



**USAID**  
FROM THE AMERICAN PEOPLE

**LEO**  
Leveraging Economic  
Opportunities

# An Analysis of Three Commodity Value Chains in Cambodia

## Rice, Horticulture, and Aquaculture

### **MARCH 2015**

This presentation was produced for review by the United States Agency for International Development (USAID). It was prepared by Olaf Kula and Cheryl Turner of ACDI/VOCA and Sanphirom Sar of DAC with funding from USAID/E3's Leveraging Economic Opportunities (LEO) project. The authors' views expressed in this presentation do not necessarily reflect the views of USAID or the United States Government.

# Table of Contents

Executive Summary.....	Page 4
Acknowledgements.....	Page 7
Conclusions: Findings.....	Page 8
Study Objectives.....	Page 13
<b>Introduction.....</b>	<b>Page 14</b>
<b>1. Political Economy and the Business-Enabling Environment.....</b>	<b>Page 16</b>
1.1 Global and Regional Trade Policies .....	Page 17
1.2 National and Commodity-Specific Policy and Enabling Environment.....	Page 18
1.3 Land Rights.....	Page 21
1.4 Labor Markets.....	Page 23
1.5 Trade Corridors .....	Page 24
1.6 Gender and Food Security .....	Page 25
<b>Value Chain Analysis: Rice, Horticulture, and Aquaculture.....</b>	<b>Page 27</b>
2. Rice .....	Page 28
3. Horticulture .....	Page 44
4. Aquaculture.....	Page 60
5. Cross-Cutting Services.....	Page 73
<b>Interviews conducted .....</b>	<b>Page 83</b>
<b>Lists of Tables and Figures.....</b>	<b>Page 87</b>
<b>Bibliography.....</b>	<b>Page 89</b>

# List of Abbreviations

ADB	Asian Development Bank	KHR	Cambodian Riel
ASEAN	Association of Southeast Asian Nations	LDC	Less Developed Countries
CADF	Cambodia Agribusiness Development Facility	LEO	Leveraging Economic Opportunities
CARDI	Cambodian Agricultural Research and Development Institute	LICADHO	Cambodian League for the Promotion and Defense of Human Rights
CCHR	Cambodian Center for Human Rights	LSO	Landing Site Operator
CDC	Council for the Development of Cambodia	MAFF	Ministry of Agriculture, Forestry and Fisheries
CDRI	Cambodia Development Research Institute	MFI	Micro-Finance Institution
CPI	Crop Protective Inputs	MOC	Ministry of Commerce
DAC	Dynamic Alliance Consulting Group Co., Ltd	MOP	Ministry of Planning
DAI	Development Alternatives, Inc.	MOWRAM	Ministry of Water Resources and Meteorology
EBA	Everything But Arms	NGO	Non-Governmental Organization
ELC	Economic Land Concessions	RGC	Royal Government of Cambodia
EU	European Union	RSIS	S. Rajartnam School of International Studies
FAO	Food and Agriculture Organization of the United Nations	SOWS-REF	Secretariat of One Window Service for Rice Export Formality
FOB	Freight on Board	SME	Small and Medium-sized Enterprises
FTF	Feed the Future	SPS	Sanitary and Phyto-Sanitary
AP	Good Agricultural Practice	USAID	United States Agency for International Development
GDA	General Department of Agriculture	USD	United States Dollars
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit	USDA-FAS	United States Department of Agriculture Foreign Agriculture Service
HACCP	Hazard Analysis and Critical Control Points	VCA	Value Chain Assessment
HARVEST	Helping Address Rural Vulnerabilities and Ecosystem Stability	WB	World Bank
IFC	International Finance Corporation	WEIA	Women's Empowerment in Agriculture Index
IFDC	International Fertiliser Development Centre	WTO	World Trade Organization
IGC	International Grains Council	ZOI	Zone of Intervention
IISD	International Institute for Sustainable Development		
ISO	International Organization for Standardization		
ITC	International Trade Centre		
IWMI	International Water Management Institute		

# Executive Summary

This value chain analysis for USAID/Cambodia was funded through the Leveraging Economic Opportunities (LEO) contract number AID-OAA-C-13-00130. The analysis was carried out during February and March 2015. The three value chain assessments drew from a rich body of secondary sources and interviews with 250 farmers, processors, traders, exporters, service providers, and acknowledged experts in relevant fields. The LEO project team was assisted by technical experts and field enumerators with Dynamic Alliance Consulting Group Co., Ltd. (DAC). Interviews were conducted in Phnom Penh, Siem Reap, Pursat, Kampong Thom, and Battambang. The four provinces, excluding Phnom Penh, comprise USAID's Feed the Future (FTF) Zone of Influence (ZOI).

The current (2010-2015) FTF strategy for Cambodia targeted three value chains: horticulture, rice, and aquaculture. The work in horticulture includes both poor households and commercial producers with the dual objectives of improving household food security and nutrition and raising incomes by increasing commercial sales and capturing a portion of the existing horticulture import market. USAID/Cambodia hypothesizes that increasing production and sales of locally grown vegetables to markets in the FTF ZOI, in key markets around Cambodia, and in the export market will allow smallholder farmers to accomplish the aforementioned objectives. The mission also hypothesizes that rice, as the most developed agricultural value chain in Cambodia, needs to be assessed for strategic investments to enhance the existing, relatively well-developed, system. Third, aquaculture activities need to be seen in the context that the vast majority of fish protein eaten in rural Cambodia comes from wild sources and there are some peri-urban commercial aquaculture operations serving the growing urban population. Because of these realities and because USAID has achieved remarkable success in scaling smallholder commercial producers, horticulture is a specific interest in the value-chain assessment.

Our assessment of these three sectors does not mean that they are the only ones with the potential to drive economic growth, poverty reduction, and improved nutrition in the FTF ZOI—although this assessment indicated that these three subsectors certainly have the potential to do so.

The goal and objectives of this assessment were to develop the analytics needed to select the best value chains for USAID investment in order to improve food security and smallholder incomes (availability, access, and utilization) in provinces with high-potential for such value chain development. The objectives were to:

1. Identify and analyze **end markets** in which Cambodian horticulture, rice (wet and dry season), and fish farmers and fishers in the targeted regions, including male and female smallholders, have or could have a competitive advantage—local, national, regional and/or global.
2. Identify and analyze horticulture, rice, and fish (wild caught and pond raised) **value chains** with the greatest potential for inclusive growth—to reduce poverty, increase resilience, and improve livelihoods year-round (for women, men, youth, and vulnerable populations).

The remainder of this report contains our principal findings from each of the above cited sectors, the service markets on which they depend, and the political economy in which they operate. It is however easy to get lost in the detail. The view from 30,000 feet is illuminating and from that we observed three things.

# Executive Summary

First, there is a direct relationship between the degree of commercialization of a sector and the performance of that sector, and quality of services that support it. Of the three sectors, rice is by far the most developed. Modern mills meeting international standards are exporting over half a million tons of quality rice to global markets. Associations of traders and exporters are coming together to advocate for their members' interests, though mostly with the support of a development partner. There has been a significant transformation in mechanization, and despite many challenges, the sector has been more effective at attracting quality inputs. A corollary to the degree of commercialization is the exposure of a sector to global markets and the quality standards that they require. The sanitary and phytosanitary (SPS) standards and global Hazard Analysis and Critical Control Points (HACCP) and ISO certifications are much higher for rice than for horticulture or aquaculture, where standards to ensure food safety are almost nonexistent. The implication of this observation is that opening up aquaculture and horticulture to foreign investment and global markets would likewise drive a level of upgrading to the sectors that would benefit smallholder farmers, consumers, and the overall economy alike.

Second, there is a wide gap between the policy narrative and the on-the-ground realities. The Royal Government of Cambodia (RGC) has a robust and generally private sector supportive set of regulations and policies. Effective policies can be expected to bring about a positive change in an environment relatively quickly--because markets respond quickly. The on-the-ground reality is very different, however. The disconnect between the many positive policies and the lack of enforcement, or absence of policies to interpret laws, is wide. As a result there is no control over inputs crossing borders or over farmers' use and disposal of chemicals, creating a health threat to farmers and consumers.

Surprisingly given Cambodia's climactic advantages and relative stability, we could not find any commercial investment in export-focused horticulture or aquaculture. For the latter, Cambodian exports are banned for failure to comply with ASEAN Good Agricultural Practice (GAP) rules. While we do not suggest that exports of horticulture and fish be a priority when Cambodia is importing roughly 70 percent from the outside, export-oriented market channels bring about a level of investment in upgrading that benefits the whole sector. Cambodia's overall position in the World Bank's *Doing Business* indicators is but one illustration of this gap.

Thirdly, we found very low levels of trust between different groups of value chain actors, e.g., between farmers and traders, as well as among groups of actors, such as farmers or input sellers. The low levels of trust impose enormous inefficiencies in the value systems we looked at. We found very few examples of producer groups working to reduce transaction costs. Industry and trade associations seemed to function best when backed by a multi- or bi-lateral development partner. There is a growing body of value chain literature that has observed that "upgrading" in a chain tends to be effective when firms performing different functions learn to cooperate (e.g., farmers and millers) and when firms performing the same function learn to compete more effectively. We found almost no examples of trust-based innovation or efficiencies. This poses an enormous behavior change challenge if Cambodia is to significantly upgrade the performance of the commodities in question.

At the same time there are exciting examples of what is working that illustrate the potential of Cambodia's agricultural environment. These include the rapid transformation toward mechanization in agriculture

# Executive Summary

driven by the rising cost of labor due to competing demand from the garment and construction industries as well as employment opportunities abroad. There is robust competition between equipment companies and considerable innovation by them in improved services. The growth in rice exports since 2009 is another indication of the potential for growth when policies send the appropriate signals to market actors.

For all three target commodities, and perhaps for the Cambodian economy overall, we observed that Cambodia must compete through the creation of value, through quality rather than quantity. Cambodia cannot compete with China, Vietnam, and Thailand on volume. It can, however, compete by focusing on premium and higher value varieties, the adoption of safe food standards, and in the case of horticulture, on highly perishable varieties where proximity to markets confers an advantage.

The remainder of this report is divided into the following sectors: the political economy, which sets the environment for all the commodity chains studied; the detailed chain analysis of the rice horticulture and aquaculture chains; followed by a brief assessment of the service markets on which the performance of these chains depend. Each of the value chains assessed begins with an end market analysis to determine the size sources and scale of demand for the commodities in question.

# Acknowledgements

The LEO Value Chain Assessment Team would like to extend their sincere thanks and appreciation to the many people who freely gave their time and expertise to help us better understand the rice, horticulture, and aquaculture sectors in Cambodia; the service markets on which these sectors depend; and the overall political enabling environment in which these sectors operate.

A number of staff at USAID in Washington and at the Cambodia mission were generous with their time and comments, especially Kristin O'Planick and Devi Ramkissoon, of USAID Washington, and William Bradley, Agricultural Officer, Phnom Penh. We would like additionally to thank USAID Cambodia Mission director Rebecca Black for her insistence on the importance of understanding market systems before intervening in them, and Sandra Stajka, Director Food Security & Environment Office, for her support and high standards. We hope this assessment lives up to them.

The study team made a conscious effort to draw as much information from the field from actual value chain actors and as such we tried to avoid influence from acknowledged experts. This was in no way an attempt to discount the invaluable knowledge they possess, but an attempt to “see for ourselves,” avoiding the risk of bias. We were imperfect in this effort and we are grateful to several experts who helped us better understand what we observed on the ground. These include Bas Rozemuller and Viryak Sem of the IFC, Dennis Lesnick and his staff from the USAID HARVEST project, and Philip Charlesworth.

Most importantly, we wish to thank the over 250 value chain actors, farmers, traders, processors, transporters, and service providers in Phnom Penh, Pursat, Battambang, Siem Reap, and Kampong Thom provinces for their time and willingness to help us better understand these sectors. For your candor, we have made all efforts to ensure your anonymity so your names are not included here.

Finally, we would like to thank ACDI/VOCA and DAC staff members. Your assistance and flexibility were greatly appreciated, as was the editing support we received.

Finally, while many contributed to this report, any errors or omissions, are the responsibility of the authors themselves.

Olaf Kula – Team Leader, LEO Project  
Cheryl Turner – Senior Researcher, LEO Project  
Sanphirom Sar – Team Leader, DAC Group

# Conclusions: Findings

## GENERAL OBSERVATIONS

- Transformation, especially in the area of labor-saving technology, has been and continues to be very rapid.
- Low levels of trust between different groups of value chain actors is one of the biggest constraints to innovation in the selected value chains.
- The level and quality of services provided as a result of pooling risks and competencies of different actors (embedded services) is very low.
- There is weak leadership in the selected commodity chains. NGOs and development partners are providing proxy leadership, introducing innovation, driving upgrading, and advocating for more effective policies. Market actors may perceive risks to leadership. NGOs and development partners may inadvertently be crowding out the emergence of market leadership by private actors.
- There appears to be more innovation and leadership emerging in the services sector, particularly in the growing inputs and equipment market as crowding in by competing firms is driving innovation to capture or protect market share.
- Low producer productivity increases vulnerability to price variability. Producer yields in all three sectors are low by regional and global standards.
- Access to year-round water sources is a binding constraint for producers in all sectors.
- Extension services are weak.
- There is minimal cold chain infrastructure (aquaculture and horticulture).
- The relatively higher energy costs (absence of industrial subsidy) and freight on board (FOB) charges (container and documentation costs) mean that Cambodian millers and exporters must focus on premium varieties and grades.

## Market Opportunities

- Proximity to cost- and volume-competitive neighbors argues for a focus on higher value and more perishable crops, with value creation, i.e., fresher and safe food.
- National pride and the perception that Cambodian products are better, suggest opportunities for Cambodia branding strategies around food safety and local sourcing.
- Aquaculture and horticulture should focus on a competitive import substitution strategy while facilitating high-end export investment.
- Rice strategy should focus on premium varieties and quality assurance to capture premiums that offset Cambodia's expensive energy and logistic costs.

## Major Challenges

- Weak relationships and low levels of trust among all actors stifles efficiency and innovation.
- Low productivity stems from weak extension services and lack of knowledge of optimal input use.
- There are high post-harvest losses, particularly in horticulture; and diminished value in aquaculture, where the absence of a cold chain drives processing of lower value products.
- There are low levels of food safety from improper pesticide use and lack of compliance with SPS standards.

## Political Economy

The principal business environment constraint in Cambodia is the failure to enforce a wide range of business-enabling policies. The results of this failure to enforce include the following:

- Low levels of investment in the agricultural sector.
- Stagnant productivity from reduced investment.
- Being locked out of important markets for failure to comply with GAP, HACCP, and sustainability policies.
- An inability to ensure the provision of safe and sustainable food for Cambodians.

# Conclusions: Findings

## AGRICULTURE POLICY

- Cambodia's agriculture sector is not held back by significant policy constraints, although some exist.
- Cambodia's agriculture sector suffers from weak governance at most levels of the chains studied.
- The boundaries between the public and private sector are unclear.
- Large rice mills that are not producing their own paddy.
- There are no large commercial horticulture operations.
- There is poor control over chemical inputs.

## Horticulture Policy

- Compliance enforcement bodies are absent.
- Controls over chemical use are absent.
- Weak linkages from farm to consumer discourage investment in "safe" food.

## Aquaculture Policy

- Absence of a quality ensured and accountable seed and fingerling supply (regulatory constraint).
- There is a lack of extension services (private or public).
- Poor sanitation and hygiene in aquaculture supply chains limits the value of fresh fish (lack of standards).
- Unregulated cage culture can contribute to resource conflicts and environmental damage.
- Weak linkages from farm to consumer discourage investment in "safe" food (due to low levels of trust).

## Agro-Chemical Inputs Policy

- Weak enforcement of current regulations increases consumer exposure to uncontrolled chemicals.
- Lack of farmer education about integrated pest management practices and limited access to Khmer-labeled chemicals contributes to misuse.
- Both consumers and farmers lack information on safe use of approved chemicals.

## Seed Policy (Rice)

- Scaling up private sector investment in the seed sector is unlikely to occur without an operational seed policy under the seed law.
- Securing waivers to CARDI-DCA-AQIP control of the paddy seed supply chain by allowing millers to produce their own seed for "their" farmers would begin to open the seed bottleneck.

## Labor Policy

Continued off-farm labor opportunities will drive:

- Increased mechanization and mechanization services.
- Consolidation of farms into larger-sized plots, facilitating the emergence of more commercial farmers.

## RICE VALUE CHAIN

- Competitive advantage is in premium quality perfumed varieties.
- There is weak private participation in seed markets.
- Weak linkages between sector actors imply a need to invest in strong and value-creating relationships.
- There is strong private sector capacity to provide extension and input services.
- Contract production/outgrowers could drive investment in increased smallholder productivity.
- Mills have low levels of operational efficiency.

## HORTICULTURE VALUE CHAIN

- Strengthening the commercial higher end of the horticulture sector will generate demand for local input providers (seed, fertilizer, high quality crop protection inputs, and extension services) as well as labor-saving equipment.
- There is an opportunity for branding Cambodian "safe" around GAP and HACCP practices
- Large commercial horticultural exporters selling into the higher end of EU and U.S. markets could drive upgrading in the sector through better services and increasing consumer awareness of "safe" food.

# Conclusions: Findings

## Horticulture Value Chain (continued)

- Roughly 70 percent of fresh vegetables and fruit in Cambodia is imported. Domestic producers have maintained but not increased market share over time.
- Despite a good environment for the production and export of high value horticulture products, we identified no large scale producer/exporters.
- Cambodia's competitive advantage in horticulture is in the production of higher value, more perishable products and from extending the production season.

## Challenges in Horticulture

- Relationships between value chain actors performing different functions are weak.
- There is very little embedded service delivery.
- Poor control over, and use of, inputs that arrive from or through Vietnam and Thailand makes it hard to optimize productivity and phytosanitary control.
- Cambodia has tremendous import substitution opportunities in:
  - Expanding production seasons
  - Focusing on perishable and high value crops
  - Adoption and certification of GAP.
- Commercial-scale production for export could be a "game changer" if export zones and clearer incentives were established.
- Extension and input service networks are just emerging.
- Contract production/outgrowers could drive investment in increased smallholder productivity.
- Investing in strong and value-creating relationships is as important as investment in technologies.
- The horticulture landscape is dynamic and responsive to technical assistance.
- All horticulture producers would benefit from investments in commercial actors as better quality inputs and technologies become more widely available.

## What You Don't See

Two things are notably absent from the Cambodian horticulture sector.

- The first is the almost complete absence of embedded service delivery between farmers, buyers, input companies and financial institutions. Low levels of trust and difficulty in enforcing agreements discourage the development of services that could increase yields and quality (increasing competition in the inputs sector, may help overcome this).
- The second is the absence of high value horticulture producer/exporters meeting global GAP and HACCP standards. In many emerging economies, a very small number of high value horticulture exporters can drive significant change by increasing awareness of safe food, stimulating demand for better quality of inputs and equipment services, e.g., cut flowers in Ethiopia, or vegetables in Kenya.

## AQUACULTURE VALUE CHAIN

- Net incomes from smallholder cage culture are not sufficient to support significant investment.
- High returns from aquaculture (cage and pond) require reliable access to high quality inputs such as fingerlings, feed and veterinary supplies.
- Cambodia's competitive strategy is in the promotion of small and larger scale pond and cage operations that take part in an integrated GAP and HACCP certified supply chain for the export and higher end local market.
- Strengthening the commercial higher end of the aquaculture sector will generate demand for local input providers (feed, fertilizer and fingerlings, as well as labor saving equipment).
- There is an opportunity for branding Cambodian "safe" around GAP and HACCP practices.
- Strengthened input markets, and the movement of larger more efficient firms into higher end species would improve inputs and service access to pond and cage culture farmers producing more economical varieties.

# Conclusions: Findings

## Aquaculture Feed and Fingerling

- Poor quality seed and fingerling inputs is a major Impediment to increased fish farmer yields.
- Vietnam, Thailand and wild capture of eggs are the principal sources of seed and fingerlings to Cambodian producers.
- Strengthening the domestic seed and fingerling supply chain is essential to upgrading food safety in the aquaculture sector.

## Challenges in Aquaculture Pond and Cage

- Industry is still dominated by small-scale informal actors.
- Imports from Thailand and Vietnam represent an import substitution opportunity for higher value and more management-intensive species.
- Small trucks carry fresh and processed fish into Vietnam and Cambodia, especially the highly valued snakehead.
- Informality and leakage across borders represents a loss of revenue for the RGC.
- There are two wholesaling functions. The first is the aggregation from large numbers of farmers and fishermen to the government landing sites. The second are the larger wholesalers of fresh and processed fish that move product from landing sites and processors to their final market.
- There is an EU and ASEAN ban on Cambodian fish imports for failure to meet GAP standards.
- Cambodia cannot compete effectively with Vietnam on low cost, low management varieties of pond and cage cultured fish.
- More industrial and larger scale commercial fisheries have a greater employment effect than smallholder ponds or cages.
- Increasing commercial pond and cage enterprises for export would generate demand for local provision of critical inputs to the sector.
- With a large tourist and growing middle-class market, export oriented firms face reduced risks because they can sell Cambodian-branded safe products to higher end consumers in the domestic market.

- Fish farming has a mixed environmental sustainability record. Cambodia will need to learn from the mistakes of its neighbors in scaling up an aquaculture industry.

## What You Don't See

- Notably absent from the Cambodian aquaculture and fisheries map are industrial scale commercial exporters shipping fresh from Phnom Penh, and frozen in reefer containers from Sihanoukville. Cambodia could be competitive in the production of high-value management intensive species to the EU and North American markets.
- The absence of HACCP-controlled supply chain and poor SPS standards have shut this market down for Cambodian entrepreneurs.

## CROSS-CUTTING SERVICES

### Inputs and Extension Services

- A number of input companies are providing extension services using Farmer Field Schools and demonstration farms.
- No embedded service agreements were observed between input companies, off-takers, and farmers.
- There is rapid mechanization of rice and to a lesser extent horticultural sectors.
- There is a parallel emergence of commercial equipment service providers (tractor services \$50 USD per hectare (ha); rice harvester \$70-\$100/ha).
- Quality control and enforcement to ensure chemical quality is poor.
- Farmer knowledge of yield maximizing practices is very limited and many misunderstandings exist.
- Knowledge of GAP and safe chemical use is limited.
- There is an emerging demand for “safe” food including organic, chemical-free, and GAP, although there is almost no certification or verification process.

# Conclusions: Findings

## Cross-Cutting Services (continued)

- Abuse of chemical applications is widespread. Farmers mix their own cocktails. Specific herbicides and pesticides are perceived to be “weak” if they fail to kill all pests
- There is little to no enforcement of out-of-date, banned, and low-quality inputs that cross borders informally.
- Porous borders and weak enforcement of documentation make actual estimation of imports and exports difficult.
- Cooperatives, producer groups, and commercial horticulture farms are not widespread.
- The area of greatest innovation is in services, as competitors “crowd-in” and innovate to maintain or gain market share (e.g., farm machinery, finance).

## Services–Transport

- Higher costs and poorer conditions make it hard for Cambodia to compete for lower value products.
- Lack of transparency and informal fees mask costs and limit foreign companies participation.
- Improved infrastructure for exports will enhance competition.
- Unofficial road and bridge levies have improved but remain a problem.

## Services–Finance

- Agriculture and agribusiness represents about 10 percent of formal finance.
- There is a wide and robust network of commercial banks and micro-finance institutions (MFIs) that lend to agricultural value chain actors.
- Loan approvals can be slow and commercial banks continue to depend on collateral-based loans.
- Lease financing is emerging as is an initiative around warehouse receipting following a similar success in China and Vietnam.
- Rice mills complain of difficulty obtaining working capital financing that makes it difficult for them to compete with Vietnamese traders who can pay farmers cash for their paddy.
- There is a missing middle in the financial sector with few products developed for small and medium-sized enterprise (SME) sector financing.

# Study Objectives

## Assessment Objectives

1. Identify and analyze end markets in which Cambodian horticulture, rice (wet and dry season), and fish farmers and fishers in the targeted regions have or could have a competitive advantage—local, national, regional and/or global.
2. Identify and analyze horticulture, rice, and fish value chains with the greatest potential for inclusive growth—to reduce poverty, increase resilience, and improve livelihoods year-round.

## Geographical Focus

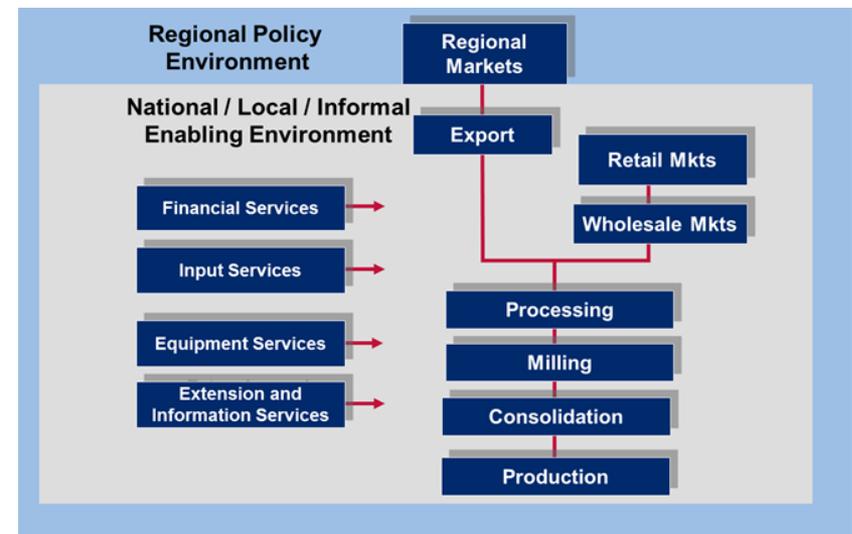
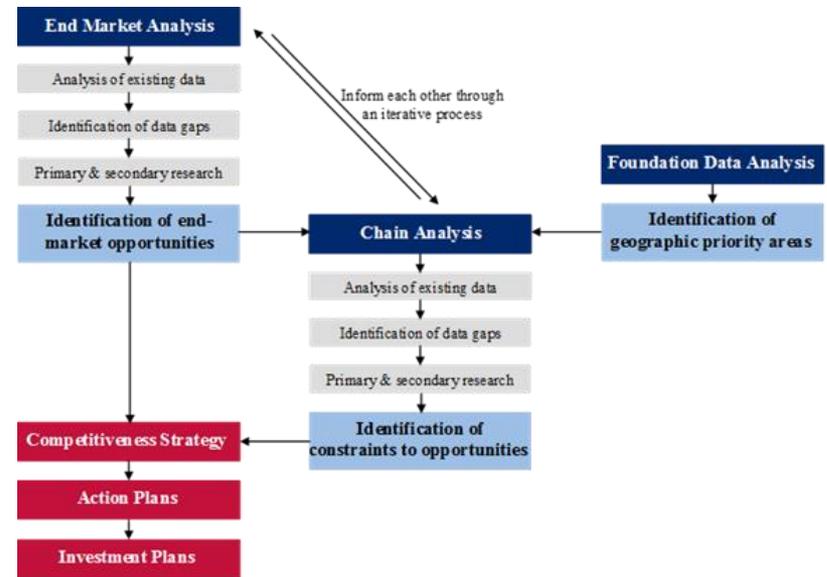
Provinces of Siem Reap, Pursat, Kampong Thom, and Battambang

## Approach

- Phase 1: Literature review
- Phase 2: Market systems facilitation and data collection training for Cambodian local team – 6 sector leaders and 12 enumerators (February 10-14)
- Phase 4: Consultations/field visits (February 16-24). More than 250 interviews in three value chains were conducted with:
  - Farmers
  - Market traders/collectors
  - Small, medium and large scale processors/millers
  - Distributors/wholesalers
  - Input suppliers Distributors/wholesalers
  - Equipment, financial and input service providers
  - Government institutions
  - NGOs
- Phase 5: Compilation of report and findings

# Methodology

Figure 1: The Value Chain Analysis Process



# Introduction

- This study provides an analysis of three commodity chains: paddy rice, horticulture, and aquaculture. Consistent with an emerging USAID and multiple development partner consensus on value chain methodology, this study begins with an assessment of the demand for the commodities studied. This study was carried out in February and early March of 2015 for USAID/Cambodia. The study was carried out by a team from the USAID Leveraging Economic Opportunities (LEO) project with the support and assistance of a local Cambodian consultant team, DAC.
- The principal objective of this study is to identify whether there is sufficient demand for the commodities in question to generate socially inclusive and environmentally sustainable economic and employment growth with appropriate investment.
- The value chain study focused on the commodities in question in the provinces of Siem Reap, Pursat, Kampong Thom, Battambang, and the terminal market of Phnom Penh. Market systems (value chains) do not follow political boundaries, however. Rather, they represent flows of products, services, and transactions, from production to the final consumer, wherever they are. In efficient markets, products move from surplus to deficit areas, processing investment takes advantage of physical infrastructure and market access availability, and many of the services on which farmers depend, e.g., equipment and inputs, are often based outside of a project's area of intervention. To say that a value chain study focuses on a particular political area, generally means that the study is concerned with one group of actors, i.e., farmers in a specific area. From the producer, the value chain proceeds through all transactions until the product gets to the final consumer.
- Before field data collection began, the LEO team conducted a three-day training on value chain concepts and data collection methods complementary to value chain analytics for the local Cambodian consulting team (DAC) in order to harmonize our approaches and to optimize the effectiveness of the field data collection.
- The assessment was based on a review of primary and secondary data sources, reviewing source documents, and conducting more than 250 interviews with value chain actors, service providers, and development professionals. A complete list of interviews conducted and source documents can be found in Section 6 of this report.



# Introduction

- There is an important inherent bias in value chain assessments. They are a diagnostic tool to identify how a particular market system works and what it would take to make the system perform better than it does. As a tool to more effectively target the poverty-reduction objectives of USAID, we use value chain analysis not only to estimate how the system could work better, but also how to maximize the likelihood that the rural poor are able to both contribute to and benefit from growth in the system in an economically and environmentally sustainable manner.
- Value chain assessments (VCA) look for opportunity pathways. VCA is not interested in an objective analysis of a system; rather it is interested in understanding how the system can change, who will drive that change, who will benefit from it, and whether and what an external actor like USAID would have to do to accelerate the desired change so that the systems actors benefit now or at least soon, rather than years in the future.
- The remainder of this report is organized into five sections. The first describes the political economy, i.e., formal and informal rules and norms that affect value chain actors' ability to pursue opportunities.
- This is followed by an analysis of the three commodity chains: rice, horticulture, and aquaculture. The analysis is followed by the last section, a description of the different service markets on which the three commodity chains depend, each of which is part of its own value chain.
- While this report was carried by the LEO project in collaboration with consultants from DAC, the views expressed in this report are those of the authors and do not necessarily reflect those of USAID, the United States Government, or of ACDI/VOCA, the implementing contractor for the LEO project.

# 1. Political Economy and the Business-Enabling Environment

- 1.1 Global and Regional Trade Policies
- 1.2 National and Commodity-Specific Policy and Enabling Environment
- 1.3 Land Rights
- 1.4 Labor Markets
- 1.5 Trade Corridors
- 1.6 Gender and Food Security

The principal business environment constraint in Cambodia is the failure to enforce a wide range of business-enabling policies. The consequences of this failure include the following:

- Low levels of investment in the agricultural sector
- Stagnant productivity from reduced investment
- Exports locked out of important markets for failure to comply with GAP, HACCP, and sustainability policies
- An inability to ensure the provision of safe and sustainable food for Cambodians

# 1.1 Global and Regional Trade Policies

## Global Markets

Cambodia:

- Is able to access duty free exports to European Union (EU) countries through the Everything-But-Arms (EBA) initiative as part of its General System of Preferences for Less Developed Countries (LDC).
- Holds Most-Favored Nation status from the United States and European nations.
- Was the first LDC to become a member of World Trade Organization.
- Has benefitted from enhanced market access for the rice export trade (CDC, 2013).

## Regional Markets

- Association of Southeast Asian Nations (ASEAN) member status helped to promote trade in the region.
- The ASEAN National Single Window initiative for imports is scheduled to become effective in 2015 and should reduce tariffs and delays in exporting within the sub-region.
- Cambodia is leveraging this program to access funds, technology, and technical expertise for improved transportation infrastructure, policy regulation, customs integration, etc.
- Free flow of labor through ASEAN countries provides opportunities for Cambodians to gain employment abroad, increasing migration away from farms.
- Cambodia has established bilateral agreements with a number of other ASEAN nations including Vietnam to enhance road and water transport (Rithi, 2014).

## GAP and SPS Standards

- Trade with many nations has been limited because of quality or processing requirements, especially related to food products.
- Minimal adoption of GAP (that clarify limited uses for chemicals in produce) and HACCP standards (applying to hygiene and sanitation).
- Rules related to Certificates of Origin and conformity assessment have limited Cambodia's ability to export its agricultural products to Singapore, Europe, and the United States.
- The EU has high SPS requirements for pesticide residues, aflatoxin, and salmonella; assurance of the absence of genetically modified organisms; fumigation to eliminate storage pests, and phytosanitary certificates.
- Rice exports to the People's Republic of China also include traceability: indication of the rice variety, the place of production, the packinghouse and storage facilities (Ministry of Commerce, 2014).

- Cambodia's agriculture sector is not held back by significant policy constraints, though there are some.
- Cambodia's agriculture sector suffers from weak governance at most levels of the chains studied.
- The boundaries between the public and private sector are unclear.
- Large rice mills that are not producing their own paddy.
- There are no large commercial horticulture operations.
- There is poor control over chemical inputs.

# 1.2 National and Commodity-Specific Policy and Enabling Environment

## National

- The RGC has created a favorable business policy framework including incentives for Qualified Investment Projects.
- There are no tariffs on imported agriculture materials such as seeds, fertilizers, pesticide, and agricultural equipment.
- There are additional incentives for investment in processing facilities, rice milling for export, and irrigation, both planned and implemented (Hok, 2012).
- The government’s Rectangular Strategy has four main components:
  - Improved productivity, diversification, and commercialization
  - Promotion of livestock farming and Aquaculture
  - Land reform and clearance of mines and unexploded ordnances
  - Sustainable management of national resources
- Cambodia has made improvements in a number of “Doing Business” criteria.

**Cambodia ranks 184<sup>th</sup> out of 189 countries in starting a company and 135 overall.**  
*2015 World Bank, Ease of Doing Business in Cambodia.*

## Rice

- In 2010, the RGC launched the Policy on the Promotion of Paddy Production and Rice Export. The policy set a target of reaching four million tons of paddy rice surplus and achieving milled rice export of one million tons.
- Efforts to improve systems to reach this target have improved conditions for export.
- Paddy quality remains an issue.
- The public and the NGO sector are crowding out private investment in the rice seed sector.
- Low levels of trust among value chain actors inhibit upgrading.
- The Supreme National Economic Council is drafting a contract farming law.
- Costs for electricity, fuel, transport, and port access remain higher than in neighboring countries.

**Table 1: Investments Eligible for Tax Incentives**

Type of investments	Size of investment
<b>Crop Production</b>	
Paddy farming	> 1,000 ha
All types of cash crops	> 500 ha
Vegetables	> 50 ha
<b>Fisheries</b>	
Hatcheries	> 2 ha
Shrimp farming and other aqua-culture production	> 10 ha
<b>Manufacture and Processing of Food &amp; Related Products</b>	
Investment Capital	> 500,000 USD
- Beverages	
- Fats & oils	
- Preserved fruits and vegetables	
- Grain mill products	
- Animal feed products	

Source: Council for the Development of Cambodia (CDC)

**Table 2: Time and Cost for Exports**

Services	Processing costs		Processing time	
	2012	2013	2012	2013
Sanitary and phytosanitary	\$150/case	\$35/case	2 days	1 day
Fumigation certificate	\$20/container	\$35/container	1 day	1 day
Certificate of origin	\$250/case	\$141/case	1 day	1 day
Custom certificate	\$25/container	\$6.50/container	2 days	½ day
CamControl certificate	\$25/container	52.50/container	2 days	½ day
GMO certificate	\$150/sample	\$80/sample	3-4 days	2-3 days
Average total	\$20/ton	\$14/ton	8 days	4 days

Source: World Bank 2014, Cambodia Economic Update

# 1.2 National and Commodity-Specific Policy and Enabling Environment

## Horticulture

- There is limited data on the health and environmental effects of high pesticide residues in Cambodia.
- The popular belief that imported horticultural products have higher levels of pesticide residues favors local producers.
- Consumers are willing to pay a higher price if GAP could be confirmed.
- Cambodia is unlikely to meet 2015 ASEAN GAP compliance.
- There is a lack of a regulatory framework to facilitate domestic adoption of and compliance with ASEAN GAP standard.
- Roles and responsibilities of governmental institutions for inspection and certification services are unclear.
- There is insufficient capacity of testing laboratories, including a shortage of qualified staff and funds (GDA, 2012).
- Insufficient pack house infrastructure reduces incentives to export.

**Takeaways**

- Compliance enforcement bodies absent.
- Controls over chemical use absent.
- Weak linkages from farm to consumer discourage investment in “safe” food.

**What’s missing?**

Cambodia has a clear competitive advantage in its ability to produce high- value horticultural products for export to EU, ASEAN, and Gulf markets. The absence of a fully commercial, export-oriented horticultural operation producing according to the global and ASEAN GAP standards, especially given a pro-investment policy environment, suggests that something is missing in this system. “Cambodia is too uncertain an investment climate for a global horticulture operation. . .” If Cambodia wants to attract global horticulture investors and the services and compliance with standards that such investment brings, the RGC will have to send a clear signal to the world that Cambodia is open for business. ---interviews with buyers for EU supermarket chains

## Aquaculture

- Creating a sustainable fisheries sector is a national priority but the policy, regulatory, and enforcement environments lag behind.
- There is increased pressure on inland water resources, which has led to a decline in the average fish catch rate in the Tonle Sap region, falling from 347 kilogram (kg) per fisher in 1940 to 116 kg/fisher in 2010 (RSIS Centre for Non-Traditional Security Studies, 2011).
- Water rights conflicts have occurred especially during droughts with cage systems.
- Cambodia has a number of advantages that would favor freshwater fish culture for exports, but the lack of a hygienic supply chain, the absence of enforceable standards, the constraints to starting a new business prevent Cambodia from being able to take advantage of this opportunity.

The EU bans fish exports from Cambodia because Cambodia allows foreign fishing vessels to fly “flags of convenience.” Cambodian aquaculture exports to the EU and ASEAN countries is constrained by the absence of GAP standards in the supply chain.

**Takeaways**

- Absence of a quality ensured and accountable seed and fingerling supply (regulatory)
- Lack of extension services (private or public)
- Poor sanitation and hygiene in aquaculture supply chains limits value of fresh fish (standards)
- Unregulated cage culture can contribute to resource conflicts and environmental damage
- Weak linkages from farm to consumer discourage investment in “safe “ food (low levels of trust)

# 1.2 National and Commodity-Specific Policy and Enabling Environment

## Agro-Chemical Inputs

- Cambodia has recently signed the Law on Pesticide and Chemical Fertilizer Control to enforce the registration and use of agrichemicals. The implementation of the law is inadequate to date.
- The limits of import tonnages to a maximum of 30,000 tons per importer per year coupled with complex procedures to get an import license, which usually involves significant informal fees, are among the factors adding to the costs of the imported agricultural inputs.
- There is a secondary market for chemical and fertilizer import licenses. License owners are paid between 2 to 3 percent of the import value by the importing firm (Vuthy & Khiev, 2014).
- About 90 percent of chemical fertilizer is imported to Cambodia informally, which is therefore unregulated (Munford, 2012).
- The assessment team observed chemical inputs with labels in either Vietnamese or Thai in several of the small input shops visited. Where labeling was in Khmer, it provided no information about product use.
- Cambodia does not have a domestic agricultural chemical industry so it depends on imports.
- RCG has regulations and policies in place to control for banned and/or expired chemicals but enforcement remains a problem.
- Many farmers mix different pesticides into more potent “cocktails.”
- FM radio is not being used by public or private organizations for extension and safety messages about proper chemical use.

### Takeaways

- Weak enforcement of current regulations increases consumer exposure to uncontrolled chemicals.
- Lack of farmer education about Integrated pest management practices and limited access to Khmer labeled chemicals contributes to misuse.
- Both consumers and farmers lack information on safe use of approved chemicals.

## Seed Policy

- Cambodia has not yet ratified its seed policy under its 2008 “Seed Management and Plant Breeder’s Rights” (Seed Law).
- There are no seed quality standards approved under the seed law.
- The policies and enforcement mechanisms essential to making the seed law operational have not been put into place, e.g., Seed Policy, Seed Management Committee, procedure of seed quality certification, intellectual property rights, and National Seed Standard.
- There is a significant absence of enforcement mechanisms to control the quality of seeds and agro-chemical inputs traded in the markets.
- Seeds of varying quality are sold in the market. Seed buyers have no recourse in the event of pest-contaminated seed or low germination.
- Over 90 percent of seed is saved from the previous season or traded between farmers.
- Public-sector CARDI and DCA and NGO dominance of the rice seed market reduces private sector incentives to invest in the commercial multiplication and distribution of high-yielding fragrant paddy seed.

### Takeaways

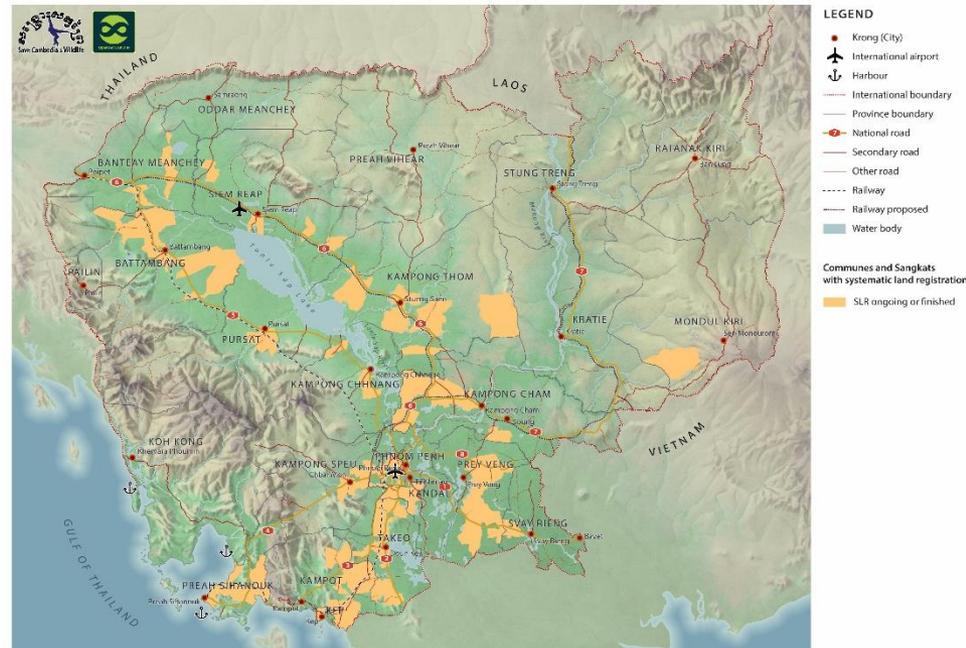
- Scaling up private sector investment in the seed sector is unlikely to occur without an operational seed policy under the seed law.
- Securing waivers to CARDI-DCA-AQIP control of the paddy seed supply chain by allowing millers to produce their own seed for “their” farmers would begin to open the seed bottle neck.

# 1.3 Land Rights

## Land Rights

- An estimated 20 percent of rural Cambodians are landless and another 20-25 percent have less than 0.5 ha. Therefore, almost half of all Cambodians cannot meet their daily nutritional requirements from their own agricultural production (De Silva, 2014).
- During the Khmer Rouge regime (1975 to 1979), records and maps were systematically destroyed, and educated people were killed or left Cambodia. All land during this period belonged to the state.
- Private property rights were reintroduced in 1989, but only for land for domiciles. For cultivation land (allocated for farmers to manage) and concession land (parcels larger than five ha), one could obtain possession and use rights, but not ownership (Ballard, 2006).
- After a land law was passed in 2001 to create strengthened systems of land tenure rights, many women owned land, partly because there were fewer men after the Khmer Rouge period. Between 2001 when the land law was passed and 2004, 78 percent of new titles were in the name of both men and women. However, in practice, women's rights may not be fully recognized, nor are they as likely to be aware of their rights (USAID, 2015).
- Demarcation of land use (forests, agriculture, urban ) and even administrative boundaries (at the District and commune level) is still vague (Sar, 2010).
- In lowland Cambodia, there has been outstanding progress in the formalization of individual land titling for land farmers were already using (cultivation land above). By 2012 this process (which is ongoing) provided secure land tenure to over 3.5 million mostly poor people, or 24 percent of the total Cambodian population (Muller, 2012).
- The land titling process has been less successful in urban areas and the highlands (Neef et. al, 2012).

**Figure 2: Communes and Sangkats with completed or ongoing Systematic Land Registration in 2012**



Source: Open Development Cambodia, 2015

### Takeaways

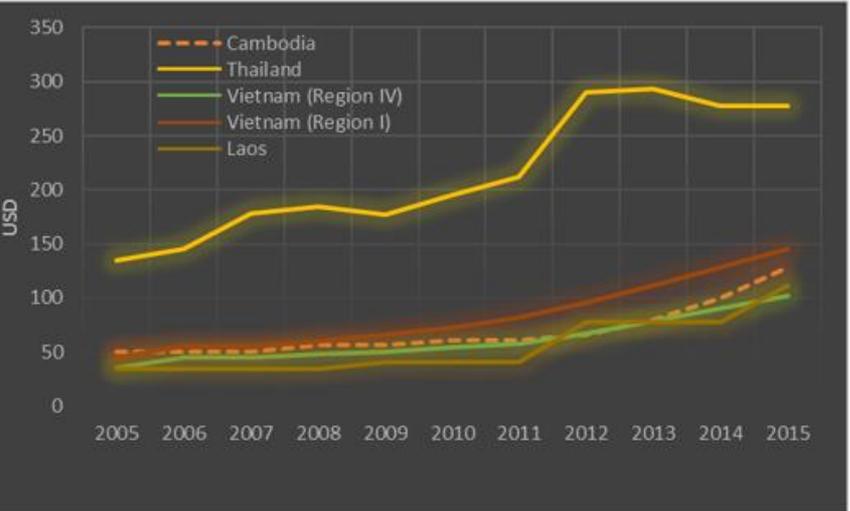
- Land title is an essential precursor to investment. Efforts to improve technical assistance, access to markets and inputs, and irrigation should be integrated with land titling for male and female farmers.
- Legal rights education, legal assistance, and conflict resolution training is important as well, especially for women.
- Awareness about joint-titling requirements and options should also be addressed.



# 1.4 Labor Markets

## Labor Market

- Daily wage rates in rural areas more than doubled from 2007 to 2012, not only because of rising costs of living in the country, but also because of costs of labor in neighboring countries.
- In rural Cambodia, the daily wage rates for plowing increased to 20,000-25,000 Cambodian Riel (KHR) (about \$5-6.25 USD) a day; transplanting to 12,000-15,000KHR (about \$3-3.75); and construction to 20,000-25,000KHR (about \$5-6.25) (World Bank, 2013).
- The agriculture sector in Cambodia is facing a labor shortage due to migration to cities and to countries with higher wages.
- Garment factory wages are now \$120 per month.



**Figure 4: Wage comparison between Cambodia and neighboring countries over time**

Note: Minimum wage in Cambodia is only for the garment and footwear industry. Minimum wage in Vietnam is divided into four regions, here the data are shown for two regions (Region I and IV with the lowest and highest minimum wage). The minimum wage in Thailand remains stable in Thai Baht from 2012 but declines in USD terms.

### Takeaways

- Continued off-farm labor opportunities will drive:
- Increased mechanization and mechanization services
  - Consolidation of farms into larger-sized plots facilitating the emergence of more commercial farmers

**Table 3: Key indicators of Cambodia’s Labor Force and Market**

Subject	Indicator	Year	Value
Context indicators	Total population (thousands)	2014	15408.3
Labor force	Labor force participation rate, women (%)	2013	77.8
	Labor force participation rate, men (%)	2013	88.7
	Labor force participation rate (%)	2013	83.0
Employment	Share of agriculture in total employment (%)	2013	48.7
	Share of industry in total employment (%)	2013	19.9
	Share of services in total employment (%)	2013	31.5
	Share of own-account and contributing family workers in total employment (%)	2013	59.4
	Employment-population ratio (%)	2013	82.8
	Unemployment	Unemployment rate, women (%)	2013
Unemployment rate, men (%)		2013	0.3
Unemployment rate (%)		2013	0.3
Youth	Youth unemployment rate (%)	2012	2.6
	Share of youth not in employment, education or training (%)	2012	7.8
	Youth labor force participation rate (%)	2012	71.4
Working time	Mean weekly hours actually worked per employed person	2010	47.0

Source: ILOSTAT, downloaded on FRI, 27 FEB 2015. The minimum monthly wage is taken from <http://www.arbitrationcouncil.org>

# 1.5 Trade Corridors

## Trade Corridors

- Cross-Border Trade Agreement creates broad framework, but regional logistics are not well-integrated. There are no agreements in place to facilitate trucking cross border traffic.
- Vietnamese operators find that the registration requirements to carry loads in Cambodia are too burdensome, and so transfer to Cambodian companies at the border. Transloading at the borders results in additional costs, delays, limited competition and limited shipping options.
- There are a limited number of transshipping permits available on the Cambodia-Vietnam border. Most of these permits have been claimed by bus companies for passenger transport between Phnom Penh and Ho Chi Minh city.
- Lack of third party insurance, a high rate of accidents, and inconsistent axle load limits add barriers to trade.
- The most competitive international shipping option is from Phnom Penh by boat to Ho Chi Minh city to an international vessel. This route is \$200 cheaper and 2 days shorter than shipping to Ho Chi Minh by road.
- Road width and safety are a significant impediment to growth. Road accidents on the road to Sihanoukville often delay traffic or close the corridor. The ferry crossing at Neak Loeung is also a barrier, but the new bridge will be completed in 2015.
- Some international logistics companies are beginning to enter the market, but border quotas limited to Cambodian-owned firms will limit competition.

### Takeaways

- Informal fees and lack of infrastructure prevent entry of international players in the transport sector.

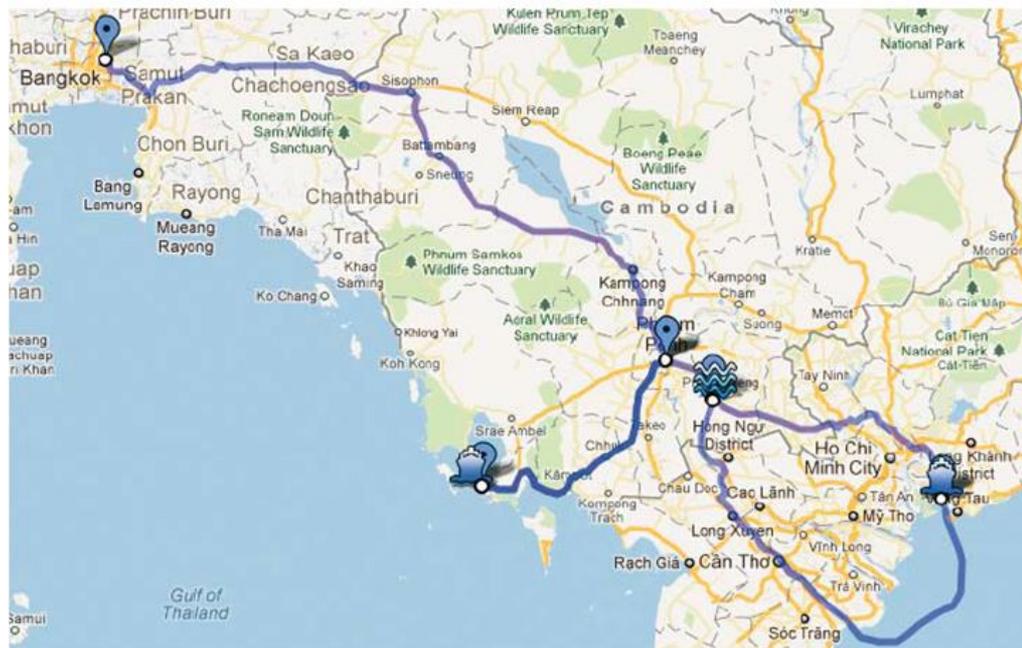
**Table 4: Logistics and Transport Costs for Cambodia, Vietnam, and Thailand**

Items	Bangkok–Phnom Penh			Phnom Penh–Ho Chi Minh City		
	Total	Cambodia	Thailand	Total	Cambodia	Vietnam
Total distance (km)	665.8	405.8	260	237.1	167.1	70
Total time (hours)	23.9	15.9	8	14	9	5
Total logistics cost (\$)*	2,064.22	1,607.08	457.14	793.36	649.14	144.22
Average time (min per km)	2.2	2.3	1.8	3.5	3.2	4.3
Average speed (km per h)	27.9	25.6	32.5	17	18.7	14
Average cost (\$ per km)	3.1	3.96	1.74	3.35	3.88	2.12
Transport cost per t-km*	0.07	0.09	0.06	0.11	0.13	0.07
Logistics cost per t-km*	0.16	0.2	0.09	0.17	0.19	0.1

Source: (ADB, 2012)

\*Assuming an average cargo weight of 20 tons, logistics costs take into account the total costs to transport normal goods from Bangkok to Phnom Penh and from Phnom Penh to Ho Chi Minh, including all documentation and other costs. Transport costs take into account only the transport related costs for shipping normal goods (including trucking costs, checkpoints, weigh bridges, transshipment, and river crossing, if applicable).

**Figure 5: Major Shipping Routes for Cambodia**



Source: Cambodia Corridor assessment report, WB 2014

# 1.6 Gender and Food Security

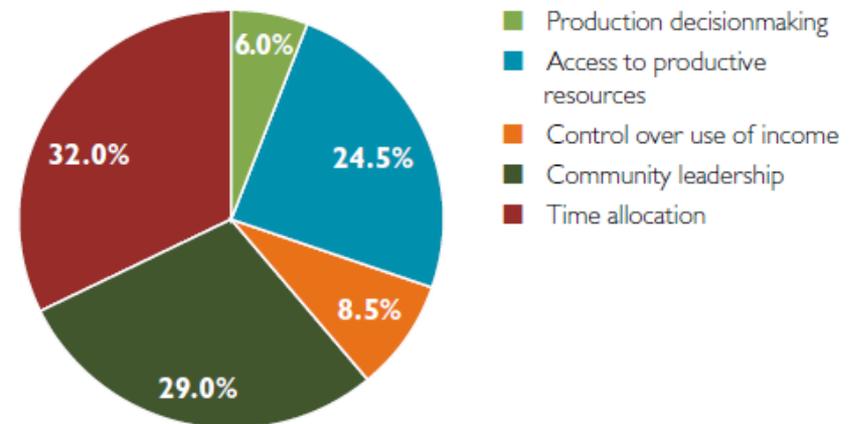
## Gender in Agriculture

- There are significant gender discrepancies in employment as a result of educational attainment at all levels. Women bear the main burden of domestic work and child care, creating a gap in access to training and government services. (ADB, 2013)
- Girls in female-headed households are more likely to work. Girls are less likely to complete school and get formal sector employment (USAID, 2010).
- Women are active in agricultural labor. Many of the small-scale collectors, small rice mills, retailers, and wholesalers functions are played by women. Larger operations, however, are more likely to be operated by men. For example, women are more likely to use a motorcycle for their business operations, while men performing the same value chain function are more likely to have a truck for their operations.
- Women are more likely to grow subsistence crops, as opposed to cash crops. They own less land, and are disadvantaged by inheritance laws, land titling systems, and their ability to purchase land. They also have less access to extension services (ADB, 2013).
- Although machinery is still typically operated by men, increased mechanization of farm labor will allow women to contract for services in agricultural production, therefore expanding production in ways previously reserved for men.
- Women traditionally control household spending, and about 80 percent of micro-finance borrowers are women. Despite this, lack of access to credit is consistently cited as a key constraint to increased agricultural participation.

## Women's Empowerment in Agriculture Index (WEIA)

- This comprehensive tool is designed to measure women's empowerment and inclusion in agriculture. Baseline data from the four Feed the Future (FTF) target provinces indicates an overall score of .98 (out of 1.00).
- Cambodia was the only FTF country where women are more empowered than men in eight of nine domains. Ninety-two point six percent of women have achieved adequate empowerment according to the index (Malapit, et. al, 2014).
- Women's largest sources of disempowerment come in workload and ability to transfer assets.
- For both men and women, the greatest source of disempowerment is group membership.
- In general women have a relatively high level of control over production decisions and use of income.

**Figure 6: Contribution of each of the five domains to women's disempowerment**



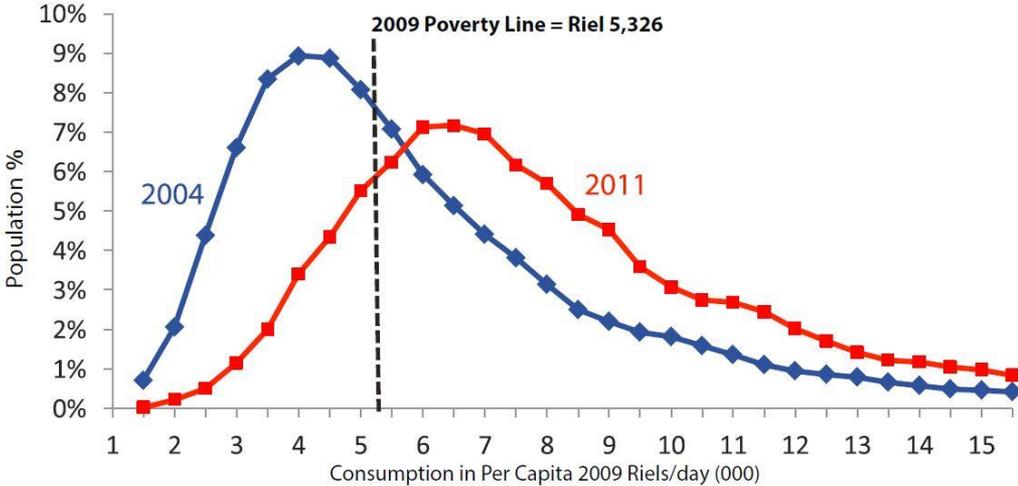
Source: Cambodia Development Resource Institute (2012).

# 1.6 Gender and Food Security

## Gender and Food Security

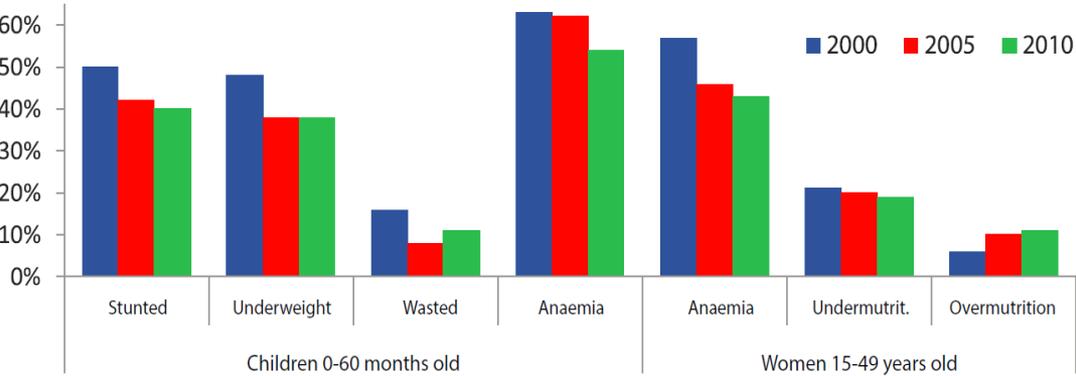
- The portion of Cambodians living below the poverty line has dropped significantly in recent years. However, most households who moved above the poverty line did not move far, and are still highly vulnerable to shocks.
- Despite increases in incomes, well-being, and consumption, nutrition levels have stagnated or declined since 2005. Failure to significantly reduce levels of stunting, wasting, and underweight can be attributed to the following:
  - Open defecation and lack of potable water
  - Maternal anemia and low BMI
  - Failure to breastfeed
  - Maternal education level
- Heavy tea consumption and thalassemia (which has a high prevalence in Cambodia) can contribute to anemia.
- Low diet diversity also contributes to malnutrition.

**Figure 7: Population Share by Consumption per Capita, Cambodia 2004-2011**



Source: World Bank, 2014

**Figure 8: Maternal Child Nutrition Issues, Cambodia 2000, 2005, 2010**



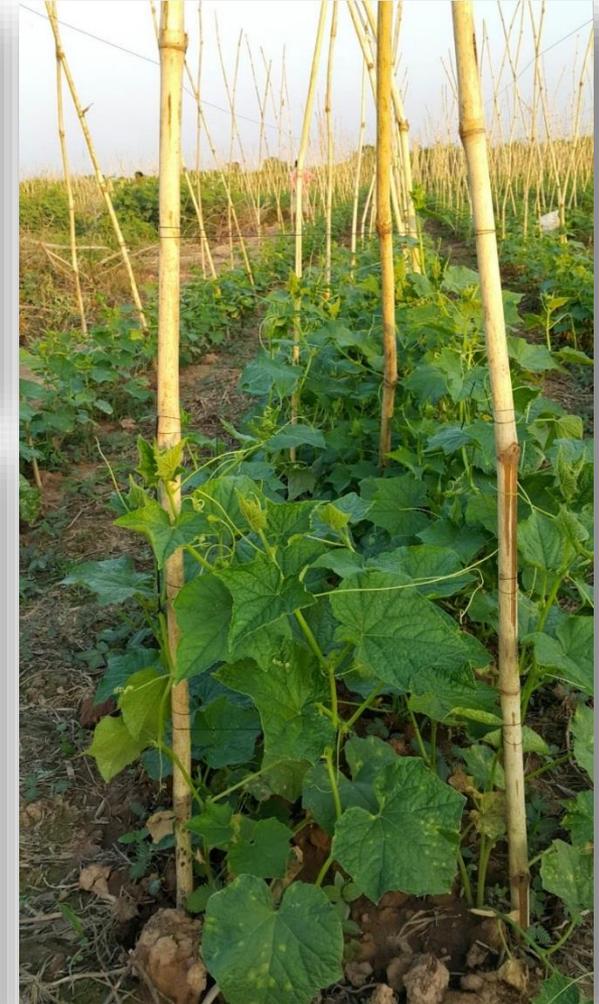
Source: World Bank, 2014

**Takeaways**

- Increased nutrition education, especially for women, on diet diversity and nutritious foods can improve utilization of increased incomes for nutritional impact.
- Improved post-harvest handling and food fortification can further enhance nutritional impacts of increased household spending.
- Home gardens are an effective way of improving access to nutritious foods if they are not available in local market. If already available, the time and workload of a home garden may not be the best allocation of women’s resources.

# Value Chain Analysis

- 2. Rice
- 3. Horticulture
- 4. Aquaculture



# Rice Value Chain Analysis

- 2.1 End Market Analysis
- 2.2 Commodity Description
- 2.3 Factors Affecting Competitiveness
- 2.4 Value Chain Map and Actors
- 2.5 Pathways for Growth



## Rice Takeaways

- Cambodia is competitive with its neighbors in premium fragrant rice varieties because the margins are higher; it cannot compete in the milling of white rice.
- Control and access to quality premium seed is the driving constraint to further upgrading in the rice subsector.
- Weak relationships among the different actors in paddy supply chains result in poor extension services, low yields, poor varietal control, and higher post harvest losses.
- The 2008 Seed Law does not yet have policies that clearly protect investors in the seed chain.
- Research in high yielding seed varieties is essential to protect Cambodia's competitive advantage in premium rice.

# 2.1 End Market Analysis – Rice

## Global Demand

- Rice is a staple for nearly half of the world’s seven billion people.
- Growth in demand is driven by rising population, incomes, and urbanization. Population and urbanization continue to shift consumer preference to rice over other grains and starches.
- The International Grains Council (IGC) expects global rice consumption in 2014-15 to increase around 482 million tons, up about 1.2 from around 477 million tons in 2013-14 due to expected increased consumption in Asian countries including India (98.3 million tons) and China (147 million tons), sub-Saharan Africa (26 million tons), and the Americas (4.2 million tons).
- Fragrant rice is estimated to account for 15-18 percent of the rice trade, procuring the highest prices on the world market. Fragrant rice is priced on the trade market at \$1,100 /T or more, whereas coarse rice is \$440 - 580/T (FAO, 2012).

## Regional Demand

- Thailand and Vietnam will remain the region’s surplus producer
- Cambodia is not competitive in the regional white rice market, though some Cambodian premium rice is sold as paddy, milled in Vietnam but marketed as fragrant.

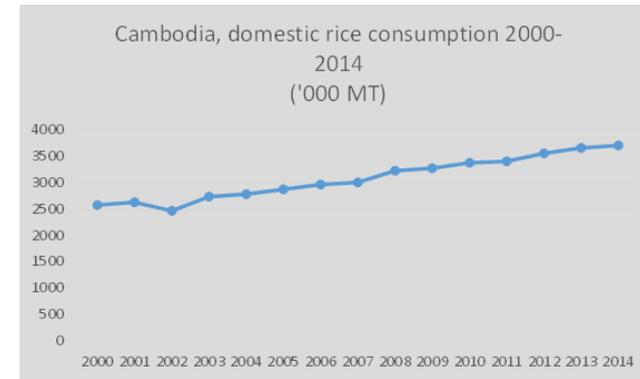
## National Demand

- Population growth (1.8%) and urbanization (2.13% est.) will continue to drive an increase in domestic consumer demand for rice in Cambodia.
- National demand will continue to grow at a decreasing rate; consumer preference for white rice will remain strong.

## Household Demand

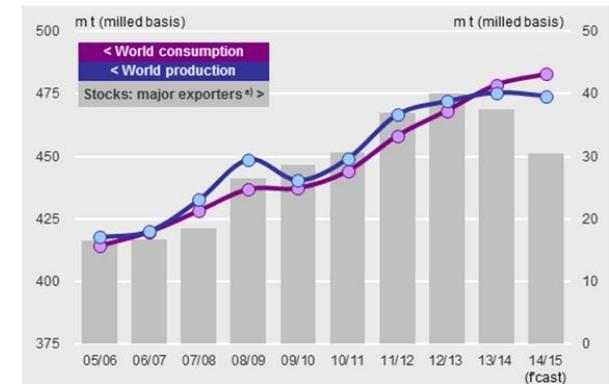
- Per capita rice consumption is estimated at 143-160 kg/capita/year (CGIAR, 2013 ). Per capita consumption will continue to rise slowly with population growth and continued poverty reduction.

**Figure 9: Cambodia, Domestic Rice Consumption 2000-2014**



Source: Derived from USDA FAS Ag Stats.

**Figure 10: World Consumption of Major Exporters**



Source: International Grains Council <http://www.igc.int/en/grainsupdate/sd.aspx?crop=Rice>

## Takeaways

- Global demand for rice will continue to rise.
- Global demand for premium aromatic varieties is growing faster than for white rice and pays a \$400-\$700/ton premium.
- Regional rice demand is growing but is primarily for white rice, which Cambodia does not have a competitive advantage in producing.
- Thailand and Vietnam will continue to dominate regional market.
- National demand will continue to grow but at a decreasing rate; white rice will continue to dominate consumer preference.

## 2.2 Commodity Description – Production and Consumption

- Rice production has significantly increased to 9.38 million tons in 2014, compared to 1.71 million tons in 1980. The average yield increased also from 1.8 ton per ha in 1980 to 3.16 tons per ha in 2014.
- The total cultivated land was 2.96 million ha (2.48 million ha cultivated during the wet season and 0.48 million ha in the dry season).
- Total production of 2014 was 9,389,961 tons: 7,271,251 tons were produced in the wet season and 2,118,710 tons were produced in the dry season (MAFF, 2013-2014).
- Milled rice was estimated as 64 percent of total rice production.
- Post-harvest loss and portions that farmers keep for seed account for another 13 percent of total rice production (MAFF, 2013-2014). In 2013, Cambodia has a paddy rice surplus of 4.82 tons or equivalent to 3.09 million tons of milled rice, up 1.96 percent from 2012.

### Takeaway

A 24-50 percent increase in Cambodian rice productivity can come from increased farm productivity from improved seed and compliance with GAP.

**Table 5: Rice Production by Province (Provinces with more than 100,000ha cultivated)**

Province	Cultivated Area (ha)	Harvested Area (ha)	Yield (tons/ha)	Production (tons)
Banteay Meanchey	243,030	218,743	2.87	628,869
Battambang	307,575	280,634	2.84	795,611
Kampong Cham	221,388	219,593	3.55	780,282
Kpg Chhnang	156,217	154,363	3.31	511,458
Kpg Speu	116,274	116,269	3.07	357,370
Kpg Thom	256,731	251,630	2.75	691,389
Kampot	144,810	144,810	3.14	454,245
Kandal	106,168	105,919	3.76	398,376
Prey Veng	372,095	371,092	3.40	1,260,911
Pursat	120,746	114,416	3.41	389,612
Siem Reap	202,285	197,105	2.84	560,109
Svay Rieng	186,971	186,713	2.89	560,202
Takeo	298,098	298,098	3.90	1,161,479
<b>Total</b>	<b>3,052,420</b>	<b>2,968,967</b>	<b>3.16</b>	<b>9,389,961</b>

Source: MAFF Statistics 2013-2014

**Table 6: Rice Food Balance by Province (Provinces with more than 100,000ha cultivated)**

Province	Population (persons)	Production (tons)	Seed saved & Post harvest losses (13%) (tons)	Remaining Paddy for Consumption (tons)	Converted to Milled Rice (64%) (tons)	Food requirement per year (tons)	Milled rice balance (surplus in tons)
Banteay Meanchey	740,294	628,869	81,753	547,116	350,154	105,862	244,292
Battambang	1,141,085	795,611	103,429	692,181	422,996	163,175	279,821
Kampong Cham	1,773,038	780,282	101,437	678,845	434,461	253,544	180,917
Kpg Chhnang	533,928	511,458	66,490	444,968	284,780	76,352	208,428
Kpg Speu	763,397	357,370	46,458	310,912	198,984	109,166	89,818
Kpg Thom	702,772	691,389	89,881	601,508	384,965	100,496	284,469
Kampot	616,816	454,245	59,052	395,965	252,924	88,205	164,719
Kandal	1,120,987	398,376	51,789	346,587	221,816	160,301	61,515
Prey Veng	1,202,893	1,260,911	163,918	1,096,992	702,075	172,014	530,061
Pursat	443,655	389,612	50,650	338,963	216,936	63,443	153,494
Siem Reap	928,335	560,109	72,814	487,295	311,869	132,752	179,117
Svay Rieng	599,260	560,202	70,096	469,106	300,228	85,694	214,534
Takeo	939,809	1,161,479	150,992	1,010,487	646,712	143,393	512,319
<b>Total</b>	<b>14,950,196</b>	<b>9,389,961</b>	<b>1,220,695</b>	<b>8,169,226</b>	<b>5,228,330</b>	<b>2,137,878</b>	<b>3,090,452</b>

Source: MAFF Statistics 2013-2014

**Figure 11: Paddy Yield by Country, MT/Ha, Select Countries**

Paddy yield by Country, MT/Ha, Select Countries 2014 (USDA FAS)



# 2.2 Cambodia Rice Exports

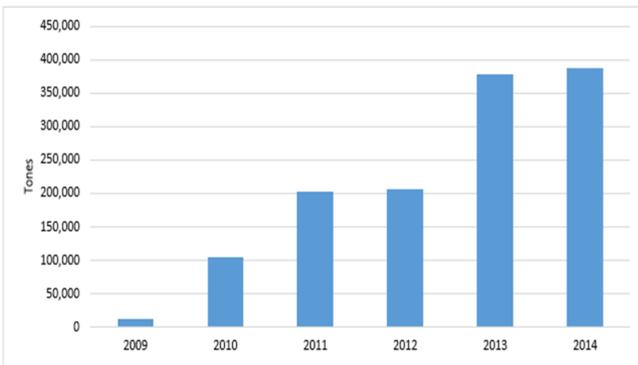
- The quantity of Cambodian rice exported has increased from 12,613 tons in 2009 to 387,061 tons in 2014, up 2.20 percent compared with 2013. The export destination is European Union (mainly France), ASEAN Member states (Thailand and Vietnam), and other destinations.
- Improvement in the quality of rice produced and greater production of fragrant (jasmine) rice for export has increased net sector income. In 2010, only 10 percent of exported rice from Cambodia was fragrant rice. In 2013, this value increased to 45 percent. The higher value fragrant rice is sold for US\$1,100/ton, while white rice is sold for only US\$440–580/ton (Giraud, 2013).
- The number of countries buying Cambodian rice increased from 35 in 2010 to 75 in 2013.

**Table 7: Types of Cambodian Rice Exported in 2014**

No	ប្រភេទអង្ករ (TYPE OF RICE)	បរិមាណសរុប/ភាគប្រភេទ (QUANTITY TOTAL/ MAIN TYPE)	តំលៃលើស (MTH./%)
1	អង្ករក្រអូបប្រុះ (FRAGRANT:Senkraob/Neangsauy/Others)	39,106.50	7,682.00
2	អង្ករក្រអូបឆាងផ្លែឆៃ (FRAGRANT NEANG MALIS)	19,432.30	2,058.00
3	អង្ករក្រអូបសូម៉ាលី (FRAGRANT SOMALY)	4,975.00	810.00
4	អង្ករក្រអូបផ្កាផ្កាស្រស់/ផ្កាដំបូល (JASMINE:PML/ PRD)	145,923.00	29,601.00
5	អង្ករក្រអូបសរវិក្កង (JASMINE ORGANIC RICE)	489.00	56.00
6	អង្ករក្រអូបប្រាក់ (PEARL FRAGRANT RICE)	668.00	48.00
7	អង្ករសច្រូចគ្រាប់វែង (LONG GRAIN WHITE)	135,226.00	157,417.00
8	អង្ករសប្រណីត (PREMIUM WHITE: GINGER/NEANG KHON)	22,191.00	1,069.00
9	អង្ករចំហុយគ្រាប់វែង (LONG GRAIN PABOILED)	19,050.00	549.00
<b>សរុប (TOTAL)</b>		<b>387,060.80</b>	<b>51,136.00</b>

Source: SOWS-REF report (2015)

**Figure 12: Quantity of Cambodian Rice Exported 2009 - 2014**



Source: SOWS-REF (2015)

**Table 8: Cambodian Weekly FOB Indication Price**

Cambodian Weekly FOB Indication price	
Week 9th: 23/02/15 -01/03/15	
FOB (USD per ton)	
<b>I. Cambodian Long Grain Fragrant</b>	
1.Premium Jasmine Rice 5% (Purity 90%)	790
2. Jasmine Rice 5% (Purity 85%)	770
3.Premium Sen Kra-Ob 5% (Purity 90%)	725
4.Sen Kra-Ob 5% (Purity 85%)	690
5.A1 Extra Super 100% Broken (Fragrant)	545
6.A1 Super 100% Broken (Fragrant)	465
<b>II. Cambodian Long Grain White Rice</b>	
7.Long Grain White Rice 5%	435
8.Long Grain White Rice 10%	430
9.A1 Super 100% Broken (LGWR)	360
<b>III. Cambodian Parboiled Rice</b>	
10.Parboiled Rice 5% Broken	500

**Parboiled Rice** Parboiled rice is currently 5.5 percent of Cambodia’s rice exports. Parboiled, or converted, rice is soaked and steamed at the harvest stage before drying. As a result 80 percent of the nutrients in the rice bran move into the rice grain. Rice is then milled and polished as usual, resulting in a highly nutritious, translucent grain. Parboiled rice is a good source of fiber, calcium, potassium, and several B vitamins. Milling parboiled rice results in fewer broken grains. Parboiling is commonly practiced in most of South Asia and parts of Africa as well as Europe and the United States.

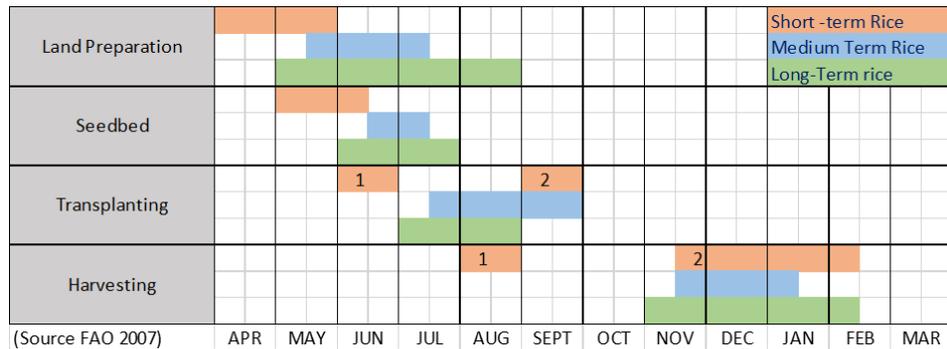


Photo credit from Fotolia.com

# 2.2 Rice Farming Systems

- Rainfed lowlands will continue to be the major rice system in Cambodia, susceptible to drought and flood.
- Paddy varieties are classified by days to maturity.
  - Short-term rice: Growing cycle is 90 days; mostly farmers grow twice a year. The first growing is planted in June and harvested in August, and the second growing starts planting in September and is harvested in November.
  - Medium-term rice: Growing cycle is 120 days. Farmers start planting in the middle of July and harvest in the second week of November.
  - Long-term rice: Growing cycle is 180 days. Farmers start planting in July and harvest in November. This is the most commonly grown in rainy season.
- Shorter maturity Jasmine varieties tend to be less aromatic than the longer season varieties. Cambodia must be able to certify new short term varieties with greater aromatic characteristics to remain competitive (Giraud, 2013).
- In the short term, 40-60 percent yield increases are possible through increased intensification and adherence to GAP.
- Small holder ability to intensify production through varietal control, higher and better timed use of inputs requires capital and better extension services. Weak linkages among producers, input suppliers, and millers is the biggest constraint to smallholder intensification.
- Contract production models in which millers pre-finance inputs and provide extension are emerging with donor support but with initially mixed results. (USAID, AFD, IFC)

**Table 9: Land Preparation, Seedbed, Transplanting and Harvesting**



(Source FAO 2007)

**Table 10: AQIP Seed Rice Varieties and Characteristics**

	Variety	Non Photo Period Sensitive	Photo Period Sensitive	Aromatic	Non-Aromatic	Maturity			Yield Potential t/ha
						Early	Medium	Late	
1	IR 66	X			X	X			4.0-6.5
2	Chul'sa	X			X	X			4.0-6.0
3	Rumpe	X			X	X			4.0-6.0
4	Sen Pidor	X		X		X			4.0-6.0
5	Malis Sral	X		X		X			3.0-5.0
6	Somaly Sral	X		X		X			3.0-5.0
7	Phka Romdoul (Neang Malis)		X	X			X		3.5-5.5
8	Phka RomChang		X	X			X		3.0-5.0
9	Phka Rom Chek		X	X			X		3.0-5.0
10	Phka Khney		X		X		X		2.5-4.5
11	CAR 1		X		X		X		2.5-4.0
12	CAR 2		X		X		X		2.5-4.0
13	CAR 3		X		X		X		2.5-4.5
14	CAR 11		X		X		X		2.5-4.5
15	CAR 4		X		X			X	2.5-5.0
16	CAR 6		X		X			X	2.5-5.0
17	CAR 13		X		X			X	2.5-4.5
18	R. Chey		X		X			X	3.5-5.5
19	Neang Khun		X		X			X	3.0-5.0

Source: AQIP Seed Company 2008

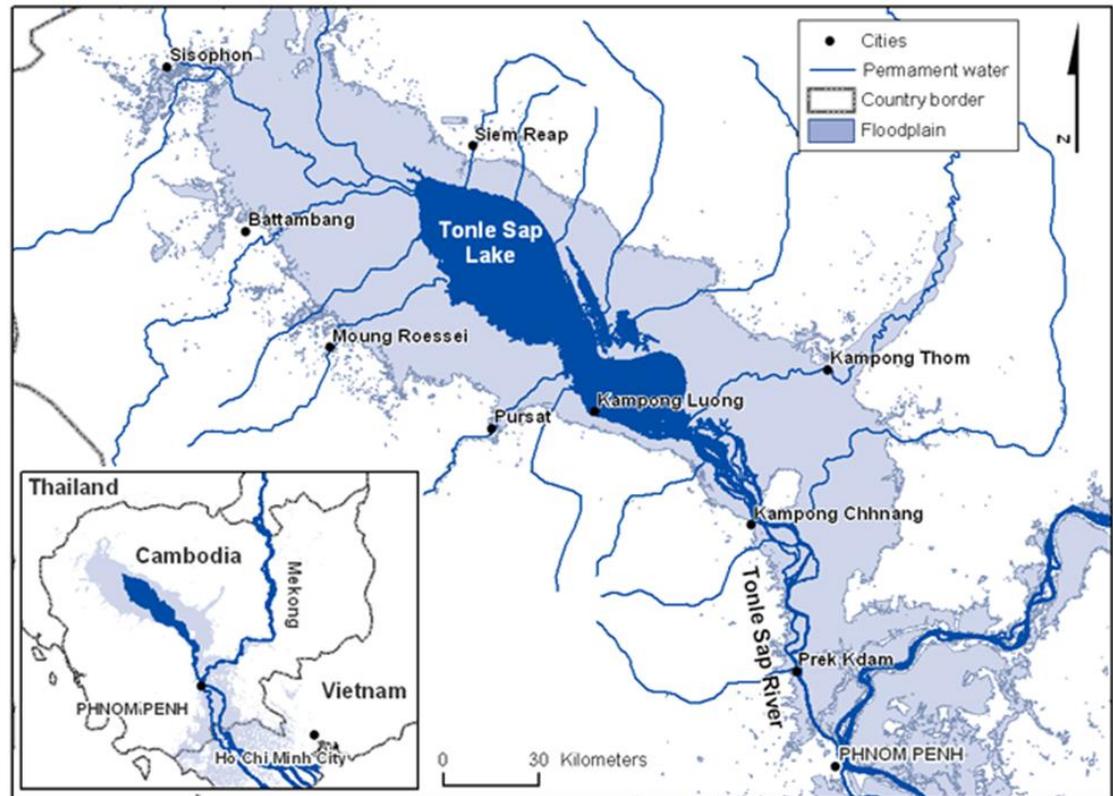
**Takeaway**

- Increasing trust and pooling risk between growers, millers, and input providers and varietal selection and breeding is essential to sustained competitiveness in premium varieties.

## 2.2 Commodity Description – Irrigation

- There are 946 existing irrigation schemes that cover about 470,000 ha; approximately 250,000 ha (53 percent) received sufficient irrigation water to produce dry-season paddy. (World Bank, 2005).
- With year-round water access, farmers can grow two or three crops per year doubling or tripling production compared with non- or poorly irrigated systems (Hossain, 2002).
- Cambodia practices double cropping of rice which, according to FAO (Crowley et al., 2011NRL, 2008), accounted for 58 percent of the total land area and 60 percent of the total area for irrigated crops. The total irrigated area of rice is 313,000 ha and 319,000 ha are irrigated crops (FAO, NRL, 2008).
- The main rice growing areas are the area surrounding the Tonle Sap and the Mekong Basin, which are the main water resources in the country (Bunthan, 2007) (Figure 9).
- Most rice is produced without irrigation during the wet season or during the end of the wet season and the beginning of the dry season in large areas where the water recedes, leaving considerable soil moisture (World Bank, 2005). (See annex 01: Inventory of irrigation systems in Cambodia 2007.)
- Most irrigated fields are flooded during the rainy season, preventing irrigated production at those times causing silting in irrigation canals when the floodwaters recede.

**Figure 13: Map of the Tonle Sap and Mekong River**



Source: Salidjanova, 2007

## 2.3 Factors Affecting Competitiveness

### Threats

- Transport costs from mill to port are 72 percent and 87 percent higher in Cambodia than in Thailand or Vietnam, respectively. Average milled rice to port charges are \$23/ton and \$25/ton in Vietnam and Thailand, respectively, and \$43/ton in Cambodia. (IFC, 2015).
- Rail transport would be cheaper but currently rail lines stop 100 meters from the port, necessitating a loading and unloading of trucks for the final 100 meters.
- Cambodian electricity costs are 40 percent higher than Thailand and 70 percent higher than Vietnam. Higher energy prices and frequent black-outs requiring diesel generators, make Cambodia paddy less competitive.
- Poor infrastructure within Cambodia— high-quality roads, bridges, and ports—inhibits the ease of trade flow (Baldwin et al., 2012). Even if that infrastructure was improved, rice exporters do not have access to enough shipping containers to export rice, as there are not enough containers coming into Cambodia.
- Rice millers experience insufficient access to finance (Hatsukano and Tanaka, 2014). Investment tends to be in mill upgrades, but this comes at the expense of short-term working capital. Thus, the mills of neighboring countries outcompete the local mills for access to the best-quality rice (Shean, 2010). Incentives for local investment and regulation of paddy rice trade across borders are topics of potential policy development.
- A fall in foreign demand and the liquidation of Thai stocks have depressed global prices, hurting Cambodian exports.
- Thai milled rice has a well-established reputation in the international market and has good distribution channels to end users. Many end users have recognized the high quality of Thai Jasmine rice and are willing to pay a premium for it.
- Thai fragrant rice dominates the market (8.5 million tons in 2013), and they are able to market their Jasmine brand well.

### Opportunities

- Cambodian paddy production is already sufficient to meet the one million ton goal. The challenge is to ensure that Cambodian paddy earns global price premiums for quality and fragrance.
- Cambodian rice is newly emerging in the international market.
- In last five years the rice milling industry has developed to include competitive modern mills with dryers, cleaners, whiteners, polishers, graders, color sorters, and digital packaging machines. Some mills have been certified as GMP and HACCP for food products.
- Cambodian rice earned a \$150 USD per premium for its fragrant rice exports to EU market over Thailand.
- Cambodian rice has long way to go to build their brand name, since costs are still high compared to its neighbors.
- Improvement in the quality of rice produced and greater production of fragrant (jasmine) rice for export has increased net sector income.
- In 2010, only 10 percent of exported rice from Cambodia was fragrant rice. In 2013, this value increased to 45 percent. The higher value fragrant rice is sold for US\$1,100/ton, while white rice is sold for only US\$440–580/t (Giraud, 2013).
- Cambodian rice has won the world's best quality rice award three times.
- Cambodian rice benefits from EBA tax-free imports to the EU.

“Thailand has dropped their prices substantially in order to export rice from their warehouses, and it affects our exports. Our members could not sell their milled rice.”  
-- Spokesman from Cambodia Rice Exporters

## 2.3 Mechanization of Paddy Production and GAP

- The costs of labor required for transplanting rice have risen as a result of alternative employment opportunities. As a result, direct-seeded rice via manual seed broadcasting has dramatically replaced transplanted rice in the lowland systems. Although seed broadcasting is rapid, easy to implement, low in labor costs, and provides quick rice establishment, significant limitations are experienced, including high seed rate, high losses to predation, and staggered crop emergence. Further issues are a high weed burden and uneven rice establishment due to poor land levelling and water management and non-uniform seedbed preparation.
- The number of two-wheel tractors (2WTs) in operation has increased markedly since the early 2000s, with a sharp rise observed over the past three years.
- Competition among equipment suppliers is already resulting in more services (after sales, services for hire) offered by equipment suppliers.
- Mechanized technologies combined with GAP have:
  - Reduced seeding rates from 200 to 400 kg/ha down to 50-80 kg/ha with mechanized row seeding, offering new opportunities to manage weeds in inter-rows
  - Significant productivity increases of 45–50 percent measured in the shift from double to triple cropping
  - Strengthening shift to mechanization primarily for seedbed preparation over the project period. In farmer focus discussion groups, 80 percent of farmers on average were found to use two-wheel tractors in the recession areas of Takeo province—with an early indication of significant farmer interest in mechanized drills for two-wheel tractors
  - Increase average crop yields by 775 kg/ha compared with conventional broadcasting seed demonstrated across 44 “farmer field schools”, from using quality seeds, improved land preparation, 15-day-old seedlings under line transplanting or DS drum seeding, fertilizer application based on soil tests, effective weed control, and integrated pest management.

Rice Transplanter



Source: Yanmar, [globalyanmar.com](http://globalyanmar.com)

### Takeaways

Cambodia's mechanization of rice production is in its early stages. Much inefficiency today arises from broadcast seeding technologies and the high labor costs of transplanting. Mechanical transplanters can reduce transplanting costs and, combined with best practice, can increase yields by 30-40 percent.

## 2.3 Rice - Competitive Benchmarking

### Bargaining power of suppliers

- Currently the government dominates the seed sector, a limiting factor both in demand driven research, varieties, and commercial development of supply.
- Limited access to quality controlled crop protection inputs due to questionable products crossing porous borders.
- Cambodia is vulnerable to new varieties of perfumed seed with shorter maturity and higher yields that minimize loss of aromatic characteristics.

### Threats of new entry

- The large premiums for fragrant varieties (\$400-\$600/ton) is a strong incentive for Vietnam to shift more of its production to these varieties.

### Bargaining power of customers

- Global demand for fragrant varieties is strong and growing. No one buyer is a price setter.
- Vietnamese traders are often able to offer Cambodian farmers a higher price for “white” rice (medium grained non-perfumed varieties).
- Local millers (n=+/-200) cannot set price.
- Millers who form backward linkages with growers will increase their operational efficiency.

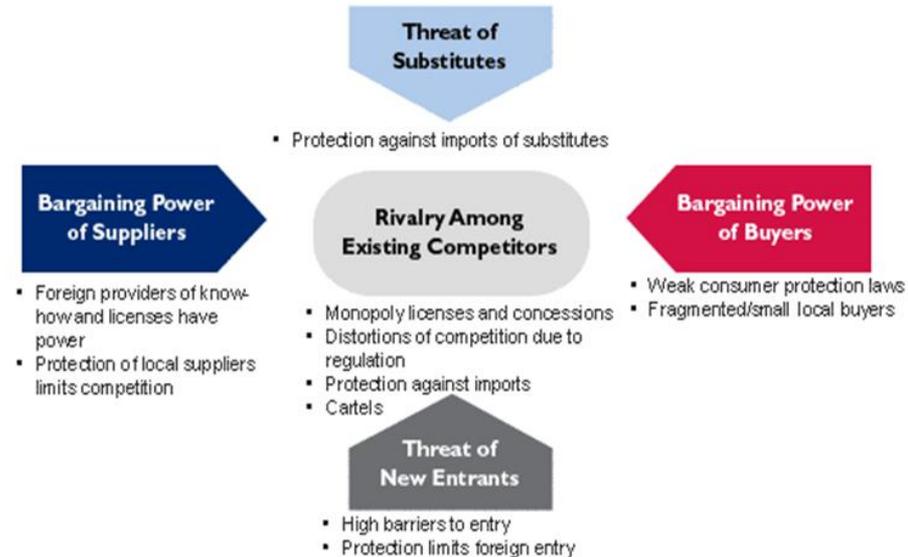
### Threat of substitutes

- Global demand for food starches continues to shift to rice.
- Price premiums for fragrant varieties continues to drive demand for more productive ones.

### Rivalry among existing competitors

- Thailand is the largest exporter; and can influence prices by holding or releasing stocks.
- Cambodian millers **who are** able to secure quality (aromatic varieties) and volume, from farmers will be more competitive.

Figure 14: End Market Analysis - Competitive Benchmarking



### Takeaways

- High energy, fuel, and infrastructure costs limit Cambodia's competitive advantage to premium quality aromatic rice varieties.
- \$400-\$600/ton premiums for fragrant varieties more than offset higher milling and transport costs.
- Public and NGO sector dominance of seed markets crowds out private investment.
- Farm productivity is about 40-60 percent of potential under GAP.
- In the longer term, Cambodia will have to continue to develop and or test and certify new aromatic varieties that are drought and floor resistant.

## 2.4 Value Chain Actors – Producer

Almost all Cambodian paddy farmers are small scale. The RGC classifies producers by size as follows:

- **Small farm:** Farmer normally has 0.5 to 1.5 hectare of rice cultivated land, and uses a small hand tractor. Small holders grow rice for their own consumption and sell any surplus, some 20- 30 percent to local or Vietnamese collectors. Small farms primarily use seed collected from the previous harvest, suffer from low levels of liquidity and produce primarily white rice, though an increasing number are switching to aromatic varieties due to the price premiums. While all size categories of rice farmers access credit, smaller farmers depend on informal sources, i.e., family or money lenders. Small farmers are more likely to hire tractor and harvesting services than to own their own equipment. When hiring equipment services smaller farmers have less control over when services are provided, resulting in lower yields and higher post-harvest losses.
- **Medium farm:** The farmer in this category has two-five hectares of land. Financially, they are able to manage getting inputs, through credit or selling production from wet season production. They use machinery by themselves or contract with service providers. Medium scale farmers have begun to upgrade, by renting or purchasing more land and investing more in to their rice farming operation.
- **Larger farm:** This farmer has five or more hectares of land. Larger farmers are more likely to perform additional functions in the supply chain including aggregation, tractor, harvesting, and milling services. Larger farmers are more likely to have access to formal sources of credit. These farmers sometimes lease their fields to small farmers. Many have tractors or combine harvesters. They may also provide contracted service with this machinery to other farmers in the area. They have ability to buy inputs in bulk or import some machine from Thailand.

- There is a correlation between family size , education, and farm size. Larger households have more off-farm income opportunities and sources of remittances to invest in purchasing or renting additional plots (extensification) and in purchasing more inputs (intensification).
- Women-headed paddy producing households tend to be smaller and more resources-constrained.
- In the past eight years there has been an almost total shift from manual and animal traction to mechanical traction as a result of labor shifts toward off-farm employment.
- Larger (medium and large) farms are more likely to engage in contract production with millers than small farmers, although this practice is still rare.
- No large scale commercial rice farms were identified, suggesting a significant land constraint, a policy constraint or both.
- Large commercial millers are not allowed to own and operate their own large plantations.
- As the shift toward more off-farm employment continues, we would expect to see an increase in average farm size from rental or purchase, though this was not evident from government statistics.



## 2.4 Value Chain Actors – Paddy Collector /Trader

- Mr. Sol is one of several collectors for a large trader in Battambang Province. His main goal is to secure volumes of rice from small farmers for his trader. To do so, he has a network of many agents that inform him about farmers' harvesting in various locations, in Pursat, Battambang, Siem Reap, and Kampong Thom province .
- Most of the collectors in his area own their own trucks (5 tons) for collecting and transporting paddy. His team has been working as collectors for 10 years, in **four** 4 different provinces and has close relationships with his farmers. He provides information to farmers on selecting good paddy (purity and variety) according to market demand. However he **cannot** can not help farmers in term of finance or with other extension services but he does pay cash on delivery for grower's paddy. Mr. Sol borrows from ACLIDA bank, or from PRASAC MFI at an interest rate of 1.7 percent monthly. On occasion he also gets credit from local money lenders with high interest rate of 30 percent in case of urgent need.
- Other than a small amount held for family consumption, farmers tend to sell surplus paddy immediately at harvest in order to repay debts. Some will store paddy at their house for later sale when they need money . Depending on the distance of farmers to mills, and the amount of rice they have for sale, farmers will sell to either collectors or transport their paddy directly to a miller.
- Paddy traders normally work closely with millers. For millers with dryers, traders will buy wet paddy. Millers instruct paddy **traders/collectors** trader/collectors on what quality and quantity they need and what price they offer. Paddy traders are significantly larger than paddy collectors and many use collectors to aggregate individual farm lots together. Some paddy traders are involved in the inter-provincial and **cross-border** cross border trade and have their own trucks .
- Traders and collectors operate at fairly tight margins (<10 percent) as there are few barriers to entry.
- Some traders own or rent a warehouse and will consolidate other traders' surpluses to get higher prices from selling to Vietnam and Thailand.
- Rice traders usually are involved in the trade of other goods and services, and also may be involved in other functions of the value chain such as farmer, collector, retailer, miller or wholesaler
- Domestic traders face steep competition from Vietnamese traders who can offer a higher price for white rice, taking advantage of Vietnam's lower milling and transport costs.



## 2.4 Value Chain Actors – Rice Miller

- Mr. Heng is a large-scale rice miller. He started his rice mill more than 20 years ago in Battambang province. He recently registered as an international trader, allowing him to export directly. His warehouse can stock 10,000 tons of paddy and rice and he has processing machines that do coloring, cleaning, and packaging. His mill operates 12 hours/day in low season and 22 hours in high season of rice production (15 tons/hour).
- He purchases paddy directly from growers, collectors, and traders, but he prefers purchasing from traders because of larger volumes.
- He additionally purchases partially milled rice from smaller mills that lack quality cleaners and color sorters that he will further polish and sort for both the domestic and export market.
- He encourages farmers to grow Mlis Sor because if it is pure, it brings a much higher price in the global market and provides seed quality checks but does not pre-finance inputs to farmers.
- The EU (70 percent of his product) and Russia are good markets for his rice due to Cambodia's tax-free export status.
- He sells the bulk of his product to exporters, but has recently started exporting his own brand as well. His company has won awards for the quality of their product.
- His mill employs 40 people year-round, 80 people in the high season. He has some trouble getting skilled machine operators.
- A few years ago, he paid \$200,000 for a gassifier to use his rice bran for power but his workers and family members complained of headaches and odors so he decided to sell it at a loss. Now he sells milled rice, whole and broken, the bran and rice flour.
- He cannot compete with Vietnamese buyers for white rice because value and margins are too low for more expensive Cambodian millers.
- Mr. Heng said that he tries to provide information to farmers about seed quality and planting techniques. He tells them that he will test their seed and tell them if it is good. He only buys rice that meets the purity standards for Mlis (85 percent pure and 13.5 moisture).

### Takeaways

- There are over 800 rice mills in Cambodia, 200 of which are medium or large scale.
- Small mills have < 5 tons/hour milling capacity; medium sized mills have a 5-10 tons/hour capacity; and large mills range from 12-80 tons/hour milling capacity.
- Most mills run at low operating efficiency (*(operating expense)/(net sales)*)
- Commercial mills do not produce their own paddy.
- The IFC is encouraging commercial mills to engage in seed production.
- Few mills have contract production agreements.
- A growing number of mills have HACCP and or ISO.
- Lack of liquidity to prefinance inputs to growers is a constraint to contract production.
- Milling costs are 40 percent higher; fuel costs and logistic costs are 60-80 percent higher for Cambodian mills (IFC).



## 2.4 Value Chain Actors – Exporters and Associations

- Cambodia has over 80 licensed exporters, some two dozen of which are large scale. These firms export milled rice to the EU, Russian Federation members, China, and Africa.
- Increasingly large millers with HACCP and ISO certification have begun direct exporting, though most still sell through large traders.
- Traders tend to contract for supply with a trusted network of primary and secondary millers. Secondary millers provide additional polishing, color sorting, and grading services that primary millers are unable to do.
- The biggest challenge expressed by traders is the difficulty in varietal and post-harvest control from their growers and or millers.
- The RGC policy goal of exporting one million tons of rice by 2015 resulted in favorable term for companies investing in large mills, currently running at low levels of capacity.
- Most exporters are members of the IFC-supported Cambodian Rice Exports Association and or the Cambodian Rice Federation.
- Much of the policy and advocacy functions by miller and exporters associations are backed by bi-lateral partners. Domestic actors may be cautious in pushing a particular agenda without the support of international partners for either cultural or political reasons
- Despite a significant disadvantage in milling and logistics costs, primarily affecting white rice to Vietnam, Cambodian exports benefit from an Import Duty exemption of 45-175 Euro/metric ton to select markets.
- Cambodian Rice Exporters efforts succeeded at obtaining “World’s Best Rice” recognition for Cambodian Fragrant rice for three years running.
- Large traders are aware of international market and miller requirements and only purchase paddy that meets them.

### Takeaways

Associations and federations Federations appear to be an effective entry point to introduce upgrading strategies for large millers to improve quality and volumes of fragrant rice, e.g.

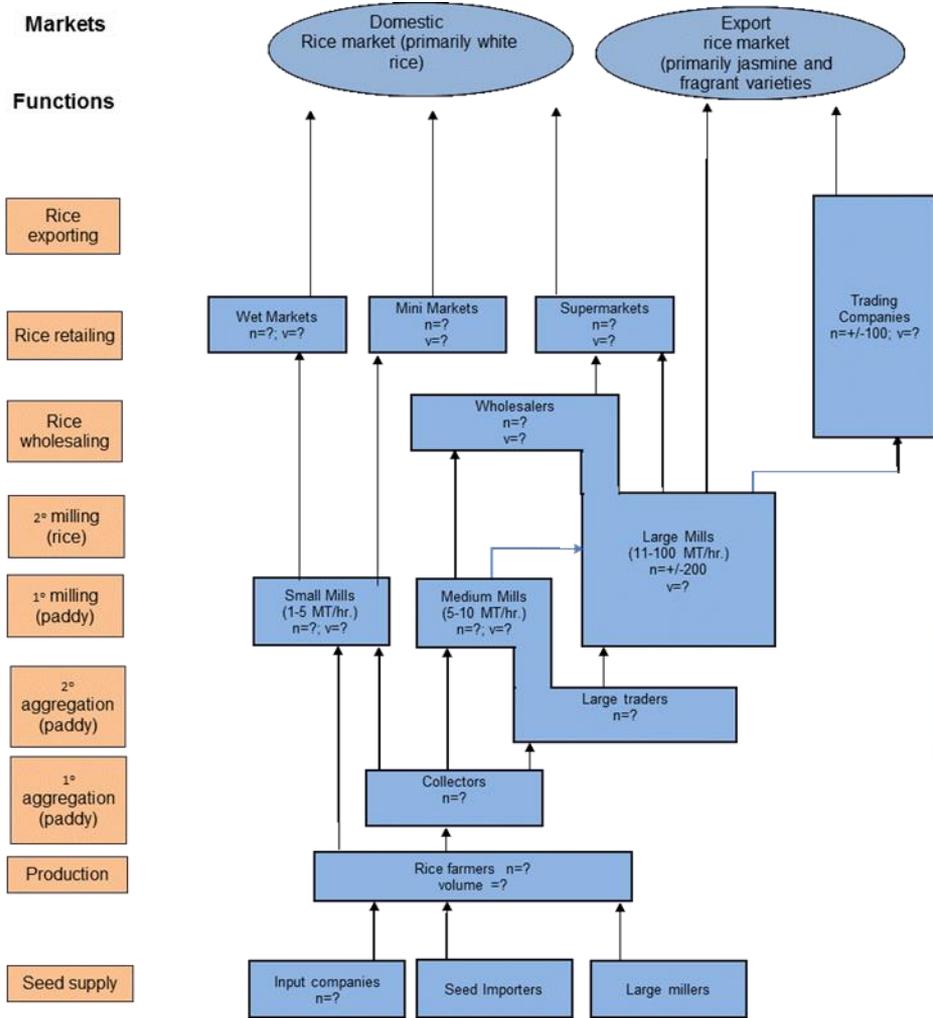
#### Examples include:

- Miller production of quality seed.
- Advocacy for greater private sector participation in the seed market.
- Introduction to best practices in contract farming systems that ensure win-wins between growers, millers, and input suppliers.
- Promotion of women in the equipment and extension services.



# 2.4 Rice Value Chain Map

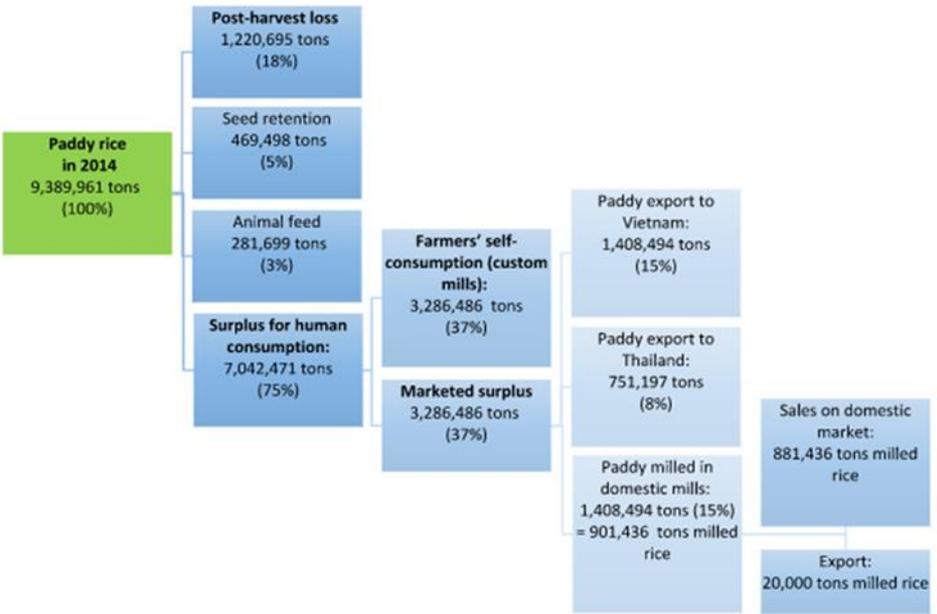
Figure 15: Value Chain Markets and Functions



### Takeaways

- Competitive advantage in premium quality perfumed varieties.
- Weak private participation in seed markets.
- Weak linkages between sector actors. Investing in strong and value-creating relationships.
- Strong private sector capacity to provide extension and input services.
- Contract production/outgrowers could drive investment in increased smallholder productivity.
- Low levels of operational efficiency of mills.

Figure 16: Estimate of Paddy exported to Thailand and Vietnam 2014/15



Source: USAID Cambodia, 2015 value chain analysis team

# 2.5 Challenges to Upgrading

## Short term

- Lack of quality seed supply and markets through which they can be made available to small holders.
- Low yields due to the lack of availability of quality inputs and the extension services to communicate and monitor GAP by small holder farmers.
- Low levels of trust and miller liquidity constraints hinder the emergence of sustainable contract farming systems with miller, input supplier, farmer, and financial institution participation.
- Poor control over paddy variety entering mills.
- Low operating efficiency of commercial mills.

## Medium term

- Working capital constraints need to be better understood through financial audits of mills.
- Consolidation of small rice farms into more economically viable units through sale or rental.
- Nascent capacity of value chain actors to advocate for more effective public investment and policies.
- Current policy constrains the emergence of large scale commercial rice farms and seed farms.
- Weak farm organization constrains use of larger equipment across multiple small plots.
- Lack of policies render the 2008 Seed Law ineffective.

## Longer term

- Continued investment in road infrastructure will reduce transport and logistics costs.
- Upgrading the rail-to-port facilities will increase the competitiveness of sea freight from Cambodia.
- Poor business and investment climate hinder innovation and investment.
- Irrigable land available for dry season production limits Cambodia's production capacity.

“Trust within all sectors — from farmers to millers and exporters — is not strong enough yet. . . . We have to figure out ways to make them trust each other. This is the main obstacle we are facing. When they have quality rice, they receive a good price. Low-end, long-grain white rice sells for \$250 to \$290 a ton; high-quality jasmine rice can go for as much as \$410 a ton.”

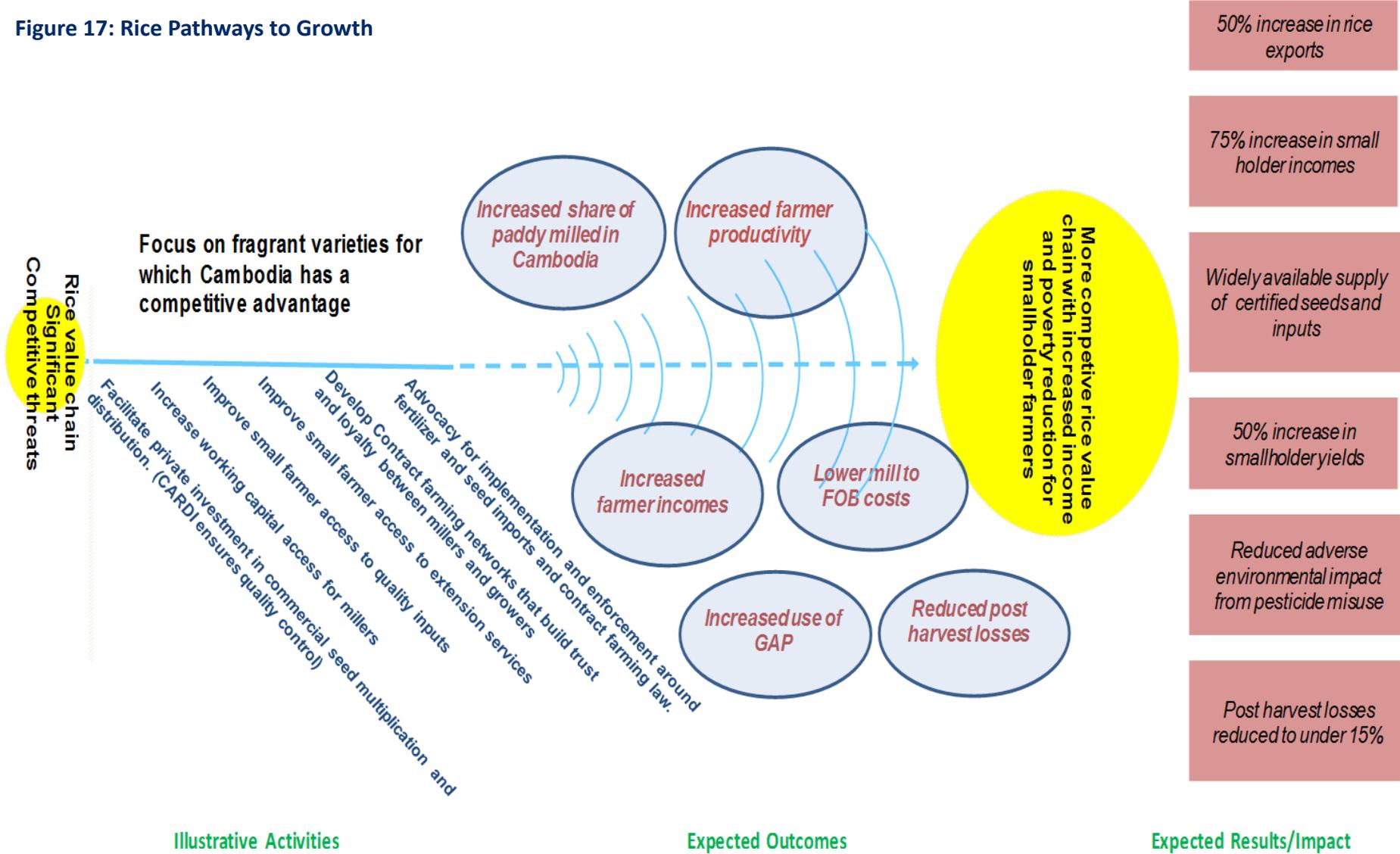
-- Sok Puthyvuth, President, Cambodia Rice Federation

## What's working well

- As crowding-in occurs in the inputs markets, some firms are offering extension and equipment services to farmers.
- Contract/outgrower systems are being tested in the rice sector.
- Some traders and collectors are beginning to invest in providing extension services and input financing.
- Access to formal sector finance is increasing.
- The shift to greater mechanization removes some of the gender-based constraints to women's participation in rice farming.

# 2.5 Rice Pathways to Growth

Figure 17: Rice Pathways to Growth



# Horticulture Value Chain Analysis

- 3.1 Rationale for Variety Selection
- 3.2 Commodity Description
- 3.3 Irrigation and GAP
- 3.4 End Market Analysis
- 3.5 Value Chain Map and Actors
- 3.6 Pathways for Growth



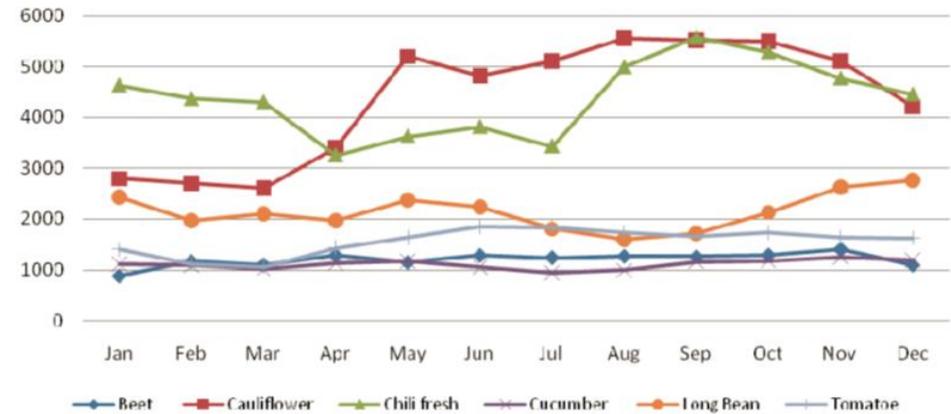
# 3.1 Rationale for Variety Selection

Cambodia's potential in an import substitution strategy should focus on what Cambodia can or could do better than its competitors. The characteristics are more important than the specific variety.

Characteristics of an import substitution strategy include:

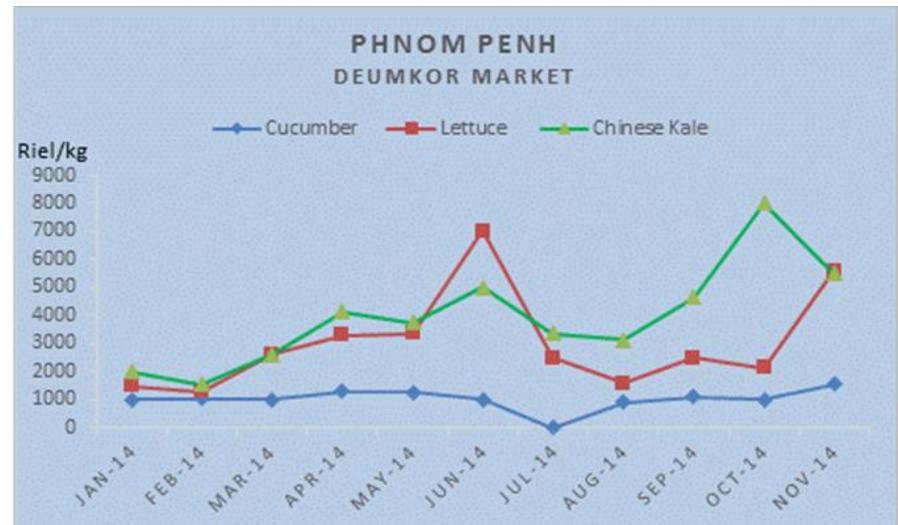
- Highly perishable (lettuces)
- Products with high seasonal price variance
- Products grown per strict adherence to GAP
- Medium level of management complexity (potential to scale-up with smallholder farmers)

**Figure 18: Monthly Fluctuation of Average Wholesale Price for Vegetable in BMC**



Source: USAID Cambodia, 2015 value chain analysis team

**Figure 19: Price Fluctuations of Three Vegetables, January to November 2014**



Source: USAID Cambodia, 2015 value chain analysis team



## 3.2 Commodity Description – Horticulture



Yard long bean is a popular vegetable in the market. It can be grown year-round but lower yields are common in the hot season based on the reliance of irrigated water. Yard long bean can be grown commercially in large plots sized more than 200 square meters ( $m^2$ ). There are problems related to yard long bean production, especially in the hot season such as pests and disease (aphids, leaf miners, thrips, and fungus). To overcome these challenges and to boost more income for farmers, improved proper growing techniques are required as they are with cucumber. Yard long bean can be harvested more than a month, but required more labor during harvest. The price at farm gate for collectors range from 1,500KHR/kg in cold season and 3,500KHR/kg in hot season. Normally, the fluctuation in price of yard long bean (minimum and maximum price) in the market varies between two to seven days. Collectors and wholesalers set the price at farm gates depending on whether there are more or less yard long beans in the market. (CADF, 2012)

Chili is a vegetable commonly used in the Cambodian diet. Chili can be cooked, dried, pickled, and eaten raw. Demand for chili is high especially during the hot season or for informal export to Thailand. The production of chili is best in the cold season from June to November, but it can grow year-round in small or large plots of land. Chili is tolerant to drought but not to pests (e.g., fungi, thrips, leaf hoppers, white flies). Seeds for several varieties (color, spicy taste, fruit size) can be found at district level input suppliers. Most of the improved hybrid seeds are from seed companies such as East-West Seed, Trang Nong Seed, Chia Thai Seed, and others. The main constraint for farmers to grow chili are labor costs. Normally, a worker can harvest around 15 to 20 kg of chili a day at a cost of 1,000KHR for 10kg chili for labor. The price of chili at the peak season is 4,000 to 5,000KHR per kg while it is 3,000KHR/kg in the cold season. Application of improved techniques such as drip irrigation systems, proper fertigation, and plastic mulching film can significantly increase yield/ $m^2$  for chili (CADF, 2012).



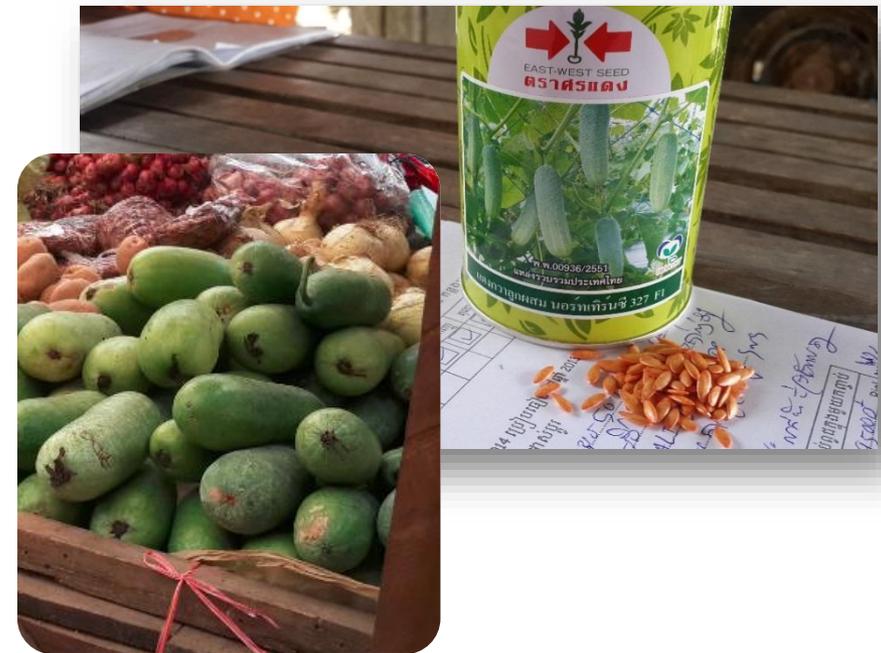
## 3.2 Commodity Description – Horticulture



### Lettuce

Generally grown as a hardy annual, lettuce is easily cultivated, although it requires relatively low temperatures to prevent it from flowering quickly. It can be plagued with numerous nutrient deficiencies, as well as insect and mammal pests and fungal and bacterial diseases. The lettuce plant can vary greatly in size, shape, and leaf type but generally, the leaves of the plant form a dense head or loose rosette. Lettuce plants can grow to a height of 30–100 centimeters (cm) (12–40 inches (in)) in height and are typically grown as an annual, harvested after only one growing season. The price at farm gate is over 5,000KHR/kg compared to a production cost of less than 150KHR/kg. The crop is highly perishable, so ready access to markets are necessary to make it a profitable crop (CADF, 2012).

Wax gourd, also called Chinese watermelon (*Benincasa hispida*) or trailing fleshy vine, belongs to the gourd family (Cucurbitaceae) and is native to tropical Asia. It is grown in many warm countries for its edible fruits. A wax gourd has solitary yellow flowers eight to 10 cm (3 to 4 in) wide, hairy oval leaves that are heart-shaped at the base, and a melon-shaped or cucumber-shaped fruit up to 40 cm long. Each hairy green fruit has a whitish, waxy covering and contains flat seeds about one cm long. The price at farm gate is about 2,000KHR/kg compared to a production cost of less than 200KHR/kg (CADF, 2012).

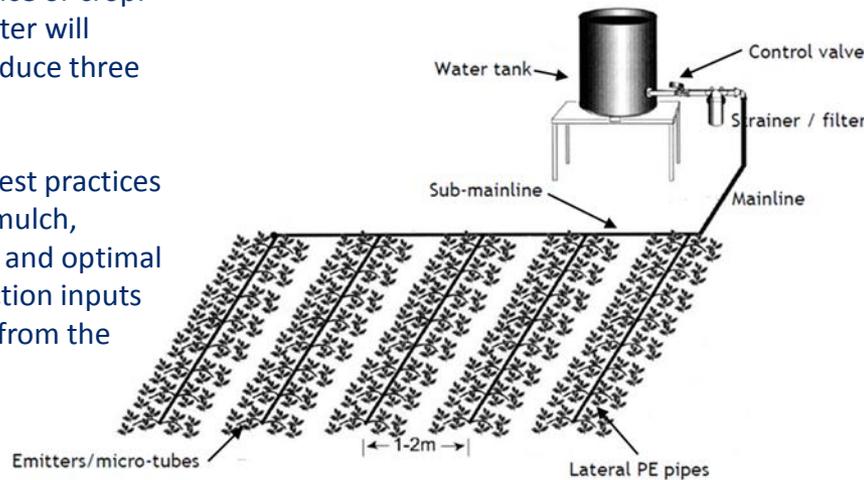


# 3.3 Irrigation and Good Agricultural Practices (GAP)

## Water

- With access to water during the dry season, a smallholder farmer should be able to earn a gross margin of between \$300-\$500/ 1,000m<sup>2</sup>, with no other change in practice or crop. Access to permanent water will enable him or her to produce three crops annually.
- Farmers who integrate best practices around plastic or green mulch, proper spacing, trellises, and optimal fertilizer and crop protection inputs can earn \$1,500-\$2,000 from the same 1,000m<sup>2</sup> parcel.

Figure 20: Drip Irrigation System



Source: Sustainable Sanitation and Water Management (SSWM), 2014

- Good agricultural practices are "practices that address environmental, economic and social sustainability for on-farm processes, and result in safe and quality food and non-food agricultural products"( FAO 2002).
- GAP codes, standards, and regulations are guidelines that have been developed in recent years by the food industry, producers' organizations, governments, and NGOs, aiming to codify agricultural practices at the farm level for a range of commodities.
- ASEAN GAP was launched in 2006 as a standard for good agricultural practices during the production, harvesting, and post-harvest handling of fresh fruits and vegetables in the ASEAN region. The purpose of ASEAN GAP is to enhance the harmonization of national GAP programs within the ASEAN region, enhance fruit and vegetable safety for consumers, improve the sustainability of natural resources, and facilitate the trade of fruits and vegetables regionally and internationally.
- Cambodia will need to comply with ASEAN GAP standards to realize the full economic benefits of the ASEAN Economic Community.



# 3.4 End Market Analysis

**Global Markets** do not represent a source of demand for Cambodian vegetable products despite Cambodia’s comparative (climate and infrastructure) advantage. Black pepper is an exception. With a dependence on imported vegetables, global markets might seem unimportant. Investment in export horticulture however often strengthens domestic demand for GAP-compliant products. Global exporters who contract with small farmers transfer GAP-compliant technologies to small farmers.

**Regional markets** will not drive upgrading in the Cambodian horticulture sector at this time. Those traders and collectors interviewed who operate on border routes indicated that there are informal exports from Cambodia. Quantities are small. High value exotic crops like black pepper are an exception but were not considered for this assessment.

**National markets** Cambodia needs between 420,000– 490,000 tons of vegetable production annually to feed the population. Currently the nation has to import around 114,000 tons more per year from or through neighboring Thailand and Vietnam. Cambodian consumers express a preference for Cambodian-produced vegetables and believe that domestically produced vegetables are safer due to lower chemical use. Import substitution strategies can succeed where Cambodia can compete in the products and seasonal production windows.

**Household Consumption** Per capita consumption of vegetables is estimated at 35kg per capita. This is well below the global average of 102 kg, with the highest level in Asia (116 kg), and the lowest levels in South America (48 kg) and Africa (52 kg). Rising incomes and increased consumer awareness could significantly increase current domestic demand.

The import substitution market is an enormous opportunity for Cambodian producers, as long as the substitution focus is on expanding production seasons and on high value and perishable crops.

**Tourism** Tourists are concerned about freshness and safety of the food they consume. Restaurant and hotel managers in Phnom Penh stated they would promote the safety aspects of food, if they could reliably source food grown according to GAP standards. Tourist demand for vegetables is in the range of 1,000-1,500 tons annually.

- The traders interviewed listed the characteristics most important to them in their purchasing decisions. These included:
1. Customer requests
  2. Price
  3. Freshness
  4. Ability to secure sufficient volumes
  5. Appearance



# 3.4 End Market Analysis – Competitive Benchmarking

## Bargaining power of suppliers

- Commercial horticulture is highly dependent on imported inputs from or through Vietnam and Thailand as well as seed from Europe.
- Competition is increasing in the inputs sector with the recent emergence of formal sector input companies.
- Competition among input suppliers is primarily on price and less on quality and services.

## Threats of new entry

- Demand far exceeds supply (70 percent imports). In the short term, increased local supply is unlikely to threaten current importers.
- Large trader importers do have the market power to retaliate (dumping) from Vietnam but dumping is difficult with a fresh and highly perishable product.
- Consumer demand for local and safe products remains an unmet market as local buyers cannot secure sufficient product quality and volumes.

## Bargaining power of customers

- Traders and retailers have difficulty securing local product despite demand.
- Lack of enforceable standards constrain the buyer's ability to secure a "safe" and local product.

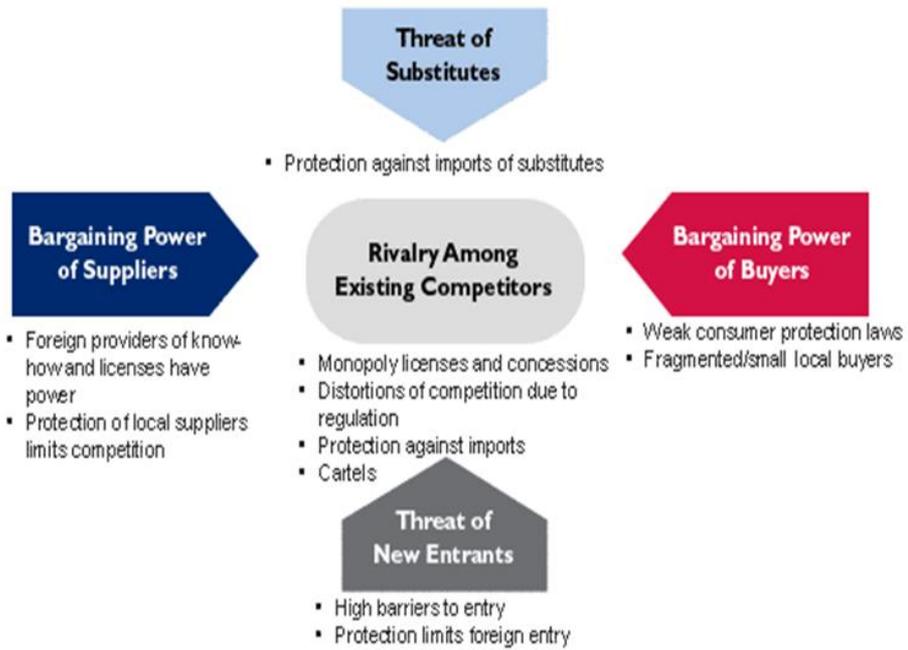
## Threat of substitutes

- Competitive pressure is very high for horticulture products that can be supplied in volumes from Thailand and Vietnam.
- Domestic actors who can document GAP and extend production seasons can easily capture premiums.

## Rivalry among existing competitors

- Local firms largely compete for the bottom of the market; no quality differentiation.
- Premiums accrue to value chain actors who can deliver "safe" food and extend the growing season.

Figure 21: End Market Analysis – Competitive Benchmarking



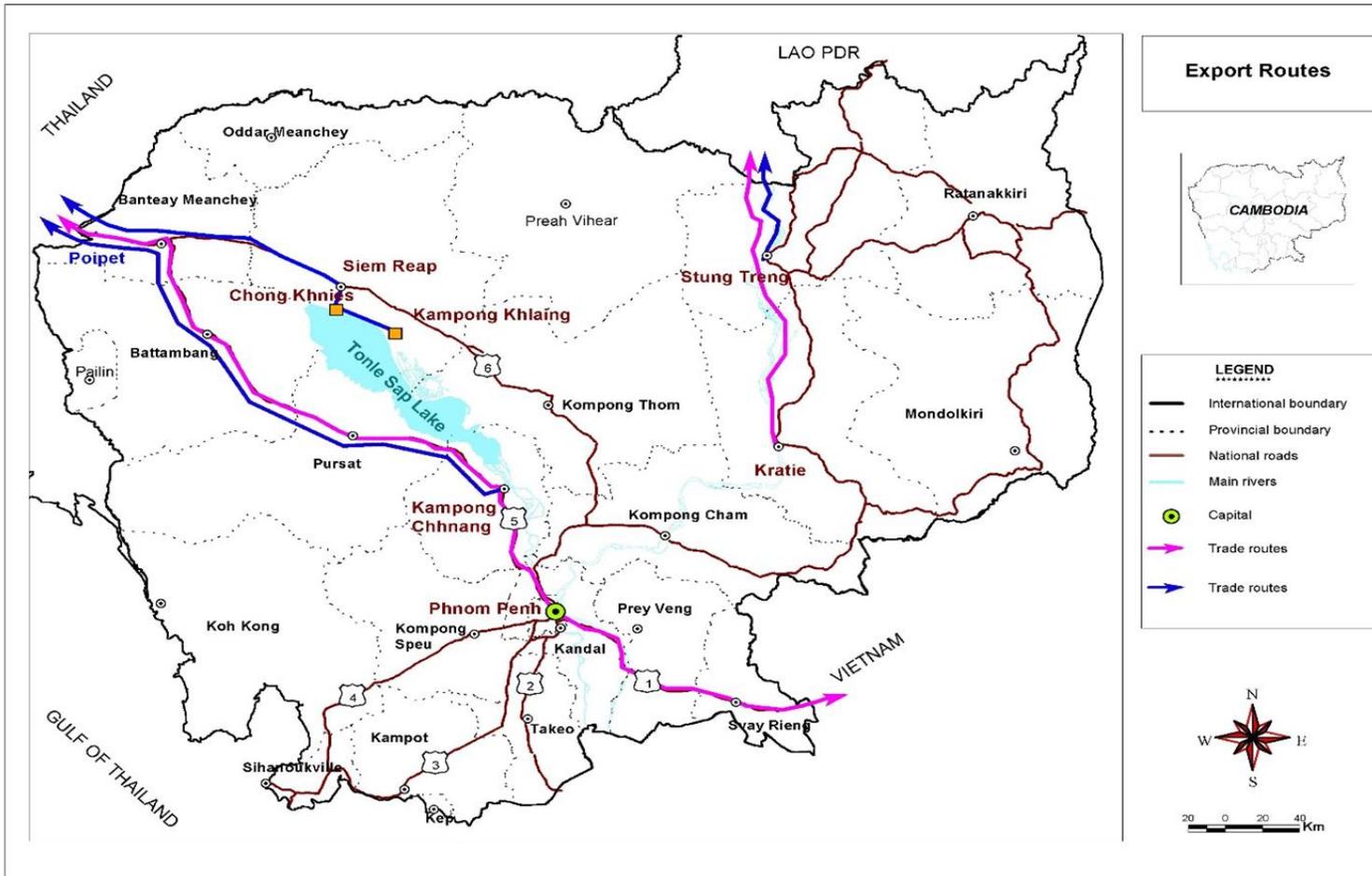
Source: Microlinks 2015

## Takeaways

- Strengthening the commercial higher end of the horticulture sector will generate demand for local input providers (seed, fertilizer, high quality crop protection inputs, and extension services) as well as labor-saving equipment.
- There is an opportunity for branding Cambodian "safe" around GAP and HACCP practices.
- Large commercial horticultural exporters selling into the higher end of EU and U.S. markets could drive upgrading in the horticulture sector through better services and increasing consumer awareness of "safe" food.

# 3.4 End Market Analysis – Vegetable Trade Flow Map

Figure 22: Cambodia Export Routes



**Principal trade routes**  
Thailand-Phnom Penh-Vietnam is the principal trade route through Cambodia.

- Vegetable seed, fertilizer, and pesticide, as well as 70 percent of market vegetables enter Cambodia from both Thailand and Vietnam.
- Most of the trade is undocumented.
- The informality of most of the horticulture trade makes it impossible to enforce sanitary and phytosanitary standards for product moving across the borders.

**Phnom Penh** There have been airfreight exports of fresh vegetables from Phnom Penh but lack of standards and a HACCP compliant cold chain has eliminated most of this trade.

**Sihanoukville.** There are vegetable exports to the regional and global market but EU and U.S. bans on Cambodian vegetables for failure to comply with sanitary and phytosanitary issues have significantly reduced exports. Vietnamese traders in Bavet report that Cambodian vegetables are popular because they are seen as “safer” (Janssen, 2012).

## 3.5 Value Chain Actors – Producer



- Mr. Sros and his wife Hem live about five kilometers from Siem Reap town. They have four children who also help with farm labor. He grows morning glory (convolvulus), cabbage, dwarf broccoli, and mustard greens. Normally he grows vegetables from November to March. From April to May he does not grow because of poor water access and an increase in pests at that time of year. In the rainy season (June to October), it is hard to grow vegetables because some vegetables can be damaged by heavy rains, and also because of flooding.
- Mr. Sros learned to grow vegetables from his parents. He has been growing for five years. He prefers to grow varieties that are easy, fast-growing, and that do not require a large investment of capital or resources. He chooses vegetables that need less chemicals and pesticides.
- He pays for natural and chemical fertilizer and insecticide, but only uses a little bit. Inputs are readily available in the village. He works the farm with only himself and family members for labor, including irrigation of his fields. He doesn't have the money to buy machinery to make the work easier (such as a pump or sprayer).
- Usually collectors come to the farm gate to buy his vegetables. Sometimes the family takes produce to the market themselves. Retail sales are about 10 kg/day. Cabbage sells based on market demand. Normally, it is 1500KHR/kg, but if the market is flooded it is 600KHR/kg. Mr. Sros says that some farmers are discouraged about growing vegetables because the price is so variable.
- Mr. Sros does not expect to expand production as that would require investment in modern equipment, such as pumps. He does not have sufficient family labor to farm a larger plot.
- Mr. Sros thinks that everyone in the country should support the local vegetables, as well as support local farmers to get more income. He also thinks the government should help create a market for local vegetables so farmers can earn a living.

## 3.5 Value Chain Actors – Collector



- Mr. Phim is a vegetable collector. He collects vegetables from local farmers in Moung Russey District, and sells to the wholesaler in Battambang.
- Each day, about 1 p.m., he goes out to buy vegetables from the local farmers. He pays cash and looks for specific vegetables that his customers want.
- He has very close relationship with the farmers from whom he buys. He collects the same vegetables from the same farmers every day.
- He has a small truck that he bought with a loan from Aclida Bank. Usually he collects about 1.4 tons of vegetables: mostly cucumbers, long beans, and tomatoes. A lot of his buyers, such as retailers and wholesalers are in Battambang Market, but some of his customers aggregate produce to send on to Phnom Penh.
- There is stiff competition for quality vegetables. There is high demand, so some collectors offer a higher price to farmers than he can pay. He also has to pay a fee to the police each time he goes to Battambang.
- Sometimes the price fluctuates over the course of a day, especially if there is a glut in the market from imports. If the price has dropped from what he paid the farmers, he loses the difference.
- He thinks the government should take steps to reduce imports of vegetables from Vietnam. Local farmers need to be trained to produce more according to market demand, as well as be informed about the requirements and proper use of drugs or fertilizers, or chemical-free practices.

## 3.5 Value Chain Actors – Retailer

- Mrs. Khut is sells vegetables in Po Sala Market in Siem Reap. She has been in this business for more than five years. The vegetables she sells include: cauliflower, Chinese cabbage, other cabbages, leafy vegetables, and carrots. She tries to buy vegetables locally: cauliflower she gets from local farmers year-round near her village. She has close relationships with these growers who are her neighbors.
- She transports local vegetables herself by motorbike. She gets other vegetables from the wholesale market in Siem Reap.
- Everyday, she needs 300,000KHR (about \$75USD ) for working capital. Now, she says her business is not doing well. Some of her formerly loyal customers are going straight to the wholesaler because she does not have as much variety. Sometimes she cannot sell all of her products, so she puts the vegetables in a cold box with ice to sell the next day.
- She usually sells around 50kg/day. Now, she earns less and spends more than she used to because she has to pay rent for her market stall and daily informal fees. There are a lot of competitors, and she has to make sure her products are good quality. Local vegetables cost less than imported, but that is discouraging for the farmers, as they get less money.
- Mrs. Khut thinks the Government should promote chemical-free local vegetables.



## 3.5 Value Chain Actors – Wholesaler

- Mrs. Lim is a vegetable wholesaler in Siem Reap. She has been in the wholesaler business for over 10 years. Her family started this business with a loan of 600,000KHR(\$150 USD) from relatives for start-up capital. They made money selling vegetables and paid back the loan. She feels that her family of four has improved their living standard as a result of this business.
- Her vegetables are imported from Battambang, Banteay Meanchey, and Siem Reap, and some from Thailand and Vietnam. She works through a network of collectors. She works with a lot of suppliers. Margins are very small. She gives her customers/retailers two to three days credit. Some do not pay on time. The best-selling vegetables right now are cabbage of which she sells about 50 to 100 kg/day. Most retailers are in the wet market in Siem Reap.
- Sometimes vegetables are damaged in transit, so she loses money when that happens. She has to sell bad quality vegetables at a lower price. She also has to pay a daily informal fee and monthly market stall rental of 100,000KHR(\$25 USD).
- She tries to get vegetables as fresh as possible. She has built customer loyalty by taking off the weight of the leaves and weighing only the vegetable. She also throws in some chilis for free to build her customer base.
- Farmers do not have the resources to increase their production. Mrs. Lim thinks that NGOs and other institutions should support farmers, with seeds and technical expertise, to help keep people working in Cambodia rather than leaving for other countries.



## 3.5 Value Chain Actors – Organic Retailer

Natural Garden is a private company with two retail markets selling about two to three tons of fresh produce a day.

- They are adding four more retail outlets in Phnom Penh and one in Siem Reap.
- They expect to be retailing 10 tons of produce daily by the end of 2015.

Natural Garden started its first organic farm in 2008 and has been expanding since.

- They have one certified organic farm, and three others that have applied for certification from the Cambodian Organic Agricultural Association.
- They grow organic European vegetables for their retail shops.
- They target the tourist and other premium markets.

Safe and chemical-free vegetable wholesaler who:

- Contracts with farmers (70 percent women), farmer groups, and aggregators (either NGOs or agricultural cooperatives).
- Use Asian GAP standards.
- Sell wholesale to 85 hotels, restaurants, and supermarkets.
- Has farmers that cultivate between 300 to 500 m<sup>2</sup>.

Incomes for their farmers have gone from about \$75/year for vegetables to over \$500USD/year.

### Market Demand

- Customers are satisfied with the products they provide.
- They provide only about 12 percent of the total volume needed.
- They have started opening wholesale markets in Battambang and Kampong Cham in 2015.
- Demand for organic and chemical-free produce will not be met with expected expansion.
- Despite a number of other organic and chemical-free produce sellers, the chief competition is cheaper Vietnamese vegetables.

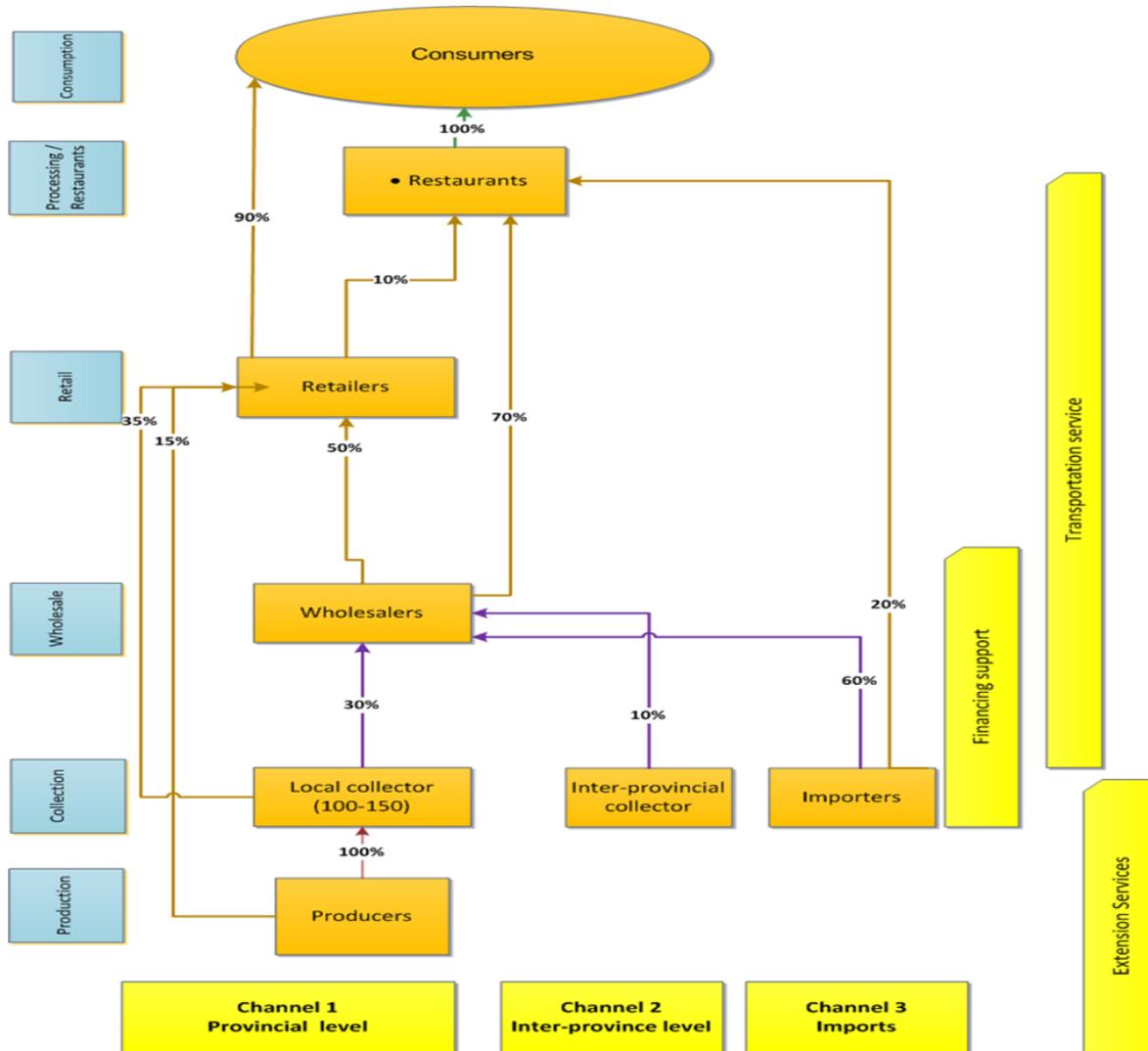
### Price Competitiveness

- Natural Garden serves as a distributor and wholesaler, cutting out middlemen to reduce costs.
- Natural Garden promotes technologies that save labor time for farmers (such as plastic mulching) reduces infrastructure costs (bamboo greenhouse construction).



# 3.5 Horticulture Value Chain Map

Figure 23: Horticulture Value Chain Map



## Key Horticulture Takeaways

- Roughly 70 percent of fresh vegetables and fruits in Cambodia are imported.
- Domestic producers have maintained, but have not increased, market share over time.
- Despite a good environment for the production and export of high-value horticulture products, we identified no large-scale producer/exporters.
- Cambodia's competitive advantage in horticulture is in the production of higher-value, more perishable products and from extending the production season.
- Relationships between value chain actors performing different functions are weak.
- There is very little embedded service delivery.
- Poor control over, and use of, inputs that arrive from or through Vietnam and Thailand makes it hard to optimize productivity and phytosanitary control.

## 3.6 Horticulture Pathways for Growth

### What you don't see can tell as much as what you do

Two things are notably absent from the Cambodian horticulture sector.

- The first is the almost complete absence of embedded service delivery between farmers, buyers, input companies, and financial institutions. Low levels of trust and difficulty in enforcing agreements discourage the development of services that could increase yields and quality (increasing competition in the inputs sector may help overcome this.)
- The second is the absence of high value horticulture producer/ exporters meeting global GAP and HACCP standards. In many emerging economies, a very small number of high value horticulture exporters can drive significant change by increasing the awareness of safe food and stimulating demand for better quality of inputs and equipment services(e.g., cut flowers in Ethiopia and vegetables in Kenya).

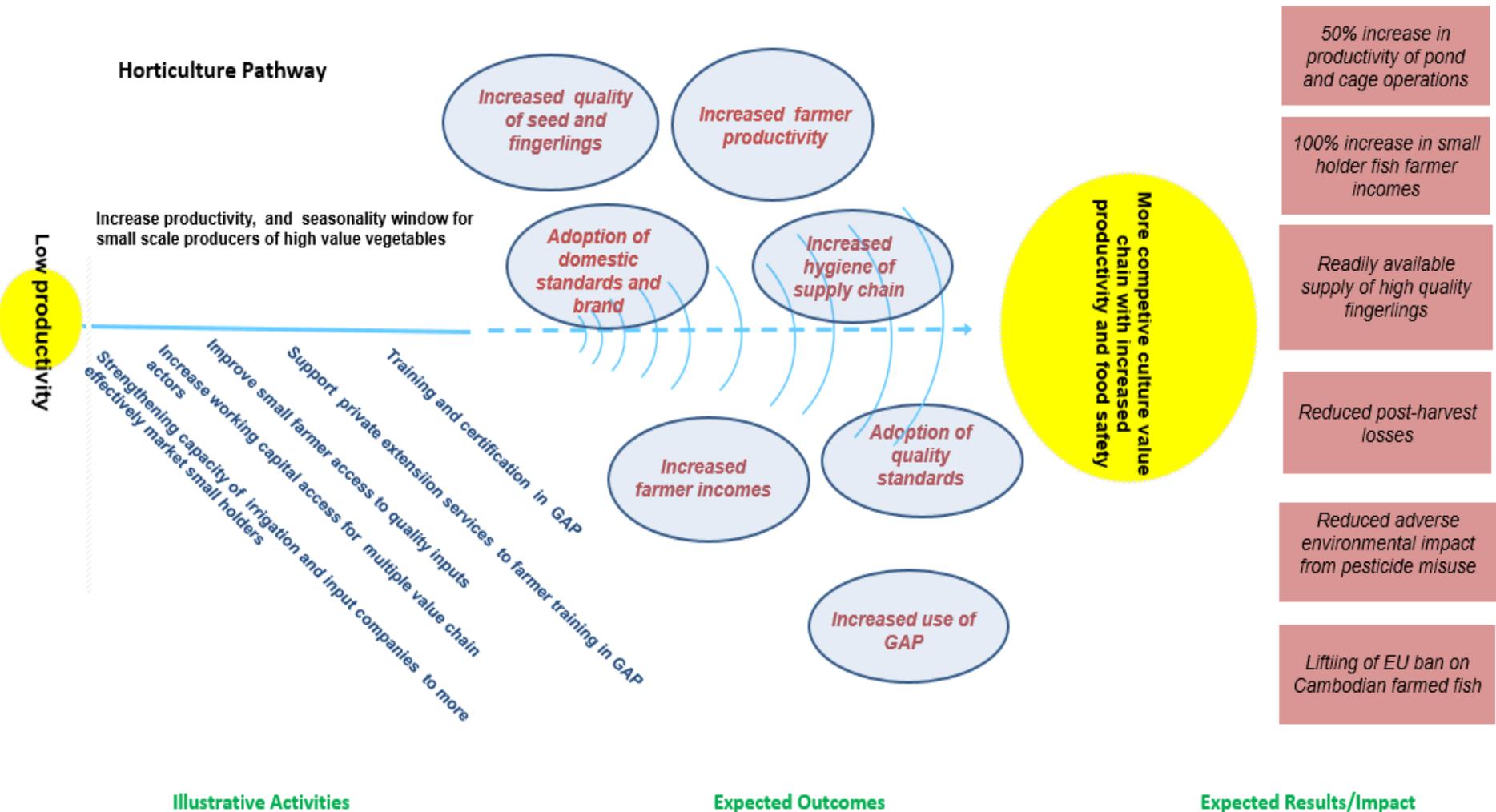
### Takeaways

- Cambodia has tremendous import substitution opportunities in:
  - Expanding production seasons
  - Focusing on perishable and high value crops
  - Adoption and certification of GAP
- Commercial scale production for export could be a “game changer” if export zones and clearer incentives were established.
- Extension and input service networks are just emerging.
- Contract production/outgrowers could drive investment in increased smallholder productivity.
- Investing in strong and value-creating relationships is as important as investment in technologies
- The horticulture landscape is dynamic and responsive to technical assistance.
- All horticulture producers would benefit from investments in commercial actors as better quality inputs and technologies become more widely available.



# 3.6 Horticulture Pathways for Growth

Figure 24: Horticulture Pathway



# Aquaculture Value Chain Analysis

- 4.1 Commodity Description
- 4.2 End Market Analysis
- 4.3 Value Chain Actors
- 4.4 Value Chain Map
- 4.5 Pathways for Growth



# 4.1 Commodity Description

- Pangasius (*Pangasianodon sp.*) is one of the intensive fish pond cultured species in Cambodia (So et al., 2005). Production of pangasius is predominantly from capture fisheries and has increased 2.6 times from an estimated 3,000 tons in 2004 to 8,000 tons in 2006 (FAO, 2008).
- The most important and highly profitable fish species in cage culture is the giant snakehead (*Channa Micropeltes*) (Trey Chhdaur in Khmer). Cultured snakeheads are imported from downstream areas of Vietnam in a small amount (Loc et al., 2007). According to Sinh and Chung (2010), 240 to 400 tons, was exported to Cambodia. Despite a ban on commercial snakehead, it remains widely popular and can be found in ponds, cages, landing sites, and restaurants



- Croaker (*Boesemania microlepis*) (Trey Promah in Khmer) are also important freshwater fish species with high commercial value in Cambodia.

**Table 11: Average Quantities of Fish Sold by Traders (ton/year), 2010**

Fish Species	Average	Min	Max
Pangasius (Pra)	18.8	1.1	171.0
Snakehead (Chhdaur/Ros)	18.8	0.2	224.6
Reddish (Kes)	12.7	0.1	60.0
Croaker (Pramah)	8.8	0.0	45.0
Henicorhynchus (Riel)	31.3	0.6	140.0
<b>All species</b>	<b>46.6</b>	<b>0.3</b>	<b>4,16.5</b>

**Table 12: Fresh Water Aquaculture Systems in Cambodia (Worldfish Center 2011)**

Fresh water Aquaculture systems in Cambodia (Worldfish Center 2011)				
Aquaculture System	Main species	Area (ha.)	Yield tons/ha/yr. or kg/m3/yr.	Estimated production, tons ('09)
Small holder low input systems	Tilapia and carp polyculture	0.02	3.5	2,750
	Pangas and carps polyculture	0.15	5.5	8,250
	Pangas monoculture	0.17	8.6	
SME scale ponds	Hybrid catfish	0.2	265	10,000
	Pangas	0.6	51	
	Snakehead	0.07	87	
Freshwater cages	Pangas polyculture			
	Pangas monoculture			
	Snakehead			
Rice-fish culture	Tilapia and Carps potential for FW prawn)	0.4	0.4	115
<b>Total (tons)</b>				<b>21,115</b>

# 4.1 Commodity Description – Aquaculture

## Cage Culture

- Cage culture represents about 70 percent of aquaculture production and the majority of aquaculture enterprises.
- There were approximately 4,492 cages (in 2004) located in the Cambodian Mekong basin, encompassing Tonle Sap Lake (42%), Tonle Sap (17%), the upper stretch of the Mekong River (19%), the lower stretch of the Mekong River (14%), and the Bassac River (7%) (So et al., 2005).
- Cage culture of snakehead has been banned since 2005 (due to concerns about over-exploitation of fingerlings but production remains widespread).
- Other cage species include *Channa micropeltas*, *Pangasionodon* (striped catfish), redbtail catfish, and tilapia.
- Cage sizes range from under 50m<sup>3</sup>- 540m<sup>3</sup> for catfish and 20m<sup>3</sup>-200m<sup>3</sup> for snakehead.
- Yields range from 30-90 kg/m<sup>3</sup> for striped catfish and 75-150 kg/m<sup>3</sup> for snakehead.
- Most cage culture is small scale and informal.

### Takeaways

- Net incomes from small holder cage culture are not sufficient to support significant investment.
- High returns from aquaculture (cage and pond) requires reliable access to high-quality inputs (fingerlings, feed, and veterinary supplies).

**Table 13: Aquaculture System**

Aquaculture System	Smallholder low input	Small holder high input			Small and Medium Enterprise			Fresh Water Cage	
	Tilapia and carp polyculture	Tilapia and carp polyculture	Pangas & carp Polyculture	Pangas mono-culture	Hybrid Catfish	Pangas	Snakehead	Pangas Poly-culture	Pangas
Parameter									
Average Farm Size pond (ha) & cages (m <sup>3</sup> )	0.02 3,500.00	0.15 5,500.00	0.17 8,600.00	0.10 20,000.00	0.20 265,000.00	0.60 51,000.00	0.07 87,000.00	240.00 35.00	240.00 35.00
Fish yield (kg/ha/yr or kg/m <sup>3</sup> /yr for cage)									
Production (kg/farm/yr)	70.00	825.00	1,462.00	2,000.00	53,000.00	30,600.00	6,090.00	8,456.00	8,496.00
Home consumption (%)	75.00	5.00	3.00	0.40	-	-	1.00	0.50	-
Labor requirement (person days/contract workers per farm)	40.00	15/1	66.00	87.00	534/4.2	880.00	150.00	635/2.4	883/1.6
Average selling price (USD)	1.50	1.75	1.50	1.20	1.25	1.20	2.10	1.50	1.50
Capital cost: (USD/farm/year)	175.00	900.00	508.00	1,000.00	1,733.00	2,760.00	3,460.00	6,948.00	7,920.00
Operational cost: (USD/farm/yr.	60.00	789.00	697.00	1,571.00	18,168.00	28,363.00	8,637.00	7,730.00	11,352.00
Net income (USD/farm/year and USD/ha/yr (m <sup>3</sup> cages)	38.00 1,900.00	522.00 3,480.00	1,235.00 7,266.00	792.00 7,925.00	17,044.00 85,221.00	8,356.00 13,928.00	3,416.00 48,809.00	4,942.00 21.00	1,392.00 6.00

## Pond Culture

- Pond culture represents about 30 percent of aquaculture production
- The number of ponds used rapidly increased from 3,455 in 1997 to 11,509 in 2004, representing a 43 percent increase. Pond culture production has increased at a rate of 26 percent per year since 1984 (So & Nao, 1999; FiA, 2005).
- Pond culture operators can be classified as smallholders (small and medium). We did not identify any large-scale pond operators.
- Smallholders range from low input use, using farm waste to feed fish and using captured eggs to raise fingerlings to farms using commercial feed, small fish, and purchasing pellet feed.
- Low input systems tend to produce carp and tilapia. More intensive systems use polyculture systems with catfish, croaker, and tilapia.
- Ponds range in size from a few hundred square meters to 10,000m<sup>2</sup>, averaging 2,500m<sup>2</sup>.
- Ethnic Vietnamese dominate this activity.

# 4.2 End Market Analysis – Aquaculture Demand

## Global Markets

- The global market for Aquaculture and Fisheries is projected to reach 188 million tons by 2020, driven by surging consumption of seafood in both the developed as well as developing regions and the continuous decline in natural fish stock.
- Global capture stocks are on the decline, increasing the importance of fish culture.
- Consumers worldwide are increasingly aware of and willing to pay premiums for "safe" food.
- Rising incomes increase demand for higher value varieties.
- Cambodian exports reached 17.6 billion in 2014.
- The absence of SPS standards in fish supply chains limits Cambodian exporters' access to premium export markets.

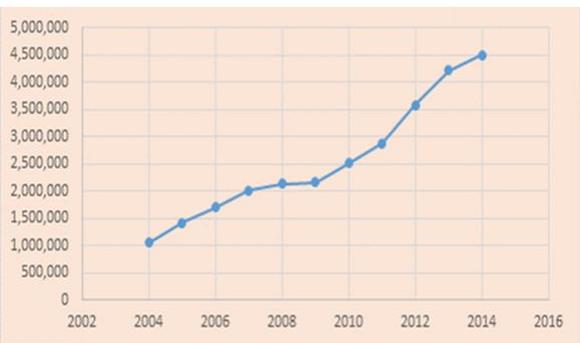
## Regional markets

- Gross Domestic Product growth exceeding 5 percent annually for 11 SE Asian economies
- By the year 2010, substantially more fish will be required to sustain the East Asian sub-region. Demand for fish will increase in both volume and on a per capita basis.

## National markets

- 2030 expected national demand indicate that aquaculture will need to supply between 106,000 tons and 281,000 tons.
- At current population growth (1.8%), population will double in 40 years. This will be slow-demand driver. Incomes that are increasing at a more rapid rate will be a bigger driver. As incomes rise, demand may begin to shift to premium varieties.
- Increased attention for safe food and emerging demand for sanitary and phytosanitary standards in aquaculture.

**Figure 25: Cambodia, Annual Number of Tourists**



Source: <http://www.cambodia-tourism.org/statistic/tourist-2004>

## Tourism

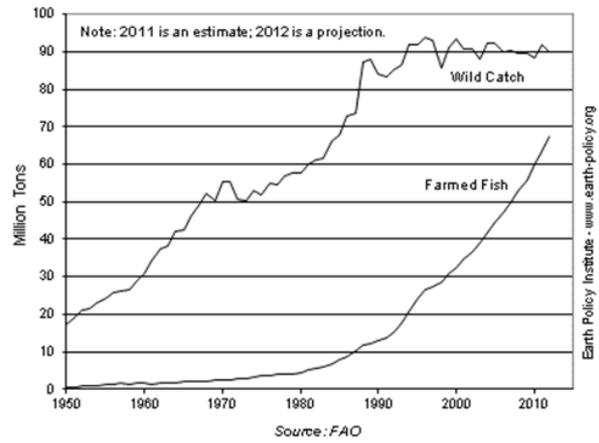
- One of the principal demand drivers for high value fish and seafood
- Phnom Penh, Siem Reap, and increasingly other tourist destinations demonstrate increased demand for premium varieties.

**Table 14: Major Importers of Cambodian Fish and Fish Products, (Billions USD)**

Major importers of Cambodian Fish and Fish products, (Billions USD)	
Hong Kong (3.1)	Nigeria (1.4)
Thailand (2.8)	Brazil (1.2)
Vietnam (2.4)	Malaysia (0.9)
Russia (2.4)	Australian (0.8)
Canada (1.9)	Singapore ((0.7

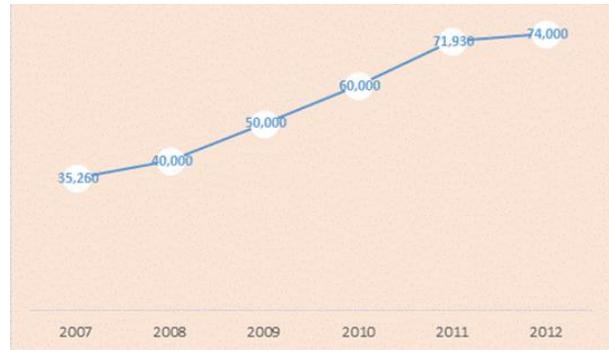
Source: Draft National Strategic Plan 2014

**Figure 26: World Wild Fish Catch and Farmed Fish Production, 1950-2012**



Source: FAO

**Figure 27: Cambodian Aquaculture Production (MT)**



Source: MAFF Fisheries Administration, Annual report 2012

# 4.2 Competitive Benchmarking – Aquaculture

## Bargaining power of suppliers

- Commercial aquaculture is highly dependent on imported inputs from Vietnam and Thailand.
- Veterinary supplies need to be imported.
- There are almost no domestic fish feed mills and extruders.
- Substantial volume discounts seem available favoring larger scale investment and formation of aquaculture associations
- Supplier concentration however is low.

## Threats of new entry

- Current demand exceeds supply, weakening new entry threats
- Possibility of retaliation (dumping) from Vietnam similar to what happened in the swine sector
- Vietnam fisheries are considered more efficient.
- There is higher end consumer demand for local and “safe” food that Vietnam and Thailand cannot meet.
- There are policy challenges to establishing local and “safe” fish supply chains.

## Bargaining power of customers

- Sector is too atomized for trader collusion
- Consumer demand for local and safe remains an unmet market
- Market is segmented by freshness and fish species

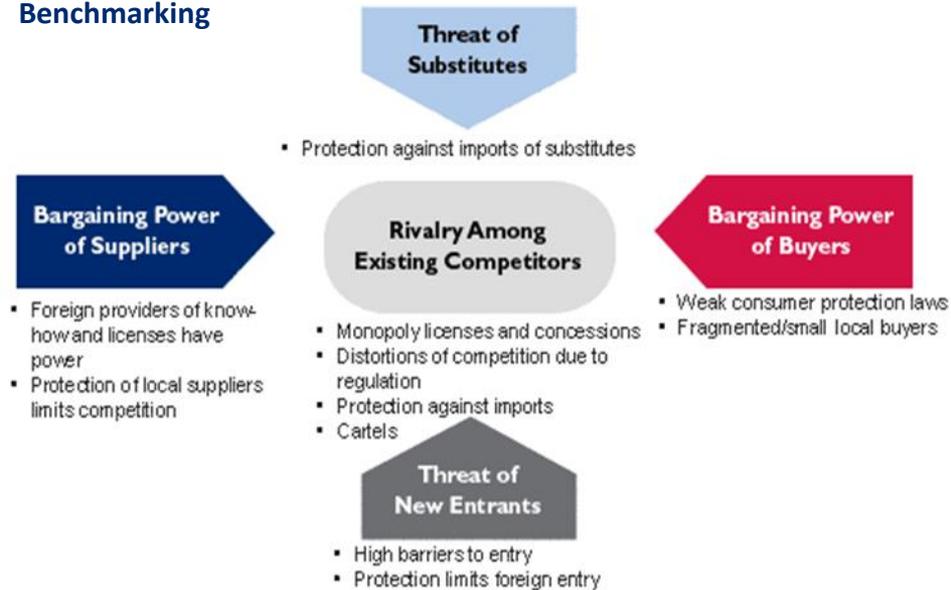
## Threat of substitutes

- Threat of substitutes remains strong unless local market “brands” itself for export and higher end markets
- There is some propensity to switch species based on availability, price, and perceived freshness

## Rivalry among existing competitors

- High end export oriented supply chain does not exist
- Local firms largely competing for the bottom of the market; no quality differentiation

Figure 28: End Market Analysis – Competitive Benchmarking

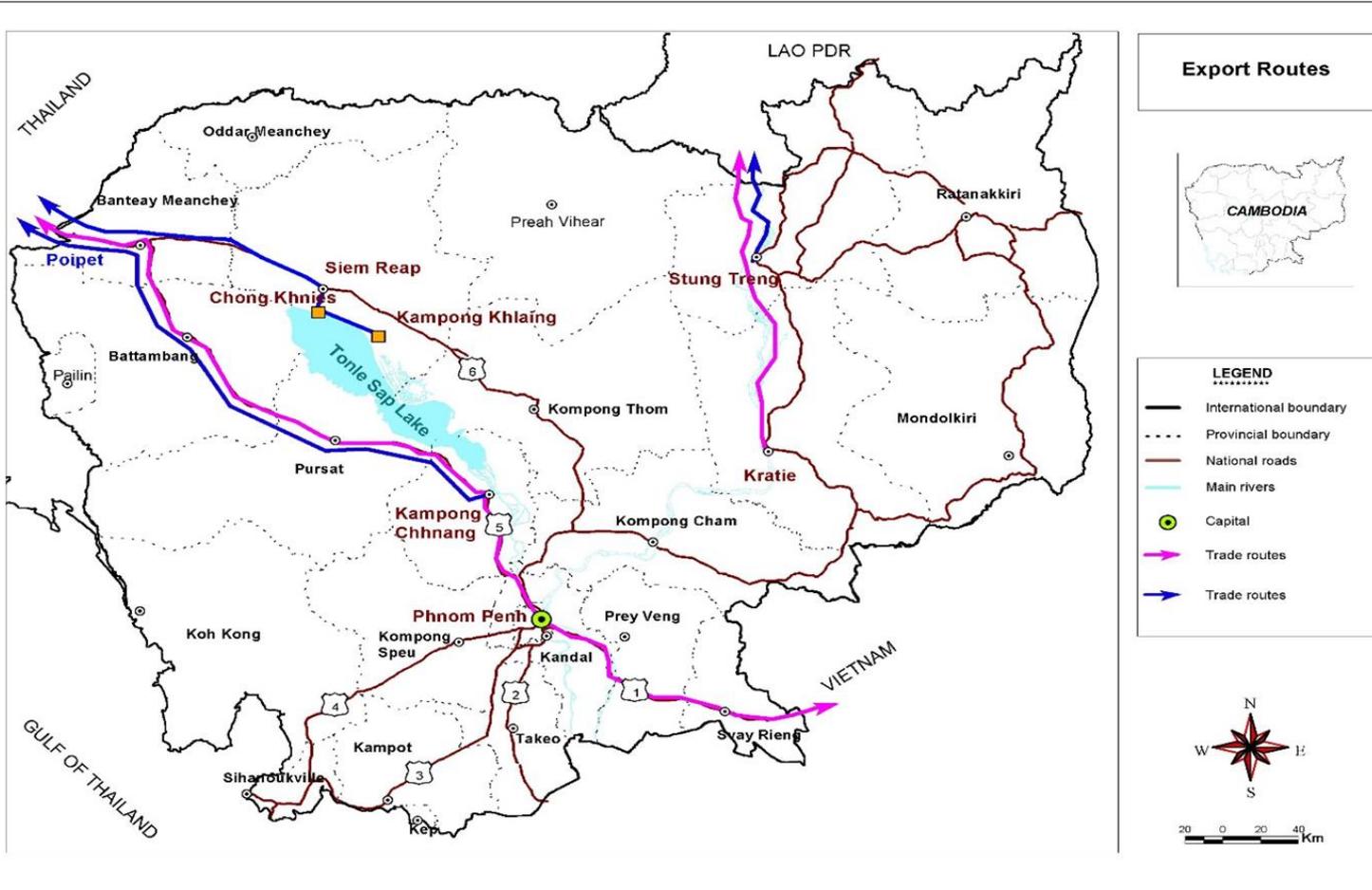


## Takeaways

- Cambodia’s competitive strategy is in the promotion of SME and larger scale pond and cage operations that take part in an integrated GAP and HACCP certified supply chain for the export and higher end local market.
- Strengthening the commercial higher end of the aquaculture sector will generate demand for local input providers (feed, fertilizer, and fingerlings, as well as labor saving equipment).
- There is an opportunity for branding Cambodian “safe” around GAP and HACCP practices.
- Strengthened input markets and the movement of larger, more efficient firms into higher-end species would improve inputs and service access to pond and cage culture farmers producing more economical varieties.

# 4.2 End Market Analysis – Fish Trade Flows

Figure 29: Cambodia Export Routes



**Principal trade routes**  
Thailand-Phnom Penh-Vietnam is the principal trade route through Cambodia.

- Fish seed, fingerlings, fresh, and processed fish enter Cambodia from both Thailand and Vietnam.
- Smaller volumes of fresh and processed fish and fish products leak across the borders into Thailand and Vietnam from Cambodia.
- Most of the trade is undocumented.
- The informality of most of the fish, seed, fingerlings, and processed fish products makes it impossible to enforce sanitary and phytosanitary standards for product moving across the borders.

**Sihanoukville** There are fish exports to the regional and global market in reefer containers but EU and U.S. bans on Cambodian fish for failure to comply with sanitary and phytosanitary issues have significantly reduced exports.

**Phnom Penh** There have been airfreight exports of high value fresh fish from Phnom Penh but lack of standards and an HACCP-compliant cold chain has eliminated most of this trade.

## 4.3 Aquaculture Value Chain Actors



### Fish Farmer

- Small family operation's small pond of 100 m<sup>2</sup> to 300m<sup>2</sup> is usually operated with family labor.
- Feed is mostly trash/low value fish, which is hard to find and hard for farmers to afford. Man-made feed (pellet feed) for fish is also expensive.
- Medium size farmers – one larger pond
- Larger scale producer – several large ponds

### Collectors

- Fish collectors buy fish, directly or through their network, from producers and then distribute to different types of clients such as: consumer, wholesaler/landing site, and processor.
- Collector sets the prices with producers depending on fish quality, supply situation, and daily fish market demand.

### Wholesaler/ Distributor/Landing Site Operator

- Wholesalers tended to represent an important part of the marketing chain, in which often major quantities of fish were channeled through them. These key middlemen (or women) typically had a permanent fish stall at a fish-landing site or at a distribution center. They buy fish from fishers, lot owners, collectors or middlemen and re-sell it to exporters, retailers or restaurant owners. This role is very location-specific, and the scale of the business might depend on whether an operator was based in a provincial town or in the Phnom Penh area (Rab et al., 2006).

### Retailers

- Permanent stall inside or outside the market
- Mostly women, but they often have their spouses who assist them in buying fish from the landing site/wholesalers

### Processors

- Transform from fresh form to various type of processing products, fish paste, fermented fish, dried fish, smoke fish, and others.
- Main processing fish were pangasius, giant snakehead, and snakehead

## 4.3 Aquaculture Value Chain Actors – Processor

### Processor

- Mrs. Nov has been a dried fish processor for about 20 years. She works with three different types of fish: dried with bones, dried fillet, and fermented. She employs six people and pays them about 10,000KHR/day.
- Dried fish with bones is mostly processed from ros, dieb, and channa fish. She works with 300kg/day of ros and dieb (at 8,000KHR/kg) and 100kg/day of channa (at 10,000KHR/kg), which she buys from a Phnom Krom wholesaler. In general she can produce 105kg of dried fish from 300kg of fresh fish per day after two to three days for drying.
- In this processing of dried fish she buys salt, sugar, seasoning, and spices about 75,000KHR/day (for 100kg of fresh fish she spends about 25,000KHR). The price of dried fish depends on the type dried (ros and dieb dried is 25,000KHR/kg and channa dried is 30,000KHR/kg). She also sells fish waste such as fish manure 500KHR/kg and fish heads 1000KHR/kg.
- Fillet fish (no bones or skin): The fillets are mostly processed from channa fish. Processing of fillet is the same process as that of dried fish with bone, but the fillet takes more time and money. Generally 100kg of fresh fish can produce only 20kg of fillet fish because fillet is boneless and skinless. It takes about three days to dry. Every day she works with 200kg of fresh channa so she can produce 40kg/day of fillets and sell for 50,000-60,000KHR/kg.
- She spends more on spices for fillet than on dried fish with bone, about 100,000KHR/day (50,000KHR/100kg) because fillet is skinless so the spices can go deeper inside the meat. The fish waste is also more valuable.
- For fillet fish she has two important customers who are the retailer of processed fish in the market and she brings her products to them every morning.
- For fermented fish (Pra Haeum) she buys the fresh pangusuis from the wholesaler who collects directly from the farmers. She buys 60kg/day at 6,000KHR/kg and produces 20kg/day of fermented fish. Fermented fish need two days to dry and spices cost about 55,000KHR/day. In general the fermented fish sells to porridge restaurants. The price of the fermented fish is about 27,000KHR/kg.
- There are three processors in her village including her but they sell in different market and customers. She knows her products are more expensive than others, but she still has more customers because her products are more delicious and better quality.
- The limiting factor for expansion in her business is the lack of skilled labor.



## 4.3 Aquaculture Value Chain Actors – Collector/Trader

### Collector in Battambang

- Mrs. Sokchea started this business two years ago when the HARVEST program started in her village and supported farmers by providing fingerlings, fish food, and other equipment in the pond. Farmers started raising tilapia, clarias, silver barb and pangusuis. So she started her business as a collector with the HARVEST members.
- She buys and sells the fish from the farm for the following prices :
  - Tilapia about 20kg/day to 30kg/day at 8,000KHR/kg and sell at 9,000R/kg
  - Clarias about 10kg/day to 20kg/day at 5,500KHR/kg and sell out at 6,500KHR/kg
  - Pangusuis about 30kg/day to 40kg/day at 4,500KHR/kg and sell at 5,000KHR/kg
- Every day she works with her husband by motorcycle with cart to collect in the village and sell to the users in the market and small restaurants. She earns about 100,000 to 150,000KHR/day.
- The challenge for her is that her work is seasonal. From November to April people mainly get fish from the river, so demand for pond fish goes down, and so do prices.



### Wholesaler in Siem Reap

- Mrs. Chim trades three types of fresh fish (channa, ros, and dieb) and sells to processors.
- She buys channa from the wholesaler in Phnom Krom at 10,000KHR/kg and sells whole fish directly to the fillet processor (about 100kg/day for 14,000KHR/kg).
- She also buys ros from the same wholesaler in Phnom at 6,700KHR/kg after she works with these fish to prepare them as *nem* (fresh boneless fillet) and then sells to the *nem* processor about 100kg/day for 11,000KHR/kg.
- She buys dieb and ros at 6,700KHR/kg and sells them in form of fillet to the Mam processor about 160kg/day for 13,000KHR/kg.
- She earns additional money selling fish heads (at 1,300KHR/kg) and fish manure (at 600KHR/kg).
- Challenges for her business include a lack of workers and informal fees collected by the police at transport stops ( about 1,000KHR/time).



## 4.3 Aquaculture Value Chain Actors – Landing Site Operator



### Landing Site Operator

- This role of a landing site wholesaler/distributor is unique to the Cambodia fishery and aquaculture value chain.
- The landing site operator (LSO) is responsible for managing the site where pond, cage, and wild catch are brought for distribution to other retail and wholesale venues. A large landing site may also have exporters collecting quantities of fish for export.
- LSOs either own their own sites and get a license from the government, or use state-owned property. Those with state-owned sites are usually larger, and process a sizeable volume of fish to importers or large-scale producers/wholesalers/collectors. These sites are typically well-equipped with machinery for lifting and moving large loads, as well as facilities for cold storage. Fees to operate this kind of state-owned site are higher than for the individually owned locations.
- LSOs who own their location perform the same distribution function on a smaller scale. They collect, distribute, and trade fishery or aquaculture products among small-scale wholesalers and/or collectors.
- Each landing site has permanent plots/stalls for wholesalers/collectors to hire to trade their fish for retailers or consumers. The plot rental/service fee is based on the total volume of fish sold daily by wholesaler/collector (e.g., 100KHR/kg). Generally, the LSO will negotiate a rate with each wholesaler/trader on a daily or per kilo basis. Service fees are generally higher at the government-owned sites as there are more services available.
- The LSO may also buy fish from producers/collectors to sell to other wholesalers, retailers, and other end users.
- Anyone has the right to apply for a license to be an LSO. If the sales volume is lower than 50 tons a year, they apply to their local fisheries administration office or to the Central Fisheries Administration if sales are over 50 tons.

## 4.3 Aquaculture Value Chain Actors – Large Producer



### Producer – Large (Pursat)

Mr. Dinh has a pond that is 80m x 200m x 3m, and he produce three types of fish in the same pond.

- He puts *pangusuis* seed about 50,000 head (about 12cm) at 150KHR/head from the wholesaler (imported from Vietnam), total 7,500,000KHR.
- *Black tilapia* seed about 20,000 head (about 10cm) at 80KHR/head from a wholesaler in Phnom Penh, total 1,600,000KHR.
- *Silver barb* seed about 20,000 head (about 10cm) at 80KHR/head from the same seller in Phnom Penh, total 1,600,000KHR.
- Additional inputs include:
  - Food for fish
  - Chemical food of about 100 bags at the price of 55,000KHR/bag= 5,500,000KHR
  - Mixing food 12,000R 12,000KHR
  - Vitamins for fish about 30R 120,000KHR
  - Gasoline for pumping water in the pond about 4,000,000KHR.
  - Firewood to boil water in mixing food process about 3,000,000KHR.



It takes eight months to harvest, at which time he can sell the following:

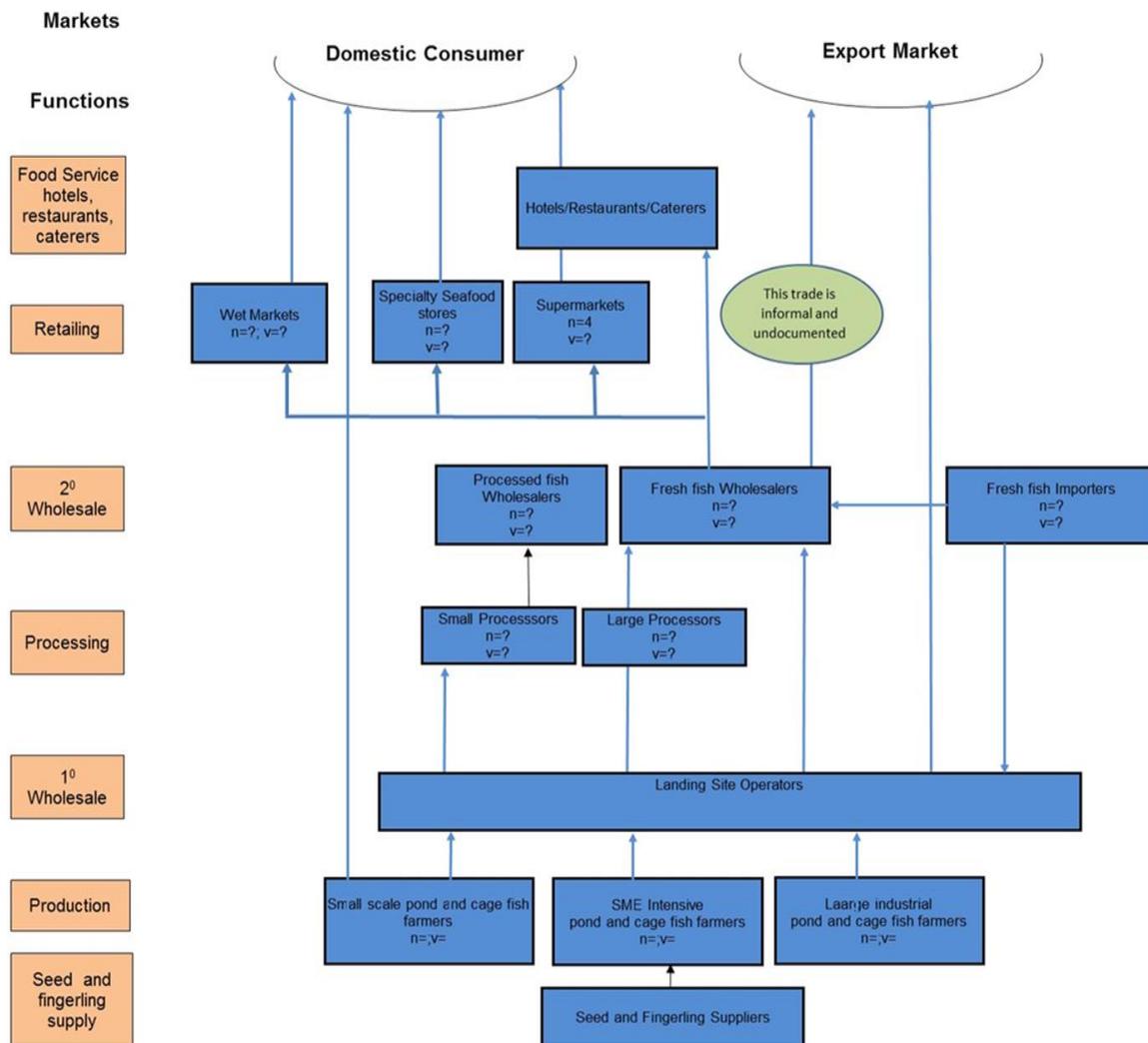
- *Pangusuis* 32,700kg for 5,000KHR/kg= 163,500,000KHR
- *Black Tilapia* 13,100kg for 7,000KHR/kg= 91,700,000KHR
- *Silver Barb* 8,100kg for 8,000KHR/kg= 64,800,000KHR

Total sales: 320,000,000KHR = \$80,000 USD

The challenge for his business is water supply for his pond because water is the most important for fish growth. These fish all need fresh water, and he has to change the water many times.

# 4.4 Pond and Cage Aquaculture Value Chain Map

Figure 30: Domestic Consumer and Export Market Value Chain



## Takeaways: Aquaculture Pond and Cage

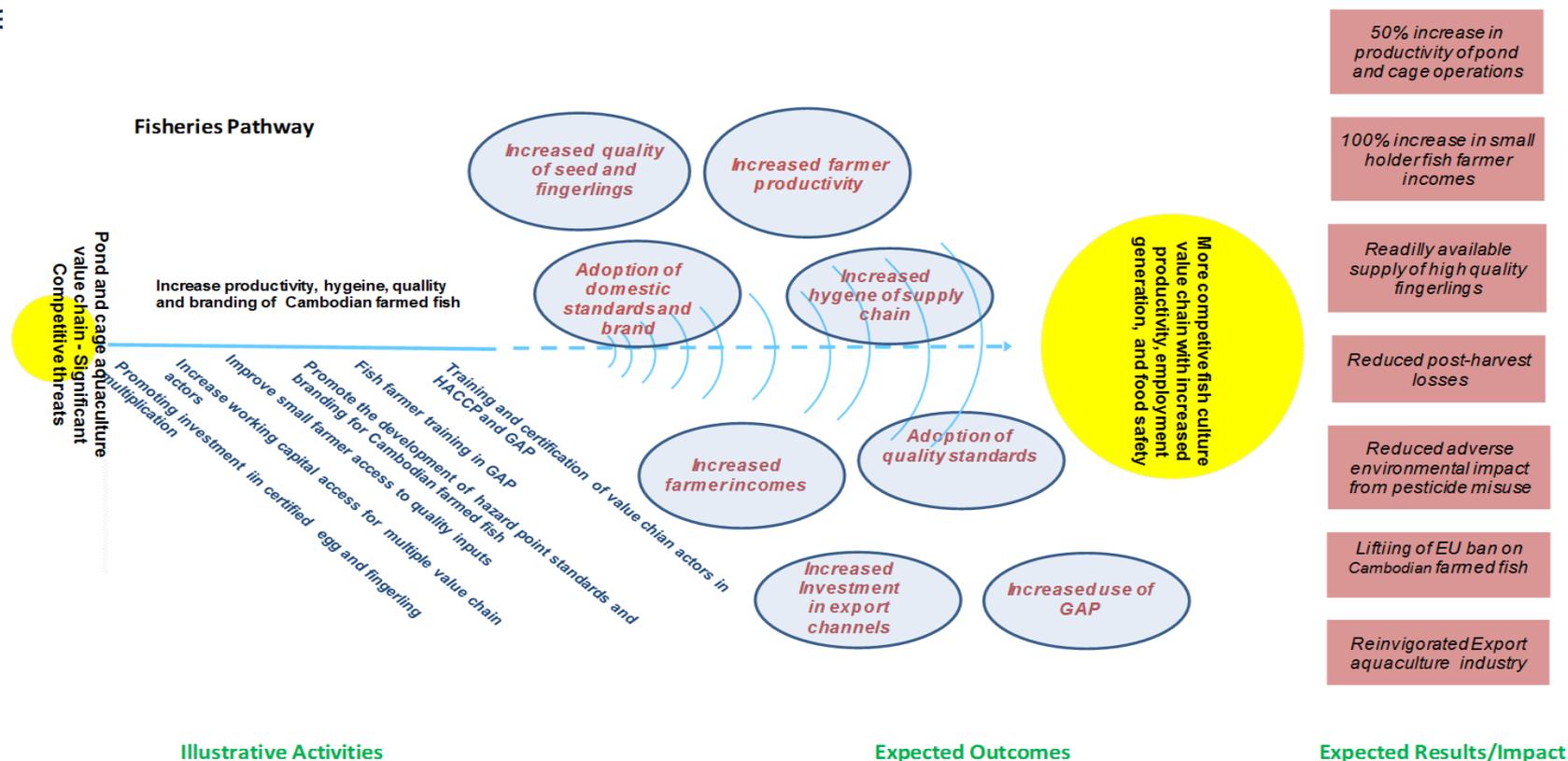
- Industry is still dominated by small scale informal actors
- Imports from Thailand and Vietnam are significant and represent an import substitution opportunity for higher value and more management-intensive species
- Small trucks carry fresh and processed fish into Vietnam and Cambodia, especially the highly valued snakehead.
- Informality and leakage across borders represents a loss of revenue for the Royal Government of Cambodia (RGC).
- There are two wholesaling functions. The first is the aggregation from large numbers of farmers and fishermen to the government landing sites. The second are the larger wholesalers of fresh and processed fish that move product from landing sites and processors to their final market.

## What you don't see can tell as much as what you do

- Notably absent from the Cambodian aquaculture and fisheries map are industrial-scale commercial exporters shipping fresh fish from Phnom Penh and frozen fish in reefer containers from Sihanoukville. Cambodia could be competitive in the production of high value management intensive species to EU and North American markets.
- The absence of HACCP controlled supply chain and poor SPS standards has shut this market down for Cambodian entrepreneurs.

# 4.5 Aquaculture Pathways for Growth

Figure 3



## Takeaways

- Cambodia cannot compete effectively with Vietnam on low-cost, low-management varieties of pond and cage cultured fish.
- More industrial and larger scale commercial fisheries have a greater employment effect than smallholder ponds or cages.
- Increasing commercial pond and cage enterprises for export would generate demand for local provision of critical inputs to the sector.
- With a large tourist and growing middle-class market, export-oriented firms face reduced risks because they can sell Cambodian-branded safe products to higher-end consumers in the domestic market.
- Fish farming has a mixed environmental sustainability record. Cambodia will need to learn from the mistakes of its neighbors in scaling up an aquaculture industry.

# 5. Cross-Cutting Services

- 5.1 Equipment Supply and Services
- 5.2 Input Supply
- 5.3 Transport
- 5.4 Finance
- 5.5 Irrigation



# 5.1 Cross-Cutting Services – Equipment Supply and Services

## Agricultural Equipment

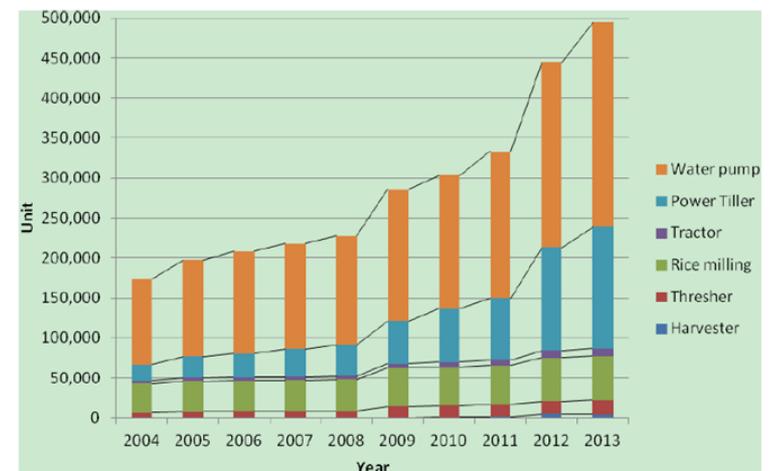
- Agricultural machine use increased six-fold from 2001 to 2011 (DAC, 2011), and has continued to increase since, especially since 2009.
- Driven by the need to increase productivity with a decreasing labor force, mechanization is increasing in all agricultural sectors.
- The RGC has a zero-tariff policy on all agricultural equipment to encourage Cambodians to buy machinery to achieve country-wide goals.
- The shift away from human and animal to mechanical traction reduces barriers for women in production who can now hire mechanical services to help with managing their farms.

## Tractors

- In 2013, 73 percent of all land preparation was done by machinery (Chan, 2014). The number of tractors increased 145 percent over the last ten years; the number of power tillers has increased 648 percent (20,000 units in 2004 to over 150,000 in 2013) (Chan, 2014).
- Tractors are supplied from Belarus, China, India, the United States, and Thailand. Siam-Kubota is the biggest dealer in large tractors and power tillers. Kubota is competing by offering after-sales and training services. They provide full servicing, maintenance, repairs, and farmer training for one agricultural season after purchase. Thereafter, they provide services at low cost to maintain customer loyalty.
- Competition between tractor dealers is heated, and has led to the introduction of limited leasing options through the tractor dealers, in addition to bank financing options.
- Some imported second-hand tractors are also available, but lack of spare parts makes them less popular for many farmers.



**Figure 32: Number of Agricultural Machines in Cambodia, 2004-2013**



Source: Chan, 2014

# 5.1 Cross-Cutting Services – Equipment Supply and Services

## Pumps

- The most common irrigation techniques used in Cambodia include traditional lifting, mobile pumping stations, gravity, or a combination of these methods pumping surface water from a source to reservoirs and canal systems (Phallika, 2011).
- Small, low-lift (< 3 meters) pumps are widely available, affordable, and effective for some aquaculture and horticultural purposes.
- Pumping on a larger-scale is cost-prohibitive for subsistence farming but appropriate for small commercial horticultural operations (>1,000m<sup>2</sup>).
- Dry season farming requires a pumping lift of four to nine meters, which is beyond the capacity of low-lift pumps. These pumping systems require skilled management and are key to expanding dry season irrigated rice production as well as larger ponds and horticulture operations (MRC, 2009).



## Equipment Manufacture

- Some small machine shops and light manufacturing exist (e.g., fabrication of threshers). Generally the quality is poorer than the imported machines.
- There is however a significant market for the local fabrication of spare parts (Chan, 2014).

### Takeaways

- The emerging equipment services industry illustrates crowding-in by private sector firms around an economic opportunity.
- A trained vocational workforce skilled in operating and repairing machinery has not kept up with the rapidly expanding machinery and machinery service markets.

## Equipment Services

- With the increase in availability of machinery, an industry is developing around service provision.
- Some farmers are expanding into service provision providing tillage and harvesting services for neighboring farmers. While an important opportunity, delays in tillage and or harvesting services can reduce yields and or increase post-harvest losses.
- Equipment services are commonly offered to farmer members by producer groups/associations/cooperatives but require strong management to ensure timely maintenance and recovery of depreciation costs (Chan, 2014).

## Equipment Repair

- Facilities for machine repair and maintenance are generally not available outside of larger towns. The demand for repair services at the District and commune level will continue to grow, especially as machinery ages.
- Vocational training facilities have not kept up with the demand for skilled technicians and mechanics
- Imported duties are occasionally levied against spare parts ostensibly because it is not clear that they are specifically used for agriculture.

**Table 15: Cost of Agricultural Machine Services in Cambodia, 2013**

No	Operations	Type of Agricultural Machinery
1	Land leveling	- For tractor: 20-25 US \$/hr (front shield equipped with tractor) - For power tiller: 15-20 US \$/hr (front shield equipped with power tiller)
2	Plowing	- For tractor: 35-70 US \$ (depend on distance and field condition) - For power tiller: 35-45 (depend on distance and field condition)
3	Harrowing	- For tractor: 20-40 US \$ (depend on distance and field condition) - For power tiller: 15-20 US \$ (depend on distance and field condition)
4	Rotavating	- For tractor: 50-70 US \$ (depend on distance and field condition)
5	Harvesting	70-90 US \$/ha (by combine harvester and the cost is depended on distance and field condition )
6	Threshing	8-10 % of total paddy after threshing
7	Transportation	0.75-1.25 US \$/(1 sack=100kg). It depends on distance and road condition)
8	Drying	20 – 25 US \$/ton of paddy (it depends on paddy varieties and moisture content)

Source: Chan, 2014

# 5.2 Cross-Cutting Services – Input Supply: Fertilizer

## Fertilizer

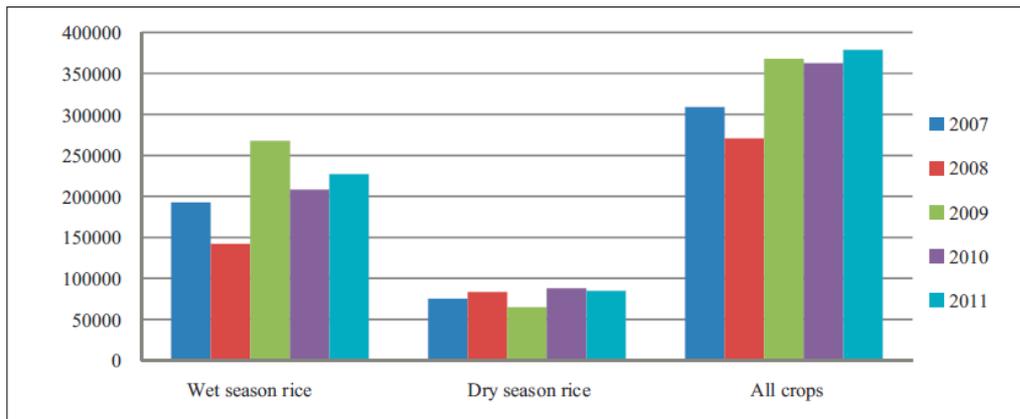
- Use of fertilizer and crop protection inputs (CPI) is wide spread.
- A March 2013 article in the *Phnom Penh Post* estimated that 40 percent of fertilizer currently being sold in Cambodia was counterfeit, down from a 2003 World Bank estimate, when up to 70 percent of agricultural inputs were reported as counterfeit.
- Certification is rare. Lack of policy enforcement results in large volumes of counterfeit fertilizer expired and occasionally banned chemicals entering Cambodia from Vietnam and Thailand.
- There is a large and informal network of input providers the majority of whom are unlicensed and unregistered.
- There is widespread overuse of CPI by farmers who lack training and cannot read labels in Vietnamese or Thai.
- Organic fertilizers were found in several provincial markets.
- There is a trend toward more formalization in the inputs sector but these shops are self regulated.
- Weak extension networks also contribute to inappropriate input use.



### Takeaways

- The input sector is almost completely unregulated.
- Misuse of inputs is widespread exposing the Cambodian farmer and consumer to unnecessary health risks (see political economy).

**Figure 33: Trends in Fertilizer Use by Rice Farmers**



Source: Vuthy et al., 2014



## 5.2 Cross-Cutting Services – Input Supply: Rice Seeds

**Demand:** Assuming that Cambodian rice exporters were able to sell 20 percent of all exports as premium fragrant varieties, it will take 6,000 tons of premium fragrant seed to meet this demand. A 40 percent premium fragrant exports target would increase demand to 12,00 tons produced on 2,400 ha.

**Seed Policy:** Currently there are a number of policy constraints identified. Only CARDI is authorized to produce foundation seed, which is then multiplied by licensed seed multipliers to produce certified seed. The research focus appears disconnected from market signals, reflected by the large number of varieties being multiplied by CARDI. There appear to be no private seed inspection and certification bodies. Most seed multipliers (formal and informal) certify themselves.

**NGO crowding:** NGOs comprise a significant market for CARDI seed. This seed is distributed to farmer seed multiplication groups and small-scale paddy producers. Removing this seed supply from private channels weakens the incentives for commercial investment.

**Lack of infrastructure and mechanization of seed supply:** No cool rooms were observed for the storage of seed to protect germination rates. While paddy production and harvest is largely mechanized, no mechanical seeders and transplanters were identified. Mechanizing the seed sector is essential to developing a commercial seed market.

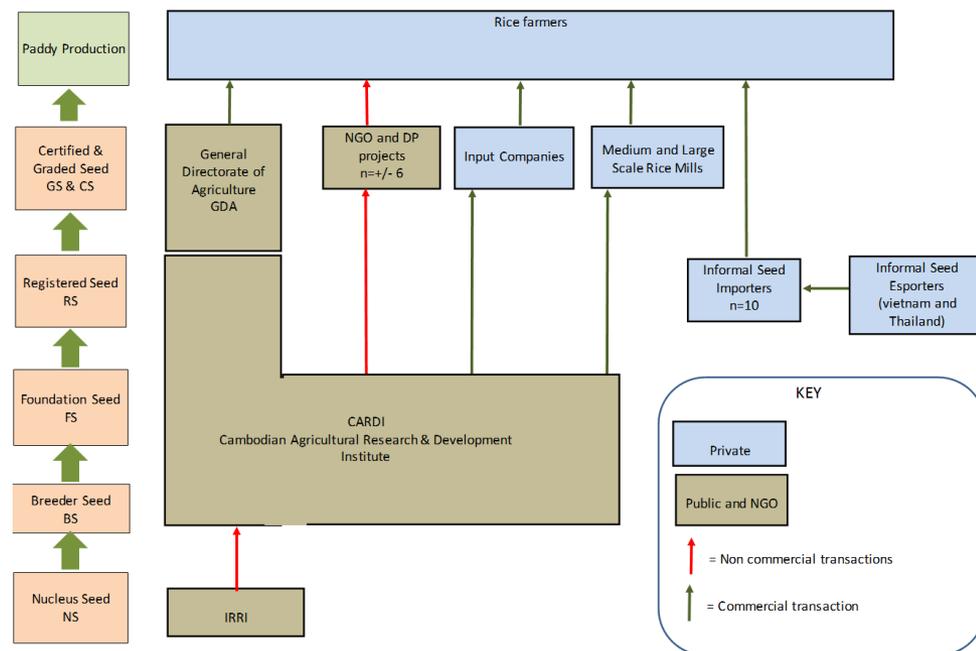
**Minimal provision of seed by millers to ensure quality control:** Low level of trust in growers, working capital constraint by many millers, and lack of miller confidence in seed supply contribute to this.

**Commercial trade:** Trade in seed remains fractured and largely informal. Very few millers supply dedicated growers with seed.

### Takeaways

- Millers are the change driver in the seed supply chain system because they have access to global price and demand information on what varieties farmers need to produce.
- Conservative demand for fragrant rice seed is 6,000 tons produced on 1,200 ha annually.
- There appears to be some crowding out of private investors in the seed sector by non-commercial (NGO driven) market channels (see red arrows).

Figure 34: Rice Seeds Input Supply



## 5.2 Cross-Cutting Services – Input Supply: Case Study

- Mrs. Rithy sells a variety of products (beverages, snacks, etc., in addition to agricultural supplies) in her shop near the provincial market. For years she was the only seller of vegetable seeds, fertilizer, and pesticides at the market.
- She sells products from both Vietnam and Thailand. In general the products from Vietnam are cheaper, but the products from Thailand are better quality.
- For Vietnamese products, she buys from a wholesaler in O'Russe market in Phnom Penh. She calls in resupply orders which are sent by taxi. The wholesaler gives her 30 days' credit.
- For Thai products, she goes to Battambang monthly to look at new products, and then orders by phone.
- Seeds do not last very long, so she buys small quantities frequently (every two weeks or so), rather than a large stock.
- She buys whatever products sell the best – seeds for convolvulus, cabbage, and bitter melon.
- Customers buy based on what they think will sell in the market. Farmers cannot read the instructions on the labels from Vietnam. The Thai products are in English and sometimes in Khmer, but labels do not include instructions on use.
- Recently, as a result of the HARVEST project, a number of other agricultural retailers have opened nearby, often selling the same products.
- Margins for seeds are very low, she makes 100 to 200KHR per packet.
- She sells to sub-retailers in rural areas. She gives them credit for 30 days, but charges a higher price.
- She said farmers are focused on price and quality of products.
- More farmers are growing vegetables now, and there are more local vegetables in the market.
- There are more people buying her products, but also more sellers who are copying her, creating stiff competition



# 5.3 Cross-Cutting Services – Transport

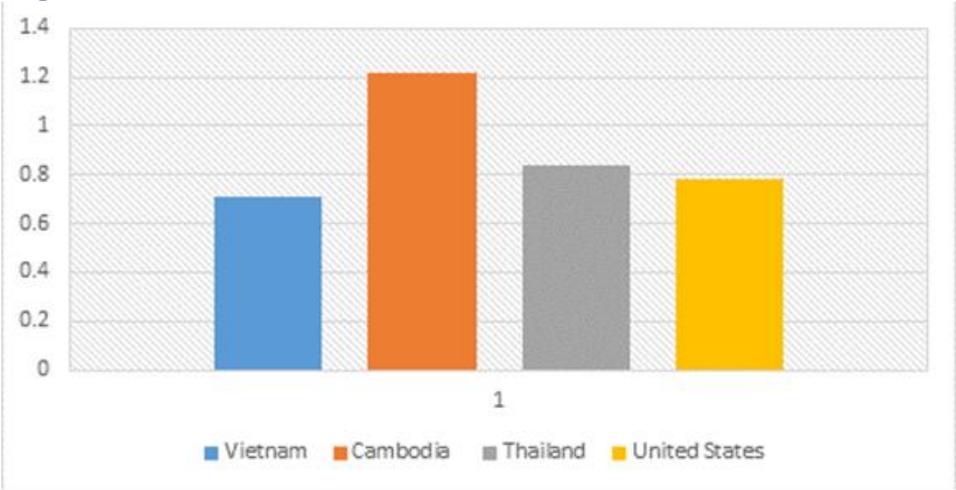
## Transport

- Cambodia Trucking Association includes all large trucking companies. Most of the fleet is old and poorly maintained, resulting in higher maintenance and fuel costs.
- A few large companies (more than 100 trucks) control most of the traffic; market concentration does not appear strong enough to facilitate price fixing.
- Back haul from Thailand and Vietnam is limited for Cambodian trucks; containers are in high demand.
- Fuel costs are 50 percent higher in Cambodia than in Vietnam.
- The system of informal payments throughout Cambodia is one of the barriers to entry for outside firms. The desire to avoid informal fees, or getting involved in payment of informal fees increases the power of agents and brokers, increasing costs.
- Lack of information about fees and regulations is perceived as a constraint. Lack of transparency allows border officials to claim informal fees from transporters.
- Informal fees are routine at weigh bridges and checkpoints. Fees can range from \$1.25 to \$10. Truckers generally pay fees to save time. Unequal treatment based on personal relationships is also perceived as a constraint.

### Takeaways

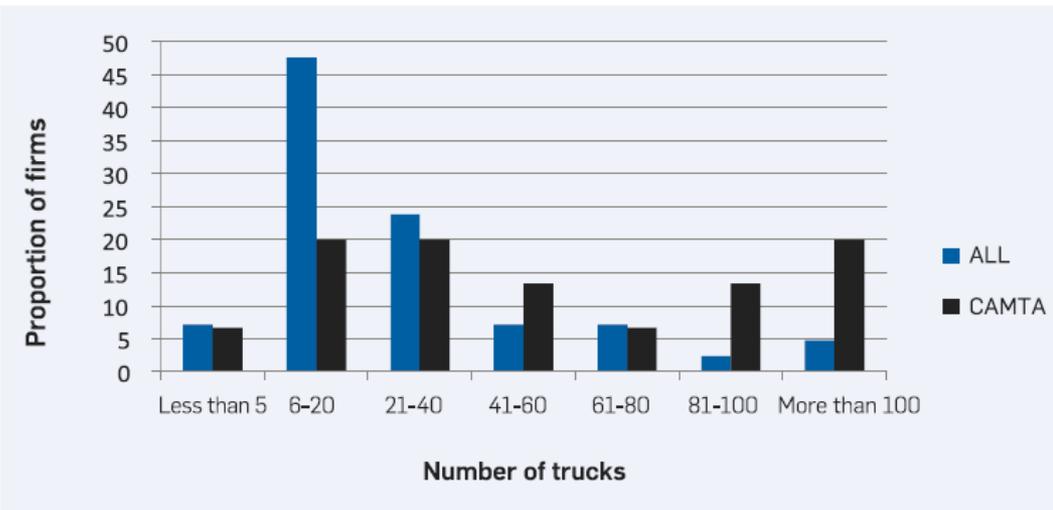
- Higher costs and poorer conditions make it hard for Cambodia to compete for lower-value products.
- Lack of transparency and informal fees mask costs and limit foreign companies' participation.
- Improved infrastructure for exports will enhance competition.

Figure 35: Diesel Fuel Prices USD/liter; 9 March 2015



Source: [www.mytravelcost.com](http://www.mytravelcost.com)

Figure 36: Distribution of Trucking Fleet sizes (Phnom Penh Companies)



Source: Cambodia Corridor assessment report, WB 2014

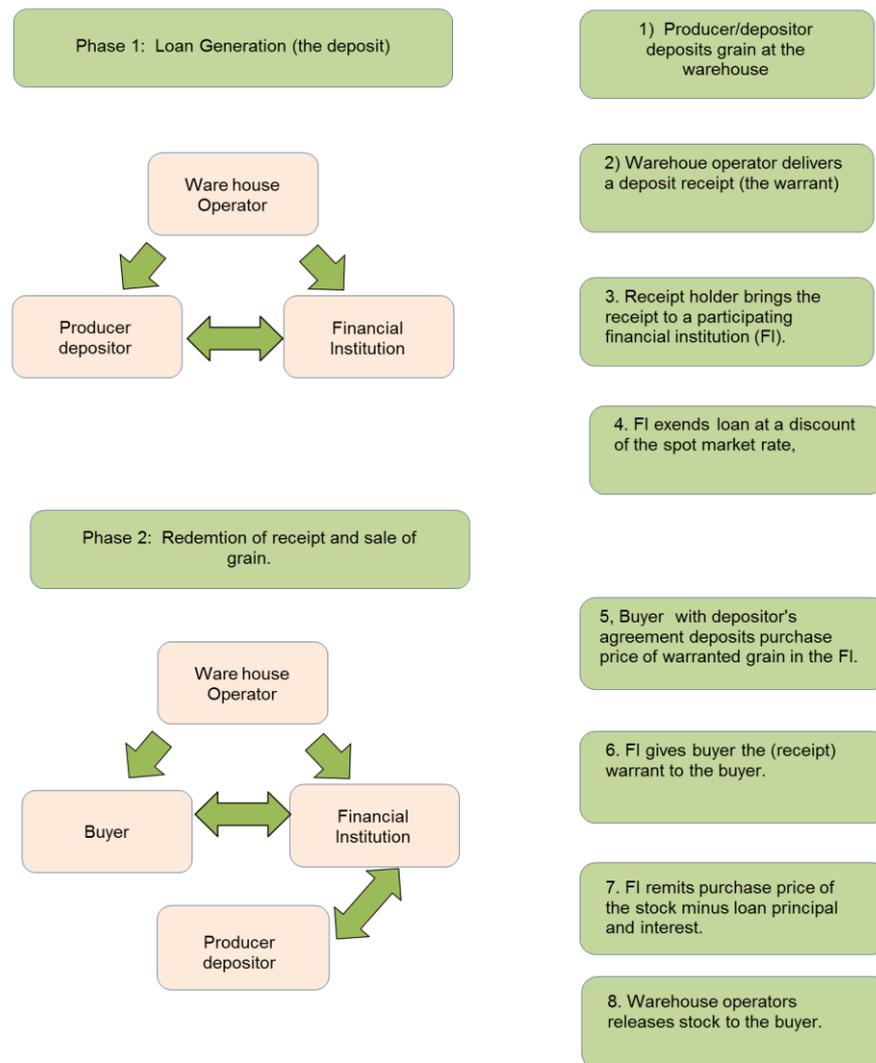
# 5.4 Cross-Cutting Services – Finance

- There are more than 30 banks and 45 registered microfinance institutions (Phnom Penh Securities Banking Sector Report, 2013).
- Financing is readily available for small amounts through rural money lenders, and for large capital expenditure financing.
- There is a significant credit constraint with the “missing middle,” including working capital financing for rice mills and equipment lease financing, though lease financing is on the rise.
- Farmers are more likely to seek financing from local money lenders rather than accessing better terms from financial institutions.
- Banks have observed the success of Wing money transfer service and are offering similar services at lower cost. There are no mobile money regulations in place.
- Insurance is available for vehicles and machinery, but no index-based weather or production insurance
- Gender: Although women traditionally control household finance, they still have to have permission from men to make many financial decisions
- Ag lending is 10 percent of current financing, but that is an increase of 50 percent over five years ago – predominantly because of the focus on expanding the rice sector.
- A collateral management warehouse receipt system is being introduced, but is not widely known about.

### Takeaways

- Formal and informal finance is widely available though often with inflexible terms.
- There appears to be a credit gap for SME financing.

**Figure 37: Elements of a Basic Warrantage or Warehouse Receipt System**



Source: Chetaille, Anne, et al., 2011.

## 5.4 Cross-Cutting Services – Finance: Case Study

- Mr. Seth is a Branch Manager of Aceda Bank, PLC. The bank has a strong focus on community access to finance and offers a range of loan products to help Cambodians access money. They also understand the challenges of agricultural lending and offer loan products designed to address the needs of farmers.
- In general, they find that farmers do not use the loans well. Frequently farmers borrow money for one purpose, and then spend it on other needs.
- Aceda has a lot of farmer clients. Micro loans are available from \$125 to \$200. Length of payment depends on the size of the loan – from three months to six years (\$30,000). Interest rates are usually about 1 percent per month on loans, but that depends on the terms of payment.
- The bank prides itself on having staff that understand the community, including agricultural seasons. They have developed loans that are tailored to the specific cash flow needs of farmers, with payback being linked to harvest season.
- After receiving a loan application, a bank staff person will visit the house of the potential borrower, assess the character and collateral of the borrower, including rental agreements.
- They do not accept contracts or warehouse receipts as collateral for loans. They will give a loan if a third party will guarantee. Staff do household-level marketing of services but no financial literacy education.
- Farmers can get an “informal sector” loan of up to \$700 based on a letter documenting market relationships.
- They will give a loan of up to \$500 or less with no collateral.
- Groups can also apply for loans without collateral if they agree to mutually guarantee the loan. They also provide services to other actors in the value chain (suppliers, wholesalers, importers, exporters).
- Aceda participates in a national program where lending institutions share information about their borrowers.



# 5.5 Cross-Cutting Services – Irrigation

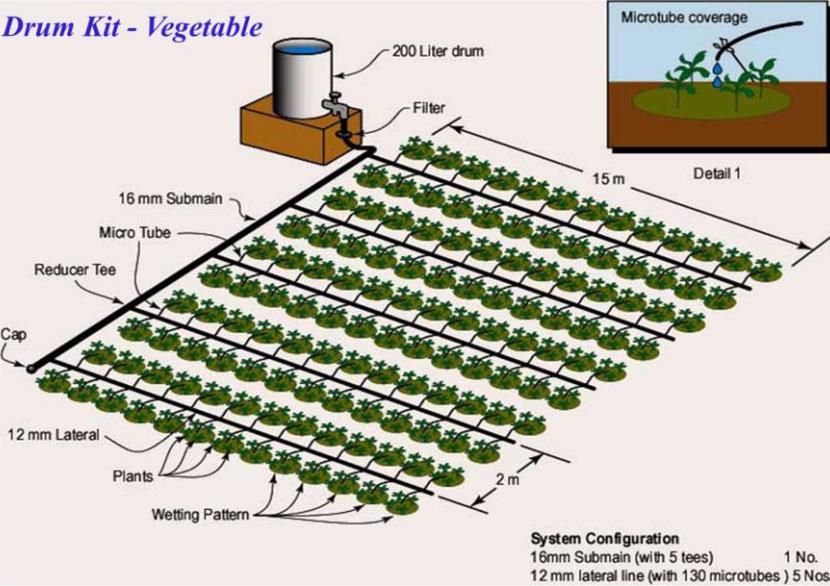
- MOWRAM estimated that there are more than 2,000 irrigation schemes (1,415 small, 955 medium, and 33 large) in 2007.
- Most irrigation schemes focus on managing floodwater to supplement rainfall for wet season rice.
- Most irrigation schemes are large scale (65 percent cover more than 500 ha). All irrigation is surface irrigation in Cambodia.
- Dry season rice has higher yields than wet season rice because of higher solar radiation, better water control, and the cultivation of more fertilizer-responsive varieties of rice.
- The area equipped for full control irrigation (dry season production) in 2001 was around 284 177 ha. The area increased to about 353,566 ha by 2012 (FAOSTAT, 2014).
- Irrigated rice represents 12 percent of the total annual rice cropping area. Dry season production is mostly close to major rivers and their floodplains (FAO AQUASTAT, 2011).
- Dry season rice varieties require more inputs and crop protection, in addition to irrigation, so trends in dry season rice are toward increased commercialization and mechanization.
- In addition to large-scale schemes, small-scale pumping by individual farmers is also common. Small portable pumps are affordable and allow farmers to access natural water sources. (IWMI, 2013) Pumping services appear widely available.

## Drip Irrigation

- Drip irrigation is the fastest growing irrigation technology in Cambodia.
- Reduces water and fertilizer needed (less fertilizer leaches away), improves yields and quality of vegetables, and reduces diseases (Palada, 2007).
- Drip systems enable growers to expand their production periods taking advantage of higher off-season market prices.
- Drip systems are essential to making the horticulture sector more competitive.

**Figure 38: Drum Kit - Vegetable**

**US\$50.00 irrigates a plot of 200-500 sq.m.**



**Table 16: Irrigated Crops in Full Control Irrigation Schemes**

Irrigated crops in Full Control Irrigation schemes			
<b>Harvested Crops</b>			
Total harvested irrigated cropped area	2006	384,531	ha
Annual crops: Total	2006	383,287	ha
Rice	2006	373,331	ha
Sugarcane	2006	9,956	ha
Permanent crops: Total	2006	1,244	ha
Citrus	2006	1,244	ha
Irrigated Cropping intensity (on full control equipped area)	2006	121	%

Source: FAO AQUASTAT, 2011

## 6. Interviews Conducted

### Political Economy Interviews

**Table 17: Number of Interviews Conducted for Political Economy Sector**

Number of Interviews Conducted for Political Economy Sector		
No	Institution	Location
1	Department of Rice Crop, General Directorate of Agriculture, MAFF	Phnom Penh
2	Department of Plant Protection, Sanitary and Phytosanitary, General Directorate of Agriculture, MAFF, and in charge of SPS at one single window service for rice export formality	Phnom Penh
3	Department of Horticulture Crop, General Directorate of Agriculture, MAFF	Phnom Penh
4	Support to the Commercialization of Cambodia Rice Project, Supreme National Economic Council (SNEC)	Phnom Penh
5	Government-Private Sector Forum, Cambodia Chamber of Commerce	Phnom Penh
6	Cambodia Rice Federation	Phnom Penh
7	Federation of Cambodian Farmer Organisation for Developmen (FCFD)	Phnom Penh
8	Provincial Department of Agriculture (Pursat)	Pursat
9	Fisheries cantonment of Pursat	Pursat
10	FINTRAC, Pursat	Pursat
11	Srer Khmer	Pursat
12	Fingerlings Producer	Sreir Lvea village, Trapeang Chorong commune, Bakan district, Pursat
14	City Rice Import Export Co., Ltd. And Lay Se Rice Mill	Battambang

# 6. Interviews Conducted

## Rice Interviews

Table 18: Rice Sector

Rice Sector							
Categories	Types	Number of Interviews Conducted					Total by Categories
		Phnom Penh	Pursat	Battambang	Siem Reap	Kampong Thom	
a. Consumers	Hotel/Restaurant	4	3	2	1	3	13
b. Retailers	i. Supermarkets	1					1
	ii. Small retail markets	3	2		1	1	7
	iii. Wet markets	1					1
c. Milled Rice Wholesalers	i. Domestic	6	2	4	2	1	15
	ii. Exporters						
	iii. Importers						
d. Millers	i. Large scale	1	1	1			3
	ii. SME						
	iii. Community		2	2	1		5
e. Collectors			2	1	4		7
f. Farmers	i. Commercial		2	2	3	2	9
	ii. Small Scale		2	2			4
<b>TOTAL</b>		<b>16</b>	<b>16</b>	<b>14</b>	<b>12</b>	<b>7</b>	<b>65</b>

# 6. Interviews Conducted

## Horticulture Interviews

Table 19: Horticulture Sector

Horticulture Sector							
Categories	Types	Number of Interviews Conducted					Total by Categories
		Phnom Penh	Pursat	Battam bang	Siem Reap	Kampong Thom	
a. Retail Market		7	8		10		25
b. Wet Market						3	3
c. Hotel/Restaurant		2		1	1	1	5
d. Wholesaler/Trader		4	2	4		3	13
e. Processor		1	2			2	5
f. Collector				4	2		6
g. Producer		2	8	6	2	2	20
<b>TOTAL</b>		<b>16</b>	<b>20</b>	<b>15</b>	<b>15</b>	<b>11</b>	<b>77</b>

## Aquaculture Interviews

Table 20: Aquaculture Sector

Fisheries Sector							
Categories	Types	Number of Interviews Conducted					Total by categories
		Phnom Penh	Pursat	Battam bang	Siem Reap	Kampong Thom	
a. Producer	Fish Raiser		8	17		1	26
b. Processor	Fish Processor		4	1	6	2	13
c. Whole Seller	Whole Seller		1		1		2
d. Ratailer	Retailer			7	8	2	17
e. Consumers	Restaurant				1	1	2
<b>TOTAL</b>		<b>0</b>	<b>13</b>	<b>25</b>	<b>16</b>	<b>6</b>	<b>60</b>

# 6. Interviews Conducted

## Cross-Cutting Services Interviews

Table 21: Cross Cutting Services Sector

Services Sector							
Categories	Types	Number of Interviews Conducted					Total by Categories
		Phnom Penh	Pursat	Battam bang	Siem Reap	Kampong Thom	
a. Service provider	Plough/harvest			1			1
b. Retailers	i. Equipment		1	1			2
	ii. Fertilizers/Pesticides			1			1
	iii. Vegetable seeds		1				1
	iv. Rice seeds						0
	v. Fish seeds						0
c. Wholesalers/ Distributors	i. Equipment		1	1	1		3
	ii. Fertilizers/Pesticides	2	1			3	6
	iii. Vegetable seeds	2			2		4
	iv. Rice seeds			1			1
	v. Fish seeds			1			1
d. Transporter		1	1				2
e. Finance	i. Bank		1	1			2
	ii. MFI				1		1
<b>TOTAL</b>		<b>5</b>	<b>6</b>	<b>7</b>	<b>4</b>	<b>3</b>	<b>25</b>

# 6. List of Tables

## List of Tables

- Table 1: Investments Eligible for Tax Incentives, slide 18
- Table 2: Time and Costs for Exports, slide 18
- Table 3: Key Indicators of Cambodia's Labor Force and Market, slide 23
- Table 4: Logistics and Transport Costs for Cambodia, Vietnam, and Thailand, slide 24
- Table 5: Rice Production by Province, slide 30
- Table 6: Rice Food Balance by Province, slide 30
- Table 7: Types of Cambodian Rice exported in 2014, slide 31
- Table 8: Cambodian Weekly FOB Indication Price, slide 31
- Table 9: Land Preparation, Seedbed, Transplanting, and Harvesting, slide 32
- Table 10: AQIP Seed Rice Varieties and Characteristics, slide 32
- Table 11: Average Quantities of Fish Sold by Traders, slide 61
- Table 12: Fresh Water Aquaculture Systems in Cambodia, slide 61
- Table 13: Aquaculture System, slide 62
- Table 14: Major Importers of Cambodian Fish and Fish Products, slide 63
- Table 15: Cost of Agricultural Machine Services in Cambodia, 2013, slide 75
- Table 16: Irrigated Crops in Full Control Irrigation Schemes, slide 82
- Table 17: Number of Interviews Conducted for Political Economy Sector, slide 83
- Table 18: Rice Sector, slide 84
- Table 19: Horticulture Sector, slide 85
- Table 20: Aquaculture Sector, slide 85
- Table 21: Cross-Cutting Services Sector, slide 86

# 6. List of Figures

## List of Figures

- Figure 1: Methodology: The Value Chain Process, slide 12
- Figure 2: Communes and Sangkats with Completed Ongoing Systematic Land Registration in 2012, slide 21
- Figure 3: Economic Land Concessions (ELC) and Special Economic Zones, 2012, slide 22
- Figure 4: Wage Comparison between Cambodia and Neighboring Countries over Time, slide 23
- Figure 5: Major Shipping Routes for Cambodia, slide 24
- Figure 6: Contribution of each of the five domains to women's disempowerment, slide 25
- Figure 7: Population Share by Consumption per Capita, Cambodia, 2004-2011, slide 26
- Figure 8: Maternal Child Nutrition Issues, Cambodia, 2000, 2005, 2010, slide 26
- Figure 9: Cambodia, domestic rice consumption, slide 29
- Figure 10: World Consumption of Major Exporters, slide 29
- Figure 11: Paddy Yield by Country, MT/Ha, select countries, slide 30
- Figure 12: Quantity of Cambodian Rice Exported, 2009-2014, slide 31
- Figure 13: Map of the Tonle Sap and Mekong River, slide 33
- Figure 14: End Market Analysis - Competitive Benchmarking, slide 36
- Figure 15: Value Chain Markets and Functions, slide 37
- Figure 16: Estimate of Paddy exported to Thailand and Vietnam, slide 37
- Figure 17: Rice Pathways to Growth, slide 43
- Figure 18: Monthly Fluctuation of Average Wholesale Price for Vegetable in BMC, slide 45
- Figure 19: Monthly Price Fluctuation of Three Vegetables, January to November 2014, slide 45
- Figure 20: Drip Irrigation System, Slide 48
- Figure 21: End Market Analysis—Competitive benchmarking, slide 50
- Figure 22: Cambodia Export Routes, slide 51
- Figure 23: Horticulture Value Chain Map, slide 57
- Figure 24: Horticulture Pathway, slide 59
- Figure 25: Cambodia, Annual Number of Tourists, slide 63
- Figure 26: World Wild Fish Catch and Farmed Fish Production, 1950-2012, slide 63
- Figure 27: Cambodian Aquaculture Product (MT), slide 63
- Figure 28: End Market Analysis—Competitive benchmarking, slide 64
- Figure 29: Cambodia Export Routes, slide 65
- Figure 30: Domestic Consumer and Export Market Value Chain, slide 71
- Figure 31: Fisheries Pathway, slide 72
- Figure 32: Number of Agricultural Machines, slide 74
- Figure 33: Trends in Fertilizer Use by Rice Farmers, slide 76
- Figure 34: Rice Seeds Input Supply, slide 77
- Figure 35: Diesel Fuel Prices USD/liter, 9 March 2015, slide 79
- Figure 36: Distribution of Trucking Fleet Sizes 2011, slide 79
- Figure 37: Elements of a Basic Warrantage or Warehouse Receipt Systems, slide 80
- Figure 38: Drumkit-Vegetable, slide 82

## 6. Bibliography

- ADB (Asian Development Bank). 2012. *Trade and Trade Facilitation in the Greater Mekong Subregion*. Manila, The Philippines: ADB.
- ADB. 2013 *Gender Equality and the Labor Market in Cambodia*. Manila, The Philippines: ADB. Available online: <http://www.adb.org/sites/default/files/publication/31193/gender-equality-labor-market-cambodia.pdf>
- Aldaz-Carroll, E. and S. Ly. 2014. *Cambodian Economic Update*. Washington, D.C.: World Bank. <http://www.worldbank.org/en/country/cambodia/publication/cambodia-economic-update-october-2014>
- ASEAN (Association of Southeast Asian Nations). 2012. *ASEAN Economic Community: Handbook for Business 2012*. Jakarta, Indonesia: ASEAN.
- Ayamdoo, J. A., B. Demuyakor, W. Dogbe, R. Owusu. 2013. "Parboiling of Paddy Rice, The Science and Perceptions of It as Practiced in Northern Ghana." *International Journal of Scientific and Technology Research*, 2(4): 13-18. Available online: <http://www.ijstr.org/final-print/apr2013/Parboiling-Of-Paddy-Rice-The-Science-And-Perceptions-Of-It-As-Practiced-In-Northern-Ghana.pdf>.
- Baldwin, K., N. Childs, J. Dyck, and J. Hansen. 2012. *Southeast Asia's Rice Surplus*. Economic Research Service/USDA.
- Ballard, B. and S. So. 2006. "Cambodia Land Titling Program: Baseline Survey Project, Rural Phase, 1." Phnom Pehn, Cambodia: Cambodia Development Resource Institute.
- Budd, Nicholas, International Finance Corporation (IFC), 2014. "Inventory Finance, Collateral Management and Warehouse Receipt Systems in Cambodia," PowerPoint presentation. December 4, 2014.
- Busch, S. 2015. "The Benefits of Parboiled Rice." *SF Gate*. Available online: <http://healthyeating.sfgate.com/benefits-parboiled-rice-7618.html>.
- Cambodia Agribusiness Development Facility (CADF). 2007. "Fresh Produce in Siem Reap: Vegetable, Fruit, and Mushroom Value Chain Survey." Phnom Pehn, Cambodia: Indochina Research Limited.
- Cambodia Airports. 2015. "Cambodia Airports Handled More than 5.7 Million Passengers in 2014." Newsletter, no. 012. Last modified January 21, 2015. <http://www.cambodia-airports.aero/en/our-business/about-cambodia-airports/news/cambodia-airports-monthly-newsletter-january-2015#anchor>.
- CCHR (Cambodia Center for Human Rights). 2013. "Cambodia: Land in Conflict. An Overview of the Land Situation." Phnom Penh, Cambodia: CCHR. Available online: <http://www.cchrcambodia.org/admin/media/report/report/english/CCHR%20Report%20%20Cambodia%20Land%20in%20Conflict%20An%20Overview%20of%20the%20Land%20Situation%20ENG.pdf>.
- CDC (Council for the Development of Cambodia). 2013. *Cambodia Investment Guidebook*. Phnom Penh, Cambodia: CDC.
- CDRI (Cambodia Development Research Institute). 2013. "Cambodia Outlook Brief: Removing Constraints to Cambodia's Agricultural Development." Phnom Pehn, Cambodia: CDRI. Available online: <http://www.cdri.org.kh/webdata/policybrief/ob13/ob2e.pdf>.
- CDRI. 2012. "Fertiliser Value Chains in Cambodia: A Case Study in Takeo Province." *Cambodia Development Review*, 16(4): 5-9.
- CGIAR. 2013. "Cambodia." A Project of the Global Rice Science Partnership. Available online: <http://ricepedia.org/Cambodia>.
- Chan, Saruth. 2013. "Agricultural Mechanization in Cambodia: Challenges and Opportunities." Presentation for UN-CSAM Regional Forum, Qingdao, China, October 2013.
- Chan, Saruth. 2014. "Agricultural Mechanization in Cambodia." Presentation for UN-CSAM Second Regional Forum on Sustainable Agricultural Mechanization. September 9-11, 2014. Serpong, Indonesia.
- Chan, Saruth, L. Lytour, and C. Sinh. 2014. "Status and Prospect of Agricultural Mechanization in Cambodia," *CSAM Policy Brief*, September 2014. Available online: <http://www.un-csam.org/publication/PB201403.pdf>.
- Crowley, E. L., I. Tercelli, and N. Ourabah Haddad. 2011. "Annual Report on FAO Activities in Support of Producers' Organizations and Agricultural Cooperatives." FAO Inter Departmental Committee and Inter Departmental Working Group on Institution Building for Agriculture and Rural Development.

## 6. Bibliography

- DAC (Dynamic Alliance Consulting). 2011. "Research on Agro-tools Market Mapping and Analysis: Final Report." Available online: <http://casamnet.org/wp-content/uploads/docs-cam/DAC%20ReportCambodia%20%20Agro-tool%20Market%20Survey%20July2011.pdf>.
- DAI (Development Alternatives, Inc.). 2007. "Cambodia SME Development in Selected Agri-Sectors Sector Analysis and Value Chains, Rice." Bethesda, Maryland: DAI.
- de Carteret, D. and H. Kimsay. 2013. "Fake Fertiliser Cuts Crop Yields." *Phnom Penh Post*. March 1. Available online: <http://www.phnompenhpost.com/business/fake-fertiliser-cuts-crop-yields>.
- De Silva, S., R. Johnston, and S. Sellamuttu, S. 2014. "Agriculture, Irrigation and Poverty Reduction in Cambodia: Policy Narratives and Ground Realities Compared." CGIAR Research Program on Aquatic Agricultural Systems. Penang, Malaysia. Working Paper: AAS-2014-13.
- Deichert, G. and S. K. Yang. 2002. "Experiences with System of Rice Intensification (SRI) in Cambodia," p. 1. Centre d'Etude et de Developpement Agricole Cambodgien (CEDAC - Cambodian Center for Study and Development in Agriculture).
- DFDL. n.d. *DFDL Legal and Tax Updates*. Available online: <http://www.dfdl.com>.
- Dixon, J., A. Gulliver, and D. Gibbon. 2001. *Farming System and Poverty: Improving Farmer Livelihoods in A Changing World*. Washington, D.C.: Food and Agriculture Organization/World Bank.
- Food and Agriculture Organization of the United Nations (FAO). 2003. "Good Agricultural Practices." Available online: <http://www.fao.org/ag/magazine/GAP-V2-June02.pdf>.
- FAO. 2012. "Rice Market Monitor." Available online: [http://www.fao.org/fileadmin/templates/est/COMM\\_MARKETS\\_MONITRING/Rice/Images/RMM/RMM-Jan12.pdf](http://www.fao.org/fileadmin/templates/est/COMM_MARKETS_MONITRING/Rice/Images/RMM/RMM-Jan12.pdf).
- FAO. 2015. "Rice Price Update." Available online: <http://www.fao.org/economic/est/publications/rice-publications/the-fao-rice-price-update/en/>
- FAO. 2007. "Technical Report on the Training on Crop Monitoring and Forecasting for Cambodia."
- FAO. NRL. 2008. "Review of Agricultural Water Use per Country, Irrigation Cropping Calendar per Country."
- FAOSTAT. 2015. <http://faostat3.fao.org/home/E>, downloaded March 1, 2015.
- FAO Aquastat. 2011. Available online: [http://www.fao.org/nr/water/aquastat/countries\\_regions/khm/KHM-CP\\_eng.pdf](http://www.fao.org/nr/water/aquastat/countries_regions/khm/KHM-CP_eng.pdf)Improving Food Quality and Safety through Good Agricultural and Postharvest Practices in Fresh Produce. Phnom Penh, Cambodia: GDA.
- FiA. 2005. Fisheries Administration Data Collection and Statistics. Phnom Penh, Cambodia.
- GDA (General Department of Agriculture). 2012. Cambodia GAP: Dynamic Alliance Consulting (DAC) Group Co., Ltd. 2011. Research on Agro-Tools Market Mapping and Analysis. Phnom Penh, Cambodia: DAC.
- Giraud, G. 2013. "World Market of Fragrant Rice, Main Issues and Perspectives." *International Food and Agribusiness Management Review* 16(2).
- GIZ (Deutsche Gesellschaft für Internationale Zusammenarbeit). 2014. Land Rights Program. Bonn, Germany: GIZ.
- Hal, H. and J. Menon. 2014. "Cambodia: Rapid Growth in an Open, Post-Conflict Economy." *The World Economy*, 37(12): 1,649-1,668.
- Hanson, Garron. 2015. "Access to Finance for Agriculture Study." Draft for Feedback. February 4.
- Hatsukano and Tanaka. 2014. "Challenges to Make Cambodian SMEs Participate in Global Value Chains: Toward Addressing Poverty and Inequality." BRC Research Report.
- Hok, S. 2012. "Foreign Investment in Agriculture in Cambodia: A Survey of Recent Trends." International Institute for International Development.
- Hossain, M. 2002. "Rice Research and Poverty Alleviation in Bangladesh," Centre for Policy Dialogue (CPD) IIRRI Policy Brief 2,1-4.
- IFC (International Finance Corporation). 2015. Conversation with Bas Rozemuller and Viryak Sen, of the IFC. February.

## 6. Bibliography

- IFC. 2014. "IFC Support to the Cambodian Rice Sector: Approaches and Results." Available online: [http://www.ifc.org/wps/wcm/connect/topics\\_ext\\_content/ifc\\_external\\_corporate\\_site/ifc+sustainability/learning+and+adapting/knowledge+products/project+examples/transforming\\_rice\\_industry\\_building\\_export\\_capacity\\_Cambodia](http://www.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/ifc+sustainability/learning+and+adapting/knowledge+products/project+examples/transforming_rice_industry_building_export_capacity_Cambodia)
- IFDC (International Fertiliser Development Centre). 2010. "Rapid Appraisal of Fertiliser Quality in Cambodia," IFDC Report prepared for the World Bank.
- Index Mundi. Cambodia Economy Profile 2014. Accessed February 27, 2015. [http://www.indexmundi.com/cambodia/economy\\_profile.html](http://www.indexmundi.com/cambodia/economy_profile.html).
- ITC (International Trade Centre). 2014. Cambodia: Company Perspectives – An ITC Series on Non-Tariff Measures. Geneva, Switzerland: ITC. Available online: <http://www.intracen.org/publication/Cambodia-Company-Perspectives-An-ITC-Series-on-Non-Tariff-Measures/>.
- IWMI (international Water Management Institute). 2013. "CGIAR Investing in Water Management to Improve Productivity of Rice-Based Farming Systems in Cambodia Project." Issue brief #1, June 2013.
- Janssen, N., U. Pokhrel, L. Seryrith, S. Heng, T. S. Lay. 2012. Supporting the Vegetable Value Chain: Approaches, Lessons and Innovations in Svay Rieng. SNV Netherlands Development Organization.
- Joffre, O., K. Yumiko, J. Pant, S. Nam. 2010. Aquaculture for the Poor in Cambodia--Lessons Learned. Phnom Penh, Cambodia: The WorldFish Center.
- LICADHO (Cambodian League for the Promotion and Defense of Human Rights). "The Great Cambodian Giveaway: Visualizing Land Concessions over Time." Available online: [http://www.licadho-cambodia.org/concession\\_timelapse/](http://www.licadho-cambodia.org/concession_timelapse/).
- Lim, V. 2006. "Cambodia Agriculture Development Report." Economic Institute of Cambodia.
- MAFF (Ministry of Agriculture, Forestry and Fisheries). 2013-2014. "Agriculture, Forestry and Fisheries Statistics in 2013-2014."
- Mak, S. 2001. "Continued Innovation in a Cambodian Rice Based Farming System: Farmer Testing and Recombination of New Elements." *Agricultural Systems*, 69(1-2): 137-149.
- Malapit, H. J., K. Sproule, C. Kovarik, R. Meinzen-Dick, A. Quisumbing, F. Ramzan, E. Hogue, and S. Alkire. 2014. "Measuring Progress Toward Empowerment: Women's Empowerment In Agriculture Index: Baseline Report." International Food Policy Research Institute (IFPRI).
- MANFF, 2013-2014. "Cambodia Country Report on Agriculture, Water and Food Security." Special Seminar on Food Security, Focusing on Water Management and Sustainable Agriculture. September 5-7, 2013, Niigata, Japan. Ministry of Agriculture, Forestry and Fisheries, Cambodia. Available online: [http://www.maff.go.jp/j/kokusai/kokkyo/other\\_meeting/pdf/cambodia.pdf](http://www.maff.go.jp/j/kokusai/kokkyo/other_meeting/pdf/cambodia.pdf).
- Mehrvar, M., C. K. Sore, and M. Sambath. 2008. Women's Perspectives: A Case Study of Systematic Land Registration in Cambodia. Phnom Penh, Cambodia: Gender and Development for Cambodia.
- Mekong River Commission (MRC). 2009. "Regional Irrigation Sector Review for Joint Basin Planning Process." Available online: <http://www.mrcmekong.org/assets/Other-Documents/BDP/BDP2-Irrigation-Sector-Review-Main-Report-Final-Mar2010.pdf>.
- Ministry of Commerce (MoC). 2014. "Cambodia's Diagnostic Trade Integration Strategy 2014-2018." Phnom Pehn, Cambodia: Kingdom of Cambodia. Available online: [http://www.undp.org/content/dam/cambodia/docs/PovRed/Executive%20summary%20-%20Cambodia%20Trade%20Integration%20Strategy%202014-2018\\_Eng.pdf](http://www.undp.org/content/dam/cambodia/docs/PovRed/Executive%20summary%20-%20Cambodia%20Trade%20Integration%20Strategy%202014-2018_Eng.pdf).
- MoC. 2010. "Rice Sector Profit and Strategy."
- Ministry of Planning (MoP), NIS and Ministry of Health, Directorate General for Health. 2013. "Poverty in Cambodia - A New Approach Redefining the Poverty Line." Phnom Penh: Cambodia: MoP.
- Muller, Franz-Volker. 2012. "Commune-Based Land Allocation for Poverty Reduction in Cambodia." Phnom Penh: Deutsche Gesellschaft für Internationale Zusammenarbeit.
- <http://www.cdri.org.kh/webdata/download/sr/agriStrategy9e.pdf>
- Phnom Penh Securities PLC. 2013. Banking Sector in Cambodia. Available online: [http://www.pps.com.kh/PPSWEB/PPSUploadFiles/iv/164\\_en-us.pdf](http://www.pps.com.kh/PPSWEB/PPSUploadFiles/iv/164_en-us.pdf).

## 6. Bibliography

- Munford, G. and Johnsen, S., 2012. "Country Environment Profile: Cambodia." Phnom Penh, Cambodia: European Delegation to Cambodia. Available online: [http://eeas.europa.eu/delegations/cambodia/documents/publications/country\\_env\\_profile\\_cam\\_april\\_2012\\_en.pdf](http://eeas.europa.eu/delegations/cambodia/documents/publications/country_env_profile_cam_april_2012_en.pdf).
- Narim, Khuon. 2015. "Lawmakers Question Minister Over Migration," Cambodia Daily, January 22, 2015. Available online: <https://www.cambodiadaily.com/news/lawmakers-question-minister-over-migration-76504/>.
- Neef, Andreas, S. Touch, and J. Chiengthong. 2013. "The Politics and Ethics of Land Concessions in Rural Cambodia." *Journal of Agricultural and Environmental Ethics* 26.6: 1,085-1,103 .
- Open Development Cambodia. 2015. <http://www.opendevdevelopmentcambodia.net/maps/downloads/page/2/>. Downloaded March 5, 2015.
- Oryza. 2015. "IGC Estimates 2015 World Rice Trade at 41.6 Million Tons; Slightly Down from Last Year." Accessed February 23, 2015. <http://oryza.com/igc-estimates-2015-world-rice-trade-416-million-tons-slightly-down-last-year>.
- Phallika, C. 2011. "Public vs Private Provision of Irrigated Water Management on Rural Economic Development." Available online: <http://www.cdri.org.kh/webdata/download/sr/agriStrategy9e.pdf>.
- Pillaiyar, P. 1981. "Household Parboiling of Parboiled Rice." *Kishan World*, 8, 20–21.
- Prahba, H. 2004. *Organic Cultivation of Rice*.
- Rab, M. A., N. Hap, L. Seng, M. Ahmed, K. Viner. 2006. *Marketing Infrastructure, Distribution Channels and Trade Pattern of Inland Fisheries Resources in Cambodia: An Exploratory Study*. Buta Maung Penang, Malaysia: WorldFish Center.
- Rithi, P. 2014. "AEC 2015: Benefits and Challenges for Cambodia." Available online : [http://www.moc.gov.kh/tradeswap/userfiles/file/uploadedfiles/Gallery/4.%20Benefits%20and%20Challenges%20for%20Cambodia%20on%20AEC%2020159\\_16\\_2014\\_10\\_40\\_5.pdf](http://www.moc.gov.kh/tradeswap/userfiles/file/uploadedfiles/Gallery/4.%20Benefits%20and%20Challenges%20for%20Cambodia%20on%20AEC%2020159_16_2014_10_40_5.pdf).
- RSIS Centre for Non-Traditional Security (NTS) Studies. 2011. International Conference on Asian Food Security 2011 – Feeding Asia in the 21st Century: Building Urban - Rural Alliances (10–12 August 2011) Report, Singapore. Available online: [http://www.rsis.edu.sg/wp-content/uploads/2014/07/ER110812\\_Feeding\\_Asia\\_21st\\_Century.pdf](http://www.rsis.edu.sg/wp-content/uploads/2014/07/ER110812_Feeding_Asia_21st_Century.pdf).
- Salidjanova, N. 2007. "Chinese Damming of Mekong and Negative Repercussions for Tonle Sap." *ICE Case Studies*, 218 (May). Available online; <http://www1.american.edu/ted/ice/mekong-china.htm>.
- Sar, Sovann . 2010. "Social Aspects of Land Administration and Land Reform," *Land Reform in Cambodia (4633)*, FIG Congress 2010; Facing the Challenges—Building the Capacity. Sydney, Australia, April 11-16, 2010.
- Secretariat of One Window Service of Rice Export Formality (SOWS-REF) Report. 2015. "The Report on Cambodian Rice Export Status in 2014." Available online: <http://www.thesoutheastasiaweekly.com/cambodia-ships-21536-tons-of-rice-in-january-2014-thailand-missing-from-the-destination-roster/>.
- Scheidel, Arnim, M. Giampietro, and J. Ramos-Martin. 2013. "Self-Sufficiency or Surplus: Conflicting Local and National Rural Development Goals in Cambodia." *Land Use Policy* 34 : 342-352.
- Shean, M. 2010. "Cambodia: Future Growth Rate of Rice Production Uncertain," *USDA Foreign Agricultural Service, Commodity Intelligence Report*. Available online: <http://www.pecad.fas.usda.gov/highlights/2010/01/cambodia/>.
- Sinh, L. X. and D. M. Chung. 2010. "Current Situation of and Challenges for Snakehead (*channa micropeltes* and *channa striatus*) Farming in the Mekong Delta, Vietnam." *Scientific and Technology Journal of Agriculture and Rural Development* , no. 10.

## 6. Bibliography

- So, N., and T. Nao. 1999. *Aquaculture Sector Review (1998-1999) and Outline of National Aquaculture Development Plan (2000-2020)*. Phnom Penh, Cambodia: Fisheries Administration (FiA). Ministry of Agriculture, Forestry and Fisheries (MAFF).
- Sobrado, C., S. Neak, S. Ly, E. Aldaz-Carroll, E. Gamberoni, F. Arias-Vazquez, T. Fukao, S. Beng, T. Johnston, M. S. Joaquin, L. Bruni, R. de Groot. 2013. *Where Have All the Poor Gone?: Cambodia Poverty Assessment 2013*. A World Bank Country Study. Washington, D.C.; World Bank Group. Available online: <http://documents.worldbank.org/curated/en/2013/11/19394207/all-poor-gone-cambodia-poverty-assessment-2013>.
- Sochet, H. 2012. "Foreign Investment in Agriculture in Cambodia: A Survey of Recent Trends." Winnipeg, Manitoba: International Institute for Sustainable Development (IISD).
- Statista. 2015. "World's Top 20 Producers of Rice in 2012 (in million metric tons)." Accessed February 23, 2015. <http://www.statista.com/statistics/255937/leading-rice-producers-worldwide/>
- Trébuil, G. 2004. "Rizicultures asiatiques: Enjeux écologiques et économiques à l'aube du XXI<sup>e</sup> siècle."
- USAID Cambodia Gender Assessment 2010, [http://pdf.usaid.gov/pdf\\_docs/Pdacr982.pdf](http://pdf.usaid.gov/pdf_docs/Pdacr982.pdf)
- USAID Microlinks <https://www.microlinks.org/good-practice-center/value-chain-wiki/porters-five-forces>.
- USAID. n.d. "Property Rights and Resources Governance, Cambodia." Available online: [http://usaidlandtenure.net/sites/default/files/country-profiles/full-reports/USAID\\_Land\\_Tenure\\_Cambodia\\_Profile.pdf](http://usaidlandtenure.net/sites/default/files/country-profiles/full-reports/USAID_Land_Tenure_Cambodia_Profile.pdf). Downloaded March 2015.
- USAID. n.d. "Property Rights and Resources Governance, Cambodia." Available online: [http://usaidlandtenure.net/sites/default/files/country-profiles/full-reports/USAID\\_Land\\_Tenure\\_Cambodia\\_Profile.pdf](http://usaidlandtenure.net/sites/default/files/country-profiles/full-reports/USAID_Land_Tenure_Cambodia_Profile.pdf). Downloaded March 2015.
- Van, D. 2014. "Challenges & Opportunities in Cambodia Rice Sector." PowerPoint presentation.
- Vuthy, T., and Khiev, P. A. 2014. "Development of the Fertiliser Industry in Cambodia: Structure of the Market, Challenges in the Demand and Supply Sides and the Way Forward." CDRI Working Paper Series No. 91.
- Vuthy, T. 2012. "Fertiliser Value Chains in Cambodia: A Case Study in Takeo Province," *Cambodia Development Review*, 16(4): 5–9.
- Vuthy, T., K. Pirom, P. Dary. 2014. "The Fertilizer Industry in Cambodia: Market, Challenges and the Way Forward." Policy Note no. 6. ReSAKSS Asia. Available online: <http://ebrary.ifpri.org/cdm/singleitem/collection/p15738coll2/id/128917/rec/1>.
- Wokker, C., P. Santos, B. Ros, and K. Griffiths. 2011. "Irrigation Water Productivity in Cambodian Rice System." CDRI Working Paper Series No. 51. World Bank. 2014. "Cambodia Trade Corridor Performance Assessment." Available online: <https://openknowledge.worldbank.org/bitstream/handle/10986/20763/912420WPOP12570rformance0Assessment.pdf?sequence=1>.
- World Bank. 2005. Cambodia - Rural Sector Strategy Note: Towards a Strategy for Rural Growth, and Poverty Reduction. Washington, D.C.: World Bank. Available online : <http://documents.worldbank.org/curated/en/2005/06/6105677/cambodia-rural-sector-strategy-note-towards-strategy-rural-growth-poverty-reduction>
- World Bank. 2014. Where Have All the Poor Gone? Washington, D.C.: World Bank. Available online: <http://documents.worldbank.org/curated/en/2013/01/18594672/all-poor-gone>.
- World Bank. 2012. East Asia and Pacific Economic Update. Vol. 1. Available online: <http://siteresources.worldbank.org/INTEAPHALFYEARLYUPDATE/Resources/550192-1337701176079/eap-update-may-2012-country-sections.pdf>
- WTO ITC and UNCTAD. 2014. "World Tariff Profiles 2014." Geneva, Switzerland: WTO. Available online: [https://www.wto.org/english/res\\_e/publications\\_e/world\\_tariff\\_profiles\\_14\\_e.htm](https://www.wto.org/english/res_e/publications_e/world_tariff_profiles_14_e.htm)



**USAID**  
FROM THE AMERICAN PEOPLE

**LEO**

Leveraging Economic  
Opportunities

[microlinks.org/activities/leveraging-economic-opportunities-leo](https://microlinks.org/activities/leveraging-economic-opportunities-leo)

[acdivoca.org/LEO](https://acdivoca.org/LEO)