcoals) is increasing. There are also opportunities for further processing downstream, for example converting copra meal which is now mostly exported9 as a crude product into 'protein enhanced copra meal' (PECM) which can then be used in livestock feeds for pigs, rather than mainly for ruminants as is the case with regular copra meal. The conversion of coconut husk into a compost medium to replace peat is also a potential value added export product. These products involve the sale of whole nuts ex farm, thus lowering farm-level labor requirements, although the incremental employment generated in the value added industries would exceed the reduction in demand for farm labor. The direct impact on smallholder farm level profitability would be quite small. Indirectly, increased demand for coconut products may lead to more focus, higher inputs, expansion of farm level production and, thus, a more profitable farming system.

Coconut oil export volume has been flat on average but with quite large year on year variations (between 479,000 tons in 1999 and 1.419 million in 2001). Total coconut product exports in 2011 were USD 2.0 billion, 70% of which was coconut oil. Philippines has a high share of the world market for coconut oil, but this is less than 2% of the total global traded volume of vegetable oils of around 65 million tons. Historically coconut oil prices have moved in parallel with other vegetable oils and have usually been at a premium (the average premium—c.i.f NW Europe—has been 12% over soybean oil and 28% over palm oil, over the last 30 years). World Bank commodity projections for 2025 foresee the real prices of vegetable oils falling well below those of the last five years and coconut oil losing some of its premium: in constant (2010) terms, the price of coconut oil and soybean oil would fall to USD 733/ton, and USD 586/ton for palm oil.[10]

Issues commonly raised Issues concerning potential growth in coconut area, production and exports are the following:

- Land availability for new planting is limited. The main new planting will likely involve replanting areas currently under coconuts.
- Coconuts, in isolation, are a relatively low input/low output crop. Given typical farm small sizes, the total value of output per smallholder is quite low—but small farmers cannot earn a reasonable living from coconuts alone.
- The remaining larger coconut farms are still subject to land reform, so owners are reluctant to invest.
- Coconuts have a particularly long gestation period—looked at in isolation it takes at least 10 years for investment in coconuts to break even.

7 Areas include both mature and immature trees; the value per ha of the mature trees would be about 20% higher than the average for the whole area.
8 See Annex A—detailed coconut budgets.
9 The Philippines is the world's number one exporter of copra meal/copra cake covering about 60% by volume of world trade in the product.
10 These figures are based on the commodity price forecasts issued by the Bank in June 2012.

Although coconut lumber is a valuable resource and potential source of investment funds for smallholders, there are stringent requirements for obtaining permission to fell and these need to be simplified to reduce (i) the burden that supervising this poses to PCA, and (ii) the cost to farmers of monetizing old trees. Inevitably there has been some unlicensed tree felling, not associated with replanting. By its very nature it is difficult to quantify this, but aggregate statistics point to a slight increase in area and production over the past decade, i.e. the 'illegal felling' does not exceed the replanting.

There is a technical problem with copra quality caused by smoke contamination. This has resulted in copra meal not being acceptable in the (higher priced) EU market, although it is still exported within Asia. Also, coconut oil made from smoky copra needs to be blended with oil from better quality copra to meet industry[11] quality standards. Some work has been done to address this through improved driers using indirect heat, but further efforts are needed to ensure that exported oil remains of a quality acceptable to all major markets.

There are significant opportunities for growth and expansion, with important implications for rural poverty reduction across a large part of the farm population—if managed, and on a significant scale, this could easily be a major legacy initiative that the current administration would leave for future generations.

Fertilization. Research by PCA and others confirms the potential for profitably raising coconut yields through fertilization, particularly through use of salt. Experimental results have produced yield increases of about 65% copra from the simple application of 2kg/tree sodium chloride annually. More spectacular research results have been obtained using specially formulated compound fertilizers. PCA's ongoing rather limited provision of salt fertilizer program covers about 8% of the coconut area, and it is now getting increased funding for the purpose. Its budget for field operations for 2012 is about P 1 billion (USD 23 million) compared to 0.6 billion (USD 14 million) in the previous year. The scale could be expanded significantly, with good returns to investment.

Inter-cropping. At farm level, such a fertilization program would boost income, but would still not provide sufficient income for an average family operating a two ha farm (see Annex 4 for details). However, coconut can serve as a shade crop combined with other higher value products—in particular cacao. Having crops that need tending underneath coconuts will potentially further increase yields, as farmers focus more closely on the state of their coconut trees and fertilization benefits both the coconuts and intercrop. Raising coconut yields, together with additional income from inter-planted crops, could increase the viability of the small-scale farms involved.

Replanting and new planting. The high value of coco lumber means that with supervised felling and replanting programs, farmers should have the resources to replant. The level of replanting[12] needs to be sufficient to at least cover the 'depreciation' of existing tree stocks. Overall, planting of 100,000–150,000 ha per would lead to an annual increase in the stock of trees of about 0.5% p.a.—or an extra half million ha under coconuts by 2040. Such new planting should employ selected seedlings to increase yields and improve the age profile within the national coconut stand.

Well-managed smallholder coconuts can achieve yields of at least three times the present national average (see illustrative budgets in Annex 4). However, this will only happen if smallholders have strong incentives to plant/replant. Specifically they will need (i) some form of replanting grant to provide cash income and (ii) the facility to easily monetize old trees that they fell. If suitable land sharing or renting arrangements can be legitimized, there is also interest from business entities to engage in coconut production and link it to marketing of higher value products, with more of the value added retained in the production areas.

The more pessimistic 2040 Scenario 1 mentioned above would involve (i) a continuation of planting at perhaps

11 Information obtained from interview with senior executive of major copra meal and oil trading company.

12 This does not necessarily involve cutting old trees and replanting on the same site, but often replanting on new sites to compensate for old trees and areas that have gone out of production.

80,000 ha of coconuts per year, enough to allow present growth to continue at just under 1%. (ii) The recommended large-scale fertilizer program would not be funded, so the expectation would be a slow uptake of fertilizer by farmers, leading to an increase in TFP of 1% p.a. at most. The marketing/export of higher value products would continue at a modest pace, possibly resulting in a reduction of sales of traditional products. The farm gate price would remain geared to export parity, as the volume of higher value products would not consume a large share of the raw material. Planted/harvested coconut area in the Philippines would increase slightly, with new planting having a higher yield than old coconuts. Taking account the effects of a modest fertilizer program, overall average yields would increase to about 1,100kg in 2030, before declining to 1050 by 2040 as the age structure of the aggregate tree stock deteriorates. Production would also increase modestly through 2030 (1.3% p.a.) before falling in the decade to 2040. If labor productivity over the period remains constant, demand for labor would increase by only about 110,000 full time equivalent jobs through 2030 (though actually spread over a larger number of part time jobs) and remain fairly constant thereafter, but these would be very poorly remunerated. Because of the projected decline in world prices, in this pessimistic scenario the value added would be lower in 2030–40 than in 2010, because the approximately 28% growth in production would not offset the 38% fall in farm gate prices.

In the more optimistic 2040 Scenario 2, significantly more farmers would replant, application of fertilizer on old stands would increase to about 60% of the crop over a 10 year period and there would be substantial inward investment by corporate entities interested in becoming involved in processing closer to the source of supply (and where labor rates are lower). This would be likely to raise the level of husbandry and lead to planting with seedlings of higher genetic potential. An estimate of the potential impact that the coconut subsector would have on the economy through 2040 is made in Annex 4. In this scenario, PCA would support 100,000 ha per year initially for five years. That replanting level is then assumed to increase to 200,000 ha from 2017 to 2026 before reverting to 100,000 ha per year thereafter. At that rate of replanting, and assuming a felling rate of 90% of the level of replanting, pretty well all of the existing coconuts would be replaced by 2040. The area increase would be expected to come mainly from rain fed land already included within farmland, but some could also be on areas that are presently included in the forest zone but are technically suitable for coconuts.

Taking account new planting and fertilization, yields per ha of mature coconuts would increase substantially to an average of 1690 kg by 3035. Copra production would more than double from the 2.7 million tons level in 2010 (average 3% p.a.). Nearly 400,000 incremental jobs equivalent would be generated, without considering incremental downstream job creation as more 'value added' coconut based products are produced.

Total investment in such a high case program, considering the full cost of new planting and the first two years of fertilizer as 'investment' would be about P 6 billion a year (USD 136 million per year) for the level of planting and fertilizing proposed through 2016, and about P 12 billion (USD 270 million per year) for the next five years. About 36% of this would be farm level labor. To rejuvenate the coconut subsector, funding will be needed to come from both the public and private sectors and, to some extent, from smallholders themselves. While every effort should be made to attract corporate funding and facilitate private sector/smallholder investment schemes, it is likely that the bulk of investment would need to be in the smallholder sector, and to make this happen will require significant public sector commitment, both in financing and in strengthening PCA's capacity to supervise effectively. On funding, release of interest and earnings from the coconut levy fund could make an important contribution.

Rubber

Virtually all rubber in the Philippines (98.7%) is in Mindanao (Zamboanga Peninsula, Soccskargen and ARMM). Soils and climate in Mindanao are well suited to rubber production and, like oil palm, rubber could potentially be developed on substantial areas currently under 'open grassland' within

the forest zone, as well as in other production forest areas to be replanted and on land currently belonging to agrarian reform beneficiaries (ARBs) or other small farmers. Unlike oil palm, rubber can be developed successfully without being close to processing facilities: it can be harvested and sold as cup lump, requiring no processing, although by producing sheet rubber, as in Thailand, value added at farm level would be greater.

Rubber has been a successful smallholder crop elsewhere in Southeast Asia (e.g. in Thailand, Malaysia and Indonesia). Prior to CARP, rubber had been an important crop in the Philippines, controlled by large corporations. Following land reform, ARBs took over the old estates as cooperatives. Production declined initially and rubber exports fell, but have since increased to an average of 45,000 tons 2006–2010. With the advent of higher world prices, and relaxation of rules that prevented rubber being grown in forest zone areas, the initial impact of land reform in rubber areas has been reversed. Recently, there has been substantial 5.7% growth p.a. in the number of trees over the past 8 years, 5% p.a. growth in production and 7% p.a. growth in area. Due to increased prices,[13] the value of production (at farm level) has risen more rapidly than production, although probably less than the estimates by BAS.[14]

The market perceives Philippines rubber quality as low—most rubber is harvested and exported as cup lump. The Philippines is potentially a small player in the world market and therefore is, and will remain, a price taker. Thus incremental production will not significantly influence expected long run price, which will likely be close to export parity price, adjusted for quality and location differences. The World Bank estimates the long run rubber price at about USD 1.95 per kg (constant 2005).[15] While that is 26% below the real average price for the 5 years 2007–11 (USD 2.64), it is substantially above (42%) the real average price for the past 30 years (.USD 1.37/kg. At the World Bank's estimated long run price, rubber is profitable for the long-term investor, and a good means of generating incremental employment—the labor requirement per ha of producing rubber is around 0.5 person per ha.

As detailed in Annex 4, the average investment cost of establishing one ha of rubber is about P120,000 (USD 2,700), with an internal rate of return of about 21% in financial terms after allowing for the cost of family labor. The economic rate (after shadow pricing labor) is 27% and the benefit cost ratio is over 1.75 (using a conservative 15% opportunity cost of capital). The differential between the economic cost of production over the whole cycle and the long run price clearly justifies encouraging rubber production, particularly on land that is not currently being used for economic purposes.

The key issues that will need to be addressed to encourage rubber development are set out below:

Solving outstanding land use issues to allow tree crops to be planted on degraded forestland, provided that the established tree crop would be more environmentally friendly than the likely land cover without planting. This appears consistent with the National Greening Program.[16] As well as promoting rubber development by smallholders, it will also be important to ensure that large scale professional investors with knowledge and experience of the industry can come in under management leases or joint ventures and contribute towards the technical development of the industry, and perhaps provide processing and marketing services under a nucleus estate type set up. For this to happen, the length of any leases or management agreements would need to reflect the lifetime of the crop. Perhaps the 25-year renewable leases that are used for integrated forest management agreement purposes could be adapted for this.

Developing suitable financing arrangements. Because of the long gestation period involved, mechanisms need to be developed so that investments can be made in rubber development while keeping smallholders involved.

13 Because of the largely fixed nature of processing and transport costs per ton, the percentage increase (or decrease) at farm level is much greater than that at the F.O.B. level.
14 Taking account export figures, world prices and the likely costs of inputs from other sectors, Gross Value Added (GVA) from rubber for 2010 is estimated at about P 6 billion, rather than the 22.8 billion indicated by BAS (It is possible that in estimating GVA, BAS applied the price of dry rubber to the volume of latex).
15 Price based on RSS3 in Singapore. It is equivalent to $2.20/kg in 2010 currency terms.
16 The first six years of this program foresees planting of 86,000 ha of rubber, which is probably optimistic.

Creating a framework through which potential investors can partner with others that have claims on the land (e.g. indigenous peoples (IPs) or squatters), if any, so that all can benefit from the proposed rubber development.

Refinancing options for smallholders, whether ARBs or not, would appear to be (i) the provision of long-term credit, or (ii) supervised planting/replanting grants. Because, unlike oil palm or sugar, rubber does not have to pass through a processing plant and cup lump is readily tradable, a credit system is likely to be fraught with difficulty, and a grant system would therefore to be more effective and easier to manage. Clearly this would put a strain on GOP resources, but one option for funding could be a cess on rubber exports. If long-term ODA could be used for investment in smallholder rubber, cess income, which would grow over time as export volumes increase, could be used to repay the loan. From the standpoint of equity, the cost per ha of rubber planting is similar to the cost of setting up an irrigation scheme, yet beneficiaries of irrigation contribute modestly to the investment in real terms (c. 10%).

Rubber Quality Enhancement. In the long term, the aim should be to improve product quality by getting away from cup lump. Measures to encourage this should be incorporated into schemes to expand production. Because processing only takes place after the cash flow from rubber has started, it should be possible to use credit to support investments in equipment by groups engaging in simple processing e.g. to make products of RSS3 equivalent quality.

Annex 4 details a pessimistic Scenario 1, if land policy and financing issues are not addressed and rubber subsector development therefore proceeds on 'business as usual' basis, with reasonable growth (as in the past decade), but nowhere near on the scale possible. Alternatively, in the optimistic Scenario 2, there would be substantial expansion of several hundred ha of rubber, mainly in Mindanao. The risk of typhoons would appear to explain the fact that in the past there has been virtually no rubber in the rest of the Philippines, however as in the rest of Asia, there could also be some limited development outside traditional areas. The optimistic scenario does show an average fall[17] of about 4% p.a. through 2020, but then GVA would but grow by 12.5% p.a. through 2030 and subsequently level off at about 7% p.a. between 2030–40. This is partly because there is no income to offset investment costs during the first six years, and also because World Bank commodity price forecasts indicate a 40% decrease from the 2010 level, as oil prices (hence synthetic rubber prices) decline. If prices were instead to remain constant in real terms over the over the 2010–20 period, there would be a 2% p.a. average growth in GVA during that period. Beyond 2020, the growth rates would again be 12.5% through 2030 and 7% from 2030 to 2040, but the final 2040 absolute GVA would of course be much higher. Scenario 2 is both positive and realistic, and would create about 138,00 new full-time job equivalents, contribute an incremental P 20 billion to value added, and provide an additional 410,000 tons p.a. of rubber for export (worth just over USD 800 million at projected real long run prices).

Oil Palm

This is still a relatively minor crop in the Philippines, but with good potential. The current planted area is about 56,000 ha (up from 34,000 ha in 2002[18]). Oil palm is similar to rubber in terms of agronomic characteristics, the main operational difference being that it requires central processing and a substantial volume of material has to be hauled from field to processing plant. To successfully develop a palm oil complex, ideally about 8,000 ha of land with good transport access would be required. Other things being equal it will be more difficult to find the land for oil palm development than it will be for rubber. However the rapid growth of one private Philippine company shows that it can be done. Policy Issues to be addressed are similar to those for rubber, but there are some important differences in potential performance:

17 Although there will be more rubber produced from existing stands in 2020 compared to 2010, as immature rubber become mature, the impact of reduced real prices from the 2010 level to those estimated for 2020 of 29% at the farm gate means that GVA at constant real 2010 prices would actually fall during the 2010–2020 period.

18 Some expansion is occurring in Palawan and Mindanao, although on a small scale in relation to potential.

Oil palm develops faster; it starts to yield in 3–4 years, v. 6–7 years for rubber, and is potentially more profitable.

Oil palm requires more sophisticated management and tighter producer/processor integration.

Unit size can be a startup issue. Ideally fresh fruit bunches (ffb) from about 8,000 ha are needed for an efficiently sized processing unit

Because of the need for close integration, clear and fair arrangements need to be established between the land owner/producer and the processor, whereas with rubber the product ex farm is a marketable commodity that can be sold directly to traders.

As with rubber, oil palm is potentially a good crop for development on former forest lands (in neither case should there be any encroachment into primary forests). The Philippines is currently a substantial net importer of palm oil, but with proper support for a major development over the next decades, it could supply its most of its own domestic market and switch to being a net exporter. With strong support and ironing out land issues, oil palm development could proceed rapidly, but would likely require direct foreign investment and experienced management skills. A mixed industry having both estates and out-growers could develop an incremental 300,000–400,000 ha by 2040, assuming improved road infrastructure. Estimates of the likely establishment cost of oil palm and its financial returns are detailed in Annex 4. At present prices, oil palm is profitable at the farm level, and estimated production costs are well both current and long run world prices (which as noted previously are projected to fall through 2025).

The more pessimistic Scenario 1 would materialize if there is no specific encouragement for oil palm production and access to degraded forestland is not facilitated. Under that scenario, it is likely that the existing 56,000 ha will be retained and replanted as needed, but that new planting will be limited to a modest expansion of areas around existing processing facilities. For the next five years, it is assumed that planting will be undertaken at about 5,000 ha/year, on land where arrangements have already been largely made and adjacent to underutilized processing facilities. As it becomes clear that area expansion is difficult and inward investment not encouraged, the planting rate will fall back to a token 1,000 ha per year.

Under the more optimistic Scenario 2, arrangements to develop significant new tracts of oil palm are made, requiring parallel investment in new processing facilities. The level of planting is also assumed to be 5,000 ha/year through 2017, but then as opportunities to develop new areas crystallize, the new planting rate will be 20,000 ha per year for the following 10 years, before falling back to about 10,000 as land availability becomes more of a constraint. Under both scenarios, oil palm will become a more important crop than at present, in the optimistic case, GVA would increase by a factor of about 5, even after taking account of the projected price reduction at the farm gate level in the World Bank commodity forecasts. The equivalent of about 100,000 full time farm level jobs would be created, as well as a similar number in the crushing, transport, refining and marketing areas.

Increasing the area of oil palm by 350,000 ha as in Scenario 2 would require substantial investment (both on-farm development and in processing facilities), most of which would need to come from the private sector. The proportion that could realistically be expected to come from smallholders' own labor would be quite small. Ideally the investors would have a strong understanding of the sector and access to the latest research and technology. That probably means it would be inward investment from Southeast Asian regional oil palm businesses, and it would therefore be important therefore that policies are put in place to encourage this.

Cacao

The Philippines was previously an important cacao producer, particularly in Davao where about 70% of national production originates. Production peaked at about 30,000 tons[19] in the 1980s. BAS data indicates that the area declined to about 18,000 ha by 1990 and 9,000 by 2010 (with a parallel reduction in output from 10,000 tons to 5,000 tons of

19 Data from Cacao Industry Development Association of Mindanao (CIDAMI).

dry beans). Currently, the Philippines imports about 30,000 tons of cacao annually.

There is potential to reverse the decline in cacao, and to substantially expand production, initially substituting for imports and subsequently becoming a significant exporter. The potentially high quality of Philippine cacao, the increasing world demand for chocolate combined with international uncertainty of supply from traditional sources, suggest a positive outlook for expanding cacao production. Furthermore, there is considerable interest among Philippine businesses in the possibility of investment in cacao. Most of this investment is likely to be in Mindanao.

From the production side, cacao can be integrated with coconuts—coconut trees providing the necessary shade. Both can be good smallholder crops, but would require specialized extension inputs. These would need to come largely from the private sector, but could in part be public sector funded as part of Agrarian Reform Communities (ARC) development programs[20], or programs dealing with Indigenous Peoples (IPs) within Ancestral Domains areas.

It would also be important to consider the possibility of cacao production from larger units, e.g. (i) though leasing arrangements with individual small farmers, (ii) leasing/crop sharing agreements in IP areas, (iii) as part of integrated forest management leases that are already in place, or (iv) as part of the National Greening program (para. below).

For cacao under coconuts, substantial expansion through 2040 could be based on a planting program rising to about 15,000 ha per year. Assuming a typical 15 year crop cycle, that could lead to a stock of cacao trees by 2040 of 235,000 ha, which is still fairly small compared to the coconut area of 3.6 million ha. At that level, the Philippines would produce about 170,000 tons of cacao annually and therefore would become a net exporter, though still a fairly small player in global trade, which is currently about 3 million tons annually. Incremental employment of about 65,000 full-time jobs equivalent would be created at farm level (in reality, they would effectively mean less farm level underemployment). Because farms are small (1–2 ha cacao per farmer), the estimates assume that cooperatives or traders would undertake fermentation and drying centrally. Thus, in addition to value added at the farm level, there would be additional value added and job creation in the fermentation and drying establishments. In the case of scenario two, this would probably involve a further 15,000 jobs by 2030 and an increase of at least 30% in value added.

The actual level of profitability and value added of this type of development would depend heavily on world prices. The per hectare models show that the financial rate of return for cacao investment at 2010 prices would be very attractive (76%), but based on long run world price forecasts by the World Bank, that figure would fall to 26%. Philippines would be a net cacao exporter. If world prices do fall to below half of the 2010 levels, the farm level GVA per job (P68,000) would be relatively low—equivalent to about P270 per person day. In that event, cacao production would be fine as means of using surplus on farm labor (farm families themselves), much needed by poor coconut-based households. However it would be attractive to plantation operators paying unionized wages only if yields are substantially improved.

Coffee

The area under coffee, about three quarters of which is Robusta, has fallen from 144,000 ha in 1990 to 121,000 ha in 2010, and production from 126,000 tons to 95,000 tons (dry bean equivalents). Coffee had been an export crop, but in 1997 the Philippines switched to being a net importer. The situation for coffee has not been estimated in the same detail as that for cacao in this study, but based on the models used for analysis, coffee could also make an important contribution to agricultural sector GVA, employment and exports. As with cacao, Integration with coconuts (para. 33) and the possibility of organizing larger units of production (para. 34) would apply to coffee. New coffee planting of about 10,000–15,000 ha/year in former forest areas and intercropped with coconuts would feasible, in addition

20 For example the upcoming IFAD funded project centered on CARAGA, Cagayan de Oro and North Western Mindanao, which plans to involve DAR, DA and DENR provides for grant funding through the private sector for investments and technical support for Value Chain led production and marketing development, relating to smallholders.

to replanting existing coffee over a 10–15 year period. This would increase the coffee area to about 200,000 ha. At that level, Philippines would be a net exporter of about 150,000 tons/year. As with cacao, the country would still be a relatively small player within the global coffee trade (currently about 6 million tons).

Horticulture

Most horticulture is presently for domestic consumption, with the exception of three major fruits (banana, mango and pineapples) and some other minor exports. As indicated in Table 5.4, the area planted to fruits, vegetables and flowers has grown by 305,651 ha (29%) during 1990–2011 (although a number of items would be double or triple cropped, so absolute area occupied would be less). Almost all of the increase was due to a net expansion of area under fruits, of which 88% was due to the three main export crops. However, a number of other minor fruits also expanded, with the exception of oranges. Flowers increased across the board, but the area involved is very small. Vegetables presented a more complex picture: aggregate area showed almost no change, but this masked very variable performance across crops. Some showed very strong performance (broccoli increasing tenfold, but from a very low base; string beans doubling); the larger cassava crop area barely changed in 20 years despite population growth; the area under sweet potatoes (camote) decreased by about one fourth, and peanuts by 40%. The only somewhat larger vegetable crop to expand area was mung bean (24%), typically grown on residual moisture in rice areas. The area under all other smaller vegetable crops expanded by 28%, but with some gaining and others losing. Current vegetable productivity is quite low, and growing at only about 1% p.a.

Production statistics are somewhat confusing. On the one hand, the Vegetable Crops Road Map 2011–2016 indicates production from the 20 priority vegetables of about 1.64 million tons in 2010, i.e. about 17.6 kg per capita, but also refers to the per capita vegetable consumption level being low at 40 kg/capita and aims for that to increase to 60 kg/capita by 2016. The 7th National Nutrition Survey (2007) indicates vegetable consumption of about 40 kg/capita, plus another 10 kg/capita of starchy roots and tubers, dried beans, nuts and seeds.[21]

Domestic consumption of fruits and vegetables will likely keep pace with population growth, although support from nutritional information campaigns could prompt one or more demand shifts over the next few decades, depending in part on the pace of per capita GDP growth. Additional output would likely come from both increased production and a switch to higher value products including vegetable products with greater value added (partially prepared vegetables, pre-packed vegetables etc.). Most of the additional production should come from an improvement in yields, brought about by better cultural practices supported by improved extension based on greater commercialization encouraged by more sophisticated marketing.

Changing consumption patterns will also require changes in the way fruits and vegetables are handled and delivered to wholesale and retail points, as market expectations of quality rise. In that context, there has been some trend towards increasing imports over time, which may reflect a mix of production shortages, reduction in tariff rates, and consumer preference for better packaged, processed, perceived better quality and/or 'healthier'products, especially in institutional markets (hotels, restaurants and fast food outlets) and supermarkets that cater to high-end clients. While most fruits and vegetables are still sold in traditional value chain outlets dominated by traders, a recent study estimated that about one-fourth of the volume now moves through the institutional markets (Digal, 2007). As retailers and processors are becoming more concentrated, farms are getting smaller and fragmenting (ibid.). Among the issues that emerge in value chain studies for the smaller crops (i.e., excluding the three large export crops) are gaps in market information, infrastructure constraints (especially road transport), inadequate promotion of nutritional issues, continuing high inter-island shipping costs, poor organization of producers, high post-harvest losses and inability of small producers to engage in storage or processing, lack of regulatory support (e.g. certification of organic products),

21 The 7th NNS also includes a miscellaneous category of about 10kg/capita, which could also include some vegetable items.

Table 5.4: Planted/harvested area under fruits, vegetables, and flowers, 1990–2011 (ha)

crop/year	1990	2000	2010	2011	area increase 2011/1990	% change 2011/1990
fruits	491,101	633,663	794,757	792,497	+301,396	61
banana	311,819	382,491	449,443	450,125	+138,306	44
mango	77,137	133,815	189,437	187,073	+109,936	143
pineapple	40,795	42,968	58,547	58,456	+17,661	43
other	61,350	74,389	97,330	96,843	+35,493	58
vegetables	569,551	549,906	575,045	573,541	+3,990	0.7
cassava	216,653	210,208	217,622	221,235	+7,582	3.5
camote	136,717	127,682	109,438	103,704	–66,013	(24)
mung bean	36,593	39,661	40,080	45,283	+8,690	24
peanut	44,489	26,866	27,123	26,902	–17,587	(40)
other	198,099	145,489	180,782	176,417	+38,318	28
flowers	727	866	1,000	992	+265	36
total	1,061,379	1,184,402	1,370,802	1,367,030	+305,651	29

Source: Centennial estimates, BAS data.

difficult access to rural finance and up to date extension services.

Sugarcane

Sugarcane has a two to three year production and processing cycle.[22] Like oil palm, it involves shifting a large bulk of material to a processing plant—in this case up to 100 tons per ha, or roughly four times the amount for palm oil. There are 29 privately owned sugar mills in the Philippines and four Ethanol plants. Sugarcane farmers number about 62,000, but 75% of production comes from larger farmers (over 5 ha), many of who may become involved in the final years of CARP. Employment needed at farm level for this volume of output would be the equivalent of about 230,000 jobs, although because of its seasonal labor requirement, more people are involved at peak times.[23] Total sugar production is around 2 million tons, of which about 140,000 tons are exported to the USA under a quota arrangement.

Under AFTA, tariffs are being reduced progressively (38% in 2011, 28% in 2012, 18% in 2013, 10% in 2014, 5% in 2015). In the circumstances, it is essential for Philippines to increase the efficiency of sugarcane production, especially by small owners. This may involve development of farming on a block basis, which the government is encouraging, so that sequencing and transportation of cane can be efficient. That in turn will depend upon the development of effective relationships among groups of growers/lessors and between such groups and the processing plant operators. Current crop sharing arrangements between farmers and millers need to be reviewed to ensure adequate incentives for investment in processing plant modernization.

While world sugar prices have been very high in the past several years, they are projected to fall to about half their present real level by 2025. Given the likely comparative advantage of Thailand over the Philippines, and the planned reduction in import duty on supplies from within ASEAN, there will be very strong pressure on domestic prices. This would likely result in some reduction in the land areas on

22 Sugar mater plan indicates this applies mainly to larger farms (over 50 ha), with small and medium farms having one to two ratoons over two more years.

23 Sugar industry sources (SRA) refer to a total of 600,000 people employed in the industry, including processing, but that number probably reflects a head-count, including seasonal and part time workers, not job equivalents. Total full time job equivalents—both growing and processing, including those of farmers, themselves are estimated by the author to be in the 270–300,000 range.

which sugarcane is grown, especially in the more marginal areas with excessive slopes and/or poor access to the mills.

From the market perspective, domestic demand for sugarcane products is expected to grow. For food, demand would increase in parallel with population growth as well as to a lesser extent with per capita earnings. Based on FAO data, per capita consumption of sugar and sweeteners in the Philippines is above that of South East Asia and East Asia, but below the world average of 24.4 kg/capita or the European average of kg 42.2 per capita. With good growth in GDP and per capita income (the Centennial Global Growth Model high case for the Philippines), there will probably be per capita consumption growth in the country, particularly as real retail prices are expected to fall as a result of tariff reduction. Domestic demand for sugar for food may therefore increase from its 2010 level of about 2 million tons to perhaps 3.5–4 .0 million tons by 2040.

Additionally, the Philippines now requires the use of ethanol—to the extent of 10% in gasoline (an estimated 486,000 tons of ethanol in 2012). Presently ethanol is being imported for this, with domestically distilled ethanol from sugarcane fulfilling only about 1% of the market in 2011 and a likely 3% in 2012. Even if the existing 4 distilling plants were used to full capacity, domestically sourced ethanol would increase to only 20% of current mandated requirements. The extent to which it will be profitable to further expand sugarcane based ethanol production capacity will need to be reviewed careful, against alternatives involving manufacture of ethanol from other products, whether domestically produced or imported from within ASEAN.

To maintain profit levels, average sugarcane producers will need to significantly reduce their costs of production by 2015. To put this in perspective: if real world prices stay the same as in 2006/7–2010/11 (i.e. very high by historic standards), and if ASEAN suppliers are able to sell at about US cents 1.7 per lb above 'world price', then average costs of production in the Philippines would need to be reduced by 25–30% to maintain margins. If the World Bank long run price forecast materializes, then margins would be maintained only if costs of production were virtually halved.

Inevitably, a proportion of sugarcane producers will not achieve the needed cost reduction, and therefore profits will fall or turn into losses. Accordingly, when the next need to replant comes up (every two or three years, depending on whether they ratoon once or twice), some of these are likely to switch out of sugarcane production. As sugar is quite a high output and labor-intensive crop, such a reduction, would likely lead to a reduction in gross output, value added and employment. For example, replacing sugar with rain fed corn would roughly halve gross output per ha and substantially reduce employment. If 25% of sugarcane growers exited the industry—say 100,000 ha, there would be a net loss of about 40,000 jobs (if replaced by corn). However in some areas land may switch out of sugar into oil palm or other intensive crops (e.g. pineapple) and the employment impact would be much less negative.

Summary of Scenarios

The development through 2040 of the crops on which this Chapter focused will depend on a number of policy decisions that will affect their attractiveness to the private sector. While it is expected that DENR and DA will have important roles to play in providing support, including infrastructure to smallholders, experience elsewhere, particularly with long term crops (rubber, oil palm, coffee, cacao) suggests that technical change and improved performance will need to come mainly through the private sector, as has already been the case with pineapple and Cavendish bananas.

Land availability for tree crop development is an absolutely central issue, as has been emphasized in each of the individual subsector sections above. Success will require a well-organized land market, where (i) ownership is clear, (ii) zoning of land is well understood, and (iii) buying, selling, renting or leasing of land is straightforward among willing participants. An important requirement for this is a reliable and trusted land registration system. Important elements of such a legal and regulatory framework are not yet in place, and this is the core reason why the Philippines has been markedly less successful to date than have neighboring countries with similar agro-ecological conditions. Identifica-

tion of exactly what is the status of the 15 or so million ha of forestland will be an important part of the equation. While much of the 9 million that has been de-forested should return to timber, it is likely that 1–3 million hectares could profitably be used for tree crop agriculture, with a positive environmental impact, compared to present conditions. Development of just and well-structured frameworks for long term agreements on land use and profit/risk sharing between potential investors on the one hand, and those with rights to land (including ancestral domain rights) on the other, will be an important element of successful tree crop development. Work is taking place on these issues, but would need to be fast tracked and given much higher priority.

If (i) land issues can be solved, (ii) legal problems concerning 'pole vaulting' dealt with sensibly, (iii) market forces allowed to determine agricultural wages, (iv) red tape associated with technical purchases minimized, (v) restriction on foreign ownership of investments eased, (vi) domestic development institutions strengthened and well-funded, and (vii) peace and order issued resolved—there is potential for very rapid tree crops development in the Philippines. Aggregating the various developments discussed above, incremental production in the optimistic scenario would be about 320,000 tons of coffee, 460,000 tons of cacao, 1.1 million tons of rubber and FFB leading to about 4.7 million tons of palm oil and palm kernel oil. Sugarcane production would grow by about 6 million tons (equivalent to some 600,000 tons of sugar). The total cropped area would increase by about 1.6 million ha, mostly from land formerly designated as forest. There would also be a substantial increase in inter-planting under coconuts, mainly with cacao, local banana, fruits etc., and some farmers outside these areas would also switch from lower value crops to higher value horticulture and/or sell their lands to others who then shift to higher value production possibilities.

At this level of growth there would be a substantial positive direct impact on employment of about 1.6 million jobs (affecting a larger number of people as these are full-time job equivalents that in many cases may be performed only part of the time). The average GVA per full time job equivalent in 2040 is estimated to be well above the both the present rural wage rate of about P150/day or the 'plantation' rate of around P275/day). In other words, there is considerable scope not only for generating new jobs but also for improvement in real wages—competitive with projections for unskilled wages in urban areas, thus affording the potential for good incomes for that part of the population that remains working in rural areas.

As to labor availability, much of the tree crop development is likely to be in Mindanao (while growth in output of other fruits, vegetables etc. will be spread more evenly across the country). Overall it is estimated that about one million of the incremental job needs would be in Mindanao. Mindanao had a population of about 22 million in 2010, of whom 4.2 million were reported to be involved in agriculture (BAS). Assuming population growth for Mindanao is similar to the rest of the Philippines through 2040 (52% increase), Mindanao's population will reach about 33 million. Taking into account that there will be a drift away from agricultural employment over the next few decades, this analysis suggests that an incremental one million agricultural jobs in Mindanao (and another 600,000 in Luzon and the Visayas) could nonetheless comfortably be absorbed, provided wage rates are competitive.

Although domestic demand will grow in line with population growth and rising per capita income, a substantial proportion of this incremental agricultural production in the optimistic scenario would translate into incremental exports. Specifically, exports would be expected to increase from Cavendish bananas, pineapple, coconut products, rubber, palm oil, cacao, other plantation crops and mango. In the case of sugar, the Philippines would probably become a significant importer, particularly if the ethanol in fuel requirement remains in place. Of these potential exports, vegetable oils, rubber, coffee and cacao are essentially commodities where there is no physical market constraint, but for pineapple, bananas and mango, the potential market will depend on demand from buying countries and the performance of competitors, as well as on the marketing skills of Philippine exporters. Incremental production for export-oriented products is estimated as follows.

The more pessimistic Scenario 1 essentially represents a continuation of the status quo. In this case, growth of about 2% overall is envisaged. While there will still be plenty of scope for expanding production of fruits and vegetables for the domestic market up to levels that will improve nutrition, the production of export products would be much less than in the optimistic scenario. New job creation would be lower, at about 300,000, assuming an increase in labor productivity of about 2% p.a.

Investment implications

An overview of the characteristics of the two scenarios has been presented for each of the crops, and quantitative implications are detailed in Annex 4. In both the pessimistic and optimistic cases, there is likely to be some increase in area planted, but this would be much more substantial in Scenario 2, and would come principally from degraded forest land, intercropping under coconuts, and some shifting of farmers presently engaged in low-value agriculture into more profitable tree crops or higher value horticulture.

The 'status quo' Scenario 1 involves growing agriculture mainly through technical improvements, without major new investments and therefore within existing financing structures. Scenario 2 involves opening up of new areas for long term crops, and this has substantial investment implications. For Scenario 2, the estimated annual investment cost would be about USD 300–400 million (depending on the particular mix of crops), or $135–250 million if only incremental coconut area is considered (with most replanting costs on the remaining 90% covered by timber sales). The majority of this financing needs to be provided as equity. This could come in the form of a mix of: (i) value of smallholders' own labor, (ii) government grants, (iii) freeing up of the coconut levy funds, (iv) equity from Philippine plantation or processing companies, (v) equity from foreign direct investors, capable of also providing technical value added or (vi) equity from special purpose funds established to take advantage of investment opportunities in agriculture. While some credit finance could be appropriate, it would probably be limited to those businesses that can provide adequate collateral. The newly established Agricultural Guarantee Fund Pool may be of some assistance in this regard, but at present it is quite small (it has about P 4 billion of funds and is able to guarantee P 8 billion of loans).

Chapter 6. Livestock and Poultry

Overview

Overall meat consumption per capita in the Philippines has risen by 55% or more over the past two decades, with pigs accounting for the largest share (about 45% of annual per capita consumption), followed by poultry (29%), beef and offals (12% each) and goats (2%). The pattern has changed slightly since 1990, with the share of pigs decreasing and poultry increasing (Table 6.1). These findings are based on BAS statistics. They show an average growth in meat consumption of 2% per year over this period, oscillating between –4% and +7% growth annually.[1]

Table 6.1: Evolution of meat consumption, 1990–2009 (kg/per capita)

	pork	beef	goat	poultry	offals	total
1990	11	2.9	0.3	4.4	2.7	21.2
1995	11.7	3.4	0.3	5.9	2.8	24.1
2000	13.2	4.3	0.3	7.2	3.4	28.4
2005	13.7	3.8	0.3	7.6	3.5	28.9
2009	14.9	3.9	0.1	9.6	4	32.8

Source: BAS.

The livestock and poultry sectors are distinguished by mode of ownership and type of production system, and by where consumers buy most of their meat products. The three main ownership systems include backyard/smallholder producers, individually owned commercial operators and commercial corporations.

These are further distinguished by type of production system, depending on source of feed: (1) those dependent mainly on fodder produced on-farm or collected in the neighborhood though cut and carry (all ruminants); and (2) those dependent on manufactured feed with a mix of local and imported ingredients.[2] Consumers also fall into two main categories: (1) lower to lower-middle income consumers who buy their food in markets and local retail shops; and (2) upper middle class and wealthy consumers who increasingly buy in modern supermarkets. The latter have now captured a 45% market share of total food retail in the cities and 35%[3] countrywide, and they play an important role in changing customers' behavior and preference away from the wet markets and "warm meat".

Table 6.2: Livestock and poulty operations, and share of inventory (%) by type of ownership

animal category/ ownership mode	cattle, goats & carabao	pigs	ducks	chickens (of which, broilers)
backyard/smallholder	100	67	75	40 (20)
commercial/individual				
commercial/corporation	--	33	25	55 (80)

Source: Centennial estimates and BAS.

Most livestock and poultry production in the Philippines is not internationally competitive at this time. This results from a combination of high input costs (especially maize for feed and energy) and low productivity (particularly in the pig and ruminant sub-sectors). The cost of inputs could be lowered if imports were liberalized. This would be a strong driver for producers to modernize, improve technical results and reduce costs, which would benefit domestic consumers by making meat products more affordable. Meat and fish products account for about 45% of total protein intake, but less than three-fifths of Philippine households meet the recom-

1 The BAS figures may understate consumption slightly, as they do not capture alleged smuggling. On the other hand, other sources like the 7th National Nutrition Survey (NNS) by the Food and Nutrition Research Institute (FNRI) yield similar results after some adjustment for differences in survey years.

2 Based on data received from the Centre of Livestock Development.

3 Romo, Glory Dee et al (2011?): The transformation of food retail in the Philippines (Asian Journal of Agriculture and Development Vol. 6, no 2, page 51–84) http://beta.searca.org/searca/ajad/files/072811102927_Romo%20FINAL%207-18.pdf accessed 27-5-2012.

mended intake,[4] hence making these products more affordable would have important income and nutrition impacts.

The Philippines also has the potential to penetrate ASEAN and non-ASEAN regional export markets (e.g., Singapore, China, Japan), because of its disease free status with respect to both HPAI (avian influenza) and FMD (foot and mouth disease). Realizing this potential will require not only improving efficiency of domestic production but also putting in pace a working tracking and tracing system, product inspection and quality control services, to meet food safety standards with which the Philippines is not yet able to comply.

With all commercial producers using the same genetics and facing the same world market prices for grains, competitiveness depends on economies of scale, input prices and technology. Feed is the starting point in the livestock value chain; it comprises on average 70% of overall production costs, and thus is a major determinant of profitability. In the case of the Philippines, high feed costs are directly related to the heavily protected and inefficient local maize market.

Over the next three decades through 2040, the private sector will drive livestock and poultry developments, but the government will have important regulatory responsibilities, as well as policy and investment functions to perform that will make the difference between achieving the high and low performance scenarios summarized below and reflected in the sector planning models in Chapter 8. The role of backyard/smallholder operators will decrease vis-à-vis that of commercial producers, but this segment of the market can survive by focusing strategically on niche markets and, in the case of pig producers, becoming out-grower participants in well integrated value chains that do not presently exist in most parts of the Philippines. Finally, livestock and poultry producers and their organizations need to contribute to reducing GHG emissions through better effluent management and raising efficiency and therefore the time from stable to table.

The remainder of this chapter summarizes findings relevant to the main livestock and poultry subsectors, quantifies possible high and low case performance scenarios for 2040, and identifies the principle policy, institutional and investment actions that should help the Philippines to remain on the high performance trajectory and therefore to sustain vibrant livestock and poultry industries capable of supplying most (though not all) of domestic food demand through 2040, as well as penetrate some high-value export markets.

Status of Individual Sub-Sectors

Poultry. Consumption has been the fastest growing (among meat products in the Philippines), and organization of the poultry industry has undergone substantial change since the late 1990s. At this time the sector is growing in volume at 3–4% per year. Growth in poultry consumption has averaged 3.7% over the last 20 years, but accelerated to 6% in the last 5 years, partly because of the high cost of beef and pork (see Figure 6.1), hence a trend towards increasing imports. Current consumption is estimated at about 10 kg/capita,[5] which is well below levels in countries such as Brazil (40 kg/capita) and Malaysia (32kg), in part because Philippines is also a major consumer of pork (therefore meat consumption is divided between pork and poultry).

Nowadays the worldwide trend is for integrators and large commercial companies to drive developments in technology, genetic improvement and increasingly financing in the poultry sector. The Philippines has been no exception. The local poultry sector has gone through several crises that led to its consolidation and regrouping. In 1996, the broiler market collapsed due to oversupply by domestic producers in parallel with the large-scale import of frozen chicken thighs, seen at the time by the sector as a pernicious effect of globalization. This was followed by the Asian financial crisis, which resulted in further financial hardship for poultry integrators. However, it also showed a lack of international competitiveness in the broiler subsector, which today is still producing at 20–30% above world market prices.[6] Many large and

4 7th National Nutrition Survey.

5 The 10k figure used in this chapter for poultry consumption in 2010 differs from the reference to 14k in Chapter 9, because the AMPLE model in Chapter 9 combines poultry and eggs (4kg) in the same line.

6 Meat Importers and Traders' Association estimate.

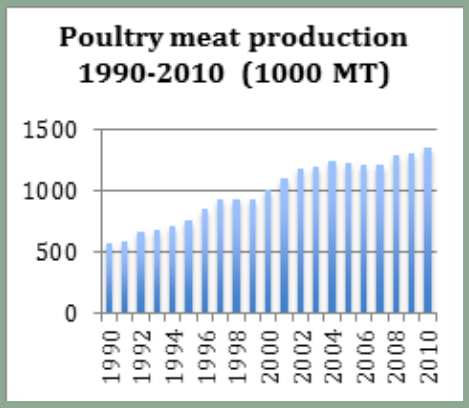
medium-scale independent commercial broiler farmers went out of business during this period; some shifted into pork production. The number of integrators reduced from 5 to 2 that now control approximately 40 and 15% respectively of the broiler market. Integrators have access to the MAV maize at 35% import duty, whereas others have to import at the 50% duty. The current level of integration is estimated at 65%, and well-informed stakeholders foresee that in 2040 it will be at least 90% integrated, as the only way to maintain competitiveness in a globalized poultry market.

The large-scale poultry integrators and processors supply most urban markets. In rural areas, backyard poultry is still an important source of supply, but hard to capture in statistical data. Imported chicken thighs are the cheapest meat in the market and favored by less affluent consumers. Local producers complain about dumping practices as the imported thighs cost about USD 0.75 CIF Philippines, including 40% tariff, whereas in the US comparable thighs are being retailed for around USD 2.00 per kg.

Eggs. In 2011, egg consumption was 3.79kg/capita[7] (BAS), which should have yielded a total demand of 356,260 metric tons, somewhat less than the actual volume of production (Figure 6.2), suggesting some over-supply.[8] Contrary to that of many countries in the region (but as in Japan and Taiwan), the Philippine market is for white eggs. Tinted eggs, considered by consumers to be eggs from local chickens, retail in the wet markets for double the prices of white eggs. This price difference in eggs is another sign that there are possibilities to further develop niche markets for specialty products targeting a different socio-economic clientele than the industrially produced bulk commodity white eggs.

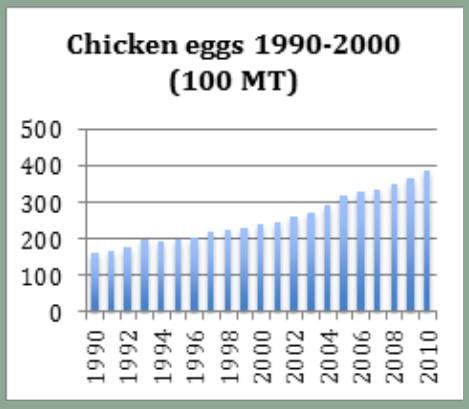
Given the current production capacity and domestic consumption level of poultry meat and eggs on the one hand, and the increasing pressure on the Philippines to liberalize the import market for poultry products on the other, a major effort is needed to reduce the cost-price relationship

Figure 6.1: Poultry meat production 1990–2010 (1000 MT)



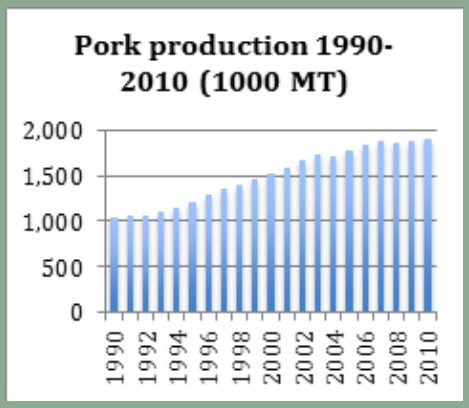
Source: BAS.

Figure 6.2: Chicken eggs 1990–2000 (100 MT)



Source: BAS.

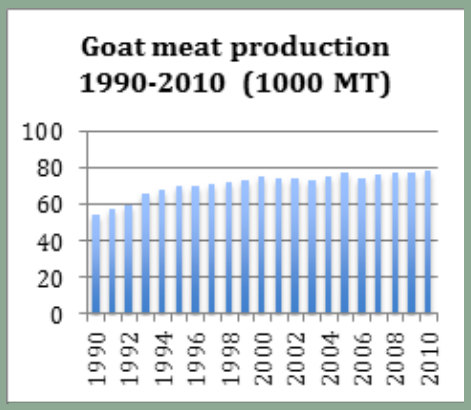
Figure 6.3: Pork production 1990–2010 (1000 MT)



Source: BAS.

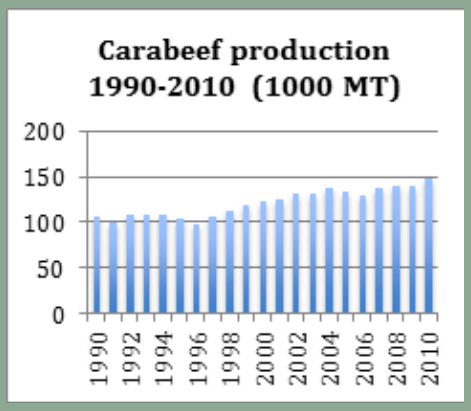
7 Approximately 16–17 eggs from industrial layers and 21–22 for the more traditional layers per kilogram.
8 A considerable part of eggs are used in the industry and it is not clear whether these eggs are included in the BAS figures.

Figure 6.4: Goat meat production 1990–2010 (1000 MT)



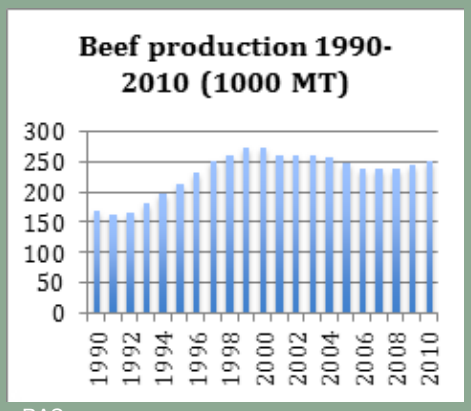
Source: BAS.

Figure 6.5: Carabeef production 1990–2000 (1000 MT)



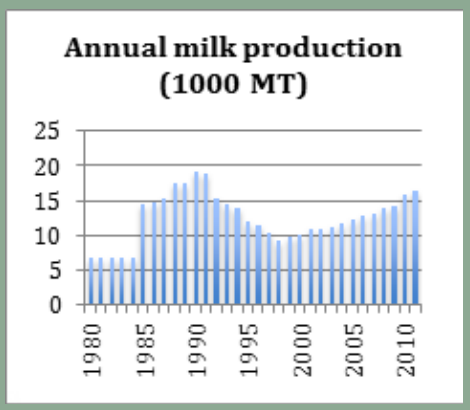
Source: BAS.

Figure 6.6: Beef production 1990–2000 (1000 MT)



Source: BAS.

Figure 6.7: Annual milk production (1000 MT)



Source: BAS.

sufficiently to be able to compete with potential imports and prepare to enter export markets to avoid another crisis due to oversupply, as occurred in 1996–98. This will require pro-active decisions to secure a sufficient supply of competitively priced feed grain in the Philippines. Raising local maize yields through wider use of hybrid seed and application of correct fertilizers at the right time, as well as improved transport, drying and storage infrastructure for grain would seem to be the quickest ways to achieve this. The often mentioned high level of smuggling is a result, rather than a cause, of non-competitiveness. There is also need for export accredited triple A poultry slaughter and processing facilities to prepare for expanding future export.

Pigs. The Philippine pig sector is fragmented, the value chain is poorly developed and the various pig sector organizations cooperate poorly with each other. There is a wide range of genetic material in use throughout the country, and this diversity makes it difficult to develop an open processing industry and export markets with a standardized and uniform product. There is currently only one vertically integrated pork supply chain, accounting for less than 3% of overall production and mainly serving the high end of the domestic market for fresh and processed pork. This integrator owns a Triple A slaughterhouse and processing facility that meet the structural, operational and management requirements to qualify for an export license and would pass the export inspection of buying countries. LGUs are advocating the construction of additional Triple A slaughterhouses, but there is so far little interest from the private sector.

Most pig trading is done by middlemen ("viajeros"), who usually also take responsibility for slaughter and retailing on the wet markets. Local experts estimate viajeros' share in the wet market at between 80–85%. Pigs used to be transported live from other regions to Manila, but this incurred heavy losses and was expensive. In 2008 a "pork in the box" system was introduced: animals are now slaughtered in Mindanao and transported to Manila packed in boxes. The National Meat Inspection Service (NMIS) monitors this process. With the viajeros controlling most of the pigs going to the market, it is difficult for slaughterhouses to rationalize operations, increase economies of scale and invest in plant expansion and/or modernization. Increasing the scale of production and vertical integration will diminish the necessity of 'viajeros necessity of 'viajeros' to aggregate within the value chain. These should be actively promoted, both by ensuring access to finance and land availability and policies that permit such upgraded larger-scale (non-corporate) pig farms.

The 3–4 existing hog producer associations have started to discuss plans to develop a national pork quality standard, through which the genetics and end product can be standardized. This would mean that payment schedules could shift in future from payment for live weight to payment for classified carcass weight.

A pig sector with a high proportion of the inventory in backyard conditions will have problems in controlling and containing pig diseases. CSF is still endemic and PRRS (first diagnosed in 2008) and Circo-virus type 2 still affect the pig population, increasing production costs due to morbidity, mortality and the need to vaccinate. This has negatively affected the Philippine pig sector's competitiveness in comparison to that of neighboring countries, which manage to maintain disease free zones, have strict quarantine regulations and vaccination, and therefore succeed in exporting to the lucrative Hong Kong, China and Singapore markets.

The local pig industry is protected, but not safe and definitely not competitive with the world market, based on its current productivity parameters (Table 6.3). In Minimum Access Volume (MAV) quota pork (54.210 ton/year) has a 30% import duty and out of quota a 40% duty. The processing industry imports offals, skins and fat with a 5% import duty due to the absence of large-scale slaughterhouses in-country able to produce these ingredients at competitive prices. The fact that the 2012 WTO pork quota has been allocated to 110 different companies is an indication of the high fragmentation of not only the producers' part of the pig value chain, but also the trade and processors' parts.

The pig sector needs major restructuring to address issues causing low productivity. Priority actions would include the following. First, clear breeding plans will be needed to attain higher productivity parameters for both sows and growing pigs. Through specialization within the value chain (separation of breeding, multiplication and growing/fattening) knowledge and skill levels for each step in the production should increase, leading to better overall management, productivity and higher output. Second, biosecurity should be developed and applied at each and every step in the value chain, with adequate quality control and compliance mechanisms. Through an initial GAHP (Good Animal Husbandry Practices), later followed by an HACCP with environmental management systems (comparable to, for example, ISO 14000 family of standards) quality and safety can be guaranteed. The NMIS will have to collaborate with sector organizations in a joint effort to establish such quality and safety assurance systems based on self-control. Third, feed needs to be of a more constant quality under independent quality control. Commercial pig feeds have penetrated all rural markets. Fourth, backyard farmers with the right conditions need to be incorporated into out-grower fattening schemes

TABLE 6.3: CROSS-COUNTRY COMPARISON OF CURRENT PIG PRODUCTIVITY PARAMETERS

indicator	Philippines	EU and US
weaned piglets/sow/yr	16	26–30
daily growth rate/grams	500	700–800
feed conversion rate	3.3	2.2–2.8
farm gate price pigs (USD/kg)		
90 kg live/65–70 kg carcass weight	2.25	--
120 kg live/90–95 carcass weight	--	1.3

Source: European and USA pig performance data and Centennial estimates.

(i.e., linking to a corporation with vertical integration, with pre-financing of superior genetic material, access to quality feed and guaranteed marketing through the integrators. This would reduce the role of middlemen and might lead to more control over quality and safety. In many cases, new fattening houses with good climate and manure control, training of farmers and increased biosecurity measures will be required. At the same time, careful attention is needed to the delicate process of pricing, which can become increasingly untransparent at the value chain becomes more complicated and the influence of the corporation increases.

Domestic production of pork was about 1.9 million tons in 2010. With consumption averaging 15kg/capita nationally and a population of 93 million, demand would have been approximately 1.4 million ton. In addition, people eat processed pork in the form of sausages at a rate of 3.5kg/capita, adding another 330,000 tons to total demand. Considering that most lower income rural households reportedly eat meat only on payday or festivities, it is quite possible that urban pork consumption exceeds 30kg/capita. This means that with urbanization and rising incomes, a larger segment of the population will demand more than 15kg/capita, causing a non-linear increase in pork consumption with increasing urbanization over the next three decades. At the moment, production volumes are not adjusting upwards, and there is anecdotal evidence that 1 in 5 smallholders have given up backyard pig production over the last 12 months. This will eventually lead to depressed supply and increasing prices, either bringing farmers back into pig production or increasing their enterprise size. However, this takes time and creates a cyclic effect of undersupply with high prices, build-up of supply again, followed by price depression, farmers going out of business and the "pig cycle" starting again. Poultry sector is less prone to sharp adjustments because it is easier and quicker to increase broiler production through importing hatching eggs and Parent Stock (PS) Day Old Chicks, which will start producing eggs for incubation after 20 weeks.

Beef. Today the national cattle herds are around 2.6 million head of cattle and 3.3 million buffalo (carabao), and these numbers have been fairly static over the last 10 years. Before the Comprehensive Agrarian Reform (CARP) in the late 1980s, the Philippines had ranching operations that produced weaners and linked into feedlots. With the dismantling of these ranches, the country at first resorted to importing weaners from Australia to fill the feedlots. The total import of live animals peaked in 1999, at about 270,000 heads, and beef production levels were maintained. However, this subsequently became too expensive due to appreciation of the Australian dollar against the Peso. Imports decreased to mainly animals for breeding; more than 100 feedlots dwindled to only a handful that are linked to agro-industry with access to cheap fodder and feed.

Beef consumption has hovered around 2 kg/capita,[9] with the main consumer base located in urban areas. The ban on frozen meat in wet markets effectively restricts beef imports for retail. Most imported beef and carabeef therefore goes to the processing industry to make corned beef and sausages, both popular meats eaten by lower income households.

Productivity in the ruminant sector is low due to extremely low calving rates (at times even less than 50%) and high calf mortality (between 10 and 20%). The government's 2010–35 road map aims to encourage "local beef cattle production catering to the high-end markets." Part of the strategy involves the import of genetic material under US and Australian grant-aid programs. In the past, similar efforts have not succeeded, with many of the imported animals suffering from adaptation problems, and the fact that land constraints pose limits on fodder availability. With the production parameters and high maintenance costs per year of a breeding cow in the Philippine today (Table 6.4), it is difficult to see how such program would succeed without resorting to large subsidies (as has been the case previously), given that the national herd is totally dispersed among many smallholders. Only 6% of cattle are kept in commercial farms, where it improving management practices is easier. Carabao, and increasingly, water buffaloes are more resilient in the humid tropics, better converters of low-quality roughage with a low digestibility than are cattle, and better fit for the rice farming system.

9 Or more.

Dairying. Milk in the Philippines is produced from cattle, buffalo/carabao and dairy goats, but most supply is from imports. Per capita consumption of dairy products is about 19 kg/year, of which less than 1% is supplied by local production. Many people now drink reconstituted milk because, with retail prices between USD 2–3 per liter, fresh milk is financially inaccessible for most. According to the National Dairy Authority (NDA), most milk produced by the relatively small domestic herd of dairy animals is sold in niche markets at 1.5 to 2 times the price of standard reconstituted milk.

Government efforts over the last 10 years to import animals to increase the inventory and improve the overall genetics of the dairy herd have not yet had a significant impact on production or animal numbers. Problems have included high mortality among imported animals in the first year and poor management capability of many of the new owners. The "dispersal" method of distribution (unconditional gifts) has been acknowledged to be ineffective and is being replaced by a dairy cow/goat or buffalo on credit scheme.

Milk powder is used for reconstitution as ready-to-drink milk, either UHT or 'fresh' (pasteurized). A few major players account for about 79% of total imports, mainly from New Zealand (36%), the USA (25%), Australia (11%) and Malaysia (6%). Australia and New Zealand have tariff free access due to the 2009 AANZFTA (ASEAN, Australia and New Zealand Free Trade Agreement); US imports have an MFN (Most Favored Nation) import duty of 1% on milk powder and 3% to 7% on cheese.[10] The main international dairy companies (Nestlé, Danone, FrieslandCampina) all now have plants in the Philippines, but have not yet started to support smallholder dairy development as they do in Indonesia and Vietnam.

The 2010–35 dairy development roadmap prepared by NDA foresees the formation of 92,600 smallholder dairy farmers through the various types of support this program will extend to (prospective) dairy farmers. Contrary to the past, animals will not be dispersed but given out on credit so as to avoid untimely sale and/or slaughter. So far, the problem for many dairy farmers has been to find a market for their milk that pays a competitive price; and for the dairy processors, the variable quality and quantity of milk produced by smallholders and the high cost for aggregating it. The fact that the government has had to start a cow-buy-back scheme to prevent slaughter of productive dairy cows and Murrah buffaloes should signal concern about profitability of the sector.

The government is promoting dairy goat raising to give to smallholders and improve their incomes, as these goats require less forage, reproduce more quickly and are easier traded than cattle. Current problems concern the incidence of diseases (especially respiratory and parasitic) that result in high mortality of kids and adult animals. Imported dairy and meat goat breeds have shown lower fertility than indigenous goats (60% versus 80%), although there is no good record keeping. In view of the extent of informal trading, this also means that production data should be interpreted with caution.

An interesting development is taking place in the carabao/buffalo sector. A private plant has established a buffalo dairy brand ('gatascarabao'). It pays farmers PhP 40–42/liter depending on quality, and runs a buffalo fund based on suitable breeding buffaloes sourced from government supported import and other breeding programs, which the company saves from slaughter. After quarantine and vaccination on the central holding farm, farmers get the use of the buffalo for 6 years, for which they pay with 50% of the milk and calves. There is intensive monitoring and veterinary support, the number of farmers and buffaloes is increasing steadily and products in supermarkets are usually sold out before the new supply comes in. The fact that this private scheme, which has foreign investor equity, can buy suitable buffaloes that farmers received from government shows that somehow the official scheme is not providing the farmers with the conditions to make buffalo dairy farming profitable by themselves. It suggests that future dairy development in the Philippines should be led by the private sector, usually dairies, to integrate smallholder dairy farmers into a dairy value chain that can guarantee both fair payment for milk and profit for all.

10 http://www.bordbia.ie/industryservices/information/alerts/Pages/ThePhilippinemarketfordairyproducts.aspx?year=2012&wk=12

Table 6.4: Projected meat requirements to meet per capita demand

UN Pop. Data (*1000)	
2010	93261
2020	109742
2030	126321
2040	141675

2010 Availability	(Metric Ton)
Pork	1371046
Poultry	959522
Beef	194555
eggs	387335

% consumption growth/yr	
high	low
0.8	0.4
4	2
1.5	0.5
5	2.5

required quantities (* 1000)	2020		2030		2040	
scenario	high	low	high	low	high	low
pork	1,747,150	1,679,044	2,177,901	2,011,415	2,645,216	2,443,007
poultry	1,671,326	1,376,352	2,847,720	1,931,229	4,727,682	2,640,300
beef	265,690	240,644	354,927	291,165	461,973	343,255
total	3,684,166	3,296,040	5,380,547	4,233,810	7,834,871	5,426,562
meat consumption/ capita	34	30	43	34	55	38
eggs	630,928	495,822	1,027,715	634,693	1,674,040	812,461

Source: BAS, UN and FAO data; Centennial estimates.

Future Development Prospects for Livestock, through 2040

The following are several observations on the prospects for development of the livestock sector through 2040. The role of the private sector will be increasingly important, with the government focusing mainly on the socio-economic aspects of livestock keeping for smallholders on the one hand, and its regulatory responsibilities on the other. Incentives for modernization will come from the opportunity to participate in regional export markets, as well as from increasingly demanding domestic clients (e.g. supermarkets, fast-food outlets and restaurants), and better informed consumers who will increasingly demand guarantees that will have to come through documented Good Practices in all fields (animal husbandry, transport, processing/manufacturing, veterinary and retail). The role of smallholders will decrease vis-à-vis that of commercial producers. Besides serving physically isolated markets, their best chances will come from working together with trusted traders and companies to build value chains for high quality branded traditional products for sale in specialty shops and special markets.

Based on historical trends, we see a long-term growth in total meat consumption of 2% per year. For this study, high and low case scenarios were developed, using the UN population forecasts, the Centennial Group Global Growth Model, and the Philippines specific multi-market AMPLE model for the agriculture sector. For historical information, the study relied primarily on the BAS statistical series, but cross-checked with information derived from the FIES household surveys and FNRI national nutrition surveys.

Poultry consumption per capita grew by an average 3.7% during 1990–2010, and by 6.1% over the last five years. It is unlikely that future growth will be as high as in the last five years, which is partly explained by the effect of PRRS and FMD outbreaks and temporary consumer shift away from pork. For this analysis an annual increase in consumption of 4% is taken as the high scenario and 2% for the low scenario.

Pork consumption per capita grew by an average 1.3% over the last 18 years, but by only 0.3% over the past five years, again partly explained by the effects on consumer demand

of PRRS and FMD outbreaks. For this analysis the study assumes 0.8% growth per year through 2040 in the high scenario and 0.4 in the low scenario.

Beef consumption per capita grew by an average 1.9% over the last 19 years, with considerable variation throughout the period. For the high case scenario 1.5% and for the low case scenario 0.5% annual growth are used.

Table 6.4 summarizes high and low case scenarios of the quantities of meat that would be required to meet food demand.[11]

At this time, most livestock and poultry production in the Philippines is not competitive in relation to world market prices, due to a combination of high input costs (especially maize and energy) and low productivity (especially in the pig and ruminant sectors). The cost of inputs can be lowered if their import would become easier, and competition in the local market from imports would be a strong driver for producers to improve their technical results and become more efficient. This, however, would have to be done in a gradual and well-monitored way. Productivity and profitability can be increased through improved technology and efficiency (in part through reducing labor costs). Most productivity gains are not likely to come from backyard and smallholder farms, unless more of these could be linked into vertically integrated arrangements. Vertical integration of farms would require investments in mechanization, which are hard to recover if family labor is readily available and without alternative application. The major increases in productivity will therefore have to come from improving technical results in the animal production process. This is always a combination of genetic improvement and better/smarter management, which are hard to separate and have a high degree of inter-dependence: better genetic capacity will not be realized without good management and environmental conditions.

Pigs. The pig production has three stages: (1) breeding, which is dominated by corporations in association with global pig genetics companies from Canada, the United States, U.K. and the Netherlands; (2) multiplication, which determines the cost price of piglets—major improvements in productivity can be made with a reduction in the cost price of weaners; and (3) fattening/finishing from weaner to slaughter pig. The cost of a pig is usually comprised 50% by the cost of the weaner and 50% the cost of feeding the weaner until slaughter.

Increased competitiveness will have to come from cheaper weaners (more weaned piglets/sow, less mortality) and a more efficient growing pig (lower feed conversion, higher growth rate, more lean meat). If there are 1.5 million sows

TABLE 6.5: EVOLUTION OF PIG PRODUCTIVITY PARAMETERS FOR COMMERCIAL AND BACKYARD PRODUCTION SYSTEMS, 2010–40

parameter	2010	2020	2030	2040
piglets weaned per sow p.a. (backyard)	16 (12)	19 (13)	22 (14)	24 (15)
daily growth rate (grams)	500 (400)	550 (450)	600 (510)	650 (580)
feed conversion rate (kg feed/kg live weight)	3.3 (4.0)	3.1 (3.9)	3.0 (3.8)	2.9 (3.8)

Source: Centennial estimates with inputs from sector representatives.

in both the commercial and backyard sector in the Philippines, an increase in the number of weaned piglets per sow per year from 16 to 24 could well reduce the price of a weaner by at least 30%. Although many farmers out of false economics keep their own gilts or buy locally for around USD 200 instead of from a recognized breeding company for USD 400, it can be easily shown that better genetics in gilts gives (1) higher fertility and thus more weaned piglets and (2) better feed conversion and faster growth. With an average life production of at least 50 piglets/lifetime per sow the additional cost per piglet for better genetics is USD 8. With a growth rate of 100 gr/day more and a feed conversion difference of 0.7 between 20 to 100 kg, such a piglet grows in 160 days in comparison to 200 days for the local genetics and uses 264kg feed against the local genetics 320 kg feed. The difference of 56kg of feed used is worth about USD 24 at current prices—three times the cost per piglet of purchasing the better genetics. In addition, there is more efficient use of the stables and a higher turn-

11 Figures for pork based on 2009 information in BAS database.

over of pigs per year. See below for a summary of the key elements needed to improve productivity in the pig sector.

Ruminants. The main technological problems/ shortcomings are the low calving rate, the high calf mortality and the low volume of production, which is partly genetics and partly management. This low fertility reduces the possibility for genetic selection (all animals needed for replacements), and it is doubtful that with the almost constant number of dairy animals over the years the population can maintain itself without imports. There is not really a corporate dairy industry: most animals are in backyards or small commercial farms. Only buffaloes have a large-scale center for selection and breeding, maintained by the Philippines Carabao Centre (PCC). The NDA prepared roadmap for the ruminant sector says that the number of dairy animals will reach to 500,000 and water buffaloes 350,000 in the assisted herds in the year 2035. The question is whether the tremendous increase in the number of animals as foreseen by the Government will be reached. It may well be that solving the lack of access to dairy markets paying a fair price, land for the production of sufficient forage and basic veterinary care would increase the number of dairy animals in the country quicker than planned large-scale imports.'

The division between dairy and beef animals is slightly arbitrary: dairy cattle also produce beef. Assuming 80% calving and 50% bull calves each dairy cow "produces" each year around 70–80kg beef including her own 30kg's annual "rest-value", when slaughtered around 6 years of age. With the current low fertility and high mortality in beef cattle this is probably at least the same quantity as a beef cow currently produces yearly. The selection of breeds for 'improving' the current cattle breed in the family farming sector needs to be reconsidered: Brahman cross cows are hardly the most suitable animals for tethering, stall feeding and should therefore be avoided in the family farming sector. It may be better to use dairy breeds to upgrade cattle in the backyard sector so that families get access to more milk. When fertility and mortality parameters improve, there will be animals that can be crossed with Brahman and other beef breeds as terminal sires: such calves should as weaners all be sold for beef production and not kept for further breeding. If attractive prices are paid for such animals with good fattening characteristics (heterosis), farmers will more easily part with them.

Table 6.6: Evolution of productivity parameters for dairy cows and buffaloes, 2010–40

parameter/year	2010	2020	2030	2040
dairy cow prod. (liter/day)	8	10	13	16
calving interval (months)	24	20	17	15
calf mortality (% in year 1)	20	15	10	5
buffalo prod. (liter/day)	4	6	8	10
calving interval (months)	24	21	19	17
calf mortality (% in year 1)	10	8	6	5

Source: Centennial estimates with inputs from sector representatives.

Feedlotting. Making use of locally available agro-industry byproducts (sugar cane tops and bagasse as roughage, molasses, bran, fruit processing waste etc.) and locally produced Brahman Dairy crosses would result in integrated dairy and beef production using locally available feed resources to the maximum extent possible and guaranteeing that the family farming sector will be working with the most suitable animal for their socio-economic conditions.

Feed Milling. Low yield/high price domestic maize production has a major impact on feed prices, and hence the profitability of the pig and poultry sectors in the Philippines. Maize and soya are the main components of any animal feed and critical in terms of price and availability: they form respectively 40–60 and 25–30% of the feed, depending upon the type. The Philippines is somewhere between 70–90% self-sufficient for yellow maize, depending upon the year, but less so for soya. Maize imports from Indonesia and Thailand are charged 5% import duty and from non-ASEAN countries under the MAV are charged 35% duty, while imports outside of quota are charged a 50% tariff rate. With this relatively expensive imported maize as reference, local maize producers have pushed up prices, and feed millers

TABLE 6.7: HIGH AND LOW CASE SCENARIOS FOR MAIZE, LIVESTOCK, AND POULTRY, 2010–40

	2009/10	2020		2030		2040	
poultry broiler	0.5 of feed consists of maize	10% added in layers for GPS and PS maize consumption					
feed conversion (kg feed/kg growth)	1.8	1.7		1.6		1.6	
10% added for parents		high	low	high	low	high	low
total maize (kg)	949,926,780	1,562,689,678	1,286,888,939	2,278,175,604	1,699,481,852	3,782,145,708	2,323,463,825
number of ha required	362,429	366,027	372,514	327,593	373,239	333,881	387,147
poultry eggs	0.5 feed consists of maize	10% added in layers for GPS and PS maize consumption					
feed conversion (kg feed/kg growth)	2.2	2.15		2.1		2.05	
total maize	426,068,500.00	746,072,242.06	586,308,979.24	1,187,010,901.95	733,070,991.23	1,887,479,592.49	916,050,158.87
number of ha required	162,560	174,751	169,718	170,687	160,997	166,624	152,637
pigs	0.6 of feed consists of maize	10% added for the feeding of the sows					
feed conversion of feed/kg growth	3.3	3.1		3		2.9	
total maize	2,714,671,080	3,574,668,550	3,435,323,074	4,312,244,189	3,982,602,478	5,062,943,445	4,675,915,887
number of ha required	1,035,739	837,920	994,419	620,084	874,657	446,948	779,123
beef	400 kg maize in 2 months' feeding 12 kg ds per day with 60% maize, 200 kg carcasses, 25% of animals go through feedlot						
total maize	97,277,500.00	132,845,126	120,322,216	177,463,373	145,582,483	230,986,619	171,627,710
number of ha required	37114.6509	31,116	34,830	25,519	31,973	20,391	15,151
total maize (kg) required	4,187,943,860	6,016,275,596	5,428,843,208	7,954,894,068	6,560,737,804	10,963,555,364	8,087,057,580
total hectares required	1,597,842	1,409,184	1,571,184	1,143,882	1,440,865	967,844	1,334,058

therefore are increasingly turning to feed wheat that currently can enter on a 0% tariff, mainly from the Ukraine and Australia. The relatively high prices on the local market for meat also encourage both real and technical smuggling and leakage out of the export free zones.

A strategic cluster development plan to address this situation could comprise the following: (1) ensure that maize farmers have access (physically and financially) to hybrid seed and the right fertilizers at the right time; (2) Improve infrastructure (roads, electricity supply and irrigation) so that the private sector will be willing to invest in driers, silo's, feed mills, slaughterhouses and cooling facilities in the rural areas; (3) gradually cancel the MAVs for maize and lower import duties; (4) improve control over smuggling (outright, technical and leaking out of tax free zones); and (5) promote alternative value chains for specialty (niche) products. The objectives would be to secure the highest possible self-sufficiency in poultry and pork, at competitive prices, to maximize both consumer welfare and the livelihoods of smallholder farmers. Such a program to raise maize productivity could feed the animal population over the next few decades without much difficulty. Table 6.7 below summarizes possible high and low case scenarios for the maize-livestock and poultry cluster.

Food Safety, Tracking and Tracing, and Producers' Responsibility. The livestock and poultry sectors are in serious need

of a modern food safety assurance program. The times of governments trying to catch people breaking the rules are over: the responsibility is now increasingly on sector organizations to prove both to consumers and the government, that all processes are under control and food safety and quality is assured. There is need for the development of tracking and tracing systems, whereby animals can be followed from stable to table. Especially the pork sector with widespread clandestine use of prohibited growth promoters (hormones, antibiotics and Beta-agonists) requires major work, whereby through spot checks and severe sanctions these practices are eradicated. The sector has to get on top of PRRS, CSF and Circo in pigs and NVD and bacterial infections in poultry. The frequent prophylactic use of antibiotics in animal feed should be replaced with better hygiene and probiotics.

The Future of Smallholder Livestock Farming

With the trend in conventional livestock production being towards increased unit sizes and diminishing margins per animal, it is difficult for smallholders to compete with commercial livestock producers, especially when demands for improved management and biosecurity are enforced. There is a growing urban (niche) market for traditionally produced products, which should derive from the more rustic breeds. Price incentives are at times more than 100% of the conventional price. Developing such value chains (traditional pork, slow-food yellow-skinned broilers, traditional eggs, traditional chicken for meat, goat kid meat and cheese, buffalo yogurt, etc.) could help to ensure a place for smallholders as providers of specialty products. As smallholders lack the land to produce sufficient quality forage to feed their ruminants (rice straw alone will not yield maximum output), stronger organizations of cattle/buffalo/goat farmers will be essential to jointly improve genetics, create economies of scale to purchase inputs, obtain milk-cooling tanks, etc. Finally, besides engaging in specialty products, smallholders can become out growers for pigs or broilers. On the one hand this is easier in the former than the latter at present, because of the lower investment levels required, on the other hand the integrators in the pig sector are not ready as yet to take on the responsibility for value addition and marketing, whereas in the poultry sector the value chains are better developed. A number of pig corporations are currently increasing their sow inventory and will need out growers to specialize in one branch: pig growing/finishing. With the design and construction of simple adequate housing with manure storage and handling facilities, pig out growers can remain profitable, provided they become integral parts of the commercial pork value chain, complying with modern Good Animal Husbandry Practices, participate in tracking and tracing, keep farm records and reduce the use of antibiotics and refrain from using growth promoters.

Environmental Considerations

The growth of animal numbers in human settlements has reached a level where management of effluents presents serious issues. The poultry sector has developed a lively market for broiler manure, for which there are traders and transporters to the horticulture production areas. Pig manure is often wet and expensive to transport. On-farm separation of the liquid and solid fraction is a first step, whereby the liquid fraction can be stored in a tank and used for fertilizing the rice or other fields through 'fertigation' (irrigation mixed with manure). The solid fraction could be composted with chopped rice straw and sold to the same vegetable producers. There are increasingly accessible techniques for on-farm production of biogas, with which household energy needs for cooking and heating can be met. The biogas effluent can be composted in pits with chopped rice straw so that also to the manure value can be added. The best were if manure could be brought back to the maize growing areas, but they are usually distant from the main poultry and pig keeping areas. Another option is to use the biogas effluent in a livestock-fish farming combined system: with Tilapia nearly the same price per kg as live pigs this would be a good way for smallholders to generate more profit from their poultry or pig enterprise.

Finally, livestock has also been identified as a major contributor to climate changes through the GHGs they and their manure release. Animals that grow optimally with well-balanced feed need fewer days to reach a certain weight and thus have a lower lifetime emission. It is therefore important

that animals are capable of growing as fast as possible, not only because of cost and profitability considerations, but also to reduce total GHG emissions.

Chapter 7. Fisheries

Overview

The Philippines is a fish-eating nation. For decades it registered the highest per capita fish consumption among ASEAN countries, although consumption per capita has been on the decline. After rice, fish is still an essential source of protein and income exceeding those of meat, chicken, eggs and milk. Although the contribution of fisheries to GDP has also been declining (from 4.4% in 1980 to 2.1% in 2010), employment in the sector during the same period doubled from about 1 million to 2 million. Some 75% of fishers are engaged in municipal (small-scale) coastal fisheries, 20% in fish culture, and 5% in commercial fisheries and sector supporting industries. Incomes of municipal fishermen are about half the national average; they play a critical role in supplying local communities, processors and traders with fresh, often cheap fish. The volume and value of fish exports are modest compared to production. The industrial sector generates about two thirds of fish export value, mainly tuna, seaweed and shrimp.

Table 7.1: Production and consumption of fish, 1982–2010

parameter/year	1982	1993	1998	2003	2010
total production for food ('000)	1,789	2,202	2,196	2,548	3,332
fish consumption per capita—survey data (kg/year)	41	36	na	38	na
total net production of fish per capita assuming 20% wastage (kg/year)	29.8	27.1	25.3*	25.2	25.4

Source: Centennial estimates based on BAS and FNRI data.

There are large differences in estimates of current fish consumption between direct consumption surveys and those derived from official catch statistics. However, all data suggest slowly declining per/capita consumption during the past three decades, mostly of lower value fish. Since 1990 prices of lower value, marine, fish have increased much faster than the consumer price index for food. Stagnant marine fish production—resulting in higher prices—could also explain the declining consumption of lower priced fish.

Marine and Municipal Fisheries

Marine fish resources are mostly over-exploited. Research suggests that on average marine resources, notably in coastal waters, are being exploited well beyond their Maximum Sustainable Yield (MSY), estimated at about 1.9 million tons. There is no consensus on the absolute level of MSY or sustainable exploitation volumes, but there is widespread agreement that bottom dwelling fish resources are universally overexploited; and biomass levels are only 10–30% of those in the 1940s. Catch rates of small pelagic species (80–90% of the total catch) are one sixth of those during the 1950s. Coral reef resource catch rates are among the lowest in the world. The oceanic areas outside the Philippine Exclusive Economic Zone (EEZ) do offer modest long-term opportunities for expanded exploitation, and the Philippines is currently actively pursuing access through bilateral negotiations. Over the next three decades, no large sustainable expansion of total marine fish production can be expected from within the EEZ. Without major improvement of fisheries resources management, production from selected over-exploited stocks will likely decline further, and fluctuate more violently than in the past.

Maintaining marine fish production at sustainable levels will critically depend on more effective resources and sector management. Through an iterative devolution process starting with the Local Government Code of 1991, local responsibility for marine resources management has been dispersed among local, national and other stakeholder

interests. Devolution forced Local Government Units (LGUs) to assume responsibilities for a set of highly complex, integrated tasks for which they were not equipped, lacking staff, experience, funding, suitable coordination processes, and, most importantly, political commitment. The system suffers from a mixture of political complacency and/or interference at the national and municipal level depending on the particular location, a changed and much less robust resource base, limited research and ineffective enforcement. The ultimate impact of devolution has been severely disappointing: coastal and most oceanic resources throughout Philippines—in 2001 already in a serious state of decline—have since been further depleted. The principle of managing multiple, complex fish resources by 861 LGUs, with at least six agencies directly involved[1] and several levels of consultation, defies rational management and requires adjustment. Achieving this is on the critical path to reducing the widespread acute poverty among fisheries households, and arresting the decline in fish consumption that is absolutely undesirable from a nutritional and food security standpoint.

Efforts to address the devolution governance issues—for agriculture—have recently been tabled as part of the 'convergence' initiative. One of its main thrusts would focus on coastal marine environment. Decision makers in DA-BFAR have for decades struggled with the practical and political aspects of balancing food security and fish resources management considerations. Assigning greater priority to resources management is not without short-term challenges and would require substantial political commitment, but it is essential to achieve longer-term food security goals. This will require strengthening the capacities of: (i) DA-BFAR fisheries management authority; (ii) marine resources research; and (iii) surveillance and control. The initial focus would need to be on industrial and commercial fisheries. In the past DA-BFAR has made substantial efforts—with external assistance—to improve management of municipal fisheries first, while paying less attention to commercial fisheries. A less costly and more effective strategy should:

prioritize management and control of industrial and commercial fisheries by DA-BAFR and its provincial branches, creating a professional management regime, with the tools to limit and control fishing efforts of the 6,000-vessel fleet currently catching about 45-55% of marine fish production;

at the municipal fisheries level, give initial priority to indirect efforts to rebuild stocks by expanding fish culture and creating alternative income-generating activities. LGUs are better able to handle this kind of activity, for which they have some institutional capacity and budget resources.

Aquaculture

Maintaining sustained high growth of food-fish aquaculture production will require a more intensive focus on research, extension, logistics, quality control, fish-health and investment. Fresh water culture has historically been practiced in the large lakes of Philippines, mostly producing tilapia (currently 25% of all aquaculture fish production). Brackish water culture also has a long tradition, producing milkfish—Philippine's preferred cultured fish; 50% of total aquaculture production. The Philippine aqua culturists' selection of species and technology reflects historic preferences (milkfish), technology improvement (tilapia, shrimp) and high financial returns (seaweed). Excluding seaweed the average annual growth of aquaculture food fish production has been about 5% annually since 1980, slightly higher since 2000. Area expansion has particularly driven past growth; in-pond productivity improvements have been relatively high for tilapia[2] and shrimp, but more limited for milkfish. The rapidly rising costs of protein-rich fish feed[3] and lack of technical competence of culturists have restrained productivity growth of most other species.

The country has substantial marine areas where fish culture, seaweed and mollusks culture potentially can be

1 LGU's, Provincial Fisheries Divisions, DA-BFAR, DENR, the Department of the Interior and Local Government (DILG), and the Department of Science and Technology (DOST). The Department of Transportation and Communication and the Department of Defense (DND) and Philippine Coastguard and local Universities are also involved. In addition, advisory stakeholder consultations take place at various levels: the Provincial Development Council, the Fisheries and Aquactic Resources Management Councils and (Provincial) Coastal Resource Management Advisory Councils.

2 The multinational GIFT program (Genetically Improved Farmed Tilapia) has been successful in substantially increasing the productivity of tilapia farming.
3 The costs of fishmeal has increased >50% since 2008. Philippine farmers increasingly use 'trashfish' produced by the commercial fleet to complement traditional feeds.

expanded, but such culture is most exposed to the effects of extreme weather. The selection of the location of future expansion of marine culture, and the development of affordable technologies that are able to withstand heavy storms will be critical for future production growth. The uncertainty created by current land ownership and transfer policies will also restrict future area expansion of brackish and fresh water culture. For milkfish and shrimp raised in brackish water ponds re-utilization of abandoned ponds and productivity increases should be the main drivers for future expansion; substantial expansion of milkfish production from marine pens and cages, combined with other integrated culture practices, is also feasible. The pollution load of freshwater culture already exceeds environmental limits in many lakes. Substantial expansion is still possible by integrating fish culture with activities that mitigate the effects of pollution, such as irrigated rice farming. Productivity of tilapia rearing can be further increased through cage culture. Maintaining high production growth of cultured fish will increasingly require total factor productivity improvements in ponds rather than just area expansion. Dependence on only two species carries substantial risks; diversification of production will be critical. Most types of fish culture currently have moderate rates of return and face environmental, technical and financial risks.

Aquaculture requires effective research, technology transfer and capacity building, involving a complex combination of human and institutional resources that require specific technical disciplines and services, as well as the development of alternative multispecies and environmentally more benign production models. This requires a coherent set of policies and regulations, an efficient transport network, a functioning land market, improved water management and effective downstream distribution and marketing. It also requires effective special planning to locate viable areas for expansion or define where restructuring of production is necessary. Integration of these multiple requirements into a coherent development strategy is the most critical long-term requirement facing the sector.

Fisheries Research

Research activities in the Philippines are currently spread over various specialized public research institutions, private institutions and faculties of Universities—with selective overlapping mandates[4] and inadequate resources. To maintain high aquaculture production growth in the future—and remain a competitive global producer of cultured fish—cutting-edge research, covering all aspects of the value chain, will be needed and international/regional efforts rather than predominantly national research networks will be required in the following areas:

1. Brood stock supply and quality. Maintaining high quality brood stock and ensuring effective hatchery operations for the long term will require sustained back-up research, training, experimentation and investment, both public and private. National strategies to deal with these risks have been defined, but parts remain to be fully implemented and updated.

2. Disease control is only partly effective and solutions—in the region and globally—for existing and newly emerging diseases need to be vigorously pursued.

3. High protein feeds. Many cultured species require—or grow faster with—specialized feeds containing (mostly imported) fishmeal and oil. Global fishmeal and oil prices are expected to substantially increase over the next ten years and beyond. Development of alternative feeds and production methods less dependent on fishmeal and oil will be critical.

The direction of aquaculture production expansion has important nutrition and food security policy implications. Should future aquaculture growth be entirely market-driven

4 Aquaculture research does not only benefit producers, consumers benefit almost twice as much from lower prices and better availability of fish; the impact of aquaculture research on the poor—who spend about 8% of their income on fish in SE Asia—is particularly striking. David A. Raitzeret al.; Prioritizing the Agriculture Research Agenda for South-East Asia: Refocusing Investment to Benefit the Poor; Asia Pacific Association of Agricultural Research Institutions, Asian Development Bank, Global Forum for Agricultural Research; Global Conference on Agricultural Research for Development; 2010.

(focus on high value products, for which ready local and export markets exist), or incentives be created for investment in the production of lower value and less profitable, but possibly less risky, products for the local market? The former option will increase the relative level of domestic fish prices and strengthen incentives to: (i) import fish[5],(ii) maintain or expand fishing pressure on already stressed marine fish resources, and/or (iii) enhance consumption of alternative foods. The alternative approach would give some (food-security) priority in public policies towards fish production for the local market—in parallel to export oriented production—aiming to support local, poor, consumers.

External Factors and Risks

Success in satisfying long-term local demand for fish will depend in part on 'external' factors. Fish consumption in the countries in the region, including China, is directly linked to their joint ability to develop and maintain an efficient and highly productive aquaculture sector, with major improvements in productivity linked to superior research, genetic improvements and development of niche products, while jointly and individually solving critical technological, disease, feed, environmental, institutional, regulatory and logistical issues. China may be able to continue to import fish from across the globe to satisfy gaps in local demand; it already implements strategies to use domestic companies operating abroad to ensure future fish supplies. Philippines may have greater difficulty pursuing the same strategy having few industrial groups operating globally. In the longer term the global availability of truly cheap food-fish to satisfy local demand is likely to decline[6]. The ability to pay higher prices for fish will increasingly determine global trade flows, and global—and Philippine—demand.

Four main external risks that could affect the sector are: (i) Substantial changes in China's aquaculture production growth would have a major impact on world market prices and fish trade. (ii) Global supplies of cheaper fish species may cost much more in the longer-term future; this may limit the effectiveness of fish imports as a short-term tool to control domestic fish prices for poorer segments of the population or to substitute imports for slower than expected aquaculture production growth. (iii) Large price increases of fishmeal and fish oil can be expected if anchovy production off the coast of Chile and Peru—the main fishmeal producers—fails through an extreme el Niño event. These events are likely to happen more frequently in the future. (iv) While it may be impossible to eliminate the risk of disease and pandemics in intensive aquaculture, these can be reduced if the Philippines puts in place a strict regulatory framework and quality controls, top-level research and effective extension services.

The expected impacts of climate change on the Philippine's fisheries sector should be manageable, provided they are anticipated and appropriate adaptation measures taken. The Philippines has extensive knowledge and expertise in dealing with the impacts to date on aquaculture activities. However, since climate change will likely intensify further beyond 2040, careful site selection for new activities and evaluation of existing aquaculture production will be important. Key factors to consider include (see also Chapter 4):

1. Increases in average temperature, or temperature spikes, may affect coral reef areas (bleaching), the health of reef fish stocks, spawning and migration of wild stocks (movement to more temperate waters is projected at the global level, but the specific impact on the Philippines' major stocks of small-pelagic and oceanic species remains to be clarified). Aquaculture has several means to easily mitigate higher temperatures—deepening of ponds, higher water exchange rates etc.

2. Precipitation increases will necessitate investment in supporting infrastructure for fresh and brackish water aquaculture. Higher levels of precipitation

5 While global supplies of cheap frozen fish are still available today, demand from Africa and potentially from South and East Asia for these products will likely grow over the next decades, while global supplies are limited.

6 Growing demand for cheap fish from emerging economies—across the globe—will in the near future exceed the clearly limited global supplies of marine fish. West Africa is already a major importer, and its demand will further increase over time. India may start importing in the future. Global resources of these species are already exploited close to environmental limits. For 2020 Japan and China are expected to remain net importers; no projections are available beyond that date. The main markets in the EU and USA will remain major importers—although the product range will differ over time. The picture may develop differently if cost effective technologies could be developed to catch and process the large, currently unexploited, mesopelagic fish resources around the globe, a truly 'black swan' event.

may also affect spawning and migration of wild stocks—the actual impact is uncertain, but marine resources subject to heavy exploitation may be more susceptible, though the likely impact may still be modest through 2040.

3. Modest sea level rise 2040 would mainly affect brackish water aquaculture; low-lying areas will require additional protection and infrastructure to manage water supply and salinity.

4. Extreme storms, while not a serious problem for submerged line cultures for seaweed and mussels, will cause more damage to floating cages. Technical solutions exist but the costs are high, and may not yet be feasible for most current culture practices and intensities. Coastal areas, lakes and ponds will also face higher risks, which can be partly mitigated through timely action to relocate operations particularly prone to wave action.

Fisheries Consumption, Production and Trade through 2040

Consumption and domestic production. This study developed two scenarios for fisheries consumption over the next three decades, using the Centennial Group Global Growth Model as a basis for faster and slower GDP growth, and hence income levels and consumption, and the Philippines specific AMPLE model to elaborate change across multiple markets in the agriculture sector. This has the advantage, compared with simple straight-line projections, of taking simultaneous account of substitution effects (e.g., as between fish and meat products), land and water constraints, etc. Table 7.2 summarizes the results of the two scenarios; Chapter 8 discusses in more detail the methodology and assumptions underlying the models.

The optimistic scenario envisions that the Philippines will largely succeed in arresting the past long-term trend of decreasing per capita consumption. Despite the expected 50% population growth through 2040, with good overall economic performance, improved governance and the right sector policies, fish consumption per capita would decrease

Table 7.2: Consumption and production of fish products, 2010–40

	consumption per capita (kg/yr)			production needed to supply 2040 optimistic scenario (million tons)
	2010	2040	2040	
	actual	optimistic	pessimistic	
low value food fish	18.2	14.6	13.3	2.8
high value food fish	7.2	8.5	7.4	1.6
total consumption	25.4	23.1	20.7	4.4

Source: Centennial estimates.

only for lower value species. Consumption of lower value fish will be constrained by relatively high fish prices, reflecting stagnating or declining marine production. The modest growth of per capita consumption of high value fish will be satisfied mainly from local (cultured) fish production. Under the optimistic scenario domestic fish culture production would almost triple by 2040; production of cultured tilapia and milkfish would grow fast enough to enable even poorer consumers to buy them. Future population will increasingly be located in towns and cities, and therefore fish consumption in urban areas can be expected to increase. Although urban consumers eat less fish than do rural consumers, they pay more for it.

The decrease in overall fish consumption would be more substantial under the pessimistic scenario, signaling that the Philippines would not have succeeded in improving the sector policy framework and institutional capacity to arrest historic trends. Acute poverty in many of the country's fishing communities would remain serious, eased only by larger and more extended public financing of the social safety net, out-migration and/or generation of alternative livelihoods. For Philippine consumers at large, the nutritional implications of the pessimistic scenario would be perverse, and would undermine the food security goal of ensuring access to a nutritionally sound food basket for the average family.

Trade. Over time, regional tuna production and imports could also play a larger domestic role, but local preferences and international developments may limit their importance.

The Philippines' future as a fish exporter is uncertain. Without tariff free access to EU markets and lacking the size and efficiency of Thai tuna producers, the Philippine tuna industry will need to expand and rationalize regionally to ensure access to raw material and key markets, and to maintain its global competitiveness. Such cooperation—with Indonesia and PNG—is already happening on a substantial scale. The Philippines is also the third largest producer of seaweed in the world (after China and Indonesia) and, given the profitability of local seaweed production, it is well placed to continue to expand its global market share provided it can focuses on quality control, reliability and strong processing and marketing skills. Future fish imports (mostly small-pelagics, tuna, fishmeal) are likely to expand, but may be constrained in the long-term as global fish prices increase and supplies become stretched.

An open trade policy—and understanding of international markets for different fish products—will dampen local short-term price volatility that might result from domestic supply constraints. Given the Philippines' exposure to developments in the region, an active fish products trade policy—within the limits of ASEAN and WTO agreements, and combined with an in-country direct support system for the poorest consumers—will remain necessary as part of the 2040 food security strategy. Reducing long-term escalation of fish prices should be approached through productivity improvements, not misuse of trade policy.

Chapter 8. Philippines Agricultural Transformation and Food Security: Quantitative Scenarios for 2040

Agriculture in the Philippines confronts several challenges over the next few decades—among these, the country's burgeoning population will require greater food supplies. The scope for expansion of farmland has narrowed, except in some areas suitable for tree crops but less so for production of foods regularly consumed by the majority of Filipinos. Prospects for faster yield growth are also becoming limited. The profile of production constraints may be dramatically altered in the coming decades by climate change and water scarcity in some locations. The Philippines shifted its position from net exporter to net food importer in the late 1980s, but still continues to obtain most of its food domestically. On the other hand, consumption of the more prominent food items has mostly been increasing. In particularly, per capita consumption of rice is high and growing, compared to levels and trends in other developing countries in Asia.

How would agriculture evolve over the next few decades in the face of these and other challenges? This study aims to answer the question with the support of several modeling instruments. The results should not be seen as forecasts, but rather as projections of market movements as determined by supply-demand fundamentals. Compared with back-of-the-envelope exercises, they offer a more systematic means of imposing internal consistency of assumptions. For the purposes of this study, a series of 'high case-low-case' assumptions were explored, and readers may well want to use the models to test alternative assumptions and questions—what is the significance, over several decades' timespan, of reaching yield targets five years sooner, or ten years later? What mix of crops, livestock and fisheries generates the highest growth, the most employment, the better incomes for the largest number, the greatest security that food scarcities will not plague future generations?

Overview of Modeling Instruments

For purposes of illustrating how the agricultural sector of the Philippines may change by the year 2040, the study employed two modeling exercises. First, the Centennial Group Global Growth Model (Annex 1) was used to project alternative GDP growth scenarios, each accompanied by specific assumptions regarding changes in Total Factor Productivity (TFP) across the economy generally and the agriculture sector in particular. These were linked to assumptions about when the Philippines may experience 'convergence' and the higher investment levels associated with that growth path. Data drawn from the Family Income and Expenditure (FIES) household surveys were then used to estimate shares of future GDP that would accrue to each income cohort in 2040; the team also analyzed patterns in comparator countries that at similar stages of growth and convergence to make adjustments. These results yielded assumptions about the distribution of private consumption in 2040. Centennial also developed the model further so that it could be used to project outcomes with respect to agricultural production, land use, consumption of specific food products and nutritional equivalencies. However, since the Philippines also had a country specific agricultural model that had been developed for other purposes several years earlier by the Philippines Institute of Development Studies (PIDS)—known as AMPLE—the study team used the Centennial Growth Model mainly for overall economic assumptions, and AMPLE for sector and subsector specific forecasts.

Macro-Economic Scenarios

The Centennial Group Growth Model was used to develop an optimistic and pessimistic scenario for the overall regional ASEAN cohort of developing countries, and for each of the VIP countries in particular—Vietnam, Indonesia and the Philippines. Under the optimistic scenario for the

Philippines, productivity growth across the economy would accelerate to 2.8% (from 1.1%) and the overall investment rate would rise to 24%. Combined with the country's potential demographic dividend, this would raise average annual GDP growth to about 5.9% during the next three decades (same as Indonesia). By 2040, the GDP of the Philippines could reach US$1.1 trillion, making it one of the 20 largest economies in the world, and per capita income would rise nearly four-fold to US$7,900, with some four-fifths of the population entering the middle class. Under the pessimistic scenario, GDP growth would average only about 3.3% p.a. Given the high population growth rate, per capita income would not even double and less than half the population would enter middle class status. In the early 1950s, the Philippines was the most advanced developing country in Asia; under the pessimistic growth scenario, it would become one of the laggards by 2040. The main outcomes of the two scenarios are summarized in Table 8.1.

Table 8.1: Philippines forecast results

	2011	2040 optimistic	2040 pessimistic
GDP (constant 2010 billion US$)	207	1,119	529
GDP per capita (constant 2010 US$)	2,182	7,898	3,730
average GDP growth rate (2011–2040)		5.9%	3.3%
% of population at least middle class	25%	76%	41%
poverty headcount (% of total)	18%	0%	3.8%
poverty gap	3.3%	0%	0.2%
population (millions)	95	142	142
agriculture as % of GDP (high TFP)	12%	7%	15%
agriculture as % of GDP (low TFP)	12%	5%	12%

Source: Centennial estimates.

Agriculture Multi-Market Model for Policy Evaluation (AMPLE)

Overview. AMPLE is a multi-product partial equilibrium model that can be used to evaluate alternative economic scenarios. It had been earlier applied for assessing productivity growth in the Philippines (Briones 2010). For this study, AMPLE was updated, revised to improve its representation of land use allocation, and applied over an extended time horizon (2009–2040). It offers a systematic framework for testing assumptions and generating projections on production, area (for crops), consumption, imports, exports and prices (producer, wholesale and consumer). Technical details are provided in Annex 2, and sets, variables and equations are available on request.

AMPLE has 18 subsectors that include: (i) 11 crops or crop groups: rice, white and yellow corn, coconut, sugarcane, root crops, banana, mango, other fruits, vegetables, and other crops; (ii) 3 livestock categories: swine, poultry, and other livestock and dairy; and (iii) 5 fish categories: freshwater, aquaculture, brackish water, seaweed, and marine fish. The model distinguishes between primary and processed forms of output, and between rice production systems (irrigated and rain fed), as well as aquaculture and capture systems for freshwater and marine fish. For purposes of this study, oil palm, coffee, rubber and tobacco are included in "other crops". Poultry incorporates chicken eggs, duck eggs and dressed chicken. Other livestock is matched to cattle. Freshwater fish capture refers to inland fishery; freshwater fish aquaculture refers to pen and cage culture. Marine fish capture refers to commercial and marine municipal fisheries; marine fish aquaculture pertains to pen, cage, oyster, and mussel culture. Units and forms of primary and processed output generally follow the corresponding treatment in the Department of Agriculture's supply and utilization accounts (SUA), with some exceptions. Quantity variables for rice, sugarcane and coconut are in terms of processed form, i.e. milled rice, raw sugar, and copra equivalent, respectively. As the SUA do not distinguish between yellow and white corn, special food balance sheets were constructed. Also, as there are no SUA for freshwater, brackish and marine water fisheries, quantity data were computed from SUA of representative fish commodities. Lastly, for Seaweeds, it is assumed all production is exported, and imports are set to zero.

Most value of production data are also from CountrySTAT. Value of imports and exports are obtained from Trademap

(www.trademap.com). Consumption is valued using retail price data from CountrySTAT.

Finally, the model takes off from a base year data set assumed to represent a market in equilibrium, although there is always the possibility of distortions affecting the base year outcomes. For one commodity however, namely rice, the study does attempt to make some corrections for production shocks (e.g. the El Nino-induced drought of 2010), as well as excess importation and stock build up in 2008 – 2010. Rice imports are currently being reduced by the stock draw-down under the current administration.

Scenarios. The study presents a 'pessimistic' and an 'optimistic' scenario that are distinguished by different rates of growth for income, productivity, area (price-independent component), as well as tariff reduction policy. AMPLE takes as given or exogenous the following variables: total agricultural area, population, per capita income, world prices, import tariffs, level of productivity: and area harvested (price-independent component). Changes in these exogenous variables represent real world drivers over the period through 2040. Both scenarios adopt the Medium variant of the UN population projections. The growth rate of area composite is set at modest levels in both scenarios. Growth rates of world prices are based on the World Bank's Commodity Price Forecast (2012). Model price projections are in real terms based on fixed base year (2010) prices.

The scenarios for income growth adopt the GDP assumptions from the Centennial Group Growth Model (paras. 9.2–9.3 and Annex 1). Guidance for assigning productivity growth in AMPLE for individual crops, livestock and fisheries was obtained from Philippines study team members in consultation with local experts. Under the 'pessimistic' scenario, productivity growth is kept at about 1%, with the exception of coconuts that experiences even lower productivity growth of 0.4%. Productivity growth under the Optimistic scenario is typically faster, by 1 to 2 percentage points (i.e. in the 2–3% range), and even greater in the case of marine fish—aquaculture. Conservative productivity assumptions are applied for rice in both scenarios, taking into account water balance and climate change constraints over the next few decades.

Price-independent area growth is applied to coconut, banana, other fruit, and other tree crops, from 2016 onward. This accounts for expansion of investment in these crops once land market issues are resolved and the agrarian reform program is completed. For the pessimistic scenario, these rates are adjusted downward on the assumption that resolution of land policy issues takes longer, thus retarding significant entry of private investment and new technology. Finally, the optimistic scenario posits tariff reduction, as the country opts to open agriculture to world competition, with the exception of rice. In the pessimistic scenario, the Philippines maintains a more closed policy with respect to tariff reduction, except for sugar for which it adheres to commitments under the ASEAN Free Trade Agreement (AFTA).

Scenario Results

Results are first summarized specifically for rice, given its prominence in food security considerations. Then, findings for all other subsectors are grouped into sections on production, area and yields, consumption, trade and prices. Details of all forecasts are available on request

Rice. Consumption (per capita and total household), production, yields and area harvested increase under both the optimistic and pessimistic scenarios. Consumption increases reflect trends discussed in Chapter 5, and do not differ very much under the two scenarios, as only households with markedly higher incomes begin to shift rice from the 'normal' to the 'inferior' goods category. While both rain fed and irrigated production increase, the share of rain fed in total output drops from 23% today to 16% in the optimistic scenario, 19% in the pessimistic scenario, as irrigated yields improve much faster. Yields have been adjusted to reflect some downward pressures over the next three decades due to climate change and water balance issues (see Chapter 4).[1]

There is very little area expansion in the optimistic scenario—farmers improve TFP substantially (especially irrigated producers), and at the margin shift into other crops (or

1 The model assumes rainfed yields increase annually through 2025 and then remain stable; irrigated yields also increase steadily through 2025, but then continue to improve (at a slower pace) through 2040.

nonfarm employment) in an overall economic environment in which growth, employment generation, improvement in incomes and shift into the middle class is happening more rapidly than in the pessimistic scenario—which is less favorable both in terms of the overall economy and conditions in the agriculture sector. The retail price of rice per kilo is assumed to increase slightly in constant terms (just under 2% in the optimistic scenario and 5% in the pessimistic case), but this would not benefit producers very much, as farm gate prices would see only small increases—i.e., rice would remain essentially a low value crop, with income gains coming mainly from increased output per ha (through improved yields) than from unit price growth.

Finally, the Philippines would have an import to consumption ratio (ICR) ranging from 22% to 25% in the optimistic and pessimistic scenarios, respectively, suggesting similar or slightly greater reliance on trade. While this may expose consumers to occasional price shocks, the share of expenditures on rice in household budgets will be decreasing over this period, to only 4% in the optimistic economic scenario and 6.2% in the pessimistic scenario (Chapter 5)—i.e. average consumers would be able to sustain brief periods of higher prices because of the smaller incidence of rice in their overall expenditures, and they would be better off doing so than if they had to bear the direct and indirect costs of maintaining associated with sourcing all demand through domestic production. At the same time, it would be important to ensure an adequate safety net system for families at the lowest income deciles.

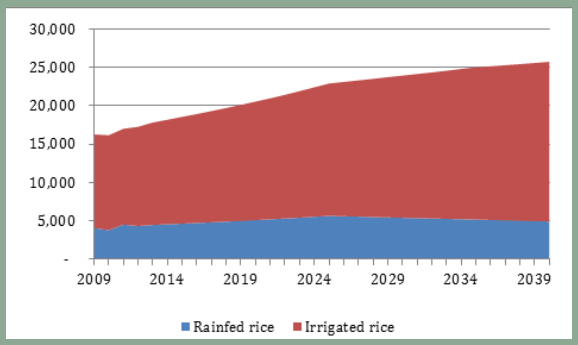
TABLE 8.2: RAINFED AND IRRIGATED RICE PRODUCTION, CONSUMPTION, AND SELF-SUFFICIENCY, OPTIMISTIC AND PESSIMISTIC SCENARIOS, 2040

rice forecasts/year/ scenario	2010	2040 optimistic	2040 pessimistic
consumption (kg/cap, milled rice)*	105.3	117.9	116.7
consumption (MMT, milled rice)	11.3	19.1	18.9
production (MMT, palay) (rainfed) (irrigated)	16.4 (3.8) (12.6)	27.3 (4.3) (23.0)	25.7 (4.9) (20.8)
yields (MT/ha) (rainfed) (irrigated)	(3.5) 2.9 4.1	(5.2) 3.8 6.6	(4.5) 3.5 5.5
area harvested (M ha) (rainfed) (irrigated)	4.5 (1.4) (3.1)	4.6 (1.1) (3.5)	5.2 (1.4) (3.8)
producer prices (P/kg, constant 2010)	14.4	14.8	15.4
retail prices (P/kg, constant 2010)	35.7	36.4	37.4
self-sufficiency (imports/consumption)	.21	.22	.25

Source: Centennial calculations, AMPLE.
* 2010 consumption based on FIES analysis, Ch. 5.

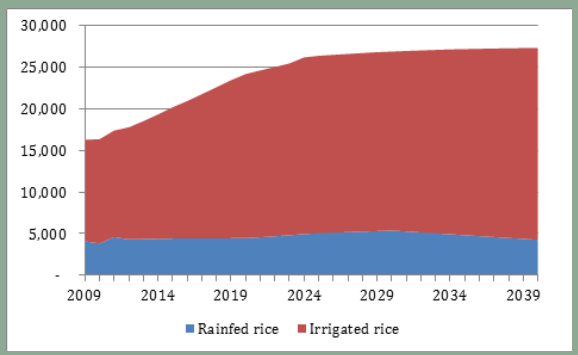
Production. Figures 8.1 and 8.2 illustrate the rice production forecasts under the optimistic and pessimistic scenarios, discussed above.

FIGURE 8.1: OUTPUT OF RICE BY PRODUCTION SYSTEM, PESSIMISTIC SCENARIO ('000 T)



Source: Centennial, using AMPLE model.

FIGURE 8.2: OUTPUT OF RICE PRODUCTION SYSTEM, OPTIMISTIC SCENARIO ('000 T)



Source: Centennial, using AMPLE model.

For the other traditional crops (Figures 8.3 and 8.4), production likewise rises, though incremental corn production is somewhat subdued under both scenarios. Expansion of output is more pronounced for bananas and other fruits under the optimistic scenario, and the fastest rate of

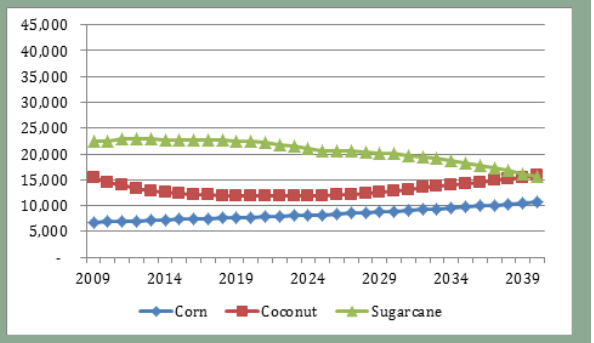
growth is in other tree crops (rubber, coffee, cocoa and oil palm) for reasons discussed in Chapter 6. Output of sugarcane is highly dependent on how the sector prepares for, and adjusts to, the trade reform commitments under AFTA, also discussed in Chapter 6. Coconut production undergoes an initial contractionary spell and faces weak medium-term international prices, but there is potential for significant improvement in output if aggressive efforts are made to deal with policy and incentives issues; this is very important inasmuch as a large share of the poorest rural households are engaged in coconuts (and fishing). Banana, mango and other fruits (Figures 8.5 and 8.6) perform well in both scenarios.

The fastest growth among the crops is achieved by other tree crops (Figures 8.7 and 8.8). Even under the pessimistic scenario, this category rises over threefold by 2040, to 3.9 million tons; vegetables more than double, while root crops expand to 4.1 million tons, from 2.6 million. Under the optimistic scenario, the increases are even sharper, with other tree crops reaching 4.8 million tons, vegetables 1.9 million tons, and root crops exceeding 6 million tons.

For livestock products (Figures 8.9 and 8.10), under the pessimistic scenario, swine production nearly doubles by 2040, poultry increases by about two-thirds, and other livestock remains virtually unchanged. In the optimistic scenario, swine and poultry production growth is much faster, but other livestock behaves similar to the pessimistic scenario.

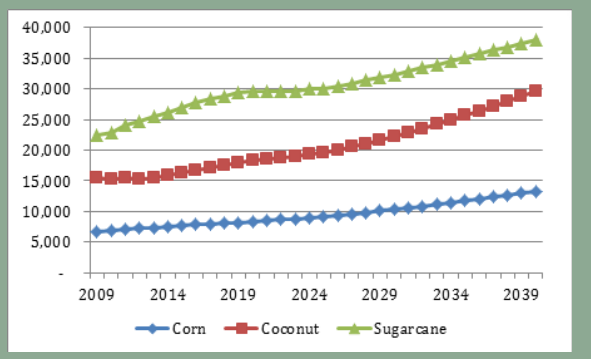
Lastly, for aquatic products (Figures 8.11 and 8.12), seaweed production is expected to reach 3 million t under the Pessimistic scenario (from a base of below 2 million t).

Figure 8.3: Output of corn, coconut, and sugarcane, pessimistic scenario ('000 t)



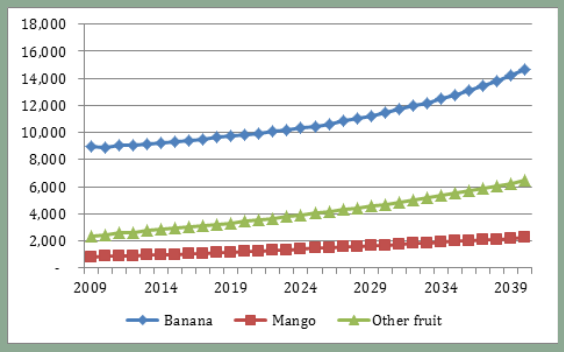
Source: Centennial, using AMPLE model.

Figure 8.4: Output of corn, coconut, and sugarcane, optimistic scenario ('000 t)



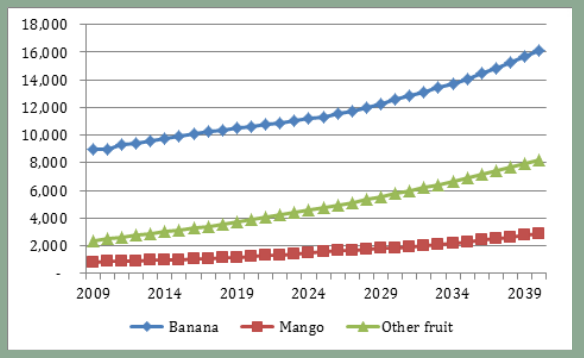
Source: Centennial, using AMPLE model.

Figure 8.5: Output of banana, mango, and other fruit, pessimistic scenario ('000 t)



Source: Centennial, using AMPLE model.

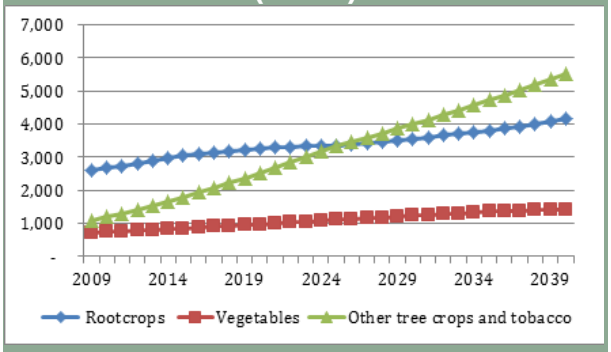
Figure 8.6: Output of banana, mango, and other fruit, optimistic scenario ('000 t)



Source: Centennial, using AMPLE model.

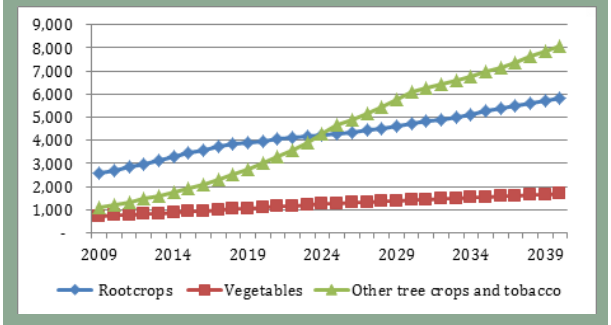
Seaweed growth is much more rapid in the Optimistic scenario (approaching 5 million t), which is due to faster rate of productivity growth. Growth in the other aquatic products is fairly moderate under either scenario; this is somewhat surprising for Marine fish, given the large productivity growth advantage for Marine fish aquaculture under the Optimistic scenario; however the capture fishery system is the larger source of marine fish and is projected to exhibit zero productivity growth in the long term under any scenario

Figure 8.7: Output of root crops, vegetables, and other tree crops, pessimistic scenario ('000 t)



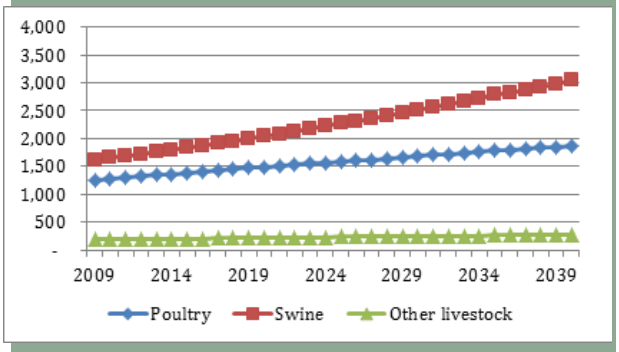
Source: Centennial, using AMPLE model.

Figure 8.8: Output of root crops, vegetables, and other tree crops, optimistic scenario ('000 t)



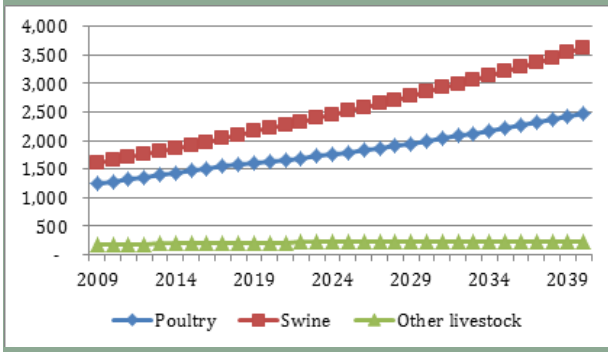
Source: Centennial, using AMPLE model.

Figure 8.9: Output of livestock products, pessimistic scenario ('000 t)



Source: Centennial, using AMPLE model.

Figure 8.10: Output livestock products, optimistic scenario ('000 t)

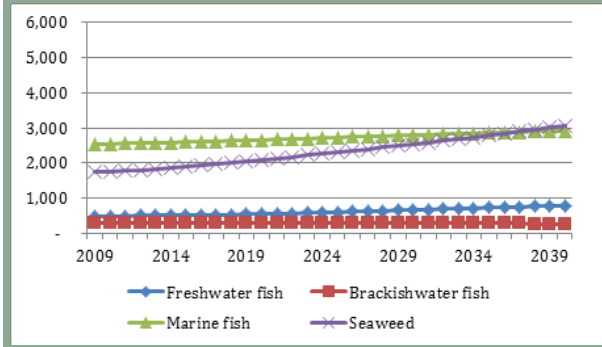


Source: Centennial, using AMPLE model.

Area and yields.Area harvested overall is projected to grow by a modest 3.1% under the pessimistic scenario, and with no change under the optimistic scenario due to the fact that yields increase substantially across most crops. The largest absolute and relative gain is posted by other tree crops, for which the majority of the expansion is assumed to take place in degraded forest lands that are released for planting rubber, cocoa, coffee and oil palm, and through intercropping of cocoa and coffee on existing coconut farms (Chapter 6).

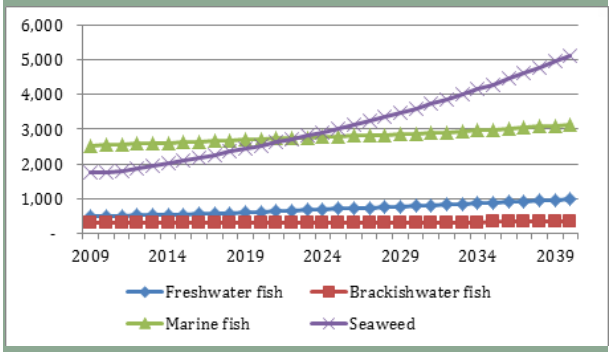
Consumption. Projections for per capita consumption of starchy staples are shown in Figures 8.13 and 8.14). Base year levels generally reflect BAS estimates, with the exception of rice, for which the base year is set at 105.3 kg/person based on analysis of FIES data discussed in Chapter 5. Rice consumption continues to increase at a modest pace, but a decrease is observed in the demand for white corn; consumption of root crops keeps pace with population growth. Under the Pessimistic scenario, over the entire horizon income growth is too weak to reduce demand for white corn, and consumption of root crops decreases; however, base year consumption of root crops is low, hence

FIGURE 8.11: OUTPUT OF AQUATIC PRODUCTS, PESSIMISTIC SCENARIO ('000 T)



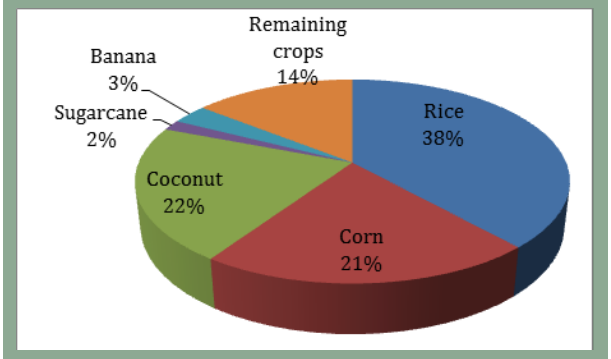
Source: Centennial, using AMPLE model.

FIGURE 8.12: OUTPUT OF ACQUATIC PRODUCTS, OPTIMISTIC SCENARIO ('000 T)



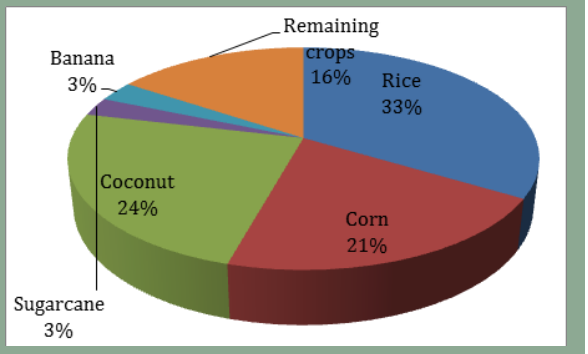
Source: Centennial, using AMPLE model.

FIGURE 8.13: DISTRIBUTION OF TOTAL PLANTED AREA, PESSIMISTIC SCENARIO (HA)



Source: Centennial, using AMPLE model.

FIGURE 8.14: DISTRIBUTION OF TOTAL PLANTED AREA, OPTIMISTIC SCENARIO (HA)



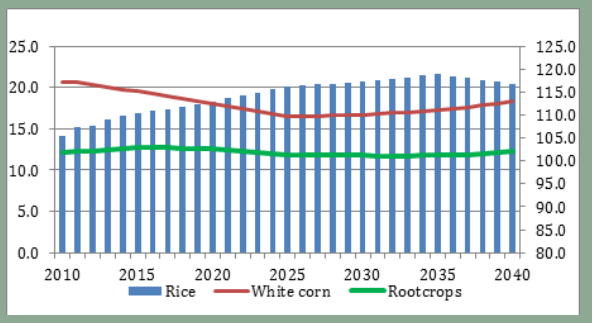
Source: Centennial, using AMPLE model.

income and substitution effects with other commodities may be highly influential in future consumption patterns.

Trade. Projected export trends are consistent with the findings presented in Chapters 6 (tree crops, sugar and other high value agriculture) and 7 (fisheries including seaweed). On the import side, Figures 8.17 and 8.18 isolate rice given its prominence. Imports temporarily dip in 2011–2012 owing to stock draw-downs; as stocks approaching normal levels, imports return to trend. Production grows, but so does consumption, because of rising population, and imports reach 4 MMT by 2040. Under the Optimistic scenario the volume of consumption is slightly higher and the level of imports remains about the same (higher yields allow a somewhat greater share of consumption to be sourced from domestic production). The government and civil society are more comfortable with relying on trade and regional emergency stock arrangements, and therefore total area under domestic rice production decreases as farmers take advantage of opportunities to expand cultivation of higher value crops and/or leave the sector for alternative employment.

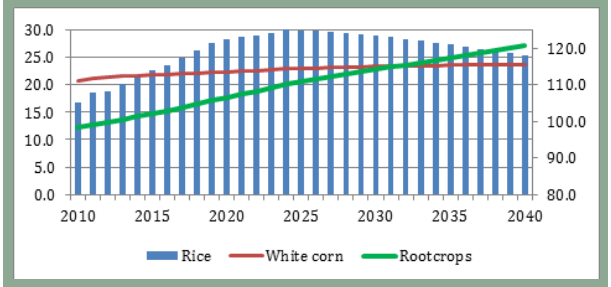
The impact of tariff reduction, declining world prices and rising meat consumption is also evident in imports of Yellow corn (Figures 8.19 and 8.20) under the optimistic scenario. Meanwhile, under the pessimistic scenario, higher tariffs and slower output growth for livestock industries account for more muted import expansion explains at least in part the more striking increase in imports of meat products under the optimistic scenario. Sugar imports rise to about 0.7 to 1 million tons depending on scenario (note that both scenarios implement the same tariff reduction schedule).

FIGURE 8.15: PER CAPITA CONSUMPTION OF RICE, CORN, ROOT CROPS, PESSIMISTIC SCENARIO ('000 T)



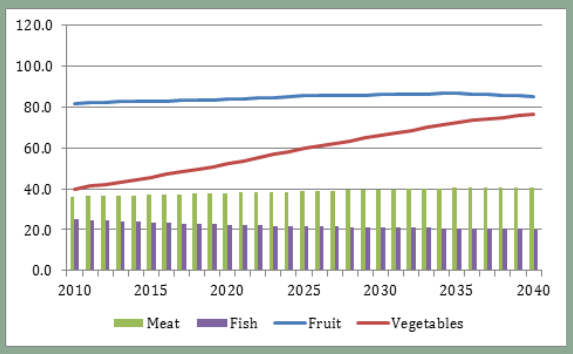
Source: Centennial, using AMPLE model.

FIGURE 8.16: PER CAPITA CONSUMPTION OF RICE, CORN, ROOT CROPS, OPTIMISTIC SCENARIO ('000 T)



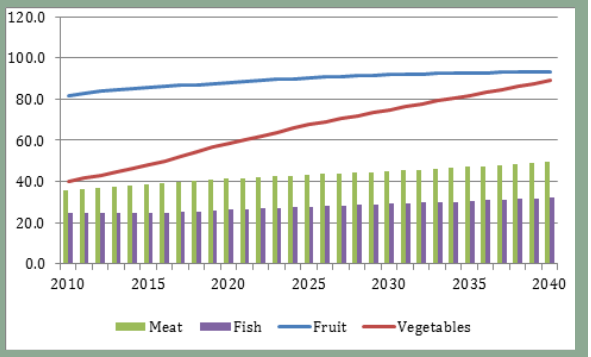
Source: Centennial, using AMPLE model.

FIGURE 8.17: PER CAPITA CONSUMPTION OF MEAT, FISH, FRUITS, VEGETABLES, PESSIMISTIC SCENARIO ('000 T)



Source: Centennial, using AMPLE model.

FIGURE 8.18: PER CAPITA CONSUMPTION OF MEAT, FISH, FRUITS, VEGETABLES, OPTIMISTIC SCENARIO ('000 T)



Source: Centennial, using AMPLE model.

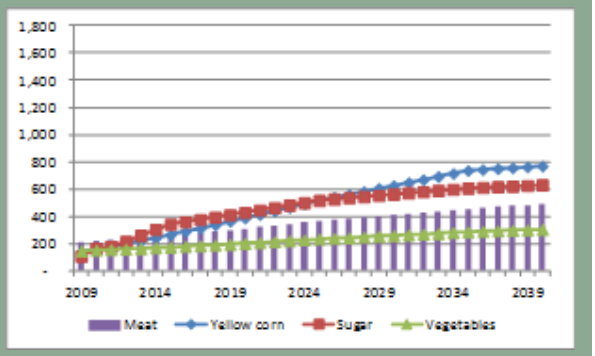
The increase in imports is rapid, but contrary to popular belief, domestic production is not displaced.

Prices. Under the optimistic scenario, the majority of consumer prices are projected to ultimately drop based on decadal averages. For some items, namely white corn, root crops and brackish water fish, the decline in consumer price begins even in the first decade of the horizon. The exceptions are rice, other livestock, freshwater fish, and marine fish. For these products, demand growth outpaces supply growth; in the case of rice, rising population also contributes to the modest price trend.

A different picture emerges under the pessimistic scenario. The direction of price movements over the horizon is quite mixed; more commodities experience increases in consumer price, as demand growth (even under weaker income growth) outpaces supply growth for more commodities compared to the optimistic scenario. Similar patterns are projected for rice, white corn (by the third decade), other livestock, freshwater fish, and marine fish, as under the optimistic scenario.

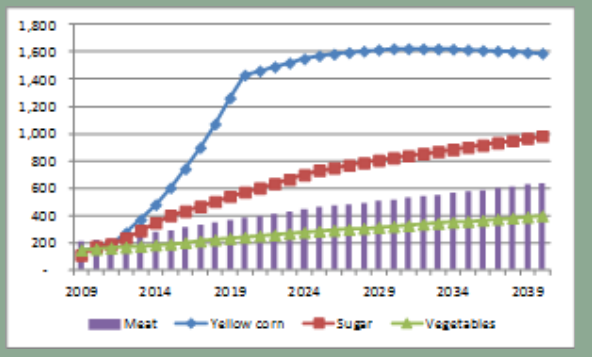
Movements in producer prices to some extent mirror movements in retail prices. Under the optimistic scenario, producer prices typically decreasing owing to rapid productivity growth, with the exception of rice, other livestock, as well as freshwater fish. The decline in price is consistent over the decades, for corn, coconut, banana, root crops, and brackish water fish. Falling prices in sugar may also be caused in part by the declining tariffs. For yellow corn, root crops,

FIGURE 8.19: IMPORTS UNDER THE PESSIMISTIC SCENARIO ('000 T)



Source: Centennial, using AMPLE model.

FIGURE 8.20: IMPORTS UNDER THE OPTIMISTIC SCENARIO ('000 T)



Source: Centennial, using AMPLE model.

and poultry; however despite removal of tariff protection, producer price of swine is still projected to rise.

Under the pessimistic scenario, producer price of rice likewise increases on average over the scenario, after an initial phase of decline. More commodities would experience an average increase in producer price, compared to the optimistic scenario; the absence of aggressive tariff reduction in this scenario may be contributing to this, together with slower assumed productivity growth. Finally even with weaker productivity growth compared to crops, poultry, and brackish water fish.

CONCLUSIONS

The Philippine population is expected to grow to some 50% by 2040 and this will increase demand for food and other agricultural products; rising purchasing power of households will also stimulate demand (except for 'inferior' goods). The challenge is to meet this demand within resource limitations, including both land and, in some parts of the country, water. The scenario analysis of this study suggests that it will be feasible to meet the demand: while some food items become more expensive (e.g., swine and some fish products), others enjoy enough supply growth so that their affordability improves, including among micronutrient sources (fruits and vegetables). However this hinges crucially on the rate of productivity growth; at pessimistic rates, more exceptions to improved affordability of food can be expected. Per capita consumption of food items would rise gently, with the significant exception of fish products where simply arresting the long-term decline in consumption would be a very positive achievement. Under the Pessimistic scenario, fish consumption continues to decline, with negative impacts on the incomes of extremely poor fisher households and on consumer nutrition more generally.

The long-term structure of production highlights the increasing prominence of livestock and poultry products in the agricultural sector; fisheries would be dominated by aquaculture owing to stagnant productivity growth in capture systems. Among the crops, the structure of production would evolve, but with slower income growth, the changes fall short of a transformation. Sharper structural changes are observed for a scenario of faster income growth, with a decline in the relative area shares of some traditional crops, particularly rice and corn; increases meanwhile are expected for coconut and non-traditional and higher value food crops and exports.

Aside from domestic supply, imports provide another means to meet domestic demand, including for rice over the longer-term. Lastly, sharp changes may also be expected on the export side: banana exporters face a softening world market, but other tree crops, tropical fruits and eventually some meat exports would gain more prominence. Philippine agriculture should be able to meet the various medium to long-term challenges it is facing, well within known resource constraints, and conditional on achieving and sustaining necessary productivity growth.

Chapter 9. Long-term Vision and Strategic Choices for Agriculture and Food Security in the Philippines in 2040

For purposes of this study, a Vision was developed for agricultural transformation and food security in the Philippines over the next three decades. It assumes that reforms and investments are carried out forcefully and early in the 30-year period. A less optimistic scenario is also elaborated, which is based on delayed and less decisive actions, in essence a 'muddling' through approach to the main sector challenges. In reality, there are many alternatives—great progress in some subsectors, muddling through in others. The models and forecasting tools used to develop the Vision can easily be adapted to elaborate other outcomes, and in fact their main contribution may be as instruments to support and refine national strategic planning efforts.

Long-Term Vision for Agriculture and Food Security

The Vision assumes strong agriculture sector performance in the context of an overall economic framework characterized by sustained high GDP growth of about 6.9% p.a., driven largely by accelerating productivity change and innovation, adherence to sound macro fundamentals, good governance, an improved investment climate, openness to trade, and a development strategy that ensures broad-based participation in the benefits of growth and therefore substantial improvements in average well-being and expansion of the domestic consumption component of the economy.

Although the last 30 years have not, on average, been particularly impressive for the Philippines in terms of overall economic performance and poverty reduction, this Vision foresees the country shifting into a higher growth trajectory. Convergence occurs in the next five years, as the current leadership proves able to sustain sufficient reform momentum to bring this about by the end of its mandate—it is then succeeded by several like-minded administrations that further develop and consolidate the reforms. The rate of TFP growth across the economy would accelerate to an average 2.8%,comparable to that achieved by other Asian convergers in recent decades, and the overall investment rate would rise to 24%. Average GDP growth would be about 5.9% and per capita income would rise nearly four-fold to US$7,900, with some four-fifths of the population entering the middle class. The Philippines would not only become the world's 9th most populous country by 2040, with a GDP of about US$1.1 trillion, it would also move into the ranks of the 20 largest economies.

Some of the salient features of this Vision include the following:

1. Real agriculture GDP growth averages about 3.5% and, although the sector share of total GDP decreases to about 5%, the multiplier effects of downstream and agribusiness activities actually drive some 20–25% of the national economy. Rural poverty is reduced to only about 5–10%, and extreme rural poverty is eliminated, both because of strong growth and well-established social safety nets.

2. The middle class' share triples to about 75% of the population, which produces a significant increase in total consumption and in consumption patterns.

3. Agriculture sector growth is somewhat higher in Mindanao, because that region is less affected by climate change and natural disasters, on the one hand, and enjoys a relatively large share of the higher value tree crops expansion, on the other. This helps to consolidate peace and contributes (along with mining and other activities) to eliminating current welfare gaps between the region and other parts of the Philippines.

4. Philippines enjoys a substantial expansion of tree crops, particularly rubber, coffee, cocoa, oil palm and other agro-forestry, driven mainly by foreign and private investment using modern technology and management arrangements. Besides growth, public revenue and trade benefits, this improves the environmental sustainability of degraded forest and upland agricultural areas.

5. Philippines retains its global leadership in the coconuts sector, but with increasingly heavy reliance on 'new' coconut products both for the domestic and export markets. This has been central to eliminating acute rural poverty, which in 2010 was concentrated among households depending on coconut production and fisheries.

6. Philippines retains a slightly smaller but highly competitive sugar industry, primarily geared to domestic food and ethanol demand. The trade regime is open to global competition and in some years this also allows Philippines to export.

7. Food consumption patterns change slowly, but rice remains a 'normal' component of the diets of most Filipinos. With a 50% increase in population, the volume of rice demand is substantial; Over time, Philippines employs a mixed domestic production + trade strategy to meet this demand, eventually importing about 25% of requirements for food, other uses and stocks, entirely through the private sector. Average rice yields improve by about 50% (to 6MT/ha), through a combination of a strong seeds improvement program on the one hand, and greater efficiency and some expansion of irrigated rice areas on the other. Some irrigated and upland rain fed rice farmers shift to higher value crops. The Philippines participates in an Asian regional stock arrangement (although it also maintains a domestic stock of some 1–1.5MMTs of rice for weather and other natural disaster emergencies).

8. Philippines reverses the long-term decline and expands slightly per capita fish consumption, especially for lower-income groups.

9. Fruits and vegetable production keep pace with population growth with only modest change in per capita consumption, but also exports and increasing share of production to regional markets (e.g., Singapore, China).

10. Aggregate agricultural employment declines, but in that context there is an important shift to higher paying jobs. The rural-urban wage differential for unskilled workers declines and an increasing share of younger people opt to remain in agriculture production and related non-farm downstream and agribusiness employment. Nonetheless, labor scarcity is an issue in selected areas. Gender gaps in earnings and working conditions have been eliminated.

11. Most agricultural extension is supplied by the private sector. Sustained investment of about 1% of GDP in agriculture research and technology development underpins higher sector TFP rates, and a friendlier environment for biotechnology and innovation. The key commodity research programs are privately managed, with financing from producers, along the lines of commodity boards in Australia. Adaptation to climate change has become a central theme across research programs, and the Philippines participates actively in regional and global research financing and dissemination.

12. Strong institutions have been created to manage and enforce food quality standards, both to protect the interests of Filipino consumers and avoid losses and/or facilitate penetration of export markets (e.g., loss avoidance due to aflotoxin content of copra exports; penetration of regional livestock and poultry markets in East Asia).

13. Philippines has in place a comprehensive risk mitigation framework and instruments well cali-

brated to protect the economy, budget, consumers, investors, producers and financial sector from challenges related to (i) natural disasters, (ii) annual weather events, (iii) long-term climate change, (iv) medium-term commodity price uncertainties.

14. Private equities, banks and financial institutions such as insurance companies and pension funds are active in agriculture, downstream and agribusiness project finance. The public sector continues to play an important role in ensuring access to rural financial services, but mainly through regulation and support for risk management instruments, rather than direct financing.

15. After investments in physical and communications infrastructure of 5% of GDP for several decades, there is good connectivity across the islands and countryside.

16. Land markets have been freed. Out-migration to towns and cities has left behind idle lands, and land consolidation and farm mechanization are now common due to shortage of labor in some areas. Pressures on land ownership have loosened and land leases—small and large—have become common. Small farms continue to dominate but there is widespread diversification in terms of modes of operation: small farms, centralized management, contract farming, joint ventures, etc. Restrictions of foreign ownership of land have been eliminated. Some of the educated, returning overseas workers and urban retirees are going back to farming, often on a part-time basis, and applying modern techniques and developing new market niches.

17. A better educated population places more emphasis on qualifications and experience in selecting leaders, and holds government more accountable for results. In that context, the civil service has been remodeled towards meritocracy, along the lines of Malaysian/ Singaporean examples. Investments in monitoring, evaluation and data collection systems have paid off, and the Philippines has the capacity at both the national and sub-national government levels to formulate realistic short/medium/long-term plans, measure results and make course corrections in a timely and transparent manner.

Strategic Choices

There are numerous policy, institutional and investment choices that are important for the future of agriculture in the Philippines; this study has touched on some, but by no means all, of them. What follows is a subset of ten issues that are likely to determine the trajectory along which the Philippines agriculture moves over the next three decades, i.e. whether agricultural transformation is sufficiently robust for the sector Vision presented here to materialize by 2040. The agenda is ambitious and clearly sequencing of reform efforts in a manner consistent with political, economic, technical and institutional absorptive capacity will therefore be essential, but early and decisive progress in each of these areas will be also be critical for success.

Concluding the land reform process and modernizing land markets

Land reform and land markets are a 'gateway issue' that cuts across the entire gamut of agriculture and fisheries subsectors. For nearly 25 years, CARP, and more recently CARPER, have nominally transferred wealth in the form of land assets to millions of poor rural households—but only a proportion of beneficiaries have been able to use these assets to materially improve their well-being, and many properties that are eligible for redistribution have yet to be processed. Three choices are critical. First, whether CARPER ends in 2014 as presently scheduled, or is extended in some fashion, a clear and transparent decision is essential, and budgetary allocations need to be fully consistent with that decision. Uncertainty about the likely 'end game' of the agrarian reform is undermining incentives and investment choices, and has been one of the main causes of low domestic and foreign private investment in the sector. Having a land reform process in place 'on the books' but without adequate budgets also undermines efforts to strengthen the Philippines' governance environment, because it feeds

perceptions that choices as to whether, and when, particular properties will be redistributed are fundamentally political ones. If the decision is to extend the time frame of CARPER, then it would be extremely important to make voluntary land transfer a major feature of the program.

Second, the legacy of land reform-related debt needs resolution once and for all. A minority of agrarian reform beneficiaries (ARBs) have repaid debts for the land transferred to them, but most have not—in many cases because of absolute inability to pay, for others because of perceptions that the obligations would never be enforced. These debts severely limit options for ARBs to improve their well-being. On the one hand, their access to rural financial services is confined to special public sector programs that will overlook uncertain land tenure and indebtedness issues, but these programs tend to be small in scale and of uncertain duration. ARB options are also limited because the legal and regulatory provisions of CARP/CARPER do not permit many kinds of transactions until 10 years or more after debts are repaid.

Third, whether the land redistribution activities of CARP/CARPER end in 2014, or some time thereafter, there is an urgent need to accelerate the land titling process and eliminate many of the regulatory restrictions that affect the farmers' ability to rent or lease land, use it as collateral, how it may be treated in inheritance, etc. These provisions that were initially intended to 'protect' ARBs from losing the land they received, before they fully understood risks, are out of date 25 years into the agrarian reform process. At this stage, far from benefiting ARBs, such paternalistic provisions are limiting the flow of investment into the sector, thereby restricting small farmers' ability to raise productivity and in many cases to dispose of assets they no longer wish to work directly, in order to engage in more remunerative non-farm rural and/or urban income activities. Raising the 5 ha maximum limit on landholdings should be among the legal/regulatory reforms.

Resolving some issues in the Local Government Code

Decentralization has been important in many respects for the Philippines, but there are some areas in which it has not served the agriculture sector very well. It has clearly been beneficial in many other respects, and this study in no way suggests reversing the process. However, insofar as agricultural transformation and rural poverty reduction are concerned, the Local Government Code of 1991 has five major defects that need to be addressed, whether through reform of the Code itself or the associated regulations: (i) Decentralization of agricultural extension is not working and this is seriously limiting technology/knowledge transfer to farmers. There is no country that manages an efficient extension system with such a degree of atomization as exists in the Philippines; while re-centralization to the national level would not make sense, there is clearly a need to restructure the extension system along provincial lines. (2) Decentralized oversight of communal irrigation by LGUs is also not working. Latest estimates suggest that the Philippines has lost some 185,000 ha of communal irrigation capacity since the 1980s (i.e., more than the aggregate of new publicly financed irrigation). Most LGUs lack the technical and financial capacity to backstop irrigation O&M and, when needed, rehabilitation. The communal systems currently represent 35% of the installed irrigation capacity of the Philippines—a resource than cannot continue to be squandered through mismanagement. Combining the communal with the national irrigation systems, under NIA management, in the context of gradual strengthening and transfer to irrigator associations, is important to ensure that yields for key crops improve as suggested in this study. (3) Decentralization of decision-making over water resource management to administrative units based on population and similar factors does not make sense in the case of water resources. The Philippines needs both to strengthen technical and coordination capacity at the national level, and reconfigure water resource management along river basin and watershed lines at the subnational level. (4) For similar reasons, the fisheries sector does not lend itself to management at the lowest level of local government, as many resource issues cut across administrative unit boundaries. If

the Philippines is to arrest the trend of declining output and consumption of some segments of fisheries resources, it will be essential to reconfigure formal responsibilities at the level of provinces or groups of provinces. (5) The resource transfer rules of the Local Government Code do not include compensatory provisions for differences in income, and this makes it extremely difficult for poorer LGUs to make certain kinds of investments, especially more costly infrastructure undertakings. The Government has attempted to address this problem through establishment of other funding mechanisms (for example, the fund for good governance), but the scale of financing is very small and to some extent discretionary. While such supplementary 'bonus' arrangements may serve certain goals, it would be important for the Philippines to review options to incorporate transparent redistributive provisions into the rules governing fiscal transfers to LGUs.

Fast-tracking the institutional rationalization process at the national government level

National government agencies have been mandated since 2004 to implement 'rationalization' plans, but few have done so in the agriculture sector (the same is also true of many other sectors). Absent a plan approved by the Department of Budget Management (DBM), an agency is not able to reorganize or recruit new staff; while some relief is possible through short-term contracting, this generally makes it impossible for agencies to attract experienced professionals in critical ongoing or new skill areas. After 8 years of such administrative restrictions, many agencies in the agriculture sector are operating on the basis of ad hoc and severely dysfunctional institutional arrangements and staffing complements. DBM has made very substantial progress in some areas of responsibility, particularly regarding oversight and timely release of budgets. However, progress on the institutional rationalization program has been very poor and this is seriously undermining the effectiveness of public expenditures. Some sector agencies consider that DBM is moving slowly because of reluctance to allocation resources for redundancies, on the scale that would be needed if the rationalization proposals were adopted. Others argue that DBM itself lacks the sector expertise to evaluate the proposals quickly and efficiently. Clearly, for the agriculture sector, DBM needs to fast track the institutional rationalization process; if technical skills are a constraint, other agencies (NEDA, PCAARD, etc.) could be asked for temporary support. If budget resources for redundancies are an issue, rationalization plans could include phases that would at least permit interim reorganizations and some new hiring of critical skills to proceed.

Opening to foreign investment and trade

The Philippines has a fairly open foreign investment and trade regime, however there are some important restrictions that affect the agriculture sector. On the trade front these include the extension of protection arrangements for the rice sector (under review at this time by WTO), and the fact that the Philippines avails itself of the highest tariff options for several other subsectors. Regarding the investment regime, the main issue concerns the Constitutional prohibition of foreign ownership of land. Whatever negotiated arrangement is agreed with WTO for the rice sector should of course be observed, but it will be equally important to use the time of the extension period to prepare realistic long-term strategic plans for intensification of rice production, on the one hand, and support to farmers who may wish to move out of rice on the other. The restriction of foreign ownership of land needs to be eliminated.

Adapting to climate change and climate variability—the 'new normal'

It is assumed that, as one of the most vulnerable countries to natural disasters and climate change, the Philippines will continue to participate actively in international climate negotiations fora. At the national level, it will be important to maximize the potential synergies between disaster risk and climate change strategic planning and institutional arrangements—some of this work is presently taking place in parallel, with less coordination than could be possible. Second, the Philippines also needs to invest more aggressively in strengthening its institutional capacity to monitor and analyze changes in temperature, precipitation and groundwater resources. This includes significant expansion

in the number of state of the art monitoring stations, on the one hand, and access to software and training in the most important climate software models on the other (at present PAGASA has access to only one).

Finally, since the impacts of different climate-related changes on food security in the Philippines are likely to be varied in terms of severity, probability, immediacy and (ir) reversibility, it will be important to prepare a differentiated and phased response strategy. A clear methodology needs to be developed for prioritizing among a host of planned hard or soft and autonomous adaptation actions that the country has an option to pursue. It is commendable that sector and regional vulnerability assessments affecting food security, using a common framework, are scheduled to be accomplished by end-2012. They should then be subjected to a systematic analysis to optimize strategic choices, taking into account the severity, immediacy and probability of various climate threats. The response strategy and methodology for prioritizing adaptation actions will then need to be re-visited at frequent intervals, as both global and national knowledge about climate change and its potential impacts deepen.

Placing poverty reduction and income growth at the center of food security policy, and relying on social safety nets to handle the occasional market failures

Food security policy is presently focused on quantities, i.e. the volume of incremental production needed to achieve higher self-sufficiency ratios in key food crops. The emphasis needs to shift to identification of long-term requirements for a nutritionally sound food consumption basket (with different options in terms of the mix of foods that could achieve those goals) and to designing strategies to ensure that all segments of the income distribution have sufficient capacity to acquire that basket. Essentially, this means the elimination of hunger and extreme poverty—widely understood to be a condition in which a household is unable to acquire at least a minimum nutritionally sound food basket. From the standpoint of all consumers, maximizing long-term welfare will be dependent on achieving the lowest average prices for key foods, not on whether these foods are produced within or outside the country. For producers, it will be depending on maximizing long-term returns to investment (with recourse to subsidies limited to only very specific purposes and periods of time), regardless of how these may 'fit' with national self-sufficiency objectives. Certainly there will be brief spikes in food prices, as occurred in 2008, but softening the impact of such spikes may be better achieved through safety nets that protect the poorest in society to navigate such periods, than by condemning all consumers to higher long-term prices.

Placing total factor productivity growth at the center of agriculture transformation policy

With the exception of a few crops, the Philippines does not have a highly productive agricultural sector; rather, yields tend to lag those of comparable countries, and returns to labor and land are low. Transforming agriculture will mean moving to a fundamentally higher TFP growth trajectory. International experience indicates that this will require a much stronger agricultural research complex (in terms of institutional mandates, coordination, financing, and public-private cooperation) than presently exists. It will also require reconfiguring the country's organization of its agricultural extension and technology transfer, resolving the 'gateway' land issues discussed above, and providing access to rural financial services and risk management instruments on a much larger scale—in other words, a 'full court press' on the land, labor, capital and knowledge dimensions of TFP and growth.

Broadening the focus from agricultural credit to financial services and risk management

Access to credit for investment in agriculture and related downstream activities is limited in the Philippines, with the main providers being public sector institutions (Land Bank and Development Bank of the Philippines). The sector will not be able to grow sufficiently on the strength of public investment alone; nor will agriculture grow if financing requirements are approached mainly as a 'credit problem' rather than a complex of issues involving credit, equity financing and other financial services that include effective

arrangements for risk management, with strong private sector participation.

Modernizing water resource management; dealing with communal irrigation

The Philippines lacks up-to-date information on water balances outside of a few geographic areas (metro Manila and metro Cebu); does not have an up to date dam safety baseline (again, with a few exceptions); has a rapidly deteriorating communal irrigation system; and has no overall institutional arrangements capable of effective oversight of water resource planning, allocation, and monitoring. Institutional responsibilities are fragmented at the national and subnational levels, and between the two. Vested interests resist change, mainly out of understandable concern over losing decision-making authority, in a very confused setting. However, there are a few 'bottom line' issues that should be central to the debate over whether or not institutional change is an imperative. First, the Philippines is estimated to have the second lowest availability of water per capita in the region and this ratio will change (for the worse) as population continues to expand at a faster pace than in neighboring countries. Second, the Philippines has no up to date knowledge base on water balances in most regions of the country, that would provide a reasonable basis for judging where the 'tipping points' may be going forward. And, third, the Philippines is one of the most vulnerable countries from a climate change and natural disaster standpoint, hence its water sector institutional coordination, management and monitoring capacity needs to be among the best in the world. The country's leadership shied away from decision-making on a reasonable set of proposals developed during the 1990s with JICA and World Bank assistance; these are presently being reviewed and other suggestions developed with ADB support—it would be unfortunate to lose another opportunity to undertake clear reforms in an area that is absolutely central to the country's future well-being (including but certainly not limited to the agricultural sector).

Raising public and private investment in all elements of the value chains

Over the past three decades, the volume of public financing for agriculture sector development in the Philippines has been low by international standards, and for much of this period budgets have been overly focused on crop production and specifically on rice. The preoccupation with expanding domestic supply of the country's main staple crop was understandable, but *the public investment strategy overlooked the importance of maintaining a strong capacity in agricultural research, extension, and other post-production services (market information, etc.).* The fact that the majority of the poor in the Philippines reside in the countryside, and that the level of poverty appears to have stagnated during the past decade, should be sufficient reason to reassess strategy—'if it isn't broken, don't fix it', but if it clearly is, as these poverty trends suggest, then change is imperative.

The changes needed include action on the range of 'strategic choices' issues discussed in this section, but these will not be possible without *raising aggregate investment levels, allocating them strategically, and sustaining them for a number of years.* For the public sector, this is easier if overall GDP and revenues grow rapidly, as appears to be the present case, but the commitment needs to extend to more difficult times as well—because this is central to reducing rural poverty and eliminating hunger and extreme poverty. It also needs to be guided by longer-term planning efforts that extend beyond the mandate of a particular administration, and hence part of the increased public investment needs to be directed towards developing the *statistical capacity, instruments and professional skills to underpin longer-term planning, monitoring and evaluation.*

Although increases in volume and more strategic use of public investment are necessary, they will not be sufficient without a concomitant increase in private capital formation. When incentives are right, the Philippines has shown the capacity to attract significant volumes of private investment—the surge in offshore outsourcing being a recent example. The large and expanding domestic market, language

and other skills of the population, large nearby regional markets, and recent demonstrated seriousness of purpose in tackling governance issues are clearly being noticed by some investors and private ratings agencies. Whether this leads to increasing investment in agricultural transformation per se, as has occurred in many other East and Southeast Asian countries, will depend on tackling *particular concerns of investors, mostly related to land issues, agriculture-specific aspects of the trade and foreign investment regimes, and the availability and cost of energy, water and transport services.* Finally, while it will be important to let the private sector lead agricultural transformation, it will *also be important to build stronger corporate social responsibility on the part of the private sector, towards that end.*

A Less Optimistic Scenario

A less optimistic scenario could likely materialize in the context of lower overall economic performance and a slower pace of sector reforms. This scenario assumes that economic convergence does not take place until nearer the end of the next three decades, either because the present leadership does not succeed in bringing the country to the point of readiness, or successor governments do not sustain the efforts. GDP grows more slowly at an average 3.2 %, and the consumption component of the economy therefore also expands more slowly. Overall and sector TFP growth remain in the 1-2% range, signaling a less dynamic and innovative development pattern. Although still the 9th most populous country in 2040, the Philippines does not become one of the world's 20 largest economies, and this is reflected in lower average well-being of the population, especially in rural areas.

Annex 1—Centennial Group Growth Model

Concepts Underlying the Macro Model and Scenarios[1]

Productivity Convergence

A wide body of research has shown that some growth differences between emerging market countries can be successfully modeled by dividing them into two groups: 'converging' countries with rapid growth and 'non-convergers' stuck in the middle income trap.

The 'convergence' idea is this: It has been observed that the convergers' incomes catch up to those of global best practice over time, and that convergers with lower incomes converge more quickly. Three main forces drive convergence: First, open economy forces yield convergent growth if poorer countries focus on their comparative and factor advantages and then trade with nations lacking those factors, e.g., cheap labor. This leads to more equal cross-country factor prices. Second, capital deepening boosts growth more in countries with lower ratios of capital to skilled labor (usually the poorer ones) due to the nature of diminishing returns.

The third force is productivity convergence. Here it is the TFP of convergers that catches up to that of best practice, with those further behind in TFP converging faster. This phenomenon reflects technology leap-frogging, technology transfers, shifting underemployed agriculture workers to efficient export-led manufacturing, transferring child laborers into schools, a steady increase in the average level of literacy, building roads to connect the unconnected to markets, and the diffusion of management and operational research from more advanced countries. It appears that countries can shortcut productivity-improvement processes by learning from economies that are already at the productivity frontier.

Middle Income Trap

However, as suggested by the records of many middle-income countries around the world, it is difficult (but possible) to avoid a stagnation in growth after a fast-growing economy reaches middle-income status. This stagnation has been termed the 'middle income trap' and results from an inability to make some difficult—yet critical—structural adjustments to the growing economy. Once the rural workers have been shifted, the labor-capital ratio approaches that of developed nations, educational attainment reaches higher levels, the old-age dependency ratio increases, everyone is connected by physical infrastructure, and productivity approaches best practice levels—so that importing foreign technology offers only small benefits—the strategies above no longer reap rewards. For example, moving from a BA to MA offers a smaller boost than moving from illiteracy to literacy.

The critical question in this context becomes the following: how have some countries managed to avoid the middle income trap?

Across the world, maintaining high growth after reaching middle-income status has required a change in approach, shifting focus from low-wage, export-led manufacturing to a knowledge-based society with strong domestic demand and a large middle class. Once a fast-growing country's citizens reach middle-income status, they will no longer accept wages low enough for low-wage manufacturing to be internationally competitive. The economy must become more dependent on innovation and differentiation, transitioning from input-driven growth to productivity-driven growth, but this cannot happen without developing advanced educational institutions, efficient financial systems to allocate

1 This subsection is taken from Kohli, Szyf, and Arnold (2012).

resources, reliable public safety and pleasant living areas to attract mobile skilled workers and prevent a 'brain drain', skill-training programs and social safety nets, affordable housing, sufficient and wise investment, elimination of corruption and inappropriate regulations, and free information flows. If countries cannot change their economic strategies and move up the value chain, they find themselves stuck in the middle—between rich countries that have the legal and financial base to allow for economic growth through high-value innovations and poor countries that are globally competitive because labor and other input costs are low.

These concepts of convergence and the middle income trap drive the productivity component of the model and form the basis for our alternate growth scenarios for Indonesia, the Philippines, and Vietnam.

Estimating Future GDP2

To estimate the total GDP of each country through 2040, the model uses the following Cobb-Douglas function, with α equal to 2/3:

$$GDP = TFP \times L^{\alpha} \times K^{1-\alpha}$$

GDP figures are generated for three different measures: real GDP (constant 2010 dollars); PPP GDP (constant 2010 PPP dollars); and GDP at market exchange rates (explained in Section 1.4).

Our units to measure labor force are the number of workers economically active each year. Labor force growth stems from population growth and from changes in labor force participation rates. Labor force participation rates are projected separately, by gender, for seven age cohorts (15–19, 20–24, 25–29, 30–49, 50–59, 60–64, and 65+), using a separate auto-regression for each cohort. The labor force in each of the fourteen age-gender cohorts equals the number of individuals in that cohort times the participation rate for that cohort. Male rates are projected directly; female rates are derived by projecting the difference between male and female rates.

For the Philippines and Vietnam, population estimates are taken from the United Nations. For Indonesia, we have two different population scenarios: one from the UN, and the other from a country source.

Capital stock is projected by applying yearly investment and depreciation to each year's stock, beginning with an initial stock derived using the Caselli method. For each country, a quota is set so that its investment rate (over historical years and projected years combined) cannot remain above 30 percent (as a share of GDP) for more than 35 years. Once it reaches its quota, its rate linearly decreases to 30 percent over 10 years. And for countries with rates below 20 percent, the rate tapers up over time, reaching 20 percent in 2020.

Finally, TFP is estimated using the following equation:

$$TFPGrowth_{i,t} = DefaultRate + CB_{i,t} - FP_{i,t}$$

where i is the country, t is the year, DefaultRate represents the expansion of the global productivity frontier (1 percent), CB is the convergence boost benefiting 'converging' countries, and FP is the penalty suffered by fragile states (–1.8 percent).

The convergence boost is defined as follows:

$$CB_{i,t} = c_{i,t} \times BoostCoefficient \times ln\left(\frac{TFP_{USA,t-1}}{TFP_{i,t-1}}\right)$$

where i is the country, t is the year, BoostCoefficient is the convergence coefficient (0.0269), TFP is the total factor productivity, and c takes a value between 0 and 1 and identifies whether the country is treated as a converger (c=1), as a non-converger or fragile state (c=0), or as in an intermediate position (0<c<1), wherein the country is experiencing some, but not all, of the convergence boost.

For non–developing-ASEAN countries, the classification of whether the model treats them as convergers, non-convergers, or failed states may be found in Annex 1 of Kohli, Szyf, and Arnold (2012).

2 Subsections 1.2, 1.4, and the middle of 1.5 are taken from or based on Kohli, Szyf, and Arnold (2012), where further details may be found, and Kohli (2011). Kohli, Harpaul Alberto. (2011). Model for Developing Global Growth Scenarios. In Harinder Kohli, Ashok Sharma & Anil Sood (Eds.), Asia 2050: Realizing the Asian Century. New Delhi: SAGE.

For developing ASEAN countries, their classification as convergers or non-convergers constitutes the most important difference between the optimistic and pessimistic scenarios.

The Macro Scenarios: Optimistic and pessimistic

In all cases, the differences between the scenarios consists in the values chosen for c in equation 3.5.1 (which affects productivity growth) and the investment rate. The precise definitions for each scenario for country are as follows:

Indonesia: In both scenarios, Indonesia starts out as a converger, continuing its overall success over the past two decades. In the optimistic scenario, this status remains unchanged through 2040, which corresponds to the c n Equation 3.5.1 remaining 1 for all years. But in the pessimistic scenario, beginning in 2017, it gradually begins to lose most of its convergent status, reaching a minimum c of 20 percent (meaning it is treated as in an intermediate position between convergence and non-convergence, in this case reaping just 20 percent of the convergence boost) in 2024 and continuing at that level through 2040.

As we also have two population scenarios, this yields four macro scenarios (identified in §1.8).

Table A1.1 provides the full details of Indoesnia's secario specifications. All other parameter values are as given earlier in this annex and Kohli, Szyf, and Arnold (2012), which is also the source of the investment rate given in the table.

Philippines: In both scenarios, the Philippines starts out as a non-converger. In the pessimistic scenario, it maintains this status through the end of the time period, and its investment rate gradually falls, reaching 15 percent in 2025 and through 2040. But in the optimistic case, it begins to experience increasing portions of the convergence boost beginning in 2014, reaching a c of 40 percent by 2022 and through 2040. In addition, in this optimistic case it enjoys the new-converger investment boost described in Kohli, Szyf, and Arnold (2012),[3] rising to 24 percent by 2020 and then falling back down to a plateau of 20.12 percent by 2035. This investment boost is needed in order for the country to transition from being a non-converger to being a converger.

Table A1.2 provides the full details of the Philippines' scenario specifications. All other parameter values are as given earlier in this annex and Kohli, Szyf, and Arnold (2012), which is also the source of the optimistic scenario's investment rate, based on the invstment boost for newly converging countries.

Table A1.1: Indonesia's scenario specifications

year	c (opt)	inv (opt)	c (pess)	inv (pess)
<=2016	1	25.45%	1	25.45%
2017	1	25.45%	0.97	25.45%
2018	1	25.45%	0.84	25.45%
2019	1	25.45%	0.72	25.45%
2020	1	25.45%	0.59	25.45%
2021	1	25.45%	0.47	25.45%
2022	1	25.45%	0.36	25.45%
2023	1	25.45%	0.25	25.45%
2024+	1	25.45%	0.2	25.45%

Source: These are the scenario definitions being presented in this section of this annex.

Table A1.2: Philippines' scenario specifications

year	c (opt)	inv (opt)	c (pess)	inv (pess)
2013	0	20.68%	0	20%
2014	0.35	21.71%	0	19.5%
2015	0.4	22.75%	0	19%
2016	0.45	23.79%	0	18.5%
2017	0.5	23.84%	0	18%
2018	0.6	23.89%	0	17.5%
2019	0.6	23.95%	0	17%
2020	0.6	24%	0	16.5%
2021	0.6	23.74%	0	16%
2022–2024	0.6	23.48%	0	15.5%
2025–2034	0.6	declines each year	0	15%
2035+	0.6	20.12%	0	15%

Source: These are the scenario definitions being presented in this section of this annex.

3 Kohli, Harpaul Alberto, Szyf, Y. Aaron, & Arnold, Drew. (2012). Construction and Analysis of a Global GDP Growth Model for 185 Countries through 2050. Global Journal of Emerging Market Economies, 4(2), 91–153.

Vietnam: Although Vietnam has traditionally been considered a converger, in the past few years its TFP growth has slowed. Therefore, in both scenarios, for 2014 Vietnam is made to benefit from only 70 percent of its convergence boost (a c of 70 percent). In the optimistic scenario, it gradually increases the share of its convergence boost it enjoys from 70 percent to 100 percent, regaining its fully convergent status in 2027. But in the pessimistic case, it gradually loses more and more of its convergence boost, reaching a thereafter-permanent low of a c of 20 percent in 2021. In addition, in the pessimistic case, its investment rate falls much faster than in the optimistic case (wherein it decreases after reaching the 35-year quota described above). As a point of comparison, in the optimistic scenario it does not fall to 35 percent until 2040 but in the pessimistic scenario it has already fallen to 35 percent by 2022.

Table A1.3 provides the full details of Vietnam's scenario specifications, except for the post-2027 investment rates, which equal the lower of 33.5% and the rate determined by the methodology in Kohli, Szyf, and Arnold (2012), which is also the source of the investment rate given for the optimistic scenario and pre-2020 for the pessimistic one.

Rest of Developing ASEAN: n the optimistic scenario, Cambodia, Malaysia, and Thailand are convergers throughout the entire time period; Laos and Myanmar begin as non-convergers but gradually begin converging, with an investment boost, in 2015 and 2017, respectively, according to the process detailed in Kohli, Szyf, and Arnold (2012).[4] In the pessimistic scenario, Malaysia (given its high income) remains a converger and Myanmar and Laos remain non-convergers throughout the time period; Cambodia and Thailand fall into the middle income trap according to the timetable explained in Kohli, Szyf, and Arnold (2012).[5]

Table A1.3: Vietnam's scenario specifications

year	c (opt)	inv (opt)	c (pess)	inv (pess)
2013	1	38.14%	1	38.14%
2014	0.7	38.14%	0.7	38.14%
2015	0.715	38.14%	0.63	38.14%
2016	0.72	38.14%	0.56	38.14%
2017	0.725	38.14%	0.5	38.14%
2018	0.7	38.14%	0.44	38.14%
2019	0.82	38.14%	0.38	38.14%
2020	0.83	38.14%	0.3	37%
2021	0.85	38.14%	0.2	36%
2022	0.85	38.14%	0.2	35%
2023	0.88	38.14%	0.2	34%
2024	0.9	38.14%	0.2	33.5%
2025	0.93	38.14%	0.2	33.5%
2026	0.99	38.14%	0.2	33.5%
2027–2036	1	38.14%	0.2	33.5%
2037	1	37.32%	0.2	33.5%
2038	1	36.51%	0.2	33.5%
2039	1	35.70%	0.2	33.5%
2040	1	34.88%	0.2	33.5%

Source: These are the scenario definitions being presented in this section of this annex.

GDP at Market Exchange Rates

As countries grow richer, over time periods of 10 years or more, their real exchange rates (RERs) tend to appreciate. This gives them an even larger share of the global economy, increases their weight in trade, and increases the international purchasing power of their citizens. To capture this effect we generate a measure of GDP at market exchange rates, which serves as our proxy for nominal GDP.

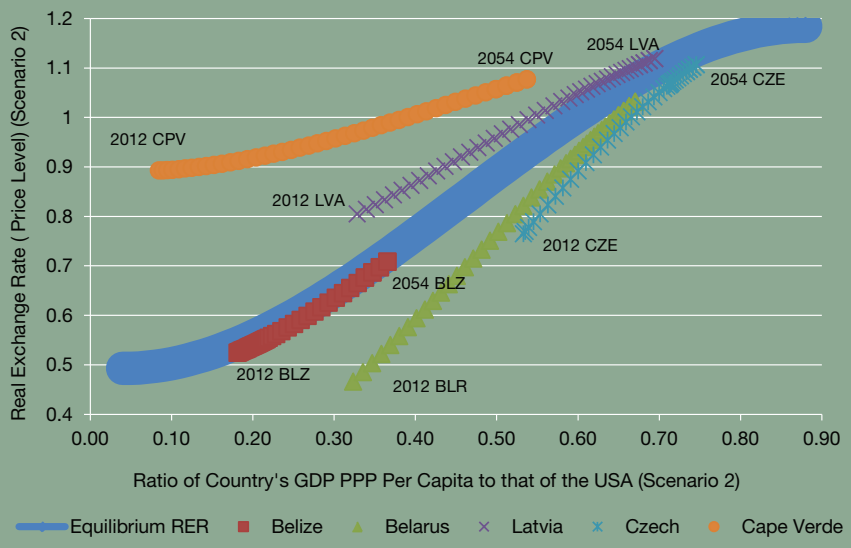
For the historical observations we create the GDP at MER measure by taking away US inflation relative to 2010 from each country's nominal GDP and leaving in exchange rate differences. But for the future we project this indicator by inflating a country's estimated real GDP (at constant 2010 dollars) by its expected real exchange rate appreciation.

Our first step in estimating future RERs is to derive the following equation to establish a theoretical equilibrium relationship between a country's RER and its PPP income relative to that of the US:

$$RER_{i,t}^{EQ} = \frac{PPP_{i,t}}{e_{i,t}} = .498 - .255\left(\frac{GDPPC_{i,t}}{GDPPC_{US,t}}\right) + 3.23\left(\frac{GDPPC_{i,t}}{GDPPC_{US,t}}\right)^2 - 2.34\left(\frac{GDPPC_{i,t}}{GDPPC_{US,t}}\right)^3$$

4 Ibid.
5 Ibid.

FIGURE A1.1: EQUILIBRIUM RELATIONSHIP AND MOVEMENT OVER TIME



Source: Kohli, Szyf, and Arnold (2012)

where i represents the country, t the year, PPPi the country's PPP conversion factor relative to the US (US$=1), ei its exchange rate relative to that of the US, GDPPCi its GDP PPP per capita, and GDPPCUS the US's GDP PC. Then, using the following equation, each country's modeled exchange rate converges (see figure) towards the value that corresponds to its income in this equilibrium equation:

$$\ln(C_{i,t}) = \beta_1 \times \ln(C_{i,t-1}) + \beta_2 \times \ln(CappedGDPPC_{i,t}) + \beta_0 + \varepsilon_{i,t}$$

where RERi,t is the modeled value of country i's real exchange rate at time t and RERi,tEQ is the equilibrium RER of country i at time t predicted by the previous equation.

Figure A1.1from Kohli, Szyf, and Arnold[6] illustrates both the equilibrium relationship and the movement over time of example countries' rates.

MEASURES RELATED TO INCOME DISTRIBUTIONS

The final aspect of the macro model used in this study is estimates of income classes and median and percentile consumption. The first step in this process is to estimate per capita total consumption.

We calculate consumption in constant PPP international dollars (both for base year 2010 and base year 2005) as the GDP PPP PC times the share of GDP spent on consumption. To estimate the latter, we begin with the historical series of the ratio of consumption to GDP from the Penn World Table (Heston, Summers, & Aten, 2009).7 We then estimate future consumption using the following autoregression across all countries and years:

$$RER_{i,t} = RER_{i,t-1} + (1.184 - RER_{i,t-1}) \times \left(\frac{RER_{i,t}^{EQ} - RER_{i,t-1}^{EQ}}{1.184 - RER_{i,t-1}^{EQ}}\right)$$

where i is the country, t is the year, C is the share of GDP spent on consumption, CappedGDPPC is the minimum of $50,000 and the GDP PPP PC in constant 2010 PPP dollars, the βs are the coefficients, and ε is the error term.

To estimate the sizes of the lower, middle, and upper classes, the model calculates what share of the population is between certain income cutoffs (middle class is $10.80

6 Kohli, Harpaul Alberto, Szyf, Y. Aaron, & Arnold, Drew. (2012). Construction and Analysis of a Global GDP Growth Model for 185 Countries through 2050. Global Journal of Emerging Market Economies, 4(2), 91–153.

7 Heston, Alan, Summers, Robert, & Aten, Bettina. (2009). Penn World Table Version 6.3. Retrieved 8/10/2010, from Center for International Comparisons of Production, Income and Prices at the University of Pennsylvania.

to $100 of consumption a day using constant 2010 PPP dollars). As a country's total income increases, more people with small shares of the country's total will attain higher living standards. We use a type of income distribution curve called a GQ Lorenz curve (Kohli, Szyf, & Arnold, 2012). We calculate these shares using the following GQ-Lorenz-based headcount function (the share of the country's population below per capita income level z in a given year):

$$H(z) = -\frac{1}{2m}\left(n + r \times \frac{\left(b+\frac{2z}{\mu}\right)}{\sqrt{\left(b+\frac{2z}{\mu}\right)^2 - m}}\right)$$

where H(z) is the headcount index, μ is the country's mean consumption level per capita in 2010 PPP dollars, and the other letters are parameters that describe the shape of the income distribution (Kohli, Szyf, & Arnold, 2012), with values taken from Povcal (World Bank Development Research Group, 2011).[8]

For our food consumption model, we will also need to calculate percentile incomes, that is, what is the income (or consumption level) so that a given percentage of the population lives under that level. For percentile pct, the following equation identifies below which income level it is that pct% of the population lives:

$$\theta \times H(z) \times (1 - H(z)) \times \left(\frac{\gamma}{H(z)} - \frac{\delta}{(1-H(z))}\right) = 1 - \frac{z}{\mu}$$

where GDPPC is either the income or consumption level per capita, pct% is the percentage of the population, and the other terms are the same as in the previous equation.

The model also generates poverty measures for all ASEAN countries except Myanmar. However, the GQ Lorenz curve (and hence the headcount formula above) is not as accurate for extremely low incomes (Kohli, Szyf, & Arnold, 2012), and so we must use the Betz Lorenz curve. Using the Beta Lorenz, the poverty headcount ratio (what percent of the population lives below the poverty line) is the value of H(z) that makes the following equation true (Datt, 1998):[9]

$$\theta \times H(z) \times (1 - H(z)) \times \left(\frac{\gamma}{H(z)} - \frac{\delta}{(1-H(z))}\right) = 1 - \frac{z}{\mu}$$

where Θ, γ, and δ are the parameters that characterize the income distribution (with values taken from Povcal (2012)), z is the poverty line ($1.25 per day, measured in constant 2005 PPP dollars), and μ is the country's mean consumption level per capita in constant 2005 PPP dollars.

This headcount index tells us how many poor there are, but not how poor they are. A country with all the poor living just below the poverty line would get the same score as a country with the same rate of poverty but with most of the poor living on incomes below half the poverty level.

To estimate the magnitude of poverty, we use the poverty gap. This takes into account how far below the poverty line the average poor person is. More precisely, it measures what share of the society's resources would have to be transferred to the poor to eliminate poverty. The poverty gap equals

$$PG = H - \frac{\mu}{z} \times \left(H - \theta \times H^{\gamma} \times (1 - H)^{\delta}\right)$$

where z is the poverty line and H is the H(z) defined in the previous equation (Datt, 1998).

However, for the Philippines 2040 estimates, we do not use the above equations for the poverty gap and headcount because its Beta Lorenz curve is not valid (Povcal, 2012). Instead, we use the GQ-Lorenz headcount function above and the poverty gap equation given in Kohli, Szyf, and Arnold (2012).[10]

Food Consumption Model

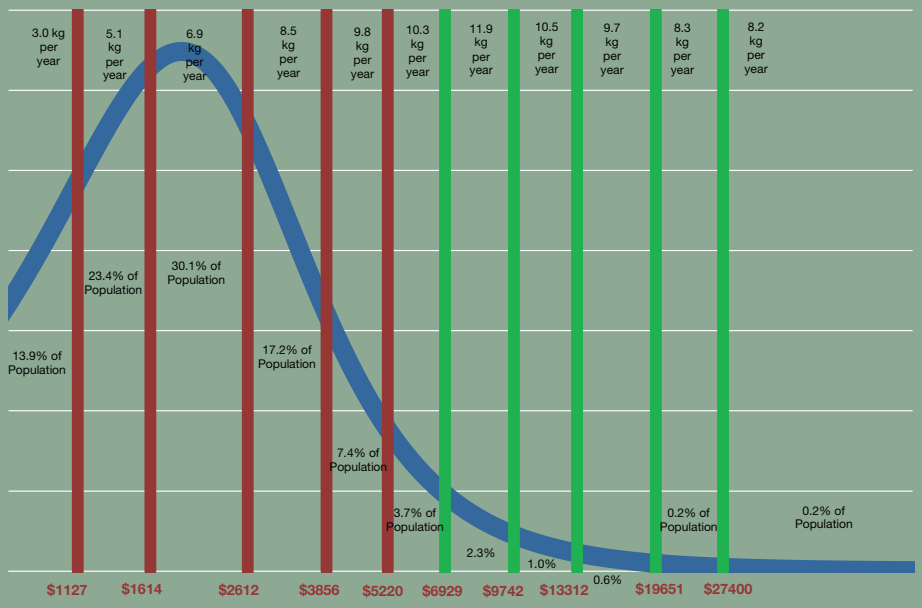
For each food commodity, future consumption is estimated as follows: a table is formed showing, for a set of 9 to 11 consumption income group cohorts, how much of that commodity the average member of each cohort eats. (This pattern already takes into account urban-rural differences.) For each year, the macro model computes what fraction of the population is in each cohort. The final per capita food consumption number equals the weighed average of how

8 World Bank Development Research Group. (2011). PovcalNet. Retrieved 12/13/2010 http://go.worldbank.org/WE8P1I8250

9 Datt, Gaurav. (1998). Computational Tools for Poverty Measurement and Analysis. FCND Discussion Papers, 50. Retrieved from http://www.ifpri.org/publication/computational-tools-poverty-measurement-and-analysis

10 Kohli, Harpaul Alberto, Szyf, Y. Aaron, & Arnold, Drew. (2012). Construction and Analysis of a Global GDP Growth Model for 185 Countries through 2050. Global Journal of Emerging Market Economies, 4(2), 91–153.

FIGURE A1.2: POPULATION DISTRIBUTION BY INCOME (BLUE) AND EGG CONSUMPTION: INDONESIA 2010



Source: Centennial Model

much each cohort consumes, weighed by each cohort's share of the total population. As the country grows richer, the number of people in each cohort changes, and so the country's average consumption changes, as illustrated in the following two charts for egg consumption in Indonesia.

In each chart, the horizontal axis represents a person's consumption income per year, in 2010 PPP dollars (as we will see below, we use PPP because we will be extrapolating between different countries' experiences of how much food each eats, for which PPP is a better measure). The blue line represents a population density function: what the probability is that a random person in the country will have that level of consumption. (The vertical axis values are arbitrary and are not shown.) The higher the value of the blue line, the more people in the country have the consumption level indicated by the corresponding value of on the x axis.

The red and green lines demarcate the different cohorts we use, each cohort defined as a range of possible consumption levels. For example, the second cohort contains everyone with a consumption level between $1,127 and $1,614 a year. As will be explained below, the red lines indicate cohorts derived from the actual 2010 or 2006 historical household consumption data and green ones are constructed based on estimates of possible 2040 (optimistic scenario) outcomes.

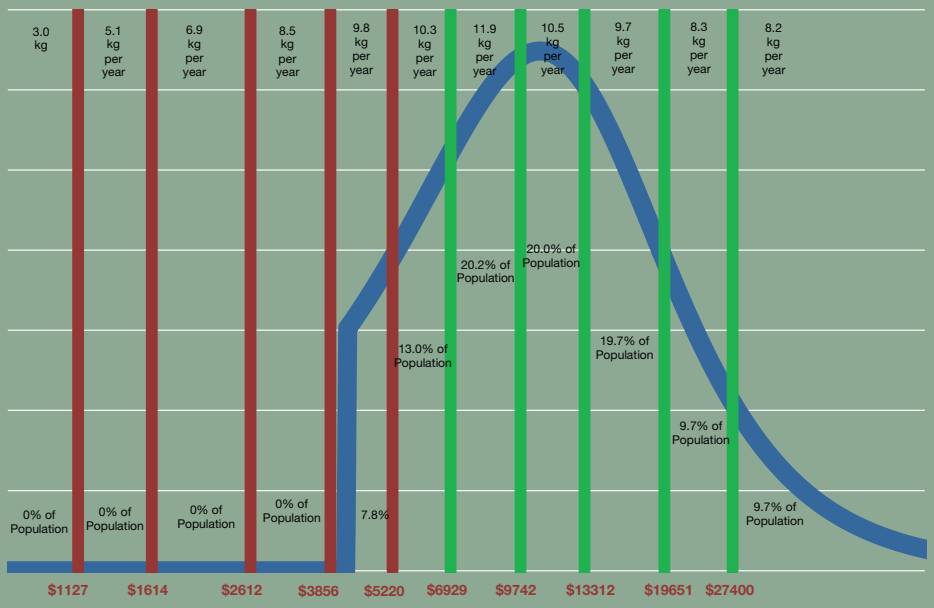
For each cohort, at the top of the chart appears how many kilograms of eggs the average person in that cohort eats a week. For example, for the $1,127 to $1,614 cohort the value is 0.426 kg.

Finally, towards the bottom of the graph appears the percentage of the population in that cohort. This simply equals the area on the graph that is under the blue curve and between the upper and lower vertical lines demarcating the cohort (more precisely, this equals the integral of the blue curve between the two demarcating vertical lines). Therefore, the $1,127 to $1,614 cohort contains 23.4 percent of Indonesia's 2010 population.

In the first chart, when we take a weighed average of each cohort's egg consumption, weighed by each cohort's share of the population (the area under the curve), we reach an average of 6.7 kg per year.

But in the following graph, representing 2040's optimistic scenario, the average is 10.1 kg per year. The only differ-

Figure A1.3: Population distribution by income (blue) and egg consumption: Indonesia 2040 (opt.)



Source: Centennial Model

Table A1.4: Indonesian eggs

income range	< $1127	$1127–$1614	$1614–$2612	$2612–$3856	$3856–$5220	$5220 +
KG eggs/year	3.0	5.1	6.9	8.5	9.8	10.6
2010 population share	13.9%	23.4%	30.1%	17.2%	7.4%	8.0%
2040 (opt.) pop. share	0%	0%	0%	0%	7.8%	92.2%

Source: Centennial Model

Table A1.5: Singapore's eating habits

	1st quintile	2nd quintile	3rd quintile	4th quintile	5th quintile
	< $6353	$6353–$10417	$10417–$15470	$15470–$24271	$24271 +
KG eggs/year	4.9	5.6	5.0	4.6	3.9

Source: Singapore Household Expenditure Survey and Centennial Model (for quintiles)

ence between the two graphs is the income distribution. The cohort definitions (and corresponding vertical lines) and cohort quantities eaten are exactly the same. But as the blue curve moves right over time (indicating more prosperity), more of the population falls into the higher cohorts and less into the lower.

Table A1.6: Inter-cohort ratios

cohort #	1	2	3	4	5	6	7	8	9	10 (& 11)
orig IDN cohort	<$1127	$1127–$1614	$1614–$2612	$2612–$3856	$3856–$5220	$5220+				
KG eggs/year	3.0	5.1	6.9	8.5	9.8	10.6				
SGP cohort						<$6353	$6353–$10417	$10417–$15470	$15470–$24271	$24271+
SGP eggs/yr						4.9	5.6	5.0	4.6	3.9
ratio of SGP quintile's KG eggs to previous quintile's							1.1= 5.6/4.9	0.9= 5.0/5.6	0.9= 4.6/5.0	0.8= 3.9/4.6
new IDN cohort	<$1127	$1127–$1614	$1614–$2612	$2612–$3856	$3856–$5220	$5220–$6929	$6929–$9742	$9742–$13312	$13312–$19651	$19651+
share of 2010 IDN population	Not relevant	Not relevant	Not relevant	Not relevant	Not relevant	3.7%	2.3%	1.0%	0.6%	0.4%
new KG eggs/yr value	3.0	5.1	6.9	8.5	9.8	10.3	11.9	10.5	9.7	8.3
new KG eggs/yr formula	3.0	5.1	6.9	8.5	9.8	x	x*1.1	x*1.1*.09	x*1.1*.09*0.9	x*1.1*.09*0.9*0.8

Source: SUSENAS (Indonesia), Singapore Household Expenditure Survey, and Centennial Model

This model is therefore an application of the macro model to an estimate of the country's food eating patterns by consumption cohort. These patterns are determined as follows:

We begin with the historical household consumption surveys (broken down by consumption income cohort) collected for each country. (For fish in Indonesia and fish, meat, eggs, roots, vegetables, fruit, and corn in the Philippines, we make adjustments based on other country sources.) For Vietnam and the Philippines, the cohorts are given as quintiles. For Indonesia, a different percentile distribution is provided. For Indonesia we use the 2010 SUSENAS, for Vietnam the 2010 GSO household survey, and for the Philippines the 2006 household survey.

As our consumption model depends on having absolute dollar cutoffs for cohorts, not percentiles, we use the macro model to translate quintiles or other percentiles into dollar amounts. In our example of Indonesian eggs, that gives us the following pattern, with these cohort cutoffs drawn in dark red in the two graphs above. (As said, the green cutoffs above are not based on the historical data.)

But although this division into cohorts gives an acceptable level of detail to analyze 2010 eating habits, it does not provide a useful level of resolution for the 2040 optimistic scenario: there, 92% of people fall into the top red cohort. In other words, if we were to remove all the green lines from the graph above (all cohorts defined in the actual SUSENAS are drawn in red), our methodology would not be very useful. If we are to understand the national eating habits as the result of the population being distributed into a changing mix of the fixed cohorts (which also already reflect urban and rural differences), not much change or information can be gleaned for 2040 if the top cutoff is $5,220.

However, our actual historical data for Indonesia does not report any cohort cutoffs above this. That is why the right half of the charts has only green lines, not red ones. If we are to have enough detail through our cohort demarcations to estimate future consumption, we will have to derive richer cohorts' eating habits from elsewhere, thus letting us decompose the richest SUSENAS cohort ($5,220+) into smaller cohorts.

We use comparator countries for this purpose. But because culture is different in other countries, we do not directly use our comparators' eating patterns. Instead, we use the following extrapolation procedure, again illustrated using Indonesia and eggs, for which we use a single comparator: Singapore.

Singapore's egg-eating habits for 2008 are:

As with the Philippines and Vietnam, the Singapore cohort data comes in the form of quintiles and not dollar ranges. We derive the dollar cutoffs via our macro model and its income distributions.

To use Singapore's data in order to estimate the behavior of Indonesia's richer cohorts for which we do not have Indonesian data, we create new richer Indonesian cohort demarcations by taking quintiles and deciles of the 2040 optimistic scenario and then construct the table below. (Note that to simplify the following explanation, we aggregate our 10th and 11th Indonesian cohorts into one)

In the below table, we very roughly line up the Singapore cohort cutoffs with our new Indonesian cohorts (the green lines in the charts above). If we were to directly apply the Singaporean eating habits to Indonesia—which we do not do, because of cultural differences—then we would take the Singaporean 5.6 value for our cohort 7. But as seen, we use a value of 11.9 instead.

To derive that, we take the ratio of many kilograms of eggs our approximate cohort 7 consumes in Singapore to how many our approximate cohort 6 consumes there, and then we multiply that by the actual kilograms of eggs consumed by Indonesia's cohort 6.

Likewise, to estimate Indonesia's cohort 9 egg consumption, we take Singapore's egg consumption ratio between cohorts 8 and 9 and then multiple Indonesia's cohort 8 egg consumption by that ratio.

Data permitting, for all countries and commodities, we employ this technique of applying the richer countries' inter-cohort ratios to our countries. As our comparators, we use Singapore and Japan, sometimes choosing one and sometimes taking their average.

One step is missing. We have established the relative values between cohorts 6, 7, 8, 9, and 10/11 based on this ratio-extrapolation method, but this does not give us the absolute values.

This is because we want our new eating pattern to be fully consistent with the real household survey table for 2010. What we have just done is decompose the richest cohort from the SUSENAS into subcohorts. We want the weighted average of our new sub-cohorts to equal the 10.6 SUSENAS value for the richest cohort.

For this we use the last line of the table. In it, the kg of eggs per year is expressed in terms of an unknown number x and the ratios derived from Singapore. We therefore search for the x that makes the weighed average of cohorts 6, 7, 8, 9, and 10/11 (weighed by the third-to-last row, which is the population shares) equal to the original 10.6 value of the original highest cohort, before we decomposed it into subcohorts. Once we have identified this x, our food eating pattern for Indonesian eggs is completed, with the relative values of the new subcohorts determined by the ratios between the Singaporean cohorts and with the absolute values chosen to be consistent with the original 2010 SUSENAS. Data permitting, we employ the same procedure for all countries and commodities.

Aggregate Agricultural Production Model

To estimate future aggregate agricultural production, we use the following function, based on Fuglie (2010b):[11]

$$AgProd = TFP \times Labor^{\alpha} \times QualAdjLand^{\beta} \times LivestK^{\gamma} \times MachK^{\delta} \times Fert^{\varepsilon}$$

where AgProd represents the total agricultural production, Labor the agricultural labor force, QuaAdjLand a measure of land area adjusted for quality, LivestK the livestock capital, MachK the machine capital, and Fert the fertilizer and

11 Fuglie, Keith O. (2010b). Total Factor Productivity in the Global Agricultural Economy: Evidence from FAO data. In J. M. Alston, B. Babcock & P. G. Pardey (Eds.), The Shifting Patterns of Agricultural Production and Productivity Worldwide (pp. 63–95). Ames, Iowa: Midwest Agribusiness Trade and Research Information Center.

chemicals. (Factor definitions are given in Fuglie (2010b).[12] The exponents α, β, γ, δ, and ε are the factor shares and together always sum to 1.

For our historical values of agricultural production, we multiply the country's GDP by the World Bank figure for agriculture's value added as a share of GDP.

Land

The quality-adjusted land measure we use is based on dividing land into 3 categories: Rain-fed land gets a weight of 1, irrigated land a weight of 2.993, and pasture land a weight of 0.094 (Fuglie, 2010b).[13] For our purposes, we ignore pasture land because its weight is so low. Land for tree crops is treated the same as rain-fed land (Fuglie, 2012).[14]

For Indonesia, we have one scenario for quality-adjusted land area change over time: a 0.50% average increase per year. For Vietnam we also have one scenario: a 0.27% decrease per year. For the Philippines, we have two scenarios: In the first, there is an increase of 0.47% per year; in the second, the increase is 0.65% per year. These rates are based on taking quality-adjusted sums of the initial and final land areas used in the country studies.

Livestock, Machine Capital, and Fertilizer

For all countries and scenarios, estimates for future growth rates for livestock capital, machine capital, and fertilizer are set equal to the average annual growth rates experienced from 1990 to 2006 derived from the data in Fuglie (2010a).[15]

Population

To estimate the future agricultural labor force, we use the following relation:

Labor=Population×Share of Population that is Rural×Ratio of Ag Workers to Rural Pop

For population we use our macro model's estimates; for the second term we use the UN urbanization estimates; and for the third term we use, for future years, the value of the agricultural-workers-to-rural-population ratio for the most recent year with actual data available. Therefore, the third term remains constant, the second term decreases over time, and the first term increases over time. The result is little net change in the agricultural labor force.

Factor Shares

The next component of the production equation is the factor shares. For years through 2013, we use the factor shares for Southeast Asia given in Fuglie (2010b).[16] As a country becomes more prosperous, though, the structure of its economy changes, and so the factor shares change. For example, in Fuglie (2010a),[17] the factor share for machine capital was usually about 0.01, and sometimes was even listed as 0. But in more developed countries, mechanization strongly boosts output. Therefore, as a country's income level rises, we set its factor shares' values to linearly change, converging to China's 1997 share values as its income approaches that of 1997 China, and, beyond that income level, converging towards the 2002 US values as its income approaches that of the 2002 United States.

TFP

The last component of the production model is the agricultural TFP growth rate. For each country macro scenario (GDP growth and population), we generate two agricultural TFP scenarios:

Vietnam and the Philippines: In the pessimistic agriculture scenarios, agricultural TFP growth is 2% per year. In the optimistic scenarios, it rises linearly to 3.22% in 2020, stays at that value for ten years, and then decreases linearly to 2.61% in 2040. (The 3.22% is that given in Fuglie and Evenson (2010) for China's most recent period.)

12 Ibid.
13 Ibid.
14 Fuglie, Keith O. (2012, August 13, 2012). [Conversation with Centennial Group].
15 Fuglie, Keith O. (2010a). Sources of Growth in Indonesian Agriculture. Journal of Productivity Analysis, 33, 225–240.
16 Fuglie, Keith O. (2010b). Total Factor Productivity in the Global Agricultural Economy: Evidence from FAO data. In J. M. Alston, B. Babcock & P. G. Pardey (Eds.), The Shifting Patterns of Agricultural Production and Productivity Worldwide (pp. 63–95). Ames, Iowa: Midwest Agribusiness Trade and Research Information Center.
17 Fuglie, Keith O. (2010a). Sources of Growth in Indonesian Agriculture. Journal of Productivity Analysis, 33, 225–240.

For Indonesia, yearly TFP growth is 3% in the pessimistic scenarios. In the optimistic scenarios, it rises linearly to 3.5% in 2020, stays at that value for ten years, and then decreases linearly to 3.25% in 2040.

Scenario Specifications

Table A1.7 shows how many variants each country has for each alterable component and in which section of this appendix those variants are defined:

Table A1.8 defines each scenario. See the previous table to locate where in this appendix the definition of each component appears.

Table A1.7: Scenario specifications

# alternatives for each component	GDP growth (§1.3)	population (§1.3)	agr. TFP (§1.7)	agr. land area (§1.7)	total # of scenarios for macro & consumption	total # of scenarios for production
Indonesia	2	2	2	1	4	8
Philippines	2	1	2	2	2	8
Vietnam	2	1	2	1	2	4

Source: This table is a re-statement and summary of the scenario specifications in this annex. Therefore, the source is the previous content in this annex.

Table A1.8: Scenario definitions

	Indonesia	Philippines	Vietnam
Scenario 1	High GDP Growth	High GDP Growth	High GDP Growth
	Low Population Growth	High Ag. TFP Growth	High Ag. TFP Growth
	High Ag. TFP Growth	Low Land Growth	
Scenario 2	Low GDP Growth	Low GDP Growth	Low GDP Growth
	Low Population Growth	High Ag. TFP Growth	High Ag. TFP Growth
	High Ag. TFP Growth	Low Land Growth	
Scenario 3	High GDP Growth	High GDP Growth	High GDP Growth
	Low Population Growth	Low Ag. TFP Growth	Low Ag. TFP Growth
	Low Ag. TFP Growth	Low Land Growth	
Scenario 4	Low GDP Growth	Low GDP Growth	Low GDP Growth
	Low Population Growth	Low Ag. TFP Growth	Low Ag. TFP Growth
	High Ag. TFP Growth	Low Land Growth	
Scenario 5	High GDP Growth	High GDP Growth	
	High Population Growth	High Ag. TFP Growth	
	High Ag. TFP Growth	High Land Growth	
Scenario 6	Low GDP Growth	Low GDP Growth	
	High Population Growth	High Ag. TFP Growth	
	High Ag. TFP Growth	High Land Growth	
Scenario 7	High GDP Growth	High GDP Growth	
	High Population Growth	Low Ag. TFP Growth	
	Low Ag. TFP Growth	High Land Growth	
Scenario 8	Low GDP Growth	Low GDP Growth	
	High Population Growth	Low Ag. TFP Growth	
	High Ag. TFP Growth	High Land Growth	

Source: This table is a re-statement and summary of the scenario specifications in this annex. Therefore, the source is the previous content in this annex.

Annex 2—Philippines Agriculture Multi-Market Model for Policy Evaluation (AMPLE)

Data

Quantities. Most of the commodities in AMPLE match categories in the CountrySTAT data sets of the BAS (http://countrystat.bas.gov.ph). The following production data are aggregated: calamundin and pineapple are combined into Other fruits; cassava and sweet potato into Root crops; cabbage, eggplant, garlic, gourd, mungbeans, onion, peanut, squash and tomatoes into Vegetables; and oil palm, coffee, rubber and tobacco for Other crops. Poultry incorporates chicken eggs, duck eggs and dressed chicken. Other livestock is matched to cattle. Freshwater fish capture refers to inland fishery; freshwater fish aquaculture refers to pen and cage culture. Marine fish capture refers to commercial and marine municipal fisheries; marine fish aquaculture pertains to pen, cage, oyster, and mussel culture.

The SUA serve as the main source of quantity data, namely, quantity produced, imported, consumed, exported and used for other purposes. Units and forms of primary and processed output generally in AMPLE follow the corresponding treatment in the SUA (with some exceptions). Quantity variables for rice, sugarcane and coconut are in terms of processed form, i.e. milled rice, raw sugar, and copra equivalent respectively. The primary quantity is converted to processed quantity using a fixed processing ratio. For sugar, quantity consumed is set to the sum of quantity produced and imported, less quantity exported, with zero other use. A similar treatment is applied to coconut. The SUA do not distinguish between yellow corn and white corn, hence the food balance sheet for these are constructed as follows: quantity produced for both white and yellow corn is equated to their primary production. Consumption quantity of corn is equated to quantity consumed for White corn. White corn is largely non-traded, hence import and export quantities are reclassified under Yellow corn. The residuals of both commodities are imputed to other use.

For banana, mango, calamundin, pineapple and root crops, quantity produced, imported and exported are all drawn from the SUA. For fruits, quantity consumed is equated to the sum of quantity for processing and net food disposable from the SUA. For coffee, import and export values are drawn from the SUA. Primary production is equated to quantity produced, while other use is set to zero; quantity consumed is imputed from the residual. Data for rubber and tobacco is taken from the SUA. For rubber, quantity consumed is set to zero, while domestic consumption is attributed to other use. For tobacco, domestic consumption is equated to quantity consumed, while waste is equated to other use.

Poultry and livestock are all taken from the SUA. For chicken eggs and duck eggs, consumption quantity includes values for eggs hatched and processing, in addition to food disposable. For both pork and beef, quantity consumed includes processing, total carcass and offal food disposable. Note that in both poultry and livestock, quantity for other use is set to zero.

As no SUA are available for freshwater, brackishwater and marine water fisheries, quantity data were computed from SUA of representative commodities. Representative commodities are as follows: roundscad for Marine fish, tilapia for Freshwater fish, and the sum of milkfish, shrimps and prawns for

Brackish-water fish. Using the data from the supply and utilization accounts of these commodities, the ratio of quantity imported, exported, consumed (sum of total net food disposable and processing), and other use (residual) to quantity produced is computed, and applied to primary production to get the quantities that will be used for the database. Lastly, for seaweeds, it is assumed all production is exported, and imports are set to zero.

Values. Most value of production data are taken from CountrySTAT. Value of freshwater fisheries and inland fisheries are combined to obtain the value of Freshwater fish. Farmgate prices for these commodities were computed based on unit values. Where value data is unavailable, values are computed as a product of farmgate prices and output quantities; this applies to yellow and white corn, sugarcane, ampalaya, onion, and squash. Farmgate prices of white corn, ampalaya, onion, and squash are obtained from CountrySTAT. In the case of yellow corn, value is computed by subtracting the value of white corn from the value of corn as a whole. Value of imports and exports are obtained from Trademap (www.trademap.com). Import and export prices are proxied by unit values. Consumption is valued using retail price data from CountrySTAT. Where multiple retail prices are available the following convention was adopted:

1. Rice: average of Rice, special; Rice, well milled; and Rice, regular milled
2. White corn: Corn, grain white
3. Banana: Saba
4. Mango: Mango, carabao ripe
5. Pineapple: Pineapple, Hawaiian
6. Mongo: green mungbean
7. Onion: Bermuda Red, and Yellow Granex
8. Peanut: Peanut with shell, dried
9. Rubber: Rubber, cuplump
10. Freshwater fish: Tilapia
11. Marine fish: Roundscad
12. Brackishwater fish: Milkfish and Shrimp (weighted average)

Calibration and limitations. Calibration of model parameters requires a baseline data set (constructed along the preceding lines), along with several sets of elasticities. For crops, data on cost shares from Gergely (2012) calibrated the elasticities for the yield function; the overall elasticity of substitution of land use across crops was set at –2. For non-crop supply, own-price elasticity is generally set at modest levels (in the range of 0.2 to 0.3), and cross-elasticities to zero (Table A2.1).

Table A2.1: Own-price elasticities of supply of AMPLE products

crops	elasticity	other products	elasticity
rainfed rice	0.33	swine	0.3
irrigated rice	0.56	poultry	0.3
white corn	0.16	other live-stock	0.3
yellow corn	0.17	freshwater fish, capture	0.2
sugar	1.40	freshwater fish, aqua-culture	0.3
banana	0.49	brackishwa-ter fish	0.3
coconut	0.74	seaweed	0.2
mango	0.15	marine fish, capture	0.3
other fruit	0.07	marine fish, aquaculture	0.3
root crops	0.38		
vegetables	0.75		
other crops	0.53		

Source: Briones, 2010

For the demand side, for the LES the minimum food expenditure was estimated using the food subsistence threshold of the NSCB. Note that over a forty-year projection, allowance was made for adjustment of the marginal propensity to consume out of supernumerary income (that is θ_i,); presents the food consumption elasticities, based on estimates from APPC (2010), which models food consumption as an Almost Ideal Demand System (AIDS). However food expenditure elasticities of cereals were modified, setting that of rice to –0.1 and white corn to –0.05; adjustments were made in the other expenditure elasticities, in part to impose zero degree homogeneity in expenditure and prices.

Table A2.2 displays Armington elasticities of substitution and elasticities of transformation. Armington elasticities are based on degree of substitutability of the foreign and

Table A2.2: Own-, cross-price, and expenditure elasticities, based on AIDS parameters

cohort #	rice	corn wt	veg	swine	banana	sugar	poultry	coconut	mango	oth fruit	rootcrops	oth crop	oth livestock	fish fw	fish bw	fish mar	expenditures
rice	-0.39	0..07	-0.02	0.03	0.01	-0.03	0.04	-0.01	0.02	0.05	0.02	0.02	0.06	-0.02	-0.02	-0.02	-0.05
corn wt		-0.83	-0.18	-0.11	-0.01	-0.03	-0.07	-0.01	-0.02	-0.05	0.01	0	-0.06	-0.19	-0.19	-0.19	-0.05
veg			-0.54	0.08	-0.02	0.03	0.04	-0.02	0	-0.02	-0.01	-0.03	0.07	0.03	0.03	0.03	0.75
swine				-1.16	0.55	-0.12	1	-0.05	0.06	-0.06	0	0.06	0.11	0.03	0.03	0.03	0.96
banana					-1.01	-0.14	0.05	0.27	0.18	-0.03	0.05	0.16	-0.4	0.06	0.06	0.06	1.19
sugar						-0.79	0.64	-0.41	0.01	-0.03	-0.07	0	-0.04	-0.19	-0.19	-0.19	1.43
poultry							-0.48	-0.5	-0.18	-0.03	0.02	0.01	-0.48	-0.3	-0.3	-0.3	1.34
coconut								-0.8	0.06	0.04	0	0.01	0.35	-0.43	-0.43	-0.43	1.1
mango									-1.55	-0.09	0	-0.03	0.11	0.35	0.35	0.35	1.21
oth fruit										-0.85	0.02	0	-0.1	-0.09	-0.09	-0.09	1.75
rootcrops											-0.39	0.3	-0.31	-0.49	-0.49	-0.49	1.42
oth crop												-0.89	-0.36	-0.34	-0.34	-0.34	1.62
oth livestock													-0.49	0.07	0.07	0.07	1.69
fish fw														-0.16	0.12	0.12	1.29
fish bw															-0.16	0.12	1.29
fish mar																-0.16	1.29

Source: Briones, 2010.

domestic versions of the commodity; higher values imply greater ease of substitution. Elasticities of transformation capture the degree flexibility in which suppliers treat foreign and domestic markets as alternative destinations. Estimates are based on figures used in the APEX model and reported in Cororaton (2000). Elasticities of transformation are reduced (in absolute terms) for rice, root crops (cassava), sugar, and brackishwater fish due to thin or highly distorted world trade.

The scenario analysis to be discussed shortly takes the form of deterministic simulations, i.e. based on evolving supply and demand fundamentals, omitting annual shocks in supply, demand, and trade. Another omission is the role of stocks; such omission is fairly standard in the literature and is partly due to patchy and unreliable stock data. Finally, the model takes off from a base year data set assumed to represent a market in equilibrium; we do however recognize the possibility of distortions affecting the base year outcomes hence not at or even far from equilibrium.

For a one commodity however, namely rice, we do attempt to make some corrections for production shocks (e.g. the El Nino-induced drought of 2010), and excess importation and stock build up in the years 2008–2010. Imports are currently being reduced by the stock draw-down under the current administration; however once stocks levels are rationalized, no further reduction in imports by this method are feasible. According to BAS data, over the period June 2010 to June 2012, rice stocks fell by 1.07 million t; from 2010 to 2011, imports declined by 1.7 million tons.

Scenarios

Among the variables that AMPLE takes as given or exogenous are the following:

1. Total agricultural area
2. Population
3. Per capita income
4. Level of productivity: $\alpha 0YU_i, \alpha 0YM_i, \alpha 0OAgU_i$

TABLE A2.3: ARMINGTON ELASTICITIES OF SUBSTITUTION AND ELASTICITIES OF TRANSFORMATION

crop/activity	Armington	transformation	crop/activity	Armington	transformation
rice	-4.0	0.1	vegetables	-0.1	2.0
white corn	-2.0	2.0	other crops	-2.0	2.0
yellow corn	-3.7	2.0	poultry	-1.4	2.0
sugar	-2.0	0.1	swine	-2.0	2.0
coconut	-2.0	5.0	other livestock	-1.3	2.0
banana	-1.1	5.0	freshwater fish	-2.0	2.0
mango	-2.0	5.0	brackishwater fish	-0.1	0.1
other fruits	-2.0	0.1	seaweed	-2.0	5.0
root crops	-0.1	2.0	marine fish	-1.1	0.1

Source: Asia Pacific Policy Center, 2010.

5. Area harvested (price-independent component):

$$\beta U_i, \beta M_i$$

6. World prices

7. Import tariffs

Changes in these exogenous variables represent real world drivers for the evolution of the agricultural sector over the projection horizon. We posit two scenarios, namely a Pessimistic scenario and an Optimistic scenario.

The scenarios are distinguished by different rates of growth for income, productivity, area (price-independent component), as well as tariff reduction policy. Both scenarios adopt the Medium variant of the UN population projections. Growth rate of area composite is set at modest levels in both scenarios. Growth rates of world prices are based on the Commodity Price Forecast of World Bank (2012). Note that the model price projections are in real terms based on fixed base year prices, hence the projections pertain to fixed $US. Note that for rice, the scenarios posit stable real prices, i.e. the base year world rice price approximates long term equilibrium.

The scenarios for income growth adopt the associated Centennial Group Growth Model runs for the Philippines. Guidance for assigning productivity growth is obtained from expert judgment (Harrison, 2012; Dy, 2012; Van Santen, 2012; van Engelen, 2012). Under the Pessimistic scenario, productivity growth is kept at about 1–2%; at the upper end of the range are Banana, Mango, Other fruit, Root crops, Seaweed, Poultry, Swine, Freshwater fish—aquaculture, and Marine fish—aquaculture. Only Coconut experiences a lower productivity growth of 0.4%. Productivity growth under the Optimistic scenario is typically faster, by 1 to 2 percentage points (i.e., TFP growth of 2–3%), and even greater in the case of Marine fish—aquaculture. Conservative productivity growth assumptions are applied for rice in both scenarios.

Furthermore, price-independent area growth is applied Coconut, Banana, Other fruit, and other tree crops and tobacco (the tree crops), from 2016 onward. This accounts for expansion in investment these crops once property

TABLE A2.4: ASSUMPTIONS ON AGRICULTURE- OR ECONOMY-WIDE GROWTH RATES, 2010–2040 (%)

	pessimistic	optimistic
area composite	0.0	0.3
population	2010–2015: 1.68 2015–2020: 1.58 2020–2025: 1.47 2025–2030: 1.35 2030–2035: 1.22 2035–2040: 1.08	same
per capita income	Centennial estimates net of population growth	Centennial estimates net of population growth
wage	1 pct- point below per capita growth	3 pct- point below per capita growth

Source: Briones, 2010

Table A2.5: Assumptions for commodity-specific growth rates, 2010–2040 (%)

	pessimistic			optimistic			world prices	
	yield	tariff	area	yield	tariff	area	import	export
rice		0			0		0	na
rainfed	varies		0	varies		0		
irrigated	varies		0	varies		varies		
white corn	1	na	0	2	na	0	na	na
yellow corn	1	0	0	2	to 5%	0	-1	0
coconut	0.4	na	0	2.4	na	0	na	-3
sugarcane	1	AFTA	0	2.5	AFTA	0	-3	0
root crops	2	0	0	3	to 5%	0	0	0
banana	2	na	0	3	na	-0.5	na	-2
mango	2	na	0	3	na	0	na	0
other fruits	2.5	0	-0.2	3.5	to 5%	-0.5	0	0
vegetables	1	0	0	3	0	0	0	0
other crops	1	0	-0.2	2	to 5%	-0.5	-2	0
swine	2	0	na	3	to 5%	na	-2	na
poultry	2	0	na	3	to 5%	na	-2	0
other livestock	1	0	na	2	to 5%	na	-1	na
freshwater fish	1.5	na	na	3	na	na	na	na
brackishwater fish	1	0	na	2	to 5%	na	2	0
seaweed	2	na	na	4	na	na	na	2
marine fish	3	0	na	6	to 5%	na	2	0

Source: Centennial based on notes below
Notes:
AFTA schedule for Philippine sugar tariffs (%): 2010: 38; 2011: 38; 2012: 28; 2013: 18; 2014: 10; 2015: 5.
Annual productivity growth for rice under Pessimistic scenario: rain fed, 1% (to 2025), 0.5% (to 2030); irrigated, 1% (to 2040). Under Optimistic scenario: rain fed, 2% (to 2024), 1% (to 2030); irrigated, 2% (to 2011), 3% (to 2020), 2% (to 2025), and 1% (to 2040).
Import and export price assumptions are applied 2010–2025 and zero change thereafter, with the exception of seaweed export price growth, which continues at 1% p.a. 2026–2040.
"To 5%" assumes a 5 percentage point drop in tariffs from 2012 onward until a 5% level is attained.
For the area term, a negative change implies an increase in the area share. The changes are applied only from year 2016 onwards. In the case of rice, under the Optimistic scenario the change is 1% from 2016 to 2040, to capture conversion of irrigated areas for other use given rapid income growth.

rights issues are resolved upon completion of the agrarian reform program in 2016. The growth rates vary from 0.5% to 1% under the Optimistic scenario; under the Pessimistic scenario, these rates are adjusted downward (even to zero in the case of Banana).

Finally, the Optimistic scenario posits tariff reduction as the country opts to open agriculture to world competition; the exception is rice, where the current protection regime is maintained even in the long run. The Pessimistic scenario maintains a largely closed policy (no tariff reduction), with the exception of Sugar. The reason is that the Philippines has committed to reducing tariffs from its major source of imports, namely Thailand, under the ASEAN Free Trade Agreement (AFTA).

References

Briones, R. and Galang, I., 2012. Assessment of Prospective Impact of Fruits and Vegetables Research at the Industry Level in the Philippines: The Case of the ACIAR-PCAARRD Horticulture Project. A paper presented at the ACIAR-PCAARRD End-of-Program Conference July 3, 2012, Cebu City

Briones, R., 2010. Scenarios and Options for Productivity Growth in Philippine Agriculture: An Application of the Agricultural Multimarket Model for Policy Evaluation (AMPLE). Discussion Paper No. 2010–05. PIDS, Makati.

Briones, R., Multimarket Modeling of Agricultural Supply when Crop Land Is a Quasi-fixed Input: A Note. Discussion Paper No. 2011–29. PIDS, Makati.

Cororaton, C., 2000. The Philippine Computable General Equilibrium Model. Discussion Paper No. 2000–33. PIDS, Makati.

Martin, N.J., and J.M. Alston, 1994. A dual approach to evaluating research benefits in the presence of trade distortions. American Journal of A

[Note: Sets, variables and equations for AMPLE are available on request.]

Annex 3—Household Survey Analysis and Rice Consumption Patterns

Family Income and Expenditures Household Survey Analysis: Engel Curves for Forecasts of Rice Consumption, 2040

Although the Family Income and Expenditure Surveys (FIES) conducted regularly by the Philippine government are widely relied on for analysis of expenditure patterns and poverty levels in the country, information in the FIES database on quantities of food products consumed is not published and had not previously been analyzed for purposes of informing the debate about trends over time in consumption per capita of rice and other foods, across rural and urban areas, and income cohorts. This analysis aimed to contribute to a better understanding of those trends, as an essential input to long-term food security planning and strategy formulation.

The analysis was prepared by Professors Joseph V. Balagatas of Purdue University; Jose M. Yorobe, University of the Philippines, Los Banos; and Roderick M. Rejesus, North Carolina State University. The work benefited from support by the International Rice Research Institute (IRRI), which made available the Family Income and Expenditure Survey databases that it had acquired for 2000, 2003, 2006 and 2009; and the Philippines National Statistical Office (NSO) staff responsible for implementation of the FIES, who generously provided time, advice and unpublished data to the study team. Principal findings of the analysis are summarized in Chapter 5; this Annex elaborates on details, in particular regarding econometric aspects.

Introduction

Rice is a staple food commodity in the Philippines, serving as both a crucial source of calories for most Filipinos, as well as an important source of income for many Filipino farmers and allied industries. Thus rice consumption is at the crux of key issues of economic development and food security for the country. In this report, we document recent trends in consumption of rice and other foods in the Philippines using data from the Food Income and Expenditure Survey (FIES). We use the survey data to report average food expenditures and consumption for the country, and disaggregated by certain demographic dimensions of interest. We also explore changes in expenditure and consumption over time, and discuss the underlying factors that likely drive those changes.

The data summary reveals that rice continues to be the main cereal in the Filipino diet, with bread consumption rising in importance, but mainly among the wealthy, urban population. Rice expenditure and rice consumption have increased modestly from 2000–2010, despite rising real prices of rice. It appears that this trend may be a reaction of consumers to changes in the relative prices of corn and other cereals.

We use the FIES data to estimate an Engel curve for rice, the empirical relationship between rice expenditure (or consumption) and total expenditure. Our analysis confirms that rice continues to be a normal good in the Philippines, and that rice consumption rises as income and total expenditure rise. We find some evidence that rice becomes an inferior good at very high levels of income (approximately twice the current mean), but only in rural areas. Thus, barring some structural shift that disrupts this fundamental economic relationship, we expect per capita rice consumption to continue to rise for some time, as incomes in the Philippines rise with continued development.

We use the estimated Engel curve to forecast rice consumption in year 2040, based on alternative scenarios of economic growth (drawn from the Centennial Group Growth Model). In a scenario of only moderate economic growth (re-

ferred to as the 'pessimistic growth scenario' , we forecast national average per capita rice consumption to rise by a country-wide average of 8% by 2040, from 105 kg to 114 kg, including and 15% increase among rural households. In a scenario of faster economic growth (the more 'optimistic scenario'), we forecast national average per capita rice consumption to grow by 13%, to 119 kg.

Aggregate rice consumption will also increase as the Philippines population continues to grow. The United Nations forecasts the Philippines population to grow by approximately 50% by 2040, with a doubling of the urban population. Combining growth in rice consumption driven by population growth, and growth in rice consumption driven by economic growth, we forecast aggregate rice consumption in the Philippines to increase by between 64% (pessimistic economic growth scenario) and 72% (optimistic economic growth scenario) by 2040. In addition to rising consumption, we find rice expenditure to fall significantly as a share of total expenditure in all scenarios; from 9% to 5% in the pessimistic economic growth scenario, and from 9% to less than 4% in the optimistic economic growth scenario.

The Family Income and Expenditure Survey

The Family Income and Expenditure Survey of the Philippines is a regular activity conducted by the National Statistics Office (NSO) mainly to track household income and expenditure information in the country. Starting in 1957 on a five-year interval and on a three-year interval after 1985 to 2009, the data are gathered using a structured questionnaire to include information on family income and level of consumption by type of expenditure. It also includes other related data on family size, employment, age, education, and housing. Expenditures are disaggregated into food consumption by type, use of utilities, durable and non-durable furnishings, payment of taxes, and other disbursements such as gifts, purchase of properties and appliances, payment of loans, deposits and housing construction or rentals. This composition has evolved over the FIES survey years as more of the non-food family expenditures have been incorporated in the more recent surveys.

The FIES is conducted nationwide to include all households using a stratified two-stage cluster sampling scheme with rural and urban classification of each province as principal domains and the administrative regions in the country as the sampling domains (Ericta and Fabian, 2009). The Census of Population is commonly used as the sampling frame where the primary sampling units (PSU—a village or group of villages having at least 500 households) are stratified according to large PSUs and other PSUs classified by province, highly urbanized city, or independent component city. This is further stratified based on some socio-economic variables related to poverty incidence. The samples are selected by dividing the entire master sample consisting of PSUs into four sub-samples. The final number of sample PSUs for each domain is determined by first classifying the PSUs as self-representing (a large PSU with selection probability of 1 or higher) and non-self-representing (too small PSUs). In the second stage, enumeration areas (discernible area in a village with about 150 contiguous households) and in the third stage, housing units are selected in each enumeration area. Sampling weights or expansion factors are applied to the data obtained from the sample households to derive estimates for the larger population (see ibid, for the weighting procedures). The semestral recall method of the survey was started in 1985. The household sample also grew substantially from less than 10,000 (1957) to over 50,000 (2006). Over the years, the survey design and questionnaire have been improved and modified in various other ways as well, but since the 2003 FIES, the design using the above structure has basically been followed.

Patterns in Rice and Food Consumption

Food and Rice. The FIES design allows inference on food expenditure and consumption patterns for the nation as a whole, as well as for sub-populations. Of particular interest for food and rice consumption are the potentially distinct rice consumption trends for rural and urban populations. Table A3.1 reports mean expenditures for all food and select cereal items as a share of total expenditure for the four survey years.

TABLE A3.1: EXPENDITURE SHARES FOR FOOD AND CEREALS: ALL, URBAN, AND RURAL HOUSEHOLDS, 2000–2009 (% OF TOTAL EXPENDITURE)

Food/Year	2000	2003	2006	2009
ALL HOUSEHOLDS				
All Food	43.64	43.08	41.37	42.61
of which, Cereals	11.93	11.08	10.87	12.04
Rice	8.41	7.69	7.79	8.94
Corn	0.79	0.73	0.58	0.52
Bread	1.27	1.30	1.23	1.26
Noodles	0.21	0.17	0.13	0.13
Other cereals	1.25	1.20	1.13	1.18
Total food eaten inside the home	38.67	37.67	35.55	36.55
Total food eaten outside the home	4.97	5.41	5.82	6.06
URBAN HOUSEHOLDS				
All Food	39.90	n.a.	38.29	39.49
of which, Cereals	8.98	n.a.	8.25	9.24
Rice	6.09	n.a.	5.67	6.60
Corn	0.24	n.a.	0.18	0.15
Bread	1.25	n.a.	1.23	1.27
Noodles	0.18	n.a.	0.11	0.10
Other cereals	1.22	n.a.	1.06	1.11
Total food eaten inside the home	34.25	n.a.	31.52	32.46
Total food eaten outside the home	5.65	n.a.	6.77	7.03
RURAL HOUSEHOLDS				
All Food	51.78	n.a.	47.64	48.67
of which, Cereals	18.36	n.a.	16.22	17.45
Rice	13.45	n.a.	12.12	13.47
Corn	2.00	n.a.	1.40	1.24
Bread	1.31	n.a.	1.24	1.25
Noodles	0.27	n.a.	0.19	0.17
Other cereals	1.32	n.a.	1.28	1.32
Total food eaten inside the home	48.30	n.a.	43.76	44.47
Total food eaten outside the home	3.48	n.a.	3.88	4.20

Source:

After having declined slowly since the early 1960s (53.8% in 1961, 53.7% in 1971, and 48.6% in 1991), the food share of total household expenditures in the Philippines has held steady at just above 40% during the first decade of the 21st Century. Similar patterns are observed in rural and urban areas, although at different levels. The average food share in urban locations is just below 40%, while the average food share in rural Philippines remains close to 50%.

The share of total expenditures allocated to rice fluctuated around 8% throughout the past decade, ranging from 7% in urban areas to 13% in rural areas. In all cases, the share of rice in total expenditure rose slightly towards the end of the period. This was caused in part by rising prices, including the dramatic price spikes observed in global rice markets beginning in 2007–08. Rice prices rose more slowly than did those of corn and other cereals (Table A3.2). As can be seen from a breakdown of cereals expenditures, consumer—particularly rural consumers—shifted away from corn and towards rice and other cereals (Table A3.3). The share of cereals expenditure allocated to corn in rural areas fell from 14% in 2000 to only 7% in 2009. The expenditure shares of bread have also increased, driven in part by increased consumption of loaf bread. The expenditure shares for all cereals grew slightly over the decade (Table 2), approaching 11% for the country as a whole, 9% in urban areas, and near 17% in rural areas. Rice comprised by far the largest component of cereals expenditure: more than 70% nationally, approximately 70% for urban households, and approximately 75% for rural households. Thus rice remains a vital food source and significant household expense in the Philippines.

However, increased consumption throughout the decade also contributed to rising rice expenditure. Despite rising prices, national average per capita consumption of rice grew from 102.8 kg per year in 2000 to 105.3 kg per year in 2006 (Table A3.4). Urban rice consumption grew by approximately 4% during that time span. Rural rice consumption grew more slowly, buoyed by increased consumption of subsidized rice from the National Food Authority (NFA)[1].

A comment on FIES vs. BAS estimates of rice consumption. The Philippine government's Bureau of Agricultural Statis-

1 It is important to note that per capita consumption figures are calculated as household expenditure or consumption divided by the number of family members reported for the household. This calculation may slightly distort per capita consumption for those households where some of the household food is consumed by non-family household members, especially among relatively high-income households with domestic servants. However, because the number of non-family household members has remained relatively stable over time, the estimates of trends in per capita consumption are reasonably accurate.

Table A3.2: Consumer Price Indices, Philippines, 1990–2010 (2000=100)

	1990	1995	2000	2005	2006	2007	2008	2009	2010
ALL ITEMS	44.9	73.2	100	129.8	137.9	141.8	155	160	166
FOOD, BEVERAGES AND TOBACCO	49.6	76.9	100	123.8	130.6	134.9	152.3	161.2	166.1
FOOD	49.6	76.8	100	123.9	130.7	135	153.3	162.4	167.4
Cereals and Cereal Preparation	49.8	78.5	100	119.9	125.1	129.6	162.4	174.4	176.8
Rice	48.7	79.4	100	115.2	119.5	123.6	159.7	171.6	173.5
Cereal Preparation	51.7	75.7	100	133.3	141.2	146.6	169.6	182.2	188
Dairy Products	54.5	77.7	100	143.1	151.7	160	180.5	191.8	195.1
Eggs	58.6	79.2	100	119	125.7	134.2	143.4	153.1	157.3
Fish	42.7	69.5	100	126.9	133.5	137.9	150.4	159.6	164.5
Fruits and Vegetables	42.9	66.3	100	116.6	126.9	130.6	145.9	154.5	155.3
Meat	55.5	83.2	100	128.9	132	135.4	147.5	155.5	161.9

Source: BAS.

tics (BAS) has published estimates of national average per capita consumption of 103 kg in 2000 and 107 kg in 2003, quite similar to those derived from analysis of the FIES data. However, while the FIES estimate for 2006 remains basically unchanged at 105 kg, BAS estimates rose dramatically to 118 kg in the same year. Such a large change in per capita rice consumption over such a short period of time is surprising, as food consumption habits to shift gradually over time. Moreover, the large, sudden departure of the BAS estimates from the FIES estimates is puzzling. One potential source of the discrepancy is the fact that the FIES rice consumption figures reported in FIES account for only rice prepared and eaten in the home. The share of food expenditure allocated to food prepared or eaten outside the home grew from approximately 13% in 2000 to 17% in 2006, but the composition of such expenditures is not recorded and therefore it is impossible to know how much rice is eaten outside the home (para. 13). But the fact that the expenditure share has not changed dramatically, at least compared to the changes in BAS estimates of rice consumption, suggests that this probably does not account for the rice-consumption discrepancy. Another possible explanation has to do with the BAS methodology. BAS estimates are based on aggregate data on production, storage, imports, and population (without migration), and each is potentially prone to measurement issues.

Food eaten outside the home, and entertainment. Expenditure shares for food eaten outside the home rose dramatically in both urban and rural areas, approaching 9% of total expenditure (22% of food expenditure) in urban areas, and 5% of total expenditure (11% of food expenditure) in rural areas. The FIES surveys do not allow for more detailed analysis of food eaten outside the home. This food category comprises a large and growing share of food expenditures with important consequences for economic wellbeing, nutrition, and consumption, and it would therefore be highly desirable for future FIES surveys to begin tracking the allocation of expenditures outside the home, at least among major food categories. Finally, there is an additional category of relevant expenditures that is not included in the food section of the FIES, namely expenditures on food and non-alcoholic beverages for entertainment purposes, which was equivalent to about 2% of total, or 5% of food expenditures in 2009. As with food eaten outside the home, this category of expenditure is not disaggregated in the FIES and therefore it is not possible to determine shares of main food groups. The combination of food eaten outside the home and food procured for entertainment purposes, on the other,

TABLE A3.3: EXPENDITURE SHARES FOR CEREALS, ALL, URBAN AND RURAL HOUSEHOLDS, 2000–2009 (% OF CEREALS EXPENDITURE)

Cereal/Year	2000	2003	2006	2009
ALL HOUSEHOLDS				
Rice	70.47	69.39	71.64	74.29
Corn	6.65	6.56	5.35	4.35
Bread	10.65	11.74	11.34	10.5
Noodles	1.73	1.51	1.24	1.04
Other cereals	10.5	10.8	10.43	9.82
Noodles	0.21	0.17	0.13	0.13
Other cereals	1.25	1.20	1.13	1.18
URBAN HOUSEHOLDS				
Rice	67.83	n.a.	68.68	71.46
Corn	2.63	n.a.	2.2	1.64
Bread	13.96	n.a.	14.93	13.77
Noodles	1.96	n.a.	1.32	1.12
Other cereals	13.63	n.a.	12.87	12.01
Noodles	0.18	n.a.	0.11	0.10
Other cereals	1.22	n.a.	1.06	1.11
RURAL HOUSEHOLDS				
Rice	73.28	n.a.	74.7	77.18
Corn	10.92	n.a.	8.62	7.12
Bread	7.14	n.a.	7.62	7.16
Noodles	1.49	n.a.	1.16	0.96
Other cereals	7.17	n.a.	7.9	7.58
Noodles	0.27	n.a.	0.19	0.17
Other cereals	1.32	n.a.	1.28	1.32

Source: Centennial eestimates, FIES data.

equaled about 19% of total food expenditures in 2009 (up from about 4% in the early 1960s).

Food consumption patterns by income. Food expenditure and consumption patterns show some differences between urban and rural populations (Tables A3.1 and A3.3). However, a breakdown of food expenditures and consumption by income levels suggests that the urban-rural differences are driven in part by differences across income groups (Table A3.5). For either 2006 or 2009, differences across income groups are dramatic, whereas urban-rural differences for the same income group are generally small. For example, in 2009, food's share of total expenditure was approximately 63% among those in the lowest income quintile in both urban and rural areas, and was approximately 30% among those in the highest income quintile in both urban and rural areas.

Consumption differences across income groups are more dramatic than expenditure differences (Table A3.6). In 2006 per capita rice consumption in the lowest income quintile was approximately 90 kg, approximately 20 percent lower than the second lowest quintile, and 24 percent lower than the highest quintile. NFA rice accounts for approximately 15 percent of rice consumption in the lowest income quintile, and approximately 1 percent in the highest income quintile. The differences across income groups notwithstanding, there appear to be some real differences between rural and urban consumers. In particular, rice consumption in all income quintiles except the lowest is significantly higher in rural households than in urban ones.

ENGEL CURVES FOR RICE

An Engel curve describes how consumer expenditure for a good relates to total expenditure or income. Engel curves determine expenditure elasticity, and thus whether a good is

TABLE A3.4: PER CAPITA QUANTITIES OF RICE AND SELECTED CEREALS CONSUMED, FOR ALL, URBAN, AND RURAL HOUSEHOLDS, 2000–2006

food group	units	2000	2003	2006
ALL HOUSEHOLDS				
Rice	kg	102.8	106.6	105.3
Rice, 1st class and ordinary	kg	95.6	99.4	98.1
Rice, NFA	kg	6.1	7.1	6.6
Noodles	kg	1.5	0.6	0.8
Bread, loaf	grm	1025	927	1150
Pandesal	pieces			
URBAN HOUSEHOLDS				
Rice	kg	100.9	n.a.	104.1
Rice, 1st class and ordinary	kg	94.6	n.a.	99.4
Rice, NFA	kg	5.6	n.a.	4.5
Noodles	kg	1.6	n.a.	0.8
Bread, loaf	grm	1663	n.a.	1756
Pandesal	pieces	287.3	n.a.	208.9
RURAL HOUSEHOLDS				
Rice	kg	104.5	n.a.	105.9
Rice, 1st class and ordinary	kg	96.6	n.a.	96.9
Rice, NFA	kg	6.6	n.a.	8.6
Noodles	kg	1.4	n.a.	0.8
Bread, loaf	grm	412	n.a.	561
Pandesal	pieces	121.2	n.a.	82.5

Source: Centennial eestimates, FIES data.

TABLE A3.5: EXPENDITURE SHARES BY NATIONAL INCOME QUINTILE, URBAN AND RURAL HOUSEHOLDS, 2006 AND 2009

	0%–10%	20%–39%	40%–59%	60%–79%	80%–99%	0%–19%	20%–39%	40%–59%	60%–79%	80%–99%
Food/Income Quintile	2006—URBAN HOUSEHOLDS					2006—RURAL HOUSEHOLDS				
All food	60.58	55.99	50.69	42.91	30.17	62.6	55.8	49.34	41.36	30.33
Cereals	25.22	17.81	13	9.11	4.83	28.66	20.8	15.49	10.75	6.22
Rice	19.66	13.65	9.43	6.23	2.93	20.93	16.2	11.87	7.93	4.24
Corn	1.96	0.56	0.21	0.13	0.07	4.71	1.39	0.66	0.3	0.11
Bread	1.7	1.76	1.66	1.42	0.96	1.3	1.43	1.34	1.2	0.92
Other cereals	1.9	1.84	1.69	1.34	0.87	1.71	1.77	1.61	1.32	0.94
All food eaten at home	57.13	50.41	43.68	35.76	23.34	60.14	52.25	44.97	36.6	26.12
All food eaten outside	3.45	5.58	7.01	7.15	6.83	2.46	3.55	4.37	4.76	4.21
	2009—URBAN HOUSEHOLDS					2009 RURAL HOUSEHOLDS				
All Food	63.13	57.1	51.67	44.62	30.5	63.5	57.15	51.36	42.76	30.86
Cereals	26.69	18.89	14.12	10.13	5.49	30.05	22.31	16.94	12.05	7.04
Rice	21.68	14.75	10.6	7.18	3.45	22.95	17.81	13.32	9.23	4.97
Corn	1.4	0.99	0.32	0.14	0.06	4.13	1.29	0.6	0.22	0.09
Bread	1.71	1.76	1.64	1.45	1.03	1.24	1.4	1.39	1.23	1
Other cereals	1.9	1.39	1.55	1.36	0.96	1.72	1.81	1.63	1.37	0.98
All food eaten at home	58.67	50.83	44.13	36.82	23.7	60.69	53.08	46.49	37.82	26.55
All food eaten outside	4.46	6.27	7.54	7.8	6.8	2.81	4.07	4.87	4.94	4.31

Source: Centennial estimates, FIES data.

a normal good (expenditure rising with total expenditure) or an inferior good (expenditure falling with total expenditure). Engel curves are of particular importance to rice markets because rice is a staple food commodity for hundreds of millions of the world's poor, many of whom live in Asia. Thus, a major question for rice markets, and for those interested in poverty and food security, is what will happen to rice consumption as Asian economies continue to develop? Thus here we develop empirical estimates of Engel curves for rice in the Philippines. We specify an econometric model of rice expenditures as follows:

$$\ln(y_i) = \beta_0 + \beta_1 \ln(x_i) + \beta_2 \ln(x_i)^2 + [\beta_0^u + \beta_1^u \ln(x_i) + \beta_1^u \ln(x_i)^2]Urban_i + \mathbf{Z}_i'\boldsymbol{\theta} +$$

where y_i is per capita rice expenditure for household i, x_i is per capita total expenditure for household i, Z_i is a vector of household characteristics that may affect rice consumption, including family size and regional indicator variables, e_i is a stochastic error term, and the βs and θ are parameters to be estimated econometrically. Note that we the term Urbani is an indicator variable equal to 1 if household i is located in an urban area and equal to zero otherwise. Our Engel curve specification is quadratic in the natural log of total expenditure, allowing for curvature of the Engel curve. Also, we interact the urban indicator with the intercept and total expenditure terms to allow different shapes to the Engel curves for rural and urban households. The elasticity of rice expenditure with respect to total expenditure obtains as the first derivative of the model with respect to $\ln(x_i)$ as follows:

$$E \equiv \frac{\partial \ln(y_i)}{\partial \ln(x_i)} = \beta_1 + 2\beta_2 \ln(x_i) + [\beta_1^u + 2\beta_1^u \ln(x_i)]Urban_i.$$

We estimate the model on each of the FIES data sets for 2000, 2006, and 2009. By estimating the model on cross sections of data, we rely on cross-sectional variation—variation across different households in a given year—to identify the model parameters. The cross-sectional analysis may be interpreted as capturing a long-run relationship between total expenditure and rice expenditure in the sense that households with higher total expenditures give a glimpse of what rice expenditure would be for households with lower total expenditures as total expenditure rises. The underlying

Table A3.6: Per capita quantities of rice and selected cereals consumed by income quintile, all , urban, and rural households, 2006

		Income quintile				
	Units	0%–19%	20%–39%	40%–59%	60%–79%	80%–99%
Food Category			ALL HOUSEHOLDS			
Rice	kg	89.8	108.1	111.2	110.0	111.4
Rice, 1st class and ordinary	kg	76.6	99.6	105.8	107.2	109.9
Rice, NFA	kg	12.9	8.2	5.1	2.6	1.2
Bread, loaf	grm	113	319	675	1,389	4,152
Pandesal	pieces	50.3	103.9	157.2	214.1	250.2
Noodles	kg	0.4	0.6	0.8	0.9	1.4
			URBAN HOUSEHOLDS			
Rice	kg	92.7	101.1	104.0	105.8	108.6
Rice, 1st class and ordinary	kg	78.6	93.9	98.9	102.9	107.3
Rice, NFA	kg	13.9	7.1	4.9	2.7	1.0
Bread, loaf	grm	167	345	694	1,449	4,399
Pandesal	pieces	84.9	143.7	198.5	245.5	266.7
Noodles	kg	0.4	0.5	0.6	0.8	1.3
			RURAL HOUSEHOLDS			
Rice	kg	89.16	112.2	120.0	120.0	123.0
Rice, 1st class and ordinary	kg	76.15	103.0	114.3	117.2	120.6
Rice, NFA	kg	12.67	8.8	5.3	2.3	1.9
Bread, loaf	grm	99	304	651	1,248	3,136
Pandesal	pieces	41.9	80.5	106.5	140.1	182.4
Noodles	kg	0.4	0.7	0.9	1.8	1.8

Source: Centennial estimates, FIES data.

assumption is that the model captures the relevant heterogeneity, and that there are no unobserved or omitted factors that influence rice expenditure and that also are correlated with the included regressors on the right-hand side of the regression (i.e., we assume the regressors are exogenous).

Key model results for each year are reported in Table A3.7, and estimates of expenditure elasticities for rice are reported in Table A3.8. Comparing parameter estimates across years (columns) in Table A3.7 and A3.8 indicates that results are robust to survey year. That is, our results are very similar for all three years. Parameter estimates are statistically significant at the conventional thresholds, and are of the expected signs.

In particular, when estimating the elasticities at the means of the data, we find that rice is a normal good (Table A3.8); as total expenditure rises, rice expenditure also rises but by only a fraction of the growth in total expenditure. Further, rice expenditure is more responsive to total expenditure in rural areas than in urban areas. For example, in 2009 we estimate an expenditure elasticity of 0.39 in rural areas and 0.18 in urban areas.

The income elasticities of rice consumption reported in Table A3.7 reflect different consumption patterns in rural and urban populations. In particular, while rice consumption tends to increase as income grows in both rural and urban areas, rice consumption is less than half as responsive to income in urban areas than in rural areas. This finding may reflect more diversified diets in urban areas. For example, urban households tend to consume more bread (sliced bread and pandesal) than rural households (Table A3.6).

Moreover, the quadratic terms in our Engel curve specification allow the expenditure elasticity to change as total

Table A3.7: Select results from a log-log parametric model of an Engel Curve for rice expenditure: dependent variable=ln(rice expenditure)

	2000	2006	2009
ln (Total Expenditure)	2.450	2.602	2.450
	0.272	0.192	0.173
ln(Total Expenditure)^2	–0.098	–0.103	–0.094
	0.012	0.008	0.007
Urban*ln(Total Exp)	–2.080	–1.657	–1.729
	0.462	0.243	0.212
Urban*ln(Total Exp)^2	0.088	0.069	0.070
	0.020	0.010	0.070
Urban	12.132	9.966	10.554
	2.646	1.433	1.273
Ln(family size)	–0.079	–0.073	–0.077
	0.002	0.002	0.001
N	37,971	37,482	37,747
R2	0.14	0.14	0.16

Source: Centennial eestimates.

Table A3.8: Estimated elasticities of rice expenditure with respect to total expenditure

	2000	2006	2009
rural	0.37	0.34	0.39
urban	0.16	0.12	0.18

Source: Centennial, using AMPLE model.

expenditure changes. To illustrate, we plot the estimated Engel curves for rural and urban households (Figure A3.1). For urban households, rice expenditure becomes less responsive to total expenditure as total expenditure rises, and the expenditure elasticity (the slope of the Engel curve) approaches zero but remains positive throughout the range of the data. For rural households, the Engel curve eventually slopes downward, meaning that above a certain threshold total expenditure rice expenditure begins to decline with additional total expenditure. That threshold, where the expenditure elasticity is zero, and beyond which additional increases in total expenditure cause rice expenditure to fall, occurs at a value of log rice expenditure of approximately 11.1. Thus, given the 2009 mean log rice expenditure of 10.1, total expenditure would have to rise by 100% before this threshold is met.

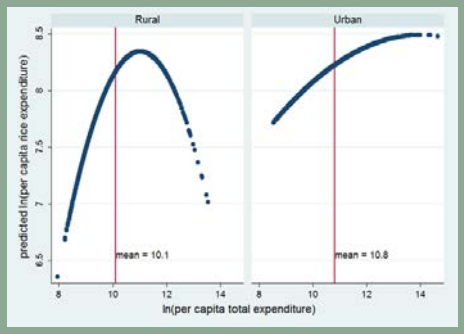
The key finding, that rice remains a normal good over a large range of incomes, is somewhat surprising, given the experience of some other countries in East Asia. However, it is broadly consistent with previous analyses of rice consumption in the Philippines (among others, Balisacan et al.; Ito et al.; Timmer et al.), and with the observed patterns published by BAS (though not necessarily the same absolute quantities). To the extent that some households might shift away from rice at higher incomes, we would expect to observe this behavior more in urban areas than in rural areas. It is important to note that, because the Engel Curves depicted in Figure A3.1 are point estimates, they are less precise at the extremes of the data. That is, there is somewhat less confidence in the estimated Engel curves at higher and lower incomes where there are relatively fewer observations. However, the estimates are most precise near the means of the data. Thus the analysis placed greater emphasis on the estimates of expenditure elasticity of rice consumption evaluated at mean income, and these estimates were used to forecast mean response of rice consumption to income growth.

Finally, an analogous model for rice consumption (not expenditure) was estimated for 2006, where the log of per capita rice consumption replaced the log of per capita rice expenditure as the dependent variable in the regression, and all right-hand side of the model remained unchanged. Results from this model were qualitatively and quantitatively similar to the expenditure results reported in Table 8. Thus, we can interpret predicted percentage changes in rice expenditure as equivalent percentage changes in consumption.

Forecasting Rice Expenditure and Consumption through 2040

We look to forecast the impacts on rice consumption of two major socio-economic forces expected to influence the Philippines in the coming decades, economic growth and population growth. To forecast the impact of economic

Figure A3.1: Estimated Engel Curves for household rice expenditure in the Philippines



Source: Centennial.
Note: Predicted values are computed at estimated population means, and are based on parameter estimates reported in Table A3.10.

growth, we take estimates of changes in total consumption and apply them to the estimated Engel curve for 2009.

We use GDP optimistic and pessimistic estimates from the Centennial Group Growth Model, and next, we use the 2009 FIES data to estimate an econometric relationship between income (GDP) and total expenditure. The estimated regression is as follows:

$$\ln(x_i) = 1.77 + 0.84\ln(\text{total income}_i) + [0.04 - 0.40\ln(\text{total income}_i)]\text{Urban}_i (.037)(.003)(.004)(.052)$$
$$R^2 = 0.92$$

where x_i is per capita total expenditure for household i, as defined previously, and total income is per capita income from agricultural and non-agricultural sources. Thus, the propensity to spend additional income is 0.84 in rural areas and 0.44 (=0.84–0.40) in urban areas. That is to say, 84% or additional household income in rural areas is spent, while 44% of additional income in urban areas is spent. The remaining portions of additional income are saved.

Combining the estimated propensities to spend with the projected GDP growth from Centennial, we compute an implied annual growth of total expenditure in rural and urban areas. In Table A3.9 we summarize the key parameter values used in our rice consumption forecasts.

Forecasting forward from 2009 (the last year for which we have a FIES estimate of rice expenditure), we compute the implied growth in total expenditure in year 2040. In Tables 11a and 11b we summarize the forecasts, reporting 2009 consumption and expenditure, 2040 consumption and expenditure, and the percentage change.

In the pessimistic economic growth scenario (Table A3.10), total expenditure per capita rises by 68.4% among rural households and 35.9% among urban households, for a nation average of 56.9%. Applying these forecasted changes to total expenditure to the estimated Engel curves for rice, we find that per capita consumption rises by 14.6% among rural households and 5.3% among urban households, for a countrywide average increase of 8.1%. National average per capita consumption rises from 105.3 kg to 113.8 kg. Meanwhile, the expenditure share of rice falls from 13.5% to 9.2% in rural areas (a reduction of 32.0%) in rural households, from 6.6% to 5.1% (22.5% reduction) in urban households, and from 8.9% to 6.2% (31.0% reduction) nationally.

In the optimistic economic growth scenario (Table A3.11), total expenditure per capita rises by 211.9% among rural households and 111.0% among urban households, for a nation average of 155.9%. Applying these forecasted changes to total expenditure to the estimated Engel curves for rice, we find that per capita consumption rises by 17.0% among rural households and 12.2% among urban households, for a countrywide average increase of 13.5%. The national average per capita consumption rises from 105.3 kg to 119.3 kg. Meanwhile, the expenditure share of rice falls from 13.5% to 5.1% in rural areas (a reduction of 62.5%) in rural households, from 6.6% to 3.5% (46.8% reduction) in urban households, and from 8.9% to 4.0% (55.7% reduction) nationally.

To put these changes in context, in 2006 (the latest year for which we have an FIES estimate of rice consumption), average per capita consumption was 105.9 kg in rural households and 104.1 kg in urban households. The projected increases due to GDP growth would raise per capita consumption to between 121.3kg (14.6% increase) and 123.9kg (17.0% increase) for rural households, and to

TABLE A3.9: PARAMETER VALUES USED TO FORECAST RICE CONSUMPTION

	Rural	Urban	National
Per Capita GDP Growth (% per annum)			
Pessimistic Economic Growth Scenario	1.9	1.9	1.9
Optimistic Economic Growth Scenario	4.1	4.1	4.1
Propensity to spend (%)	84.0	44.0	64.4
Per capita expenditure growth (% per annum)			
Pessimistic Economic Growth Scenario	1.7	1.0	1.4
Optimistic Economic Growth Scenario	3.7	2.4	3.2
Population growth (% per annum)	0.2	2.3	1.2

Source: Centennial eestimates.
Note: GDP growth rates are assumed to be the same in urban and rural areas.

between 109.6kg (5.3% increase) and 116.8 kg (12.2% increase) for urban households.

In addition to changes in per capita consumption, significant population growth is expected in both rural and urban areas. We take the United Nations medium variant population projection, and FAO's estimates for rural and urban population. The FAO forecasts a rural population of 51.0 million people and an urban population of 90.7 million people by 2040, indicating increases of 6.2% in rural areas and 97.8% in urban areas. We make the further assumption that the population elasticity of rice consumption is 1.0, i.e., that a g-% increase in population causes a g-% increase in aggregate rice consumption. Thus, the FAO population forecasts imply a 6.2% increase in aggregate rice consumption in rural Philippines, and a 97.8% increase in aggregate rice consumption in urban Philippines as a result of population growth alone (Tables A3.10a and A3.10b).

Adding percentage changes in per capita rice consumption due to GDP growth to the percentage changes in rice consumption due to population growth yields the predicted percent change in rice consumption. In the pessimistic scenario, we forecast rice consumption to rise by 22.5% in rural areas and 109.5% in urban areas, for an average increase of 64.2% for the Philippines as a whole (Table A3.11a). In the optimistic scenario we forecast rice consumption to rise by 25.2% in rural areas and 123.1% in urban areas, for an average increase of 72.2% for the Philippines (Table A3.11b).

CONCLUSION AND DISCUSSION

Rice is a staple of the Philippine diet, contributing significant share of calories and accounting for approximately 9% of total expenditures in urban areas and more than 13% in rural areas (2009). Rice is also important to millions of Filipino farmers who rely on rice as an important source of income. Thus, a sound understanding of the demand for rice in the Philippines will shed light on the well-being of Filipino rice consumers and producers alike. This analysis attempts to advance that understanding.

Using data from the NSO's Family Income and Expenditure Survey (FIES), we document recent trends in food expenditure and consumption in the Philippines, with particular focus on rice. Among other finds, it appears that despite recent, dramatic increases in rice prices in recent years, rice demand actually appears to be slowly rising. One potential explanation is that prices for corn and other grains have increased even faster than prices for rice. Moreover, with the exception of the wealthiest urban families, who are allocating a significant share of their cereals budget to bread, there appears to be only a very slow move to diversification away from rice.

We also use the FIES data to estimate the empirical relationship between total expenditure and rice expenditure. Our findings support those of previous studies, finding that rice is a so-called normal good, meaning rice expenditure rises with total expenditure. This pattern has also been found for other developing countries. But in developed Asian countries including Japan and Taiwan, as well as some Asian "tigers", researchers have found negative expenditure elasticities. The explanation for this result is that as economies develop and total expenditure rises, consumers begin to trade the

Table A3.10: Rice consumption and expenditures, 2009 and 2040 forecasts, pessimistic economic growth senario

	units	2009			2040			% change, 2009–2040		
		rural	urban	all	rural	urban	all	rural	urban	all
Population	1000	47,654	45,607	93,261	50,961	90,714	141,675	6.9	98.9	51.9
rice consumption					pessimistic GDP growth scenario					
per capita	kg	105.9	104.1	105.3	121.3	109.6	113.8	14.6	5.3	8.12
total	1000 tons	5,047	4,758	9,820	6,182	9,946	16,129	22.5	109.5	64.2
expenditure per capita										
total	2009 P	29,954	49,482	37,070	42,034	67,223	58,162	68.4	35.9	56.9
rice	2009 P	3,361	3,267	3,315	3,850	3,441	3,588	14.6	5.3	8.2
rice share of total	%	13.5	6.6	8.9	9.2	5.1	-32.0	-22.5	-31.0	
rice consumption					optimistic GDP growth scenario					
per capita	kg	105.9	104.1	105.3	123.9	116.8	119.3	17.0	12.2	13.3
total	1000 tons	5,047	4,748	9,820	6,316	10,592	16,908	25.2	123.1	72.2
expenditure per dcapita										
total	2009 P	24,954	49,482	37,070	77,841	104,416	94,857	211.9	111.0	155.9
rice	2009 P	3,361	3,267	3,315	3,933	3,665	3,761	17.0	12.2	13.5
rice share of total	%	13.5	6.6	8.9	5.1	3.5	4.0	-62.5	-46.8	-55.7

Source: Centennial estimates, FIES data.
a. GDP growth figures are from Centennial, and are assumed to be the same in urban and rural areas.
b. 2009 quantities are not yet available. Here we use the 2006 per capita consumption as a proxy.

traditional, rice-based diet for a Western-style diet, with increased consumption of wheat products, as well as animal protein, and reduced rice consumption. Our results suggest that the Philippines has not started down this path, perhaps with the exception of those in the highest income brackets.

Finally, we use our estimated Engel curves, together with forecasts of GDP growth and population growth, to forecast Philippines rice consumption in year 2040. In a modest growth scenario, we forecast national average per capita rice consumption to rise from 105 kg to 114 kg, with a particularly large rise in rural areas where the consumption response to increased income.is greatest. In a scenario with more rapid economic growth, we actually find forecast rice consumption to rise to 119 kg by 2040. In both scenarios, despite increased rice consumption, we find rice expenditure to fall significantly as a share of total expenditure. If realized, such a reduction in the rice share of expenditure would advance the efforts of poverty alleviation and food security in the Philippines.

A couple of caveats are worth mentioning. First, our forecasts assume GDP growth to be spread uniformly across the income spectrum, and along the rural-urban spectrum. Different growth patterns could lead to very different results. In particular, if GDP accrues mainly to households with higher incomes, we'd expect to see slower growth in rice consumption, as we find households at higher income levels to be relatively unresponsive to income growth, or may even reduce consumption in response to income growth. We leave this topic for future consideration. Also, we do not attempt to forecast prices in this study, and thus implicitly hold prices constant at current levels. This may not be realistic, but long-term forecasts of rice prices are highly uncertain, and incorporating endogenous rice price into our analysis would require a model of the rice economy. We leave this topic, too, for future work.

References

Balisacan, A.M., M.A. Sombilla, and R.C. Dikitanan. 2010. "Rice Crisis in the Philippines: Why did it Occur and What are its Policy Implication." Ch. 7 in The Rice Crisis, D. Dawe (ed). Earthscan, Washington, D.C. (See pp. 127–128)

Briones, R.M. 2012. "Scenarios for Philippine Agriculture 2010—2040." Unpublished report.

Ericta, C. and E. Fabian, "A Documentation of the Philippine's Family and Expenditure Survey", PIDS Discussion Paper series No. 2009–18, July 2009, Philippines.

Food and Agricultural Organization (FAO) of the United Nations. FAOSTAT online database, http://faostat3.fao.org/home/index.html#HOME, accessed July 15, 2012.

Ito, S., W. Wesley, F. Peterson, and W. Grant. 1989. "Rice in Asia: Is it becoming an inferior good?" American Journal of Agricultural Economics 71(1): 32–42.

National Statistics Office, Family and Expenditure Survey Bulletin, various years.

Timmer, C.P., S. Block, and D. Dawe. 2010. "Long-run Dynamics of Rice Consumption: 1960–2010." Ch. 1.6 in Rice in the Global Economy: Strategic Research and Policy Issues for Food Security, S. Pandey et al. (eds). IRRI. (See. fig 6)

Annex 4—Tree Crops, Horticulture and Sugar

Introduction

Overall importance; area planted. Crops other than rice and corn account for over one-third of agricultural Gross Value Added (GVA) and probably involve 40–50% of agricultural employment (including self-employment). The total area occupied by these crops is about 5.5 million ha (56% of the reported total farmland area of 9.7 million ha), and has increased since 1990 at an average rate of 0.9% p.a. Of this, two-thirds is coconut, part of which is intercropped.[1]

Production. Output growth of crops other than rice and corn has been quite slow, averaging about 2% p.a. since 1980, indicating an increase with respect to the productivity of land of about 1% p.a. Main changes, which are discussed in sections on specific crops, have been the spectacular growth of production in bananas and the development of a new crop—oil palm. Coffee and cacao production have fallen, whilst that of coconut, the largest crop by value has grown modestly.

Gross value added (GVA). The earlier BAS statistics (see Chapter 3 for explanation of rebasing of national accounts in 2008) shows that real GVA has grown at a low average of 1.1% p.a. between 1980/82 and 2008/10, or substantially below the average rate of population growth (of 2.1%) over the same period (Table A4.2).

The GVA of these crops mostly fell in the late 1980s but then slowly picked up. Since 1998/2000, GVA has grown in all crop categories, led by bananas, which have been an export success story. This growth has continued through 2011.

Table A4.1: Other crops: Area planted/harvested by crop and year ('000 ha)

	1990	1995	2000	2005	2010	Av an Growth
Coconut	3,112	3,095	3,144	3,243	3,576	0.70%
Other Plantation Crops	377	378	365	410	478	1.20%
Mango	77	108	134	164	189	4.60%
Other Fruit/ Nut Trees	57	59	72	85	93	2.50%
Banana	312	339	382	418	449	1.80%
Pineapple	41	42	43	49	59	1.80%
Sugarcane	235	302	384	369	355	2.10%
Cassava	214	226	210	205	218	0.10%
Cotton/ Tobacco	74	64	47	36	30	–4.40%
Camote (Sweet Potato)	137	145	128	121	109	–1.10%
Mongo (Mung beans)	37	35	40	36	40	0.50%
Peanut	44	48	27	27	27	–2.40%
Other Vegetables	144	150	150	182	187	1.30%
Flowers	1	1	1	1	1	1.60%
Total	4,861	4,990	5,125	5,345	5,811	0.90%
Estimated Land Used 1/	4,496	4,603	4,726	4,911	5,521	0.90%

Source: BAS.
Note: 1/ Assumes vegetables on average are double cropped and 30% of other fruits and bananas are under coconuts and so also included in the coconut area.

The 'new' BAS statistical series currently provides details by crop only for 2008–11; it indicates a somewhat lower volume of GVA for the non-rice and corn crops than did the old series.

The 'new' series indicates that the subsector has grown strongly over the last three years, both nominal and real terms for six of the eight categories. Only mango and coffee have lower GVA in 2011 than in 2008.

1 It was not possible to get a meaningful estimate on the proportion of coconuts intercropped. Although some estimates as high as 50% have been suggested, it is doubtful whether the area intercropped to the extent of 100% land cover would be more than about 10%.

Table A4.2: Real changes in annual average GVA 1983/85 to 2008/10 for all crops excluding rice and corn

	1983/85 1988/90	1988/90 1993/95	1993/95 1998/00	1998/00 2003/05	2003/05 2008/10
Coconut Including Copra	–10.1%	1.1%	–3.1%	1.7%	3.8%
Sugarcane	–4.4%	2.1%	–2.9%	1.0%	3.3%
Banana	2.0%	5.8%	2.8%	5.3%	13.3%
Other Non Rice & Corn	3.6	3.0%	1.2%	0.9%	2.7%
Total Crops excl Rice and Corn	–0.9%	2.8%	0.4%	1.4%	4.2%

Source: BAS.

Further analysis of these figures reveals that if the various sub-sector Value Added figures are expressed in terms of 2010 Pesos, the overall growth in the Value added of the non-rice and corn crops sub-sector has been 25%, compared to 5% for rice and corn, 6% for livestock and 10% for agricultural activities and services. Part of the reason for this higher relative increase is that the international prices of key products, copra (derived from coconut oil) and sugar as well as rubber has increased substantially between 2008 and 2011.

Table A4.3: Gross value added in tree crops, sugar HVA and others as well as total agriculture (P billion)

	Old Series for GVA 2010		Revised Series for GVA 2010	
	P Billion	% Tot agric.	P Billion	% Tot Agric
Coconut and Copra	62	6.2	77	8.3
Sugarcane	33	3.3	27	2.9
Bananas	82	8.2	87	9.4
Others	288	28.6	127	13.7
Total All crops ex rice & corn	465	46.3	318	34.3
Total Agriculture	1,004	100.0	926	100.0

Source: BAS.

While the majority of these probably provide a reasonable reflection of sub-sector performance, as a whole, there are doubts about a few individual items. For example, GVA from rubber is almost certainly over estimated (by about a factor of four in 2010). For some other crops and fruit trees, the estimates shown above, which are less than half of those of the old series, may be on the low side. In particular they appear to underestimate the value of production of fruit and vegetables for home consumption.

Table A4.4: Gross value added—agricultural sector (new series, current prices, P millions)

	Base Year					
	2008	2009	2010		2011	
Coconut including Copra	75,771	60,964	76,856	8.30%	117,709	11.10%
Sugar-cane	23,651	19,377	27,351	3.00%	38,293	3.60%
Banana	61,560	72,737	86,891	9.40%	83,623	7.90%
Mango	19,251	17,584	17,396	1.90%	16,717	1.60%
Pineapple	9,939	10,495	9,916	1.10%	13,143	1.20%
Coffee	5,922	5,280	5,261	0.60%	5,964	0.60%
Cassava	10,706	11,888	12,103	1.30%	14,317	1.40%
Rubber	14,992	11,741	22,890	2.50%	27,879	2.60%
Other Crops	61,476	68,196	59,788	6.50%	78,335	7.40%
Total excluding rice and corn	283,268	278,262	318,452	34.40%	395,980	37.50%
Rice & Corn	273,146	284,806	281,813	30.40%	320,253	30.30%
Total Crops	556,414	563,068	600,265	64.80%	716,233	67.70%
						0.00%
Total Livestock including Poultry	218,051	233,818	252,175	27.20%	258,821	24.50%
Total Ag Activities & Services	66,399	70,367	73,707	8.00%	82,150	7.80%
Total Agricul-ture GVA	840,864	867,253	926,147	100.00%	1,057,204	100.00%

Source: BAS.

Exports. Sixty to seventy percent of agricultural exports derive from these crops. The most important in the last two years (2010 and 2011) have been coconut products, including both coconut oil which contributed 72% of coconut of USD 1.96 billion in 2011, and desiccated coconut which contributed USD 0.29 billion (15%).

Table A4.6 provides further export detail. The most important crops after coconuts are fruits and vegetables (mainly bananas and pineapples—including canned and juices), sugar and rubber. Sugar exports have been relatively static

Table A4.5: Gross Value Added in Agriculture (In real 2010 prices (P Million))[1/]

			Base Year				Real Change 2008–2011
	2008	2009	2010		2011		
Coconut including Copra	81,246	63,326	76,856	8.3%	112,497	11.1%	38%
Sugarcane	25,360	20,128	27,351	3.0%	36,597	3.6%	44%
Banana	66,008	75,556	86,891	9.4%	79,920	7.9%	21%
Mango	20,642	18,265	17,396	1.9%	15,977	1.6%	–23%
Pineapple	10,657	10,902	9,916	1.1%	12,561	1.2%	18%
Coffee	6,350	5,485	5,261	0.6%	5,700	0.6%	–10%
Cassava	11,480	12,349	12,103	1.3%	13,683	1.4%	19%
Rubber	16,075	12,196	22,890	2.5%	26,645	2.6%	66%
Other Crops	65,918	70,839	59,788	6.5%	74,866	7.4%	14%
Total Tree Crops etc.	303,736	289,045	318,452	34.4%	378,447	37.5%	25%
Rice & Corn	292,883	295,842	281,813	30.4%	306,073	30.3%	5%
Total Crops	596,619	584,887	600,265	64.8%	684,519	67.7%	15%
Total Livestock & Poultry	233,807	242,878	252,175	27.2%	247,361	24.5%	6%
Total Ag Activities & Services	71,197	73,094	73,707	8.0%	78,513	7.8%	10%
TOTAL AG GVA	901,623	900,859	926,147	100.0%	1,010,393	100.0%	12%
Deflator to 2010 Pesos	0.933	0.963	1.000		1.046		

Source: BAS

1/ current prices adjusted aby CPI for each year

and are normally confined to the US quota (in most years it is not profitable for the Philippines to export based on the unprotected world price), rubber exports are 'commodity' exports often for further processing, while exports of pineapple and bananas are within competitive markets where Philippine exporters have to compete for market share.

In essence, the export market for coconut products or rubber is essentially unlimited, that for sugar is controlled administratively (abovementioned US quota), while expansion of the banana and pineapple markets may be limited by both demand and competition.

Employment. Small farmers, many of whom are underemployed, occupy most of the land planted to other crops. Typical family rural size is 5–6 persons, with an average of about two members of working age available for farm work, yet farm size averages about 2 ha (In total there are about five million[2] farm families on 9.7 million ha of farmland). The level of unemployment and underemployment is reflected in the low wages in the informal sector, which currently vary by region from P 80–180 per day (USD 1.80–4.10) per day, compared with wage rates paid by estates, which are subject to regional minimum wage rates of P235–291 per day (USD 5.35–USD 6.60) per day.

Based on areas of crops planted and typical person day labor requirements for the these crops, total labor needs are estimated at 540 million person days, or the equivalent of two million full time jobs. This equates to an average of 0.4 jobs per ha, so a 2 ha average sized farm has a labor need of about 0.8 jobs, yet availability of about 2 people, without taking account of landless workers who are also engaged in agriculture. This suggests very substantial underutilized

2 The 2002 Census gave a total of 4.8 million farms, but a further 10 years of land reform has probably increased that number.

Table A4.6: Exports of Products mainly from 'Other Crops' 1995–2010 (USD millions)

	1995–1999	2000–2004	2005–2009	2010	
Fixed Vegetable Oils and Fats	624	465	722	1,270	49%
Animal Feeds excl cereals—Mainly Copra Meal	58	36	47	85	3%
Vegetables and Fruits	597	717	981	920	36%
Sugar and Sugar Preparations	113	80	134	105	4%
Crude Rubber	23	23	42	56	2%
Coffee, Tea, Cocoa, Spices and Manufactured thereof	26	15	14	13	1%
Miscellaneous Edible Products and Preparations	37	62	96	119	5%
Oil Seeds and Oleaginous Fruits	4	1	0	0	0%
Animal and Vegetable Oils and Fats	17	21	30	20	1%
Total Other Crops Exports	1,499	1,421	2,066	2,589	100%

Source: BAS

labor resources on the order of 40–60% (though individuals may be occupied in other non-farm income-earning activities).

Institutional Environment

Just under half of the 30 million ha of land in the Philippines is classified as alienable or disposable land that is mostly held by the private sector. In 2002, 9.7 million ha of this was classified as farmland, although as a result of agrarian reform, the ownership of this is supposed to be redistributed so that no person can own more than 5 ha. The land reform process is not yet fully completed so that there remains some land that may still be acquired from current owners and redistributed to agrarian reform beneficiaries (ARBs). At the beginning of 2012, the balance of unreformed private farmland was reported by DAR to be 962,000 ha, or about 10% of all agricultural land.

Tree Crops

Tree crops are well suited to the Philippines from an agro-ecological standpoint and a number of analyses, such as those undertaken in the World Bank Tree Crops Study[3] indicate that their further development would be economically attractive. More recent studies[4] indicate that they have attractive Domestic Resource Coefficients (DRCs). With the exception of coconuts, employment and value added per ha would be higher for these crops than for non-irrigated upland crops such as cereals, pulses or oilseeds. Given the high level of rural underemployment and also the fact that tree crops have environmentally positive impacts with respect to carbon absorption, compared to annual crops, there is a strong case for facilitating their further development, particularly in those areas of former forestlands outside the Philippines' typhoon belt, in particular in Mindanao.

Land availability. Statistics from the Forest Management Bureau (FMB) of DENR indicate that of the 15.8 million ha of public land designated as forestland/timberland, or forest zone, less than half[5] (6.4 million ha) actually had forest cover in 2003 (Table A4.7). Government is developing a program to replant some of these forest zone areas. Since 2003, when these areas were assessed, through the end of 2010 there is reported to have been government reforestation of 175,000 ha (22,000 ha per year). In parallel, it is likely that there has also been deforestation since 2003—possibly of similar orders of magnitude to replant-

3 Report No 19281 PH Tree Crops for Rural Development June 1999.
4 Report No 19281 PH Tree Crops for Rural Development June 1999
5 Total forest cover in the Philippines in 2003 was estimated as 7.168 million ha, of which 6.432 million ha was forest cover within forestlands. Most of the balance is forest on alienable and disposable (A & D land).

ing. Overall, a conservative estimate is that at present there are more than 9 million ha of unplanted forestland.

Table A4.7: Summary of Public Forest Statistics (million ha)—2003

	Luzon[1/]	Visayas[2/]	Mindanao[3/]	Total
Total Forestland (not A & D)	7.49	2.25	6.07	15.81
Forest Cover on Forestland	3.77	0.75	1.91	6.43
Land for Potential Replanting (2003)	3.72	1.50	4.16	9.38

Source: DENR
1/ Includes CAR, NCR and regions 1–5
2/ Includes Regions 6,7 & 8
3/ Includes Regions 9–13 and ARMM

Of the land in the forest zone, without forest cover, about 5 million is classified as 'wooded grassland', 1.1 million ha are 'open grassland' and the balance is 'cultivated' largely by the 6 million families who inhabit these upland areas.

Of the total 15.8 million ha of 'forest zone', about 40% (6.1 million ha) is in Mindanao, including 4% (0.6 million ha) in the ARMM. The amount of actual forest cover in Mindanao within the forest zone in 2003 was 1.9 million ha of which 0.2 million ha was in ARMM. By deduction therefore there are just over 4 million has of land in Mindanao which are designated as forest zone but do not have forest cover, included in that are about 0.4 million ha in ARMM. Some of that land may be in 'protected forest'[6] areas and therefore unsuitable for including agricultural tree crops. While we have data on the proportion of forestland unsuitable for productive tree crops, there is no data on how much of this is included in the 9 million ha of unplanted land. Based on the overall figures, it is probably less than one third of the area. *Clearly an important issue to be followed up in the development of forest areas will be getting a up to date sound overview of the amounts of land in the various legal categories.*

Part of the forest area is managed under community based forest management agreements, involving 1.6 million ha and 320,000 households, of which 0.8 million ha and 115,000 households are in Mindanao.

Table A4.8: Community Based Forest Management Agreements 2009

	Luzon	Visayas	Mindanao	Total
Area (million ha)	0.61	0.21	0.81	1.63
No of agreements	656	445	689	1,790
No of HH	159,824	47,603	114,473	322,248
No of POs	656	445	685	1,790

Source: DENR

In addition, some forestland is managed by commercial entities under Integrated Forest Management Agreements (IFMAs). In 2009 there were 154 of these, covering 867,000 ha of which 95 agreements covering 500,000 ha were in Mindanao including 13 agreements on 50,000 ha in ARMM.

Table A4.9: Integrated Forest Management Agreements 2009

	Luzon	Visayas	Mindanao	Total
Area (million ha)	0.27	0.03	0.57	0.87
No of agreements	43	15	96	154

Source: DENR

Besides these, about 70,000 ha of forestland is managed under Tree Farm and Agro forestry Farm leases, 35,000 ha

6 Included within the total public forestland area are 3.3 million ha of forest reserves, 1.3 million ha of national parks, and about 0.4 million ha of military and civil reserves and fishponds or a total of 5 million ha which would not be available for agricultural crops or productive timber—1.8 million ha of which are in Mindanao. There is no data on how much of this area had forest cover in 2003.

Table A4.10. Summary Characteristics of Different Tree Crops

	Coconuts Local Talls	Rubber	Oil Palm	Robusta Coffee	Cacao under Coconuts	Mango	Banana (Cavendish)
Development period (years)	6	6	3	2–3	3	7	1
Typical Investment cost/ha over whole establishment period USD (excludes processing)	1,000–1,500	2,000–3500	2,200–3,000	1,400–2,000	800–1,200	2,000– 4,000	5,000 –8,000
First year in which annual cash flow breaks even	7	7	4	3	3–4	8	2
Typical crop life cycle (years)	30 years +	30	25	10	15	30	7

Source: Centennial

under Socialized Industrial Forest Management Agreements, 5,000 ha under Private Forest Development Agreements and 97,000 ha under Forest land Grazing Management Agreements and Permits.

The National Greening Program[7] (2011–2016) led by DENR, but also involving more than a dozen other agencies under the 'Convergence' banner, is being implemented. Under this program, it is planned to plant trees on some 1.5 million ha of the forest zone, or an average of 250,000 ha per year. This is more than ten times the annual amount achieved on average 2003–2010. Within this total tree planting, provision is made for 86,000 ha of rubber, 86,000 ha of coffee 62,500 ha of cacao and 164,000 ha of fruit trees, but no oil palm. It is not yet fully clear who the owners/operators of these incremental agricultural tree crops would be, or how these plantings would be financed and implemented. But the outline of the program clarifies that (i) there are substantial tracts of land in the Philippines in the 'forest zone' which from a technical standpoint could be planted to agricultural tree crops and (ii) DENR is comfortable with planting a substantial proportions of these areas to rubber, coffee, cacao or fruit trees although they have reservations about oil palm, except on 'open grassland'. Investment Characteristics and Financing Mechanisms

Since the development of tree crops requires a long gestation period before any significant income generation, potential investors (whether large or small) need to (i) be confident in their entitlement to use the land for the period of the whole crop cycle (7–50 years depending on crop), and (ii) be in a position to finance the relatively long period before the cash flow from the crop itself breaks even. Table A4.10 summarizes the investment characteristics of the different tree crops.

While corporate plantations and wealthy landowners may be prepared for such long time horizons, smallholders need mechanisms to finance planting and provide for income until tree crops generate positive cash flow. Other countries in the region have adopted different approaches, including rubberreplanting grants in Thailand, FELDA/FELCRA land development schemes in Malaysia for rubber and oil palm, and long-term credit in Vietnam for coffee and rubber. The grant experience from Thailand in particular has been successful, as was Malaysia's land development approach.

In the Philippines, there is already some experience of smallholder tree crop new planting in the oil palm sector in recent years. Initial development costs, including the farmer's own labor, were financed on long-term credit partly by Land Bank (LBP) and partly by the processing mill. The financing for the farmers is handled through a farmers' cooperative—LBP is not set up to deal directly with individual farmers. This methodology requires financially sound farmers' cooperatives, which in the past have been difficult in the Philippines. More recently, the strength of cooperatives is reported by LBP to have improved. As this

7 This program was initiated through Executive Order No. 26 signed on February 24, 2011. Guidelines were issued on March 8, 2011 and the program was launched on May 13, 2011.

oil palm financing is still in process, it is too early to be clear whether all loans will be fully repaid, although it can be seen that the physical development of a substantial area has been achieved.

With coconuts, which have a relatively longer gestation period and typically lower profitability, an ongoing new planting/replanting grant scheme is progressing well (seedlings to cover an estimated 138,000 ha—equivalent to 4% of the coconut area are expected to be funded by Philippine Coconut Authority in 2012). An incentive to replant low yielding coconuts is also provided by the high value of coco lumbar. In well-located areas, receipts[8] from sale of this would more than cover the cost of replanting. However obtaining a permit to fell old coconuts trees is difficult and bureaucratic, and takes up considerable time of PCA field staff.

The Way Forward for Tree Crops

In order to quantify tree crop development through 2040, and its impact on the economy as a whole with respect to land use, labor absorption/job creation, contribution to exports, contribution to GVA and demand for investment resources, two broad scenarios were considered.

In order to quantify tree crop development through 2040, and its impact on the economy as a whole with respect to land use, labor absorption/job creation, contribution to exports, contribution to GVA and demand for investment resources, two broad scenarios were considered.

Scenario 1: No major changes take place. Agrarian reform comes to an end as planned, but the legislation restricting land markets remains as it is, creating uncertainty, particularly among those who would be subject to land reform if the resources were available. Funding for PCA, DA, DAR DENR etc. remains at about the present level and there is neither improvement nor deterioration in the peace and order situation.

Scenario 2: This is the scenario consistent with the 2040 Vision for agriculture (Chapter 9). There is strong government support for tree crop development, Investment friendly legislation is put in place in land markets, restrictions on foreign investment are eased, private sector investment in agricultural tree crops is encouraged as part of the reforestation effort, funding for the key rural development convergence agencies is increased, including releasing the coconut levy resources to more directly benefit coconut production. The peace and order situation improves, thus facilitating investment in what were traditionally good rubber areas.

Coconuts

Production and farm income. The Philippines is a major producer and exporter of coconuts and coconut products. Over 3 million farmers (40% of all farmers) own coconut trees. BAS reports only modest growth in area and number of trees over the past 20 years (an average of 0.6–0.7% p.a.) and an output in terms of coconuts with husk, which increased from 12 million tons in 1990 to 15.5 million tons in 2010—an average annual rate of increase of 1.3% p.a. The main product at farm level remains copra, which is processed into coconut oil with a copra meal by-product. National average production of copra equivalent is reported at only about 0.8 tons/ha overall or just under one ton per ha based on the mature stand only.

A typical smallholder with one ha of mature coconuts and average production levels would receive an income of about PhP 24,000 (USD 550) at 2010 prices. In real terms, the annual gross income per ha[9] oof coconuts at the farm level has varied from a low of P10,900 in 2001 and a high of P25,700 in 2007. Labor requirements for one ha of coconuts at this level of production, including harvest and copra making would be about 30–50 person days per year, some of which may traditionally be done by hired landless workers. Even with well-managed higher yielding coconuts, labor requirements would normally be less than 70 person days per year. Not surprisingly, households depending heavily on coconuts are among the poorest in the Philippines.

Trade, marketing opportunities, and prices. The global market for other coconut products (besides copra) is

8 This depends on location, but in favorable locations a stand of old trees at say 80 trees/ha at P 1,000 per tree would exceed the 6 year establishment costs of new coconut, estimated at about P 65,000.

9 Area includes immature trees so the average value of production per ha of mature coconuts would be about 20% higher

Table A4.11: Average Yields from Coconuts (tons/ha)

	90–94	95–99	00–04	05–09	2010
Reported Yield Coconut with husk a/	3.8	4.0	4.3	4.5	4.3
Copra Resecada Equivalent (6% Moisture) b/	0.60	0.64	0.69	0.72	0.69
Convert to typical farm gate copra (15% M)	0.66	0.71	0.76	0.80	0.76
Assumed percent of immature coconuts	16.7%	16.7%	16.7%	16.7%	16.7%
Average farm gate yield from mature area	0.80	0.85	0.91	0.95	0.92

a/ Calculated from BAS data
b/ PCA standard conversion—one metric ton whole nuts (with husk) yields 0.159 tons copra resecada.
Source: Centennial

increasing. If coconuts are to be used for other products, this involves the sale of whole nuts ex farm, thus lowering the farm level labor requirements, since copra is not made. However, incremental labor needed in the value added industries would exceed the reduction in on farm labor demand. Other products include desiccated coconut, coconut water, coconut cream and in some cases high specification charcoals. There are also opportunities for further processing downstream, for example converting copra meal which is now mostly exported[10] as a crude product into 'protein enhanced copra meal' (PECM) that can then be used at a higher inclusion level in livestock feeds for pigs (rather than mainly for ruminants as is the case with regular copra meal). The conversion of coconut husk into a compost medium to replace peat is also a potential value added export product. While such processing would generate jobs and value added in the agribusiness sector, the direct impact on smallholder growers' farm level profitability would be quite small. Although as a secondary factor, increased demand for coconut products may lead to more focus, higher inputs, more farm level production and so a more profitable farming system.

Coconut oil export volume has been flat on average but with quite large year on year variations. Over the last 17 years, it has varied between 479,000 tons in 1999 and 1.419 million in 2001. Most recently, total coconut product exports in 2011 were USD 2.0 billion, 70% of which was for coconut oil. While specifically with respect to coconut oil, Philippines has a high share of the world market, but within the whole vegetable oil sector, it generally contributes less than 2% of the total global traded volume of vegetable oils of around 65 million tons.

Historically coconut oil prices have moved in parallel with other vegetable oils and have generally been at a premium. Over the past 30 years, the average premium (c.i.f NW Europe) has been 12% over soybean oil and 28% over palm oil. Projections by the World Bank through 2025 foresee the real prices of vegetable oils falling well below those of the last five years and coconut oil losing some of its premium. Latest projections (June 2012) are for the prices in 2025 to be USD 1,000 per ton for coconut oil and soybean oil and USD 800 per ton for palm oil. In terms of 2010 real prices, these equate to USD 733 for coconut oil and soybean oil and USD 586 per ton for palm oil.

Issues for coconut development concerning potential growth in coconut area, production and exports are:

1. Land availability for new planting of coconuts is limited. The main planting is likely to come from replanting of areas that were formerly used for coconuts.

10 The Philippines is the world's number one exporter of copra meal/copra cake covering about 60% by volume of world trade in the product.

Table A4.12: WB Commodities Data for Vegetable Oils (price per ton in 2005 constant USD)

	Coconut Oil	Ground nut Oil	Palm Oil	Soybean Oil
Av Price 1982–1991	786.7	1240.6	619.7	752.8
Av Price 1992–2001	607.2	866.5	485.5	517.3
Av Price 2002–2011	695.3	918.3	525.4	588.2
Av last 30 Years	696.4	1008.4	543.5	619.4
Projections 2025 in 2005 USD	649.0	1201.0	520.0	649.0
Change over 30 yr average	–7%	19%	–4%	5%
Change compared to 2002/11	–7%	31%	–1%	10%
Projections 2025 in 2010 USD	732.9	1356.2	587.2	732.9

Source: Centennial, based on World Bank commodity price forecasts (June 2012)

2. Coconuts are a relatively low input/low output crop when planted in isolation.

3. The total value of output per smallholder from coconuts is quite low, given average small farm sizes—it is not possible for a small farmer to earn a reasonable living from coconuts alone.

4. Remaining larger coconut farmers are still subject to land reform, and thus reluctant to invest, however after the Land Reform is concluded, this should no longer be a problem.

5. Coconuts have a particularly long gestation period—looked at in isolation it takes at least 10 years for investment in coconuts to break even.

6. There is a problem with copra quality—caused by contamination from smoke. This has resulted in the oil bi-product, copra meal, not being acceptable on the (higher priced) EU market, but it is still exported within Asia. There is also an issue that some coconut oil made from smoky copra needs to be blended with oil from better quality copra to meet industry[11] quality standards. Some work has been done to address this through improved driers using indirect heat. Further efforts may need to be made to promulgate knowledge and awareness of this in order to ensure that exported oil remains of a quality acceptable to all major markets.

7. Coconut lumberis a valuable resource and potential source of investment funds for small holders. The stringent requirements for obtaining permission to fell may need to be simplified to reduce (i) the burden that supervising this poses to PCA, and (ii) the cost to farmers of monetizing old trees. Inevitably there has been some unlicensed tree felling, not associated with replanting. By its very nature it is difficult to get a handle on this, but given that the aggregate statistics point to a slight increase in area and production over the past decade this 'illegal felling' would not appear to be major.

Opportunities for growth and expansion. In future, increased coconut production could be achieved from roughly the same land area as at present, provided appropriate policies are followed to encourage intensification of production.

Fertilization. Research carried out by PCA and others indicates that there is considerable potential for profitably raising coconut yields through fertilization, particularly through use of salt. Experimental results indicate yield increases of about 65% copra from the simple application of 2kg/tree sodium chloride annually. More spectacular research results have been obtained using specially formulated compound fertilizers. A widespread program to distribute coconut specific fertilizer to all interested farmers could follow PCA's current rather limited provision of salt fertilizer program (which currently covers about 8% of the coconut area). At the farm level, such a program would boost income, but it would not be sufficient for a family to be supported by two ha of coconuts alone.

Intercropping. Coconut can serve as a shade crop combined with other higher value products—in particular cacao. Having crops that need tending, underneath coconuts, means that farmers will be more aware of the state of their coconut trees and able to give them more detailed attention. This will

11 Information obtained from interview with senior executive of major copra meal and oil trading company.

potentially lead to higher coconut yields and per ha income, thus increasing the viability of small-scale farms.

Replanting. The high value of coco lumbar means that with supervised felling and replanting programs farmers should have the resources to replant.

Likely growth in coconut production through 2040 can be expected to result from the following:

- Additional planting that will largely be replanting.[12] The level needs to be sufficient to at least cover the 'depreciation' of existing tree stocks. Overall, planting of 100,000–150,000 ha per year would lead to an annual increase in the stock of trees of about 0.5% p.a.—indicating about an extra half million ha under coconuts by 2040. Such new planting using selected seedlings would result in an increase in unit yields because of (i) better genetic material and (ii) improved age profile of the national coconut stand.

- Fertilization. Higher productivity would also result from more of the coconut area being fertilized. If the ongoing fertilizer program takes off, this could have an important impact on production.

Quantification of growth potential. Well-managed smallholder coconuts can achieve yields of at least three times the present national average level. The physical data in this model is based on information obtained from PCA as well as from other sources and publications, including previous analysis of coconuts in the Philippines by the consultant.

New planting and replanting will certainly create a situation where long run production will increase. Realistically though, this will only happen if smallholders have strong incentives to plant/replant. Specifically they will need (i) some form of replanting grant to give them cash income and (ii) the facility to easily monetize old trees that they fell. If suitable land sharing or renting arrangements can be legitimized, there is also an interest from businesses and corporate entities to become involved in coconut production and link it to marketing of higher value products, with more of the value added retained in the production areas.

The question of fertilizing coconuts is a conundrum. PCA shows good benefits from using fertilizer, particularly salt, yet in the past very few farmers have chosen to fertilize. Whether this is due to 'lack of knowledge', 'lack of cash', disbelief that experimental results can be transferred to the farm level is not fully clear. Possibly it may be because farmers feel that it is the role of Government (PCA), the industry, or formerly their landlords, to provide inputs.

Fertilizer needs to reach farmers in a timely manner to produce good results. PCA are doing this and are now getting increased funding for the purpose. The budget for field operations for 2012 is about P 1 billion (USD 23 million) compared to 0.6 billion (USD 14 million) in the previous year

The likely development of coconuts under Scenario 1 would be a continuation of planting at perhaps 80,000 ha of coconuts per year, which should be enough to allow present growth to continue at just under 1%. It would be unlikely that a massive fertilizer program could be funded, so the expectation would be a slow uptake of fertilizer by farmers, perhaps leading to an annual growth in factor productivity of 1% p.a. Marketing/export of higher value products would grow, possibly resulting in a reduction of sales of traditional products. The farm gate price would remain geared to export parity, as it is very unlikely that the volume of higher value products would consume so many raw materials that exports of coconut oil ceased.

Under Scenario 1, the area of coconuts would increase slightly by 2040. The new planting would have a higher yield than the old coconuts. Taking account of that, and the effect of a modest fertilizer program, on the one hand, but declining yields of old coconuts, on the other, overall average yield from mature trees would increase from about 940 kg copra equivalent in 2010 to about 1,100kg in 2030 before declining to 1050 by 2040, as the age structure of the aggregate plantation deteriorates.

12 This does not necessarily involve cutting old trees and replanting on the same site, but often replanting on new sites to compensate for old trees and areas that have gone out of production.

TABLE A4.13: SUMMARY OF COCONUT DEVELOPMENT UNDER TWO SCENARIOS

		2011	2020	2030	2040
Scenario 1. Limited support for coconut development. new planting takes place at roughly the resent rate of 80,000 ha/year with parallel felling of old trees at 9.5% of the rate of replanting. A modest 50,000 ha/year fertilizer program continues through until 2021.	total coconut area ('000 ha)	3,560	3,592	3,632	3,672
	total production copra ('000 t)	2,750	3,089	3,468	3,340
	farm level jobs in sector '000	463	514	568	564
	gross value of production (WB price proj) PB	77.8	57.3	60.5	58.3
	average change in gross value of production per decade		–3.0%	0.6%	–0.4%
	gross value of production in P billion (no price decline)	77.8	87.4	98.1	94.5
	average change in gross value of production per decade		1.2%	1.2%	–0.4%
Scenario 2. Coconut development is well supoported. Planting takes place at 100,000 per year through 2016 and increases to 200,000 p.a. from 2016 through 2026 before falling back to 100,000 p.a. thereafter. Fertilizer program for both salt and multinutrient fertilizer operates at 100,000 ha/year initially, increasing to 150,000 from 2017–2021.	total coconut area ('000 ha)	3,560	3,690	3,850	3,950
	total production copra ('000 t)	2,750	3,095	4,888	5,241
	farm level jobs in sector '000	462.9	554.3	756.1	794.7
	gross value of production (WB price proj) PB	77.8	57.4	85.3	91.5
	average change in gross value of production per decade		–3.0%	4.0%	0.7%
	gross value of production in P billion (no price decline)	77.8	87.5	138.2	148.2
	average change in gross value of production per decade		1.2%	4.7%	0.7%

Source: Centennial estimates

Production would increase from 2.7 million tons in 2010 to 3.47 million tons in 2030 (by 28% or 1.3% p.a.) before falling off to 3.34 million tons in 2040. If labor productivity over the period remained constant, demand for labor by coconuts would increase from 119 million person days in 2010 to 148 million in 2030 and remain fairly constant thereafter. In terms of jobs, equivalent full time employment at the farm level on coconuts would increase from about 460,000 in 2011 to about 570,000 in 2030 (but in fact would affect more people because these are full-time job equivalents, whereas in reality many people would be carrying out some tasks part of the time).

Because of the projected decline in world prices and the expectation that it would reflect back to the farm gate price of copra, value added under this scenario would be lower in 2030 and 2040 than it was in 2010. The 28% in production, mentioned above would not be sufficient to counterbalance the projected fall of 38% in farm gate price of copra from P25.6/kg to 15.8/kg expressed in 2010 constant currency terms.

Under Scenario 2, it is assumed that there would not be much change to the coconut area, but significantly more farmers would replant, fertilizer use on old stands would increase to cover about 60% of the crop over a 10 year period, and there would be substantial inward investment by corporate entities interested in becoming involved in processing closer to the source of supply (and where labor rates are lower). This would raise the level of husbandry and lead to planting with seedlings of higher genetic potential.

Under this Scenario, PCA would support new planting of 100,000 ha per in the initial five years. That replanting level is then assumed to increase to 200,000 ha from 2017 to

2026, before reverting to 100,000 ha per year thereafter. At that rate of replanting, and assuming a felling rate of 90% of the level of replanting, pretty well all of the existing coconuts would be replaced by 2040. The area would increase from 3.56 million ha to 3.95 million. Most of this additional land would be expected to come from un-irrigated land already included within farmland, but some could also be on areas that are presently included in the forest zone but are technically suitable for coconuts.

In parallel to the replanting, it is assumed that there would be more fertilization, with 100,000 new hectares per year of old trees being fertilized from 2012 to 2016 and 150,000 per year from 2017 to 2022. Taking account of these two factors, new planting and fertilization, yields per ha of mature coconuts are projected to go up from 940 kg in 2010 to an average of 1690 kg by 3035 before falling back to 1,560 kg by 2040 as the age structure of the overall stand deteriorates slightly (by 2040, the first of the heavier level of planting 2017–2026 will have begun to age and yields will have declined.

Production in terms of copra equivalent is projected to more than double from 2.7 million tons in 2010 to 5.6 million in 2035, an increase of about 3% p.a. on average. Labor requirements would increase from the equivalent of 458,000 jobs in 2010 to 842,000 jobs in 2034. This figure does not take account of incremental jobs likely to be created downstream as more 'value added' coconut based products are produced. It should be noted however that coconuts alone will not be sufficient

Total investment in such a program, considering the whole cost of new planting and the first two years of fertilizer as being 'investment,' would be about P 6 billion a year (USD 136 million per year) for the level of planting and fertilizing proposed for 2012 to 2016, and P 12 billion per year (USD 270 million per year) from 2017 to 2022. About 36% of this would be for farm level labor. To rejuvenate the coconut subsector, funding will need to come from both the public and private sectors, and to some extent from smallholders themselves. It is difficult to envisage major corporate investment in coconut development, except as part of a scheme to ensure supplies for enhanced coconut products. While every effort should be made to attract such corporate funding and facilitate private sector/smallholder investment schemes, it is likely that the bulk of investment will need to be in the smallholder sector, and to make this happen, will require public sector funding and support, in particular the strengthening of PCA's capacity to finance planting and fertilization and to supervise its use effectively. On the funding side, release of interest and earnings from the coconut levy fund could make an important contribution.

Rubber

Virtually all rubber in the Philippines (98.7%) is in Mindanao. BAS statistics indicate the main areas the Zamboanga Peninsula (47%), Soccsksargen (23%) and the ARMM (16%). BAS data on planted areas is presented in Table 14. While industry sources think the present level of 139,000 ha is probably a realistic estimate, the area reported in the past may have been an underestimate of the volume of rubber in place[13]. Estimates from the rubber industry suggest that of the 139,000 ha, 25% is immature rubber (0–6 years old) and that the rest comprises 60% old rubber, and 15% mature rubber (less than 20 years in tapping). Actual annual production, expressed in terms of dry rubber content is estimated at about 60,000 tons per year.

Soils and climate in Mindanao are well suited to rubber production and, like oil palm, rubber could potentially be developed on substantial areas currently under 'open grassland' within the forest zone, as well as in other production forest areas to be replanted. There are also opportunities for rubber planting/replanting on land currently belonging to ARBs or other small farmers. Unlike oil palm, rubber can be developed successfully without being close to processing facilities. It can be harvested and sold as cup lump, requiring no processing, although by producing sheet rubber, as in Thailand there would be the opportunity for greater value added at the farm level. Rubber has been a successful smallholder crop elsewhere in the region (e.g. in Thailand, Malaysia and Indonesia).

13 For example the apparent increase of rubber in ARMM of 13,000 ha or 155% between 2006 and 2007 is much more likely to reflect under recording in previous years than actual planting..

Table A4.14: Rubber Area by Region HA

	1990	1995	2000	2005	2006	2007	2008	2009	2010
Calabarzon	..	..	..	216	227	227	227	227	227
Mimaropa	..	..	40	42	45	50	50	400	616
Central Visayas	..	..	..	..	14	14	14	495	1,005
Zamboanga Peninsula	33,091	31,501	32,278	34,066	41,548	42,133	54,250	57,127	65,084
Northern Mindanao	3,828	4,648	4,808	4,491	4,425	4,535	4,567	4,567	4,567
Davao Region	5,695	6,240	6,687	6,291	6,220	6,196	6,267	6,411	6,409
Soccsksargen	21,679	22,172	23,878	23,284	28,129	31,078	31,195	31,235	31,927
Caraga	9,559	9,547	5,610	5,435	5,434	5,546	5,546	5,941	6,840
ARMM	12,480	12,560	7,735	8,100	8,305	21,193	21,144	21,934	22,034
Total Philippines	86,332	86,668	81,036	81,925	94,347	110,972	123,260	128,337	138,710

Source: BAS

Prior to CARP, rubber had been an important crop that was mainly controlled by large corporations. Following land reform, most rubber corporations left, and the old estates were taken over as cooperatives by the ARBs. The initial impact was a production decline. Rubber exports fell from 34,000 tons in 1996 to 13,000 tons in 2001, but they have since increased to an average of 45,000 tons 2006–2010. With the advent of higher prices, and relaxation of rules preventing rubber being grown in forest zone areas, the initial negative impact of land reform in rubber areas has been reversed.

BAS data[14] indicates that there has recently been substantial growth in rubber production, with a 5.7% growth p.a. in the number of trees over the past 8 years, a 5% p.a. growth in production and 7% p.a. growth in area (2010: 139,000 ha).

Due to increased prices[15] in recent years, the value of production (at farm level) has increased much more rapidly than production itself although, again, there seem to be some issues with the official statistics. Taking account of the export figures, world prices and the likely costs of inputs from other sectors, GVA from rubber for 2010 is estimated at about P 6 billion, rather than 22.8 billion indicated by BAS (It is possible that in estimating GVA, BAS applied the price of dry rubber to the volume of latex).

Philippines rubber quality is perceived as being low—most rubber is harvested and exported as cup lump. The Philippines is potentially a small player in the world market and therefore is, and will remain, a price taker. Thus incremental production will not significantly influence expected long run price, which will likely be close to export parity price, adjusted for quality and location differences. World Bank estimates of long run rubber prices are for the price to be about USD 1.95 per kg in 2005 dollar terms.[16] While that is 26% below the real average price for the 5 years 2007 to 2011 inclusive of USD 2.64, it is substantially above (42%) the real average price for the past 30 years of USD 1.37/kg. At the World Bank's estimated long run price, rubber is profitable for the long-term investor, and a good means of generating incremental employment—the labor requirement per ha of producing rubber is around 0.5 persons/ha.

14 There is considerable doubt about the reliability of BAS data for rubber production; informed sources suggest that production is much lower than the published figures—which would in recent years appear to represent latex, rather than cup lump production.

15 Because of the largely fixed nature of processing and transport costs per ton, the percentage increase (or decrease) at farm level is much greater than that at the fob level. Also with higher fob prices there is a greater incentive for formers to supply a better quality product.

16 Price based on RSS3 in Singapore. It is equivalent to $2.20/kg in 2010 currency terms.

In financial terms (in constant 2010 P), the six years of expenditures needed to establish one ha of rubber total about P120,000 (USD 2,700). Once established, rubber sales are estimated to average about P100,000 per year over the 25 year mature period, with costs including labor averaging P38,000, leaving an annual cash flow per ha of about P62,000 (USD 1,400), or P83,000 (USD 1,900) if the farmer does not hire in labor. The internal rate of return from planting one ha of rubber is estimated at 21% in financial terms after allowing for the cost of family labor. In economic terms, with labor shadow priced at P110/day, the economic rate of return is 27% and the benefit cost ratio, using a 15% OCC is over 1.75.

The economic cost of production for rubber (at 15% OCC) over the whole cycle in 2010 currency terms is estimated at P 39.2/kg compared with its estimated long run price at farm gate of P69.5/kg. Clearly therefore it will be well worth encouraging rubber production, particularly on land which is not currently being used for economic purposes.

The key issues that will need to be addressed to encourage rubber development are set out below:

Solving outstanding land use issues so that tree crops can be planted on degraded forestland, provided that the established tree crop would be more environmentally friendly than the likely land cover without planting.[17] It appears that this is being handled under the National Greening Program.[18] As well as promoting rubber development by smallholders, it will also be important to ensure that large scale professional investors with knowledge and experience of the industry can come in under management leases or joint ventures and contribute towards the technical development of the industry, and perhaps provide processing and marketing services under a nucleus estate type set up. For this to happen, the length of any leases or management agreements would need to reflect the lifetime of the crop. Perhaps the 25-year renewable leases that are used for integrated forest management agreement purposes could be adapted for this.

Developing Suitable Financing Arrangements. Because of the long gestation period involved, mechanisms need to be developed so that investments can be made in rubber development while keeping smallholders involved.

- Creating a framework through which potential investors can partner with others who may have claims on the land (e.g. indigenous peoples (IPs) or squatters), if any, so that all can benefit from the proposed rubber development

- For individual smallholders, with title, whether ARBs or not, the main options would appear to be (i) the provision of long-term credit, or (ii) supervised planting/replanting grants. Unlike oil palm or sugar, rubber does not have to pass through a processing plant and cup lump is readily tradable, therefore a credit system is likely to be fraught with difficulty. A grant system would be more effective and easier to manage. Clearly this would put a strain on GOP resources. Some other countries have handled this through a cess on rubber exports. From the standpoint of equity, the cost per ha of rubber planting is similar to that of setting up an irrigation scheme, yet most beneficiaries of irrigation contribute only modestly to investment costs and are subsequently intended to support O&M.

Enhancing Rubber Quality. In the long term, the aim should be to improve product quality by getting away from cup lump. Measures to encourage this should be incorporated into schemes to expand production. Because processing takes place only after the cash flow from rubber has started, it should be possible to use credit to support investments in equipment by groups engaging in simple processing, e.g. to make products of RSS3 equivalent quality.

Likely growth potential: With land policy and financing issues resolved, a substantial increase in rubber planting could take place. Within Mindanao there would be room for several hundred thousand ha of additional rubber. The growth in recent years suggests that even if the status quo is maintained, rubber planting/investment may take place at an average rate of at least 5,000 ha per year. The risk of

17 Subject to verification by climate change specialist.
18 The first six years of this program foresees planting of 86,000 ha of rubber, which is probably optimistic.

typhoons appears to explain the fact that in the past there has been virtually no rubber in the rest of the Philippines, although there may be some limited rubber development outside traditional areas.

A model was developed to explore the impact of different levels of rubber planting. It takes account of (i) the existing stand in 2010, potential production from it, the rate of felling of senile trees and the likely period over which presently immature rubber will become mature; and (ii) different rates of new planting which might take place under various scenarios. Based on these, the likely growth of the industry, in terms of area planted, rubber production, value-added and jobs created are estimated. An optimistic scenario considers planting at the rate of 5,000 ha initially, but increasing to 15,000 ha per year from 2017, by which time CARP will have been concluded.

The results indicate that there will be an average fall[19] in gross value added of 4% p.a., but after that, GVA will grow by 12.5% p.a. through 2030 before falling back to 7% p.a. between 2030 and 2040. Rubber GVA estimated at P 6 billion in 2010 would increase to P 26 billion under this Scenario 2. It should be noted that in the short run, planting rubber actually reduces sector value added on a cash flow basis. For any particular planting, for the first six years incremental resources/outputs from other sectors—mainly manufacturing are utilized (fertilizers, chemicals etc.) in establishing the trees yet there is no incremental output. A second and more important reason for the 4% per annum projected fall in GVA between 2010 and 2020 is the assumption that by 2020 rubber prices will fall by 40% from their 2010 level, due in part to the projection[20] that oil prices, hence prices of synthetic rubbers will fall.

If, instead, prices were to remain constant in real terms over the 2010–2020 period, rather than falling, there would be a 2% p.a. average growth in GVA for rubber. The incremental GVA from the maturing existing rubber would more than offset the 'cost' in GVA terms of new planting. Beyond 2020, the growth rates would again be 12.5% through 2030 and 7% from 2030 to 2040, but the final 2040 absolute level of GVA would be P 47 billion rather than P26 billion in the case where prices fall in line with World Bank projections.

A more positive and more negative scenario (Scenarios 3 and 4, respectively) were also reviewed, to explore the impact of different planting levels on value added, rubber production and employment. Clearly, a high rate of rubber planting in the short and medium term will have a major impact on the 2040 situation, but because of the long gestation period, high planting rates do not have much of an impact within the next decade. The base situation in 2010 is a rubber area of 139,000 ha, rubber production of 60,000 tons, employment in the sector of 43,000 jobs and value added in 2010 of P6.0 billion. Under Scenario 2, these would grow to 138,00 new jobs by 2040, contributing an incremental P 20 billion to value added and providing an extra 410,000 tons per year of rubber for export (worth just over USD 800 million at projected real long run prices in terms of 2010 currency). The main GVA and percentage increase calculations for the various scenarios are shown assuming a 40% real price fall from the 2010 levels. The final two lines for GVA and percent change for each scenario show what the situation would be in the event that real prices remain at the 2010 level. Under scenario 2, annual investment requirements of the sector would initially be about USD 14 million p.a. but would rise to USD 40 million p.a. from 2023 through 2034. About 46% of the investment cost would be for labor.

Oil Palm

Oil Palm is still a relatively minor crop in the Philippines. The area planted is reported to be only 56,000 ha (up from 34,000 ha in 2002). In terms of agronomic characteristics, oil palm is similar to rubber. The main operational difference is that it requires central processing, and the volume of material that has to be hauled from field to processing plant is substantial. To develop a palm oil complex successfully, ideally about 8,000 ha of land with good transport access

19 Although there will be more rubber produced from existing stands in 2020 compared to 2010, as immature rubber become mature, the impact of a 29% reduction in real prices at farmgate, from the 2010 level to those estimated for 2020, means that GVA at constant real 2010 prices would actually fall during the period.

20 World Bank commodity forecasts in real 2005 USD terms are for oil prices per barrel to fall from USD70 and 85 in 2010 and 2011, respectively, to USD 64.9 in 2025.

TABLE A4.15: IMPACT OF DIFFERENT LEVELS OF RUBBER PLANTING ON RUBBER AREA, PRODUCTION, JOBS, AND VALUE ADDED
(FINANCIAL FIGURES IN P MILLION AT 2010 REAL VALUES)

		2010	2020	2030	2040
Scenario 1. Continue at about present level of replanting of 5,000 ha/yr.	Total Rubber Area (ha)	139,000	128,560	136,960	156,667
	Area under Producing Rubber (7-31 y.o.) (ha)	29,000	68,560	106,960	126,667
	Rubber Production tons DRC	59,975	79,950	141,460	187,167
	Jobs in Sector	43,022	51,491	62,008	74,669
	Rubber Gross Value Added (WB Price Proj) PM	6,000	4,477	7,789	10,234
	average change in GVA per decade		*-2.9%*	*5.7%*	*2.8%*
	Rubber Value Added in P Million (no price decline)	*6,000*	*7,986*	*14,110*	*18,839*
	average change in GVA per decade		*2.9%*	*5.9%*	*2.9%*
Scenario 2. Positive Present level through 2017, then increase to 15,000, before slowing to 12,000 ha/year from 2034.	Total Rubber Area (ha)	139,000	168,560	276,960	378,667
	Area under Producing Rubber (7-31 y.o.) (ha)	29,000	68,560	186,960	306,667
	Rubber Production tons DRC	59,975	79,950	246,460	468,067
	Jobs in Sector	43,022	61,798	112,769	180,639
	Rubber Gross Value Added (WB Price Proj) PM	6,000	3,976	12,944	25,713
	average change in GVA per decade		*-4.0%*	*12.5%*	*7.1%*
	Rubber Value Added in P Million (no price decline)	*6,000*	*7,485*	*24,128*	*47,330*
	average change in GVA per decade		*2.2%*	*12.4%*	*7.0%*
Scenario 3 Very positive - 7,000 ha/year through 2017 then 15,000 ha/yr before falling back as land becomes a constraint to 20,000 ha/yr 2022 - 2027 and 10,000 ha/yr thereafter	Total Rubber Area (ha)	139,000	218,560	381,960	491,667
	Area under Producing Rubber (7-31 y.o.) (ha)	29,000	74,560	261,960	431,667
	Rubber Production tons DRC	59,975	85,550	356,260	580,267
	Jobs in Sector	43,957	75,894	156,969	245,226
	Rubber Gross Value Added (WB Price Proj) PM	6,000	3,879	19,077	32,321
	average change in GVA per decade		*-4.3%*	*17.3%*	*5.4%*
	Rubber Value Added in P Million (no price decline)	*6,000*	*7,768*	*35,348*	*59,134*
	average change in GVA per decade		*2.6%*	*16.4%*	*5.3%*
Scenario 4 Very Negative - planting falls back to 1,000 ha year and remains at that level	Total Rubber Area (ha)	139,000	92,560	60,960	40,667
	Area under Producing Rubber (7-31 y.o.) (ha)	29,000	56,560	54,960	34,667
	Rubber Production tons DRC	59,975	68,750	61,860	46,767
	Jobs in Sector	41,151	39,789	30,950	19,952
	Rubber Gross Value Added (WB Price Proj) PM	6,000	3,868	3,546	2,600
	average change in GVA per decade		*-4.3%*	*-0.9%*	*-3.1%*
	Rubber Value Added in P Million (no price decline)	*6,000*	*6,617*	*6,180*	*4,702*
	average change in GVA per decade		*1.0%*	*-0.7%*	*-2.7%*

Source: Centennial estimates

would be required. Other things being equal, it will be more difficult to find the land for oil palm development than it will be for rubber. However the rapid growth of one private Philippine company shows that it can be done.

Policy issues to be addressed are similar to those for rubber, but there are the following differences in potential performance:

1. Oil palm develops faster, it starts to yield in 3–4 years, v. 6–7 years for rubber, and it is potentially more profitable.

2. It requires more sophisticated management and tighter producer/processor integration.

3. Unit size can be a startup issue. Ideally fresh fruit bunches (ffb) from about 8,000 ha are needed for an efficiently sized processing unit

4. Because of the need for close integration, clear and fair arrangements need to be established between the land owner/producer and the processor, whereas with rubber the product ex farm is a marketable commodity that can be sold directly to traders.

Growth potential. As with rubber, oil palm is potentially a good crop for former forestland that is not currently in active use. This may require oil palm development companies to work out land use arrangements with IPs.

- The Philippines is currently a substantial net importer of palm oil, but with proper support for a major development over the next decades, it could supply most of its own domestic market and switch to being a net exporter.

- Oil palm development could proceed rapidly, but would probably require direct foreign investment and the introduction of experienced management skills. A mixed industry having both estates and out growers could probably cover a further 300,000–400,000 ha by 2040, making use of improved road infrastructure. Given the likely need for time to resolve land issues, rapid growth is more likely to take place five years or so from now than in the short term.

With regard to establishment costs and profitability, at 2010 prices (and at present prices) oil palm is profitable at the farm level. Estimated cost of production is well below both the current world price and the long run world price, which is projected to fall over the next decade.

Two scenarios are considered, Scenario 1, in which there is no specific encouragement for oil palm production and the use of forest zone land is not feasible. Under that scenario, it is likely that the existing 56,000 ha will be retained and replanted as needed, but that new planting will be limited in the longer term to a modest expansion of areas around existing processing facilities. For the next five years, it is assumed that planting will be undertaken at the rate of about 5,000 ha/year, on land where arrangements have already been largely made and that are adjacent to underutilized processing facilities. As it becomes clear that extending the area is difficult and inward investment is not encouraged, it is postulated that this planting rate will fall back to a token 1,000 ha per year.

Under Scenario 2, it is assumed that arrangements to develop significant new tracts of oil palm are made, requiring parallel investment in new processing facilities. Under this scenario, the level of planting is also assumed to be 5,000 ha/year through 2017, but then as opportunities to develop new areas crystallize, the new planting rate will accelerate to 20,000 ha per year for the following decade, before falling back to 10,000 as, the availability of land becomes more of a constraint.

A summary of the two scenarios is presented in Table A4.16.

Under both scenarios, oil palm is likely to become a more important crop than at present, contributing to employment and the balance of trade. In the case of scenario 2, GVA would increase by a factor of about 5, even after taking account of the projected price reduction at the farm gate level of about 40% in real terms, between the projected price for 2025 and that of 2010. If oil prices remain at the real 2010 level, in the case of scenario 2, GVA would increase from about 4 billion to 44 billion in real terms. The equivalent of about 100,000 full time farm level jobs would be created, as well as a similar number in the crushing, transport, refining and marketing areas.

Based on the model, to increase the area of oil palm by 350,000 ha (i.e., Scenario 2) would require aggregate investment of about P 40 billion (USD 900 million), over a 28 year period. Substantial additional investment would also be required in processing facilities. For this to be realistic, a significant amount of the farm level investment as well as

Table A4.16: Impact of Different Levels of Oil Palm Planting on Area, Production, Jobs and Value Added (financial figures in P Million at 2010 real values)

		2010	2020	2030	2040
Scenario 1. New Planting takes place at 5,000 ha/year initially, as existing investors expand hectarage to make better use of existing facilities. But as it becomes clear that there is no major new support initiatives for palm oil, it slows to a modest 1,000 ha/year from 2017.	Total Oil Palm Area (ha)	56,000	85,000	95,000	85,000
	Total Production FFB ('000 t)	565	1,241	1,644	1,452
	Potential Palm Oil Production ('000 t)	113	248	329	290
	Potential Palm Kernal Oil Production ('000 t)	14	31	41	36
	Farm Level Jobs in Sector '000	15.5	23.2	26.5	23.5
	Gross Value Added (WB Price Proj) PM	4,000	4,662	5,537	5,123
	average change in GVA per decade		1.5%	1.7%	-0.8%
	Palm Oil Value Added in PM Million (no price decline)	*4,000*	*8,471*	*10,150*	*9,209*
	average change in GVA per decade		*7.8%*	*1.8%*	*-1.0%*
Scenario 2. New Planting takes place at 5,000 ha/year initially, as existing investors expand hectarage to make better use of existing facilities. As it becomes clear that there is strong support for palm oil, new investors come in and planting expands to 20,000 ha/year for 10 years, before falling back as land availability becomes a constraint.	Total Oil Palm Area (ha)	56,000	161,000	321,000	401,000
	Total Production FFB ('000 t)	565	1,424	6,480	8,165
	Potential Palm Oil Production ('000 t)	113	285	1,296	1,633
	Potential Palm Kernal Oil Production ('000 t)	14	36	162	204
	Farm Level Jobs in Sector '000	15.5	38.7	87.9	114.8
	Gross Value Added (WB Price Proj) PM	4,000	4,060	17,562	21,737
	average change in GVA per decade		0.1%	15.8%	2.2%
	Palm Oil Value Added in PM Million (no price decline)	*4,000*	*7,358*	*35,590*	*44,440*
	average change in GVA per decade		*6.3%*	*17.1%*	*2.2%*

Source: Centennial estimates

all of the investment in processing facilities would need to come from the private sector. The proportion that could realistically be expected to come from smallholders' own labor would inevitably be quite small. Even if this were boosted by (i) planting grants funded by the public sector and targeted towards farmer groups and (ii) funding by banks using Land Bank resources. Ideally the investors would have a strong understanding of the sector and access to the latest research and technology. That probably means it would be inward investment from regional oil palm businesses. It will be important therefore that policies are put in place to encourage this.

Other Tree Crops

Bananas (Cavendish for Export)

There has been strong growth in bananas over the past two decades. In the eight years 2002–2010, the area under bananas has grown at 4.6% p.a. and production has grown at 7.1% p.a., with spectacular growth of 12.6% p.a. in area and 12.7% in production from the export oriented Cavendish variety. In 2010, there were 440,000 ha of bananas of which 80,000 ha were Cavendish. Of the main crops in the Philippines, bananas give the highest gross return to land. BAS data for 2010 indicates an average gross value of production at farm gate per ha for bananas of all types at P242,000 (USD 5,500) compared with USD 2,200 for sugar or USD 550 for coconuts. The figure for Cavendish bananas alone is substantially higher still.

In evaluating prospects for development of the banana industry, a disaggregation needs to be made among:

- Export varieties Cavendish: there appear to be good growth opportunities, but mainly by established private companies. Although production is efficient, these varieties are quite contested worldwide among relatively few players and can be subject to non-trade barriers.

- Local varieties sold to city markets face little external competition, though this could happen if prices were very high. Overall demand per capita may be quite inelastic, therefore rural banana producing communities will probably maximize farm gate returns if they are careful not to oversupply and to expand in pace with the growth of city populations and in pace with income expansion.

Local bananas for own/village consumption are essentially a non-tradable, and almost certainly price inelastic. Gains to producers will come from improved efficiency while allowing volumes to grow only in line with population growth and earnings.

Cacao and Coffee

There are a number of other agricultural tree crops in the Philippines, including coffee and cacao, mango (which is widespread and an export crop), as well as a whole range of other fruit trees, some of which are grown as commercial crops for sale, but many of which are essentially part of house lots for families' own consumption.

The area under coffee, about three quarters of which is robusta, has fallen from 144,000 ha in 1990 to 121,000 ha in 2010, and production from 126,000 tons to 95,000 tons (dry bean equivalents). Prior to 1997, coffee was an export crop, but since then the Philippines has been a net importer. The value of production per ha has fallen at farm level in real terms, from an average P 78,500/ha in 1998 to P44,600/ha in 2010.

Philippines had been an important cacao producer, particularly in Davao from which about 70% of national production comes. Production peaked at about 30,000 tons[21] in the 1980s. Subsequently, the area planted to cacao decreased from 18,000 ha in 1990, to 9,000 ha in 2010, and production from 10,000 tons to 5,000 tons (dry beans). The Philippines currently imports about 30,000 tons of cacao p.a.

Based on the favorable climate and availability of good local planting material, there is potential to reverse the decline in coffee and cacao, and to substantially expand production of both crops, initially substituting for imports, but particularly in the case of cacao, becoming a significant exporter. The potentially high quality of Philippine cacao, the increasing world demand for chocolate yet international uncertainty of supply, particularly from the traditional source in West Africa, suggest a positive outlook. Furthermore, there is considerable interest in cacao among Philippine businesses. Most of this investment is likely to be in Mindanao, so a key factor will be resolution of peace and order situation.

From the production side, both coffee and cacao can be integrated with coconuts—coconut trees providing the necessary shade. Both coffee and cacao can be good smallholder crops, but would require specialized extension inputs. These would need to come largely from the private sector, but could be partially public sector funded as part of Agrarian Reform Communities (ARC) development programs,[22] or programs dealing with Indigenous Peoples (IPs) within Ancestral Domain areas.

There is also the possibility of both coffee and cacao production from larger units, including : (i) though leasing arrangements with individual small farmers, (ii) through leasing/crop sharing agreements in IP areas, (iii) as part of integrated forest management leases which are already in place, or (iv) as part of the National Greening program (see paragraph 5).

The potential for substantial expansion through 2040 might be anchored on a planting program for cacao under coconuts rising to perhaps 15,000 ha per year. Assuming a typical 15 year crop cycle, that could lead to a stock of cacao trees by 2040 of 235,000 ha, which is still pretty small compared to the coconut area of 3.6, thus becoming a net exporter. But the country would still be a fairly small player in world trade, which is currently about 3 million tons annually. An estimated incremental 65,000 jobs would be created at farm level—in reality much of this labor demand might actually reduce underemployment rather than major

21 Data from Cacao Industry Development Association of Mindanao (CIDAMI).

22 For example the upcoming IFAD funded project centered on CARAGA, Cagayan de Oro and North Western Mindanao, which plans to involve DAR, DA and DENR provides for grant funding through the private sector for investments and technical support for Value Chain led production and marketing development, relating to smallholders.

Table A4.17: Impact of Different Levels of Cacao Planting on Area, Production, Jobs and Value Added (financial figures in 2010 real values)

		2010	2020	2030	2040
Scenario 1. Status Quo New Planting takes place at 500 ha/year initially, rising to 750, existing 10,000 ha is replanted at a level needed to sustain it	Total Cacao Area (ha)	10,000	14,500	19,750	20,500
	Cacao Production ('000 tons Dry Beans)	5.00	8.62	12.90	14.10
	Farm Level Jobs in Sector ('000)	3.0	4.3	5.7	6.2
	Cacao Value Added in P Million	400	295	397	428
	Cacao Value Added in P Million (no price reduction)	400	700	980	1,066
	Annualized growth rate of GVA (at est LR prices)		-3.0%	3.0%	0.7%
	Annualized growth rate of GVA (at 2010 prices)		5.8%	3.4%	0.9%
	GVA per job ('000) at est LR prices	133	69	69	69
	GVA per job ('000) at 2010 Price Levels	133	163	171	171
Scenario 2. New Planting takes place at 5,000 ha/year initially, which increases to 15,000 in 2017 as support becomes available from PCA and area for cacao is widened.	Total Cacao Area (ha)	10,000	95,000	225,000	235,000
	Cacao Production ('000 tons Dry Beans)	5.00	46.48	165.10	173.79
	Farm Level Jobs in Sector ('000)	3.0	24.5	61.8	67.6
	Cacao Value Added in P Million	400	1,488	4,352	4,583
	Cacao Value Added in P Million (no price reduction)	400	4,246	12,034	12,667
	Annualized growth rate of GVA (at est LR prices)		14.0%	11.3%	0.5%
	Annualized growth rate of GVA (at 2010 prices)		26.6%	11.0%	0.5%
	GVA per job ('000) at est LR prices	133	61	70	68
	GVA per job ('000) at 2010 Price Levels	133	173	195	187

Source: Centennial estimates

net new employment. Because farms are small (1–2 ha cacao per farmer), the estimates assume that fermentation and drying would be done centrally by cooperatives or traders. Thus in addition to value added at the farm level, there would be additional value added and job creation in the fermentation and drying establishments. In the case of scenario two, this would probably involve a further 15,000 jobs by 2030 and an increase of at least 30% in value added.

The actual level of profitability and value added of this type of development would depend heavily on world prices. The per hectare models show that the financial rate of return for cacao investment would be about 76% if 2010 prices were to continue, or 26% if the World Bank commodity forecast materializes. At that level of production (174,000 tons), Philippines would be a net cacao exporter. If World prices do fall to below half of the 2010 levels, the farm level GVA per job (P68,000) would be relatively low—equivalent to about P270 per person day. At that level, cacao production would be fine as means of using surplus on farm labor (farm families themselves). However it would only be attractive to plantation operators paying unionized wages if yields were substantially higher than the rather low figure, of kg 740 p.a. dry bean equivalent averaged over the whole 15-year cycle, which was used in the model.

The situation for coffee has not been estimated in the same detail as that for cacao, but based on the models shown in Annex D, coffee could also make an important contribution to agricultural sector GVA and employment, provided that the land and peace and order obstacles were removed. It would be realistic in the positive scenario for new coffee planting, which could largely be in former forest areas to take place at 10–15,000 ha per year from 2017 onwards in addition to replanting existing coffee over a 10–15 year period. This would increase the coffee area to about 200,000 ha. At that level, Philippines would be a net exporter of coffee and might export about 150,000 tons/year. At that level it would still only be a relatively small player within world trade. World trade in coffee is currently about 6 million tons.

Horticulture

Most horticulture is presently for domestic consumption, with the exception of three major fruits (banana, mango and pineapples) and some other minor exports. As indicated in Table 18, the area planted to fruits, vegetables and flowers has grown by 305,651 ha (29%) during 1990–2011 (although a number of items would be double or triple cropped, so absolute area occupied would be less). Almost all of the increase was due to a net expansion of area under

fruits, of which 88% was due to the three main export crops. However, a number of other minor fruits also expanded, with the exception of oranges. Flowers increased across the board, but the area involved is very small. Vegetables presented a more complex picture: aggregate area showed almost no change, but this masked very variable performance across crops. Some showed very strong performance (broccoli increasing tenfold, but from a very low base; string beans doubling); the larger cassava crop area barely changed in 20 years despite population growth; the area under sweet potatoes (camote) decreased by about one fourth, and peanuts by 40%. The only somewhat larger vegetable crop to expand area was mung bean (24%), typically grown on residual moisture in rice areas. The area under all other smaller vegetable crops expanded by 28%, but with some gaining and others losing. Current vegetable productivity is quite low, and growing at only about 1% p.a.

Production statistics are confusing. On the one hand, the Vegetable Crops Road Map 2011–2016 indicates production from the 20 priority vegetables of about 1.64 million tons in 2010, i.e. about 17.6 kg per capita, but also refers to the per capita vegetable consumption level being low at 40 kg/capita and aims for that to increase to 60 kg/capita by 2016. The 7th National Nutrition Survey (2007) indicates vegetable consumption of about 40 kg/capita, plus another 10 kg/capita of starchy roots and tubers, dried beans, nuts and seeds.[23]

Domestic consumption of fruits and vegetables will likely keep pace with population growth, although support from nutritional information campaigns could prompt one or more demand shifts over the next few decades, depending in part on the pace of per capita GDP growth. Additional output would likely come from both increased production and a switch to higher value products including vegetable products with greater value added (partially prepared vegetables, pre-packed vegetables etc.). Most of the additional production should come from an improvement in yields, brought about by better cultural practices supported by improved extension based on greater commercialization encouraged by more sophisticated marketing.

Changing consumption patterns will also require changes in the way fruits and vegetables are handled and delivered to wholesale and retail points, as market expectations of quality rise. In that context, there has been some trend towards increasing imports over time, which may reflect a mix of production shortages, reduction in tariff rates, and consumer preference for better packaged, processed, perceived better quality and/or 'healthier' products, especially in institutional markets (hotels, restaurants and fast food outlets) and supermarkets that cater to high-end clients. While most fruits and vegetables are still sold in traditional value chain outlets dominated by traders, a recent study estimated that about one-fourth of the volume now moves through the institutional markets (Digal, 2007). As retailers and processors are becoming more concentrated, farms are getting smaller and fragmenting (ibid.). Among the issues that emerge in value chain studies for the smaller crops (i.e., excluding the three large export crops) are gaps in market information, infrastructure constraints (especially road transport), inadequate promotion of nutritional issues, continuing high inter-island shipping costs, poor organization of producers, high post-harvest losses and inability of small producers to engage in storage or processing, lack of regulatory support (e.g. certification of organic products), difficult access to rural finance and up to date extension services.

Sugarcane

Sugarcane has a two to three year production and processing cycle. Like oil palm, it involves shifting a large bulk of material to a processing plant—in this case up 100 tons per ha or roughly 4 times the amount for palm oil. There are 29 privately owned sugar mills in the Philippines and 4 Ethanol plants. There are about 62,000 sugarcane farmers, but 75% of sugarcane production comes from larger farmers (over 5 ha), many of who may become involved in the final years of CARP. Employment in the farm production element of sugar cane is the equivalent of about 230,000 jobs although because of its seasonal labor requirement, more

23 The 7th NNS also includes a miscellaneous category of about 10kg/capita, which could also include some vegetable items.

Table A4.18: Planted/harvested area under Fruits, Vegetables, and Flowers, 1990–2011 (ha)

Crop/Year	1990	2000	2010	2011	Area Increase 2011/1990	% change 2011/1990
Fruits	491,101	633,663	794,757	792,497	+301,396	61
Banana	311,819	382,491	449,443	450,125	+138,306	44
Mango	77,137	133,815	189,437	187,073	+109,936	143
Pineapple	40,795	42,968	58,547	58,456	+ 17,661	43
Other	61,350	74,389	97,330	96,843	+ 35,493	58
Vegetables	569,551	549,906	575,045	573,541	+3,990	0.7
Cassava	213,653	210,208	217,622	221,235	+7,582	3.5
Camote	136,717	127,682	109,438	103,704	–33,013	(24)
Mung bean	36,593	39,661	40,080	45,283	+8,690	24
Peanut	44,489	26,866	27,123	26,902	–17,587	(40)
Other	138,099	145,489	180,782	176,417	+38,318	28
Flowers[1/]	727	866	1,000	992	+265	36
TOTAL	1,061,379	1,184,402	1,370,802	1,367,030	+305,651	29

1/ Chrysanthemum, gladiola, orchids and roses.
Source: Centennial estimates, BAS data

people are involved at peak times.[24] Total sugar production is around 2 million tons, of which about 140,000 tons are exported to the USA under a quota arrangement. Under AFTA, tariffs are being reduced progressively (38% in 2011, 28% in 2012, 18% in 2013, 10% in 2014, 5% in 2015). In the circumstances, it is essential for Philippines to increase the efficiency of sugarcane production, especially by small owners. This will need to involve development of farming on a block basis so that sequencing and transportation of cane can be efficient. That in turn will depend upon the development of effective relationships among groups of growers/lessors and between such groups and the processing plant operators.

Current crop sharing arrangements between farmers and millers also need to be reviewed. These are based on a fixed percentage ownership of the final product—with typically 65–70% belonging to the producer and 30–35% to the miller. In the likely event that prices fall, these fixed shares would need to be adjusted to provide the adequate incentives for investment in processing plant modernization.

While world sugar prices have been very high in the past three years, by historic standards, they are projected to fall to about half their present real level by 2025. If this materializes, it will affect ASEAN prices, meaning that Thailand's comparative advantage over the Philippines could increase further and prices in the Philippines' domestic market would fall. This would lead to some reduction in the land area devoted to sugarcane, which includes a mix of good lands, and marginal areas with excessive slopes and poor access to the mills.

On the hand, the domestic market for sugarcane products is expected to grow. Sugar for food should increase in parallel with both population growth and rising incomes. Based on

24 Sugar industry sources (SRA) refer to a total of 600,000 people employed in the industry, including processing, but that number probably reflects a headcount, including seasonal and part time workers, not job equivalents. We estimate the number of full time job equivalents (both production and processing) to be in the 270–300,000 range.

Table A4.19: Philippine and World Sugar Prices

Sugar Price Analysis (US cents/lb)					
Sugar Year	Philippines Composite Price	Duty	Competetive Landed Import Price Cif Manila	World Price fob Caribean	Premium of Philippines Price over World Price
2006/07	15.93	38%	11.54	10.64	50%
2007/08	22.29	38%	16.15	12.09	84%
2008/09	17.92	38%	12.99	14.66	22%
2009/10	32.74	38%	23.72	20.50	60%
2010/11	38.99	38%	28.25	26.24	49%
5 Year average	25.57		18.53	16.83	52%
2013	24.61	18%	20.18	18.48	
2015	17.46	5%	16.58	14.88	
2020	15.84	5%	15.04	13.34	
Long Run	14.21	5%	13.50	11.80	
Long Run assuming same av prices as 07/07 -10/11	19.51	5%	18.53	16.83	
Cost of Production changes needed to maintain margins					
	If COP was 80% of sales price		If COP was 90% of sales price		
Taking account of Long Run Price Estimates					
COP reduction needed to maintain % margins	44.4%		44.4%		
COP reduction needed to retain margins/ha	55.5%		49.4%		
Assume Prices Stay at 2006/7 to 2010/11 levels					
COP reduction needed to maintain % margins	23.7%		23.7%		
COP reduction needed to retain margins/ha	29.7%		26.4%		

Source: Centennial estimates, based on BAS and World Bank commodity price forecasts (June 2012).

FAO 2007 data, consumption of sugar and sweeteners in the Philippines at 23.3 kg per capita is above that of South East Asia (19.4 kg per capita) and East Asia (11.3 kg per capita), but slightly below the world average of 24.4 kg per capita and well below the European average of 42.2 kg per capita. This suggests that there will probably be per capita consumption growth, particularly if local retail prices decline. Domestic demand for sugar for food could therefore increase from its 2010 level (2 million tons) to perhaps 3.5–4 .0 million tons by 2040.

Additionally, Philippines legislation now requires the use of ethanol—to the extent of 10% in gasoline (an estimated 486,000 tons of ethanol in 2012). Presently ethanol is being imported, with domestically distilled ethanol from sugarcane filling only about 1% of the market in 2011 and possibly 3% in 2012. Even if the existing 4 distilling plants were used to full capacity, domestically sourced ethanol would increase to only about 20% of current mandated requirements. The extent to which it will be profitable to further expand sugarcane based ethanol production capacity is unclear. It may be that it is cheaper to manufacture ethanol from other products, whether domestically produced or imported from within ASEAN, than from domestically produced sugarcane.

To maintain profit levels, average sugarcane producers will need to significantly reduce their costs of production by

2015. If real world prices stay the same as in 2006/7 to 2010/11, and if ASEAN suppliers are able to sell at about US .017/lb. above 'world price', then average costs of production would need to decrease by 25–30% to maintain margins. However, if the World Bank forecasts (dated June 2012) prevail, then margins would be maintained only if costs of production were virtually halved.

Inevitably, a proportion of sugarcane producers will not achieve the needed reduction in cost of production, consequently profits will fall or turn into losses. Accordingly, when the next need to replant comes up (every 2–3 years, depending on whether they ratoon once or twice), some of these are likely to switch out of sugarcane production. As sugar is quite a high output and labor-intensive crop, such a reduction would likely lead to a decrease in gross output, value added and employment. For example, replacing sugar with un-irrigated corn would roughly halve gross output per ha and substantially reduce employment. If 25% of sugarcane growers exited the industry (involving, say, 100,000 ha), there would be a net loss of about 40,000 jobs (if replaced by corn or comparable crop). However in some areas land may switch out of sugar into oil palm or other intensive crops (e.g. pineapple), in which case the employment impact would be much less negative.

Aggregate Impact

The combination of the various Scenario 2 estimates for individual crops or groups of crops would be fully consistent with the 2040 Vision for the Philippines, in Chapter 10 of this study. The result (combined with the estimates for rice, corn, livestock and fisheries) would be sustained overall sector growth about 3.5% p.a.[25] The combined Scenario 1 forecasts reflect the less optimistic 2040 Scenario in Chapter 10.

At this level of growththere would be asubstantial positive direct impact on employment. This has been assessed in detail in the models for coconut, rubber, cacao and oil palm, and is calculated based on the changes in GVA and assumptions on increases in labor productivity for other crops. Overall with a parallel annual increase in labor productivity over the 2010 to 2040 period of 1% for the modeled crops and 2.5% for the others, the increase in GVA would generate the equivalent of about 1.6 million jobs. Average GVA per full time job equivalent in 2040 is estimated at P311,000 at 2010 prices or P263,000 at projected prices. These figures equate to P1,200 and P1,020 per day respectively—well above the both the present rural wage rate of about P150/day or the 'plantation' rate of around P275/day, thus providing considerablescope for real wage increases, as would be expected in a growing economy.

As to labor availability, much of the tree crop development is likely to be in Mindanao while other fruits, vegetables etc. will be spread more evenly across the country. Overall it is estimated that about three-fifths of the incremental job needs would be in Mindanao. In 2010 Mindanao had a population of about 22 million, of whom 4.2 million were reported to be involved in agriculture (BAS). Assuming population growth for Mindanao is similar to the rest of the Philippines through 2040 (52% increase), Mindanao's population would reach about 33 million. Taking into account that there will be a drift away from agricultural employment over the next few decades, this analysis suggests that an incremental one million agriculture-related jobs in Mindanao, and another 600,000 in Luzon and the Visayas, could be comfortably absorbed, provided wage rates are competitive. That said, while labor scarcity is not likely to be a generalized problem, it could be an issue for specific locations and crops.

From a food security standpoint, the situation of most crops that are mainly for domestic consumption is positive. With the exception of cassava that experiences a slight decrease in availability per capita, growth in GVA of all other products could exceed the rate of population growth, leaving comfortable margins to increase per capita consumption without major price increases for consumers (including crops that are the source of important micronutrients), and for some items opening the possibility of export.

25 As noted in the discussion of individual tree crops, these estimates are based on the long-term commodity price forecasts of the World Bank, as of June 2012, which foresee important decreases (although expansion along the lines proposed in this study is still profitable). If current 2010 prices were to continue in real terms, the aggregate impact would be to raise GVA growth these crops to about 4.3% p.a.

Even though domestic demand will be growing in line with population growth and rising per capita income, a substantial proportion of this incremental agricultural production would translate into exports. Specifically, exports would be expected to increase from Cavendish bananas, pineapple, coconut products, rubber, palm oil, cacao, other plantation crops and mango. In the case of sugar, the Philippines would probably become a significant importer, particularly if the ethanol in fuel requirement remains in place. Of these potential exports, vegetable oils, rubber, coffee and cacao are essentially commodities where there is no physical market constraint but for pineapple, bananas and mango, the potential market will depend on demand from buying countries and the performance of competitors as well as on the marketing skills of Philippine exporters. Incremental production for export-oriented products is estimated as follows.

Table A4.20: Comparison of Scenarios

Scenario Outcomes	2010	2040 Scenario 1	2040 Scenario 2
Planted area ('000)[1/]	5,811	5,915	7,800
GVA (2010 P billion)	318	522	927
Incremental jobs	--	297	1,565
Ave. GVA/job	157	225	258
Incremental output of exportables ('000t)			
Coconut oil (63% of incremental copra)		726	2,733
Rubber (DRC)		157	1,121
Cacao (dry beans)		11	457
Coffee (green beans)		32	320
Veg oil from oil palm (PO & PO total 22.5% of ffb)		252	4,654
Sugar (10% of cane production)		(539)	610

Source: Centennial estimates

Less optimistic scenario.In the event that there is no improvement in the business environment, development of 'other crops' would be expected to follow the 'Scenario 1' results of the individual crop analyses. In this case, growth of about 2% overall is envisaged. While there will be plenty of room for expanding production of fruits and vegetables for the domestic market up to levels that will improve nutrition, the production of export products and generation of new jobs would be much lower than in the Vision Scenario 2.

Comparison of scenarios.An overview of the characteristics of the two scenarios is presented below. In all cases there is likely to be some increase in area cropped, coming from former forestland. The main difference between the scenarios is the extent that this takes place. In either case, some growth is expected from this type of agriculture, creating a greater demand for labor. In the less optimistic Scenario 1, because of the high underemployment in the sector, it is not anticipated that the headcount nominally involved will increase—rather, those who work in the sector will on average be more gainfully employed. However in Scenario 2, new land will be opened up for agriculture, thus creating employment (or self-employment) for different people. The models expect that in both cases there will be increased value added per job or per person day, but in Scenario 2 the scope both for new jobs and considerable improvement in remuneration is much greater.

Investment implications. Scenario 1 involves continuing in roughly the same way, and growing agriculture mainly through technical improvements and so could take place within the existing financing structures. In the case of Scenarios 2, there would be substantial opening up of new areas for long term crops. The annual investment cost would be about USD300–400 million (depending on the particular mix of crops), or about $135–250 million, if only incremental coconut area is considered (with most replanting costs on the remaining 90% covered by timber sales). The majority of the necessary financing needs to be provided as equity. This could come as (i) value of smallholders own labor, (ii) government grants, (iii) freeing up of the coconut levy funds, (iv) equity from Philippine plantation or processing companies, or (v) equity from foreign direct investors, capable of providing technical value added or (vi) equity from special purpose funds set up to participate in investment opportunities in agriculture. While some credit finance could be appropriate, it would probably be limited to financing those businesses that can provide adequate collateral. The newly established Agricultural Guarantee

Fund Pool may be of some assistance in this regard, but at present this pool is quite small (it has about P 4 billion of funds and is able to guarantee P 8 billion of loans).

Annex 5—Fisheries

Development of the Fisheries Sector; Past and Present

The Philippines is a fish-eating nation and sustainability of the fish supply for its food security is crucial. Fish is a major source of protein for Filipinos, and contributes about 18% to agriculture GVA (2010).

With 36,000 km of shoreline, 250,000 ha of inland water area, 287,000 km2 of municipal sea area (within 15 km from shore, almost equal to the total land area), an oceanic area of 1.9 million km2 within its Extended Economic Zone (EEZ), about 27,000 km2 of coral reef area (the second largest in the world), and some 450,000 km2 of mangrove forests (in 1918), Philippines has the basic resources to provide high quality food for its population, substantial employment in coastal areas and to contribute considerably to the economy and exports. However, for decades, the country has been unable to exploit these resources sustainably. The issues are not new: since 1972 at least seven major national plans and programs and a multiple of regional and local programs have attempted to address the sector's issues[1].

Through an iterative devolution process starting with the Local Government Code of 1991, local responsibility for marine resources management has been divided among local, national and other stakeholder interests[2]. The impact has been disappointing. Coastal and most oceanic resources were already in a serious state of decline in 2001, although small areas (parts of Mindanao) still have less exploited marine resources.[3] Depleted resources have been brought about by excessive fishing effort and destructive fishing practices caused by an de-facto open access regime, leading to ever declining catches of the still growing fleet of municipal and commercial fishing boats[4]. About 70% of mangrove forests have been destroyed to create brackish water ponds. Most coral reef areas are in serious decline.

Poverty is pervasive particularly among small-scale fishermen, who operate some 470,000 small fishing boats. Sector employment has continuously expanded from about one million in 1988 to an estimated two million in 2011. About 75% of fishing folk are engaged in municipal (small-scale) coastal fisheries, 20% in fish culture, and 5% in commercial fisheries and sector supporting industries. As coastal resources declined, the share of traditional fishermen in total production also declined, while commercial fisheries expanded. Incomes of municipal fishermen are about half the national average;[5] they play a critical role in supplying local communities, processors and traders with fresh, often cheap fish and seaweed.

The commercial sector, lacking access to appropriate funding and subject to an increasingly pervasive – but often ignored—blanket of public sector regulations and declining productivity (catches/vessel/day), has also expanded well beyond resource limits, while increasingly intruding in municipal waters.[6]

Public infrastructure and services to support the sector (ports, ice-plants, quality control) are seriously deficient. The

1 Recently, Chapter 2 (agribusiness component) of the Medium–term Philippine Development Plan, 2004-2010, provides an exhaustive analysis of the failings of the system and proposals to address them.
2 Local governments (municipality/city) have acquired full responsibility for management of coastal resources, and the Bureau of Aquaculture and Fisheries (BFAR) of the Department of Agriculture (DA) remains responsible for marine fisheries outside the 15 km coastal zone. A multitude of management councils (at Barangay, municipality/city, cross-municipality and national levels) represent stakeholder interests.

3 Department of Environment and Natural Resources (DENR): Proposed National Coastal Resource Management Policy, Manila, 2001.
4 Department of Agriculture, Bureau of Fisheries and Aquatic Resources ((DA-BFAR); Comprehensive National Fisheries Industries Development Plan (CNFIDP), Manila, 2005.
5 ibid.
6 DA-BFAR; Comprehensive National Fisheries Industries Development Plan, Manila, 2005.

performance of multiple research and extension services has not kept pace with requirements.

Industrial fishing and fish culture activities have targeted tuna and shrimp; more recently, investment has targeted seaweed processing, mainly for export. Although industrial employment levels are modest compared to Municipal fisheries, the industrial sector generates about two-thirds of fish export value. Tuna and sardine processing and seaweed production and processing have been the only activities showing sustained production growth over the past decade. Not all export industries depend on industrial investment: smallholder investment dominates rapidly growing seaweed production.

The Philippines has been largely able to isolate itself from regional tensions over fisheries in the past, but will be challenged by the future, global, quest for fish. The country will increasingly be exposed to what the tuna industry is facing right now—being forced to seek access to tuna resources abroad. By 2040 East Asia will consume over half of all global fish production. This influence will not only be transmitted through trade—which will expand—but also through technical, research and political channels. Foreign technology—combined with local experience—will support aquaculture development and marine fisheries. Integration of global and regional research will be a critical catalyst of future national sector development. Domestic consumers will become more urban and affluent and will demand higher quality fish products while eating 'out'; they will also change habits with regard to where they purchase food.

Historic Fish Production and Trade Trends; Resources Potential

Marine and freshwater fish catches

Marine fish production—which includes large catches of tuna species made partly outside the country's 200 mile Exclusive Economic Zone (EEZ) totaled 2.4 million tons in 2011; capture fisheries from fresh water bodies added about 0.2 million tons. Statistics suggest that since 1980 marine capture production increased an average of about 1.5%/year, inland capture from open inland water bodies declined by 1.1% per year; trends vary widely between provinces. Philippine fisheries statistics cover about 30 commercial fish species, of which pelagic[7] (including round scad, Indian sardines and skipjack) currently constitute nearly 90% of the total catch. Decades of excessive exploitation have substantially impoverished the marine environment, reducing the critical role of demersal and large predator species in the food pyramid, which is now dominated by small pelagic species, which grow faster, but also show much larger variability in annual year classes and biomass on account of unpredictable—and changing—environmental and climate factors.

Since 1980 total food fish production (2.0%), grew less than the reported annual population growth of 2.5%.

Status of marine fish resources

Table A5.1: Philippine Fish Production 1980-2011 ('000 tons)*

	1980	1990	2000	2011	Percentage annual change 1980–2011 (%)	Percentage annual change 2000–2011 (%)
Commercial Fisheries	488	701	946	1,040	2.5	1.0
Municipal Fisheries	1009	1,132	945	1,332	1.0	3.1
Marine	762	895	793	1,138	1.3	3.3
Inland	247	236	152	193	(1.1)	2.0
Aquaculture	179	671	1,100	2,608	9.0	9.0
Fish	166	380	393	768	4.9	6.3
Seaweed	13	291	707	1,840	17.1	10.3
Total Fish Production (including seaweed)	1,676	2,504	2,991	4,980	3.5	5.1
Total Production Food Fish	1,663	2,213	2,284	3,140	2.0	3.1

Source: Bureau of Agricultural Statistics (BAS)
* The statistics, based on monthly surveys, probably underestimate fish production during the 1980 and 1990, when data collection procedures were relatively poor, and may overestimate production after 2000, reflecting increasing political interference in statistics reporting.

7 Pelagic: species that mostly stay in the top layers of the water column and frequently migrate; demersal: species that stay close to the bottom.

Research suggests that on average marine resources are being exploited well beyond their Maximum Sustainable Yield (MSY), estimated at about 1.9 million tons8; if the cautionary principle would be applied, sustainable production may not exceed 1.6–1.8 million tons. No recent consensus about the absolute level of MSY can be found. Scientific consensus does exist that bottom dwelling fish resources—a critical food fish resource—are universally overexploited; biomass levels are 10-30% of those in the 1940s.[9]. Resources of small pelagic species in coastal areas – a key resource for cheap, traditionally processed fish—are also fully or overexploited – catch rates are one sixth of those during the 1950s. For coral reef resources the current catch rates are among the lowest in the world. Some stocks may be less exploited in oceanic areas. The status of oceanic resources (tuna like species) within the country's Extended Economic Zone (EEZ) is less clear. In some areas they are recorded as overexploited, in others the status is uncertain or resources are moderately exploited (skipjack). The picture is not universally bleak – in some areas (Mindanao) resources are reported in better shape. Nevertheless, over the next three decades, no large sustainable expansion of total marine fish production can be expected from within the EEZ. Without major improvement of the effectiveness of fisheries resources management, production from selected overexploited stocks may well further decline, and their biomass fluctuate more violently than in the past.

Ineffective resources management under the traditional top-down management paradigm applied before 1991 was one of the drivers behind the move towards devolution. Now, after decades of centralized and decentralized management fisheries resources management still suffers from multiple ills: political complacency or interference at the national and municipal level, a changed and much less robust resource base (and changing resource management requirements)[10], a lack of knowledgeable people in the field, limited research focused on critical management issues, a lack of money, ineffective enforcement, and low political priority at the national and lower institutional levels. The unfortunate truth is that neither the centralized nor the decentralized approaches have come to grips with the management issues of Philippine marine fish resources, although some pilot activities have made progress[11], be it at huge costs. The experiences of the past two decades does suggest the principle of managing multiple, complex fish resources, notably those freely moving, based on 'control' over a 15 km piece of the coastal waters, with at least six agencies directly involved[12] and several levels of consultation, defies rational management[13] and requires adjustment.

The oceanic areas outside the Philippine EEZ do offer opportunities for expanded exploitation. Tuna resources in the Pacific Oceans are mostly moderately exploited[14], but ongoing efforts to control exploitation by the Western and Central Pacific Fisheries Commission (WCPFC) and major competition for access to the resources from other countries are likely to limit unrestricted future access. The Philippines currently actively pursues access to Papua New Guinea's large tuna resources through bilateral negotiations, and recently received permission to fish a 'donut hole' in between the EEZs of Pacific countries. Yet, the role of tuna for local consumption should not be exaggerated: tuna and

8 Barrut et al (1997); earlier estimates of MSY by Kvaran (1971), Menasveta (1973), Aoyama (1973), Norconsult (1975), AID (1977) and Yutuc and Trono (1977) range from 1,65 million tons to 3.7 million tons. Kvaran and AID estimates were close to Barrut's estimate. All estimates were based on assumptions about productivity /km2 at a time that demersal stocks played a much bigger role in the marine environment. The changes in the marine food pyramid since the 1970s may have modestly increased the MSY, as fast growing species currently completely dominate catches. However, much larger fluctuations in recruitment also increased the need for short-term management of selected large stocks.

9 Over-exploitation generally implies human fish catches, natural predation and mortality substantially exceed biomass growth, which reduces the robustness of fish stocks to accommodate natural shocks. Fish stocks collapse once the spawning biomass is being reduced below a critical level, which differs for each species.

10 For a recent assessment of the key requirement for effective fisheries management, balanced harvesting, see: Garcia et al; Reconsidering the Consequences of Selective Fisheries; Nature, Policy Forum; www.sciencemag.org; March 2, 2012.

11 Completion Report for the Fisheries Improved for Sustainable Harvest (FISH) Project; DA-BFAR and USAID, Manila 2010.

12 LGU's, Provincial Fisheries Divisions, DA-BFAR, DENR, the Department of the Interior and Local Government (DILG), and the Department of Science and Technology (DOST). The Department of Transportation and Communication and the Department of Defense (DND) and Philippine Coastguard and local Universities are also involved. In addition, advisory stakeholder consultations take place at various levels: the Provincial Development Council, the Fisheries and Aquatic Resources Management Councils and (Provincial) Coastal Resource Management Advisory Councils.

13 For a detailed analysis of the complexity of the current situation at the Municipal level, read: Alexis C. Yambao et al.; The Coastal Environment Profile of Negros Oriental, Coastal Resources Management Project, DENR, Manila, 2001. Also: Completion Report for the Fisheries Improved for Sustainable Harvest (FISH) Project; DA-BFAR and USAID, Manila 2010.

14 Exceptions are bigeye and bluefin stocks, while yellowfin and particularly skipjack tuna stocks are generally still in good shape.

related species comprise less than 15% of total marine catches. Commercial tuna fisheries produce about a third of commercial catches; about two thirds of all tuna catches are being exported.

Fish culture

Fresh water culture has historically been practiced in the large lakes of Philippines, mostly producing tilapia (currently 25% of all aquaculture fish production). Brackish water culture also has a long tradition, producing milkfish—Philippine's preferred cultured fish—comprising 50% of total current aquaculture fish production. The Philippine aquaculturist's selection of species and technology reflects historic preferences (milkfish), technology improvement (tilapia, shrimp) and high financial returns (seaweed). A Seaweed culture developed several decades ago [15] and its expansion has been phenomenal, reflecting almost ideal growing conditions, very high financial returns, low investment requirements and moderate risks[16]. Excluding seaweed the average annual growth of aquaculture food fish production has been about 5% annually since 1980, slightly higher since 2000. Area expansion has particularly driven past growth; in-pond productivity improvements have been relatively high for tilapia[17] and shrimp, but more limited for milkfish. In many areas, low productivity aquaculture—based on natural in-pond feed production—is still being practiced. The rapidly rising costs of protein-rich fish feed[18] and lack of technical competence of culturists have restrained productivity growth of most other species. Shrimp production has been affected by disease[19] and high feed costs; production decreased by a tenth since 1980.

Fish culture potential

Fish is being reared in pens in protected coastal sea areas, in cages in inland waters, and in ponds near the coast (brackish water) or inland (fresh water). In addition, small amounts are reared in rice fields. Seaweed is mainly grown in coastal sea areas, notably in Palawan and Tawi-Tawi, using multiple methods.

The country has substantial marine areas where fish culture, seaweed and mollusks culture potentially can be expanded, but such culture is most exposed to the effects of extreme weather: hurricanes (mostly in the more northern provinces), excessive temperatures and unpredictable rainfall. The selection of the location of future expansion of marine culture, and the development of affordable technologies that are able to withstand heavy storms will therefore be critical.

The area of brackish water culture area could potentially also be expanded. However, expansion would raise environmental risks (mangrove destruction, coastal erosion, and loss of coastal environment for fish spawning; Philippines makes major efforts to recreate mangrove areas). The uncertainty created by current land ownership and transfer policies will also restrict future area expansion. For milkfish and shrimp raised in brackish water ponds re-utilization of abandoned ponds and productivity increases should be the main drivers for future expansion; substantial expansion of milkfish production from marine pens and cages, combined with other integrated culture practices, is also feasible, but faces the same risks as seaweed culture discussed above.

The pollution load of freshwater culture already exceeds environmental limits in many lakes. Substantial expansion is still possible by integrating fish culture with activities that mitigate the effects of pollution, such as irrigated rice farming—practiced extensively in Indonesia with carp, but much less in Philippines, where carp species have only modest consumer appeal. Productivity of tilapia rearing can be further increased through cage culture, and the use of alternative feeds (fermented rice bran etc.).

The Bureau of Fisheries and Aquatic Resources of the Department of Agriculture (DA-BFAR) has assessed the technical and financial feasibility, private investment levels and potential risks of many forms of aquaculture. The ability and willingness of the private sector to invest in expansion and intensification in the future will depend on many fac-

15 Mostly used to produce hydrocolloids known as carrageenan and agar-agar.
16 Although seaweed is being affected by disease (ice-ice).
17 The multinational GIFT program (Genetically Improved Farmed Tilapia) has been successful in substantially increasing the productivity of tilapia farming.
18 The costs of fishmeal has increased >50% since 2008. Philippine farmers increasingly use 'trashfish' produced by the commercial fleet to complement traditional feeds.
19 White spot.

tors. Seaweed production appears most promising, notably in the southern provinces, although it is not feasible in all coastal areas. With an estimated Internal Rate of Return of over 300%[20], an investment payback period of 3 months and moderate production risks—although market risks have been considerable—it compares well to rates of return of 25-50% and much longer payback periods (2–4 years) and potentially higher weather related risks for most other aquaculture activities. The Philippines does have the potential to substantially increase future seaweed production, but faces market and climate risks. Maintaining high production growth of cultured fish will increasingly require total factor productivity improvements in ponds rather than just area expansion. Dependence on only two species for most fresh water fish culture production carries substantial risks; diversification of production will be critical. Most types of fish culture have moderate rates of return and face environmental and financial risks.

External and internal fish trade

While the volume of in- and export increased in parallel over time, Philippines increasingly imported cheap raw material for its canning industries (tuna and sardines) and feed for its fish and shrimp culture, while exporting high value canned and fresh tuna, sardines, shrimps and seaweed-based products.

Philippine's future as a fish exporter is uncertain; a medium-sized producer, the country faces stiff competition from the three dominant global canned tuna producers and many smaller ones, including Indonesia. Without tariff free access to the EU markets, and lacking the size and efficiency of Thai production, the industry will need to expand and rationalize regionally (cooperating with PNG, Western Pacific, Indonesia) to assure access to raw material and maintain global competitiveness.

The country is a moderate producer in global shrimp markets and faces competition from multiple shrimp producers in the region and globally. Future production growth will require broad application of global research findings and investment in intensification, feed development and improvement of disease and quality control.

The Philippines is currently the third largest producer of seaweed in the world, after China and Indonesia. The sector faced major problems the last two years on account of the global economic downturn, which reduced global food consumption and demand for carrageenan, in some cases by 50%, while prices declined. Given the profitability of production, the country should continue to expand its role in the global market, focusing on quality control, reliability and strong processing and marketing skills.

Table A5.2: International Fish Trade 1980-2010*

	1980	1990	2000	2010
Fish export				
Volume ('000 t)	76	143	200	221
Value (US$ m)	8	474[12]	658	877
Fish Imports				
Volume ('000t)	53	196	242	202
Value (US$m)	39	75[13]	124	207
Trade Balance (US$m)	(31)	399	534	670

Source: BAS
* FAO statistics for 2009: Value of fish imports: $192 M; exports $ 569 M.

The Philippines maintains several modest trade tariff levels and restrictions on international trade. Tariffs on exports of fish products are less than 5%. Fish is transported and traded after being landed or cultured. Few statistics illuminate the complex domestic logistic network of traders, processors and retailers, and the credit relationships they employ. Although public investment in fish landing facilities has increased during the past decade, hundreds of small fish landing places and larger fishing ports (Novotas!) are in a deplorable state, and do no longer provide the level of services and sanitary standards required for handling of fish for human consumption[21]. The task of upgrading the infrastruc-

20 http://mariculture.DA-BFAR.da.gov.ph/mz_species.htm.

21 Closure of landing centers happens regularly. Key reasons are proximity of the landing center to a new fishing ground, problems of security and safety, especially, declining number of boats, and changes in marketing practices of buyers. The transfer of landing places from the Philippine Fisheries Development Authority (PFDA) to the Local Government Unit (LGU) may also be a factor.

ture to suitable standards is huge, in terms of the number of landing facilities (8,800!) and necessary infrastructure. To sustain quality and sanitary standards for its seafood industry, over the next decades the country will need to substantially increase funding to upgrade its portfolio of fishing ports, be more selective which facilities to upgrade and maintain, and seek cooperation with the private sector to operate (parts of) fishing harbors and landing facilities.

Although most traders and processors operate small- or medium-sized enterprises, some are large, such as vertically integrated shrimp and milkfish farms. In fish production, culture, processing and marketing, size matters, notably when firms operate in highly competitive foreign markets (tuna), when activities require cutting edge research (shrimp, milkfish, tilapia) or involve substantial operational risks.

Public and Private Roles in the Fisheries Sector

The role of the Government in fisheries sector management—including resources management and domestic food supply—has changed fundamentally over time. During the 1980s development policies focused on rapid production growth[22]. Administrative mechanisms to indirectly control fishing effort proved ineffective. This led already in the 1980s to over-exploitation and marginalization of some coastal fishing areas and increase of destructive fishing practices.

Devolution

The governance approach changed fundamentally following the introduction in 1991 of the Local Government Code, followed in 1998 by the Fisheries Code. These defined the local government unit (LGU) as the key manager of natural resources within its boundaries. Devolution also shifted responsibility to provide basic sector services from national to a large number of Local Government Units-LGUs (provincial, cities/municipalities and villages). From a political, social, development and fisheries management point of view, the devolution approach satisfied prevailing theory; in practice it has proven less effective, cumbersome and a bureaucratic nightmare. It created almost 900 fisheries management and coastal zone management and development functions where once there was one.

- LGUs (861 coastal municipalities and cities) became responsible for enforcement of fisheries regulations and environment and natural resource laws, water and soil resources utilization and conservation, fisheries extension and research and some operations of local infrastructure (ports, ice plants and local fish distribution channels)[23]. They also grant fishery privileges and impose license charges for fishing inside the 15 km municipal/city coastal sea zone. In practice, most LGUs maintained a de-facto open access policy and had limited interest—or positively refused—to take politically sensitive resources management decisions. Their impact on sector development has been mixed.

- DA-BFAR maintained jurisdiction over commercial fishing; it issues licenses, and is responsible for all management, conservation, protection and utilization of all fish and aquatic resources except those within the 15 km municipal water zone. It remains responsible for policy, enforcement, industry development, research, statistics, quality control and indirectly, extension activities. In municipal waters, DA-BFAR is supposed to coordinate and assist LGUs and FARMCs. DA-BFAR has eight Technology Centers that assumed extension and research responsibilities. It maintains Provincial offices responsible for MCS, training and extension, and separate training centers to train LGU staff.

- The NIPAS act (1992) provides a common framework for national parks and (marine) protected areas, enabling LGUs to establish and manage

22 The Basic Provisions of Local Government Law No. 5/1974 asserted Provinces and Districts did not have jurisdiction over marine and fisheries resources. Fisheries Law No. 9/1985 did not clearly mandate fisheries management to either the local government or the local people.

23 LGUs can also ban or restrict certain fishing methods, define the minimum size of landed fish, perform land and water zoning, habitat conservation, mangrove reforestation, coral reef conservation, and support credit supply.

marine protected areas (MPAs). The Department of Environment and Natural Resources (DENR) requires an environmental impact statement from public or private projects that impact on the natural environment—including aquaculture. DENR involvement in aquaculture and other natural resources management matters necessitated close coordination between LGUs, DA-BFAR and DENR; in practice it created frequent turf battles but insufficient coordination[24].

- Councils. The Fisheries Code specifies that contiguous fisheries resources 'be managed in an integrated manner, and not be based on political subdivisions. To this end the Code encourages the creation of fisheries and aquatic management councils (FARMCs) at village, municipality/city, inter- municipality (IFARMCs). The impact of Council decisions has been limited as political interference or complacency influenced decision-making and restricted implementation.

- The Department of Agriculture (DA) is responsible for planning and budgeting of the DA-BFAR budget, all agribusiness and marketing, and post-harvest research and extension. It also handles standards for fishery products.

- Other Agencies. A number of agencies are involved in other aspects of the sector. Research is handled by multiple agencies: the National Fisheries Research and Development Institute, the Philippine Council for Aquatic and Marine Research, and State Universities and Colleges. Fish culture in lakes is handled by multiple Lake Development Authorities. Enforcement of fisheries activities is shared between the Philippine National Police, the Philippine Navy and Coast Guard.

Devolution forced 861 coastal LGUs to assume responsibilities for a set of highly complex, integrated management and development tasks for which they were not equipped, lacking staff, experience, funding, suitable coordination processes, or, most importantly, political commitment. It resulted in a severe lack of leadership in a sector that, because of its common property nature, persistent over-exploitation and critical role in supplying food, requires strong leadership and political commitment. Devolution also accelerated political interference in what ideally should be a scientific and technical resources management process and sector development strategies; it reduced the urgency to address the festering resource management issues[25] while development strategies changed with each administration. Now, two decades after the devolution process started, Philippine fisheries and aquaculture are not being sustainably managed or developed[26].

Restructuring and streamlining of responsibilities of DA-BFAR was part of the decentralization process, but the task was not accompanied by an assessment of how its future responsibilities could realistically be carried out. The Fisheries Resources Management Division in DA-BFAR lacks the staff and other resources to properly execute its job, including supporting LGU activities. As many earlier studies have pointed out, governance capacity and accountability of the political and administrative establishments at the local and national level require strengthening, overlapping responsibilities of multiple stakeholders should be reduced, and necessary consultation processes simplified[27]. Management and development needs to achieve results, not pursue a process. Korea, Malaysia and Japan have simpler and more effective resource management and sector development structures. Plans have been drafted, but far too little leads to decisive action[28].

24 Department of the Environment and Natural Resources (DENR); Proposed National Management Policy for the Philippines, Manila, 2001.

25 Completion Report for the Fisheries Improved for Sustainable Harvest (FISH) Project; DA-BFAR and USAID, Manila 2010.

26 In addition to depleted marine resources and degraded fresh water fishery habitats, resource use competition has intensified, product quality has declined, livelihoods of the still growing number of municipal fishermen have declined, many of the 8,800 fish landing centers and ports lack adequate facilities to appropriately handle fish, post-harvest losses have increased and domestic per capita fish consumption levels have been declining. These problems have been analyzed multiple times, a.o. in the Comprehensive National Fisheries Industry Development Plan (CNFIDP), Manila, 2005.

27 Land distribution and titling responsibilities that affect aquaculture development are also spread across many agencies, including DAR, DENR and the National Commission of Indigenous Peoples (NCIP), depending on their respective target communities and areas. Legislation for a Land Administration and Reform Act (LARA), which would bring together the many agencies within a Land Administration Authority, has been awaiting approval in Congress for many years.

28 The process of design, stakeholder consultation and redrafting of the CNFIDP took over 4 years.

One of the main thrusts of the recent 'convergence' initiative in agriculture would focus on coastal marine environment; various options for a new institutional arrangement are on the table for consideration, but consensus has yet to be reached.

Many complex, sometimes temporary, tasks at the LGU and Provincial level require human resources that are just not available locally. These should be contracted to external parties—including to teams of DA-BFAR—and funded accordingly. Other activities being undertaken by the national and local government agencies should be the responsibility of the private sector, or delivered in partnership with the private sector. The government heralded public-private partnerships (PPPs) as important generators of economic development, but the principle has only sparingly been pursued effectively in support of the fisheries/aquaculture.

Philippine Development Plan 2011–16

The latest Philippine Development Plan (2011-16) aims to increase food security, rural incomes and resilience to climate change risks and to improve the sector policy framework and governance, but the plan fails to address fundamental sector Governance issues outlined before. Improvement of local sector infrastructure, quality control, adaptation of technology and diversification, streamlining the research agenda and expansion of new and innovative ways of disseminating results (extension) and human resource development also receive modest attention. Some specific plan targets appear highly unrealistic: it assumes marine commercial and municipal fisheries production to increase to 3.1 million tons by 2016, or 1.2 million tons in excess of presently calculated MSY (and almost double production in accordance with precautionary principles. Among its many strategies it seeks to: (i) increase sector productivity, (ii) develop climate change sensitive technologies, (iii) review the current legal and regulatory framework for the sector and pursue public-private partnerships to enhance production and marketing. Philippines has multiple other initiatives and strategies to support the sector. Regional frameworks[29], investment promotion plans, activities of local or regional authorities and other initiatives all in theory support development, and most do, in a modest way.

Investment climate

The investment climate in Philippines has been rated poorly in multiple analyses. The regulatory framework ranks 148 out of 183 countries in the 'Doing Business' 2011 report. Although much progress has been made in reducing trade barriers, many 'behind the border constraints' remain; the costs of doing business in Philippines are much higher than in other SE Asian countries. In addition to cumbersome and costly regulations, the high costs—and inappropriate features—of financial intermediation are a major impediment to sector investment for small and medium enterprises to large investors. Inadequate infrastructure and logistics is quoted as being the third largest problematic factor for competitiveness in the Philippines—in Thailand and Malaysia it is no factor at all[30].

Scorecard of Past and Current Sector Policies

GDP and GVA. During the past 30 years the fishing sector has almost tripled in terms of GVA (in constant pesos); it doubled production of food fish, but was unable to keep up with population growth. The quality of the statistics – based on monthly surveys – is an issue. Equally, the sector's contribution to GDP may not reflect full reality, since 2000 the contribution of the marine sector may actually have been lower, while industrial activities (tuna and sardine canning, seaweed processing) may not have been fully included in the sector contribution to GDP.

Sector employment. After 2002 no new census data have been made public; at that time 1.6 million people were engaged in the sector, almost 1.4 million in municipal fisheries and 226 thousand in aquaculture. The aquaculture sector—

29 For example: the Mindanao Peace and Development Framework, the Brunei Darussalam, Indonesia, Malaysia, Philippines East Asia Growth Area, the Philippine Investment Promotion Plan 2010-14, the One Town One Product (OTOP) program, the Special Regional Economic Zones program, activities of Regional Development Authorities etc.

30 IBRD, Program Document for a Proposed First Development Policy Loan to Foster more Inclusive Growth; Washington DC, 2011.

growing fast—must have created additional employment. It is likely that the number of municipal fishermen also increased, as employment opportunities in coastal areas outside fisheries have been limited. Poverty estimates of the NSCB suggested fishermen incomes were half those of the population at large; 40% of coastal communities were classified as 5th class[31].

Table A5.3: Fisheries Sector Gross Value Added (GVA), in Real and Constant Prices and Fisheries Contribution to Total GDP (1980–2010)

	1980	1990	2000	2005	2010
Fisheries GVA (current prices: P million)	9.9	40.8	78.5	116.3	174.9
Fisheries GVA (Constant 1985 prices: P million)	21.5	30.7	37.1	51.8	64.3
Fisheries contribution to total GDP at current prices (%)	4.4	3.8	2.3	2.1	2.1

Source: DA-BFAR

Fish Consumption 1973–2011

According to the 1978 Food and Nutritional Research Institute (FNRI) survey, Philippine consumers purchased about 40kg of fish per capita[32]; in 1993 the amount had declined to 36 kg, and increased by 2003 to 38kg[33]. During this period the consumption per capita of meat almost trebled and of poultry and eggs about doubled. Milk consumption marginally increased. The survey results for fish consumption cannot be reconciled with DA-BFAR/BAS fish production statistics. In 2003 FNRI fish consumption survey data—when translated in national production requirements—exceeded available supplies by almost 23%—more if one assumed a rather moderate 20% waste between catch and consumption. DA-BFAR did once calculated fish supply and utilization estimates for 1997-2001 which were substantially lower than those of FNRI, (see table 4), but no official estimates have been published since. According to DA-BFAR/BAS statistics, fish consumption per capita has since 1978 declined by 12%[34]. Other indicators (including the single analysis from DA-BFAR for 1997-2001) suggest consumption of marine fish has declined more substantially, while that of cultured fish increased[35].

No detailed estimates are available of the annual fish consumption of urban and rural consumers by monthly income group. In Indonesia fish consumption increased by income group, leveling at about 35 kg/capita/year. Rural consumers used consistently more fish then their urban counterparts. By comparison, a 2003 estimate of per capita fish consumption for the South-East Asia region[36] showed a modest annual growth of 1.3% from 17.6 kg/year in 1973 to 23.0 kg/year in 1997, while China saw consumption increase by 10.4% annually from a low of 5.5kg/year in 1973.

Consumer diets and food preferences are changing in Philippines, but also reflect relative prices and shortages in addition to income growth. Since 1990 prices of lower value, marine, fish have increased faster than the consumer price index for food, which suggests supply shortages of a price inelastic product. The relatively steep price increases of lower value marine fish may have forced the poorer sections

31 Comprehensive National Fisheries Industry Development Plan (CNFIDP), Manila, 2005.
32 FNRI 1978, 1982, 1987 and 1993 surveys—it is uncertain whether the surveys were national.
33 These figures include losses in the kitchen.
34 Production prior to devolution may well have been under reported, while after devolution incentives existed for over-reporting. Ian Smith et al. Philippine Municipal Fisheries, ICLARM, Manila, 1980.
35 Consumption of round scad, a widely consumed marine species, declined between 1990 and 2010 by 30%, to 1.87 kg/capita. Consumption of tilapia—25% of all cultured fish—doubled in the same period to 3.13 kg while consumption of milkfish (comprising 50% of all cultured fish) initially declined by 40%, after which consumption increased to 1991 levels (2.44kg/capita) by 2010. Source: http://countrystat.bas.gov.ph/selection.asp
36 Delgado, Christopher L., Nicholas Wada, Mark W. Rosegrant, Siet Meijer, and Mahfuzuddin Ahmed; Outlook for Fish to 2020, Meeting Global Demand; International Food Policy Research Institute, Washington DC and World Fish Center, Penang; October 2003.

of the population to reduce fish consumption[37]. The rapidly increasing consumption of instant noodles, and other snack foods, particularly by the poorer sections of the population[38] may also reflect the rising costs—and reduced availability—of low-value fish. Prices of cultured fish increased substantially less—and less than the consumer price index—reflecting the rapid growth of aquaculture production. Demand for cultured fish reportedly is also price inelastic[39], but less so than of cheaper fish species. While consumption of meat, pork, eggs and chicken substantially increased during the last three decades, their relative prices—with the exception of pork—declined.

Food Security

Although most food security policies focus on rice, domestic fish supplies are being regularly reviewed. According to the 1998 Philippine Fisheries Code (RA 8550): Food security is the primary goal of and consideration in the utilization, management and conservation of coastal and fisheries resources. Public programs to ensure food security in fisheries currently mostly focus on aquaculture[40]. In addition, the DA, through its regular operations, continues to invest in marine fisheries infrastructure and sector services. It continues to participate in ASEAN Integrated Food Security framework (AIFS) and Information system.

Assuming future population growth will be more concentrated in urban areas, and average per capita income growth will remain modest (in real terms), two conclusions can be drawn. Fish consumption per capita will further decline: urban consumers eat less fish (but pay more for it), and have access to a larger variety of alternative foods. Demand growth for (cheap) fish in rural areas will reflect the success of migration to the cities, local fish price movements—reflecting the success of future resources management—and rural income growth. A stable or declining rural population, relatively high fish prices and modest income growth would constrain demand. The implications are that future incremental fish production— virtually all from aquaculture—will require substantially more effective logistics to move fish to the urban centers, and that to maintain supplies of cheap fish to rural and urban areas, DA-BFAR's policies should not only focus on production growth but also on fish distribution. In addition to sustained expansion of aquaculture, management of the marine resource base will remain critical to satisfy demand.

Future Challenges for Sector Governance and Resources Management

Of all countries in the region, the Philippines faces the sternest of three fundamental and linked political economy choices to satisfy demand for fish in the short- and long-term.

Short-term pain against long-term gain: Decision makers in DA-BFAR have for decades struggled with the practical and political aspects of short-term food security and long-term resources management; considerations of meeting the livelihood requirements of fishermen on one end, and consumption and demand for fish at the other. Limiting fishing efforts to levels necessary to restore depleted fish stocks in the short-term will result in loss of livelihood and of fish production[41], leading to tight domestic supplies and seafood price spikes, a politically untenable scenario, given the prevailing perception that in the short-term few livelihood and food supply alternatives are available. As this scenario would unfold slowly anyway without decisive action, DA-BAFR has long allocated top priority to expanding aquaculture production. The political priority to ensure

37 The share of fish protein in total animal protein expenditure is higher for lower income groups, demonstrating their dependence on fish as a source of animal protein. Poor people consume mostly low-price fish and rich people spend a significant portion of their fish budget on expensive fish. Per capita fish consumption is substantially higher in rural areas than in urban areas'. Madan Mohan Dey et al, Fish Consumption and Food Security: a Disaggregated Analysis by Types of Fish and Classes of Consumers in Selected Asian Countries, Aquaculture Economics and Management, 9:89–111; 2005.

38 Some of which are meat or chicken flavored, or include small amounts of protein: FNRI, Dietary facts and figures, 2003.

39 Bureau of Agricultural Statistics: Estimating Price and Income Elasticities of Demand of Selected Food Commodities in the Philippines, Manila, 2011.

40 BA-BFAR also considers the following activities to directly support food security: (i) maintaining existing mari-culture parks, (ii) establishing multi-species hatcheries, (iii) implementation of coastal management projects, (iv) providing training and technical assistance to municipal fishermen, (v) ensuring compliance with global food quality standards and (vi) pursuing bilateral talks with neighboring countries about fisheries access and participation in the Coral Triangle initiative. From: Recide. R. S., Philippine Food Security Cooperation, Paper presented at the 3rd Roundtable meeting of ASEAN+3 food security cooperation strategy, Nanning, Guangxi, 9–10 November, 2011.

41 The Fisheries Code specifically declares that effective fisheries management is the means to achieve food security (Sec. 2).

the supply of sufficient fish in local markets through support for aquaculture development always trumped the political inconvenience of reducing short-term marine fishing effort to ensure longer–term sustainability of marine resources exploitation. Continuing this policy will deepen the well-documented social ills of this policy – an impoverished municipal fishermen class and lower nutrition levels of poor people. Giving political priority to improvement of resources management could become a component of the ongoing 'convergence' process. More effective management involves three themes:

- Strengthening DA-BFAR fisheries management authority and implementation capacity. DA-BFAR —in cooperation with its Provincial Branches—is responsible for management of all marine fish resources and all Industrial and commercial fishing activities outside the municipal fisheries zone; its current capacity to effectively implement that responsibility is woefully inadequate. Its institutional structure, human and financial resources require substantial strengthening. Ring-fencing decision making and implementation concerning levels of resource exploitation and vessel licensing from external and internal political interference should have particular high priority.

- Strengthening of resource and fisheries economic research, statistics and other data collection. Plain stock assessment and resource management seldom attract the scientific interest of the research community or appeal to their most senior scientists. DA-BFAR and DOST should create incentives and guide research planning to substantially enhance the quality of marine resources analysis and the reliability of the recommendations of the research community. Strengthening of the resources management capability will require a multinational team of top researchers to direct and execute the research agenda for marine fisheries.

- Strengthen the MCS[42] function at the national and local level. Monitoring, controlling and surveillance of fisheries is a critical component of fisheries management. Linked to effective adjudication it enables effective implementation of fisheries management measures. Plans to strengthen MCS and adjudication functions have been made by the National Law Enforcement Coordinating Council and the Philippine National Police. Some have been implemented in a few locations. Strengthening these functions at the national and provincial level, and further integration of an effective Municipal Law Enforcement function with the Navy and Coast Guard should be given the funding and political support it requires.

Prioritizing Resources Management targets—Industrial versus Municipal fisheries: The risks are real that continuing poor marine resource management will lead to more volatile—and lower—marine fish production levels. In the past DA-BFAR has made substantial efforts—with foreign assistance—to improve management of Municipal fisheries first, while paying less attention to management of commercial fisheries. This report proposes an alternative priority within the current legal and institutional framework to more effectively initiate the process of controlling all fishing effort, at lower costs. The proposed strategy is not without risks; effective implementation would require substantial political commitment, both at the national and municipal levels. The strategy has three major themes:

- Give priority to more effectively managing and controlling industrial and commercial fisheries by DA-BAFR and its provincial branches. This would translate in the design and execution of a professional management regime, with all the tools to limit and control fishing efforts of the 6,000-vessel fleet currently catching about 45–55% of marine

42 Technological advances have made effective electronic surveillance of the commercial and industrial fleets feasible. Adjustment of at sea and in port monitoring practices, and the use of dedicated ports would substantially improve the government's ability to monitor commercial and industrial fisheries activities, including trespassing in Municipal waters. Incentives for local enforcement officers, including support from the local Municipal fishermen community, will also be critical.

fish production[43]. Recent technological advances make electronic and human surveillance of national and municipal waters feasible and much more effective; extending and improving the MCS capability at sea and on land and the use of a restricted number of designated fishing ports could substantially reduce illicit fishing.

- At the municipality level, give initial priority to in-direct efforts to rebuild stocks: expand fish culture and create other alternative income-generating activities. These activities are clearly within the available Municipality/City institutional implementation capacity and budgets, and more in line with political aspirations, as the historic expansion of seaweed production and MPAs, and multiple pilot projects have demonstrated. Reduction of fishing pressure in coastal areas should initially be achieved through in-direct measures (reducing industrial and commercial fishing pressure in over-exploited non-coastal areas and species nationwide, and effectively reducing illicit commercial fishing inside the 15 km municipality zone).

- Prepare for the restructuring of the process of managing the Municipal fisheries. Many reports and studies have recommended minor and major ways to improve the process, but few recommendations have been effectively implemented[44]. While Philippines strengthens management and control of its Industrial and commercial fishing fleet, it should explore the political, legal and institutional constrains limiting change[45] and seek a path towards meaningful adjustment.

Market-driven aquaculture fish supply versus policy incentives: Should future growth of the aquaculture sector be entirely market-driven—focus on high value products, for which ready local and export markets exist—or should future expansion be given incentives towards investment in the production of (lower value, less profitable, less risky?) products for the local market? For seaweed and high value fish products (except shrimp[46]) demand from developed markets and possibly China will cause global prices to continue to increase compared to other sources of protein[47]; the Philippines may benefit from such demand if it can maintain local competitiveness, quality requirements and trust from global and regional consumers, increasingly looking for sustainably produced seafood. This will increase the relative level of domestic fish prices and strengthen incentives to: (i) import fish[48], (ii) maintain or expand fishing pressure on already stressed marine fish resources, and/or (iii) enhance consumption of alternative foods[49]. The alternative approach would give some (food-security) priority[50] in public policies towards fish production for the local market—in parallel to export oriented production—aiming to support local, poor, consumers. That may take the form of direct support—income dependent vouchers or food cards—or indirect support—public assistance encouraging development of selected fish culture activities, or policies that remove import constraints. It may also include incentives for the local tuna industry to focus more on the local market.

Aquaculture: Future Systems and Sustainability

Aquaculture will carry most of the future production growth burden necessary to satisfy future demand for food fish. Above all aquaculture requires drivers to ensure effective research, technology transfer and capacity building. It also

43 Total Allowable Catches (TACs) for 10–15 key species, enforceable reference points, limits on the number of licenses, support for social schemes to mitigate the impact of fleet consolidation, and ultimately a TAC based quota allocation system.
44 Completion Report for the Fisheries Improved for Sustainable Harvest (FISH) Project; DA-BFAR and USAID, Manila 2010.
45 Many reports analyzing Municipal fisheries management issues have been authored by people with a Coastal Zone Management background. It may be desirable to seek the views of more people with hands-on experience in fisheries management in the tropics.
46 World Bank: Commodity Prices and Price Forecasts, in Constant 2005 Dollars, Washington DC, January 17, 2012.
47 Delgado et al. 2003. Only if China produces more than currently projected would fish prices globally decline—including demand for regionally produced aquaculture export products.
48 While global supplies of cheap frozen fish are still available today, demand from Africa and potentially from South and East Asia for these products will likely grow over the next decades, while global supplies are limited.
49 This scenario has already happened; the poorest sections of the population have reduced fish consumption and switched to fortified noodles.
50 "In the realm of exports of fishery products it may also be desirable for national governments to place some degree of social control over the quantum and species of fishery products exported. When there is clear evidence that certain species are essential for the food security of local populations, certain developmental and social 'safeguards' may have to be instituted to ensure that the larger social good is optimized. The prospect for moving from free trade to 'negotiated' international trade, particularly in contexts where issues of food security may be at stake, needs to be strongly supported." (Delgado et al.)

requires a complex combination of human and institutional resource capacity building to satisfy specific technical disciplines and services, and development of alternative multispecies, and environmentally more benign production models. It requires a coherent set of policies and regulations, an efficient transport network, a functioning land market, improved water management and effective downstream distribution and marketing. It also requires effective special planning to locate viable areas for expansion or define where restructuring of production is necessary. It requires enforcement of international quality control and sanitary standards across the entire value chain. Integration of these multiple requirements into a coherent development strategy is the most critical requirement facing the sector.

Past efforts to improve the efficiency of existing fish culture operations have been quite successful, driven by local and internationally supported research and local extension. But Philippines remains particularly vulnerable, as it depends on only two species for 75% of its aquaculture production, and some fish culture operations remain traditional, with modest productivity. Continued rapid aquaculture growth will require sustained gains in research, including bioscience and operational research to maintain and improve suitable culture techniques for high value export products and for lower cost production methods and species. Aquaculture research does not only benefit producers, consumers benefit almost twice as much from lower prices and better availability of fish[51], and the impact of aquaculture research on the poor—who spend about 8% of their income on fish in SE Asia—is particularly striking.

Research activities in the Philippines are currently spread over multiple institutions, specialized public research institutions, private institutions and faculties of Universities, of which selective mandates are overlapping. Several agencies and boards coordinate research. To maintain high future aquaculture production growth—and remain a competitive global producer of cultured fish, aquaculture research budgets will require substantial expansion. In parallel, research agenda's and programs require adjustment. For critical research subjects listed below sustained, exceptional research will be needed, integrated with international/regional efforts rather than predominantly national networks. Cutting-edge research, covering all aspects of the value chain, will be critical to maintain future aquaculture production growth.

Outstanding research issues

Brood stock supply and quality. Timely and adequate supply of quality seed is a pre-condition for effective aquaculture. Maintaining high quality brood stock and ensuring sufficient effective hatchery operations for the long term will require sustained back-up research, training, experimentation and investment, both public and private[52]. Seed shortages—for milkfish and other species—have forced farmers to import seed from Indonesia; regional seed shortages occur regularly. The risks to the genetic integrity of wild stocks from artificial propagation and genetic manipulation are considerable; poor quality seed, caused by poor genetic management of breeders and accidental hybridization remains a risk. National strategies to deal with these risks have been defined, but parts remain to be fully implemented and updated.

Disease control remains only partly effective and satisfactory solutions—in the region and globally—for existing and newly emerging diseases (white spot, ice-ice) need to be vigorously pursued. Several universities have programs dealing with fish and seaweed diseases. Coordination of these programs within a national and international research strategy will be critical.

High protein feeds. Many cultured species (including shrimp, milkfish, groupers, pangasius, other catfish) require—or grow faster—with specialized feeds containing (mostly imported) fishmeal and oil. Global demand for fishmeal has substantially increased over the past 15 years while fish resources supplying meal (about 22 -26 million tons globally, producing about 6 -7million tons of fishmeal and 1 million

51 David A. Raitzer et al.; Prioritizing the Agriculture Research Agenda for South-East Asia: Refocusing Investment to Benefit the Poor; Asia Pacific Association of Agricultural Research Institutions, Asian Development Bank, Global Forum for Agricultural Research; Global Conference on Agricultural Research for Development; 2010.

52 This particularly applies to tilapia. The genetically improved variety (GIFT) has significantly increased local aquaculture productivity.

tons of fish oil) are limited and fully exploited[53]. Substitutes exist but the cost of production and extraction remain very high, while resistance against GMO foods persists. Fishmeal and oil prices are expected to show some of the highest price increases globally over the next ten years and beyond, notably if global aquaculture production exceeds current baseline estimates[54]. For less intensive fish culture, some alternative feeds are available (fermented rice bran), but are not yet universally used. Unless more alternative protein rich feeds are developed—or fishmeal and oil are more efficiently used—fish feed costs for high intensity fish culture will continue to rise. Development of alternative feeds—or alternatives to fishmeal and oil—expansion of culture of herbivores or filter feeders to reduce future demand for high protein feeds, or production methods less dependent on high -growth will be critical, and may be best pursued through regionally and internationally coordinated research.

Defining an appropriate structure for the sector

Efficient fish culture requires the right environmental conditions, access to land and water, and location to markets. Effective spatial planning to properly locate new and existing production capacity will be essential to enhance future productivity and locate production where effective logistics are available. Some spatial planning has been performed in the past, but translating such planning into real investment programs in which the requirements for aquaculture have been fully taken into account has proven difficult; human and institutional capabilities and financial resources at the district and provincial level are usually inadequate. Notably in areas exposed to tidal waves or frequent hurricanes the resulting restructuring is expensive, and requires a combination of traditional—mangrove—and alternative infrastructure. Expansion of marine cage culture requires a proper regulatory framework covering leasing, operations, environmental safeguards to limit marine pollution and a regulatory framework to limit exposure to future climate change conditions. For land-based fish culture and culture in lakes and rivers, facing natural and environmental constraints, area expansion will become less of an option and sustained total factor productivity increases—and expansion of integrated production systems—will be critical to maintain production growth. Strengthening implementation capacity at the provincial and Municipal/City level to translate the conclusions of spatial planning into private and public investments will be the key to maintaining aquaculture production growth.

On-farm activities are only one link in the total value chain, and create only one half of total value added. Outside Philippines growing coordination between private and public sector inputs and output chains and between smallholders and large processing companies are increasingly common, leading to greater efficiency, improved quality assurance, and improved marketing. Export certification demands has also streamlined production. Supermarket chains increasingly mold urban consumption behavior. In Philippines these trends have started, but mainly affect high value products. Most cheaper food fish production is still small-scale and relies on traditional distribution and marketing chains. The benefits of a more integrated industry, in terms of efficiency and export competitiveness, will be enhanced by having more, and larger, vertically integrated operations functioning in parallel to the traditional networks. This requires improvement of the investment climate in general, but also a regulatory framework supporting vertical integration and ensuring value added created by vertically integrated companies benefits the country. Tuna and seaweed are cases in point, with processing concentrated in General Santos and Cebu city, and processors organized in Associations. While a competitive export industry may reduce incentives to produce for the local market, it may also guide—and support—transformation of the culture of food fish for the local market.

Technology transfer will play a critical role. Multiple extension efforts have played a role in transforming aquaculture from a subsistence food system to an important sub-sector. Improved hatchery technology, genetic manipulation, feed

53 The global share of fishmeal and oil being used for fish feed (52% of meal, 82% of oil in 2004, currently higher) has been steadily increasing, with fish oil being the critical limiting factor. Large supplies of alternative sources of raw material (mesopelagic species) exist, but the cost-effective technology to catch these fish and process them into fishmeal have not been developed.
54 Delgado, Christopher et al: Outlook for Fish to 2020, Meeting Global Demand; International Food Policy Research Institute, Washington DC and World Fish Center, Penang; October 2003. World Bank; Changing the Face of the Waters, Washington DC; 2007.

improvements and disease control did all play a positive role, but their impact could have been higher. Philippines requires markets, education systems and extension services particularly tailored to highly disperse smallholder activities. Large operators have access to international research and technology developments—small operators don't. Devolution has reduced the effectiveness of traditional aquaculture extension activities, while universities have assumed part of their responsibilities. Alternative systems have been successfully tested in the SE Asia region (pooling of resources, public private partnerships, private extension services linked to feed providers or NGOs, one-stop service centers, and producer associations) all have strengths and weaknesses. Philippines needs an effective aquaculture extension function; testing various approaches and selecting the most effective (combination) will be essential for future production growth and farmer income.

Expansion of industrial fishing outside the 200-mile EEZ—Tuna

After decades of enjoying the fruits of being a mature industry with monopsony control, the global tuna industry is facing fundamental adjustments. Fish resources—once plentiful—are becoming scarcer, while the costs of catching tuna—and producer prices—are increasing. Well-established tuna canning companies are stuck in a maelstrom of corporate take-overs. Access to traditional markets is increasingly regulated through market defined quality and sustainability concerns. Markets for fresh and frozen tuna products are expanding rapidly. The Philippine tuna industry has been at the forefront to stay ahead of these global developments, expanding activities in PNG and Indonesia, securing access to relatively plentiful Pacific Ocean stocks[55] and focusing on high-quality tuna and canned products. Philippines possesses the vessel technology and knowhow to exploit these resources, but it will face increasing (public supported) competition from China, Vietnam, USA, the EU and local operators to catch tuna[56]. Thailand has been substantially more cost effective canning tuna. To maintain a regionally competitive industry, Philippines needs to ensure future resource access and maintain competitiveness in value chains supplying increasingly cost and sustainability conscious consumers.

- Resource Access. In the Pacific access to (major) tuna resources is already subject to a fairly strict management regime; in the Indian Ocean management is still less effective. Long-term commitment to sustainable and controlled exploitation of the tuna resources inside Philippines is likely to be part of the price for future access to regional tuna resources. Pacific and Indian Ocean Island countries increasingly link future access to tuna in their EEZ to bilateral agreements, which may delineate how future catches can be used, or direct support for their won development needs. Long-term access to these tuna resources will require political coordination between the public and private sectors, whereby additional resource access may be obtained in exchange for Philippines supporting local Pacific or Indian Ocean Island fisheries developmental objectives (stronger participation of Island countries in the tuna value chain[57], direct support for development of local fisheries, support for other development programs etc.).

- Staying Competitive. Philippines cost effectiveness in catching and canning tuna has been mediocre—it uses the oldest vessels and globally low factory utilization rates. If it wishes to maintain a competitive tuna industry it will above all require investment in efficiency improvements, development of different markets, and support for a level playing field in terms of (foreign fuel and vessel construction) subsidies. Efficiency improvement requires a

55 Pacific stocks of skipjack (mainly used for canning) are still plentiful, although catch-rates have been declining. Yellowfin (used for canning and direct human consumption) stocks are fully exploited. Bigeye (direct human consumption) and albacore (used mainly for canning) stocks are under pressure, and will require increasingly strict management measures.

56 The Chinese long-lining fleet operating in the Pacific reportedly enjoys substantial public sector subsidy support (fuel, shipbuilding). The EU and USA provide direct subsidies to their fleets to support access to the Pacific tuna resources.

57 This is already happening in PNG, where Philippines is seeking resource access in exchange for agricultural or other commodities and support for other development activities.

regional strategy—the industry could benefit from closer regional coordination with Indonesia to pool and coordinate capacity and investment[58]. The subsidy issue requires a stronger say in the RFMOs and World Trade Organization (WTO) tuna and other fish trade negotiations.

- New Markets—Regional and Local. The local tuna industry has long targeted export markets—the potential of the local market was considered limited on account of fish consumption preferences and modest purchasing power. As the urban population expands, and the middle class becomes well established, the tuna industry may play an increasingly important role in satisfying future demand for fish, developing products particularly targeting local and regional consumers (Indonesia). While high-end fresh and frozen tuna products (sashimi-quality) may still be exported, lower valued (canned, pouched, cooked) products and species (skipjack, frigate tuna) may find a ready local market as consumers increasingly change their buying (supermarkets) and consumption habits.

Fish requires complex, effective—and cheap—logistics

The current transport network to move perishable fish products from multiple production locations to consumers is often costly and ineffective. Some studies estimate Philippines wastes 20–30% of its fish production to between fish catching and consumption; quality deterioration is pervasive. Infrastructure at fishing harbors and smaller landing places often don't have the facilities to preserve and properly store fish, and facilitate rapid transportation. Effective logistics could improve the national supply of fish by ten percent or more. Poor logistics already impairs the potential effectiveness of DA-BFAR's strategy encouraging future expansion of aquaculture fish production for export and for local consumption. Although interisland transport and export logistics fall outside the scope of this report, it is a critical issue that will have a major impact on the success of future production growth. Substantial investments will need to be made in infrastructure, services, and equipment, and in fish preservation and handling methods to satisfy future logistics requirements in terms of frequency, price and quality.

Effective investment in fisheries infrastructure in a country like Philippines, with dozens of fishing harbors and hundreds of smaller fish landing places requires judicious use of scarce funding. Many ports are currently old; some are dilapidated or lack critical services. The effectiveness of port management shows considerable variation. Careful selection is needed of port facilities to be maintained, upgraded or replaced and the locations of landing places to be provided with minimum facilities (water, power, proper access, IT) to assure the most impact from limited budgets. As the Philippine Fisheries Development Authority party responsible for management of port and landing facilities—Regional Ports Management Authorities, LGU's and private parties play an increasing role—effective port management requires permanent training of all parties involved in port and landing place operations, and regular evaluation of their management and investment performance. Ports are critical, capital intensive, links in the value chain. Port effectiveness is equally dependent on the availability of supporting services: catch data collection, quality control, fuel supply, boat, net and engine repair facilities, ice production, fish preservation and storage facilities, packing and transport. Proper maintenance of the ports and long-term effectiveness of these integrated services will have a substantial, positive, impact on the value of fish production, the level of export, on post-harvest losses and on the nutritional impact of fish.

58 Both countries have tuna industries that have difficulty competing with the 'big three' global concerns currently dominating the canned tuna industry and the few trading houses dominating the fresh and frozen sashimi quality tuna trade and distribution in the region. Both countries have large populations demanding local fish products, and face future shortages of supply. While most of the tuna caught by Philippines is being canned, the markets in the developed world will increasing seek fresh and deep frozen tuna for direct consumption. Continuation of this global trend may have two implications: (i) larger tuna will increase in value, and will require highly efficient catching and international (air and container) transport; and (ii) the large quantity of small tuna (juvenile tunas, lesser tunas) currently caught in Philippines and Indonesia may increasingly be used for the local market, in canned, frozen or other processed form.

Future Global Fish Supplies and Prices

Projected global fish prices for 2020 suggest real price increases of 6-15% for food fish, and 18% for fishmeal and fish oil relative to modest declines of prices for all protein alternatives, including meat, chicken and eggs. Whether these relative price movements will be followed by Philippines in the longer term will depend on future domestic—and regional, mostly China's—aquaculture production growth[59], and the openness of the Philippine consumer to consumption of imported—non-traditional—fish products. Fundamentally, the fish consumption fate of the countries in the region, including China, is directly linked to their joint ability to develop and maintain an efficient and highly productive aquaculture sector, based on major improvements in productivity linked to superior research, genetic improvements and development of niche products, while jointly and individually to solve critical technological, disease, feed, environmental, institutional, regulatory and logistical issues[60]. China may be able to continue to import fish from across the globe to satisfy gaps in local demand, using domestic companies operating abroad, as it already does on a modest scale at present. Philippines may have greater difficulty pursuing the same strategy having few industrial groups operating globally catching fish, while in the longer term the global availability of truly cheap food-fish to satisfy local demand is likely to decline[61]. The ability to pay higher prices for fish will increasingly determine global trade flows, and global—and Philippine—demand.

59 Delgado et al, 2003.

60 Faster than projected production expansion in China may lead to fish price declines, notably for high value fish and higher levels of Chinese exports. An ecological disaster in Philippines, a major decline of food fish catches on account of poor resources management or climate change would increase low value fish prices and probably lead to demand for larger imports and alternative products like chicken, noodles.

61 Growing demand for cheap fish from emerging economies—across the globe—will in the near future exceed the clearly limited global supplies of marine fish. West Africa is already a major importer, and its demand will further increase over time. India may start importing in the future. Global resources of these species are already exploited close to environmental limits. For 2020 Japan and China are expected to remain net importers; no projections are available beyond that date. The main markets in the EU and USA will remain major importers—although the product range will differ over time. The picture may develop differently if cost effective technologies are being developed to catch and process the large, currently unexploited, mesopelagic fish resources around the globe, a truly 'black swan' event.

Lower fish production growth than required to satisfy future demand in Philippines—in combination with effective import constraints—will likely translate in relatively large increases in lower value food fish prices, as demonstrated during the past decade[62]. As in neighboring Indonesia, one would expect more rapid changes in consumption patterns towards alternative protein sources for higher priced fish. However, Philippine consumers really prefer tilapia and milkfish, rapid expansion of production during the past decade only caused prices to increase slightly less fast then for lower priced species. Tuna production may in the long-term future also play a larger domestic role as regional demand turns towards high priced fresh and frozen products from larger tunas, and the Philippine catch contains relatively many smaller tunas. The role of imports will also play a key role in satisfying local demand, Philippines has a history of importing sardines for local canning. Sustained import limitations (in terms of tariffs or quantities, or rapid increases in global prices, see footnote 69) in combination with lower domestic production growth will eventually cause consumers to increase the consumption of alternative protein products, and reduce overall consumption of proteins.

Future Domestic Supply of fish

Aquaculture will need to carry most of the burden of satisfying the growing local demand, as marine catches are unlikely to grow much above current levels, and volumes may fluctuate more violently from year-to-year. In the low-consumption scenario of Table 7, aquaculture food fish production, currently about 768 thousand tons, would need to triple by 2040 to 2.3 million tons; the high-consumption scenario would require production to increase more than six-fold, or 6% annually over 30 years, to satisfy projected domestic demand—assuming no changes in external trade, prices and consumption preferences. In the low-consumption scenario the share of aquaculture in total fish production by 2040 may need to increase from 24% at present to about 48% and the share of low value food fish would decline from 66% to 54% of total consumption. Alternative assumptions about annual consumption growth (higher

62 Socio-economic Statistics Section, Agricultural Accounts and Statistical Indicators Division, BAS; Estimating Price and Income Elasticities of Demand of Selected Food Commodities in the Philippines; Manila, 2011.

income growth, a more rapid decline of the percentage of poor people in society) would increase future demand levels, and the requisite aquaculture production growth. If the Philippines also becomes a larger exporter of food fish, local production will need to grow even faster.

Maintaining such sustained growth for three decades will necessitate a fundamental evaluation of the aquaculture production system, as discussed above. To maintain sustained long-term growth, Total Factor Productivity will need to increase, based on high-level and sustained research, multiple technological advances and major improvements in operational productivity and control over logistics and capital costs. In addition to expansion of marine based aquaculture, environmentally benign intensification of fresh and brackish water production will need to become the core of the industry growth strategy.

Table A5.4: Consumption and Production of Fish Products, 2010–40

	2010 Actual	2040 Optimistic	2040 Pessimistic	
Low value food fish	18.2	14.6	13.3	2.8
High value food fish	7.2	8.5	7.4	1.6
Total consumption	25.4	23.1	20.7	4.4

Source: Centennial estimates

External risks

From the multiple external risks that the Philippine fishery sector may face until 2040, four are particularly important:

- China's aquaculture production. Global fish production growth during the past 20 years has been largely generated by China; it produces almost 70% of global aquaculture production and an increasing share of marine production[63]. The impact on world market prices and fish trade would be major if China's production growth were to substantially decline or increase compared to currently projected levels. Faster growth would lead to substantially lower fish prices but much higher fishmeal and oil prices[64] on global markets, and would probably increase China's fish exports, competing with regional producers. Alternatively, slower expansion, or even an absolute decline would lead to rapidly increasing global fish prices and declining fishmeal and oil prices, and probably lead to stronger demand for regionally produced fish.

- Availability of reasonably priced fish in global markets. Although fish can be stored in frozen and canned form, no country has created national stockpiles to satisfy demand for fish in cases of emergency, or to regulate local market prices. Like the rest of the world, the Philippines will need to depend on global markets to satisfy large gaps between demand and local supply of fish, or absorb price hikes for fish and alternative products. In the short-term global markets for high- and low-value species are well developed and fish imports may only be constrained on account of prices, tariffs, non-tariff barriers and consumer preferences. Dependence on imports of cheap fish in the more distant future may be riskier as future demand for low-value fish may increase substantially, as will price volatility. Global supplies of cheaper fish species may cost much more in the longer-term future; this may limit the effectiveness of fish imports as a tool to control domestic fish prices for poorer segments of the population or to substitute imports

63 The actual level of China's marine production remains the subject of substantial international debate—yet few doubts exist about the country's astonishing growth of aquaculture production over the past 20 years.
64 Delgado et al. 2003.

for slower than expected aquaculture production growth.

- Shortages of fishmeal and fish oil for aquaculture feeds. Fishmeal and oil form critical ingredients for fish feeds, while chicken, egg, and pork production also benefit from—globally declining—meal and oil rations in feeds. Global fishmeal and oil production—based on current technologies—are finite, and unless suitable replacements or efficiency improvements are found, demand will increase, leading to higher prices. Price increases of well over 100% can be expected if anchovy production off the coast of Chile and Peru—the main fishmeal producers—fails through an extreme el Niño event. These events are likely to happen more frequently in the future. New fish processing technologies may increase the suitability of fish species currently processed into fishmeal for direct human consumption, causing global fishmeal production to decline. The historic ratio of fishmeal and soya meal prices has been around 2 to 3. In 2009 it peaked at 5.5, and currently is about 4. Historically high fishmeal and oil prices will remain, and peaks will occur more frequently than in the past.

- Pandemics. Intensive aquaculture already had its share of disease and pandemics—shrimp, salmon, carp—and the risk of a new disease seriously affecting a globally important fish is not negligible. That may affect global fish supplies and prices, but may also affect production in the Philippines. While it may be impossible to eliminate this risk, the country can reduce it having a strict regulatory framework and quality controls, top-level research and effective extension services.

Fish trade policy

Current trade tariffs reflect ASEAN efforts to reduce regional trade impediments. The Philippines may have limited flexibility in setting its future trade policy and tariffs within the context of future ASEAN, WTO and other fora. It may consider further reducing tariffs on 'low value' imports as part of its food safety policy. In exceptional cases it may also consider temporary volume limits on exports of fish products that appeal to low- and middle-income consumers in situations where China and other countries in the region suffer short-term declines in production. In general, an open trade policy—and understanding of international markets for different fish products—will dampen local short-term price volatility resulting from supply declines within the country[65]. However, given its exposure to developments in the region, an active fish products trade policy—within the limits of ASEAN and WTO agreement, and combined with an in-country direct support system for the poorest consumers—should remain part of the food security strategy. Measures to reduce long-term price escalation should not include trade policy, but concern productivity improvements, as discussed above.

The risks of medium-term climate change

The fishing sector in the Philippines will particularly be exposed to future climate change[66].

Temperature. Increases in average temperature, or temperature spikes may affect coral reef areas (bleaching) and the health of stocks of reef fish. Temperature increases may also affect spawning and migration of wild stocks—a movement to more temperate waters is globally being projected—but the specific impact for Philippines major stocks of small-pelagic and oceanic species remains to be clarified; it appears unlikely to be substantial by 2040. Aquaculture has several means to easily mitigate high temperatures—deepening of ponds, higher water exchange rates etc.

Precipitation increases will affect fresh and brackish water aquaculture, and may necessitate investment in supporting infrastructure. Higher levels of precipitation may also affect

65 World Bank and IMF; Global Monitoring Report 2012: Food Prices, Nutrition and the Millennium Development Goals; Washington DC; 2012.
66 Anand Seth: For 2050, Global Mean Temperature (GMT) is projected to rise by 1C. A temperature rise of 0.1–0.3 C per decade has been observed in SE Asia. Global Mean Precipitation (GMP) is projected to increase in high latitudes and tropics. Global Sea Level Rise (GSL) is projected to be from 0.18M to 0.6M by 2100 and increased ocean acidification is projected to increase with a Ph change from 8.1 to 7.7 to 8. Sea level has risen by 1–3 mm/yr. over last 50 years in SE Asia. Global Sea Surface Temperature (GSST) is projected to rise by 1.5C to 2.6 C by 2100, with regional differences. SE Asia has seen a significant increase in the number of tropical depressions.

spawning and migration of wild stocks—the actual impact is uncertain, but marine resources subject to heavy exploitation may be more susceptible. The likely impact may still be modest for the period under review.

Sea level rise is projected to be relatively modest until 2040. Brackish water aquaculture will be mostly affected; low-lying areas will require additional protection and infrastructure to manage water supply and salinity.[67]

Storms. The Philippines faces the most serious threat from an increase in the frequency and potential area of exposure from extreme storms, which increases from the south—where hurricane risks are lowest to the north. While submerged line cultures for seaweed and mussels may be less prone to storm damage, floating cages are. In sea areas with limited natural protection from waves and currents fish cages may particularly be prone to losses, leading to the escape of the crop. While technical solutions exist to limit storm damage—submerged cages, heavier anchors etc.—the costs are high, and may not yet be feasible for most current culture practices and intensities. Coastal areas, lakes and ponds will also face higher risks; these can be partly mitigated through timely action to relocate operations particularly prone to severe wave action.

The Philippines already has extensive knowledge and experience to minimize the impact of climate change on aquaculture activities. Since all climate change effects are expected to further intensify beyond 2040, careful site selection of new activities and evaluation of existing aquaculture production will be critical to minimize these risks in the more distant future.

The 2040 Vision for Fisheries in the Philippines

The future of the Philippine fisheries sector will be shaped by the performance of both the local and global economy, and by politically sensitive decisions, some outlined in this report. The objective of the following representation is to exemplify the potential impact of a change process that would require improved sector governance, enhance international competitiveness and improve local supply of fish.

Marine fisheries. Prioritizing effective management of commercial and industrial fisheries, improvement of CZM and providing incentives to younger fishermen to engage in alternative employment would lead to an improved coastal marine environment, lower fishing pressure and a major expansion of integrated marine fish culture. Coastal fisheries, limited to fewer—registered and licensed—traditional boats, generate higher local incomes.

A reduced fleet of efficient commercial and industrial vessels, exploits clearly defined and monitored resources outside zones reserved for Municipal fisheries, under a nation wide fisheries management plan drafted and executed by a DA-BFAR and its Provincial branches, supported by an MSC system in which Municipal police, Navy and Coast Guard functions are clearly defined, funded and implemented. Total marine fish production is monitored and managed below (regularly updated) MSY levels, reflecting application of the cautionary principle (and sustainability requirements of selected international markets for fish products). Marine research is fully integrated within international research networks with funding for direct stock assessments guaranteed through multiple year rolling budgets, also supported by the industry. Most fish would be landed at a centrally located well-equipped, managed and maintained landing facilities with proper logistics connections to markets; well organized collection of fish from a reduced number of small landing places, Universal quality control is applied along the entire value chain. Improved education of fishermen and their children prepares them for jobs outside the sector; widespread Municipal and Provincial support for the creation and funding of alternative employment. Multiple traders handling the local distribution of fish; large industrial groups—some regional—dominate fish processing and exports of higher value species and seaweed, A modern tuna fleet – with a capacity in line with longer term quota access—exploits the EEZ and the Pacific and Indian Oceans under bilateral and RFMO protocols; tuna processing is concentrated in large,

67 In selected areas the impact may well be mitigated by simple restoration of mangrove forests, which can trap silt and 'grow with the rise'. If such option is not available, man-made structures may protect low-lying ponds. In some areas the costs of embankments may become too high, and ponds may be abandoned.

efficient plants owned by regionally operating tuna processors.

Aquaculture. A long-term public and private sector focus on sustained development of the aquaculture sector within a permanently applied Municipal spatial planning framework would lead to fundamental research being concentrated at a few domestic centers of excellence that are networked into global and regional research efforts; applied research managed by area, technology and subject; long-term public and private funding of research budgets, partly targeted at improving production of lower value species. Government, industry, academia and NGOs provide a network of extension services supported by sufficient public and private funding; practical and academic education and recurrent training for fish culturists and related services being provided at multiple locations and levels, partly funded by the private sector. A wider spectrum of fish species is cultured; niche products are regularly introduced and their production expanded. Most fish and seaweed production is concentrated at locations that satisfy requirements of efficiency, technical and financial feasibility, controlled environmental impact, and adequate mitigation of well-defined risks of the potential impact of climate change. There is full integration of the sector's water and land requirements in Municipal/City coastal zone management plans. There is a reduced incidence of fish disease outbreaks. An industry structure for locally consumed fish is mostly based on individually owned smallholder production – many integrated into larger distribution networks – in parallel to several large and medium-sized producers. Production and export of high-value cultured fish products dominated by larger industrial groups, partly based on smallholder-estate arrangements. Public and private hatchery activities are subject to rigorous quality and performance control. DA-BFAR supports an annual, independent and public evaluation of the advances and multiple risks being faced by the aquaculture sector.

Sector governance and trade. Sector policies are coherent with a stable long-term vision of development and resources management; policy implementation relies on high quality economic, statistical and political information—DA-BFAR has a strong, permanent, resources management team and a sector policy team advising the political top of DA-BFAR.

There is frequent consultation between DA-BFAR, the private sector and municipalities/cities. Provincial and municipal/city institutional capacity capable to perform clearly defined permanent tasks; part-time support for more complex and temporary tasks being provided—on demand—by DA-BFAR and its Provincial branches, and by specialists from the private sector and NGOs; DA-BFAR maintains a substantial, highly experienced, labor-force available for such support. DA-BFAR maintains a permanent review team of the legal, fiscal and regulatory framework at the international, national and local level of the fishing sector, and actively seeks adjustment and simplification. Active trade policies can constrain the export of low value fish products, and—for products that require processing—unprocessed commodities; minimal tariffs and use restrictions are applied to imported fish and fish products. Strong public and private efforts support broad education programs to educate local consumers about the positive health effects of fish consumption

The Private Sector. Export oriented industrial activities are handled by companies able to function effectively in key markets; the Philippines actively encourages industry cooperation at the national and regional level, notably for selected aquaculture, tuna and seaweed related activities. A pro-investor business climate enables continuing industry renewal and efficiency improvements, aquaculture expansion and development of new products. The regulatory and fiscal environment encourages high quality production rather than volume growth. The industry convinces its national and international clients Philippine production is sustainable, traceable and of consistent high quality. The regulatory and fiscal environment is coherent, simple and its application is dependable at the national and municipal level. Financing of industrial, commercial and small-scale fisheries activities is widely available at reasonable costs. Transport between producers and consumers is frequent, reliable and cost-effective. The industry encourages changes in consumption from inside the home to outside venues, and aims to develop new products, logistics and

niche markets. Private sector supported infrastructure to preserve fish, and logistics to collect fish from remote locations is available, and operators maintain consistent high quality and sanitary standards. The private sector maintains frequent consultations with the public sector at the national and municipal level, participating in research, extension and resources management.

Strategies to Achieve the Philippines 2040 Vision in Fisheries

The Challenge

Given the still high rate of population growth in the Philippines, the demand for fish will increase considerably by 2040. This fish may be caught by marine fishermen, grown by domestic aqua culturists, or be imported. If the Philippines fails to satisfy local demand, fish prices will increase relative to other protein foods, demand will decline, and the poorer sections of the population will be unable to maintain their current—modest—intake of a critical food. The more well-to-do will have fewer problems satisfying their demand for protein rich foods.

How to get there

Rapid aquaculture production of food fish will be the key to satisfy future demand. Maintaining marine production at current levels—even outside the EEZ—will require major improvements in resource management effectiveness. High aquaculture production growth will entail a strong emphasis on productivity growth: more capital and knowledge intensive production methods, supported by substantial public and private investment in research, extension, local infrastructure, production and marketing capacity.

Innovation—research: As a global industry, aquaculture will increasingly depend on cutting edge international and private research, and adaptive research. The Philippines should actively participate in the former, and dominate the latter.

Extension: Productive and efficient aquaculture requires well-educated and trained fish-farmers. In the short-term, strengthening the current mix of public, private, academic and NGO executed 'extension' channels will be needed; in the long-term the knowledge transfer mix should increasingly be based on the relative efficiency of each method. Farmer preferences should be built into the system.

Local infrastructure: Maintaining, upgrading and operating coastal port and fish landing infrastructure is expensive. Spreading available funding too thinly will not satisfy future needs of the sector, and therefore it is essential to target locations with long-term potential, and engage the private sector in guiding future public and private investment.

The private sector- business environment: Future investment by the private sector in food fish production requires a clear, supportive and dependable business environment; specifically, regionally competitive bank lending interest rates, a better performing land market and a streamlined regulatory and fiscal environment. The proliferation of lower level authority regulations needs control and the regulatory and fiscal framework should be part of a national, coherent, system. Without improvement in the business climate, investment levels by large and medium-sized domestic investors will likely remain modest.

Industry structure: Aquaculture production requires a healthy mix of many small- and medium-sized producers and a limited number of large-scale operators. The actual mix may well vary over time and by production system.

Public-private partnerships: To ensure high production growth of lower value food fish, involvement of large operators is essential, to play a 'lead' role in diversification of the product mix. Public-private partnerships should be encouraged, especially small-scale producers and distribution systems.

Logistics: Marine fisheries and aquaculture production require effective and cheap logistics. Improvement of the current, cumbersome transport and distribution of fish will be critical, as logistics systems targeting large urban consumers—and exports—will increasingly demand reliable and cheap transport.

Marine fisheries—maintaining sustainable production: Current production levels mostly exceed MSY, often by a substantial margin. While some areas may produce more fish, most others require a reduction of 'fishing effort' to rebuild over-exploited fish resources, and maintain sustainable and profitable fisheries for the long term. The institutional infrastructure, necessary funding and political will to achieve a major reduction of small-scale fisheries does not exist at present, while the immediate impact on rural coastal employment and incomes could be severe. To reduce the risks of major declines in marine fish production, the country should aim for a gradual reduction in marine Municipal/City fisheries employment in parallel to a major up-front reduction of the commercial and industrial fleets. The negative income consequences for people leaving the sector should be mitigated by major, long-term efforts—largely administered by the Municipalities/Cities—to support the expansion of coastal fish culture, fish processing and marketing and non-fishery related employment generating activities, retraining of active fishermen and education programs encouraging non-fishery employment for the next generations. For selected commercial and industrial vessels, direct compensation may be considered, paid for by the remaining operators.

Natural resources management—a focus on commercial fisheries management and coastal zone improvement: Rapid improvement of effective control over commercial and industrial fisheries would provide the fastest and surest way to achieve a major part of the necessary reduction of marine fishing efforts, eventually leading to exploitation levels of marine resources below MSY, and recovery of major fish stocks. Over time, MSY estimates (and more appropriate estimates of sustainable exploitation) may well increase. Coastal zone development actions should particularly expand Marine Protected Areas, restructure mangrove zones, reduce land-based pollution and expand areas for carefully selected fish culture.

Institutional restructuring: Strengthen the political support, the institutional structure and human and financial resources of the fisheries resources management activities of DA-BFAR at the national and provincial level. Ring-fence decision making about levels of resources exploitation and vessel licensing and fleet adjustment. Create incentives and guide research planning to substantially enhance the quality of marine resources analysis and the reliability of the recommendations of the research community. Develop a multinational team of top researchers to direct and execute the research agenda for marine fisheries and resources management.

Enforcement. Link MCS to effective adjudication to enable effective implementation of fisheries management measures. Strengthen the MCS functions at the national and provincial level, and integrate an effective Municipal Law Enforcement function with the Navy and Coast Guard.

Public Sector Governance: DA-BFAR should receive strong political support to modify the resources management paradigm. It should, among others, be responsible for: (i) the formulation and implementation of national policies, plans and budgets, aspects of accountability, industry structure; (ii) defining the overall regulatory framework related to the fisheries and natural resources management (dealing with marine resources, but also land use and rights for aquaculture, water resources access, fish seed) as well as food quality and safety issues (fish and seed standards, product quality, traceability and enforcement); (iii) setting technical standards for aquaculture and marine fisheries; (iv) providing an—demand driven—extensive technical backstopping service to Provincial and Municipal/City administrations to build capacity at the local level to support the design and implementation of local programs; and (v) maintaining a high-level, permanent, management team to implement the above responsibilities and moderate conflicts between DA-BFAR and lower level authorities and the private sector.

Annex 6—Rural Financial Services

Philippines: Rural Financial Services and Risk Management, 2040

Access to financial services is important for improving the productivity and growth of the Philippine agriculture sector by enabling farmers to obtain farm inputs, rejuvenate/replant trees, deploy new technologies, and market outputs, and thereby improve productivity, job creation and incomes. Finance is critical not only for agricultural production, but also for the entire value chain including off-farm activities, processing, logistics, marketing and exports. At the same time, finance needs to be available within a risk management framework that encourages individual farmers, investors, the banking system and government to provide sustained support, on the scale necessary, to optimize the agriculture sector's potential contribution to inclusive growth and poverty reduction.

Almost half of the Philippine population of 93.3 million live in rural areas, and three-fourths of the 26.5% who are below the national poverty line live in rural areas. The agriculture sector comprises some 6 million farm units, nearly two-thirds of which are headed by marginal farmers and fishers. Although the Philippines also has a long agricultural credit history, access remains a serious constraint, especially for small holders and fishers, small processors and those engaged in certain crop types. The agriculture sector presently receives only 2.5% of total banking sector credit;[1] agriculture production loans (APL) receive under 1% of total banking sector credit; agriculture production loans account for only 3.9% of total outstanding credit; and the ratio of total agriculture loans is about 10% of the total credit. (ACPC) The provision of other financial services (e.g., access to insurance and other risk management products, savings and investments options, etc.) in rural areas is also quite weak, as most commercial banks and large formal institutions focus their most of their attention in large cities.

Institutional Overview

The Philippines financial system is primarily bank-based rather than capital market-based. The banking system is sound, though small relative to GDP: total assets of about US$150 billion, or 74% of GDP. (World Bank) The non-bank sector is even less deep, accounting for only 18% of the total assets of the financial system (and 17% of GDP in 2010). Among banking groups, universal and commercial banks hold the lion's share, accounting for 88.3% of total assets, 83.8% of core loans, 87.8% of deposits, 87.9% of capital, 90.2% of net profits, and 57.4% of the branch system. Reflecting the uneven distribution of regional income and savings, financial institutions and delivery of financial services are concentrated in high-income and urbanized areas. Bank density, for instance, has remained at five banking offices per city or municipality for the last decade, leaving some 37% of the country's municipalities either unserved or underserved. (Philippine Development Plan 2011–2016—Chapter 6, Towards a Resilient and Inclusive Financial Sector.)

Currently, the Philippines banking sector includes 38 universal and commercial banks with 4,819 branches/other offices, 71 thrift banks with 1,420 branches/other offices, and 577 rural banks and 40 cooperative banks together with 2,085 branches/other offices. Other institutions in the rural financial market include cooperatives, micro-finance institutions (MFIs) and non-government organizations (NGOs). Overall, the banking system is profitable and stable with a capital adequacy ratio (CAR) of 17.4 and non-performing loans (NPL) ratio of 3.1%, and is very liquid. The five largest universal and commercial banks account for almost 50% of banking sector assets. The three government banks (Land

1 The data available for agriculture credit includes agriculture, fisheries and forestry (AFF).

Bank of the Philippines, LBP; Development Bank of the Philippines, DBP; and the Philippine Postal Savings Bank, PPSB) account for 13.4% of the total assets, of which two development banks account for about 10% of agriculture credit while the rest is provided by commercial banks, rural banks, credit and other cooperatives, and MFIs. (BSP—A Status Report on the Philippine Financial System, Second Semester of 2011.)

With respect to the delivery of rural finance, the institutions involved are at two levels: wholesale and retail. The main wholesale players include LBP, DBP, People's Credit and Finance Corporation (PCFC), and the Small Business Corporation (SBC). The institutions at the retail level include: rural banks, NGOs and credit cooperatives. In addition, there are some thrift banks with main focus on the provision of microfinance services. Some cooperative rural banks (rural banks owned by primary cooperatives) are also engaged in microfinance. Some commercial banks are present in some areas, but most do not provide much agricultural credit.

The Land Bank of the Philippines (LBP). The Land Bank, a fully government-owned universal bank, is the largest single source of credit to small farmers and fishers. It was established in 1963 to purchase landholdings and finance their distribution to tenants under the Agricultural Land Reform Code. In 1973, it was given a license to operate as a universal bank. Under the Comprehensive Agrarian Reform Law of 1987, Land Bank has primary responsibility for land valuation and payment of compensation to land owners, and for collection of land amortization payments from agrarian reform beneficiaries. Land Bank has an extensive network presence in 79 provinces with 327 branches and over 7,000 staff. To expand its outreach, LBP provides wholesale funding through cooperatives and private rural financial institutions. Land Bank is also tasked to implement the AFMA-mandated Agri-Fisheries Modernization Credit and Financing Program (AMCFP), as one of the program's wholesalers. In 1995, Land Bank fully capitalized the People's Credit and Finance Corporation (PCFC) as its principal arm for poverty alleviation lending programs. More recently, Land Bank has also been providing wholesale loans to various MFIs.

Land Bank also provides equity investment to augment the financial strength of farmers, fishers, cooperatives, NGOs, Local Government Units (LGUs), private entities, and other investors, to engage in new economic ventures or expand existing economic projects through pooling of resources. As a major development partner in the countryside, LBP also extends capacity building assistance to cooperatives and MFIs. The loans granted to the farmers and fishers amounted to about 11% of LBP's total gross loan portfolio as of March 2012, and about 25% of its agriculture sector lending, including loans to agri-business, agricultural infrastructure projects of LGUs, and other agriculture-related projects (LBP).

The Development Bank of the Philippines (DBP). After the Second World War, in 1949, the Rehabilitation and Finance Corporation (RFC) was established to help finance the reconstruction and rehabilitation of the war-ravaged economy. RFC was renamed DBP in the late 50s'. Today DBP operates with 77 branches nationwide and has links with commercial banks for the wholesale of program loans. It caters mainly to small and medium enterprises (SMEs), and since 2005 provides wholesale microfinance lending to retail MFIs. More recently DBP has been increasing its lending for agriculture, but is still a relatively small actor in the sector.

The People's Credit and Finance Corporation (PCFC). The PCFC, established in 1996 as a subsidiary of Land Bank, is the leading microfinance agency with the mandate to support the government's poverty alleviation lending programs. The PCFC provides wholesale funds (short-, medium-, and long-term loans) for on-lending to the poor thru some 140 accredited MFIs including 70 rural banks, cooperative rural banks, thrift banks, and some 70 cooperatives and NGOs. The PCFC also supports the formation of self-help groups and extends capacity building support to eligible MFIs to strengthen their organizational capabilities, develop technologies, and upgrade the knowledge and skills of their staff.

The Quedan and Rural Credit Guarantee Corporation (Quedancor). The Quedancor was created to accelerate the flow of investments into the countryside under AFMA. Quedancor as one of the wholesalers of the AMCFP used to be the primary guarantee institution of the government; 95% of its

portfolio was in retail lending, although this was not intended to be its main function. High default rates by borrowers from its credit facility pushed Quedancor into bankruptcy, causing it to cease both its credit and guarantee operations and focus on settling financial obligations to its creditors.

The Philippine Crop Insurance Corporation (PCIC).[2] The PCIC with some 250 staff and 13 regional offices provides insurance facilities for palay, corn, high value commercial crops, livestock, and agricultural assets/facilities. It also sells term insurance products such as mortgage redemption insurance, and group life and accidental/dismemberment policy. The PCIC has recently also launched an insurance program for fisheries. Its insurance provides protection to agricultural producers against loss of crops, livestock and agricultural assets due to natural calamities, pests and diseases. It does not cover losses due to fire, theft/robbery, heavy rains not induced by typhoons, and avoidable risks emanating from neglect such as non-compliance with accepted farm management practices. The national government provides a subsidy for the rice and corn insurance program of PCIC (up to 65% of premium costs). The PCIC's ability to provide coverage depends upon the allocation of premium subsidy by the Government (P113 million in 2008, P183 million in 2009). Overall, PCIC is considered a fairly weak institution with a low capital base (P2 billion with a proposal pending in Congress to increase to P10 billion) and unprofitable operations, outdated policies and processes, poor reputation in the market and low coverage of some 250,000 farmers (out of 4 million potential). PCIC settles claims based on actual physical visits by inspectors and therefore takes too long to pay, lacks much automation, has high labor costs for the size of business, and has been criticized for the discretion it exercises in deciding who to cover (rationing subsidized coverage) and mostly providing coverage to repeat farmers. Currently, PCIC is piloting weather index-based and area yield-based insurance programs, but has not yet decided whether it will mainstream such approaches.

2 This note focuses on rural finance, mainly agricultural production and processing, and therefore does not deal with other insurance products. For example micro-insurance has been expanding following the Philippines' introduction of enabling regulations: as of June 2012), micro-insurance products were offered by six life insurance entities, 12 non-life insurance entities and 19 mutual benefit associations. (World Bank)

Rural Banks (RBs). The rural banks were established in the 1950s with government assistance and subsidies, mostly as family owned small banks confined to work in a given geographical area, and many of them grew out of the operations of moneylenders. Through special deposits and rediscount facilities, the government provided subsidized and uncollateralized production loans through RBs, 80% of which were never recovered. This and the discontinuation of rediscount facilities in 1985 led to widespread closures. At the time, the sector shrunk from over 1,500 to about 850 RBs that were rehabilitated by the Bangko Sentral ng Pilipinas (BSP), which supervises and regulates them. Most RBs are members of the Rural Bankers Association of the Philippines, a national tertiary organization. Presently there are 617 RBs, including 40 cooperative banks; as of April 2012, some 165 RBs are under special care by BSP, including rehabilitation/consolidation and closure. The system is not strong and RBs are a mix of some good and many not so good banks. Although in many respects RBs form a basic backbone of the rural finance system in the Philippines, they remain predominantly family-owned, small in scope (one bank, one branch type) and fragmented.

Cooperatives, MFIs and Non-Government Organizations (NGOs). Cooperatives have grown rapidly from a total of 2,888 cooperatives and pre-cooperatives in 1987, to over 100,000 today. There are several types of cooperatives: multi-purpose cooperatives, consumer cooperatives, marketing cooperatives, savings and credit cooperatives, housing cooperatives and electricity distribution cooperatives. Cooperatives have become active in providing microfinance services through their affiliation as program partners of PCFC. The NGO sector has also grown rapidly, but most NGOs are small and highly localized with a few full-time staff. Many of them see their role as organizing cooperatives or associations that will eventually be in a position to access credit directly and many NGOs are directly involved in microfinance. NGOs are not supervised nor regulated by any government agency. They are, however, required by law to submit audited financial statements to the SEC.

Except for a small number of strong institutions, most credit cooperatives and microfinance institutions (MFIs) are not

regulated by BSP, and are quite weak. The Cooperative Development Authority (CDA) is tasked to regulate cooperatives under RA 6539, but its institutional capacity is weak, lacks transparency, and suffers from conflict of interest issues, as CDA handles the regulatory/oversight function as well as the developmental role and lending to the sector. Like the rural banking system, the cooperative sector also has the potential to be a significant player in microfinance because of its extensive network. The Economist Intelligence Group recently rated the regulatory environment that the Philippines has been putting in place since 2007 very favorably (see Global MicroScope 2010). There are no regulatory restrictions on MFIs, whether banks or NGO-MFIs, to accept debt investment from international investors in foreign currency (RBs cannot take foreign equity investments). BSP requires all regulated MFIs to disclose effective interest rates and be audited by an external auditor. However, NGO-MFIs, which are among the largest providers in the country, are unregulated and thus not subject to these obligations. Regulated MFIs can accept deposits, and those linked to the international payments system can accept remittances. There are a relatively small number of MFIs that operate on a national scale, and many smaller local ones (the top 10 service providers account for just over half of all loans outstanding in the sector and 66% of all MFI clients).

Evolution of Rural Finance Policies and Programs

During the 1970s and 1980s, credit allocation, loan targeting, credit subsidies and directed credit to certain sectors were the main features of a supply-led finance approach. Funding was provided from government budgetary appropriations and foreign loans. Commodity-specific credit programs were intended to meet the government's objective of attaining self-sufficiency, particularly in rice and corn. The loans were channeled through the Philippine National Bank (PNB) and the Central Bank of the Philippines (CBP) to RBs, as a source of cheap funds for onlending to small farmers at highly subsidized rates. The Presidential Decree 717 or the Agri-Agra Law, issued in 1975, mandated banks to set aside 25% of their loan portfolios for lending to agriculture, 15% of which should be allocated to general agricultural lending and 10% to agrarian reform beneficiaries.

At the beginning of the 1980s, some market-oriented financial and credit policy reforms began to replace the earlier policies. These included the start of deregulation of interest rates and gradual removal of credit subsidies, although it would not be until the passage of AFMA in 1997 that interest rate subsidies would be fully eliminated and directed credit programs terminated.

In 1986, some 19 commodity-specific funds used for agricultural lending were consolidated into the Comprehensive Agricultural Loan Fund (CALF), which was used to expand the guarantee operations of the Guarantee Fund for Small and Medium Enterprises (GFSME), the Quedan Guarantee Fund Board (QGFB), and the Philippine Crop Insurance Corporation (PCIC) for agricultural production of small farmers, and for the Bagong Pagkain ng Bayan Program for rural-based projects of local government units (LGUs). The credit guarantee program was intended to encourage private sector participation in agricultural lending by reducing the risks associated with agricultural lending.

The highly subsidized directed credits programs had benefited only targeted borrowers, and led to massive loan repayment problems and huge loan arrears among participating RBs, many of which closed shop as a consequence. In 1987, CBP began a rehabilitation program for RBs, which required them to provide fresh infusion of equity in order to access the rehabilitation package. Several years later, the CBP closed its rediscounting window, and the 1992 Rural Bank Act institutionalized the rehabilitation scheme for RBs, allowing for conversion of arrears with the CBP into government-preferred stocks in the RB. Owners were required to infuse an equal amount of capital over a period of 15 years.

In November 1994, the Bangko Sentral ng Pilipinas (BSP), which replaced the CBP, lifted the ceiling on lending rates for rediscounted papers covering agricultural production, cottage and small industries and financing of working capital. The closure of subsidized credit facilities forced RBs to reduce their dependence on cheap government loan funds and rely more on savings mobilization as the source of their funds for lending to the rural sector.

Agricultural Competitiveness Enhancement Fund (ACEF). The ACEF was created in under the 1995 Tariffication Act (but actual implementation started in 2000) from the proceeds of the in-quota minimum access volume importations, to finance projects that will make the agriculture sector globally competitive. The Fund was supposed to provide interest-free and collateral-free loans to small farmer and fisher cooperatives and organizations, agri-business, NGOs and LGUs. Eligible projects include irrigation, farm-to-market roads, post-harvest facilities, research and development, marketing infrastructure, training and other extension services. The overall management of ACEF is undertaken by its Executive Committee (ExeCom) responsible to allocate funds and review, approve, and prioritize project proposals and feasibility studies submitted for ACEF funding. The Secretary of the DA and the Chairperson of the COCAFM serve as the Chair and Co-Chairs of the ExeCom. The Land Bank serves as the conduit bank for the ACEF program to service the needs for the release and collections of loans to and from the program beneficiaries.

However, the program has been plagued by numerous problems that significantly derailed the attainment of its objectives and its implementation was suspended in January 2011. A substantial portion of ACEF funds were actually not utilized for the program, only a small portion of the collectibles of the program were collected, additional loans were granted to beneficiaries with unpaid past loans, some fund transfers were actually not released to project proponents, and loans were granted without interest and collateral to the disadvantage of the national government (COA 2010). As of end 2010, ACEF funds totaled P10.71 billion, of which loans in the amount of P5.82 billion (54%) were allocated for 304 projects. In addition, grants were made in the amount of P2.96 billion, bringing the sum of funds used to P8.7 billion (81% of total). The remaining unused funds are with the Treasury. As of 2011, P2.35 billion (40% of the P5.82 billion loans) was due for collection (the ACEF loan given to Quedancor is included here), but only P345 million had been collected. The Fund is supposed to restart in 2012 with new guidelines and will provide only 30% as loans, 60% as grants and 10% for scholarship programs—with a major share going to the livestock business sector to improve its competitiveness in the global market.

The Agriculture and Fisheries Modernization Act (AFMA). The Republic Act 8435 AFMA was passed in 1997 to transform agriculture into a productive and competitive sector to enable farmers and fishers to meet the challenge of globalization. The Law covers the many elements critical to agricultural modernization such as research and development, infrastructure, training, marketing and credit, among others. AFMA mandated the adoption of market-based interest rates for government agriculture credit programs with greater role for the private sector (including rural banks, cooperative rural banks, cooperatives and NGOs) and government financial institutions (GFIs) in the provision of financial services. The AFMA also provided for the phase out of all directed (subsidized) credit programs (DCP) implemented by government non-financial agencies in the agriculture sector over a four-year period. The proceeds from the phased-out DCPs were consolidated into the Agricultural Modernization Credit and Financing Program (AMCFP, see below). Other reforms included the enactment of the General Banking Act in May 2000 which included provisions mandating the Bangko Sentral ng Pilipinas (BSP) to recognize the unique nature of microfinance as it formulates banking policies and procedures. As such, the moratorium on branching was lifted specifically for microfinance banks.

The Agricultural Modernization Credit and Financing Program (AMCFP). The AMCFP is an umbrella program of the Department of Agriculture (DA) to provide financing for farm, off-farm and non-farm income-generating projects of small farming households. The Agricultural Credit Policy Council (ACPC) is tasked to administer/oversee the implementation of AMCFP; collect and consolidate DCP funds into AMCFP; and develop and implement innovative financing schemes and institutional capacity building programs in support of AMCFP. Through AMCFP, government credit resources are administered via the "wholesaler-retailer" lending approach whereby government financial institutions serve as wholesalers and qualified private banks and other organizations such as farmer cooperatives and NGOs as retailers. The AMCFP is being funded out of the remaining loanable

funds and past due loans from the terminated agricultural directed credit programs. As per Sec. 111 of AFMA, AMCFP should have been appropriated P2.0 billion for its first year of implementation and P1.7 billion every year for the next six years thereafter. However, since the passage of AFMA in 1997, the AMCFP has received no budgetary allocations. Its only source has been collections from closed DCP programs and reflows from lending of these funds. As of end 2011, ACPC had collected P1547 million from terminated DCPs and the total outstanding remained at P4,835 million; it collected P1,084 million from AMCFP programs and outstanding was P1,161 million, as of end 2011

The AMCFP is different from the past government rural finance programs in that it is demand-driven, uses market-base rates, covers the entire agriculture sector value chain (rather than specific commodities), and credit decisions made by lenders with GFIs as wholesalers and private banks as retailers. Credit guarantee and crop insurance programs are also supported to reduce the risks in lending and encourage formal financial institutions to lend to small farmers. As of end 2011, AMCFP has generated a total of P3.2 billion in loans to some 115,915 farmer and fishers. The key AMCFP initiatives (all administered by ACPC) include the following (source ACPC).

Agri-Microfinance Program (AMP), being implemented with the People's Credit and Finance Corporation (PCFC), started in April 2009 to extend credit outreach to small farming and fishing households by utilizing PCFC's extensive network of MFIs. Eligible projects include: agricultural value chain activities (e.g., production, processing, marketing); and microfinance income-generating livelihood activities (e.g., farm, off-farm and non-farm) of agricultural households. As of end 2011, the program has released a total of P412 million to some 40,078 borrowers.

Agri-Fishery Microfinance Program, being implemented with Land Bank, started in 2008 with P100 million of seed funding. It also has the objective of improving credit access of small farm and fisher households. Some P44.1 million has been lent to 3,641 borrowers.

Cooperative Banks Agricultural Lending Program (re-designed CBAP). Launched in September 2011 with an initial funding of P378 million, CBAP provides stable, low-cost financing to cooperative banks to provide agricultural loans to small farmers and fishers. Under this new scheme, special time deposits (one-year maturity at maximum 3% interest rate) are placed directly in cooperative banks, eliminating the need for a wholesaler, thus resulting in lower rates to small borrowers. Eligible borrowers are charged a maximum rate of 15%. As of end 2011, P333.5 million were released by ACPC (88% of the approved allocation) to 12 cooperative banks; of this, P195 million in loans were made to 3,090 sub-borrowers. Prior to its redesign, the old CBAP had provided a total of P2,300 million to some 37,159 borrowers.

Cooperatives Agri-Lending Program (CALP) implemented jointly by ACPC and the DBP. Launched in June 2011, CALP aims to strengthen the lending programs of cooperatives servicing small farmers and fishers, particularly in the national convergence areas of the DA, DAR and DENR. The DBP, as program wholesaler, re-lends to viable cooperative-retailers for on-lending to small farmers and fishers for agriculture production or microfinance loans at market-based rates (1-3 years maturity). The repayment schedule is cash flow-based, either every semester or annually, or balloon payment upon maturity. After extensive road shows by DBP, some 52 cooperatives had submitted indicative target credit proposals of P275.8 million. As of end 2011, of these 52 cooperatives, 13 had applied for accreditation/credit lines of P167.0 million, of which P20 million was approved by DBP for release during 1st quarter of 2012.

Credit Program in Support of the National Convergence Initiative (under preparation). The ACPC is currently developing a value chain financing-cum-capacity building program in support of the DA-DAR-DENR National Convergence Initiative. This program would organize and strengthen farmer organizations, link producers to markets, and provide financing intervention where it is needed.

Innovative Financing Schemes. To be responsive to the diverse credit needs of small farmers and fishers, ACPC also develops and pilot-tests agricultural and micro-financing schemes for borrowers who do not have access to bank

financing or do not have collateral to offer. If successful, these schemes are adopted as regular programs under the AMCFP. Some of the successful schemes that were piloted include the Rural Household Business Financing Program (e.g. Tomato Production and Paste Processing System Project launched in 2008, total P127.0 million to 5,702 borrowers) and the Direct Market Linkage Program (total P99.9 million to 26,008 beneficiaries.

Institutional Capacity Building Program. The ACPC also provides grant and technical assistance through partner institutions intended to strengthen the capacity of rural financial institutions serving as lending conduits of ACPC's credit programs, and to transform farmer and fishers organizations into sustainable entities capable of accessing credit from formal sector.

Agricultural Guarantee Fund Pool (AGFP). Recognizing the need for a guarantee facility in place of Quedancor, the AGFP was created May 2008 by Presidential Administrative Order No. 225-A that instructed government corporations and government financial institutions to contribute 5% of their 2007 surplus funds to a pool that would be utilized to guarantee loans of small farmers engaged in food crops. The AGFP offers guarantee cover (up to 85%) to lending institutions including banks, farmer cooperatives and associations, NGOs and small and medium enterprises (SMEs) for unsecured loans extended to small farmers. It includes all types of default risks including nonpayment due to weather, pest and diseases, and other fortuitous events, except those arising from willful default and/or fraud. To avail of guarantee, the participating lender pays 2% premium per annum of the outstanding loan amount. As of end 2011, some 378 financial institutions have provided guarantee cover to loans of 220,658 borrowers amounting to P8,873 million; claims paid amounted to P122.2 million (1.4%).

Agri-Agra Credit Policy. The Agri-Agra Reform Credit Act of 2009 (Republic Act 10000) signed in February 2010 is the amended version of Presidential Decree 717 or the "original" Agri-Agra Law issued in 1975. Like its predecessor, this Act still requires banks to allocate 25% of their loanable funds to agricultural and agrarian reform credit. The modes of compliance have been rationalized to eliminate non-agricultural activities and, at the same time, expand the types of agricultural-based loans that can be counted as compliance by banks. The Act now requires an "erring" bank to pay an amount equivalent to 0.5% of the non-compliance amount. In the previous Law, the fine was only P1,000 to P30,000 per day depending on the bank's asset size, rate of compliance and length of non-compliance. Further, unlike the PD 717 provision that required all penalty collections to remain with the BSP, the amended law allocates only 10% of the total penalty collections to the BSP. This time, the bulk of penalty collections (90%) will form part of the credit guarantee and insurance funds of the AGFP and the PCIC.

Agricultural Credit Performance and Issues

In spite of the many government initiatives during the past decades access of small farmers to credit, these programs have not made a significant impact. Despite banking sector's large amount of funds available for lending, access to formal credit by smallholders in the agriculture sector remains limited. For 2010, the ACPC estimated the total credit requirement for selected DA priority commodities, including palay, corn, coconut, sugarcane and fisheries, among others, to be about P359 billion of this amount, banks financed only P107 billion, or 30%.

According to ACPC, the proportion of borrowing farmers has shown an increasing trend during past decades increasing from 28% in 1995 to 57% in 2008). ACPC surveys also revealed that, on the average, farmer borrowers deal more with informal than with formal lenders (50% v. 43%, although the share dealing with formal lenders has been rising).[3] The informal lenders, not regulated by the BSP or any regulating body, include input suppliers, millers, traders, friends and relatives, and landowners. They typically

3 This is in an overall country context in which use of formal financial services is still quite limited: only 27% of Filipinos have an account in a formal financial institution (for cross-country comparison, the World Bank's Findex Database 2012 shows: 73% in Thailand, 66% Malaysia, 64% China, 27% Lao PDR, 21% Vietnam, 20% Indonesia, 4% Cambodia). The distribution by wealth group for the Philippines is: only 10% of low-income adults have accounts in formal financial institutions, compared with 40% of high-income adults. The rapidly expanding use of mobil phone services, an area in which the Philippines is a regional leader, is helping to expand access. The World Bank estimates that the number of people using mobile phones to receive remittances and to make payments (though not generally to engage in borrowing for agricultural production purposes) supercedes the number using accounts in financial institutions, notably in rural areas and in the low income group (World Bank, 2012).

Table A6.1. Estimated Agricultural Production Credit for Priority Commodities Un-served by Banks (P billion)

Estimated Credit Needs for Priority Commodities/Year	2009	2010	% Change
Total Credit Requirement	347.94	359.15	3.2
Agri-Production Loans Granted by Banks	101.96	107.08	5.0
Credit Un-served by Banks	245.98	252.07	2.5

Source: ACPC Staff Paper- State of Agricultural Credit, July 2011

charge high interest rates (as much as 50% per annum) in exchange of no documents and/or collateral. In 2011, the ACPC prepared a medium term strategic plan that outlines strategies for 2011–2016, to give small farmers and fishers increased access to timely, adequate and affordable formal credit. The target is to increase the proportion of borrowing farmers and fishers from formal sources from 57% (2008 level) to 85% by 2016 (including access to micro-finance for farm households engaging in non-farm activities). In terms of the number of small farmers and fishers, the goal is to increase credit outreach by more than 800,000 farmers and fishing households. (ACPC Staff Paper 2011—Agriculture and Fisheries Credit Strategic Plan 2011–2016.)

Bank Lending to Agriculture. Total loans granted by banks during 2001–2010 amounted to P17,069 billion on the average per year. Of this, P440.5 billion (or 2.6%) went to agriculture and P156.2 billion (0.9%) to agricultural production. The average share of agricultural loans to total loans granted by banks for the 2001–2010 period remained low at 2.6%. The shares of agriculture loans and agri-production loans were highest during 2001 at 5.9% and 1.8%, respectively, and lowest in 2006 at 1.7% and 0.5%, respectively. However, from 2006 to 2010, the proportion of agricultural loans—including those used for production—to total loans granted by the banking sector have showed an increasing trend. The loan to output ratio for agricultural production during the past 10 years declined during 2001–2006. The highest ratio of agricultural production loans to gross value added (GVA) in agriculture and fisheries was recorded in 2001 at 22.8%, and lowest in 2006 at 11%; but it increased in succeeding years reaching 20.3% in 2010. (ACPC Staff Paper- State of Agricultural Credit in the Philippines, July 2011)

The limited access to credit by small farmers and fishers, despite the banking sector's reported good liquidity, has been due to: (i) the lack of track record among farmers; (ii) lack of knowledge on accessing formal or bank financing, particularly putting together the required documents; (iii) lack of acceptable collateral; delayed release of loans; and (iv) large documentary requirements that formal lending institutions require from farmers upon commencement of transactions. Banks' aversion to high-risk and low-income agricultural projects, the high cost of administering small loans, poor repayment performance of agricultural loans, absence of well-developed credit information and movable collateral registry systems, among others, have constrained the provision of credit to farmers and fishers. (ACPC)

Credit Information. The limited availability of credit information on prospective borrowers, and the absence of a nationwide movable collateral registry, contribute to banks' reluctance to lend. Table 4 compares the depth of credit information coverage in the Philippines with other countries and regions. In East Asia, patterns clearly vary, with some countries relying exclusively or mainly on private credit bureaus (Thailand, Singapore, East Asia generally), and others mainly on public bureaus (Indonesia, Vietnam); Malaysia has high coverage by both private and public bureaus. The Philippines overall score for depth of credit information (1-6, with 6 being the highest) is about average by world, middle income and East Asia standards, but low compared with rapidly growing Southeast Asian neighbors. In other words, banks and other financial institutions have a substantially easier time obtaining credit information on prospective borrowers in neighboring countries, than in the Philippines.

Compliance under Agri-Agra Credit. The compliance with the previous Agri-Agra Law has been quite low as the banks were allowed loose alternative way of compliance including investments in government securities. The banks have found it very difficult (especially with the 10% agrarian

Table A6.2. Total Bank Loans Granted to Agriculture (in constant 1/ and current P Billion)

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Total lending (constant prices)	6,639	13,057	13,520	13,381	9,195	12,675	12,312	13,573	15,455	15,100
All lending to agriculture	390	297	298	385	367	219	272	299	379	376
of which, for agri production	117	112	117	136	84	68	108	125	142	144
Total lending (current prices)	7,090	14,363	15,386	16,137	11,936	17,480	17,459	21,038	24,727	25,081
All lending to agriculture	417	327	340	464	476	302	386	463	606	625
of which, for agri production	125	123	133	164	109	93	154	193	228	240
% Agri Loans to Total	5.88	2.28	2.21	2.87	3.99	1.73	2.21	2.20	2.45	2.49
% Agri Prod Loans to Total	1.77	0.86	0.87	1.02	0.91	0.53	0.88	0.92	0.92	0.96

Source: ACPC and BSP

1/ Constant 2000 prices, using GDP deflator

Table A6.3. Total Loans Outstanding to Agriculture by Type of Banks (P Billion)

Financial Institution	2000	2005	2010
Government Banks	19.844	25.437	57.730
Development Bank of the Philippines (DBP)	7.864	8.378	14.559
Land Bank of the Philippines (LBP)	11.980	17.059	43.171
Private Banks	263.143	172.664	238.999
Private Commercial Banks (PKBs)	236.382	137.068	160.462
Thrift Banks (TBs)	8.460	5.535	38.302
Private Development Banks (PDBs)	2.907	1.002	2.761
Savings and Mortgage Banks (SMBs)	4532	3.537	34.225
Stock Savings and Loan Assoc. (SSLAs)	1.022	0.996	1.316
Rural Banks (RBs, incl Cooperative Banks)	18.301	30.061	40.234
All Banks:			
Total AFF Outstanding	282.987	198.100	296.729
Total Loans Outstanding	1,904.693	2,038.953	3,119.836
Ratio of AFF Outstanding to Total Loans Outstanding (%)	14.86	9.72	9.51

Source: ACPC, BSP

reform beneficiaries part) to comply with this affirmative action due to lack of perceived high risk and low bankable demand from the agriculture sector, although, as a result of the 2010 amendment, recently some banks (such as DBP) have started to make special efforts to extend credit to agriculture sector. In 2010, banks lent a total of P522.5 billion (or only 19.4% of the mandate): 10.4% for agriculture related activities and 9% for agrarian reform lending.

For 2010, banks complied mostly (61%) through actual loans granted (P319.0 billion). On the agricultural sub-quota, banks complied largely (87%) through actual loans (P242.6 billion) and on the agrarian reform; banks compliance through alternative modes (69%) was much higher than through actual loans granted (31%).

Among the banks, rural banks (RBs) posted the highest share (83%) of actual or direct loans relative to total compliance followed by universal banks (UBs) at 64%, Commercial banks (KBs) at 50% and thrift banks (TBs) at 34%. By sub-quota, UBs complied largely in the form of actual loans granted (88%) for the agri sub-quota and through alternative modes (65%) for the agra sub-quota. On the other hand, TBs complied mostly (77%) in the form of actual loans for the agri sub-quota and through alternative modes (95%) for the agra sub-quota. Only RBs registered high compliance through actual loans granted in both agricultural and agrarian reform sub-quota at 94% and 67%. Only rural banks had a remarkable compliance ratio of 36% (21% with agricultural credit quota and 15% with agrarian reform quota). This is because these banks cater mostly to agricultural borrowers. The under compliance of other banks may have been due partly to location, which is mostly in urban centers, making them less

AMCFP Outreach. The impact of AMCFP lending facilities is quite small due to its limited resources. As of year-end 2011, AMCFP program has so far generated only P3.2 billion in loans to some 115,915 farmer and fishers borrowers. The loans under AMCFP represent only a small portion (P1.16 billion) or 0.2% of the total outstanding agricultural loans of P624.5 billion as of end 2010). In 2010, this program provided P656 million representing only about 0.1% of the total loans granted to agriculture by the banking sector in that year. In 2011, under AMCFP the ACPC disbursed a total P474 million—to 34 lenders—P333.5 million to 12 cooperative banks via depository mode and P140.7 million to 22 accredited retailers of partner GFI-wholesalers (Land Bank and PCFC) via wholesaler-retailer mode. This amount was leveraged by lenders to generate around P490 million in loans to some 35,640 small farmers and fishers. (ACPC)

TABLE A6.4: DEPTH OF CREDIT INFORMATION COVERAGE BY PRIVATE AND PUBLIC BUREAUS

Indicator/ Country Group	Private Credit Bureau Coverage (% adults)	Public Credit Bureau Coverage (% adults)	Credit Depth of Information
World	25.5	8.5	3.2
High income	53	7.5	4.2
Middle-income	10.2	6.7	2.8
Low income	0.8	1.0	1.3
East Asia	29.7	8.8	2.7
PHILIPPINES	7.4	0	3
Indonesia	0	31.8	4
Vietnam	0	29.8	5
Singapore	53.8	0	5
Malaysia	83.4	49.4	6
Thailand	41.7	0	5

Source: World Development Indicators

SUMMARY OF MAIN OBSERVATIONS

The key observations related to the low access to rural finance in the Philippines include the following:

The Government's low budgetary support for agriculture and policy emphasis on the self-sufficiency in rice production have resulted in the neglect of investments important for raising productivity in other subsectors, and this has contributed to the reluctance of lenders to provide finance to smallholders and other value chain actors.

Issues related to the agrarian reform program, including prolonged and weak implementation, fragmented small land holdings, restrictions on the use and sale of land including

inability to offer land as collateral, poor provision of relevant services, lack of opportunities for scaling up farm production, and low use of technology and mechanization, etc. A large number of CARP beneficiaries are also reportedly in arrears, or in complete default, on their land purchase obligations.

The Government did not provide any budgetary funding for AMCFP even though AFMA required allocation of P12.2 billion during the first 7 years. Thus the impact of AMCFP is quite small, as its lending facilities are funded out of collection of terminated DCPs only.

Table A6.5: Banks' Compliance with Agri-Agra Law

Item	2009	2010 a/	% Change
Total Compliance (25%)a/	570,977	522,500	(8.49)
Amount (PM)	22.74	19.41	(14.63)
% to Loanable Funds			
Agricultural Credit (15%)	342,965	278,534	(18.79)
% to Loanable Funds	13.66	10.35	(24.23)
Agrarian Reform Credit (10%)	228,012	243,966	(7.00)
% to Loanable Funds	9.08	9.06	(0.18)

a/ As of September 2010.

Source: ACPC Staff Paper—State of Agricultural Credit, July 2011.

Banks find it difficult to comply with the agri-agra credit requirements, there are no known independent assessments of their impact on agriculture credit recipients and the banking system.

There is weak capacity and overlap among government institutions involved in the delivery of agriculture credit. For example, the PCIC efficiency and coverage are low. The CDA has limited capacity and undertakes conflicting roles of oversight and development. The PCFC's micro-finance business has stagnated. Although the Land Bank is supposed to be Government's main development bank for agriculture sector, only 1/3rd of its portfolio is focused on agriculture and related activities. There is also some overlap between the roles of Land Bank and DBP.

Banking sector's reluctance to engage actively with the agriculture sector, especially with small farmers, is heightened by difficulties in getting appropriate information, lack of collateral, high transaction costs and lower margins, and perceived risks given the Philippines vulnerability to extreme weather events and other natural disasters.

The rural finance system (including rural banks, cooperatives and MFIs) is weak, highly fragmented, and there is no credible regulatory body overseeing the financial status and performance of MFIs and NGOs that engage heavily in credit activities. While there are a number of good rural banks, most remain small, and lack modern management and technology capabilities.

Many farmers are reluctant to apply to banks and/or unable to prepare bankable applications, due partly to low financial literacy, and lack of good records of their earnings and expenditures.

The Philippines lacks strong risk mitigation systems, including small credit guarantee and crop insurance programs. This is especially important given that it is one of the world's most vulnerable countries in terms of frequency and intensity of extreme weather events and other natural calamities.

There are no nationwide credit information or collateral registry systems. The lack of supportive financial infrastructure, including credit information, makes it difficult and costly for lenders to obtain relevant data on prospective borrowers.

Way Forward in the Long Run

Agriculture will not grow to anywhere near potential in the Philippines unless there is a significant increase in the availability of rural finance.

The government could get more mileage out of current efforts if the number of fragmented and small financing initiatives were consolidated into a more substantial wholesale fund to provide long-term finance to the banking system. Such a fund would need to be properly sized in relation to demand, and should be co-financed by financial institutions, transparently administered, with clear monitorable perfor-

Table A6.6: Amount of Loans Granted and Number of Farmer and Fishers Borrowers, under AMCFP

Program/Project	2010		2011		As of year-end 2011 (Since Prog. started)	
	Loans Granted (P mil)	Borrowers (No.)	Loans Granted (P mi)	Borrowers (No.)	Loans Granted (P mil)	Borrowers (No.)
1. Cooperative Banks Agricultural Lending Prog.						
Depository Mode (Modified Scheme)			195.1	3,090	195.1	3,090
Wholesaler-Retailer Mode	468.3	7,256	/a	/a	2,300.2	37,159
2. Agricultural Microfinance Program	144.2	13,978	206.8	20,158	412.0	40,078
3. Direct Market Linkage Development Program/b	3.2		43.0	10,138	99.9	26,008
4. Agri-Fishery Microfinance Program	9.3	478	19.3	917	44.1	3,641
5. Fisheries Financing Program	--	--	1.0	15	3.5	237
6. Tomato Production and Paste Processing Sys. Proj.	31.1	2,126	23.9	1,322	127.0	5,702
7. Cooperatives Agricultural Lending Program/c	--	--	--	--	--	--
TOTAL	656.1	23,838	489.1	35,640	3,181.8	115,915

/a Operations were terminated in June 2010. /b DMLDP is DA-AMAS funded.
/c Launched in June 2011; no releases as of end 2011.

Source: ACPC 2011 Annual Report.

mance indicators, and fully regulated by BSP. However, even with such a program in place, overall volume would still be small in relation to needs. The government's main focus will have to be on addressing those issues that are at the core of private sector reluctance to lend.

The roles of the various GFIs should be reviewed and consolidated (including the ACPC, Land Bank, DBP, PCIC, PCFC and others), with a view to improving effectiveness, efficiency and service delivery. The Government should consider: (i) closing the PCFC and transferring its functions to Land Bank, which is already handling some similar activities; (ii) restructuring the PCIC and incentivizing the private sector to undertake many of its functions; (iii) over the longer-term, consolidating the functions of DBP and Land Bank into one development bank, when the financial sector is well developed and commercial banks are more active in SME lending; and (iv) revising the role of the ACPC to become a policy and oversight body without the loan rediscounting function (given very low impact of this activity), which could be handled by Land Bank. In this context, the Government could also consider abolishing the Agri-Agra Credit policy, as and when the banking sector enhances its outreach to agriculture.

The rural bank system needs to be upgraded, including sound capital requirements, policies, operating procedures, and institutional capacity, with the possibility of encouraging FDI to bring investment and know-how. RBs should be encouraged to mobilize savings, open branches and modernize their governance, management and technology systems. Some of this is being pursued, but there are also still restrictions on opening branches outside their areas, rediscounting could require co-financing from own funds through savings mobilization, training of bank directors and managers, etc. The BSP's current RB consolidation program should be expedited. Some best practices experiences that may be applicable may include factoring, leasing, informal lending techniques, group guarantees, collateral substitutes and micro-insurance to address the problems of imperfect information, high transaction costs and the risks inherent to an agriculture setting. Group guarantees are quite com-

Table A6.7: Loans Released to Partner Banks/Financial Institutions/Other Lenders under AMCFP in 2011

Program/Project	Year Started	Mode of Credit Delivery	Type/Name of Partner Bank/ FI	No. of Partner Banks/FIs	Loans Released (P million)
1. Cooperative Banks Agricultural Lending Program	2011	Depository Mode	Cooperative Banks	12	333.5
2. Agricultural Microfinance Program	2009	Wholesaler-Retailer	PCFC	12	96.5
3. Agri-Fishery Microfinance Program/a	2008	Wholesaler-Retailer	Land Bank	8	19.3
4. Fisheries Financing Program/a	2009	Wholesaler-Retailer	Land Bank	1	1.0
5. Tomato Production and Paste Processing System Project	2008	Wholesaler-Retailer	UCPB	1	23.9
Sub-Total under Wholesaler-Retailer				22	140.7
TOTAL				34	474.2

/a Program terminated in July 2011

Source: ACPC 2011 Annual Report

mon in many countries, thru savings and loan associations (Moldova, India, Bangladesh Grameen Bank, some in Latin American countries. Factoring/leasing are also being used increasingly (e.g., Turkey, India), and more loan processing and management systems automation and simplified loan applications are widely popular.

The Cooperatives and MFI systems also need to be strengthened, with sound capital, policies, operating procedures and institutional capacity building. This should include development and enforcement of national standards for the establishment and supervision of cooperatives (both credit and non-credit coops) and extension of the Philippines regulatory framework for MFIs to cover most entities in the sector. While there may not be a strong case for having prudential regulations over some sections of NGOs, observance of performance standards would foster greater financial discipline and enhance their credibility before donors and patrons. The use of appropriately developed performance standards will signal to potential sources of capital that the NGOs are 'good' credit risks, thereby segregating themselves from the 'bad' credit risks in the microfinance market.

Problems related to the agrarian reform program need to be addressed, including: (i) enabling farmers to fully own, use, mortgage and market their land assets freely; and (ii) developing a robust, transparent and easily accessible nationwide electronic land registry system to enable quick and low cost access to land records by farmers and lenders alike.

Given its vulnerability to natural disasters and climate events, the Philippines needs to put in place a state-of-the-art crop insurance program (and safety net arrangements for households affected by such disasters). The Government should continue to encourage the private sector (including FDI) to develop suitable insurance and re-insurance products capabilities. However, precisely because of the country's relatively high vulnerability, the private sector alone will find it very costly and unprofitable to provide such coverage on its own. Therefore, the Government will have to share some of the risk/burden in particular for smallholders and vulnerable groups.

A robust and sustainable credit guarantee system is also necessary, operated on market based principles (preferably owned and operated by the banking system) to provide credit risk protection at a reasonable cost. Here again, the

Government may have to share some of the costs in the case of smallholders and vulnerable groups.

Nationwide credit information and collateral registry systems (both for fixed and movable assets) need to be developed, with comprehensive data on current and prospective borrowers, including farmers and fishers. This would go beyond current arrangements, providing nationwide coverage for all types of borrowers and collateral national-wide collateral. Timely availability of good quality information should help to reduce transaction costs for lenders, thereby enhancing their interest to serve this important market.

Although the discussion in this Section has centered on credit and related risk instruments, equity financing is also scarce in the Philippines and will be essential for development of some subsectors, especially tree crops, biotechnology/new product development, processing and other downstream activities. Making the foreign investment regime more user friendly, in particular addressing restrictions on the share of foreign investment in business undertakings, and land ownership, will be important to attract longer-term equity financing (as well as technology and skills) on the scale needed to maximize agriculture's potential contributions to the growth, employment, energy, environmental sustainability, food security and rural poverty reduction.

Annex 7—Research and Technology Development

Introduction

This Annex benefited from the inputs of participants in an Agriculture & Fisheries Research 2040 Forum in June 2012, which was organized to elicit views on future long-term directions for agricultural research in the Philippines through 2040.[1] Forum participants concurred on the need for (1) critical structural reforms and (2) increased, well-thought out investment in the country's agriculture research and development (AR&D) system. They considered such fundamental reforms to be important prerequisites for achieving the dynamic application of advanced agricultural science and technology by both the public and private sectors, to achieve the optimal use of finite resources towards the pursuit of inclusive growth.

The vision that emerged is based on an understanding that agriculture in the Philippines today has two faces at this time:

- One face is modernizing more rapidly due to a relatively high level of adoption of new knowledge and technologies generated from agricultural research, an important part by the private sector. This is the agriculture of some small, but mainly medium to larger farms with better productivity, generally located in more favorable environments. These farms are typified by export fruits (Cavendish bananas, pineapples, mango farms); fully irrigated and intensively operated rice fields; some hog and poultry farms under contract growing arrangements; parts of the aquaculture industry, especially tilapia and milkfish; parts of the yellow corn industry; parts of the sugar industry; the tuna industry; medium sized root crop farmers; and a small but growing number of salad vegetable and cut-flower producers. There are serious value chain issues for each of these subsectors, but generally they have better access to transport, telecommunications, market, and financial services. Despite the greater dynamism of these 'modernizing' farms, however, efficiency is mixed: some are clearly competitive by any international standards, but many produce yields that, while improving, are still below regional and global standards and are profitable mainly because of trade protection.

- The other face is modernizing very slowly and is characterized by a low level of adoption of modern methods of agriculture production and processing. These are the generally small, multi-commodity farms that comprise a substantial part of the agricultural landscape of the country. Their productivity is low; many are operated by tenants, sharecroppers or producers with very insecure tenure; they are often located in difficult areas whose access to the market and financial services is made complicated by the absence of all weather roads and poor transportation and telecommunication facilities. These farms essentially compose the "agriculture of the poor" typified by artisanal fishing in municipal waters, upland and rainfed rice farmers, irrigated rice farmers in communal or national systems with low operating efficiency, white corn producers, backyard hog and poultry raisers, and small root crop producers. They also include farmers of minor tropical fruits (jackfruit, avocado, guava, etc.), the tenanted coconut farms and some sugar estates and farms. Yields are extremely

1 The Forum was sponsored by Undersecretary of Agriculture Fred Serrano, and chaired by Assistant Secretary Romeo Recide. Participants represented a range of national and international research entities active in agricultural research in the Philippines

low by international standards, and in some cases appear even to be stagnating.

Participants discussed an agriculture sector and Philippine society in 2040 that are shaped by the mega forces of population growth, climate change, technology and globalization. Filipinos will become richer, extreme poverty will disappear, and food consumption patterns will change as a result both of rising incomes and new kinds of foods that will become available (e.g. new algae-based products). The pace of change in agriculture sector growth, employment and trade will be driven by the pace of productivity and technological change across the two 'faces' of agriculture described above. The quality, sophistication and volumeof agricultural research, technology generation and dissemination will have a decisive impact on the overall level of Total Factor Productivity (TFP), and therefore on the ability to raise rural incomes and improve long-term food security in the Philippines.

The vision that emerges for agricultural research in 2040 is based on a vibrant public-private partnership, with public sector research being mainly of a basic or upstream nature, intended to advance the state of knowledge, with the outcomes being public goods in character and non-excludable (e.g., research on plant nutrition, physiology, and insect anatomy), serving as a foundation for robust technology development that would be carried out largely by the private sector as part of normal business activity. Where market failures exist, public sector technology generation and dissemination would also be important, especially to focus on the needs of the poor. Some essential research and technology generation and dissemination should also be directed towards support of public and private sector responsibilities for food safety, risk assessment, and related safeguards.

Organization of Agricultural Research in the Philippines

Agriculture research in the Philippines has a long history, dating to 1901 when the Bureau of Agriculture was created under the Department of Interior. Bureaus of Plant Industry and Animal Industry were soon established as well, and for the first half of the 20th century, agriculture research was essentially carried by these Bureaus and the University of the Philippines' College of Agriculture. Subsequent organizational changes in the second half of the century can be roughly divided into two periods: Green Revolution (1966-1981) and Post-Green Revolution (1982-present). During these years, three AR&D systems have evolved, which in many ways overlap and complicate the country's agriculture research services and, therefore, their over-all efficiency and effectiveness.

- The Department of Science & Technology (DOST) system through the Philippine Council for Agriculture, Aquatic, & Resources Research & Development (PCAARRD) (Figure A7.1), was established in 1972, early in the Green Revolution period. PCAARRD has since undergone six reorganizations, the latest in 2011. It was initially the Philippine Council for Agriculture Research (PCAR), and was mandated to provide better coordination in planning and implementing agriculture research of the country (David et. al., 1999). PCAR was attached to the Department of Agriculture Natural Resources (DANR) but when the latter was divided into the Ministry of Agriculture and Food (MAF) and the Ministry of Natural Resources (MNR), PCAR was renamed the Philippine Council for Agriculture and Resources Research and Development (PCARRD) and attached to the National Science and Development Board (NSDB), which subsequently became DOST. Later, the Philippine Council for Agricultural and Marine Resources Research and Development (PCAMRD) was established to provide greater importance to fisheries research, and PCARRD's responsibility was confined to agriculture and forestry. In 2011, responsibility for agriculture, forestry and fisheries were again merged into PCAARRD (re-named to include 'Aquatic'), as a result of the rationalization program under the Arroyo administration.

- The state colleges and universities of agriculture (SCUAs) are the backbone of the DOST-PCAARRD system (Table A7.1). At the top is the national

Table A7.1: DOST-PCAARRD Agricultural R&D System

Region	Name of consortium	Base location
	National University	University of the Philippines, Los Baños (UP Los Banos)
	Zonal Universities	• Central Luzon State Univ. • Visayas State Univ. • Univ. of Southern Mindanao
Region I: Ilocos	Ilocos Agriculture and Resources R&D Consortium (ILARRDEC)	Mariano Marcos State University (MMSU)
Region II: Cagayan Valley	Cagayan Valley Agriculture and Resources R&D (CVARRD)	Isabela State University (ISU)
Region III: Central Luzon	Central Luzon Agriculture and Resources R&D Consortium (CLARRDEC)	Central Luzon State University (CLSU)
Region IV: Southern Tagalog	Southern Tagalog Agriculture and Resources R&D Consortium (STARRDEC)	University of the Philippines Los Baños (UPLB)
Region V: Bicol	Bicol Consortium for Agriculture and Resources R&D (BCARRD)	Bicol University (BU)
Region VI: Western Visayas	W.Visayas Agriculture and Resources R&D Consortium (WESVARRDEC)	U. Philippines in the Visayas (UPV)
Region VII: Central Visayas	Central Visayas Consortium for Integrated Regional R&D (CVCIRRD)	Central Visayas Polytechnic College (CVPC)
Region VIII: Eastern Visayas	Visayas Consortium for Agriculture and Resources Program (VICARP)	Leyte State University (LSU)
Region IX: Western Mindanao	W. Mindanao Agriculture and Resources R&D Consortium (WESMARRDEC)	Western Mindanao State University (WMSU)
Region X: Northern Mindanao	N. Mindanao Consortium for Agriculture and Resources R&D (NOMCARRD)	Central Mindanao University (CMU)
Region XI: Southern Mindanao	S. Mindanao Agriculture and Resources R&D Consortium (SMARRDEC)	University of the Southeastern Philippines (USEP)
Region XII: SOCCSKSARGEN	Cotabato Agriculture and Resources R&D Consortium (CARRDEC)	University of Southern Mindanao (USM)
Region XIII: Caraga	Caraga Consortium for Agriculture, Forestry, and Resources R&D (CCARRD)	N. Mindanao State Inst. of Science and Tech. (NORMSIST)
Cordillera Admin. Region (CAR)	Highland Agriculture and Resources R&D Consortium (HARRDEC)	Benguet State University (BSU)

Source: Agriculture Science and Technology Indicators (ASTI)

university of agriculture, the University of the Philippines at Los Baños, and the three zonal universities of agriculture, one each in Luzon, Visayas, and Mindanao. These universities with their specialized research institutes, well trained staff, and research facilities constitute the centres of excellence tasked to undertake upstream and multi-commodity research. At the regional level are the regional consortia that have been organized by PCAARRD to implement a regional R&D agenda. Membership of the consortia includes the SCUAs, the DA Regional Field Units (RFUs), other DA regional agencies involved in R&D, the regional office of the National Economic Development Authority (NEDA), and, more recently, local government units (LGUs). Each consortium has a base agency, which often is the key regional SCUA. The base agency is the seat of the consortium secretariat.

PCAARRD is responsible for: "formulating policies, plans, programs, projects and strategies for Science and Technology development; programming and allocating funds; monitoring research and development projects; and generating

Table A7.2: Regional Integrated Agricultural Research Centers (RIARCs)

Region	Regional Agency
Region I	Ilocos Integrated Agricultural Research Center (ILIARC/DA-I)
Region II (Cagayan Valley)	Cagayan Valley Integrated Agricultural Research Center (CVIAR/DA-II)
Region III (Central Luzon)	C. Luzon Integrated Agricultural Research Center (STIARC/DA-IV)
Region IV (Southern Tagalog)	Southern Tagalog Integrated Research Center (STIAR/DA-IV)
Region V (Bicol)	Bicol Integrated Agricultural Research Center (BIARC/DA-V)
Region VI (Western Visayas)	W. Visayas Integrated Agricultural Research Center (WESIARC/DA-VI)
Region VII (Central Visayas)	C. Visayas Integrated Agricultural Research Center (CENVIARC/DA-VII)
Region VIII (Eastern Visayas)	Eastern Visayas Integrated Agricultural Research Center (EVIAR/DA-VIII)
Region IX (Western Mindanao)	W. Mindanao Integrated Agricultural Research Center (WESMIARC/DA-IX)
Region X (Northern Mindanao)	N. Mindanao Integrated Agricultural Research Center (NOMIARC/DA-X)
Region XI (Southern Mindanao)	S. Mindanao Integrated Agricultural Research Center (SMIARC/DA-XI)
Region XIII (Caraga)	Caraga Integrated Agricultural Research Center (CARIARC/DA-XIII)
Cordillera Admin. Region (CAR)	Highland Integrated Agricultural Research Center (HIARC/DA-CAR)

Source: Agriculture and Science Technology Indicators (ASTI)

external funds " (www.dost.com.ph). The Council structure provides transparency and stakeholder participation, and its primary role is to provide important advisory services by reviewing and recommending program priorities, funding, and key appointments. However, the Council does not itself have real authority and accountability. PCAARRD, like the Bureau of Agricultural Research (BAR, see below) and other government non-corporation agencies, does not enjoy administrative and financial autonomy; therefore, it has limited administrative flexibility to meet changes in corporate environment in the pursuit of its mission and vision. It does not have power to create positions, set competitive salary scales, and create income generating projects, for example, without obtaining DBM approval. Its Executive Directors is ultimately responsible to the Secretary of the DOST, not to the Council.

- The birth of the Department of Agriculture Research or BAR (Figure A7.2), took place in 1986, early in the Cory Aquino administration. At the time, there was criticism that PCARRD was not fully responding to the priorities and needs of the DA, and since it resisted being brought back to the newly reorganized DA, the decision was made to establish BAR (David et al, 1999). The backbone of the system are four bureaus directly under the Office of the Secretary (OSEC), ten attached agencies and corporations with R&D functions (e.g., Philippine Carabao Center/PCC, the Philippine Rice Research Institute/PhilRice), and 14 Regional Integrated Agriculture Research Centers or RIARCs (Table A7.2). The RIARCs are tasked to undertake mid- and downstream research (except for fisheries, see below) and to interface with provincial and local governments(LGUs) in the transfer of research knowledge from the national research centres to farmers' fields, through a system of on-farm research and demonstration farms. The RIARCs are administered by the DA Regional Field Units (RFUs), with BAR providing technical supervision and funding support. For fisheries, regional research is undertaken by state universities, the National Fisheries Research Development Institute (NFRDI), and the Regional Integrated Fisheries Research Centres (RIFCs) that are under the Regional Office of the Bureau of Aquatic and Fisheries Resources (BFAR). NFRDI provides technical supervision and financial support.

BAR, through the RIARCs, has organized in every region a Regional Research, Development, and Extension Network (RDEN) with the aim of achieving efficiency in the development and implementation of the DA regional R&D agenda and to strengthen research-extension linkages. The RRDEN essentially includes the same members as the PCAARRD's R&D Regional Consortia: SCUs, the national agencies in the region engaged in agriculture research and development, and the local government units (LGUs) specially the provincial LGUs. The DA's Regional Technical Director for R&D is the de facto RRDEN Chair, and the RIARCS provide the networks' offices. The RIFCs do not yet have corresponding regional networks for fisheries.

There are some similarities in the responsibilities of PCAARRD and BAR. Per EO 116 s. 1986, BAR is mandated to provide coordination and leadership of the whole country's agriculture and fisheries research activities to achieve system efficiency. It is also tasked to link all R&D providers such as the SCUAs and the private sector, and to connect them to other stakeholders by networking. This mandate was further affirmed by Republic Act 8435 (AFMA) in 1997; the law expanded and strengthened the mandate of BAR to provide leadership in the establishment and operation of the National Research and Development System in Agriculture and Fisheries (NaRDSAF) of the country. As note above, PCAARRD and BAR also both oversee regional R&D institutional structures with similar composition.

- The third system consists of the Department of the Environment and Natural Resources (DENR) through the Ecosystems' Research and Development Bureau (ERDB) (Figure A7.3), which was also created during the Cory Aquino administration as part of the newly formed DENR. The bureau provides technical supervision of the DENR research divisions in the regional offices. One key priority of the ERDB research is agro-forestry systems, which involves farmers and farming systems in the uplands, an area that is also covered by PCAARRD and BAR.

As a consequence of the passing of the Agriculture and Fisheries Modernization Act (AFMA) of 1997, attempts have been made to integrate the research agendas and priorities of the DOST-PCARRD, DA-BAR, and DENR-ERDB systems. Towards this end, BAR attempted to organize national and regional research networks across various areas in agriculture and fisheries to develop and implement a common research agenda among government institutions under the theme: "One System, One Program." But weaknesses in the over-all governance of the agriculture bureaucracy during the Arroyo administration prevented any meaningful reforms from taking roots. The DA itself has not completed its rationalization for the last eight years; the process was started in 2003, but there has been no approval of DA's proposal by the DBM as of July 2012. In the meantime, DBM has prevented DA from creating new positions and filling vacancies in existing positions deemed important to carry its mission and functions (Table A7.3). In effect, for nearly a decade, DA has had to discharge its functions with what has been left of its staff after retirements and transfers (although it has been able to hire short term consultants).

The Philippines and CGIAR/IARC linkage

The International Agriculture Research Centers (IARCs) under the Consultative Group in International Agriculture Research (CGIAR) have a heavy presence in the Philippines. This began with the International Rice Research Institute (IRRI) establishment in 1965 in Los Baños, Laguna. Since then, several other IARCS have established programs in the Philippines, in partnership with DA research agencies, state colleges and universities, and PCAARRD. The IARCs and their programs based in the Philippines have been the source of many international public goods in agriculture, fisheries and forestry, and their presence has contributed to strengthening the national system (Renkow, 2010).

Research Programs and Budget

The flow of funds from DBM to finance national agricultural R&D programs is shown in Figure A7.3. As the diagram indicates, a research agency can supplement its own allocation by tapping into the allocations of other government agencies (i.e., over and above its own appropriation from DBM).DBM proposes annual budget ceilings for all

Government departments and subsidies for all Government Controlled Corporations (GOCC) like PCA and PhilRice of the DA. Each department, in turn, provides budget ceilings for the agencies and key programs under it. Each agency justifies its programs and budget through its annual work and financial plan according to procedures set by DBM. Any request to go above the DBM-proposed budget ceiling is negotiated by the Office of the Secretary with the President, through DBM. During the Arroyo administration, the banner programs (Table A7.4) were generally treated as Centralized Funds (CF), which were under the direct control of the Secretary. Therefore, once budgets were approved, the Secretary had full discretion to make changes. Sub-allotment to different agencies under the DA is made after budget approval and is considered to have been a source of inefficiency and governance issues (e.g. the fertilizer scandal). Under the current administration, sub-allotments to different agencies are already indicated in the National Expenditure Program (NEP), which means that the budget is directly released by DBM to the agencies concerned once it has been approved by the President and Congress (although as of 2012, the Secretary of DA still controls a large CF).

PCAARRD collaborates with the National Academy of Science and Technology (NAST), a body attached to the DOST, and other stakeholders in the development of its 10 Industry Strategic Plans (ISPs). The research agenda are derived from the ISP, and the final integrated R&D agenda includes 31 specific commodities under the 10 industry clusters across 14 geographical regions (www.pcaarrd.dost.gov.ph). From 2008 to 2012, DBM allocated to PCAARRD and PCMARD (while it existed) a total of about P1.4 billion. The 2012 budget is only about 14% above that of 2008, in current terms (i.e., has not kept pace with annual inflation), but is expected to increase substantially in 2013 (from P388 million to P840 million, a 216% increase). Also, the PCAARRD budget in the NEP represents only a portion of total resources for the year. Like the SCUAs and DA research agencies, PCAARRD can, and does, also source funds from various government and private agencies, both local and foreign. By way of illustration, the budget for key SCUs involved in the DOST-PCAARRD system is shown in section 7.

For its part, BAR has listed 13 priority programs covering areas ranging from organic agriculture, to climate change, and eight Research and Development, Extension Agenda and Programs (RDEAPs) for 2010–2016 for grains, vegetable and root crops, fruits, livestock and poultry, fisheries, climate change, indigenous plants and biofuels (www.bar.da.gov.ph). Essentially, RDEAPs are matrices of generic problems, researchable areas, expected outputs in broad, generally non-quantified terms, possible implementation agencies, and thematic areas. The RDEAPs do not specify annual budgets, but funding in 2012 of P1.02 billion is 315% higher than in 2008, in current terms. This is the equivalent of 2.1% of the overall DA budget and represents a substantial increase by DA for research and extension. The RDEAP allocation for 2013 will not be known until after Congressional budget hearings, but DA management has indicated its general commitment to continue to strengthen the budgets for research and extension. The bulk of the government annual budgetary appropriations for agricultural R&D lies with the DA system, as part of its regular budget (Table 3.2–6). In addition, DA agencies can source R&D funds from banner programs, which have a total appropriation of PhP 50 billion for the same period.

The DENR-ERBD research program is set with in the context of the DENR RDE Framework 2011-2016, which covers nine priority areas shown in Table 3.2-8 (http://erdb.denr.gov.ph). The National Expenditure Program shows that the budget for the ERDB from 2009-2012 amounts to almost PhP 500 million, and that there has been a significant increase in the last two years under the current government. The regional offices received a more modest increase. The DENR-ERDB budget increased from P344 million in 2011 to P789 in 2012 (229% increase) and is planned to increase further to P1.17 billion in 2013 (further 148% increase).

It appears that very significant improvements in budget allocations for agriculture research and technology development are already underway in 2012 and/or planned for 2013, which increases the importance of having a coherent strategic approach, good coordination across, and active public-private stakeholder participation within the three R&D systems, to maximize the impact on this increase in budget

resources. Unfortunately, the systems lack a common vision, priorities, and programs.

The DOST-PCAARRD system has an institutionalized participatory and transparent process of priority setting and program approval through its Council. The DA-BAR and DENR-ERDB systems do not exhibit these properties. On the part of the DA-BAR, the Council for Agriculture and Fisheries Research and Development (CERDAF), the equivalent to the PCAARRD Governing Council, has not been called to participate in any R&D priority setting and program funding during the last nine years; the Council has in fact stayed dormant since 2003. Therefore, approval mainly rests with the Director of BAR and superiors. The same situation appears to govern the DENR-ERDB system.

The budget structures of the three systems also do not follow any common formula Table A7.3), for example with respect to the relationship between volume of research grants managed by the entity and personnel services allocated for this purpose. In the case of BAR, its budget for personnel services is equivalent to only 2% of the volume of funds it is managing. Also, while funds passed by BAR to the entity conducting research can be used for capital outlays, BAR itself cannot do so and therefore its ability to improve facilities or purchase essential equipment is limited. PCAARRD spends 35% of the budget it administers on personnel services; DENR-ERDB spends 22%.

Examples of Impact of Public Agricultural R&D and Technology Dissemination in the Philippines

Selected impacts of R&D in the Philippines can be seen both on the country's competitive export crops and major commodities central to the diet of the Filipinos. The development of new technologies from the private sector have been responsible for the growth of important export crops (pineapple, asparagus, bananas), as well as cut-flowers, salad vegetables, yellow corn, broiler, and the hog industry. On the other hand, advances in technologies developed by the public sector have been responsible for the development of modern, high yielding varieties of rice that allowed the country to raise yields and improve self-sufficiency (Box 1), and the development of Genetically Improved Farmed Tilapia (GIFT) that triggered the phenomenal growth of the tilapia industry in the Philippines, with production tripling during the last ten years, 2001 to 2011 (Box 2). Rice and tilapia illustrate the impact that public research in agriculture has had in the Philippines. The two cases demonstrate the impacts on productivity and output that can occur when adequate funding is available for agricultural R&D and when attention is paid to dissemination of results. The two cases also involved strong partnership between the international research centers of the CGIAR and national research agencies of the Philippines, including both the Department of Agriculture and the State Universities of Agriculture.

Investment Levels in R&D

The Philippines Agricultural and Fisheries Modernization Act (AFMA) of 1997 mandated that the Government should invest at least 1% of agricultural GVA in research and development of the sector. Nothwithstanding the kinds of impacts mentioned above, however, data shows that actual expenditures have been well below that amount through much of the last decade: even when budget allocations increased substantially in 2009, the result was still only about 0.53% of GVA. When private sector investments are included, total R&D investment reached only about 0.61% of GVA in the year (2009) of the highest allocations. Within the public sector, since 2007 roles of higher education and public agencies have reversed earlier patterns, with universities and colleges accounting for about two-thirds of R&D, and government agencies the balance.

However, the budgetary situation now appears to be changing, for the better. The budgets of all three research systems have been increased substantially in 2012 and/or will be in 2013.

The Challenge of Biotechnology

Advances in genetic engineering, genomics, and molecular biology have made it possible to develop new crop varieties that pack more nutrients, protect themselves from pests, fix nitrogen, and adapt to both biotec and abiotec stresses. At the same time, advances in biotechnology have led to the development of biofertilizers and biopesticides to reduce

applications of inorganic counterparts. Herein lies the challenge for Philippine agriculture research and extension, both public and private.

Table A7.3: R&D Investment in Agriculture and Fisheries as % GVA, 2002–09

Source/Year	2002	2003	2005	2007	2009
Public Sector	0.35	0.31	0.32	0.36	0.53
Government Agencies	0.22	0.22	0.22	0.13	0.18
Public Higher Education	0.13	0.09	0.10	0.23	0.35
Private Sector	0.03	0.03	0.03	0.02	0.08
Private Non-Profit	0.02	0.01	0.02	0.02	0.06
Private Higher Education	0.00	0.02	0.01	0.00	0.02
Total	0.38	0.34	0.35	0.38	0.61

Source: World Development Indicators

The Philippines was the first country in the ASEAN region to implement a regulatory system for transgenic crops, which started in 1990. The area planted to biotech maize increased to 600,000 hectares in 2011, accounting for 48% of the total area for yellow corn. Reports show that small resource-poor farmers, growing on average 2 hectares, account for about 40% of total users.[2] Despite the success in the introduction of transgenic yellow corn, however, public perceptions of transgenic food have been largely negative, making public research quite challenging. Research by the UPLB on Bt eggplant to control fruit borer, delayed ripening of papayas, and papaya ring-spot virus have has met with some opposition, though such technologies would potentially be quite important for small farmers, if they reach commercialization stage.

Public Research and the Poor

Private sector research has propelled the banana and pineapple industries into a leading export role for the Philippines. But private research invariably focuses on commercial crops such as transgenic yellow corn for feeds and hybrid rice. Public research has played an important role in areas central to the livelihood of the poor (e.g., rice, tilapia), although efforts in other areas (e.g. sweet potato, white corn, and tropical fruits for the domestic market) have lagged behind. There is also an increasing demand for new products based on traditional crops, e.g., coconut water and tropical fruits such as avocado and papaya for neutraceuticals, but growth in these areas has been hobbled by low productivity and product quality. Public research investment in coconut and non-traditional crops with high export potential, also central to the livelihoods of the poor, has been low and erratic.

The Need for a Common Strategic R&D Vision

The lack of a national strategic direction cutting across all three main research systems (DOST, DA and DENR), fragmented planning and implementation, and low public investment in research over the past decade have certainly contributed to lagging productivity levels in various subsectors. Recent significant increases in the 2011 and 2012 research budgets of the three research systems both BAR and PCAARRD are likely to yield less than optimal results unless efficiency and governance issues are effectively addressed. In addition, new knowledge and technologies generated from research are not immediately made available to the farmers and other agricultural producers due to weak research-extension linkages that are currently more ad hoc than institutional in character.

The key strategic requirements to strengthen the Philippines' agriculture research systems that should underlie a "Straight Path Strategy", following President Aquino's call for a more efficient government, should include:

1. a higher level of systems integration with clearly defined accountability for outcomes;

2 There has also been some increase in the use of hybrid rice on well-irrigated farms.

2. a significant increase in public funding (building on and sustaining those in progress since 2011) combined with a more predictable, participatory and transparent system of research prioritization;

3. substantial upgrading of the physical and human infrastructure for agricultural and fisheries R&D research;

4. development of more dynamic public-private partnerships in agriculture research; and

5. institutional research-extension linkages.

BIBLIOGRAPHY

Agrifood Consulting International, Inc. 2010. Enhancing Food Security in ASEAN: Policy Reforms Private Investment in Food Supply Chains and Cross-Border Trade Facilitation. Report for Supply Chain Organization and Infrastructure study of he World Bank, February 2010.

Aguilar, Filomeno V. Jr. 2008. 'Rice in the Filipino Diet and Culture'. Research Paper Series No. 2008-03, PIDS, Makati.

Alavi, Hamid R. et al. 2012. Trusting Trade and the Private Sector for Food Security in Southeast Asia. World Bank, Washington D.C.

Aoyama, T. 1973. The South China Sea Fisheries Demersal Resources. FAO/UNDP South China Sea Fisheries Development Programme. SES/DEV/73/3.

ASEAN. 2012. ASEAN Annual Report 2011-2012: Evolving Towards ASEAN 2015.

Asia Pacific Policy Center, 2010. 'Outlook for Philippine Agriculture: Scenarios and Options for Productivity Growth: Consumer Core'. Reported submitted to the Philippine Institute for Development Studies under the Productivity Growth in Philippine Agriculture Project. PIDS, Makati City

Asian Development Bank. 2012a. Asian Development Outlook 2012: Confronting Rising Inequality in Asia. ADB, Manila. Also: Asian Development Outlook 2012 Supplement: Sluggish Global Economy Weights on Asia's Growth (July 2012). ADB, Manila.

_____. 2012b. Food Security and Poverty in Asia and the Pacific: Key Challenges and Policy Issues. ADB, Manila.

_____. 2009. Building Climate Resilience in the Agriculture Sector in Asia and the Pacific. ADB and IFPRI, Manila.

_____. 2005. An Impact Evaluation of the Development of Genetically Improved Farmed Tilapia and Their Dissemination in Selected Countries.

Balisacan, A.M. et al. 2010. 'Rice Crisis in the Philippines: Why Did it Occur and What are its Policy Implication'. Ch. 7 in The Rice Crisis, D. Dawe (ed). Earthscan, Washington, D.C. (See pp. 127-128).

Ballesteros, Marife M. 2010. 'The Cost of Redistributive Land Reform in the Philippines: Assessment of PD27 and RA6657 (CARL)". Discussion Paper Series No. 2010-09. PIDS, Manila.

Barut, Noel C. et al. 1997. 'Philippine Coastal Fisheries Situation' in Assessment, Management and Future Directions for Coastal Fisheries in Asian Countries, G. Silvesre et al. (eds). WorldFish Center Conference Proceedings 67, 1.

Binswanger-Mkhize, H. et al. 2009. Agricultural Land Redistribution: Toward Greater Consensus. World Bank, Washington D.C.

Borras, Saturnino. 2007. Pro-Poor Land Reform: A Critique. University of Ottawa Press.

Briones, R. and Galang, I., 2012. 'Assessment of Prospective Impact of Fruits and Vegetables Research at the Industry Level in the Philippines: The Case of the ACIAR-PCAARRD Horticulture Project'. A paper presented at the ACIAR-PCAARRD End-of-Program Conference July 3, 2012, Cebu City

Briones, R. 2011. 'Multimarket Modeling of Agricultural Supply when Crop Land Is a Quasi-fixed Input: A Note'. Discussion Paper No. 2011-29. PIDS, Makati.

Briones, R., 2010. 'Scenarios and Options for Productivity Growth in Philippine Agriculture: An Application of the Agricultural Multimarket Model for Policy Evaluation (AMPLE)'. Discussion Paper No. 2010-05. PIDS, Makati.

Castillo, G.T. et al. 'Philippine Rice Production, Productivity, Population, Per Capita Rice Availability and Poverty Incidence: A Provincial-Level Analysis (2000-2009)'.

Center for Research on the Epidemiology of Disasters. Database EM-DAT (www.embat.be-Universite Catholique Louvain – Brussels – Belgium) last accessed September 7, 2012.

Clarete, Ramon. 2010. 'ASEAN-China Free Trade Area Agreement: The First Ten Years". Commissioned by the Asian Development Bank for ASEAN Secretariat.

_____, 2008. 'Options for National Food Authority Reforms in the Philippines'. In From Parastatals to Private Trade: Lessons from Asian Agriculture. Gulati, R.S. and Cummings Jr., R. (eds). Baltimore: The Johns Hopkins University Press.

_____. 2006. 'Ex-post Effects of Trade Liberalization in the Philippines'. In Coping with trade Reforms: A Developing Country Perspective on the WTO Industrial Tariff Negotiations. Laird, S. and de Cordaba, D. (eds.). New York: Palgrave Macmillan.

Cororaton, C. et al. 2009. 'Agricultural Price Distortions, Poverty and Inequality in the Philippines' in Agricultural Distortions, Poverty and Inequality. Anderson, K. et al (eds). World Bank: 247-282.

_____, 2000. The Philippine Computable General Equilibrium Model. Discussion Paper No. 2000-33. PIDS, Makati.

David, Cristina C. 2003. 'Agriculture Part III The Sectors' in Philippine Economy: Development Policies and Challenges. Balisacan, A. and Hill, H. (eds.) Ateneo de Manila, University Press, Manila.

David, I. P. et al. 2006. 'Food Poverty Estimation and Monitoring Surveys: Analyses and Suggestions for Improvement.' Presented at the Philippine Economic Society 44th Annual Meeting, November 21, 2006.

Delgado, C. et al. 2003. Outlook for Fish to 2020, Meeting Global Demand; International Food Policy Research Institute, Washington DC and World Fish Center, Penang; October 2003.

Dey, M. M. et al. 2005.' Fish Consumption and Food Security: a Disaggregated Analysis by Types of Fish and Classes of Consumers in Selected Asian Countries.' Aquaculture Economics and Management, 9:89-111.

Dy, R. et al. 2011. The Business of Agribusiness: From the Roots to the Fruits. University of Asia and the Pacific. Pasig City.

_____. 2009. Food for Thought: How Agribusiness is Feeding the World. University of Asia and the Pacific. Pasig City.

_____ (ed). 1998. Food and Agriculture Centennial Book. University of Asia and the Pacific. Pasig City.

Ericta, C. and E. Fabian. 2009. A Documentation of the Philippine's Family and Expenditure Survey. Discussion Paper No. 2009-18, PIDS, Makati.

Escano and Buendia. 1994. 'Climate Impact Assessment for Agriculture in The Philippines: Simulation of Rice Yields under Climate Change Scenario' in Implications of Climate Change for International Agriculture: Crop Modeling Study. C. Rosenzweig and A. Iglesias (eds), U.S.E.P.A. Washington D.C.

Food and Agriculture Organization. 2012. The State of Food Insecurity in the World 2012: Food Security Indicators. FAO, Rome.

_____ and World Bank. 2010. Quantitative Assessment for Comparative Advantage of Major Crops in the Philippines.

FNRI. Seventh National Nutrition Survey, 2008. FNRI/DOST.

Garcia et al 2012. 'Reconsidering the Consequences of Selective Fisheries' in Nature, PolicyForum; www.sciencemag.org; March 2, 2012.

Gergeley, N. 2010. 'Quantitative Assessment of Comparative Advantage for Major Agricultural Crops in the Philippines'. Unpublished report prepared for FAO and the World Bank.

Goldman Sachs. 2007. The N-11: More than an Acronym. Global Economics Paper No. 153, March 28, 2007.

Guiang, M.S. and Castillo, G. 2005. Trends in Forest Ownership, Forest Resources Tenure and Institutional Arrangements in the Philippines: Are They Contributing to Better Forest Management and Poverty Reduction?

Habito, C.F. and Briones, R.M. 2005. 'Philippine Agriculture over the Years: Performance, Policies and Pitfalls' presented to Conference on Policies to Strengthen Productivity in the Philippines, sponsored by Asia-Europe Meeting (ASEM) Trust Fund, Asian Institute of Management Policy Center, Foreign Investment Advisory Service, PIDS and the World Bank. Makati, June 27, 2005.

Habito, C.F. et al. 2010. 'Fostering Our Farms, Fisheries and Food: Technical Assistance for the Formulation of the Successor Agriculture and Fisheries Modernization Plan (AFMA) of the Department of Agriculture (DA). Unpublished report prepared for the World Bank.

HSBC. 2011. The World in 2050, report by Karen Ward, January 4, 2011.

Inter-Governmental Panel on Climate Change. 2007. Fourth Assessment Report (AR4). IPCC.

International Food Policy Research Institute. 2009. Climate Change: Impact on Agriculture and Costs of Adaptation. IFPRI, Washington D.C.

_____. 2010. Food Security, Farming and Climate Change to 2050, Scenarios, Results ad Policy Options. IFPRI, Washington D.C.

International Fund for Agricultural Development. 2012. 'Convergence on Value Chains for Rural Growth and Empowerment (Project Converge)". Working Paper 4: Institutional Aspects and Implementation arrangements (Draft). IFAD, Rome.

International Monetary Fund. 2012. The Philippines 2011 Article IV Consultation. IMF Country Report No. 12/49.

Ito, S. et al. 1989. "Rice in Asia: Is it becoming an inferior good?" American Journal of Agricultural Economics 71(1): 32-42.

Joint Foreign Chambers. 2010. Arangkada Philippines. Retrieved from www.investphilippines.info.

_____. 2012. Arangkada Philippines: Moving Twice as Fast.

Kholi, Harinder S., Ashok Sharma and Anil Sood. 2011. Asia 2050: Realizing the Asian Century. Sage Publications, Los Angeles, London, New Delhi, Singapore and Washington, D.C.

Kotaro, K. and Xie, M. 2008. 'Sustainable System of Irrigated Agriculture (SSIA): An Application of System of Rice Intensification (SRI) in the Philippines – How Does it Improve Productivity?'. Paper prepared for World Bank Institute training program module on developing on-farm water management.

Kvaran, E.R. 1971. Marine Fisheries Potential in the Philippines and Southeast Asia. Fish. Newsletter (July-Dec): 8-17.

LLanto, Giblerto and Jocelyn Badiola. 2010. "Innovations in Financing Food Security." Discussion Paper Series No. 2010-14. PIDS, Manila.

Martin, N.J., and J.M. Alston, 1994. A dual approach to evaluating research benefits in the presence of trade distortions. American Journal of American Journal of Agricultural Economics 76(1) (February): 26-35.

McKinsey Global Institute. 2011. Meeting the World's Energy, Materials, Food and Water Needs.

Menasveta, D. et al. 1973. Pelagic Fishery Resources of the South China Sea and Prospects for their Development. FAO/ UNDP, Rome, Series SCS/DEV/73/6.

Mindanao Development Authority. 2011. Mindanao 2020 Peace and Development Framework Plan: 2011-2030. Executive Summary.

Moya, P. et al. 2010. 'Closing the yield gap in Philippine rice production: A long term analysis of high and low yielding irrigated farms.' Paper presented in the International Rice Congress, November 8-12, 2010, Hanoi.

Norconsult, A.S. 1975. Philippine Fish Marketing and Distribution Study.

Nozawa, Katsumi. 2012. Banana Production and Cooperatives in the Philippines. Discussion Paper No. 2012-07. University of the Philippines School of Economics, Quezon City.

Pandey, Shshil et al. 2010. "Strategic Research and Policy Issues for Food Security." International Rice Research Institute (IRRI), Manila.

Pedro, M.R.A. and Barba, C.V.C. 2006. 'Dietary changes and their health implications in the Philippines' in FAO, The Double Burden of Malnutrition: Case Studies from Six Countries. Food and Nutrition Paper 84: 205-258.

Philippines Climate Change Commission. 2011. National Climate Change Action Plan 2011-2028. CCC, Office of the President, Manila.

_____2010. National Framework Strategy on Climate Change 2010-2022. CCC, Office of the President, Manila.

Philippines National Disaster Coordinating Council. 2009. Strategic National Action Plan (SNAP) for Disaser Reduction 2009-2019. NDCC, Manila.

Philippines National Economic Development Authority. 2011. Philippines National Development Plan 2011-2-16. NEDA, Manila

Philippines National Irrigation Administration. 2011. Inventory of National Communal & Private Irrigation System Summary by Region as of December 31, 2010, dated December 7, 2011. NIA, Manila.

Philippines National Statistical Office: Technical Paper on the Major Revisions on the Philippine System of National Accounts: Implementation of the 2008 System of National Accounts (TP20120412-ESO-1), April 13, 2012. NSO, Manila.

Raitzeret, David. A. et al. 2010. Prioritizing the Agriculture Research Agenda for South-East Asia: Refocusing Investment to Benefit the Poor; Asia Pacific Association of Agricultural Research Institutions, Asian Development Bank, Global Forum for Agricultural Research; Global Conference on Agricultural Research for Development.

Recide. R. S., 2011. Philippine Food Security Cooperation, Paper presented at the 3rd Roundtable meeting of ASEAN+3 food security cooperation strategy, Nanning, Guangxi, 9-10 November, 2011.

Regmi, Anita et al. 2001. "Cross-Country Analysis of Food Consumption Patterns" in Changing Structure of Global Food Consumption and Trade. USDA WRS-01-1. Washington, D.C.

Reyes, Celia et al. 2009. "Policy Options for Rice and Corn Farmers in the Face of Seasonal Variability". Discussion Paper Series No. 2009-11. PIDS, Manila.

Romo, Glory Dee et al. 2009. 'The transformation of food retail in the Philippines'. Asian Journal of Agriculture and Development Vol. 6, no 2: 51-84.

Rushford, Greg. 2012. "Asia's Next Tiger" in Foreign Policy, June 17, 2012: www.foreignpolicy.com/articles/2012/05/19/asias_next_tiger

Smith, Ian et al. 1980. Philippine Municipal Fisheries, ICLARM, Manila.

Tayamen, M.M. 2002. Nationwide Dissemination of GET EXCEL Tilapia in the Philippines. Munoz, Nueva Ecija. NFFTC, DA-BFAR.

Teruel, R.G. and Dumagan, J.C. 2011. 'Measuring and Explaining Total Factor Productivity (TFP) Growth and Patterns in Philippine Agriculture: A Regional Panel Data Framework'. Paper presented to 7th Asian Society of Agricultural Economists (ASAE) International Conference, Hanoi, October 13-15, 2011. SEARCA.

Timmer, C.P. 2012. 'Food Security and Political Instability in East and Southeast Asia'.

_____. 2012. 'The Dynamics of Food Security in Asia: Structural Transformation and the Changing Role of Rice". Paper presented at a Workshop on Broad-based Strategies for Food Security and the Changing World Food Markets organized by IFAD and the Philippines Department of Agriculture, Quezon City, March 14, 2012.

_____ et al. 2010. "Long-run Dynamics of Rice Consumption: 1960-2010." Ch. 1.6 in Rice in the Global Economy: Strategic Research and Policy Issues for Food Security, S. Pandey et al. (eds). IRRI.

_____. 2010. "The Changing Role of Rice in Asia's Food Security". Sustainable Development Working Paper Series No. 15. ADB, Manila.

Tiongco, Marites andKris Francisco. 2011. "Philippines: Food Security versus Agricultural Exports?" Discussion Paper Series No. 2011-35. PIDS, Manila.

Tolo, W.B.J. 2011. The Determinants of Economic Growth in the Philippines: A New Look. IMF Working Paper 11/288.

United Nations Economic and Social Commission for Asia and the Pacific. 2011. "Facilitating Agricultural Trade in Asia and the Pacific." Studies in Trade and Investment No. 74. United Nations.

United Nations Industrial Development Organization. 2010. Meeting Standards – Winning Markets. Trade Standards Compliance Report 2010. UNIDO, Vienna.

United States Agency for International Development. 1977. The Philippines: Fishery Sector Study. USAID

_____ and DA-BFAR. 2010. Completion Report for the Fisheries Improved for Sustainable Harvest (FISH) Project. Manila.

World Bank. 1999. Tree Crops for Rural Development, Report No. 19281. World Bank, Washington, D.C.

_____. 2005. Natural Disaster Risk Management in the Philippines: Enhancing Poverty Alleviation through Disaster Risk Reduction. Report No. 33822. World Bank, Washington, D.C.

_____. 2007. Changing the Face of the Waters: The Promise and Challenge of Sustainable Aquaculture. World Bank, Washington, D.C.

_____. 2007. World Development Report 2008: Agriculture for Development. World Bank, Washington, D.C.

_____ and United Nations. 2010. Natural Hazards, UnNatural Disasters: The Economics of Effective Protection. World Bank, Washington, D.C.

_____. 2011a. Implementation Completion Report on the Philippines Diversified Farm Income and Market Development Project. Washington, D.C.

_____. 2010b. Philippines: Agribusiness, Infrastructure and Logistics for Growth in Mindanao (Draft). World Bank, Washington, D.C.

_____. 2011c. Philippines Discussion Notes: Challenges and Options for 2010 and Beyond (DN 1 – Economic Growth; DN2 – Poverty; DN4 – Public Spending; DN6 – Competitiveness; DN10 – Agribusiness; DN18 – Disaster Risk Management; DN19 – Climate Change; DN20 – Environment; DN2 - Decentralization). World Bank, Washington, D.C.

_____. 2011d. Philippines Public Expenditure Review: Strengthening Public Finance for More Inclusive Growth. World Bank, Washington D.C.

_____. 2011e. Philippines: Robust Growth Stubborn Poverty. World Bank, Manila.

_____. 2011f. Philippines: Sustaining Growth in Uncertain Times. World Bank, Manila.

_____. 2012. Philippines: Investing in Inclusive Growth and Global Uncertainty. World Bank, Manila.

_____ and IMF. 2012. Global Monitoring Report 2012: Food Prices, Nutrition and the Millennium Development Goals.

World Trade Organization. Country Profiles. Various countries and years.

Yambao, A.C. et al. 2001. The Coastal Environment Profile of Negros Oriental, Coastal Resources Management Project. Manila.

Yutuc, S. and Trono, GC. 1977. A review of Philippine fishery resources and their productivity. Final Report. Population, resources, environment and the Philippine future, Vol II-3b. Development Academy of the Philippines.

In addition, the webpages of numerous Philippine government agencies were consulted for data and reports, including in particular those of the Departments of Agriculture (including the Bureau of Agricultural Statistics/BAS and other related agencies), Agrarian Reform, Budget Management, Environment and Natural Resources, Finance, Science and Technology; and the Central Bank (BSP),National Economic Development Authority and National Statistical Office.

The team also accessed the webpages of various international entities for data and research findings, including those of ASEAN and related bodies, Asian Development Bank, Consultative Group for International Agriculture Research and related bodies, Food and Agriculture Organization, International Finance Corporation, International Food Policy Research Institute, International Fund for Agricultural Development, International Monetary Fund, International Rice Research Institute, Organization of Economic Cooperation and Development, United Nations Children's Fund, United National Development Program, United Nations Industrial Development Organization, United Nations Population Division, World Bank, World Food Program, World Health Organization, and the World Trade Organization.

Finally, the team accessed the webpages of various bilateral agencies for data, reports and research, in particular those of the Governments of Japan, Australia, New Zealand, and the United States.