

Report No: AUS15856

Socialist Republic of Vietnam

VDR: Agricultural Modernization

Transforming Vietnamese Agriculture: Gaining More for Less

April 29, 2016

GFA02

EAST ASIA AND PACIFIC



Standard Disclaimer:

This volume is a product of the staff of the International Bank for Reconstruction and Development/ The World Bank. The findings, interpretations, and conclusions expressed in this paper do not necessarily reflect the views of the Executive Directors of The World Bank or the governments they represent. The World Bank does not guarantee the accuracy of the data included in this work. The boundaries, colors, denominations, and other information shown on any map in this work do not imply any judgment on the part of The World Bank concerning the legal status of any territory or the endorsement or acceptance of such boundaries.

Copyright Statement:

The material in this publication is copyrighted. Copying and/or transmitting portions or all of this work without permission may be a violation of applicable law. The International Bank for Reconstruction and Development/ The World Bank encourages dissemination of its work and will normally grant permission to reproduce portions of the work promptly.

For permission to photocopy or reprint any part of this work, please send a request with complete information to the Copyright Clearance Center, Inc., 222 Rosewood Drive, Danvers, MA 01923, USA, telephone 978-750-8400, fax 978-750-4470, <http://www.copyright.com/>.

All other queries on rights and licenses, including subsidiary rights, should be addressed to the Office of the Publisher, The World Bank, 1818 H Street NW, Washington, DC 20433, USA, fax 202-522-2422, e-mail pubrights@worldbank.org.

Transforming Vietnamese Agriculture: Gaining More from Less



Vietnam Development Report 2016

Transforming Vietnamese Agriculture: Gaining More from Less

April 2016

[disclaimer]

Acknowledgements

This report is the result of collaboration between the World Bank Group and Vietnam's Institute for Policy and Strategy for Agriculture and Rural Development (IPSARD). Elements of this report were prepared as part of a background paper on agriculture for the Vietnam 2035 study. Hence, the attention given to benchmarking Vietnam's performance against that of peers, to providing a vision for the agricultural sector's development over the coming one to two decades, and the emphasis given to nearer-term policy and institutional reforms needed to put the sector more clearly on the trajectory toward realizing this vision. While Vietnam's circumstances are distinctive in some dimensions, the country has much to learn from the experiences of other countries which have undergone (or are now also undergoing) significant structural changes in their agro-food systems. These experiences are widely referenced in this report.

The preparation of this report did not involve new primary research. Rather, it represents a synthesis of pertinent recent analyses, some further use of Vietnamese and comparative international statistics, and the harvesting of pertinent international experiences from many sources. The report benefitted greatly from the recently completed OECD study on agricultural policies in Vietnam.

This report was prepared by a team led by Steven Jaffee and consisting of Dang Kim Son, Nguyen Do Anh Tuan, Emilie Cassou, Truong Thi Thu Trang, Nguyen Thi Thuy, Mateo Ambrosio, and Donald Larson. Material on structural transformation in Southeast Asian agriculture and food systems was drawn from a collaborative research project involving Patrick Labaste, David Dawe, Francesco Goletti, Nelissa Jamora, John Lamb and others.

Others who made contributions included Dang Kim Khoi, Kim Van Chinh, Nguyen Thi Cam Nhung, Pham Kim Dung, and Nguyen Van Lam (all from IPSARD), Nguyen Huu Dung (VASEP), Le Duc Thinh (Department of Cooperatives & RD, MARD), Vu Trong Khai (College of Management for ARD, MARD), Pham Van Du (Department of Crop Production, MARD), Nguyen Van Ngai (Nong Lam University), Nguyen Phuong Vy (PHANO), Tran Kim Lien (VinaSeed), Dao The Anh (CASRAD), Nguyen Van Sanh (Can Tho University), and Le Canh Dung (Can Tho University).

The team would like to thank Andrzej Kwiecinski, Chris Jackson, Binh Thang Cao, Son Thanh Vo, Lan Van Nguyen, and Sergiy Zorya as well as the many experts and private sector representatives who participated in roundtable discussions in Hanoi and Ho Chi Minh City in December 2014 and March 2015. For their guidance throughout the preparation of this work, the team wishes to thank Victoria Kwakwa, Nathan Belete, and Sandeep Mahajan. It also wishes to thank Laurent Msellati, Dina Umali-Deininger, Madhur Gautam, Holger Kray, and Michael Morris for their advice. Administrative support was provided by Tam Thi Do and document formatting support was provided by Budy Wirasmo.

Acronyms

AGEI	Agricultural Growth Enabling Index	IFPRI	International Food Policy Research Institute
ARP	Agricultural Restructuring Plan	IPSARD	Institute for Policy and Strategy for Agriculture and Rural Development
ASEAN	Association of South East Asian Nations	JICA	Japan International Cooperative Agency
CENDEV	Technology Based Business Incubator	KHDP	Kerala Horticultural Development Programme
CIEM	Central Institute for Economic Management, Ministry of Planning and Investment of Vietnam	LDC	Least Developed Country
CIFOR	Center for International Forestry Research	MARD	Ministry of Agriculture and Rural Development
CRP	Corporate Responsibility Program	MKD	Mekong Delta (region of Vietnam)
DAP	Diammonium Phosphate	MLSCF	Malaysia Life Sciences Capital Fund
EU	European Union	MONRE	Ministry of Natural Resources and Environment
FAO	Food Agricultural Organization	OECD	Organization for Economic Cooperation and Development
FAO	Food and Agriculture Organization	PES	Payments for Ecosystem Services
GAP	Good Agricultural Practice	POC	Province of China
GDP	Gross Domestic Product	R&D	Research and Development
GHG	Greenhouse Gas	SOE	State-owned Enterprise
GIs	Geographic Indications	TFP	Total Factor Productivity
GSO	General Statistical Office	TSP	Trisodium Phosphate
GTAP	Global Trade Analysis Project	UN	United Nations
GVA	Gross Value-Added	UNDP	United Nations Development Program
HACCP	Hazard Analysis and Critical Control Point	UNESCO	United Nations Educational, Scientific and Cultural Organization
HCMC	Ho Chi Minh City	USAID	United States Agency for International Development
IAA-IPB	The Incubator for Agribusiness and Agroindustry at Bogor Agricultural University in Bogor	USDA	United States Department of Agriculture
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics	VFPCK	Vegetable and Fruit Promotion Council Kerala
IDMC	Irrigation and Drainage Management Company	VHLSS	Vietnam Household Living Standard Surveys
IFAD	International Fund for Agricultural Development	WWF	World Wildlife Fund

Contents

Acknowledgements	iii
Acronyms	iv
Foreword	x
Executive Summary	xi
Vietnamese Agriculture at a Crossroads	xi
Looking Ahead: Transformations and Aspirations of a Modernizing Agro-food System (Circa 2030)	xii
Getting from Here to There: Directions of Policy and Institutional Reform	xiv
Sustainable Agricultural Productivity and Growth	xiv
Competitiveness in Domestic and International Markets	xvi
About the report	xvii
Chapter 1. Structural Transformation in Agriculture: Where is Vietnam Today?	1
Changes in Agricultural Employment and Rural Incomes	4
Changes in Agricultural Land-use and the Structure of Production	8
Shifts in Food Consumption and Expenditures	14
Chapter 2. Agricultural Performance: A Varied Picture	21
Uneven Agricultural Growth	22
Changes (and Shortfalls) in Productivity	27
Land Productivity	27
Labor Productivity	28
Water Productivity	31
Over-Intensive Input Use	33
Total Factor Productivity	34
The Environmental Footprint of Vietnamese Agriculture	34
International Market Integration	37
Value Chain Inefficiencies and a Deficit of Collective Action	41
Chapter 3. Expectations and Aspirations for Vietnamese Agriculture: The Coming Decade (and Beyond)	45
Macro-Societal Setting	46
Expected Changes in Regional and Domestic Food Demand	46
International Commodity Markets	50
Climate Change Impacts	52
Anticipating Vietnam Agriculture: Circa 2030	58

Chapter 4. Institutions for a Modern Food Economy: Realizing the Vision via Policy Change and Institutional Innovation	61
Role of the State: Cross-Cutting Considerations	65
Looking Beyond Traditional Agricultural Policy	65
Leading Less and Facilitating More	65
Sustainable Agricultural Productivity and Growth	67
Facilitating More Efficient Use of Agricultural Land	67
Facilitating More Efficient and Sustainable Use of Irrigation Water	68
Strengthening Green Agriculture Policies and Implementation Capacities	69
Managing Climate Change Risks to Vietnamese Agriculture	72
Fostering Learning for Knowledge-Based Agriculture	74
Competitiveness in Domestic and International Markets	75
Stimulating Innovation throughout Agro-food Value Chains	76
Strengthening Systems and Capacities for Managing Emerging Food Safety Risks	77
Fostering Collective Action for Competitive and Inclusive Agricultural Value Chains	79
Repositioning and Rebranding Vietnamese Agriculture in International Markets	81
Conclusions	83
References	85
Thematic Sheets	95

Thematic Sheets

Thematic Sheet A - Agricultural Innovation Systems (AIS)	96
Thematic Sheet B - AIS II: Agricultural Research	98
Thematic Sheet C - AIS III: Agricultural Extension	99
Thematic Sheet D - AIS IV: Agribusiness Incubation	101
Thematic Sheet E - Economies of Scale and the Mechanization of Smallholder Agriculture	102
Thematic Sheet F - Greening Agriculture I: Payment for Ecosystem Services	104
Thematic Sheet G - Greening Agriculture II: Eco-certification and Eco-labeling Programs	107
Thematic Sheet H - Greening Agriculture III: Multi-Stakeholder Approaches to Greening Agriculture	110
Thematic Sheet I - Adaptive Management and Climate Change	112
Thematic Sheet J - ICT in Agriculture	113
Thematic Sheet K - Collective Action I: Producer Organizations	115
Thematic Sheet L - Collective Action II: Contract Farming	117
Thematic Sheet M - Collective Action III: Agro-based Clusters	119
Thematic Sheet N - Food Safety Governance	120
Thematic Sheet O - Repositioning I: Shifting Product Mix	122
Thematic Sheet P - Repositioning II: Branding Strategies	124

List of Boxes

Box 1: Diversification of Rural Livelihoods	5
Box 2: Migration and Remittances	7
Box 3: Recent Land Consolidation in China	11
Box 4: A Robust Rice Surplus	18
Box 5: Global Supply of and Demand for Cereals to the Mid-2020s	51
Box 6: The Policy Context for Vietnamese Agriculture	62
Box 7: Examples of Planned Adaptation Measures that Vietnam is Unlikely to Regret	74
Box 8: Approaches to Changing the Behavior of Farmers, Firms, and Consumers to Improve Food Safety	79
Box 9: Public-Private Provision of Technical and Other Services: An Indian Example	99
Box 10: Types and Examples of Agribusiness Incubators	101
Box 11: Korea's Agricultural Mechanization Plan: Combining Supply- and Demand-Side Components	103
Box 12: Public-Private Water Services and Quality Protection in Latin America	104
Box 13: Examples of Government-Led PES in China and the United States	105
Box 14: Building a Legislative Framework for Sustainability: Organic Agriculture in Tunisia	107
Box 15: Building a Business Case for Sustainability: Ireland's Origin Green Program	108
Box 16: Building Capacity for Sustainability: Certified Soy in Brazil	109
Box 17: The Landcare Movement in Australia and Beyond	110
Box 18: Getting to Zero Deforestation in Paraguay	111
Box 19: An Agro-Environmental Pact to Cut Agro-Chemicals in Italy	111
Box 20: Applications of Adaptive Management in the United States	112
Box 21: Data-Driven Planning: Uruguay's Agricultural Information and Decision-Support System	113
Box 22: Information-based Farming: Actionable Weather Forecasts in Kastamonu Province, Turkey	114
Box 23: From Cooperation to Product Innovation: the Case of Ocean Spray Cranberries	116
Box 24: The Dragonhead Enterprise: An East Asian Take on Contract Farming	118
Box 25: Public Sector Support for Clusters: Examples from Latin America	119
Box 26: Examples of Co-regulation of Food Safety	120
Box 27: Knowledge-Intensive Value-Addition in the Indian Spice Industry	122
Box 28: From Commodities to Value-Added Products: Taiwan, China	123
Box 29: Pu'er Tea in China	124
Box 30: Mexican Tequila	124
Box 31: Marketing Undifferentiated Products in the USA	125
Box 32: Geographic Indicators for Tea and Coffee	126

List of Tables

Table 1: Proportion of Income Earned from Different Economic Activities, 2008–2014	4
Table 2: Economic Activities of Households, 2008–2014	5
Table 3: Composition of Household Income among Sampled Mekong Delta Rice Producers	6

Table 4: Changes in the Urban-Rural Income Gap	6
Table 5: Agricultural Growth Rates in Selected Asian Countries, 1990–2012	22
Table 6: Rice versus Alternative Crops: Revenue and Margins in Chau Phu and An Giang, Mekong Delta, 2012	25
Table 7: Net Production Value in Rice and Other Crops in Vietnam 2000–2013	25
Table 8: Subsector Share of Gross Output in Vietnamese Agriculture	26
Table 9: Composition of Agriculture and Agricultural Growth by Region	26
Table 10: yields of Selected Crops	27
Table 11: Growth in Agricultural Value-Added per Worker	29
Table 12: Low Labor Productivity in Agriculture: Both Fact and Statistical Artifact, 2006	30
Table 13: Water Productivity in Large-Scale Irrigation Schemes	32
Table 14: Average Annual Growth in Agricultural Total Factor Productivity	34
Table 15: Vietnam’s Agro-Environmental Hotspots	35
Table 16: Environmental Risks, Drivers and Impacts Associated with Coffee Expansion and Intensification in the Central Highlands	36
Table 17: Agro-food sector’s integration with international markets, 2000–2012	38
Table 18: Vietnam is a High Ranking Commodity Exporter—at Discount Prices	39
Table 19: Vietnamese Food Exports Value 2013: Primary and Processed Products	40
Table 20: Daily Food Availability in Selected Asian Countries, 1961–2009 and 2009–2030 (projected)	47
Table 21: Daily Consumption of Selected Food Groups in East and Southeast Asia, 2009 (actual) and 2030 (projected)	48
Table 22: International Commodity Price Index Projections (2010=100)	51
Table 23: Shifts in Government Roles in a More Market-Led Vietnamese Agriculture	66
Table 24: Government Roles and Instruments in Agro-Environmental Mitigation	71

List of Figures

Figure 1: Urban Share of East and Southeast Asia’s Population, 1950–2050	2
Figure 2: Agriculture’s Share of GDP and Employment, Selected Countries, 1980–2011	2
Figure 3: Agricultural Transformation: The Position of Vietnam and Regional Peers	3
Figure 4: Agriculture Share of Vietnamese GDP, Employment, and Trade, 2000–2013	4
Figure 5: Agriculture’s Contribution to Rural Household Income by Region, 2002–2012	5
Figure 6: Domestic Migration Flows, 1999–2009	7
Figure 7: Share of Food Crop Area under Selected Crops in China and Vietnam	9
Figure 8: Percentage Distribution of Farm Units by Landholding Size, 2001 and 2011	10
Figure 9: Concentration of Rice Surplus in Six Mekong Delta Provinces, 2008	12
Figure 10: Breakdown of Urban and Rural Household Food Expenditures in 2002 and 2012	15
Figure 11: Calories Available per Capita per Day in East and Southeast Asia, 1961–2011	15
Figure 12: Share of Household Food Expenditures by Income Quintile Group	16
Figure 13: The Early Stages of a Challenge of Feed Security for Vietnam Rice Exports versus Feed Imports	17
Figure 14: Expected Rice Surplus in 2030 for Different Amounts of Rice-Land, under a “Worst Case” Productivity Scenario	17

Figure 15: Share of Modern Retail in Total Food Retail in Several Countries, 2009–2012	20
Figure 16: Ratio of Agribusiness GDP to Primary Agriculture GDP, 2011	20
Figure 17: Vietnam’s Comparatively Stable Agricultural Growth	22
Figure 18: Retail Prices for Milled Rice in Selected Southeast Asian Countries	22
Figure 19: Annual Growth of Vietnamese Agricultural Subsectors, 2000–2013	24
Figure 20: Varied Patterns of Growth Among Leading Crops and Livestock Products	26
Figure 21: Growth in Land Productivity in Selected Asian Countries, 1990–2010	27
Figure 22: Declining Productivity in Vietnamese Fisheries	28
Figure 23: Agricultural Value-Added per Worker	29
Figure 24: Ratio of Average Value-Added per Agricultural Worker to Average Income per Capita	29
Figure 25: Labor Use in the Major Rice Bowls of Asia	29
Figure 26: Consumption of NPK Fertilizer per Hectare of Paddy, 2006–2011	33
Figure 27: Vietnam’s Share of World Exports of Selected Commodities, 2000–2012	37
Figure 28: Vietnam’s Agro-food Trade Balance, 2000–2013	38
Figure 29: Composition of Food Calories in Vietnam, 2009 (actual) and 2030 (projected)	48
Figure 30: Projected Changes in the Volume and Value of Vietnam’s Domestic Food Market	49
Figure 31: Mekong River Delta Suitability for Rice under a 17 cm Rise in Sea Level	55

Executive Summary

Vietnamese Agriculture at a Crossroads

Over the past quarter century, Vietnam’s agricultural sector has made enormous progress. Steady advances in smallholder rice productivity and intensification through the 1990s and beyond have played a central role in Vietnam’s successes in poverty reduction, national food security, and social stability. Vietnam once experienced hunger yet its per capita food availability now ranks among the top tier of middle-income countries. Many countries are trying to learn from Vietnam’s food security success. Vietnam’s average rice yields now trail only those of China among Asia’s emerging economies. The country has also achieved explosive growth in agricultural exports and now ranks among the top five global exporters in products as diverse as shrimp, coffee, cashews, rice, and pepper.

Vietnam’s performance in terms of agricultural yields, output, and exports, however, has been more impressive than its gains in efficiency, farmer welfare, and product quality. Vietnam lags behind regional peers in relation to agricultural land, labor, and water productivity and has seen its once robust growth in total factor productivity decline in recent years. A chasm is forming between farm and non-farm incomes, and income inequality is rising within rural areas. Most of Vietnam’s agricultural trade is in the form of raw commodities, typically sold at prices lower than those of leading competitors due to quality or other differences. At home, there are growing concerns about food safety.

More output has come from more and more inputs, at increasing environmental cost. A large proportion of Vietnam’s agricultural growth has stemmed from expanded or more intensive use of land and other natural resources, and relatively heavy use of fertilizer and other agro-chemicals. As a result, aspects of Vietnam’s agricultural success have come at the expense of the environment. Environmental consequences of Vietnam’s agricultural success have ranged from deforestation and fishery resource depletion, to a growing incidence of land degradation and water pollution. Hence, Vietnam’s agricultural growth has relied very heavily on human, natural, and chemical factors of production.

Vietnamese agriculture now sits at a turning point. The agricultural sector now faces growing domestic competition—from cities, industry, and services—for labor, land and water. Rising labor costs are beginning to inhibit the sector’s ability to compete globally as a low cost producer of bulk undifferentiated commodities. The consequences of over-intensive input- and natural resource-use—both for the environment and for farmer profitability—are increasingly coming into view. Some environmental problems are now adversely impacting both productivity and the international position of Vietnam’s commodities. Vietnam faces bright opportunities in both domestic and international markets, yet effectively competing in these will depend upon the ability of farmers and firms to deliver (food and other) products with reliability, and with assurances relating to quality, safety, and sustainability.

Going forward, Vietnam’s agricultural sector needs to generate “more from less.” That is, it must generate more economic value—and farmer and consumer welfare—using less natural and human capital and less harmful intermediate inputs. Future growth can rely primarily on increased efficiency, innovation, diversification, and value-addition. This strategic shift was highlighted in the government’s Agricultural Restructuring Plan (ARP), approved

by the Prime Minister in June 2014. The ARP defines sector goals in terms of the triple bottom line of economically, socially, and environmentally sustainable development. It lays out expected changes in the roles and spending patterns of the government in the sector and discusses the need to work with other stakeholders, including in the private sector. There are currently many initiatives aiming in these directions. Yet achieving the shift these represent on a large, sector-wide scale, will require important changes in certain economy-wide and sector-specific policies and, over time, major changes and additions to the core institutions servicing agriculture. It calls for an ambitious and ongoing process of learning and experimentation, and several potential directions are offered below for consideration.

Looking Ahead: Transformations and Aspirations of a Modernizing Agro-food System (Circa 2030)

Over the coming 10–15 years, an array of demographic, economic and other factors will alter the context in which Vietnam’s agriculture will need to compete. Vietnam will experience further urbanization (to some 50 percent by 2025) and a large expansion in its middle class. The dietary patterns and food expenditures of domestic consumers will continue to change with reduced consumption of rice and increased consumption of animal products, fruits and vegetables, and processed foods. Climate change is expected to give rise to more erratic weather patterns. Recent agreements should lead Vietnam’s economy to become increasingly integrated, both regionally and internationally. During this period, Vietnamese agriculture is expected to continue along a path of structural transformation with the following characteristics:

The share of primary agriculture in gross domestic product (GDP) will decline, yet the share of the broader agro-food complex will not. This would be consistent with patterns observed in other formerly agrarian (and non-oil exporting) countries. The GDP share of primary agriculture is expected to decline over the coming two decades, perhaps by 0.5 percent per annum. By the early 2030s, primary agriculture will then account for some 8–9 percent of Vietnam’s GDP. However, agro-industry, together with food distribution and logistical (and other) services could account for nearly double this share (15 percent of GDP). This means that the agro-food complex will still account for one-fourth of total GDP.

The agro-food sector will continue to play a very important role in employment and livelihoods. Primary agriculture (including fisheries and forestry) could remain the major livelihood or source of employment for between 25 and 30 percent of the population, though this is less than the current 47 percent. The share of employment in agro-industry and agro-food services will likely be just below its share of GDP. Hence, the overall agro-food complex will still account for 35 to 40 percent of employment in the early 2030s. The importance of seasonal and full time (or near-full time) employment in agriculture will vary markedly, remaining very strong in the Mekong Delta, Central Highlands, and the Southeast, but of declining in importance in the Red River Delta, Central Coast and parts of the Northern Mountains area.

Significant changes will occur in terms of agricultural land-use, and the organization of production and value chains. For example, one can anticipate that market, environmental, and other factors will contribute to upward of one-third of the current paddy-land being shifted by 2030 to alternative agricultural land-uses or ecosystem services. Paddy-land affected by saline intrusion will be converted to aquaculture, involving more diverse species than at

present. Much of the paddy-land in peri-urban areas will be used for vegetable or ornamental plant production. Paddy-land near the coast and near ecologically sensitive sites will take on greater multi-functional roles, seeking to maintain or revive biodiversity and support eco-tourism. Where drainage services are improved, some paddy-land will be converted to maize production. Rice-based production systems will also change, incorporating more rotation crops to improve soils and manage pests, and moving toward greater specialization—including in fragrant varieties and organic or other eco-safe production systems. Despite the decline in the rice-growing area, Vietnam will continue to experience production levels providing a significant exportable surplus with a larger share consisting of high quality and specialty variety products which will provide higher profits for farmers and enterprises. Rice and other product value chains will feature a higher level of farmer organization and more direct linkages between these entities and processors or food distributors (or exporters).

Against the backdrop of these shifts, the following represent a set of ambitious yet realistic outcomes that Vietnamese agriculture can achieve in the 2025–2030 time range. While not exhaustive, these illustrate the range of accomplishments that are within Vietnam’s reach, taking into account expected conditions in international commodity markets, changes in domestic food demand, climate change impacts, and past performance.

Sustainable Agricultural Productivity and Growth

- The **agricultural growth** rate will cease its ten-year decline and revert to the pace experienced in years just after the turn of the millennium at an annual average of between 3.0 and 3.5 percent.
- This acceleration of growth will come primarily from **growth in total factor productivity** (TFP) and the reversal of its recent decline. Mirroring patterns observed in other high-performing middle-income countries, more than 80 percent of growth will be due to TFP growth. **Agricultural labor productivity** will increase substantially, and this will close the gap which currently exists between Vietnam, Thailand, and China. It will also close the gap between Vietnam’s agricultural sector and its labor-intensive manufacturing subsectors.
- The current gap in **water productivity** in Vietnam’s large irrigation schemes (vis-à-vis those in China and other middle-income Asian countries) will be closed as a result of land-use changes and improved water management and irrigation services.
- The reality and reputation of Vietnamese agriculture as **eco-unfriendly** will fundamentally change. In large portions of the sector, the monitoring of agronomic practices against sustainability standards, natural resource management, waste management, and energy efficient methods will have been mainstreamed. Vietnam will be among the leading developing countries in the effective **utilization of agricultural wastes**—for energy, feed, composting, and other purposes. Dimensions of Vietnamese agriculture will be domestically and internationally recognized for their **multi-functionality**—including their protection of landscapes and contribution to eco-tourism.
- The sector will continue to play a major role in meeting national **food security**, servicing increasingly diverse food demands and meeting domestic consumer expectations for safety, quality, and price. Vietnam will meet or exceed all of the World Health Assembly **nutrition** targets for 2025, including those related to under-nutrition (i.e., child stunting), micro-nutrient deficiencies, and obesity. While this is a multi-sector challenge, the agricultural sector will help promote a healthy and diverse diet.

Competitiveness in Domestic and International Markets

- Vietnam will rank in the top 10–20 percent of developing countries in terms of the proportion of its agricultural commodity export volume which is derived from production areas which are either internationally certified or otherwise recognized for **compliance with a broad range of environmental and social standards**.
- More than 50 percent of Vietnam’s **agro-food exports** will consist of processed and other value-added products, more than double the current proportion. More than two dozen brands of Vietnamese companies that make **agro-food products will be well-recognized in major regional and international markets**. In the process of this recognition, the current discrepancy between the high international regard for Vietnamese cuisine and the invisibility of most Vietnamese foods and raw materials abroad will be resolved.

Getting from Here to There: Directions of Policy and Institutional Reform

Realizing this vision will rest on important policy reforms and institutional arrangements that help to drive innovation and efficiency. Particular potential lies in reforms relating to agricultural land, irrigation, agricultural research and extension, and food safety. In these and other areas, much can be learned from the policies and institutional arrangements that have helped other countries sustain a high level of sector or subsector competitiveness, or improve their sustainability, and the report provides many examples of these.

The modernization of the Vietnamese agro-food system will occur more smoothly if the government’s approach involves leading less and facilitating more. Administrative controls on land, and direct state involvement in both input and output markets were important factors in the sector’s stability and inclusive growth over recent decades. However, maintaining these policies and certain legacy institutions could delay the agricultural sector’s transformation in directions needed for it to remain in step with a modernizing, middle-income country. Demographic and other domestic changes, as well as changes in the external environment, will deepen the pressures and raise the stakes for the modernization of the sector. Micro-managing these change processes would be exceedingly difficult and ultimately constrain the inherent energy and resilience of Vietnamese farmers, as well as deter investment throughout the agro-food system.

The following are examples of promising directions and steps that can be taken.

Sustainable Agricultural Productivity and Growth

Enable (small) farms to achieve economies of scale. Land consolidation, in various forms, will be critical for upgrading production systems and product quality, reducing transaction costs within value chains, and enabling households to gain and maintain a middle living standard based at least partly on agriculture. Land consolidation will also enable further mechanization, a process which will become increasingly important as labor costs rise. Vietnam has already demonstrated that the development of land rental markets can offer an important pathway to land consolidation—if not in title, then in practice. In this respect, much will be gained from improved land services (e.g., information, recording, dispute settlement) and other interventions that improve the efficiency of

land rental markets. By the same token, there could be significant gains from interventions that bolster farmers' embrace of collective action, or that enable entrepreneurs to develop the shared economy on a commercial basis, enabling economies of scale to emerge on the basis of pooled resources.

Continue to facilitate agricultural diversification to respond to emerging food demand and improve income and employment opportunities. Among other things, this will require giving farmers more land-use choices by further loosening restrictions on uses of rice-land, improving irrigation services, and developing more flexible irrigation infrastructure suited to growing various crops. Other examples of supportive measures include strengthening animal health and pest surveillance services, better enforcing regulations relating to the use of agro-chemicals and antibiotics, and facilitating farmers' and small enterprises' access to finance.

Support and broker broad-based innovation across the agricultural and food sectors. Shifting from resource-intensive to knowledge-based growth will require major changes in the ways in which farmers and other actors in the food system learn and gain access to technical and commercial information. While the government has initiated a shift away from top-down, supply-driven approaches to agricultural research and extension, a deeper rethink is needed with respect to public sector objectives, approaches, and roles. For example, public sector extension services may still have an important role to play, though less as the main provider of centralized advisory services and more as a broker, mobilizer, and funder of services provided by others. For many agencies, moving into these roles will rest on an embrace of structural and cultural changes, both internal and external to their organization. In particular, integrating brokerage functions into traditional extension services will often require these institutions to build new skillsets, reframe their mission, and modify staff incentives by changing performance measurement criteria. Brokering requires specific facilitation skills for managing group processes and building trust; and it cannot be judged by traditional performance indicators such as publications or numbers of trainings. In parallel, the heavy focus on improving yields and output suggests room for rebalancing investments to ensure their alignment with the realities and aspirations of a modernizing food system.

Support environmental stewards to compete on quality. Some legacy agricultural promotion policies seemingly conflict with environmental protection goals. This liability can be converted into an asset. Increasingly, environmental protection is becoming central to suppliers' ability to enter markets and command higher prices. Recognizing the need to prioritize and improve environmental performance, government can enable and encourage private actors to invest in environmental protection through incentives and information. International experience offers examples of how, through procurement, research and development, extension, quality systems, or payment for ecosystem service schemes, government can enable and encourage private actors to invest in environmental protection. More generally, experience highlights the need for pro-active agro-environmental strategies which anticipate and prevent degradation from occurring in the first place. In practice, this can involve strengthening capabilities and infrastructure to monitor, learn, and do things differently, through investments in anything from testing laboratories and data collection, to training in areas of technical specialization and facilitation skills. It can also involve mobilizing multiple stakeholders, developing public-private partnerships, and intervening at multiple levels, from farm, to landscape, to region. These principles could for instance be used to develop sustainable agro-based ecosystems around industrial crops and agro-forestry in the Central Highlands.

Manage climate risk adaptively. Vietnamese agriculture's potential vulnerability to climate change risks such as shifting rainfall patterns and temperature, and sea level rise, together with the fundamental uncertainty that is intrinsic to climate change, suggest at least three orientations when it comes to planning adaptation strategies and

shaping a public sector response to climate change. These are to embrace the tenets of adaptive management, to cultivate resilience by strengthening capacity for innovation at every level of society and throughout the economy, and to privilege no-regrets strategies. Improved water resources management will be critical. With increasing competition around land-use, water, and budgetary resources, irrigation will need to become more efficient and accountable. For this, Vietnam's Ministry of Agriculture and Rural Development (MARD) can work with provincial and user agencies to promote and facilitate a more service-oriented approach to irrigation based on modified incentive structures and a less top-down approach to communication that favors joint problem solving among management and user organizations.

Competitiveness in Domestic and International Markets

Strengthen collective action to build competitive and inclusive value chains. The emergence of more competitive and inclusive value chains will be made possible by stronger collective action. The government can support this in producer and industry organizations (and commodity boards) in two broad ways, by investing in organizational strengthening, and through legal and regulatory means. Many such entities currently perform government (program) liaison functions, but in the future will need to play more important technical and/or commercial roles. While contract farming is primarily private-sector led, government support for such arrangements is not uncommon on the grounds that these can contribute to meeting broader policy objectives such as inclusive growth, food security, or the protection of natural resources (though this approach has its pitfalls). In a number of Vietnamese contexts such as in aquaculture, specialty rice, and horticulture/floriculture, agricultural cluster development may be an appropriate strategy and lends itself to incremental forms of public sector support.

Strengthen public and private sector capacities to ensure safe food. In response to food safety challenges, Vietnam has already revamped its food safety regulations, invested in laboratories, and streamlined institutional structures by reducing the number of ministries in charge of food safety from six to three. It is also redirecting capacity developed to ensure export food safety to focus on the domestic market. To bolster these changes, the government will need to address financial and human resource pressures creatively, and may consider models such as co-regulation, which rely on greater private sector involvement, to manage the constraints it is encountering. In any case, technical and other forms of support may be needed to enable private food operators (and especially SME food processors and informal sector food distributors) to improve their food safety management practices. Adopting a risk-based approach will help to provide a set of clear foci for public interventions.

Reposition and rebrand Vietnam's offerings to enhance its commercial performance in the food and other sectors. Noting the low visibility and perceived value of many Vietnamese exports overseas, Vietnam could consider any number of repositioning and rebranding strategies that draw on the rich experience of other countries in this domain. In a number of countries, such strategies, together with competitive pressures and market opportunities, have stimulated shifts to differentiated commodities or value-added product development. Indeed, the national or regional branding of a product—combining elements of marketing, legal protection, and quality management—can have a transformative effect on both domestic and international markets. Enhancing Vietnam's national brand in certain industries could help in attracting foreign direct investment and tourism, and more generally promote exports and domestic sales.

In general, what emerges in considering promising ways forward is first, that overcoming the long-term competitiveness and sustainability challenges of the agricultural sector will call for broad government involvement and joint-ministerial action. Many key reforms, such as those related to land, state-owned enterprises, science and technology, government decentralization and coordination, and others needed to support the business of agriculture, cannot be undertaken single-handedly by the Ministry of Agriculture and Rural Development. Second, to achieve its aspirations, the government will need to invest more selectively in core public goods and services, while encouraging much greater investment and initiative by farmers and the private sector. In short, the government will need to lead less and facilitate considerably more.

About the report

This report explores the processes of transformation that have been reshaping Vietnam’s agricultural sector, highlighting recent structural changes in Chapter 1, and benchmarking these and various indications of performance against the patterns observed in Asia’s other emerging economies in Chapter 2. In Chapter 3, the report lays out a scenario and set of goals for how Vietnam’s agricultural sector could evolve over the coming 10 to 15 years, along with some of the key policy and institutional challenges the country will need to address along the way. Chapter 4 then draws on international experience to present multiple examples of policy instruments and programmatic approaches from which Vietnam can learn as it steers its way through the changes of the coming decades. While drawing on these concepts, Vietnam will need to blaze its own path—building on the economic, social, and ecological dynamics that are playing out in the agricultural sector and beyond—to realize its national vision of a modern food system.



Chapter 1. Structural Transformation in Agriculture: Where is Vietnam Today?

Structural transformation is a defining characteristic of the development process, both a cause and effect of economic growth. At a macro level, structural transformation typically features major demographic changes—including declining birth and death rates, internal migration, and urbanization (Figure 1)—and changes in the composition of the economy, including a declining share of agriculture in gross domestic product (GDP) and employment (Figure 2) and the emergence of modern industrial and service sectors (Timmer and Akkus 2008). With rising incomes, the share of expenditures made on food and other necessities declines even as absolute spending on these increases.

Structural changes also occur within agriculture and the rural economy, although the nature, magnitude, and pace of these changes vary among countries. Common tendencies include a consolidation of landholdings and agricultural production, reduced labor and increased mechanization and use of purchased inputs, shifts in land-use patterns, a growing importance of non-farm employment and other income sources within rural areas, and changes in the commodity composition of agricultural GDP (Dawe 2015). These patterns are strongly influenced by demographics, agro-ecological resources, the development of infrastructure, and changes in consumer demand and international markets. In many countries, the trajectory and status of agricultural and rural transformation vary among regions.

Beyond the farm-gate, further structural changes occur with the development of value chains involved in the handling, transportation, processing, conversion, distribution, and marketing of food and other agricultural products. Systems once featuring many small, loosely connected players selling generic goods give way to or are supplemented by more integrated, consolidated, and differentiated value chains characterized by higher levels of investment (e.g., in cold chains to maintain the quality and safety of high value perishable foods) (Reardon et al. 2014). Modern agro-food systems emerge which combine primary production, manufacturing and an array of services. Such food systems are also increasingly integrated into the world market, through trade, inward and

Figure 1: Urban Share of East and Southeast Asia’s Population, 1950–2050

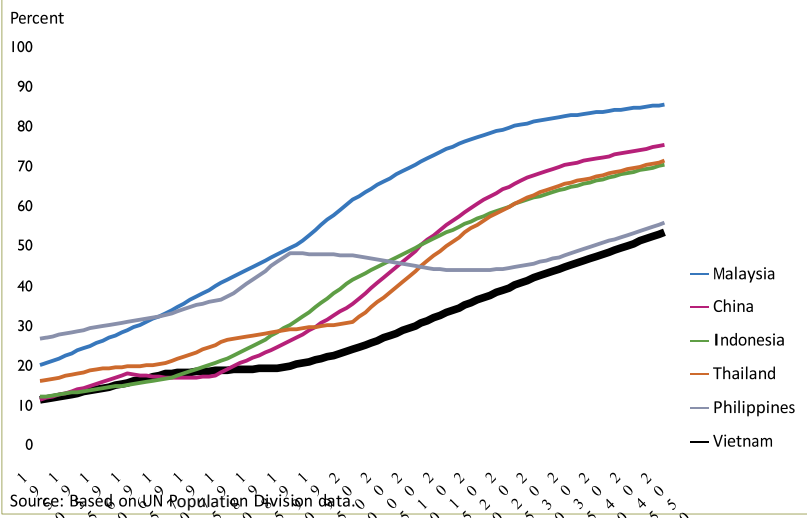
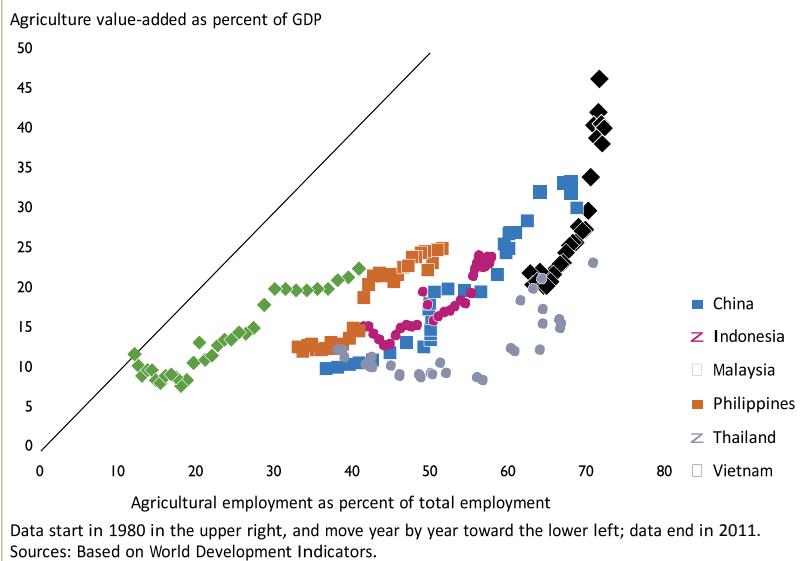


Figure 2: Agriculture’s Share of GDP and Employment, Selected Countries, 1980–2011



outward investment, and sometimes, labor migration. The final outcome of these structural transformations is a situation in which agriculture as an economic activity and various forms of agribusiness differ little from other sectors in terms of the productivity of labor and capital.

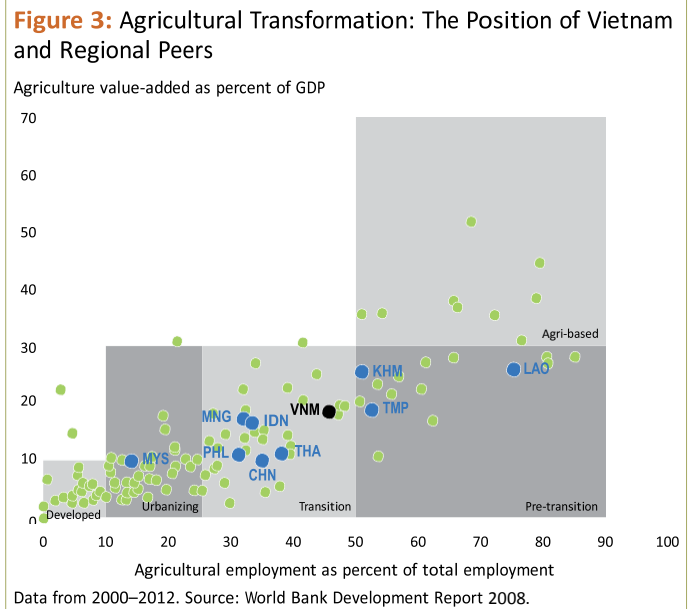
The World Development Report 2008 classified different countries into five categories based on the share of agriculture in national GDP and employment: “ag-based, pre-transition, transition, urbanizing, and mature.” For ag-based countries, the focus of policy attention has tended to be improving basic rural infrastructure; and raising output and productivity through opening up new agricultural areas and increasing the use of so-called modern inputs. Primary goals tend to relate to assuring food security, reducing rural poverty, and contributing to a country’s trade balance. For pre-transition countries, these goals are supplemented with efforts to support agricultural diversification and increase private investment. For transition and urbanizing countries, greater attention is given to multi-sectoral concerns or opportunities, including nutritional outcomes, food safety, competitiveness, and reducing agriculture’s environmental footprint. Safety nets tend to replace the physical supply of food to the poor.

Figure 3 depicts the current position of Vietnam on this structural transformation curve, together with that of regional peers. Vietnam’s trajectory has been relatively rapid, leading it to shift from an ag-based to transition country in only 15 years (from the mid-1990s to 2010–2011). This shift has resembled the one China experienced ten years earlier, from the mid-1980s to around 2000. The pace of change in the past two decades has been far slower—in relation to these two variables (share of agriculture in national GDP and employment)—for Thailand, Indonesia, and the Philippines.

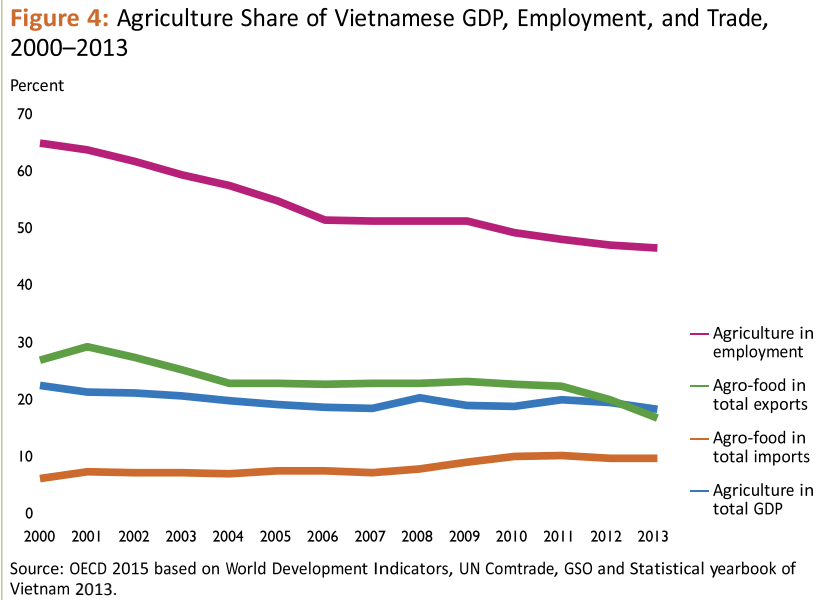
For Vietnam, the most significant change has been in the share of agriculture in employment, which fell from 65 percent in 2000 to 47 percent in 2012 (World Development Indicators). How rapidly this

trend continues will mostly be determined outside the agricultural sector—notably by the growth of services, and by the growth and labor-intensiveness of manufacturing. The contrasting experiences of other countries in the region is instructive. In China, the agricultural sector accounted for a similar share of employment (47 percent) in 2004, yet by 2011, its share in employment had fallen to 35 percent. In contrast, it took two decades (from 1993 to 2012) for agriculture’s share in employment to fall from 46 to 32 percent in the Philippines. Slow change is also evident in Thailand where the share of agriculture in employment fell only from 46 to 40 percent between 2001 and 2012. Outside of the region, Turkey nearly halved its agricultural employment share (from 47 to 24 percent) over the two decade period from 1990 to 2010.

As shown in Figure 4, the share of agriculture in Vietnamese GDP and trade has been relatively flat since the mid-2000s. In 2005–2006 the sector’s GDP share was 19 percent while over the 2011–2013 period, it averaged 19.4 percent. Within East and Southeast Asia, the only other country which experienced an increase in agriculture’s share of GDP during this period was Thailand (from 10.6 to 12.9 percent). For Vietnam, agriculture’s steady share



in trade can be attributed to various factors, including favorable international commodity prices, changing patterns of domestic demand, and industry-specific developments. But agriculture’s steady share of total GDP is more a reflection of the recent challenges faced by Vietnam’s manufacturing and services sectors, than of especially strong performance in the agricultural sector overall. What follows is more detail on the emergent structural changes within Vietnamese agriculture observed over the past decade or so. Several indications of the sector’s recent performance are highlighted in Chapter 2.



Changes in Agricultural Employment and Rural Incomes

The share of agriculture in employment is declining. The transformation from farm to non-farm activities at the household level is reflected in households’ income structure. The share of income from agriculture (including forestry and fishery) in household income nationally country declined from 28.6 percent in 2002 to 19.9 percent in 2012. For rural households only, primary agriculture’s income share fell from 43.4 percent in 2002 to 31.8 percent in 2012, having been overtaken in proportion by “salaries and wages” in 2010. These shares are drawn from the national Vietnam Household Living Standard Surveys (VHLSS). Somewhat different shares yet the same trends are observed from the Vietnam Access to Resources Rural Survey (VARHS) which covers a representative sample of households in 12 provinces. Box 1 provides some insights on the trends and patterns of rural income diversification over the past decade.

Table 1: Proportion of Income Earned from Different Economic Activities, 2008–2014

Percent household	Agriculture	Labour	Enterprise	Other
2008	34.76	28.15	12.63	24.36
2010	23.36	31.26	13.67	31.66
2012	23.00	32.92	3.85	40.11
2014	23.80	44.35	12.28	19.54

Source: Based on VARHS data for 2008–2014, Newman and Kinghan 2015.

The pace of this shift in income sources has, however, varied substantially across the country. The most significant declines have occurred in the Red River Delta, the northern mountainous areas, and the North Central Coast. There has been much less change elsewhere, with agriculture remaining the leading income source in the Mekong Delta and Central Highlands, both in rural and in urban households (Figure 5). The degree of change in the structure of rural households’ income reflects factors such as landholding size, education, and proximity to urban centers.

The role of agriculture is thus taking on a different and changing shape in different parts of the country. In much of the Central Highlands, agriculture continues to account for the largest share of GDP and employment and

Box 1: Diversification of Rural Livelihoods

Vietnamese households are increasingly relying on non-farm and even non-agricultural sources of income. A striking statistic is that nearly 50 percent of households involved only in agriculture in 2008 had diversified into another economic activity in 2010. These activities included waged labor and non-farm enterprise (Table 2). Between 2008 and 2014, waged employment grew as a source of household income, even as agricultural activities declined. Enterprise activity wavered, meanwhile, possibly a reflection of macro-economic conditions.

Table 2: Economic Activities of Households, 2008–2014

Percent household	Agriculture only	Labour only	Enterprise only	Agriculture & labour	Agriculture & enterprise	Agri, labour & enterprise	Labour & enterprise	No activity
2008	25.16	4.09	2.39	40.62	11.41	11.50	2.44	2.39
2010	22.38	4.45	3.03	41.91	12.10	10.04	2.93	3.16
2012	20.59	5.73	3.58	43.15	9.35	10.45	2.43	4.72
2014	19.53	5.64	3.76	45.62	6.79	10.36	3.39	4.91

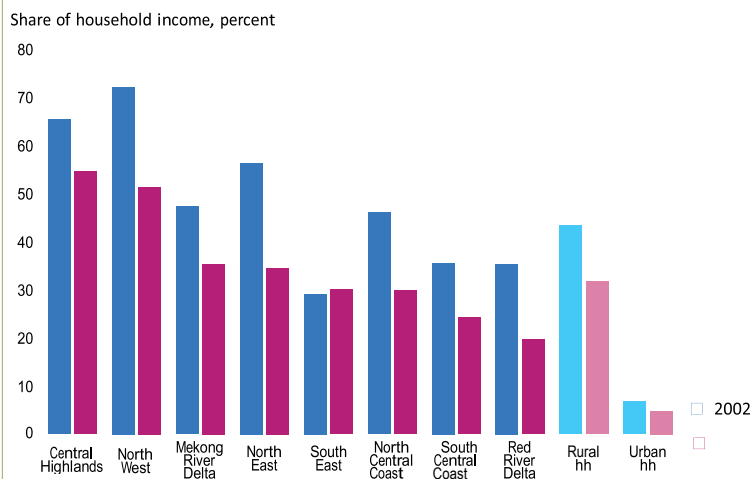
A household’s economic activity can fall into one of eight categories: activity in agriculture, labor, enterprise, a combination of these, or inactivity. n= 2,181. Source: Calculated using VARHS data for 2008–2014, Newman and Kinghan 2015.

A close look at patterns of diversification over this period (using the Vietnam Access to Resources Household Survey) suggests that this phenomenon (of diversification) is primarily being driven by income opportunities. Low household income, and having experienced an income shock, appear to be the strongest predictors of transition out of agriculture (Newman and Kinghan 2015).

Continued to next page.

most rural households still obtain a large share of their income from agriculture—from their own farms and sometimes also through seasonal work for others. In the Red River Delta, a rapidly declining proportion of households still derive much of their income from agriculture. The majority now cannot be referred to as “farming households” but instead as “rural households which continue to farm.” Nguyen (2011) and Nguyen et al. (2014) found that many Red River Delta households retain land and continue to farm as a safety net, but not for commercial purposes. The majority no longer cultivate during the winter season.

Figure 5: Agriculture’s Contribution to Rural Household Income by Region, 2002–2012



Source: Based on the Vietnam Household Living Standard Survey (VHLSS) 2012 (GSO 2013).

Elsewhere the picture is more diverse, even within regions. In the Mekong Delta, for example, fewer and fewer households can continue to earn a livelihood from intensive rice monoculture—even though yields have continued to improve over time. A 2009 survey found that in traditionally rice-growing areas, households with landholdings of less than 1 hectare earned the largest proportion of their income from non-farm (and especially non-agricultural) sources (Table 3). Households with between 1 and 3 hectares relied evenly on paddy sales, animal product sales,

Box 1 continued.

Survey data also reveal that, on average, diversification away from agriculture has been welfare enhancing, and that household enterprise activities have been among the most economically beneficial to households. Non-farm work has, according to several studies, been associated with higher per capita consumption as well as lower vulnerability to shocks, especially for those participating in skilled employment (Imai et al. 2015, Hoang et al. 2014). A reduction in farm-work due to an increase in non-farm work, interestingly, has not translated into less agricultural income (Hoang et al. 2014). At the same time, non-farm employment has seemingly widened the non-farm income gap between rich and poor households (Development Analysis Network 2003).

These findings are generally consistent with the literature on income diversification, which shows that it is positively correlated with income and wealth, but can be associated with greater inequality. This is generally explained by the fact that better-off families are generally better able to engage in high return activities than those that are worse off. And this pattern tends to be more pronounced when diversification is spurred by push factors such as shocks or survival (Newman and Kinghan 2015).

Table 3: Composition of Household Income among Sampled Mekong Delta Rice Producers

Farm Size		Total Income per Capita	Rice Income per Capita	Other Crop Income per Capita	Animal and Aquatic Income per Capita	Off/Non-farm Income per Capita
<1 Ha	Mean	849	151	84	82	533
	%	100	18	10	10	63
1–2 Ha	Mean	1,165	284	72	359	449
	%	100	24	6	31	39
2–3 Ha	Mean	1,901	658	26	728	490
	%	100	35	1	38	26
>3 Ha	Mean	1,933	1,296	10	88	540
	%	100	67	0	5	28
Total	Mean	1,312	535	56	209	512
	%	100	41	4	16	39

Source: Mekong Development Institute 2009.

and off-farm activity as sources of income. Only the households with more than 3 hectares were earning a large majority of their (above poverty line) income from paddy sales.

The income gap between rural and urban areas continues to grow in absolute terms, although the ratio between the two has remained relatively steady (Table 4). The household income gap is also widening within rural areas. In

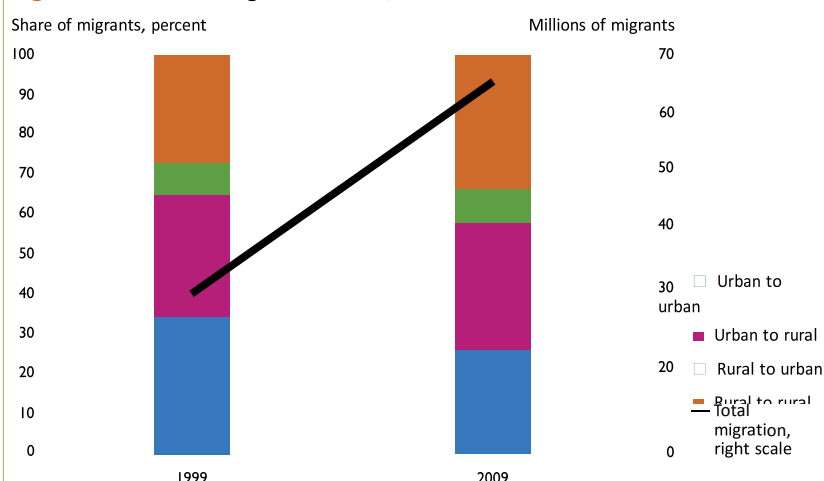
terms of average per capita income, the ratio of fifth to first quintile income has increased from 6 in 2002 to 8 in 2012. This widening gap has been especially pronounced within the Central Highlands, and closely aligned with the size and quality of landholding as well as effective participation in the region's leading commodity value chains. In urban areas, the Gini coefficient (which measures income inequality on a scale of 0 to 1) declined from 0.420 in 2002 to 0.385 in 2012. In contrast, this coefficient increased in rural areas from 0.360 to 0.399 over the same period (IPSARD based on VHLSS). The growing gap in income earning opportunities has been a major driver of migration,

Table 4: Changes in the Urban-Rural Income Gap

	2002	2004	2006	2008	2010	2012
Whole country	356	484	636	995	1,387	1,999
Urban	622	815	1,058	1,605	2,129	2,989
Rural	275	378.1	505.7	762	1,070	1,579
Urban/rural ratio	2.3	2.2	2.1	2.1	2.0	1.9
Urban-rural income gap	347	437	552	843	1,059	1,409

Unit is monthly income per capita in thousands of VND. Source: Based on 2012 VHLSS, GSO.

Figure 6: Domestic Migration Flows, 1999–2009



Migrants in 1999 are those having the residence in 1999 being different from the residence in 1994; migrants in 2009 are those having the residence in 2009 being different from the residence in 2004. Source: Based on GSO 2011 data.

both internal and external (see Box 2). Within Vietnam’s borders, migration has been multi-directional, and not only a movement of populations to cities: more than a third of domestic migrants having moved from one rural area to another (Figure 6).

Box 2: Migration and Remittances

A very high percentage of Vietnam’s population is made up of domestic migrants, defined as people who have moved within or between provinces. Vietnam’s 2009 census found that 8.5 percent of the population met this definition (split almost evenly between inter- and intra-provincial migrants), and the government expected the percentage of migrants to continue rising (this and the remainder of the box is based on Narciso 2015). This trend has been ongoing since *Doi Moi* took effect in the late 1980s, prompting many Vietnamese to seek economic opportunity in cities or faster growing areas of the country. More recent data from the 2012 and 2014 Vietnam Access to Resources Household Survey (VARHS), a rural household survey covering 12 provinces, also provide evidence of significant domestic migration.

Around 20 percent of surveyed households counted at least one migrant, and 48 percent of those migrants had left to work (while others left for education, family reunification, or military duty). In certain provinces, the percentage of migrant households with at least one person living elsewhere (permanently or temporarily) was a good deal higher, at 47 percent in Nghe An, and 27–28 percent in Quang Nam, Dak Lak, Dak Nong, and Lam Dong (though a smaller portion of these migrants left these provinces for work purposes). Overall, 73 percent of the migrants in the 2014 sample moved to a different province, 47 percent headed to the heavily urban provinces of Hanoi and Ho Chi Minh, and 10 percent moved abroad (a large increase from less than 1 percent crossing national borders in 2012).

On average, migrant households, and particularly working migrant households, seem to be better-off than other households, judging from 2014 food expenditure and net income levels reported in the VARHS survey—whether this is a cause or effect of migration, or both. Remittances may offer a partial explanation, as migration is often but not systematically a source of remittances for the members of the household that stayed behind. In 2012 and 2014, for example, 26 percent and 45 percent of surveyed migrant households received remittances respectively.

Remittance-receiving households, according to the VARHS, use most of their remittance money for daily consumption and bills (45–55 percent on average), over 10 percent for savings (11–15 percent), and the remainder for special occasions and medical and educational expenses. Of note, a portion of working migrants are also recipients of transfers—7 and 14 percent in 2012 and 2014 respectively—highlighting their possible vulnerability.

Migration is not strongly correlated with natural or economic shocks (exposure to these did not consistently differ between migrant and non-migrant households at a statistically significant level, though there was a significant difference

Continued to next page.

Box 2 continued.

in exposure to natural shocks in 2012). However, migration does seem to help households cope with shocks—specifically to maintain per capita food expenditures—at least when the purpose of migration is to work. This is consistent with recent literature on migration that has found it to correspond most closely, at times, to a strategy of income risk diversification within households, particularly when it involves household members moving to another labor market. Earlier literature on migration attributed domestic, rural to urban migration primarily to wage differentials between the place of origin and the destination (Harris and Todaro 1970), and to factors such as income uncertainty and relative deprivation (Stark 1991).

Changes in Agricultural Land-use and the Structure of Production

Vietnam’s agricultural land-use reflects the historical importance of and dominant policy and public investment attention to rice, together with the agricultural sector’s response to international market opportunities from the mid-1990s onward. Despite the conversion of an estimated 700,000 hectares from agricultural to non-agricultural uses (i.e., industry, hydropower, urban development), the total area under agriculture has grown nearly 15 percent since 2000. Over the 2001–2003 period, this land area averaged 8.9 million hectares, while over the 2011–2013 period it averaged 10.2 million hectares (GSO statistics).

During this period, the area under paddy rice changed very little, remaining in a range between 4 and 4.2 million hectares. Even so, due to double or even triple cropping in some areas, the total harvested area for rice increased by an average of 1.7 percent per year between 2000 and 2010.¹ The harvested area for rice has thus exceeded 7.5 million hectares in some years. The area under other annual crops grew little in the period up through the mid-2000s, but increased plantings have occurred in recent years, especially for maize and cassava. Other annual crops went from covering around 2 million hectares in the early 2000s to occupying around 2.3 million hectares in the 2011–2013 period.

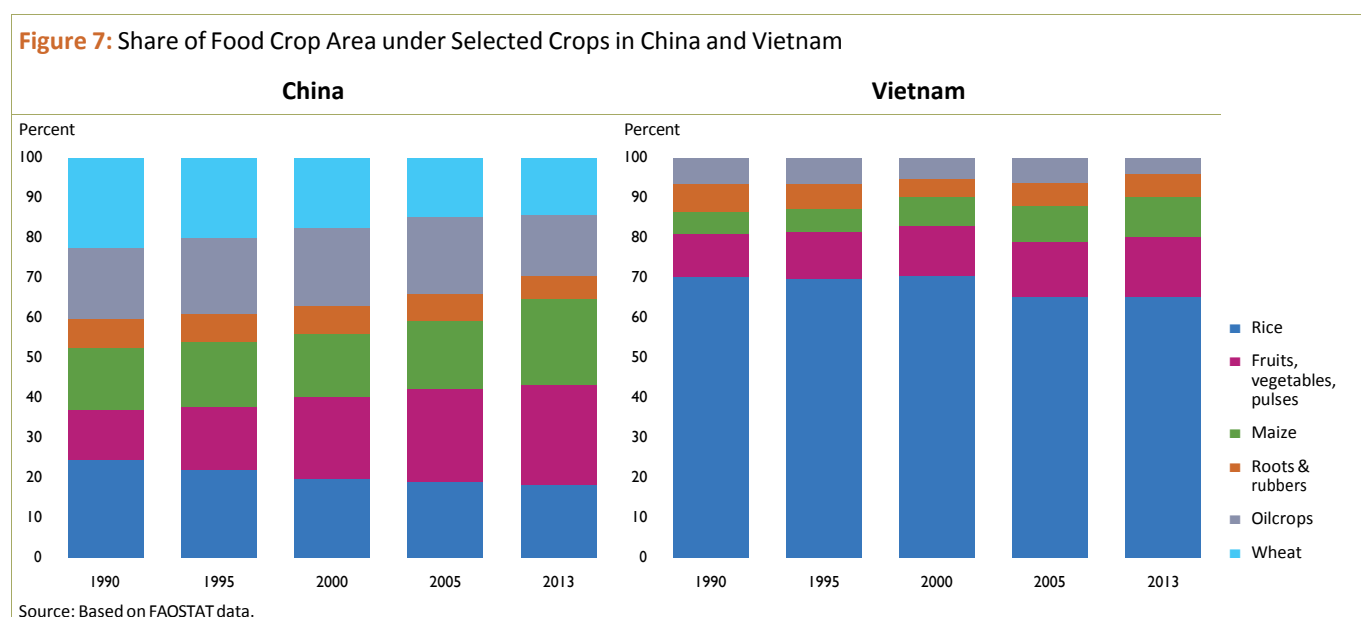
Still, the biggest change in land-use has had little to do with changes in the domestic market. The planted area for perennial crops has increased by about 7 percent per year, from 2.2 million hectares in the early 2000s to 3.8 million hectares in 2011–2013. This category includes many crops and the most sizeable expansion has occurred for coffee and rubber. The area under aquaculture grew rapidly during the 1990s and until the mid-2000s, and has since stabilized near 1 million hectares. As further discussed below, this agricultural expansion—mostly geared toward exports—has come at considerable environmental cost. In upland areas for example, the expansion of coffee plantings, and more recently of rubber and cassava, has cut into natural forest and contributed to biodiversity loss and land degradation. The major expansion in shrimp aquaculture in the 1990s and early 2000s both replaced paddy-land and contributed to the destruction of nearly half of the Mekong Delta’s mangrove forests (Nair 2015).

At a macro level, food crop diversification has just begun in Vietnam. Rice remains completely dominant even though, as we will see later, significant changes have already begun in food consumption and expenditure patterns.

¹ In the Mekong Delta, the average crop intensity rose from 1.6 in 1990 to 1.91 in 2000 to 2.10 in 2010. While only 11 percent of the paddy-land was triple cropped in 2000, by 2010, this was 27 percent. While certainly increasing aggregate production, the expansion of the ‘third rice crop’ has had severe environmental implications. Disrupting the natural flood restricts the transfer of nutrients and normal cleansing effects, leading farmers to use even more fertilizers and pesticides.

Crop diversification has been constrained by land-use policies—whereby much of the irrigated lowland areas have been designated as rice-land, with restrictions placed on alternative uses. Nationally, some 90 percent of paddy cultivation takes place on such designated land (Gisseke et al. 2013). Most of Vietnam’s expansion of irrigation and a high proportion of its public research and advisory service resources have, over the years, been geared toward maximizing national or provincial rice output.

Figure 7 contrasts the patterns of land-use since 1990 for food crops between China and Vietnam. Chinese production has greatly shifted in response to market opportunities, at home and abroad. Between 1990 and 2010, the area there under fruits and vegetables grew from 15 to 40 million hectares. Since 2000, the area harvested for maize has gone from 22 to 33 million hectares. Vietnam is at a much earlier stage in this process of food crop diversification. It has only recently recognized the need and opportunity, and begun to shift public resources to support the production and marketing of other food crops.



Agricultural production in Vietnam is undertaken by different types of production units. The agricultural census recognizes the following categories.

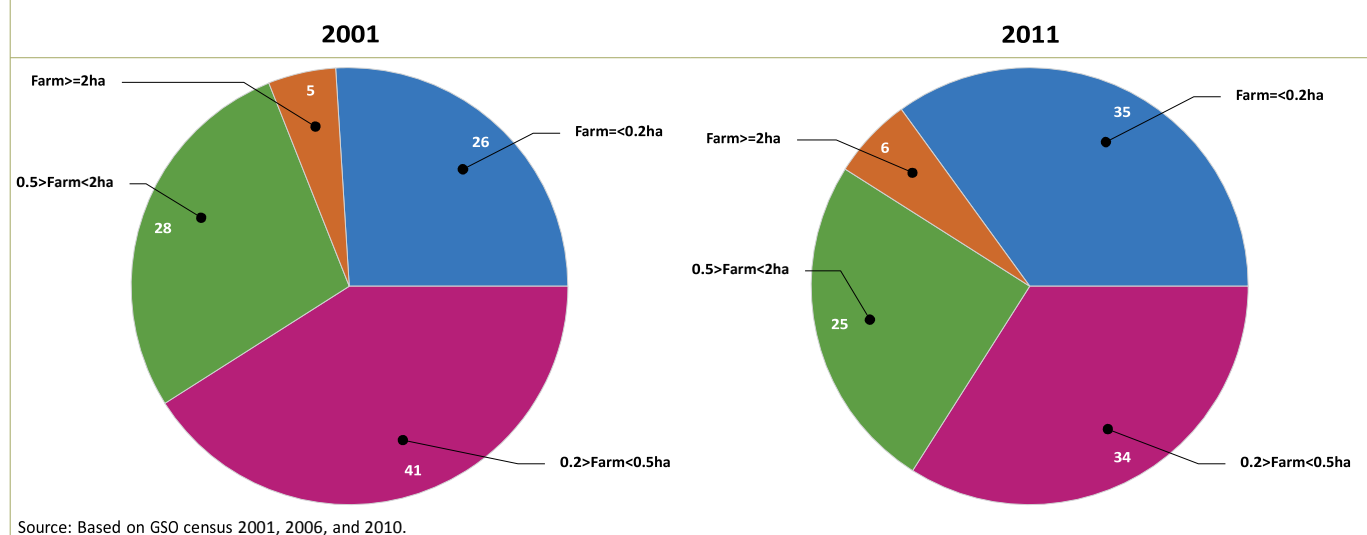
- “Agricultural” households which numbered 8.9 million in 2011, down from 10.1 million in 2001.²
- “Farms” which number 126,000 in 2011, up from 61,000 in 2001.
- “Agricultural Enterprises” which numbered 2536 in 2011. While most of these enterprises are private sector, nearly two-thirds of the capital invested is accounted for by majority or wholly state-owned entities.
- Other entities, including farms managed by Commune People’s Committee, other domestic agencies, and foreign individuals/companies.

Nearly 90 percent of agricultural land falls under either agricultural households or farms, about 6 percent under the enterprises, and the balance is held by other entities. The agricultural household segment is

² There are also fishery households (which numbered 617,000 in 2011) and forestry households which numbered 52,000.

dominated by very small farms. Figure 8, based on agricultural census data, suggests only minor changes over time in this agrarian structure. The smallest size category—less than 0.2 hectares—applied to 26 percent of households in 2001 and 35 percent in 2011. This was likely due to further sub-division of holdings in the next category up—0.2–0.5 hectares—whose share declined from 41 percent to 34 percent. The share of the largest category of holdings—above 2 hectares—increased only slightly from 5 to just over 6 percent.

Figure 8: Percentage Distribution of Farm Units by Landholding Size, 2001 and 2011



In many contexts, researchers have found very small farms to be highly efficient—in terms of obtaining high levels out output per units of land and other resources. For some crops, research has found either an inverse relationship between farm size and efficiency or some type of inverted U-curve whereby efficiency is improved over some (often small) farm-size increment but then declines thereafter. However, this notion that small is beautiful doesn't take into account the capacity of farm operators to manage risks, the livelihood viability of households dependent for income on very small landholdings, and the transaction costs associated with aggregating the supply of large numbers of very small farmers for sale to the market.

In Vietnam's case, small farms are often rendered less efficient by the fragmented nature of their landholdings, or in other words, the fact that they are often made up of non-contiguous plots. In many locations, farmland was allocated to community members in an egalitarian way. The highest quality land was allocated among households as was the land of lesser or even marginal quality. As a result, small household landholdings often consist of three, four, or many more tiny plots, sometimes separated by considerable distance. This has affected the efficiency of household farm labor and management. The degree of land fragmentation has differed among areas due to particular features of terrain, population density, land allocation, and historical and cultural factors. In general, fragmentation has been much greater in the Red River Delta and northern mountainous areas than elsewhere. Fragmentation is greater for annual crop land rather than land used for forestry, perennial crops or aquaculture.

The government of Vietnam has aimed to reduce land fragmentation by implementing land consolidation programs in many communes. Such programs have generally tried to facilitate plot exchanges between households, although there have also been efforts to promote cooperative farming. In some cases, households have leased out their land to companies and arranged for certain household members to continue working on these professionally

managed farms. These programs have had some effect, especially in the Red River Delta.³ Nationally, the average number of plots per household has fallen from 4.27 in 2004 to 2.83 in 2014 (Brandt 2015). Still, land fragmentation remains a considerable constraint on agricultural modernization. In most parts of the country, a land rental market remains underdeveloped due to limits or restrictions on land holding sizes and uses, high transaction costs in land transfers, and the administrative setting of land price values by provincial bodies. Nevertheless, the recent experience of China suggest that a more concerted policy drive can, in fact, accelerate processes of land consolidation in a farming system akin to that of Vietnam (see Box 3).

Box 3: Recent Land Consolidation in China

From the 1980s to the mid-2000s, China experienced a decline in the average farmland holding size as a result of rural population growth and the conversion of a considerable amount of farmland to urban and industrial uses. Since then, however, a process of land consolidation has occurred in several parts of the country. This has been driven by rising labor costs and out-migration and been facilitated by: (i) the emergence of local government land transfer services (providing information, contract design, and dispute settlement services); (ii) policy support in the forms of loan guarantees and subsidies for larger farm investments; and (iii) the emergence of an active market in mechanization services.

Huang and Ding (2015) report that in 2013, some 53 million rural households (23 percent of the total) had rented out some agricultural land. Their survey in Northeast and Northern China points to a remarkable increase in the average farm holding from 1.03 hectares in 2008 to 1.73 hectares in 2013. In parallel with this expansion in the size of household farms, a growing number of land cooperatives and company run farms have emerged. These have an average of around 200 hectares and 100 hectares respectively and accounted for an estimated 20 percent of the total agricultural land area in these regions in 2013, up from a negligible share only six years earlier.

How does Vietnam’s agrarian structure compare with that of other Southeast Asian countries? Vietnam has only 0.34 hectares of arable per member of its agriculturally active population. This is about half (0.6 to 0.8 times) that in Cambodia, Myanmar, or Philippines. The agrarian structure of Vietnam is most like that of Indonesia. There, about 30 percent of farm households have less than 0.2 hectares, 26 percent have between 0.2 and 0.5 hectares, 18 percent between 0.5 and 1 hectares, 15 percent between 1 and 2 ha and 12 percent more than 2 hectares. Large plantations account for the majority of Indonesia’s oil palm and rubber production. At the national level, Thailand has seen little change in the proportion of farms in different size categories and has many more medium-sized smallholdings. In 2013, about 25 percent of farms were less than 1 hectare, 40 percent were between 1 and 3 hectares, and 35 percent were larger than 3 hectares. The latter accounted for some 70 percent of the total farmed area. Myanmar has an unusual agrarian structure as 40 percent or more of rural households there are landless. Of the households which do have land, the average holding is 1.6 hectares and the distribution is more or less evenly split between farms of less than 1 hectare, farms of 1–2 hectares, and farms that are larger than 2 hectares.

This national picture of Vietnam’s agrarian structure masks some significant regional contrasts. In the Red River Delta for example, 97 percent of holdings in 2011 were under 0.5 hectares, and these holdings typically consisted of multiple (3 to 7) plots of roughly similar size or quality under management. Only 0.1 percent of agricultural holdings are larger than 2 hectares in the Red River Delta. Contrast this situation with that of the

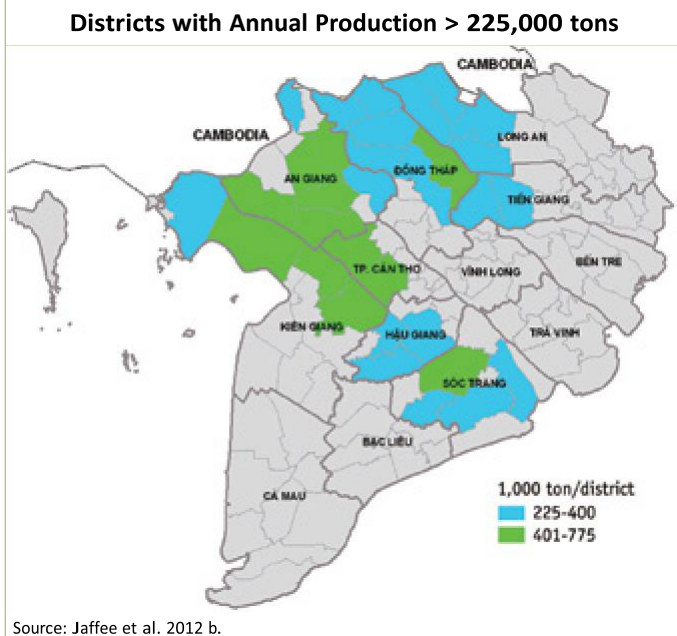
³ Since 2008, some 15 percent of all plots in the Red River Delta were consolidated. Elsewhere, this process has been negligible, affecting 7 percent of plots in the North and Central Coastal areas and less than 1 percent elsewhere.

Central Highlands where 23 percent of households have more than 2 hectares—and more holdings are of this size than under 0.5 hectares (21 percent)—although these land holdings vary in quality (i.e., due to differences in soil, elevation, and access to water). In the Mekong Delta, more than 10 percent of land holdings are larger than 2 hectares in the Mekong Delta, and 23 percent fall in this category in the Southeast.

Across Vietnam the number of households producing paddy has changed little since the mid-2000s. Strangely, this number, 9.3 million, is greater than the number of households classified as agricultural households. This implies that at least some non-agricultural households grow at least small plots of paddy. Nationally, the average size of a paddy holding is only 0.44 hectares, yet in the Mekong Delta the average paddy holding is 1.2 hectares with more than 13 percent of these being above 2 hectares in size.

Rice production in Vietnam appears to be highly fragmented, but a distinction needs to be made between subsistence-oriented production and commercial production. Since 2000, the Mekong Delta has accounted for two-thirds of the growth in national rice production, and most of this growth has taken place in some 20 districts—what might be called “the core rice belt” (see Figure 9). While some 1.4 million households grew paddy in 2008, two-thirds of the net surplus (i.e., paddy sales minus purchases of rice in paddy equivalents) were produced by the top 20 percent of growers⁴ (whose average landholding was 2.74 hectares). Some 85 percent of the surplus was accounted for by the top two quintiles. These statistics reflect a trend toward greater concentration in commercial rice production. Of the 9 million rice-growing households, about 300,000 households account for most of the country’s exports. This makes the challenge of promoting competitiveness and value-addition in rice value chains much more manageable.

Figure 9: Concentration of Rice Surplus in Six Mekong Delta Provinces, 2008



The national-level picture when it comes to livestock production is also one of fragmentation, yet there are initial signs here too of a move toward consolidation. The number of pig producing households declined from 7.7 million in 2001 to 4.1 million in 2011, in part due to government efforts to move livestock production and slaughter away from cities to reduce disease (livestock and human), improve food safety, and mitigate environmental risks.⁵ More than half of the remaining producers only have one or two pigs and essentially keep these for their own consumption on important events or to sell them in case of a cash emergency.

⁴ In terms of net sales.

⁵ Between 2006 and 2011, a million households stopped producing pigs in the Red River Delta.

Commercial production looks different. Since the mid-2000s, the number of households raising fewer than 10 pigs has declined by 39 percent while the number raising 50 or more pigs has increased by 80 percent.⁶ A similar pattern is being observed in the poultry sector: a continued predominance of small, backyard growers (in number), yet an emergence of more medium- and large-size operations, some of which involve contract farming arrangements with feed-production-processing integrators.

Most of the expansion of livestock production is occurring in medium- and large-size farms. The number of such farms active in livestock production rose from under 2000 in 2001 to 23,500 in 2011. In that latter year, nearly half of these farms were raising more than 200 pigs, whereas only 11 percent were raising that many five years earlier. Milk production in Vietnam has tended to involve farmers—with a few to maybe a dozen cows—working together as a group to interface with buyers. In the past five years however multiple very large investments have gone into integrated feed production, dairy cow operations, and modern milk processing facilities. These operations are managing from 10,000 to 40,000 cows. While some successful smallholder dairy groups remain, the bulk of Vietnam’s milk production is likely to come from these large, vertically integrated operations located in the Central Coast and some midland areas.

A similar process of consolidation has occurred over the past few years in parts of the aquaculture sector and especially in the production of *Pangasius*. There were tens of thousands of aquaculture producers in the mid-to-late 2000s, but problems with water quality management and disease, and adverse movements in the fish-to-feed price ratio, have driven many small growers out of the sector—some by leasing their land and ponds to larger producers. Today, an estimated 70 percent of *Pangasius* is raised by processing companies with vertically integrated operations (up from only 10 percent five years prior).

Consolidation is also under way though has been less pronounced in other parts of the aquaculture sector. There were still 1.7 million households raising fish in 2011, although 75 percent of these were producing for themselves or their community on 0.2 hectares or less. An estimated 320,000 households and farms remain active in the Mekong Delta shrimp aquaculture industry, either on an intensive or extensive basis. That said, shrimp-growing and processing are becoming increasingly integrated there. Overall, the number of farms now active in shrimp aquaculture has remained relatively flat, but most are moving to scale: at the time of writing, only 10 percent of these having less than 3 hectares.

Most perennial crop production is dominated by smallholder households. In many parts of the country, households raise small clusters of fruit and special purpose trees (e.g., for incense and medicinal uses). Export-oriented production of coffee, black pepper, and cashews is most prominent in the Southeast and the Central Highlands, where some 20 percent of growers have more than 2 hectares planted and the average planting is one hectare-wide. The 2011 agricultural census recorded more than 640,000 smallholder coffee growers and some 430,000 cashew growers. Some 25,000 medium or large farms grow perennial crops, the production of which exhibits a clear trend toward concentration. While in 2006 some 31 percent of these had plantings of less 3 hectares and only 14 percent had plantings of more than 10 hectares, by 2011 less than 5 percent farms were in the small-size category and 37 percent had more than 10 hectares. Vietnamese rubber production is now more or less evenly split between several thousand smallholders on the one hand, and a small number of state-owned enterprises on the other.

⁶ According to the 2011 Agrocensus, 50 percent of pork is from farms with <20 pigs, 23 percent from farms that have 20–100 pigs and 17 percent from farms with >100 pigs. Thus, nearly one-fifth of pork production is supplied by <1 percent of the farms.

Overall, agricultural land consolidation remains at an early phase in Vietnam, yet the consolidation of commercial agricultural production is taking place at a faster pace—especially in livestock, commercial rice, and parts of the aquaculture subsector. The vast majority of farm households are not exiting but remaining involved in agriculture, either out of preference or out of obligation—i.e., because they are stuck and unable to find a secure, remunerative livelihood outside of agriculture. Many households, including most of the 35 percent of households which have less than 0.2 hectares of land, are probably holding onto their land for social rather than economic reasons. Maintaining their agricultural land provides them with a source of security, a means to retain strong ties with their community, and perhaps even a site to retire to.⁷ For those wanting to lease or sell land, the transaction costs have often been high, especially for households which previously benefitted from the egalitarian approach of distributing multiple parcels of land. Certain regulations have also created barriers to consolidation. Examples include the limits placed on annual cropland holding sizes (3 hectares at the time of writing although the revised Land Law provides for exceptions), and the policy of designating some of the best farmland as rice land, which limits its commercial potential for local entrepreneurs or other investors (World Bank 2012). At least in some areas, the persistence of these landholding limits and land-use restrictions have generated very large opportunity costs for farm households and communities. And they have held back the development of specialized, medium-scale farming operations by enterprises and individuals who want to invest in agriculture.⁸

Vietnamese agriculture has traditionally relied predominantly on human and animal labor and little on engine-powered machines. Mechanization has increased quite significantly over the past decade however, driven by such factors as rising labor costs, increased attention to reducing post-harvest losses, and the development of specialized forms of agricultural production in livestock and horticulture. In 2011, some type of machinery was used on more than 90 percent of paddy farms for land preparation and threshing. Machine-use for other functions was more variable—23 percent for seeding, 78 percent for harvesting, and 14 percent for drying. Tractors, water pumps, and various forms of mechanical harvesters are in growing use, particularly in the Mekong Delta and among large farms with more than 1 hectare. The horsepower in use in agricultural machinery is growing at an accelerating rate, according to government statistics (GSO). Its annual growth rate went from 4.6 percent in the first half of the 2000s, to 11 percent between the mid-2000s and 2011. The total number of tractors in use grew from an estimated 163,000 in 2000 to 375,000 in 2013 (GSO).

Shifts in Food Consumption and Expenditures

Rice has long been Vietnam’s dominant food staple. As recently as 1996, rice accounted for more than 70 percent of calories consumed. Only among certain communities in mountainous areas were other food crops, especially maize and cassava, more important food staples. At the national level, annual per capita rice consumption increased from 190 kg in 1990 to over 150 kg in the mid-2000s, in step with household production and incomes for the half of the population not involved in rice production (these also rose according to the IPSARD database). Since 2008 however, this trend has reversed. Per capita rice consumption is now declining and absolute consumption appears to have peaked and begun to decline (Jaffee et al. 2012a). This pattern is likely the beginning of a long-term trend

7 Still, in some communities, especially in the Red River Delta, efforts have been made to ‘consolidate’ smallholdings by reducing the number of tiny, scattered parcels held by individual households. The re-allocations of the plots are generally negotiated among households with the backing of local authorities. The emerging land holding structure may better enable infrastructure upgrades in the communities.

8 A company recently leased several hundred hectares of land in a province east of Hanoi in order to carry out the specialized production of hybrid rice seed. To do this, the company needed to gain the cooperation of 3,500 households.

in which rice consumption continues to decline before leveling off—by around 2030—in the range of 90 to 110 kg per capita.⁹

Vietnam is now in the early stages of major changes in the structure of food consumption, and in both food spending and food shopping patterns. The past decade has seen very high levels of growth in the consumption of meat (especially pork), milk, and eggs—growth rates higher than those experienced by any country in the region. Significant growth has also occurred in the consumption of fish and of certain processed foods. Somewhat surprisingly for an emerging, middle-income country, Vietnam has seen little change in the consumption of fruits and vegetables. Dietary diversity is growing, although Vietnam still has a way to go to catch up with some of its peers.¹⁰

Changing consumption is translating into big changes in food spending patterns. And differences in this respect have been more pronounced between urban and rural populations than between rich and poor. Between 2002 and 2012, Vietnamese household expenditures on food rose by 51 percent in real terms; and whereas the growth in food expenditures differed little across income quintiles, food expenditures by rural households rose by 53 percent while those for urban households rose by 41 percent. More interesting is the changing composition of expenditures. Comparing these two years, absolute spending on rice declined (by 4 percent) and household spending on animal products—meat and dairy products—doubled.

Figure 10, based on analysis by Vietnam’s Institute for Policy and Strategy for Agriculture and Rural Development (IPSARD), illustrates the changing shares of different food categories in the food expenditures of urban and rural households. Among urban households, the share of rice fell from 25 percent in 2002 to 17.2 percent in 2012, while that of animal products went from 32.7 percent to 37.8 percent. Among rural households, the share of rice fell from 38.9 percent to 25.4 percent while the share of animal products rose from 23.4 percent

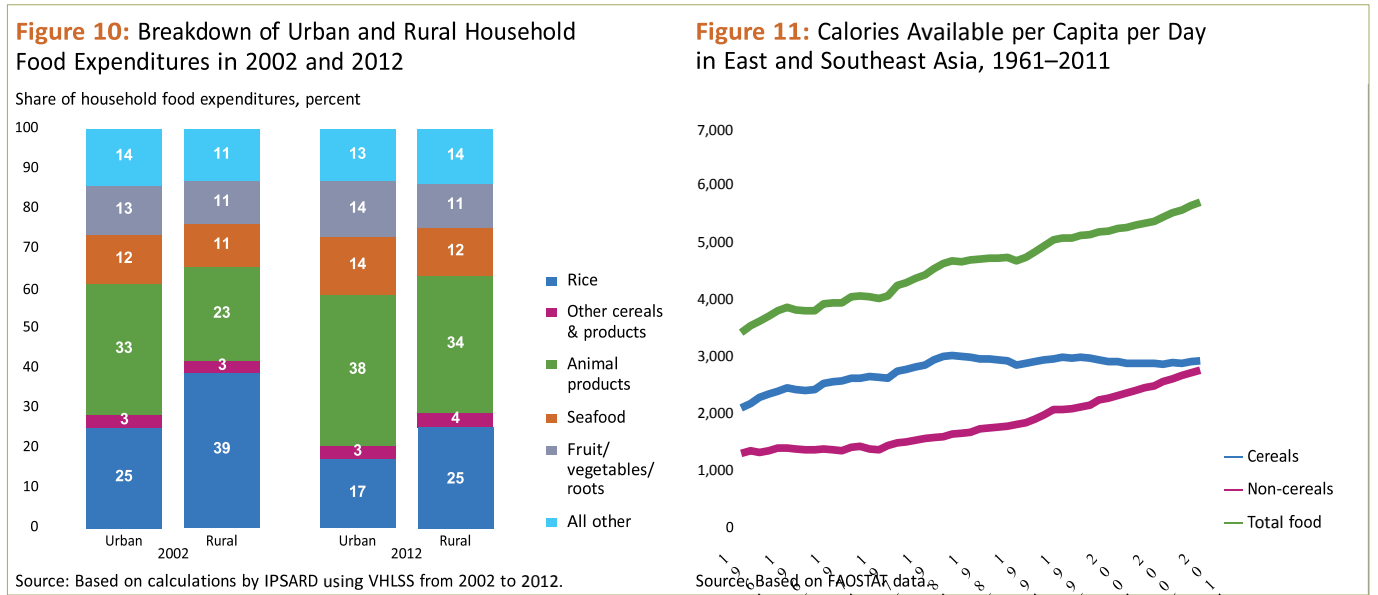
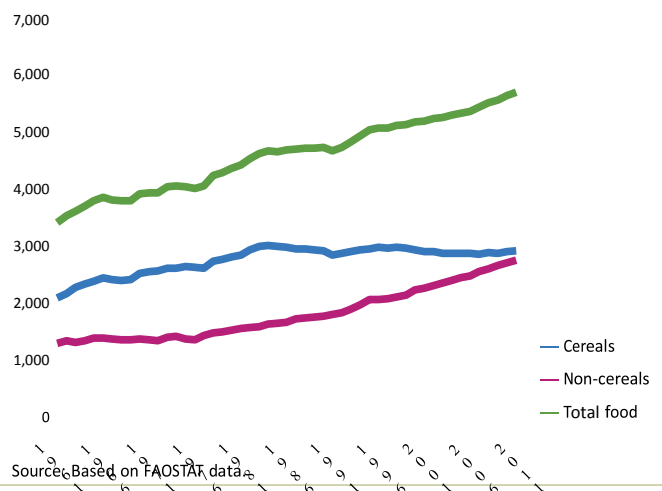


Figure 11: Calories Available per Capita per Day in East and Southeast Asia, 1961–2011



9 Per capita rice consumption in China, Malaysia and India is 95, 80, and 77 kg, respectively. In Vietnam, it is currently around 135 kg.

10 Nutritional experts have constructed a scoring system on ‘dietary diversity’ based upon the number of unique foods typically consumed by households. This has been found to be closely associated with micronutrient sufficiency. The analysis for 2014 has Vietnam’s score being similar to that of India and the Philippines, much higher than that of Myanmar and Cambodia, yet much lower than that of Thailand, China, and Malaysia.

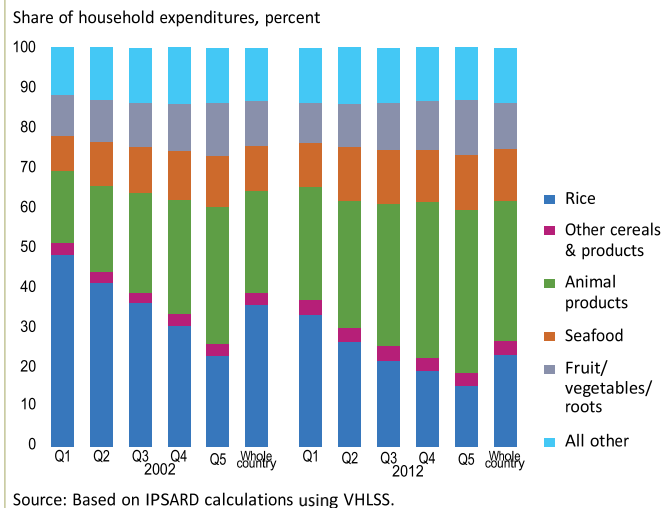
to 34 percent. Only small increases occurred in the share of expenditures in other food groups, although absolute spending on these increased. This shift in spending from (staple) cereals to high protein, higher-value, and more processed foods is a pattern that is being observed more broadly across much of East and Southeast Asia (Jamora and Labaste 2015). For example, amongst Indonesia’s urban population, between 2001 and 2013 for example, Indonesia’s urban population went from spending 17 percent to 31 percent of its food budget on processed foods, while its spending on cereals fell from 18 percent to 12 percent. The region’s long-term shift from a diet dominated by cereals to one that is far more diversified is illustrated in Figure 11.

In Vietnam, the emerging dietary shift is not confined to wealthier segments of the population. Figure 12 illustrates that changes are occurring across all income quintiles. For all but the lowest income quintile, expenditures on animal products now exceed those for rice. That being said, some of the most significant changes in spending patterns are occurring among the poor. While in 2002, first quintile (Q1) households spent more than 48 percent of their food budget on rice and only 18 and 9 percent on animal products and seafood respectively, by 2012, the tide had shifted to protein. In that year, some 33 percent of spending was on rice, while that for animal products and seafood was 28 and 11 percent respectively.

Why are the shifts in food consumption and expenditure patterns so significant? These have multiple implications.

These consumption shifts alter the food security equation and policy agenda. These have long been focused on rice and especially on the expansion of national, regional, and provincial rice production.¹¹ Today’s situation is now one of a food secure nation, with spatial and household pockets of food insecurity associated primarily with poverty (or losses from extreme weather events). While a significant number of households will continue to grow paddy for their own consumption rice will remain a very important food staple, the affordability of food for most households will increasingly become a function of the price of other foods. In the coming years for example, food security concerns are likely to be increasingly tied to the cost and availability of animal feed and the performance of a livestock sector now going through a major restructuring. “Feed security” may become an increasingly important issue (see Figure 13). Vietnamese food policy will need to become more multi-dimensional and incorporate greater consideration for goals associated with nutritional outcomes rather than agricultural outputs.¹²

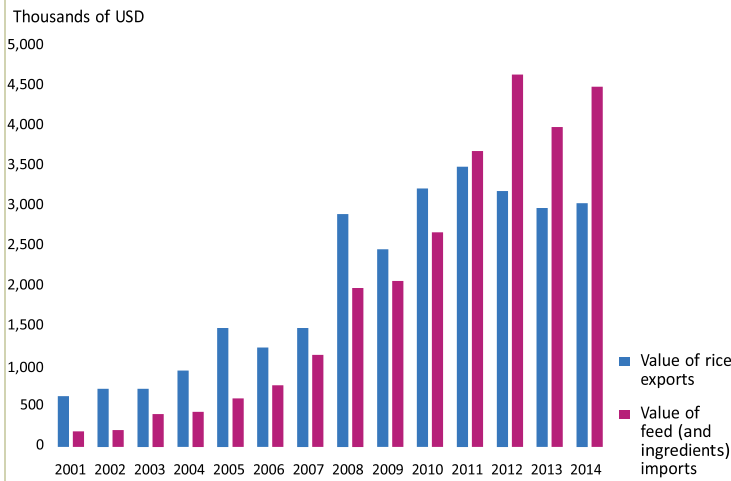
Figure 12: Share of Household Food Expenditures by Income Quintile Group



11 While the 2009 Decree adopted the FAO’s very broad definition of food security to embrace goals related to dietary diversity, nutrition, and food quality, the listed ‘solutions’ were largely related to rice production.

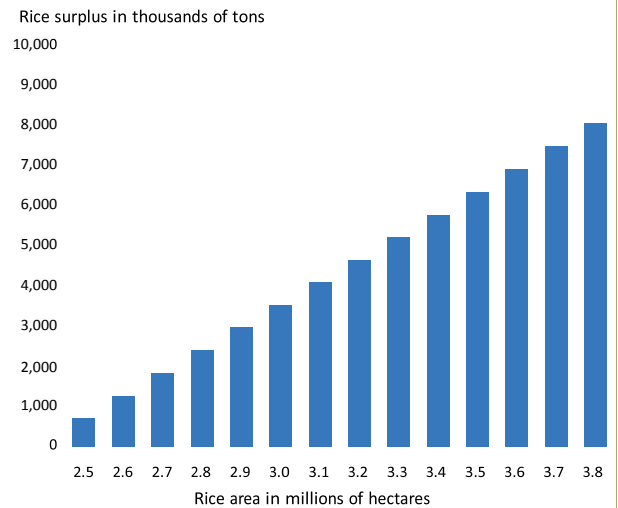
12 Over the past two decades Vietnam has made remarkable gains in reducing malnutrition, among children and among the population as a whole. Still, rates of chronic child malnutrition remain high (>30 percent) in many upland ethnic minority communities and nutritional imbalances are found in other segments of the population. Solutions to the existing nutritional challenges do not rest on producing more rice. Rather, they require multi-sectoral approaches to raise incomes, improve maternal health, improve water and sanitation, and foster a more ‘nutrition-sensitive’ agriculture (World Bank 2013).

Figure 13: The Early Stages of a Challenge of Feed Security for Vietnam Rice Exports versus Feed Imports



Source: Based on Customs and Vietnam Feed Association data.

Figure 14: Expected Rice Surplus in 2030 for Different Amounts of Rice-Land, under a “Worst Case” Productivity Scenario



To put the projected surpluses into perspective, rice exports since 2010 have generally been in the 5 to 7 million ton range. Source: Jaffee et al. 2010.

Vietnam has a policy of protecting rice-land that places restrictions on its agricultural uses and its conversion to alternative uses. Farmers holding rice-land have been required to grow at least one rice crop during the year, and many irrigation systems have been designed and managed to support second and third rice crops. In the absence of effective drainage, farmers have faced difficulties introducing rotation crops which otherwise might be more profitable, help to maintain soil fertility, and interrupt cycles of pest and disease. To the extent that food security (and improved nutrition) now calls for crop diversification or different forms of specialization, the rice-land designation and associated restrictions are becoming as much a barrier to food security as a basis for its protection. Recognizing this, Vietnam’s Ministry of Agriculture and Rural Development (MARD) has called for the conversion of some 200,000 hectares of land from paddy production to maize and other crops. And Decree 35, released in February 2015, enhanced the flexibility of rice-land with a provision rice-land under which it can more easily be put to alternative agricultural uses, including the cultivation of other seasonal crops and aquaculture. This is likely just the beginning of a major reform to come with respect to the governance of agricultural land-use.

A joint IPSARD/World Bank analysis in 2010 (Jaffee et al. 2010) modeled a range of scenarios for Vietnam’s rice consumption and production to 2030 (see Box 4). It found that even if the dedicated paddy-land were to decline by 20 to 25 percent (from 4.0 million hectares to 3.0–3.2 million hectares), there would still remain a comfortable exportable surplus of between three and six million tons. Figure 14 shows that, even under pessimistic assumptions, Vietnam would generate a rice surplus—or in other words, it would produce more domestically than is consumed as food or feed, or used for seed—even if rice plantings fell to 2.5 million hectares.

The shifts in consumption put a premium on improving food safety management and managing animal health risks. These will become increasingly important not only to protect consumers but also to ensure the competitiveness of the domestic agro-food system. With urbanization come longer supply chains. With increasing consumption of high-value perishables come greater risks associated with food contamination, chemical and antibiotic residues, and the transmission of zoonotic diseases. With processed foods, it is often not possible to judge quality and safety by taste or other sensory tools, and so consumers tend to focus on certain brands that they come to trust.

Box 4: A Robust Rice Surplus

In 2010, IPSARD together with the World Bank carried out a detailed analysis examining how Vietnam's rice surplus would fare under alternative scenarios through 2030. The study looked specifically at different scenarios for rice production, rice consumption, and the resulting "rice balance," (i.e., rice deficit or surplus) with consideration for a wide range of variables. These included population growth and composition, per capita rice consumption, demand for rice for seed, feed, and industrial uses, rice-land use and cropping intensity (i.e., number of crops per year), productivity, and both harvest-related and post-harvest losses. National time series data on these and other selected variables were gathered for the years 1990 through 2010.

Scenarios were then developed for the next two decades. Given the large number of variables and possible combinations of these, some simplifying assumptions were made and a more limited set of scenarios were generated. For example, only one (United Nations) estimate of future population growth (1.2 percent per annum) was used. For cropping intensity, the conservative estimate of 1.8 was used based on the expectation that more crop or rice-aquaculture rotations will be introduced over time in the Mekong Delta. (Cropping intensity has increased over the years and in 2010 was 1.82 nationally and 2.09 in the Mekong Delta.) Recent estimates of seed- and feed-use were retained even though, in future years, one would expect some decline as farmers make increasingly efficient use of increasingly high quality seed, and feed conversion efficiency improves.

With regard to productivity, three scenarios were considered.

- The first is a "business-as-usual" scenario in which rice yields continue to improve at the recently (slower) pace of 1.5 percent between now and 2030. This would bring the average national yield to 7 tons per hectare at the end of the period. The other two productivity scenarios are pessimistic in relation to the historical trend.

Continued to next page.

If consumers, with rising incomes, come to distrust the safety of domestic fresh products or processed foods, then they will turn to imported products. Once domestic supply chains have lost out to imports, inertia in consumer behavior can make it very difficult for domestic retailers to build backward linkages and substitute imports.

Vietnam has recognized these emerging challenges. Its new Food Safety Law of 2010 introduced the concept of risk-based control. Public laboratories have since been upgraded, and the country now has the capacity to test for most foodborne pathogens. The law streamlined institutional structures by reducing the number of ministries in charge of food safety from the previous six to the current three. However, the most control and testing is focused on final products and very little testing occurs higher up in the value chain with a focus on raw materials, soil, or water for instance. It is also not clear yet how testing and inspection results are used in decision-making. The public financial and human resources devoted to food safety matters are still limited. Major capacity strengthening needs remain, and greater collaboration with the private sector and with consumers to "co-manage" food safety could pay off.

Vietnam has experienced many significant animal disease outbreaks in recent years, affecting farm productivity, consumer prices for animal products, and overall consumer confidence—as one of the responses to disease outbreaks has been to increase the use of antibiotics in production. Significant losses have occurred due to disease in poultry and pig operations, and in shrimp aquaculture. While emergency responses have sometimes been effective (e.g., in controlling the spread avian influenza), greater attention and resources need to be devoted to promoting good practices in animal husbandry and aquaculture, and to improving disease surveillance and early warning systems.

Box 4 continued.

- Under one of these, the “middle yield” scenario, yield growth slows progressively throughout the studied period, bringing the average rice yield to 6.3 tons per hectare by 2030. While in the past, yields tended to increase by 1 ton per hectare per decade, this projection has the 1 ton increment occurring only over two decades. Some of the leading rice-growing areas in the Mekong Delta already have yields exceeding this longer-term projection.
- The most pessimistic, “low yield” scenario features slowing yield growth followed by an actual decline in yields from 2025 onward. This might occur if the actual adverse impacts of climate change were to exceed current expectations, resulting perhaps in more rainfall or temperature variation and unusually severe pest or disease problems. Under this scenario, average national yields are 5.8 tons per hectare in 2030. This level of productivity is below the current productivity of the five to six provinces which now account for the bulk of paddy production in the Mekong Delta. It is thus quite a pessimistic picture and essentially assumes that near-term efforts to improve irrigation management, to promote the use of higher quality seed, and to develop and spread the use of seed varieties more resistant to water stresses and pests, collectively fail. This scenario is also far worse than any predicted by recent climate change-impact modeling exercises.

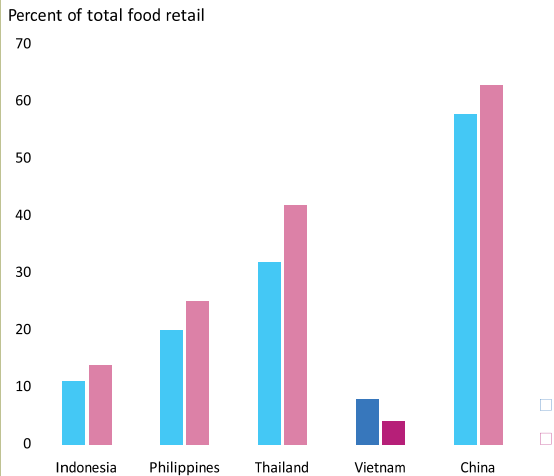
Figure 14 shows the national rice surplus that can be expected under this worst case (“low yield”) scenario according to how much land is devoted to rice production. In recent years, the actual amount of land used to produce rice was just over 4 million hectares. On the consumption side, the chart reflects a scenario in which annual per capita rice consumption falls to 100 kg. What this set of results demonstrates is Vietnam’s very strong “rice balance” position going forward. Vietnam can expect to generate a comfortable and exportable rice surplus even if the land-area dedicated to paddy falls by 25 percent to 3 million hectares, and very pessimistic scenarios play out in relation to average rice yields.

Changing consumer demand will open up greater opportunities in the non-farm segments of the food system.

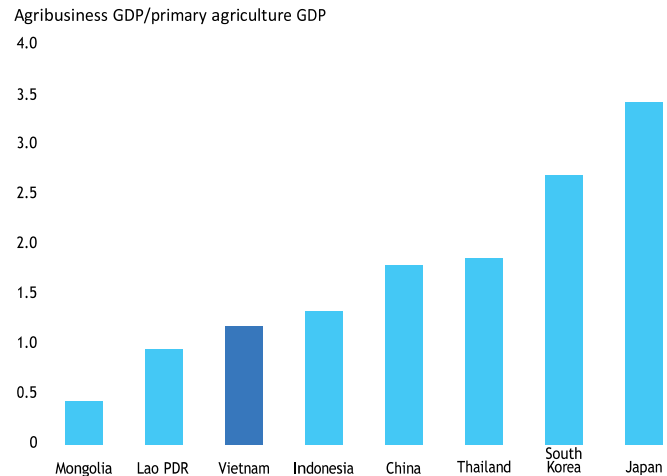
Demand will grow for safer and better performing agricultural inputs, for more specialized agricultural advisory and conformity assessment services, for machinery which increases post-harvest productivity, for effective cold chain services, and for improved food distribution and consumer services. A more diversified primary agriculture allows for greater variations in processed and prepared foods and in a range of other agro-industries.

Elsewhere in Asia, rising incomes, urbanization, and shifting consumer tastes have given rise to the emergence of supermarkets and other mass-retail, grocery store formats. A number of changes in product sourcing have accompanied this process to better ensure reliable delivery and compliance with quality and food safety standards. Modern retail distribution has emerged only quite recently in Vietnam due to a combination of reasons which help to explain the relatively high costs and risks associated with developing multi-chain operations in Vietnam (i.e., fragmented primary and secondary production, logistical constraints, overall business environment uncertainties, and so forth) (see Figure 15). Most Vietnamese consumers continue to make the bulk of their purchases in open air wet markets, yet, at least in major cities, shopping patterns are beginning to change. Mass-market grocery sales—through a combination of hypermarkets, supermarkets, and convenience stores—are estimated to have doubled from VND 64 trillion in 2005 to VND 138 trillion in 2013, bringing the latter to account for an estimated 15 percent of total food sales. Both international and domestic companies are increasing investment in one or a combination of different retail formats and extending this retail modernization beyond Hanoi and Ho Chi Minh City to the center of the country.

Changes in demand will lead to a broader change in the structural composition of agriculture-related GDP. As seen in many other middle-income countries as food consumption and expenditures shift to higher-value and more processed foods, the GDP share of the post-farm segments of the agro-food system may increase and come to account

Figure 15: Share of Modern Retail in Total Food Retail in Several Countries, 2009–2012

Source: Verhofstadt et al. 2014 adapted from Dyck et al. 2012.

Figure 16: Ratio of Agribusiness GDP to Primary Agriculture GDP, 2011

Source: Based on calculations using GTAP data.

for a higher proportion of GDP than primary agriculture. We might call this the agro-industrial or agribusiness transition. This transition has begun to happen in Vietnam, yet as Figure 16 shows, we might expect agro-industrial and other agribusiness services to come to account for double or more of a (declining) primary agricultural GDP in the coming decade as incomes continue to grow and food consumption patterns change further. Since the mid-2000s, growth in domestic sales of snacks, processed foods, and even ready-to-eat foods has accelerated. With the domestic food processing sector consisting mainly of very small companies, a significant part of the recent growth has corresponded to sales of imported goods and locally-produced foreign brands which are perceived to be of higher quality.¹³ One recent study (BMI 2015) ranked Vietnam 8th out of 14 Asian countries in terms of its overall attractiveness for food and beverage investment, yet ranked the country 1st in terms of the near-term upside potential given expected consumption patterns and existing opportunities for food industry consolidation.

The shifts in consumption will influence Vietnam's agro-food trade patterns and related attitudes. Recent national agricultural strategies have emphasized the role of exports as a driver of agricultural growth, yet the growing domestic middle class and changing dietary preferences offer very significant opportunities for Vietnamese farmers and SMEs. At the same time, the shift toward higher-value foods will likely result in increased agro-food imports by Vietnam. The rapid development of the animal protein sector has been fundamentally connected to imports—first of powdered milk, now of dairy cows; and of a growing volume of animal (and aquaculture) feed and feed ingredients. Domestic dairy production is rising quickly, yet imported powdered milk still accounts for more than 60 percent of the product underwriting the explosive growth in domestic milk (and milk product) consumption. Some import substitution will be possible—especially in maize—yet it is unlikely to keep pace with domestic demand for animal feed. Nevertheless, all successful agro-food exporters are also food (and raw material) importers—a phenomenon that reflects the concentration of resources in areas where a country has a comparative advantage. Overall, Vietnam should maintain a very healthy food-trade balance longer-term. While some subsectors might face intense competitive pressures as Vietnam engages in trade liberalization as part of ASEAN and the Trans-Pacific Partnership, an open trading environment will ultimately benefit Vietnamese agriculture and food consumers.

¹³ Industrial statistics show that in 2011, the respective shares of food product manufacturing was 10, 58, and 32 percent for SOEs, domestic companies, and foreign owned companies, respectively. The share of beverages was more or less equally split among the three, with SOEs having a slightly larger share (Nguyen et al. 2014).



Chapter 2. Agricultural Performance: A Varied Picture

Uneven Agricultural Growth

Looking at an extended period, Vietnam’s rate of agricultural growth has been impressive by regional standards. Between 2000 and 2012, Vietnam’s agricultural value-added grew at an average rate of 3.7 percent per annum. This was a higher growth rate than that experienced in all other Asian countries other than China, Mongolia, and Cambodia (Table 5). Agricultural growth in Vietnam has also been less volatile than elsewhere in the region (Figure 17). Having very ample water supplies and a comparatively large proportion of its agricultural area serviced by irrigation, Vietnam has not experienced the wide fluctuations in food and other agricultural output faced by other countries. More than 70 percent of Vietnam’s cultivated area (taking into account multiple crops within a year) is now serviced by irrigation infrastructure. For the Philippines, Indonesia, Malaysia and Thailand, only between 25 and 40 percent of cultivated land is serviced by irrigation.

Agriculture has been an enduring source of both economic and social stability for Vietnam, with contributions extending well beyond GDP and employment. For example, its performance in reliably delivering an affordable and increasingly diverse supply of food has helped to contain inflation and thus dampen wage pressures which might have undercut the competitiveness of manufacturing. During the financial crisis of the late 2000s and throughout the more recent ups and downs of the macro-economy, rural communities and (at least part-time) agricultural employment have provided a safety net or shock absorber for many people.

Table 5: Agricultural Growth Rates in Selected Asian Countries, 1990–2012

Percent	1990–1999	2000–2012
East Asia		
China	4.2	4.4
Japan	-0.7	-1.2
Korea	1.6	1.7
Mongolia	0.9	4.0
Southeast Asia		
Cambodia	4.2	5.5
Indonesia	2.2	3.5
Lao PDR	4.7	3.5
Malaysia	0.1	3.2
Philippines	1.7	3.0
Thailand	0.7	2.2
Vietnam	4.2	3.7
South Asia		
Bangladesh	2.5	3.7
India	3.3	3.2
Nepal	2.4	3.3
Pakistan	4.4	3.2
Sri Lanka	1.8	3.3

Average annual growth in value-added. Source: based on World Development Indicators, as reported in Dawe 2015.

Figure 17: Vietnam’s Comparatively Stable Agricultural Growth

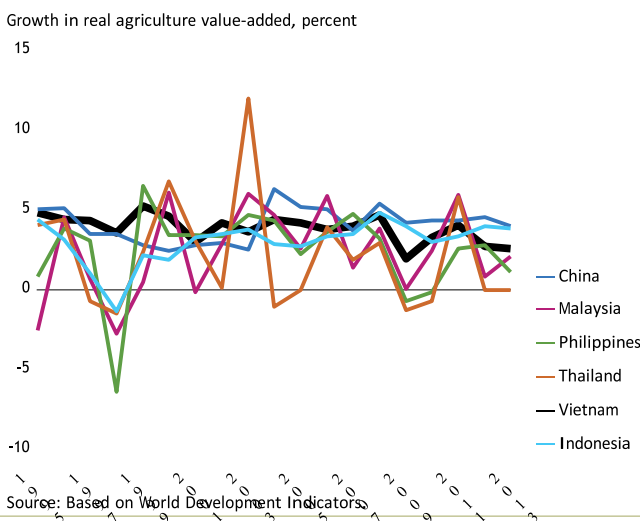
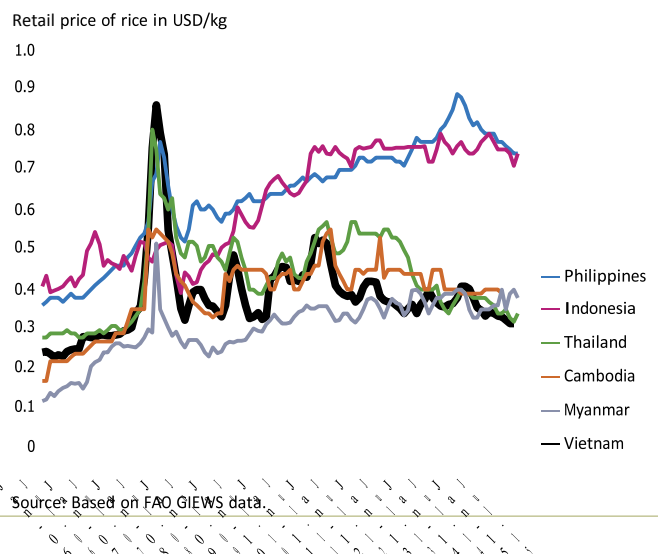


Figure 18: Retail Prices for Milled Rice in Selected Southeast Asian Countries



With most of Vietnam’s best agricultural land being reserved, officially, for paddy production, and with the bulk of its irrigation capacity designed to support food security, the steady expansion of rice output (per annum)—even in the face of weather variability—has served as the sector’s core stabilizing force. Between 1990 and 2010, national paddy production increased from 19.2 to 40 million tons. Two-thirds of this expansion took place in the Mekong Delta. With advances in irrigation supporting a shift to double and triple cropping—Mekong Delta paddy-land is now fully irrigated—the region experienced extremely low, year-on-year volatility in rice output, and its growing surplus was exported (Jaffee et al. 2012b).

An important benefit of the long-term expansion of Vietnam’s rice output has been the lower price that Vietnamese consumers have faced for this staple compared to other consumers in the region (Figure 18). Currently, Vietnamese consumers pay some of the lowest prices in the world for rice. Of the 47 locations around the world covered by FAO’s Food Rice Market Monitor, Vietnam’s representative site, Dong Thap, had the second lowest prices in the world (at \$0.36/kg) in November 2014, trailing only yangon, Myanmar. In that month, the average national price in China (\$0.98/kg) and the Philippines (\$0.96/kg) were two and a half times higher while those in South Korea (\$2.11/kg) were nearly six times higher.

The stabilizing role of the agricultural sector, generally, and of the rice subsector in particular, has not come without cost. It was and is not necessary for Vietnam to generate a rice surplus equivalent to 30 percent of its production in order to achieve or maintain national food security.¹⁴ By the mid-2000s, a very comfortable structural surplus had been achieved as a result of the sustained advance in production and a leveling off of consumption—as a population with growing incomes began to turn to a more diverse diet. Nearly all of the 2000s’ increment in rice production from the Mekong Delta has gone for export, primarily in the lower-quality/lower-price segment of the international market. Despite this, a policy of restricting alternative uses of designated rice-land and focusing irrigation services on rice has persisted until very recently.¹⁵ The evidence suggests that this continued concentration of resources has come at a high cost—to the sector, to many farming communities, and to the country as whole.

In some ways, Vietnam has been a victim of its own success in achieving its food security targets. This has been a drag on recent sector growth and has inhibited a more rapid process of structural transformation—both within the sector and beyond. As Vietnam’s national level food security has gone from strength to strength, the country’s agricultural growth rate has been decelerating. Between 1994 and 2000 the average rate of growth was an impressive 4.5 percent per annum. Between 2001 and 2007 the average growth rate fell to 3.3 percent per annum, and between 2008 and 2013 it fell further to 2.6 percent. In hindsight, an earlier pivoting of the country’s food security strategy toward a more diversified cropping and resource-use pattern would have been more beneficial for farmers, consumers, and agricultural workers. This has now been recognized and efforts have begun to achieve a more balanced and efficient use of resources. Decree 35, released in April 2015, eases the restrictions on paddy-land use, especially conversions to other short-term crops, and provides a stronger framework for provincial and local initiatives to promote such conversions.

Within Vietnam’s agricultural sector, the pace and pattern of growth has varied considerably among different subsectors. Over the 2000 to 2013 period, Vietnamese capture fisheries and aquaculture grew at a very impressive

14 For 2010, Jaffee et al (2012) estimated that the level of rice exports was equivalent to 31.5 percent of the ‘rice available’, taking into account national paddy production, provisions for seed and feed, post-harvest losses, and rice grain out-turns from processing. Another 8 percent of the available rice was carried over as stock into the subsequent calendar year and 4 percent was put into natural disaster response reserves. The exportable surplus ten years earlier had been below 20 percent.

15 Several factors have contributed to this including memories of an earlier period of widespread hunger, concern about an uncontrolled conversion of land from agricultural to non-agricultural use, and national pride in being able to serve the food security needs of other countries.

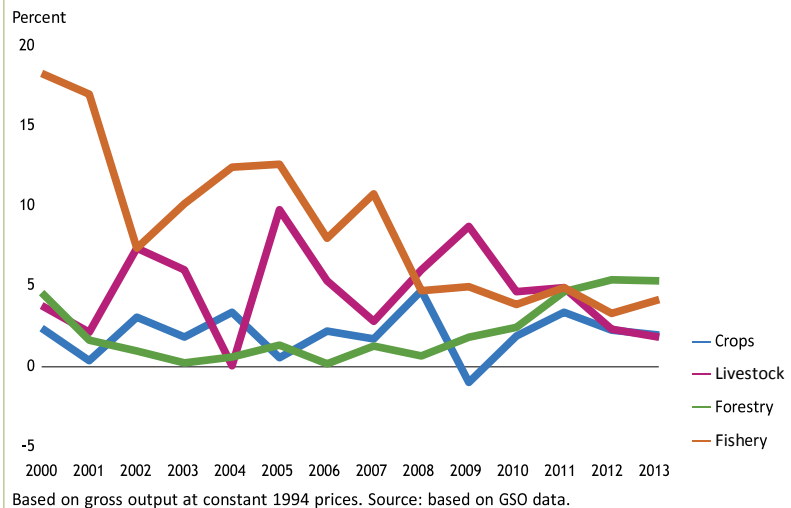
8.8 percent per annum, although as Figure 19 illustrates, the bulk of this growth took place in the period up through 2007. Since then, capture fisheries have had to contend with a partially depleted near-shore fisheries resource-base (CIEM 2010), while the shrimp aquaculture industry has faced large losses of production, as it in 2012 and 2013, due to disease. The forestry subsector, featuring a mix of state-owned and private farms and processors, has long been an underperformer—both in terms of commercial development and natural forest protection (World Bank 2011 a). The forestry subsector grew at only 2.2 percent over the 2000 to 2013 period, although some faster growth has been recorded in the past few years.

Livestock production also grew at an impressive average of 4.7 percent, per annum, over this period. Yet, this production has been quite volatile, in large part due to disease outbreaks plus volatility in the costs of animal feed. While domestic milk production is growing rapidly, this still accounts for a very small share of livestock value-added.

Pork production accounts for some 70 percent of this subsector. That industry has recently experienced problems of disease, consumer concerns about feed additives and food safety, and a declining ratio of farm-gate prices to feed costs. While efforts are being made to relocate major elements of the livestock industry away from residential areas to lower the risk of transmission of zoonotic diseases, this relocation will take considerable time. Waste from a growing livestock sector represents a significant human health risk. Some 80 million tons of livestock waste are discharged directly and indirectly into the environment every year, according to the Livestock Research Institute's estimates.

In statistical terms, the crops subsector has weighed down the overall growth of Vietnamese agriculture. The subsector grew at an average of only 2 percent per annum between 2010 and 2013. This is rather remarkable as this period coincided with a continuous expansion in national rice production and a very large increase in the volume of exports for a diverse range of crops. Much of the explanation for this seems to relate to rice. This has remained the dominant food crop. While output growth has been impressive, the value-addition to this crop has remained low, both at primary and secondary levels, and both in absolute and relative terms. Table 6 illustrates the value-addition that occurs at the farm level in the Mekong Delta.¹⁶ In 2011, the value added in primary processing was estimated to be 12 percent for rice, compared with 17 percent for fish and more than 25 percent for sugar and fruits and vegetables. In that same year, Vietnam's rice sector overall experienced physical and quality losses of a value that exceeded the value-added of the entire rice export industry.

Figure 19: Annual Growth of Vietnamese Agricultural Subsectors, 2000–2013



¹⁶ Although land, water, and climatic conditions (and the existing infrastructure) limit the scope for conversion over to other field crops in some locations. In the rainy season, rice-fish rotations have good potential, although shifts to specialized forms of aquaculture may entail high investment costs and various production risks. Switching paddy-land to fruit trees or most industrial crops often requires physical changes in the height and protection of the land.

Table 6: Rice versus Alternative Crops: Revenue and Margins in Chau Phu and An Giang, Mekong Delta, 2012

Crops	Growing Duration (month)	Gross Revenue (mill. VND)	Total Cost (mill. VND)	Gross Margin (mill. VND)	Benefit-Cost Ratio
Upland crop (n=38)					
Bean	3.5	300.97	127.66	173.30	4.98
Chili	5.5	341.69	139.03	202.66	2.22
Gourd	6.0	159.94	26.09	133.84	4.23
Lotus	9.5	631.07	169.87	461.20	10.42
Flower	3.5	170.00	51.85	118.15	2.34
All	5.3	269.68	100.03	169.65	3.42
Rice crop (n=101)					
Winter-spring season	3.5	36.61	19.34	17.26	1.01
Summer-autumn season	3.5	33.38	19.99	13.39	0.80
Autumn-winter season	3.5	39.63	19.43	20.20	1.13

Source: Le Canh Dung and Shigeki yokoyama 2012.

Farmers' low gross margins on paddy derive from a combination of small farm sizes and unfavorable prices (or terms of trade). Rice farmers made only modest gains during the food price crisis in the late 2000s as their paddy sales generally predated the market price-spikes (Jaffee et al. 2012 b). And in recent years, the terms of trade for rice producers has declined. From early 2010 to the second half of 2013 for example, the ratio of the price of paddy to the price of nitrogen fertilizer—a major cost item—in Can Tho fell from 0.80 to between 0.45 and 0.55. Whereas in the mid-2000s the typical gross margin for a market-oriented smallholder rice farmer was some 50 percent over production costs, this gross margin has tended to be 25 to 30 percent in recent years, and well below this (or even negative) for the summer-autumn crop (Keyser et al. 2012). Because rice accounted for nearly 60 percent of the overall crops-subsector value-added in 2000, its relatively low annual growth rate dragged down the subsector average (Table 7 and Figure 20). And although certain crops recorded double- or even triple-digit growth rates (e.g., cassava and rubber), these were diluted by the lower performance of more dominant crops subsector.

Different rates of growth within the agricultural sector are however resulting in some considerable changes in the composition of (gross) agricultural output (Table 8). Among agricultural subsectors, crops still accounted for the majority of output value in 2013, yet their share fell by 10 percent compared to what it was in 2000. Rice alone saw its contribution to the total value of agricultural output fall from 35 percent to 27 percent over

Table 7: Net Production Value in Rice and Other Crops in Vietnam 2000–2013

Net Production Value				
Constant 2004–06, US\$1,000				
	2000	2013	Difference	Share of total NPV
Rice (NPV)	7,846,938	10,922,070	3,075,131	33%
Other Crops (NPV)	5,911,822	12,143,293	6,231,470	67%
Total Crops (NPV)	13,758,760	23,065,363	9,306,602	
Rice (NPV per capita)	97.0	119.1	22.1	
Other Crops (NPV per capita)	73.1	132.5	59.4	
Total Crops (NPV per capita)	170.1	251.6	81.5	
Annual Growth Rate				
Constant 2004–06				
	Net Production Value		Net Per Cap. Production Value	
Rice	2.6%		1.6%	
Other Crops	5.8%		4.8%	
Total Crops	4.1%		3.1%	

Source: Based on FAOSTAT data.

Table 8: Subsector Share of Gross Output in Vietnamese Agriculture

Percent	2000	2005	2011
Crops	66.7	60.4	56.2
Livestock	13.5	14.7	16.1
Capture Fisheries	9.9	8.7	8.2
Aquaculture	5.6	12.6	16.3
Forestry	4.2	3.5	3.2

Source: GSO.

this period. Livestock’s share grew, although the most significant change lay in the growing prominence of aquaculture. Both capture fisheries and forestry saw a small decline in their contribution to the value of agricultural output.

Figure 20: Varied Patterns of Growth Among Leading Crops and Livestock Products

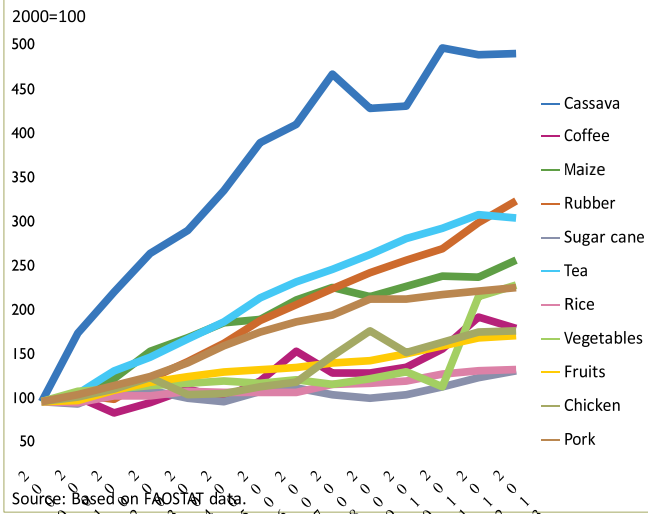


Table 9 highlights some regional differences in the pace of recent agricultural growth within Vietnam. Several regions, including the Red River Delta and the two Central Coast regions, have seen their rates of growth lag over most of the period since 2000. The Red River Delta, for instance, has seen an absolute decline in agricultural gross value-added in four of the past five years. Urbanization and industrialization are the main drivers of economic development there. The Central Highlands region has witnessed the most robust rates of agricultural growth, as these have not tailed off as they have tended to, recently, in most of the country. The Southeast has also seen higher-than-average growth. Commercial tree crop development has underpinned this growth in both regions, together with expanding livestock development in the Southeast. The Mekong Delta region, which accounts for about one-third of agricultural gross value-added (AGVA), saw growth taper off between 2009 and 2013 due to some disruptive events in the aquaculture subsector and declining rates of growth in rice value-added. Among regions, Vietnam’s two rice bowls—the Mekong and Red River Deltas—have experienced the slowest pace of agricultural growth since 2009. Three regions, the Mekong Delta, the Southeast, and the Central Highlands, now account for about 60 percent of Vietnam’s gross agricultural output and more than 80 percent of its agricultural exports.

Table 9: Composition of Agriculture and Agricultural Growth by Region

Percent	Rate of Growth in Agricultural Gross Value-Added by Region			Share of National AGVA	
	2000–13	2000–04	2009–13	2000	2013
Total	3.6	3.9	2.8	100	100
Red River Delta	1.2	1.9	0.3	20	14
North East	4.4	3.4	5.7	9	10
North West area	4.5	4.7	4.2	2	3
North Central Coast	2.5	3.0	1.2	11	9
South Central Coast	2.9	3.1	1.7	7	6
Central Highland	8.7	8.5	8.6	6	11
Southeast	4.6	4.0	5.6	12	14
Mekong Delta	3.5	5.0	1.1	33	32

Based on constant prices. Source: IPSARD calculations based on GSO data.

Changes (and Shortfalls) in Productivity

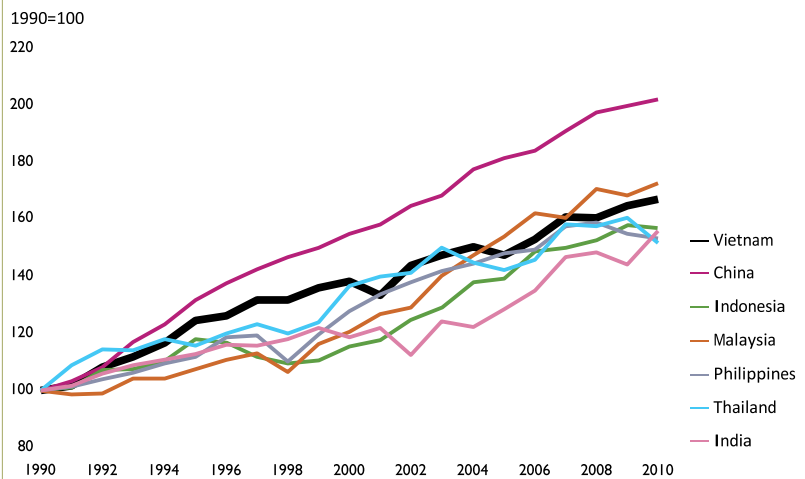
The picture with regard to agricultural productivity has been a mixed one. This section considers land productivity, labor productivity, water productivity, the efficiency of input use, and total factor productivity.

Land Productivity

Vietnam’s impressive gains in land productivity compared to those of regional peers appear in Figure 21, depicting changes in land productivity since 1990 (OECD 2015). A closer look, however, reveals that if Vietnam outperformed its neighbors in terms of land productivity growth during the 1990s, it actually fell back into the pack in the subsequent decade, and the land productivity gap widened between China and Vietnam.

The picture with regard to crop yields is varied (Table 10). Compared to regional and other developing country peers, Vietnam has achieved relatively high rice yields, has the highest yields amongst major coffee producers, and is in the middle of the pack for other major crops. Direct comparisons are hard to make given differences in growing conditions, patterns of input use, seed varieties, and so forth, but Vietnam’s average paddy yields have reached 5.5 tons per hectare in recent years, compared with average yields of 5.2 and 3.8 tons per hectare in Indonesia and the Philippines, respectively. Average rice yields in China are higher than those in Vietnam, in part due to China’s faster advances in science and technology and its greater use of

Figure 21: Growth in Land Productivity in Selected Asian Countries, 1990–2010



Agricultural land productivity is calculated as total agricultural output (constant 2005 USD) divided by total agricultural land, expressed in hectares of “rainfed cropland equivalents.” This is the sum of rainfed cropland (weight equals 1.00), irrigated cropland (for Asia weight equals 2.9933) and permanent pasture (for Asia weight equals 0.0566). Source: OECD 2015 based on Fuglie and Rada 2013, International Agricultural Productivity Dataset, USDA Economic Research Service.

Table 10: yields of Selected Crops

Metric tons per hectare	Cashew Nuts	Cassava	Coffee	Maize	Rice	Rubber	Sugar cane	Tea
Brazil	0.16	14.08	1.42	5.25	5.01	1.33	75.34	2.05
China	0.45	16.10	2.36	6.02	6.71	1.26	70.59	1.10
India	0.76	34.96	0.85	2.45	3.62	2.04	67.43	2.14
Indonesia	0.20	22.46	0.56	4.84	5.15	0.87	74.89	1.21
Philippines	5.10	10.89	0.67	2.88	3.89	0.60	73.21	—
Sri Lanka	0.30	12.65	0.64	3.09	3.89	0.96	46.19	1.53
Thailand	1.69	21.82	0.98	4.42	2.91	1.60	75.74	3.49
Vietnam	3.69	17.93	2.50	4.44	5.57	1.73	64.88	1.76

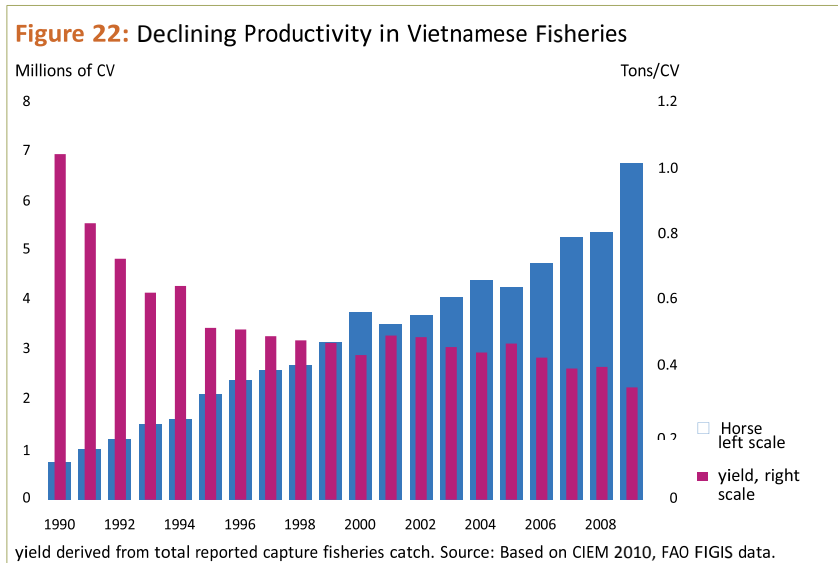
Source: FAOSTAT, BMI.

hybrid varieties. Within Vietnam, growth in paddy yields has varied enormously by location and season. yet it is important to note that Vietnam’s rice yields are growing at a slowing pace. Rice yields grew at an average rate of 3.1 percent per annum from 1990 to 1995, at a rate of 2.9 percent from 1996 to 2005, and at a rate of 1.6 percent from 2006 to 2013. Agro-chemical and seed use is already high, if not excessive. Climate change and pesticide resistance are also hurting yields in some areas.

Vietnam’s coffee yields are well above international norms, yet these have progressed little over the past decade as a result of the aging of the tree stock, the considerable spread of coffee plantings onto less- suitable or un-suitable land¹⁷, and various episodes of drought (1999, 2005, 2013). Vietnam’s average coffeeyields peaked as far back as in 1997. Vietnam’s maize yields, at 4.4 tons per hectare, are similar to those of other Southeast Asian countries, yet well below those of China. Maize yields improved during the late 2000s but have leveled off since then. Productivity in the sugar sector, both in primary production and in milling, is comparatively low within the region.

Significant increases in milk productivity have occurred in recent years, yet Vietnam’s livestock productivity otherwise lags well behind that of regional and global peers. For example, the average amount of feed used to generate 1 kg of pork meat is higher in Vietnam (4.4 kg) than in China (3.5) or Brazil (2.8). Factors contributing to this difference include the quality of the feed and breeding stock that are used, as well as animal husbandry and health practices (Agrifood Consulting International 2014).

In 2013, Vietnam slaughtered an average of 12.3 pigs per sow per year, compared with 13.8 in China and 22– 25 in developed countries (Hoste 2012). Massive growth in fishing capacity during the 2000s contributed to the degradation of near-shore fishery resources, leading to very sharp productivity declines¹⁸(see Figure 22) and forcing many fishers to seek alternative sources of livelihood (CIEM 2010).



Labor Productivity

Aggregate patterns of change in agricultural labor productivity do not paint a favorable picture for an emerging, middle-income country. Table 11 compares the growth rate in this indicator among nine medium and large Asian countries including Vietnam. The productivity of labor in Vietnamese agriculture has grown at a faster

17 In the leading coffee-growing provinces of Dak Lak and Lam Dong, some 20 percent of coffee plantings are on ‘unsuitable’ land, taking into account soils, water availability and slope (Havemann et al 2015, based on data from NIAPP).

18 Average yield per CV per year fell from just over 1 ton in the early 1980s to 0.6 in the mid-1990s to below 0.4 in the late 2000s.

Table 11: Growth in Agricultural Value-Added per Worker

Percent	1990–99	2000–13
Bangladesh	2.4	4.0
China	3.5	4.3
India	1.8	2.0
Indonesia	0.7	3.2
Korea	6.6	7.1
Malaysia	0.9	4.5
Philippines	0.4	0.6
Thailand	1.9	3.2
Vietnam	2.7	2.5

Data in constant 2005 US dollars. Source: Based on World Development Indicators.

pace than it has in only two of the eight other Asian countries shown in the table. And Vietnam is the only country among these which has seen a decline in agricultural labor productivity growth. As a result, the gap between the productivity of Vietnam’s farm labor and that of its peers has widened (Figure 23), and Vietnam has seen the steepest decline in agricultural labor productivity as a share of average per capita income within Asia (Figure 24).

Figure 23: Agricultural Value-Added per Worker

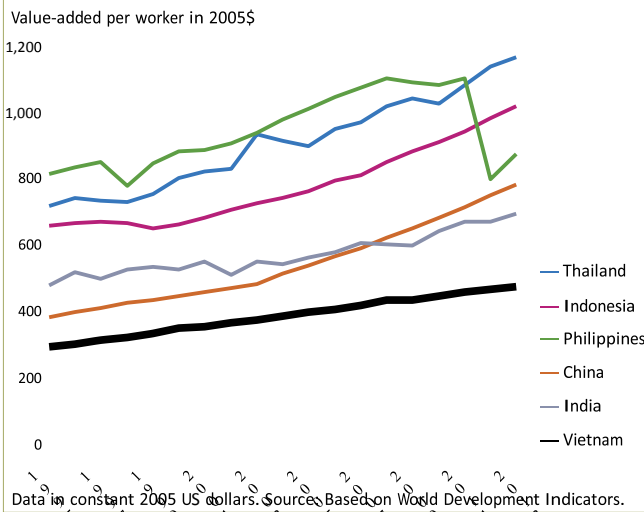
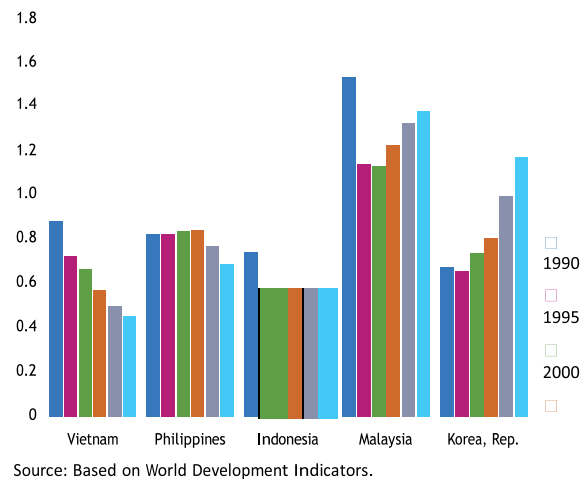
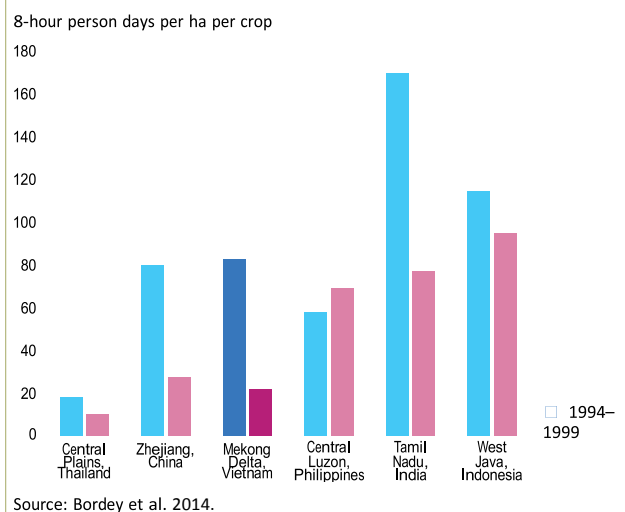


Figure 24: Ratio of Average Value-Added per Agricultural Worker to Average Income per Capita



What accounts for such low value-added per agricultural worker? An important factor is the dominance of rice—in the use of Vietnam’s best land and irrigation capacity. Value-addition to rice is low, as is the water productivity of rice-centered irrigation schemes (Table 13). A very low productivity of labor for rice is evident in the Red River Delta and other areas where production occurs on multiple small parcels held by households. On a per hectare-equivalent basis, upward of 150 person-days are involved in cultivating rice in the Red River Delta (including time spent moving between parcels). In sharp contrast, labor input in commercial rice-growing areas of the Mekong Delta generally ranges from 35 to 55 person-days per crop, although one comparative study by Bordey et al.

Figure 25: Labor Use in the Major Rice Bowls of Asia



(2014) found labor use to be as low as 20 person-days in areas where many processes have been mechanized (Figure 25). In the latter areas, agricultural labor productivity has certainly increased.

The productivity gap between agricultural and non-agricultural labor is certainly growing, although official estimates may exaggerate its size. In some parts of the country agricultural work is now primarily a part-time or seasonal activity. Yet, people without formal employment in rural areas are deemed to be “working in agriculture.” They may only be working in agriculture for 60, 90 or 120 days, while working in other activities for much of the remainder of the year. In the Red River Delta and greater Ho Chi Minh City area, many people either commute to or temporarily migrate to (part-time or extended) jobs in industrial zones, in construction, and in informal service-sector activities. Often, they remain formally registered in their (rural) place of origin. Reforms in the household registration system and better (union and other) protections for seasonal or migrant workers would contribute to a more efficient release of surplus agricultural labor, both in reality and statistically.

Agricultural labor productivity in Vietnam probably varies greatly by location and farming system; but labor productivity has not been systematically analyzed for this sector, taking into account actual levels of agricultural effort rather than the official tally of “agricultural workers.” The issue is that the official count of agricultural workers in the census almost certainly represents an overestimation of actual time spent working in agriculture, as informal employment outside of agriculture sometimes gets reported as agricultural work. This residual labor is most likely skewing estimates of agricultural labor productivity. This can be shown for 2006, as labor statistics for that year include actual data on the number of person-days spent working on specific crops and in aquaculture. Based on these numbers, value-added per (full-time-equivalent¹⁹) agricultural worker in Vietnam was 1½ to 6 times greater than the official estimate for 2006 (Table 12). Value-added per agricultural worker was officially estimated at VND 8 million in 2006, far below the estimates for either the services or the manufacturing sectors (respectively VND 36 million and VND 41 million), or the economy as a whole (VND 24 million). In fact, value-added per worker in shrimp and *Pangasius* aquaculture may actually have been higher in 2006 than it was in Vietnam’s manufacturing or services sectors overall.

Table 12: Low Labor Productivity in Agriculture: Both Fact and Statistical Artifact, 2006

VND million

	Official Value-Added Per Worker Per Annum	Re-estimated Subsector Specific Value-Added Per Worker Per Annum	
Agriculture	8.3	Catfish	52
Manufacturing	36	Shrimp	42
Services	41	Coffee	22
Total	24.1	Pig Production	13
		Tea	12

Source: IPSARD Analysis.

This makes sense. The value-added in Vietnamese shrimp production is very high; the value-added in parts of the garment and footwear industries is comparatively low due to the very high import content of products. Although data aren’t readily available for these, the productivity of labor in parts of Vietnam’s horticultural and floricultural industries almost certainly matches or exceeds that observed in some manufacturing and service subsectors. More analysis is needed to differentiate the productivity of agricultural (and other sectoral) labor by area of specialization and location.

19 Assuming that one year comprises 250 working days.

Water Productivity

Until recently, some 80 percent of total freshwater withdrawals in Vietnam were for agriculture. Since the mid-1970s, it is estimated that \$6 billion (present value) have been invested in irrigation—representing about 80 percent of the government’s capital investment in the agricultural sector. While freshwater resources available to Vietnam are relatively abundant, some 60 percent of Vietnam’s available water originates upstream in other countries. Water flow is highly uneven during the year, with nearly three-quarters of the annual run-off occurring during a three-to-four month period. Irrigation has been critical in offsetting water shortages during the dry season and for protecting flood-prone areas during the wet season. Some 4.5 million hectares are serviced by a variety of small, medium, and large irrigation schemes, with about two-thirds of these being in either the Red River or Mekong River Deltas (FAO Aquastat, accessed 2015).

While irrigation coverage is high, with most amenable areas equipped, the current irrigation systems were designed primarily for rice and several factors impede increases in water productivity (World Bank 2013). From a design perspective, schemes typically do not have structures for accurate flow measurement and control, and low canal-density results in high dependency on field-to-field conveyance. This makes it difficult to deliver water flexibly and reliably. Fields are also inadequately equipped for both field and storm drainage, constraining the timing of harvesting operations. Further, most irrigation schemes were developed 30–40 years ago with less than adequate attention to maintenance. Incomplete structures and water losses during operations have many schemes operating at only 60–70 percent of their capacity.²⁰ And in some areas there have been problems in managing water quality, especially in relation to the polluting effects of fertilizer and agro-chemical run-off.

The larger irrigation schemes are managed by state-owned Irrigation and Drainage Management Companies (IDMCs), the operating revenues of which come from a combination of public subsidies and water-use charges collected from industry and municipalities. Since 2008, most farmers have been exempt from paying fees for services provided by IDMCs. Although this measure was adopted to improve farmer welfare, it has weakened the accountability of IDMCs to local water-user organizations. There is now fiscal pressure to reduce the level of central government subsidies and to set IDMCs on a path of greater commercial autonomy, where favorable market conditions exist. This will involve planning a set of transitions for managing assets and generating revenues to cover operation and maintenance and MARD are currently piloting performance contracts with Provinces and IDMCs to assess continued disbursement of this central subsidy,

At present, under a strict measure of average water productivity, the performance of Vietnamese irrigation schemes would appear to be low, especially the performance of those entirely dedicated to rice production. This is illustrated in Table 13 which compares from the water productivity of four large-scale irrigation schemes in Vietnam, China, and India. The introduction of a rotation crop or the act of supporting a different crop pattern raises the average productivity in Vietnamese schemes considerably. The output per unit of water is ten times higher in one Vietnamese scheme involving a rice-sugar rotation compared to one involving rice monoculture. Similar patterns are observed in the other two countries, China having much higher productivity rates per unit of water.

²⁰ In other words, an irrigation scheme might be designed to provide irrigation services so that rice can be double-cropped on 100 hectares, but may only be serving farmers on 60 to 70 hectares with reliable irrigation service. All the needed canals and other structures may not be completed, and these may experience water losses due to leaks and evaporation.

Table 13: Water Productivity in Large-Scale Irrigation Schemes*

Country	Cropping Pattern	Output Per Service Area (US\$/Ha)	Output Per Unit of Irrigation Water (US\$/m ³)
Vietnam	Rice	654	0.03
	Rice and Vegetables	1,051	0.11
	Rice and Sugar	3,603	0.34
	Vegetables	4,862	0.49
China	Rice	1,541	0.06
	Rice and Rape Seed	1,546	0.38
	Wheat/Corn	2,491	1.46
	Applies	4,163	1.20
India	Rice	988	0.09
	Rice/Chili/Cotton	1,206	0.12
	Sugarcane	1,844	0.17
	Coconut and Sugarcane	2,165	0.12

*Sample of schemes larger than 5000 hectares. Source: Based on data in Burke et al. 2015.

In many locations, existing irrigation schemes cannot provide the level of irrigation and drainage services that farmers need to intensify rice production or diversify crops away from rice (World Bank 2013). While such schemes have played a major role in Vietnam’s impressive progress with respect to food security and poverty reduction, their utility will come under increasing scrutiny as farmers seek to diversify land- uses and as competition for land, water, and budgetary resources

intensifies. Irrigated agriculture needs to increase overall factor productivity and better account for its water-use where opportunity costs in competing uses are higher. Existing infrastructure will need to deliver a range of multi-functional water services—not just irrigation and drainage. Water supply to municipalities, rural centers, industry and maintenance of flows for aquaculture, fluvial transport, and environmental services are becoming increasingly important.

Away from lowland rice and cereal production, the application of deficit irrigation can improve coffee yields and reduce pressure on otherwise stressed groundwater resources (Amarasinghe et al. 2015).²¹ All these examples point to a future where smarter crop-water management and better adapted planning and infrastructure investment will have to catch up with the rate of transformation and declining access to land and water resources. Matching these irrigation and drainage services to improved agronomy and value chain development is likely to be the critical area of transition rather than a focus on notional measures of water productivity.

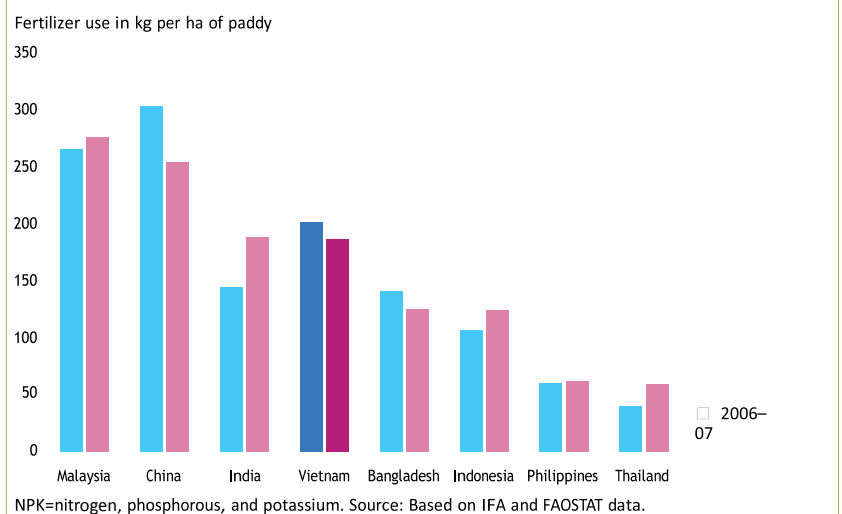
Improved water productivity is also needed in coffee production, a sector where there is heavy reliance on irrigation drawn from surface and especially from groundwater (Amarasinghe et al. 2015). Irrigation is crucial for growth of the coffee crop during the dry season between January and April. For years, the public extension service has advised farmers to irrigate with 650 liters per plant per round in three rounds. In practice, many farmers have been using twice as much water based on the belief that this is beneficial to crop yields. Farmers don’t pay for water, although they do incur irrigation-related expenses (labor, diesel or electricity for pumping, and so forth). Farmer water-use is not monitored. And, the most common ‘sustainability’ standard being applied in Vietnam’s coffee sector, 4C, has very lax conditions provisions in relation to water management. Field experiments have highlighted that in years of average rainfall, the optimal irrigation level would be only 364 or 456 liters per plant per round in 3 rounds per year, a level which is only 70 percent of what is locally recommended and between one-third and one-half of the common practice. Moving toward more appropriate levels of water-use will be critical for avoiding water shortages in the Central Highlands where it is expected that climate change will result in more variable and seasonally concentrated rainfall patterns in the future. Already, excessive groundwater pumping has contributed to a declining water table (D’haeze et al. 2003).

21 In the Central Highlands, the average annual water-use among urban and rural households is 137 tons and 144 tons, respectively. For comparison, the average household use for coffee irrigation is 2,822 tons (Technoserve 2014).

Over-Intensive Input Use

The intensification of Vietnamese agriculture has featured very heavy and sometimes inefficient use of fertilizer and pesticides. More than 10 million tons of fertilizer are used per annum, with about 80 percent of this coming from domestic supply.²² About two-thirds of fertilizer are used for rice; other significant uses (between 5 and 10 percent of the national total) are for maize, coffee, and rubber. Fertilizer is the largest single cost-item for each of these crops. Fertilizer application rates grew rapidly during the 1990s but have more or less stable since the early 2000s. Still, at around 180 kg per hectare of paddy, the

Figure 26: Consumption of NPK Fertilizer per Hectare of Paddy, 2006–2011



application rate in Vietnam is about 30–200 percent higher than that observed in other Southeast Asian countries (Figure 26). Within the region, only China, Malaysia, Korea, and Japan have higher uses. Soil testing in Vietnam is rare and farmers often do not apply fertilizer with the optimal composition or at the optimal time. Between one-half and two-thirds of fertilizer nutrients are not taken up by crops. Excess fertilizer use, together with water management practices, leads a large proportion of fertilizer to either run off into streams or groundwater or be emitted as nitrous oxide.²³ Vietnam needs to be careful to avoid the very serious land degradation and water pollution effects of very heavy fertilizer use which China has experienced.

Vietnam is also a relatively heavy user of pesticides, despite various programs over the years to promote integrated pest management. There has been growing use, both of newer, less toxic products as well as less expensive generic (and sometimes inaccurately labeled) products, some of which are no longer permitted for use in many of the destination markets for Vietnam’s agricultural exports. Pesticide use seems to have increased sharply since the mid-2000s, perhaps due to increased pest pressure from more intensive production and the development of pesticide resistance. Frequent and late chemical spraying of crops has contributed to growing concerns about pesticide residues, in rice, tea, and fruits and vegetables, although systematic data are not available on the breadth and seriousness of the problem. Based on past violations, various Vietnamese products entering the EU are subject to more frequent sampling and testing (EU Food and Veterinary Office 2014). Relatively strong national legislation is in place, yet the capacities to advise on and to monitor agro-chemical use are limited, both within government and among food distribution and trading companies. Perhaps even more serious have been the health risks to farmers and to community members drawing water from streams where pesticide run-off is pronounced. One study (Dasgupta 2005) found that among the surveyed Mekong Delta rice farmers who were medically tested, 35 percent showed signs of poisoning—from organophosphates and carbamates—with 21 percent having symptoms of chronic poisoning.

22 Domestic production is supported through subsidized pricing for natural gas, electricity and coal, made available to the state-owned companies who account for the bulk of domestic fertilizer production.

23 FAO estimates that some 80 percent of the nitrous oxide emissions in Vietnam derive from agriculture.

Total Factor Productivity

Vietnam's total factor productivity (TFP) in agriculture has grown at a relatively rapid pace over the past two decades, although, as with the trend in agricultural GDP and for the yields in major crops, the rate of growth has been declining. Table 14 shows that the pace of TFP growth in Vietnam has fallen behind that of many regional peers since the mid-2000s. And the share of Vietnam's agricultural growth accounted for by TFP has been lower than that of the regional peers. Dawe (2015) reports that over the 2001–2010 period, TFP accounted for 57 percent of Vietnam's agricultural growth. The comparative shares for Thailand, China, and Malaysia were 83 percent, 86 percent, and 92 percent, respectively. In the past three years, TFP has accounted for an average of only 40 percent of Vietnam's agricultural growth, according to IPSARD. These are not encouraging trends.

Table 14: Average Annual Growth in Agricultural Total Factor Productivity

Years	Vietnam	China	India	Indonesia	Malaysia	Philippines	Thailand
1991–00	2.86	4.13	1.12	1.23	1.87	0.46	3.27
2001–05	2.52	2.39	1.11	3.36	3.73	2.64	2.18
2006–10	2.18	3.25	2.36	2.62	2.94	1.68	1.60
1991–10	2.65	3.10	1.25	2.26	2.92	1.67	2.73

Source: OECD, based on Fuglie and Rada 2013.

One contributing factor to a slowdown in productivity gains in the sector has been underinvestment in agricultural research and an overall sub-optimum performance of the agricultural innovation system. This system played an important role in the earlier take off of the sector, especially the introduction of improved crop varieties.²⁴ yet, Vietnam's current research and innovation capacity is limited by various factors, including: the relatively small proportion of university lecturers and researchers qualified at PhD level; a shortage of world-class scientists; the bureaucratically fragmented and cumbersome mechanisms used to allocate research funds; the fragmented provision of research services; a lack of co-operation between leading scientists in research institutes and universities; and continued separation between research and teaching. Despite recent steps to reform it, Vietnam's agricultural innovation system tends to be supply-driven, insufficiently responsive to farmers' demand, and still rather weak in collaborating with other institutions and the private sector (see more on recent and needed reforms in Chapter 4).

The Environmental Footprint of Vietnamese Agriculture

The expansion and intensification of Vietnam's agriculture over recent decades has significantly broadened its environmental footprint.²⁵ Part of this relates to the over-intensive use of inputs and the inefficient use of water noted above. Multiple forms of environmental degradation have been associated with several of the most dynamic areas of Vietnamese agriculture. For example, the expansion of shrimp aquaculture in the Mekong Delta has resulted in large-scale destruction of mangroves and has also been a major source of water pollution. Under so-called intensive systems, shrimp farmers often use large amounts of chemicals and antibiotics to keep the overcrowded

²⁴ This discussion is based primarily upon OECD (2015) and a rapid assessment of the agricultural innovation system in 2010 by the World Bank.

²⁵ For further detail, see Khoi et al. 2015; Vu et al. 2014; Pham et al. 2010.

shrimp healthy. Effluent from these ponds (which also contain large amounts of organic wastes) contaminate surrounding freshwater and coastal waters. The expansion of coffee and rubber production in the Central Highlands has been an important contributor to deforestation, biodiversity loss, and groundwater depletion. Production of livestock products is growing swiftly as is the livestock sector’s contributions to water pollution and greenhouse gas (GHG) emissions. The intensification of rice production has contributed to land degradation, water pollution, biodiversity loss, and the growth of GHG emissions. Table 15 summarizes Vietnam’s agro-environmental hotspots—commodities and locations or landscapes where environmental problems are either moderate or severe.

Table 15: Vietnam’s Agro-Environmental Hotspots

Commodity	Location	Soil degradation	Water and air pollution	Water scarcity and salinization	Deforestation biodiversity	GHG emissions
Rice	MRD	High impact	High impact	High impact	Medium impact	High impact
Coffee	CH	Medium impact	High impact	High impact	High impact	High impact
Corn	Northern Mtn	High impact	Low impact	Medium impact	High impact	Medium impact
Cassava	Northern Mtn, CH	High impact	Low impact	Medium impact	High impact	High impact
Pork	RRD & South East	No impact	Medium impact	Low impact	No impact	Medium impact
Shrimp	MRD	Medium impact	High impact	Low impact	High impact	Medium impact
Catfish	MRD	Medium impact	High impact	Low impact	Medium impact	No impact

Source: Khoi et al. 2015.

Multiple factors have contributed to the agricultural sector’s increasing effect on the environment. These can be classified under three categories: (i) policy and administrative failures, (ii) market failures, and (iii) knowledge and information gaps.

- Policy and administrative failures.** Agricultural policies in Vietnam have been primarily geared toward expanding output in order to meet food security, economic growth, and trade targets. This policy orientation has encouraged land expansion and intensification, more intensive use of agricultural inputs and all other means to raise production capacity. While the government has sought to protect farmers, protecting the environment has not, until recently, been a pillar of agricultural policy. Even where national policies have favored conservation, provincial governments have often maintained the course of expansion and intensification to live up to growth and revenue imperatives. Inter-sectoral coordination has also been problematic in translating green agriculture aspirations into practice.
- Market failures.** Generally in Vietnam, agricultural producers neither pay the actual costs of the scarce natural resources that they use nor have they been required to bear the costs of their environmental footprint. Groundwater or controlled irrigation water is either underpriced or not priced. For many farmers, “dirty” production may be temporarily more profitable, although the costs are borne by local communities or downstream farmers. The fragmented production structure of Vietnamese agriculture results in very high transaction costs, both in providing technical advice on more sustainable practices and in monitoring farmer compliance (or otherwise) with regulatory or private standards. With only some exceptions, downstream distribution channels or consumers have not punished or rewarded bad and good practices in Vietnamese agriculture. Consumers are still generally agnostic or unaware of environmental impacts of commodities, so consumer pressure for farmers

to change their practices has been low. Much of Vietnam’s agricultural exports are raw commodities which are invisible to final users.

- **Knowledge gaps.** The knowledge-base for green agriculture in Vietnam is growing yet it is still limited. Knowledge about the underlying resource vulnerabilities is lacking in some areas—e.g., groundwater stock and flows in the Central Highlands. Farm-level awareness of technical options and their financial implications is uneven especially where extension services are inadequate and farmers’ primary source of information is input stockists. Vietnam’s agricultural research system has, over the years, prioritized yield-enhancing measures rather than practices and technologies to lower agriculture’s environmental footprint.

In Vietnam, it is not uncommon to find a combination of policy failures, market failures, and knowledge gaps affecting environmental management for individual subsectors and landscapes. This is illustrated in Table 16 in relation to coffee. For the most part, the environmental costs associated with the intensification or extensification

Table 16: Environmental Risks, Drivers and Impacts Associated with Coffee Expansion and Intensification in the Central Highlands

Risks	Drivers	Impacts
Forest encroachment, production on unsuitable lands	<ul style="list-style-type: none"> • Demand for land for the production of coffee linked to policy and market incentives • Limited suitability of land for coffee planting in Dak Lak Province 	<ul style="list-style-type: none"> • Land instability and heightened risk of flooding and landslides • Habitat loss; loss of (flora and fauna) biodiversity • Soil erosion, leading to siltation of waterways • Greenhouse gas emissions from the reversal of carbon stocks linked to reduced vegetative cover and soil degradation
Excessive fertilizer and agro-chemical use	<ul style="list-style-type: none"> • Lack of awareness of soil testing benefits and limited soil testing infrastructure • Risk aversion and perception of fertilizer as risk insurance • Lack of farmer understanding of the fertilizer dose-response function • Improper timing of irrigation washes away agro-chemicals and reduces plant use efficiency 	<ul style="list-style-type: none"> • Soil acidification • Increased soil hospitality to nematodes and plant diseases (affecting productivity and fertility) • Increased reliance on agro-chemicals • Accelerated aging of trees • Surface water pollution (nutrients, pesticides) with impacts on biodiversity, water quality and costs of water filtration/treatment • Greenhouse gas emissions from production and consumption of fertilizer • Lower margins on coffee
Excessive irrigation/ Overexploitation of groundwater	<ul style="list-style-type: none"> • Water neither monitored nor priced • Province-level limits on water usage not enforced • Farmer risk aversion resulting in over-irrigation 	<ul style="list-style-type: none"> • Groundwater drawn down faster than it is replenished • Acute water shortages in (or following) drought years • Soil salinization • Accelerated aging of trees

Source: Havemann et al. 2015.

of Vietnamese agriculture have not been quantified. As a result the true value-addition of Vietnamese agriculture has been over-estimated.

Various programs have been initiated in Vietnam to promote more sustainable production and natural resource management practices, with some oriented around either national (VietGAP, “three gains, three reductions”) or international standards. Statistics on adoption rates of national standards are not readily available. Provincial departments of agriculture in the Mekong Delta have estimated the proportion of rice producers who are applying techniques involving much lower use of fertilizer, pesticides, and water. For tea and coffee, Vietnam’s move toward (certified) sustainable practices appears to still lag behind that of important peers. For example, in 2013, less than 3 percent of Vietnam’s tea production was Rain Forest Alliance-certified. A much larger share of production was certified in the four countries tea exports of which exceed those of Vietnam—India (34 percent), Sri Lanka (10 percent), Kenya (88 percent), and Indonesia (34 percent). The comparison is somewhat better for coffee. Some 30 percent of Vietnamese coffee is certified under one or another international standard—compared with 41 percent for Brazil, 60 percent for Colombia, and 11 percent for Indonesia. Vietnam has the largest number of sustainability-certified aquaculture farms in the world, although in the case of shrimp, a large majority of the growing area is not yet monitored (or certified) for environmental management practices.

International Market Integration

Over the past two decades, Vietnam has emerged, seemingly out of nowhere, to become a major supplier in international agricultural commodity markets. Both the scale and the breadth of this trade have been very impressive. Vietnam now has more than \$1 billion in trade for seven different commodities (or commodity groups), and it ranks among the top five global exporters of each. Figure 27 highlights Vietnam’s stable or growing international market-share for various products. Vietnam’s farmers have responded exceptionally well to the opportunities provided by (i) growing global demand for agricultural

raw materials and both staple and higher value foods; (ii) Vietnam’s entry into the WTO and into various trade agreements; (iii) an improved domestic environment for business and investment; (iv) the country’s diverse agro-ecological conditions; and (v) Vietnam’s favorable geography nearby to rapidly growing middle-income countries.

Vietnam’s agro-food exports have grown six-fold since the early 2000s, with the ratio of these to agricultural GDP tracking the same pattern as in the economy overall, going from about 50 percent in 2000 to 75 percent

Figure 27: Vietnam’s Share of World Exports of Selected Commodities, 2000–2012

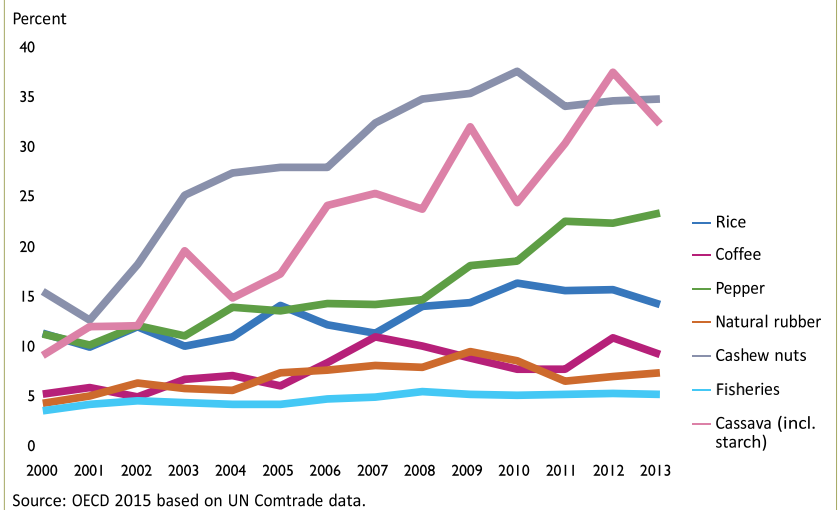


Table 17: Agro-food sector's integration with international markets, 2000–2012

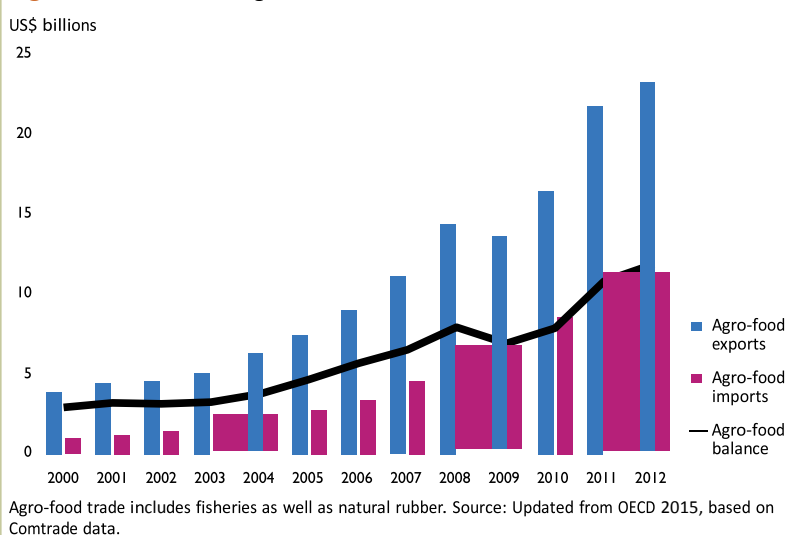
		2000	2005	2010	2011	2012
Agriculture, GDP, current prices	USD billion	7.6	11.1	21.9	27.2	30.6
Agro-food exports	USD billion	3.9	7.5	16.5	21.8	23.1
Agro-food imports	USD billion	1.0	2.8	8.6	11.0	11.2
Agro-food trade balance	USD billion	2.9	4.7	7.9	10.8	11.9
Coverage degree of imports by exports	%	396	268	191	198	206
Share of agro-food in total trade						
Exports	%	27	23	23	22	20
Imports	%	6	8	10	10	10
Ratio of agro-food exports to agricultural GDP	%	51	67	75	80	75
Ratio of agro-food imports to agricultural GDP	%	13	25	39	40	36
Ratio of total exports to total GDP	%	46	56	64	72	75
Ratio of total imports to total GDP	%	50	64	75	79	74

Agro-food trade includes fisheries as well as natural rubber. Source : OECD calculations based on UN, UN Comtrade data, 2014 ; WB WDI, 2014 ; MARD, 2013.

in recent years (Table 17).²⁶ Vietnam's agro-food imports have also grown significantly in the past few years, with these consisting of:

- Commodities and raw materials that Vietnam is not able to produce (i.e. wheat) or in which it is not a very competitive producer (i.e. cotton, soybeans, sugar, and beef);
- Raw materials for which domestic supply has fallen well short of processing capacity (for wood, increasingly so for cashew nuts, and significantly for shrimp during recent years' disease outbreaks);
- Products for which domestic production lags behind surging domestic demand (i.e. milk and animal feed and feed ingredients); and
- Higher value foods and beverages wanted in greater variety or higher quality by Vietnamese consumers.

Still, until the past two years, agro-food export growth was outpacing import growth (Figure 28). Whether this trend can continue will depend upon whether the competitiveness and value-addition in certain export industries can continue to improve, whether efficient import substitution can occur for maize and some other animal feed components, and whether Vietnam's livestock and

Figure 28: Vietnam's Agro-food Trade Balance, 2000–2013

²⁶ In some official reports, both wood products and wood furniture are included in Vietnam's agricultural exports. Elsewhere, trade in wood is commonly included in this category yet not manufactured products such as furniture (or textiles) which use agricultural raw materials. Some 70 percent of Vietnam's wood furniture exports have been based upon imported raw materials.

sugar industries can effectively restructure to stave off the much higher competition which will come as a result of the ASEAN and Trans-Pacific Partnership trade agreements.

Yet the picture of Vietnam’s agro-food trade is not all positive. Most of Vietnam’s expanding export subsectors have left money on the table—failing to take full advantage of the market opportunities for generating increased value and, in some cases, failing to have a transformative impact on the farmers and communities which serve as their foundations. Vietnam has been cost-competitive when it comes to crop-based commodities. Put differently, Vietnam’s commodities have been sold at a discount as a result of several factors, including:

- Issues related to (lower or inconsistent) quality or food safety;
- The incidence of and perceived risk of contract non-fulfillment by Vietnamese suppliers;
- Real or perceived risks regarding the environmental footprint of Vietnamese commodities; and
- Intensive competition among Vietnamese exporters, which has enabled international buyers to negotiate prices downward.

For higher-value and processed foods, a range of food safety concerns are being tracked by buyers and regulators, especially in high-income countries. Some of the most common problems have been the presence of (unapproved) antibiotic residues in farmed fish, violative pesticide residues in tea, fruits and vegetables, harmful microbiological substances in harvested clams and processed foods, and improper labeling. From the mid-to- late 2000s, Vietnam’s agro-food trade faced a relatively high number of food product consignment interceptions or rejections by regulatory authorities. There have since been signs of improvement—both absolutely and in Vietnam’s relative position.²⁷ Major efforts are being made to identify and better manage critical control points, especially in relation to fish exports, yet problems are still evident more generally—and relate to proper pest and disease control, environmental contamination, and overall supply chain management.²⁸

Table 18 illustrates the current situation. For each of the listed commodities, Vietnam is among the five leading exporters in volume terms and generally also in total value. yet most of Vietnam’s exports sell at a discount to that of the other global leaders. For some commodities, Vietnam’s particular variety (i.e. *Robusta* coffee) and lead market position (i.e. 25 percent broken white rice) generally have a lower unit value than alternatives (i.e. Arabica coffee, or parboiled or jasmine rice). Vietnam’s average FOB prices, even within those variety categories, have tended to be lower than that of peers. For example, Vietnam’s 25 percent broken rice has tended to sell at a \$30 to \$40 per ton discount of the same product from

Table 18: Vietnam is a High Ranking Commodity Exporter— at Discount Prices

	Global Rank (Total Volume)	Global Rank (Total Value)	Rank Among Top Ten Exporters in Unit Value
Cashews (shelled)	1	1	6
Black Pepper	1	1	8
Coffee (green)	2	2	10
Cassava (dried)	2	2	6
Rice	3	4	10
Rubber	4	4	10
Tea	5	7	10

Source: Based on FAOSTAT data.

27 Between 2006 and 2008, Vietnam had, by far, the highest incidence among major developing country exporters of food product rejections per millions of dollars of trade by U.S. regulatory authorities. In contrast, by 2013, the food product rejection rate on imports into the EU were lower for Vietnam than for India, China, Bangladesh, Egypt, and Thailand.

28 International buyers are now giving more attention to the environmental risks within their supply chain. These are risks which could either undermine their supply or harm their reputation and brand when their final products are publically associated with environmental degradation. Companies with global brands are now regularly monitoring or auditing supply chains for both environmental and social risk and many have made commitments to their shareholders and consumers to increasingly source from ‘sustainable’ sources.

Thailand. Vietnam's *Robusta* exports have tended to sell at a small discount to the LIFFE (International Price) index. In 2013, the average unit value for Vietnam's tea (\$1,524)—some 40 percent lower than that of India (\$2,688) and Kenya (\$2,799). Until the late 2000s, the bulk of Vietnam's rice exports consisted of medium and especially lower quality white rice sold at some of the lowest prices in international rice trade, in some years primarily to public agencies abroad for distribution via supplemental feeding programs. In recent years, there has been some repositioning of the rice trade into higher quality or different variety segments, including for aromatic varieties. But there too, the Vietnam product earns a lower price than that of peers.

Much of Vietnam's large agro-food trade is virtually invisible to the majority of end-users or consumers abroad. Its less-expensive raw materials tend to be blended with those from elsewhere to obtain a finished product. Vietnam's low cost *Robusta* coffee is blended with Arabica coffee from Africa or Latin America to produce different brands of instant coffee in Europe and North America. Vietnam's dried cassava is converted into animal feed, starch, and other products, generally in China. The bulk of Vietnam's exports of bamboo follow a similar path (along which most of the value-addition occurs overseas). Many of its raw materials are sold in products with labels that say "made with supplies from different countries." Fresh produce may go unlabeled or sometimes it is even labeled with a different country origin. Paradoxically, while Vietnamese cuisine is attracting more and more attention in high income countries, most Vietnamese-supplied food products and ingredients remain out of sight. Part of this may relate to perceptions about food safety or environmental risk.

The bulk of Vietnam's agro-food exports are sold as primary commodities or initially processed products (i.e. milled rice). In 2013, primary commodities accounted for nearly 83 percent of exports, by value (Table 19). Value-Added shrimp products account for a large proportion of a recent expansion in processed food exports. While there has been some growth in recent years in processed product exports, much of that growth is accounted for by gains by several firms in selling value-added shrimp products. Given Vietnam's pattern of agro-food exports, relatively few Vietnamese brands are recognized and sought after by consumers abroad.

Table 19: Vietnamese Food* Exports Value 2013: Primary and Processed Products

Primary Products	Value (1,000 USD)	% total food exports	Processed Products	Value (1,000 USD)	% total food exports
Live animals (incl. fish, crustaceans)	4,293.2	27.8	Meat, fish, dairy, edible animal products	1,458.7	9.5
Edible vegetables, fruit, nuts	2,494.2	16.2	Vegetable, fruit, nut food preparations	218.0	1.4
Coffee, tea, spices	3,971.9	25.8	Misc. (incl. coffee, tea extracts, essences, concentrates)	245.0	1.6
Cereals	1,914.4	12.4	Processed cereals	482.8	3.1
Oil seed, oleag. fruits, grain, seed, fruit, etc	57.2	0.4	Animal, vegetable fats and oils, cleavage products, etc	165.4	1.1
Raw sugar	2.4	0.0	Sugar confectionery	98.6	0.6
Raw cocoa	8.3	0.1	Cocoa preparations	7.5	0.0
Total Primary	12,741.5	82.7	Total Processed	2,676.0	17.3

*Food includes UN COMTRADE codes 01–21, except codes 05 (Products of animal origin), 06 (Live trees, plants, cut flowers, bulbs), 13 (Lac, gums, resins, vegetable saps and extracts), and 14 (Vegetable plaiting materials, vegetable products). Source: ITC, UN COMTRADE.

There is nothing intrinsically bad about being primarily a supplier of agricultural commodities, especially if one is a very efficient supplier with a strong international reputation. Brazil fits this description. Upward of 80 percent of its massive agro-food exports consists of primary commodities—soybean, maize, cotton, raw sugar, coffee, chilled beef, and so forth. Canada, the United States, and the Ukraine also have large agro-food export industries in which primary commodities predominate. yet these are all countries with very large land areas where large-scale mechanized farms deliver the bulk raw materials which are transported by low-cost rail or river freight.

Vietnam has an entirely different agrarian structure, and by international standards is heavily land-constrained. It therefore needs to get more value from its relatively scarce resources—especially land.²⁹ That can be achieved through changes in land-use, changes in varieties and farmer and post-farm production practices (toward higher value or differentiated commodities), and the transformation of more raw materials into value-added products. Thailand has a factor endowment which is closer to Vietnam’s than that of the other large commodity exporters noted here. And Thailand has had some success in developing competitive value-added product lines from its raw material base—even as it continues to be a major exporter of the primary commodities underlying some of these. That country is now a major exporter of consumer and industrial rubber products, processed fruits and vegetables, sugar confectionery, and value-added fish products.

Value Chain Inefficiencies and a Deficit of Collective Action

Generating rural wealth from agro-food exports and higher-value domestic food markets need not depend on moving up the value chain. In several of Vietnam’s commercial agriculture value chains there are major inefficiencies which contribute both to higher, unnecessary costs and to a weakening of the signals and incentives for farmers and intermediaries to meet certain quality standards. Although one needs to be cautious about making generalizations, the following structural and institutional features are quite common.

At the farm level, very inefficient (and generally excessive) use of fertilizer, chemicals, and other inputs broadly persist. Farmers are risk averse and have been guided in the mind-set of maximizing yields, rather than raising efficiency and lowering costs to realize higher financial returns. Focused initiatives to promote lower input— yet better-managed—crop production have demonstrated a very considerable potential for reducing both material and environmental costs. The example of water-use for coffee production was noted earlier. Farmers adopting production practices involving lower input and water use for rice have often increased their yields and profitability while reducing GHG emissions (Tran Thu Ha 2015, Keyser et al. 2013).

A very small proportion of exported commodities is aggregated by cooperatives or other formal entities serving commercial purposes. There has been a long-standing government policy of supporting farmer cooperatives, but the number of cooperatives has fallen significantly over time and the vast majority of the surviving ones are involved mostly in coordinating water-use and channeling advisory services to members. Of the nearly 9,200 service cooperatives still active in 2012, 84 percent were in regions of the country which account for little of Vietnam’s agricultural exports. Less than 1 percent of Vietnam’s smallholder coffee farmers are members of commercially oriented cooperatives; the proportion in core sourcing areas for rice exports is similarly very low. In the Mekong

²⁹ Taking into account average yield and price differences, the return per hectare of land under tea is five times higher in Kenya than in Vietnam. Smallholder tea farmers in Kenya are relatively wealthy; those in Vietnam are not.

Delta there are many thousands of informal collaborative groups, but these are not permitted to perform business functions. For commercially-oriented cooperatives there are issues of cooperative management and governance, and (local) government interference in decision-making. The paucity of well-functioning cooperatives raises the transaction costs in most export supply chains as it is more challenging for downstream firms or intermediaries to communicate with farmers, influence and monitor their practices, and aggregate their production. It may also contribute to higher post-harvest losses as raw materials may not get properly dried or be handled properly. There are at least some economies of scale in most post-harvest functions. However the lack of collective commercial action diminishes the bargaining power and voice of many small farmers in the value chain.

Contract farming is much less well developed in Vietnam than in other countries where smallholders play a prominent role in commercial value chains (Verhofstadt et al. 2014). Such arrangements tend to involve a combination forward selling and buying commitments, the provision of quality inputs (often on loan), and management advice. Such arrangements can help in managing price risks, minimize inappropriate and ineffective input use, and improve the alignment between production and the raw material quality needs of companies. Contract farming has featured in the domestic dairy industry and has grown in importance in both the horticulture and aquaculture industries. Although still small, a growing proportion of broiler and pork production involves forward contracts together with breeding animal and feed supply. This pattern is predictable—these are perishable higher-value products for which quality may be highly variable.

In the coffee sector, there are few direct purchases by processor-exporters from farmers. Based on Circular 08/2013/TT-BCT issued by the Ministry of Industry and Trade, foreign-owned companies are not permitted to source directly from farmers but must instead buy through a registered local company (or cooperative). Formal contract arrangements may not be very beneficial in *Robusta* coffee value chains, yet an inability for companies to source directly from farmers serves as a barrier to providing clear incentives or requirements for farmers to adopt more environmentally sustainable practices. In the rice export industry, there are some interesting emerging examples, yet the current share of supply which falls under some type of direct contracting arrangement is somewhere in the 3 to 6 percent range. Such arrangements make sense where the company has very specific variety or quality requirements and is trying to promote a brand based on quality differentiation. Recent regulations and measures by provincial government agencies aim to accelerate the pace at which the rice export subsector moves toward more integrated, contractual arrangements.

So, at the level of aggregating farm supply there remain only limited patterns of collective action. And direct linkages between farmers and processor-exporters is still uncommon, outside of aquaculture. Most value chains therefore feature large numbers of intermediaries and, in the case of rice, several steps of intermediaries (i.e., local assemblers, first stage millers, sometimes another set of traders or brokers who then supply the larger miller-exporters). Technologies, capabilities, financial strength, and business ethics vary across these intermediaries. And it becomes difficult to track one's supplies (i.e. for lack of a chain of custody). With this, it is difficult to make forward commitments to buyers and assure them that the product's origins are safe and sustainable. Where there is a deficit in supply chain governance, it is often best to keep one's products invisible in the eyes of consumers. A considerable amount of Vietnam's agro-food trade is invisible in another way. This is informal, cross-border trade with neighbors to the north and west, with the participants seeking to avoid taxes, quality and sanitary and phytosanitary controls, or restrictions on the sale of certain products (i.e., wildlife, certain types and origins of wood).

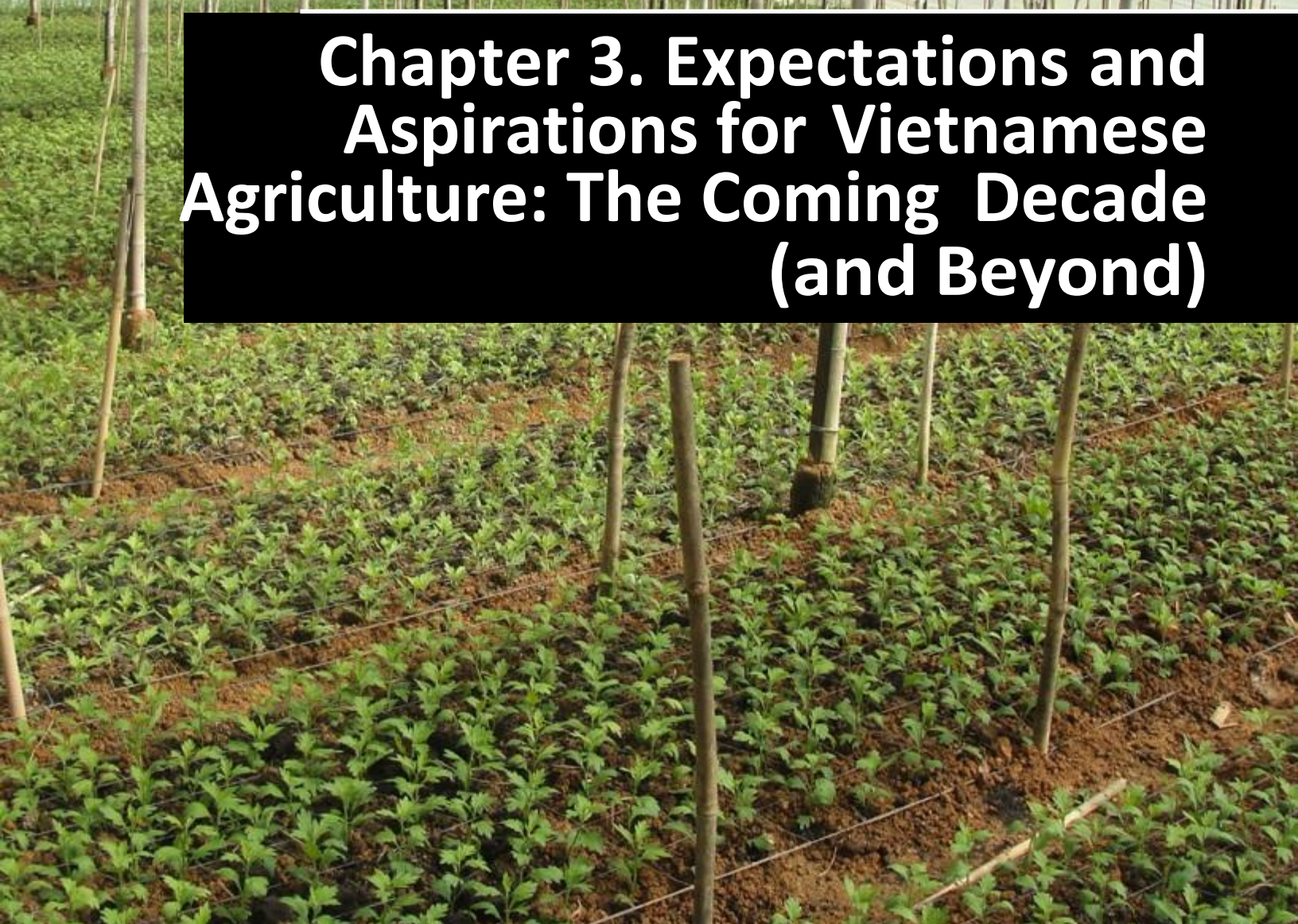

Collective action at the industry level has shown more promise in recent years, although in the past, many industry associations played more of a political and information-monitoring function than technical and professional ones. In many other countries, industry associations play very significant roles in product promotion, in incentivizing improved practices (through industry codes of practice and labels), in prioritizing research, and in other functions. Aspects of this are emerging in Vietnam, for example through the newly formed Coffee Coordination Board and through the industry associations for tea and fish products. For rice, the Vietnam Food Association continues to play primarily administrative roles and has helped to maintain a very large share for state-owned enterprises in rice exports. Partly as a result, a country which is the world's second or third largest rice exporter lacks a coherent commercial export competitiveness strategy. In its place have been a flow of new regulations seeking to reshape the structure and direction of the industry. While the orientation has strong merit, and improving technical efficiency in the value chain is essential, it is very difficult to achieve improved market relationships by decree. Within the rice sector, both stick and carrot are needed, together with improving the enabling environment for commercial businesses by either levelling the playing field between them and SOEs or refocusing the efforts of the latter primarily on social, food security-focused functions rather than commercial functions.

The mixed record of Vietnam's agricultural exports—with major expansion in trade volumes yet significant shortcomings in quality and sustainability—is partly a reflection of the compressed time period (i.e., 10 to 20 years) over which various industries have gained prominence. It is also a reflection of government policy and the ways in which the public sector has focused its engagement in certain industries. In several of these, state-owned farms and processing or trading companies have played a very prominent role, historically if not currently. State-owned coffee and tea enterprises contributed, for many years, to a culture of low product quality, while their prominence delayed the emergence of the types of professional industry organizations commonly found in beverage crop industries world-wide. State-enterprise dominance of Vietnam's rice export trade from its emergence to the 2000s gave the industry more of a political than a commercial orientation, with the bulk of trade occurring through government-to-government transactions. Private and otherwise professional value chain operators were limited by export quotas or otherwise forced to work around the margins of the state-dominated trade. The emergence of a quality product segment and recognizable brands, along with a growing private sector share in the trade, has only begun in recent years.

The SOE presence—and favored access to finance—in these and several other subsectors has retarded or delayed greater involvement in agribusiness activities, both by international and domestic companies. It has also tied up government resources in comparably unproductive farms and factories. Such resources might have had a more transformative impact by providing technical, financial, and trade promotion services to the private sector and by developing high caliber systems for food safety and biosecurity management. This is the direction needed now.

In other respects, there has been an imbalance between government efforts to promote industry growth and to manage the risks associated with this growth. For example, the environmentally destructive pattern of coffee and aquaculture expansion during the 1990s and 2000s was condoned if not facilitated (through infrastructure investments and support services) by provincial and other government entities. Only more recently, as industry growth has been seemingly threatened—by pests, diseases, or aging assets, has the government made a major commitment around sustainability initiatives. Competition among provinces to attract and promote investment in fisheries and fish processing contributed to the build-up of excessive industry capacity and the over-exploitation of the near-shore fisheries. Efforts to sustainably manage coastal and fishery resources—a core public interest—have also been subject to insufficient budgetary resources. With government primarily engaged as an industry operator

or growth-promoter, and with other players unable to or not encouraged to take on industry leadership roles, systems of industry or value chain governance have either been slow to develop in Vietnamese agriculture or been too under-developed to be effective given the size and complexities of the industries. The result of these modes of public sector intervention has been the quality and sustainability deficits widely observed in the agricultural sector.



Chapter 3. Expectations and Aspirations for Vietnamese Agriculture: The Coming Decade (and Beyond)

In thinking about what Vietnamese agriculture can become in the future, it is important to consider the evolving context which includes broader changes in the Vietnamese economy and society, expected changes in domestic agro-food demand, possible trends in international commodity markets, and anticipated climate change impacts.

Macro-Societal Setting

- **During the upcoming one to two decades several important demographic and socio-economic trends are expected in Vietnam as it aspires to become a “modern industrial economy.”** These include (World Bank/ MPI 2016) an aging population structure. Vietnam has recently benefitted from having a bulge in the share of the population of working age. This demographic dividend has now ended—the working age share peaked in 2013 and has begun to decline. The absolute number of people of working age is expected to peak in the mid-2030s. Over this period, Vietnam is expected to change from being a young to an aged society, according to UN definitions.
- **Continued urbanization.** Between the mid-1980s and 2015 Vietnam’s urban population grew from 13 to 30 million, accounting for one-third of the total population in that latter year. A decade from now, it is anticipated that Vietnam will have more than 50 million urban residents, accounting for half of the total population.
- **An expanding middle class.** By the mid-2030s, more than half of Vietnam’s population is expected to join the middle class (consumption of \$10 or more per day, compared with less than 10 percent today).

These demographic changes have significant implications for human capital development, the domestic labor market, and competition for land and water resources. The expanding middle class offers major potential for the domestic market to be a driver of growth, including in agriculture (see below).

Expected Changes in Regional and Domestic Food Demand

Within East and Southeast Asia, total food consumption is projected to continue to increase and diversify rapidly driven by a growing population, economic growth, rising incomes, and urbanization. Total calorie consumption in the region has gone up together with income, and will continue to increase in the future, particularly among the poor, but the rate of growth is expected to decline in most countries including Vietnam. Table 20 shows the daily calorie availability per capita based on food balance sheets for 1961, 2009, and a projection for 2030.³⁰ Looking forward, the main change will be in diet composition, assuming that the rates of urbanization and income growth continue. Overall calorie intake is projected to rise by 19 percent. In China, the changes will be even more dramatic. Total calorie intake, already higher than in the rest of East Asia, is projected to grow by 23 percent through

³⁰ It is important to note that calorie “consumption” as calculated in food balance sheets is actually a measure of “availability” after industrial, feed, and other non-food uses (e.g., biofuels) have been deducted from the total domestic supply (production plus net trade). This availability does not include spoilage, plate waste and other losses, which are significant in most countries. Hence, food balance sheet estimates inevitably overestimate actual per capita intake.

2030, led by a doubling of meat consumption. China will account for about two-thirds of total meat demand in East and Southeast Asia by 2030.

Growth in food demand will mainly come from substitution effects in diets between food categories driven by income growth and urbanization.³¹ The composition of the diet changes as wealthier consumers shift to preferred, income-elastic foods. This dietary change includes an increase in the level and proportion of: (i) non-grains including vegetables and fruits, animal proteins (meat, fish, eggs, milk), and pulses and oilseeds; animal protein demand in turn creates derived intermediate demand for feed-grains for livestock; (ii) processed products to cook at home; and (iii) prepared foods bought away from home. Diet diversification and these shifts are strongly linked to urbanization, but also to the commercialization of food in rural areas. Table 21 shows the average calorie intake per capita by main type of food, in 2009 and projected for 2030.

In East and Southeast Asia as a whole, rice consumption is declining among the urban population and higher-income groups. Direct consumption of wheat and maize (as food) is projected to increase. Total calorie intake of cereals will grow slightly, but indirect cereal and oilseed consumption (as feed) will grow much more rapidly than the demand for meat. Consumption of non-grains is also growing faster and further in urban areas than in rural areas in Asia. As countries urbanize, the value chain embodies a much higher degree of processing and cold storage. Urban consumers have a much higher share of prepared foods in their diet. Demand for meat has doubled in quantity per capita in the fifty years between 1961 and 2009 and can be expected to double again between 2015 and 2030. The strong and steady growth in meat consumption, particularly of pork and poultry, has huge indirect consequences through the rapid growth in the demand for animal feed (Agrifood Consulting International 2014). Demand for fish and seafood products has more than doubled in per capita terms from 1961 to 2009. Fish consumption per capita is expected to increase by around 50 percent between now and 2030. Dairy products are expected to become the fastest growing food category as demand will continue to catch up with the world’s standard levels of consumption.

Growing population, rising incomes, and dietary changes will require huge additional volumes of some of the main groups of commodities—apart from the basic staples—to become available to meet the food demand of 2030. Given the trends and projections presented in Table 21, the value of food demand in East and Southeast Asia could increase by 30 percent between 2009 and 2030 in constant dollars. In value terms, according to available projections, food consumption for the selected commodity groups and countries could go up from \$824 billion in 2009 to above \$2 trillion in 2030—equivalent in constant dollars to around \$1,062 billion, i.e., an increase of nearly 30 percent. The final composition of demand will of course be influenced by relative prices for different categories

Table 20: Daily Food Availability* in Selected Asian Countries, 1961–2009 and 2009–2030 (projected)

Region/Country	Actual		Projected	Annual Growth Rates**	
	1961	2009	2030	1961–2009	2009–2030
World	2,189	2,831	3,050	0.54%	0.35%
China	1,426	3,036	3,739	1.57%	0.99%
Cambodia	2,019	2,382	2,667	0.34%	0.54%
Indonesia	1,759	2,646	2,963	0.85%	0.54%
Japan	2,524	2,723	2,613	0.16%	-0.20%
Lao PDR	1,946	2,377	2,662	0.42%	0.54%
Malaysia	2,419	2,902	3,249	0.38%	0.54%
Myanmar	1,684	2,493	2,792	0.82%	0.54%
Philippines	1,806	2,580	2,889	0.74%	0.54%
S. Korea	2,141	3,200	3,583	0.84%	0.54%
Thailand	1,899	2,862	3,205	0.85%	0.54%
Vietnam	1,794	2,690	3,012	0.84%	0.54%

*Unit is kcal per capita per day. **Logarithmic growth estimate. Source: Jamora and Labaste 2015.

31 A recent study on China has shown that between 1980 and 2009, one third of the increase in food consumption could be attributed to the country’s population growth, and the remaining two-thirds to dietary changes China’s Urbanization and Food Security, World Bank, 2014.

of foods—but the current projections point to very large business opportunities in relation to animal products, fish, and fruits and vegetables.

In Vietnam, per capita calorie consumption is expected to rise, though modestly, over the coming decades.

Average consumption is expected to increase from 2,690 calories per day in 2009 to 2,895 calories per day by 2030. If recent trends continue—driven by urbanization, income growth, and increased nutrition awareness—then

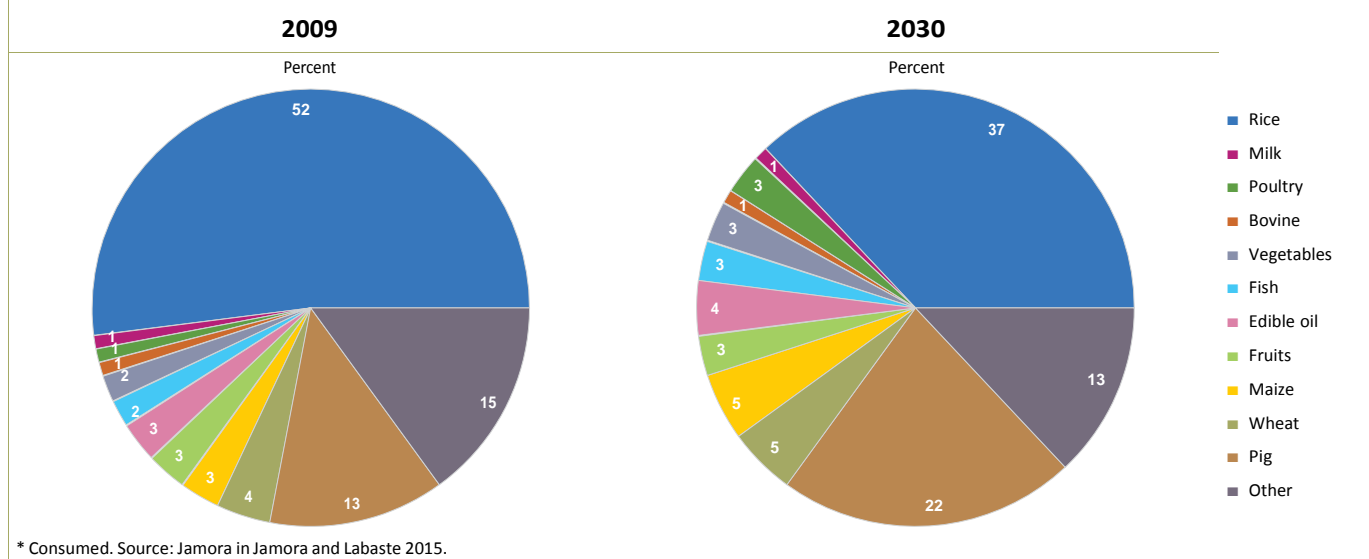
the composition of food calorie consumption will look quite different. As recently as the late 1990s, rice accounted for nearly 70 percent of Vietnam’s food calorie consumption. Rice’s share of calories has been declining steadily and reached 52 percent in 2009 (see Figure 29). By 2030, rice’s share is expected to further decline to just over one-third of the total. Animal products including seafood are expected to account for just under one-third while the remaining one-third could come from edible oil, fruits and vegetables, sugar, and various processed foods. Rapid growth in milk consumption is expected to continue.

Table 21: Daily Consumption* of Selected Food Groups in East and Southeast Asia, 2009 (actual) and 2030 (projected)

	2009	2030	Change
Rice	889	850	-4%
Other Cereals	535	645	21%
All Meats	350	664	90%
Fish	54	79	46%
Milk	55	78	42%
Vegetables	74	111	50%
Fruits	160	280	75%
Edible oil	143	210	47%
Others**	434	273	-37%
Total	2,694	3,190	29%

*Unit is kcal per capita per day. **"Others" is a residual that includes principally sugar, other sweeteners, legumes, pulses, nuts, other oils, spices, and animal fats. Source: Jamora and Labaste 2015.

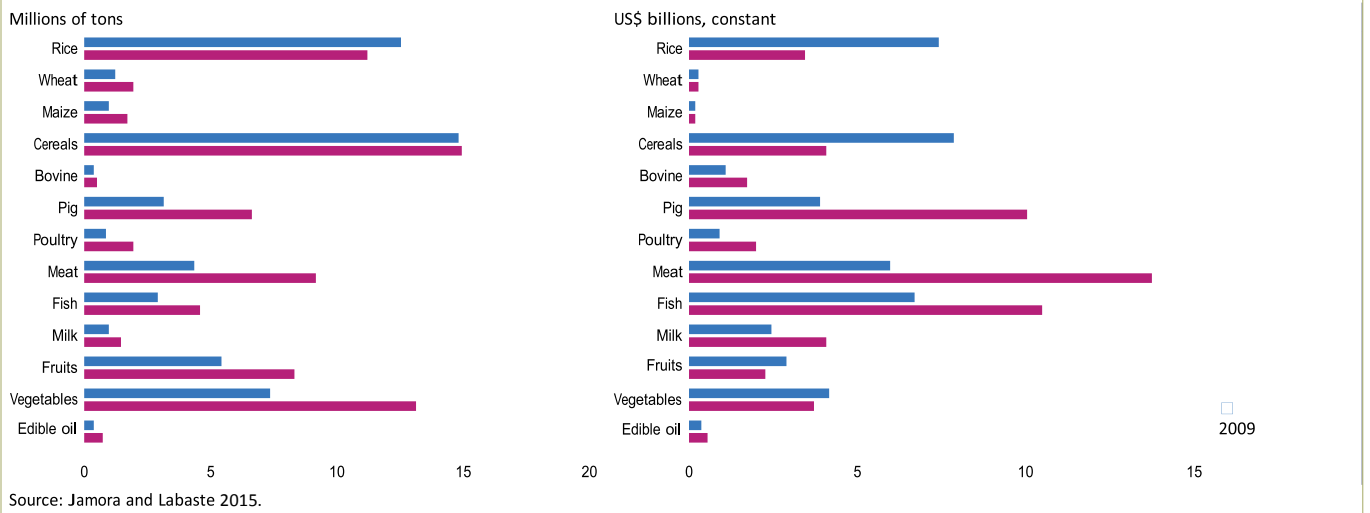
Figure 29: Composition of Food Calories* in Vietnam, 2009 (actual) and 2030 (projected)



* Consumed. Source: Jamora in Jamora and Labaste 2015.

If such consumption patterns emerge, then the economic implications will be very large. Figure 30 highlights the current and expected volume and values of different food categories. While aggregate rice consumption would fall in volume by around 10 percent, the value of this, in current value terms, would be substantially lower than that in 2009 given an expected decline in real prices for rice. In contrast, the value of domestic spending on livestock products and seafood will surge. While direct human consumption of maize is unlikely to grow much, there could be significant market opportunities for maize and other crops for animal feed, if the productivity of such crops can be

Figure 30: Projected Changes in the Volume and Value of Vietnam’s Domestic Food Market



raised substantially through improved varieties, better water drainage, and changes in farming practices. Otherwise, feed and feed ingredient imports could continue to grow. While many factors might influence absolute and relative prices for different food commodities, the general picture is likely to hold, yet maybe with less dramatic shifts in the value-composition of the domestic food market. Still, if this is the broad direction, then there will be large opportunities in the animal-protein space; and there will be a premium on effective animal disease control and food safety management, and on the development of integrated cold chains to maintain quality and reduce physical wastage of higher-value perishables.

Along with changes in domestic food consumption and spending, major changes could shake the structure of the agro-food system, and the behavior of downstream actors. Structural changes in the food market will involve the number of segments and sub-segments of agro-food supply chains, and the degree of concentration and ownership of capital (public versus private, domestic versus foreign) per segment. Behavioral changes are likely to include how actors per segment buy, make, and sell; their choice of technology, the role of market practices, such as quality standards and contracts, and the extent of vertical and horizontal integration and coordination among market actors. “Expectations” and “confidence” become critical behavioral dimensions of change. The essence of the transformation is the shift from a system that is local, small-scale, based on spot markets, and labor-intensive, to a system with geographically long supply chains, with varying degrees of disintermediation, and with increasingly capital-intensive technology used in all segments. In relation to the above, Vietnam’s food retail industry will continue to modernize (Reardon et al. 2014). While supermarkets are attracting increasing investment, their share of total food expenditures remains lower in Vietnam than elsewhere in the region. Whether this share grows to 30 or 50 percent by 2030 will depend upon demographic factors, urban land markets, and the extent to which Vietnam’s current wholesale and wet markets are upgraded over the years to assure higher levels of food safety.

How this plays out will have widespread repercussions. A pattern observed elsewhere is that modern retail trade starts off with the trade of processed foods (canned, dry, and packaged items such as rice, noodles, and edible oils) and later on includes semi-processed foods (dairy products, processed and packaged meat products, processed fruits) and finally fresh fruits and vegetables (IFPRI 2008). This is a reflection of the risks linked to perishable produce, marketed volumes, seasonality in supply, and the challenge of standardizing quality. The risks involved need to be managed and this requires the procurement system to become vertically coordinated, from farm to fork.

It also requires the establishment of traceability systems. This is often accompanied by the emergence of formal and informal contracts, possibly including the forward provision of credit, inputs, and technical support to producers; and a shift from local procurement by each store, to centralized procurement using distribution centers, coupled with a wider procurement hinterland and elongated supply chains that may involve national, regional, and global sources of supply (Reardon et al. 2014). Modern procurement systems use distribution centers and warehouse networks to achieve economies of scale.

There may be no way to stop the consolidation and disintermediation processes that make sense from an economic and business perspective. The issue for public policy is how to guide and support the private sector to deliver outcomes that are not only economically efficient but also considered socially desirable—without getting in the way. Experience has shown that policies can play a key role in facilitating the adaptation of small farmers and small-scale operators and their inclusion in modern marketing chains. There are a variety of models for inclusive value chains, the suitability of which depends upon the local context and the characteristics of the commodity. Systems of contract farming are appropriate and feasible in some contexts; in others the aggregation and transaction cost problem needs to involve farmers organized in a different fashion, including commercial cooperatives (Labaste and Jaffee 2015).

International Commodity Markets

Multiple organizations have modeled expected trends in international commodity markets over the coming decade. The results vary, although these variations are more common in relation to the magnitude rather than the directions of expected changes. For the purposes of this report, the predictions from recent USDA (2015) and OECD/FAO (2015) studies are highlighted.

With regard to consumption, global demand for agricultural commodities will continue to rise through 2024 in both the USDA's and OECD/FAO's forecasts. According to the OECD/FAO, however, consumption growth, while robust, will be less so than over the past decade. Growth will be strongest for grains, oilseeds, cotton, and livestock products, and come mostly from changes in low- and middle-income countries (USDA) (see Box 5 on the outlook for cereals). Key drivers include population and income growth, and with these, urbanization and dietary diversification (USDA). The ongoing evolution of dietary preferences will particularly boost demand for meat and dairy, along with the coarse grains and protein meals that are used as animal feed (OECD/FAO). Other related factors include improved infrastructure, and greater access to modern food markets (USDA). Meanwhile, oil prices are expected to remain low, putting downward pressure on prices by keeping energy and chemical costs down (on the supply side), and moderating the appetite for energy crops (on the demand side) (OECD/FAO). Major exceptions to this are likely to be policy-driven, as in Brazil and Indonesia, where government incentives are expected to fuel biofuel expansion.

Global production of agricultural commodities is anticipated to rise—faster than the world population, in the USDA's view. This growth outlook reflects the expectation that yields will continue to improve as a result of technological enhancements—albeit at a slowing rate (the continuation of a two decade slow down. To a lesser extent, it also reflects an expected expansion in agricultural land, though that expansion will be constrained by decreasing water availability and rising water access costs in many places (USDA), and the translation of environmental and responsible investment concerns into policy (OECD/FAO). Potential for land expansion exists

primarily in South America, according to the OECD/FAO. By contrast, land and natural resource constraints are particularly binding in the Asia-Pacific region (OECD/FAO). Meanwhile, the coming decade is likely to see a cooling of investment in large scale farming operations, as the high commodity price levels that attracted investors are unlikely to be sustained (OECD/FAO). China is the only significant producer country where production is not expected to rise, in the OECD/FAO’s view.

Growth in trade flows, the OECD/FAO predicts, will slow relative to the past decade, though will generally keep pace with production. Meanwhile, the world will source most of its agricultural exports from a narrower set of exporting countries, making trade flows more vulnerable to disaster- or policy-related disruptions. By contrast, imports will become increasingly dispersed over a large number of countries.

Projecting prices into the future, and especially projecting the expected terms of trade for agriculture, is a hazardous exercise. Only a year ago, before international oil prices plummeted, the World Bank was projecting more or less a steady decline in the terms of trade for agriculture during the upcoming decade. The updated analysis in 2015 still projects a decline in agricultural commodity prices, yet, at least until 2020, more favorable terms of trade considering the lower fertilizer and energy prices. yet, the current projection is for these terms of trade to turn in a negative direction during the early 2020s (Table 22). Importantly for Vietnam, the real prices for traded rice are expected to decline by some 10 percent, from \$423 per ton in 2014 to \$380 per ton in 2025 (represented by Thai 5 percent broken). *Robusta* coffee prices are also expected to decline in real terms from an average of \$2,200 per ton in 2014 to \$1800 per ton by 2025. This cautionary outlook re-enforces the emphasis placed here on improving the efficiency of (input use and) production and raising efficiencies in post-farm dimensions of Vietnam’s value chains.

Table 22: International Commodity Price Index Projections (2010=100)³²

	2010	2014	2020	2025
Agricultural prices	100	97.0	83.4	82.9
Food	100	101.4	85.7	85.7
Grains	100	98.1	85.6	87.3
Other food	100	102.3	88.5	83.2
Beverages	100	96.1	77.8	69.2
Raw materials	100	86.8	80.8	83.0
Fertilizer prices	100	94.9	81.2	73.1
Energy prices	100	111.7	72.3	89.1
Agricultural terms of trade	1.00	0.94	1.05	0.92

Based on 2010 US dollars. Source: World Bank Commodity Price Forecast, October 2015.

Box 5: Global Supply of and Demand for Cereals to the Mid-2020s

Cereals will remain the most consumed agricultural products, predicts OECD/FAO (2015), and consumption will increase by 390 million metric tons (Mt) by 2024, primarily in response to growing demand for animal feed (which will claim 70 percent of coarse grain, i.e., grains other than rice and wheat). Boosted by meat demand and the intensification of animal agriculture, trade in soybean meal as a source of livestock feed, for example, will continue to grow strongly, particularly as many countries have no choice but to meet their growing need for oilseed through imports (USDA 2015). Imports of the meal are expected to climb especially fast in Vietnam, Indonesia, Thailand, the Philippines and Malaysia. Competition for imports will also come from rising demand from North Africa and the Middle East and South

Continued to next page.

32 Agricultural price index is the sum of food, beverages and raw materials. Grains include barley, maize, rice, sorghum and wheat. Other food includes bananas, oranges, sugar, meats, and fish. Beverages include cocoa, coffee, and tea. Raw materials include cotton, rubber and tobacco. Fertilizers include DAP, urea, TSP, potassium, and phosphate rock. Energy includes coal, crude oil, and natural gas.

Box 5 continued.

American countries other than Brazil and Argentina. Imports of wheat—which is primarily consumed by humans—are also expected to rise especially rapidly in China, Vietnam, Thailand, Bangladesh and the Philippines (e.g., for bakery and specialty products) (USDA).

Mostly grown for human consumption, rice demand will grow more moderately than that for coarse grains—though only slightly less than in the past decade—with consumption slated to increase by 62.5 Mt (13 percent), under the OECD/FAO forecast. Nearly all of the increase in rice consumption is expected to come from developing countries. Rice production is expected to rise by close to 70 Mt, or 14 percent over 2012–2014 levels—with 28 percent of that increase coming from LDCs, and 69 percent coming from other developing countries (OECD/FAO). Rice trade, according to the USDA's forecast, is projected to grow 1.8 percent per year from 2015–2016 to 2024–2025, reaching nearly 50 Mt, an increase of 41 percent over the previous decade average. World rice trade as a share of world consumption has grown from 4 percent in the early 1990s to 8.6 percent; and this share is projected to rise to 9.5 percent by the end of the next decade.

China is and will remain the largest importing country. China became a net importer of rice in 2011–2012; however, its rice imports are expected to gradually decline (USDA). Still, its imports in absolute terms will remain historically high—particularly for lower-priced rice from Southeast Asia. The next largest rice importers after China are Nigeria, Indonesia, Iran, and the Philippines. Each are expected to import 1.9 Mt to 2.2 Mt per year by the end of the coming decade. Other large importers include Iraq and Saudi Arabia (>1.5 Mt per year), South Africa and Malaysia (> 1 Mt per year). Due to a rising population and land constraints, Bangladesh's rice imports will be among the fastest rising, as these could go from 0.6 Mt in 2015–16, to 1.5 Mt in 2024–2025—an annual growth rate of over 10 percent.

Climate Change Impacts

As this report documents, Vietnam's agricultural sector is undergoing a variety of transformations as a result of demographic, economic, market, and other factors. Going forward, Vietnam's changing climate could gain prominence as a driver of sector transformation as well as in changes in the geography, nature, and quality of production. Indeed, temperature and sea-level rise, the disruption of rainfall patterns, and the intensification of weather extremes will alter sector constraints over time, namely with respect to land-use possibilities. That said, with proactive policies and investments that sustain a fast pace of sector restructuring, Vietnamese agriculture has the opportunity to remain ahead of the race against climate change.

In the timeframe of the coming two decades, many of the changes that are anticipated as a result of climate change—including a contraction of rice production, further aquaculture development, and an end to coffee's and other tree crops' physical expansion—will largely be consistent with the sector's potential, not only to adapt, but also to thrive by “producing more from less.” In these and other cases, the challenges brought by a changing climate need not represent binding constraints. This report argues that this will be possible with targeted investments in a range of no-regrets measures illustrated in Chapter 4. These include investments in agricultural innovation systems, in the strengthening of natural resource and farm management skills, and in the institutional capacity to mount, monitor, learn from, and redirect a coordinated climate change response (i.e., institutions equipped for adaptive management).

In Vietnam, as in many other parts of the world, several manifestations of climate change have not gone unnoticed by farmers, and over time these are projected to become more pronounced still.

- Since 1958, Vietnam’s average surface **temperature** has increased by 0.5–0.7°C, with the largest departures from the norm observed during the winter months, and in the north of the country. Since the 1970s, temperature has risen much faster in Vietnam than it has worldwide, on average during each decade. At the same time, the incidence of extended cold fronts has increased, as has the number of exceptionally hot days and nights, in every season (McSweeney et al. 2010 a&b). Looking ahead to 2030, average temperature is expected to rise by 0.5–1.2°C, compared to 1980–1999 levels, depending on the scenario and region (World Bank 2010). Warming will be felt more acutely in the summer, potentially resulting in unprecedented heat extremes in the 2030s and 2040s.
- In relation to **rainfall patterns**, no clear trend has been discernable across regions and time periods during the past 50–60 years. Overall, rainfall decreased by around 2 percent over the 50-year period spanning 1958–2007, but this trend was not seen consistently (MONRE 2010). Looking forward, while overall rainfall may or may not continue to decline (it could decrease or increase depending on the global warming scenario and region)³³, it will almost certainly become more concentrated and intense. The difference in rainfall between wet and dry seasons is expected to become more pronounced, which is to say that the wet season will become wetter, and the dry season drier.
- Changes in temperature and rainfall distribution will affect **water resources**. For example, river flows are expected to decline in the South, groundwater is expected to drop compared to present-day levels (GIZ 2012), and evapotranspiration rates are expected to rise, causing greater demand for irrigation. Evapotranspiration in the Central Highlands, for example, is expected to increase by 8.5 percent (1,726 mm) by the middle of this century (MONRE 2010 in Haggard and Schepp 2012).
- Meanwhile, over the past several decades, the **sea level** has been rising at an accelerating rate: by 1.3–2.3 mm per year between 1961 and 2003, and by 2.4–3.8 mm per year since. By 2040, the sea level will likely have risen by 23–24 cm over 1980–1999 levels along Vietnam’s shorelines, and that could increase to 28–33 cm by mid-century (World Bank 2010, based on official projections).
- Sea level rise is anticipated to exacerbate **coastal erosion and salinity intrusion**, both of which are already under way. Severe coastal erosion has already been observed in parts of the Red River Delta, for example, with Hai Thinh experiencing more than 45 percent erosion linked to sea level rise between 1965 and 2005. Similarly, Vietnam’s low-lying coastal areas are already dealing with salinity intrusion during the dry season. In the Mekong River Delta in particular, the area affected by salinity intrusion (at a concentration of 4g/liter) could increase from around 1.3 million hectares to over 1.7 million hectares by 2050 with a 30 cm rise in sea level (World Bank 2010). Of note, these forecasts do not take into account the exacerbating effect of subsidence, which could reach 9 mm per year, or 1.5 times the rate of sea level rise (Doyle et al. 2010 in IFAD 2014).

The consequences of climate change for agriculture will depend not only on what global warming scenario unfolds, but also on the country’s ability to adapt to its new environment; and this will depend on many factors including the speed at which the climate changes, private resourcefulness, and public sector action. Thus, what the above means for the sector may differ substantially from modeled projections, not only because of

³³ For example, for the Northwest region, the IPSL model predicts a 16.5 percent decline in annual precipitation by 2030 while the GISS model points to a 9.8 percent increase. For the Mekong Delta, these two models, respectively point to a 10.5 percent decline and a 5.2 percent increase. The MONRE model anticipates much lower impacts by 2030—a 1.7 percent increase for the Northwest and a 0.9 percent increase for the Mekong Delta.

climate forecasting uncertainty, but also because the models assume a limited range of adaptations, spontaneous or planned.³⁴ In reality, agriculture is constantly adapting to change—up to a point—giving little credence to a do-nothing scenario. Nonetheless, impact projections offer some insight into the nature and magnitude of sector risks.

Rice production could be impacted by several factors, including warming and water availability, and in Vietnam’s deltaic regions where much of the agricultural land lies 2 meters below sea level, by the risk of salinity intrusion and inundation (which impact the area considered suitable for rice). Warming, pest incidence, and other factors are expected to impact rice yields.³⁵ For example, under the MONRE scenarios, IFPRI has estimated that national level rice yields would be 4.3 percent lower over the 2016–2045 period than would have been the case in the absence of climate change. For the Mekong River Delta, the reduction from the business-as-usual scenario is projected to be 4.2 percent.

Sea level rise and salinity intrusion will almost certainly impact the geography of rice production in the future. On this, the time horizon one takes is very important in considering potential impacts. MONRE has estimated that the sea level could rise by 17 cm over 1980–1999 levels by 2030. By 2050, the sea level could rise 30 cm above baseline, while by 2100, it could rise by as much as 75 to 100 cm.³⁶ This long-term picture presents a frightening prospect for many of Vietnam’s coastal areas and is leading to discussions about the need for a complex system of sea dykes, sea walls, and mangrove forests to protect these coastal areas. However, nearer term scenarios are less dire. Figure 31 highlights the suitability of different parts of the Mekong Delta for rice production under the condition of a 17 cm sea level rise. The green color denotes “highly suitable”, the yellow is “suitable,” the red is “marginally suitable,” and the turquoise areas are “flooded.” The white areas (e.g., the southern tip of the Delta) are unsuitable for rice production due to restrictions or topography (e.g., urban land, sandy land, mountain, aquaculture, or other). It is important to note that a very large proportion of this red and white area has already been converted to aquaculture production. Most of the now dominant, core rice area would remain highly suitable or suitable, with the exception being some parts of the Kien Giang coastal area which will become more marginal for rice production.

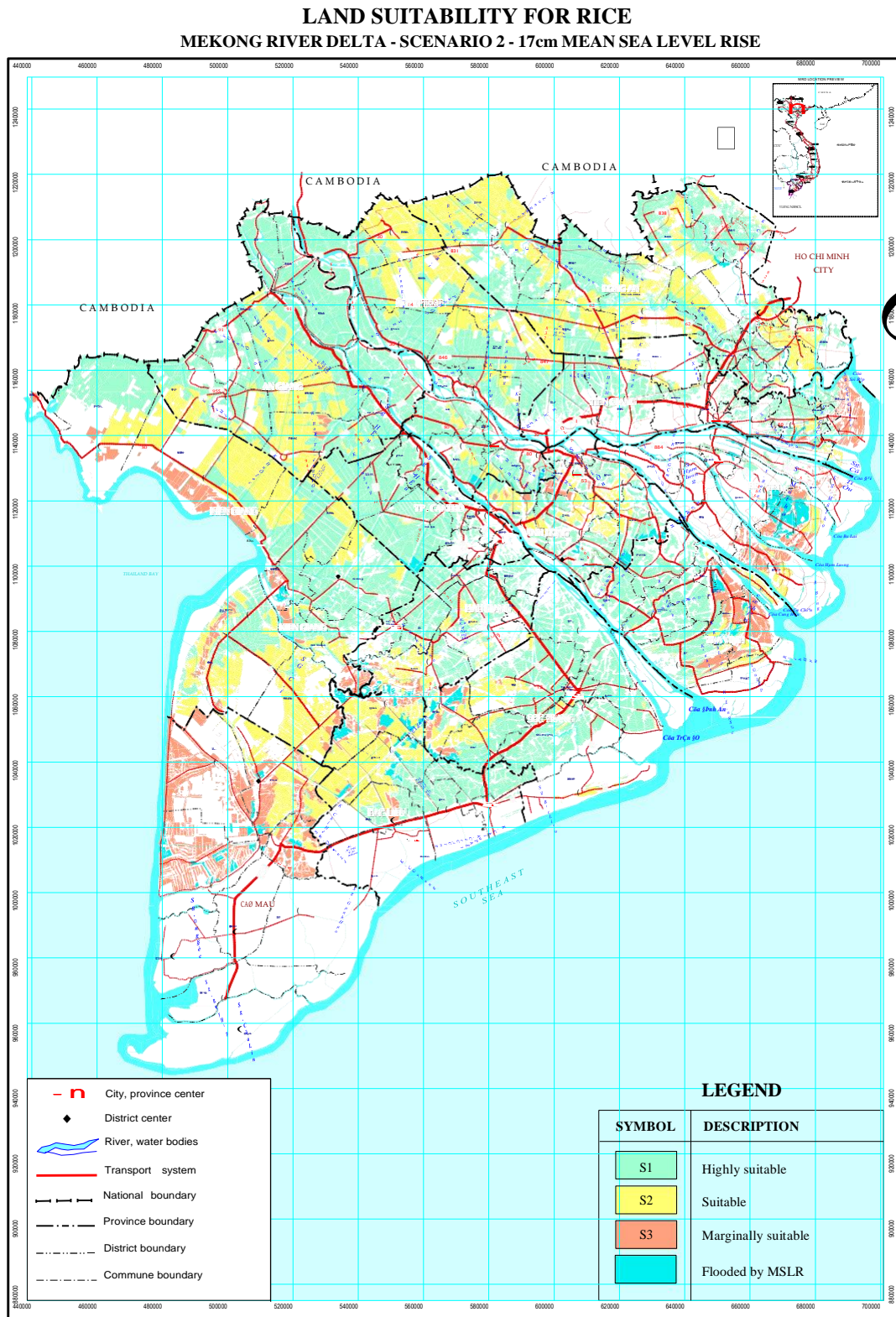
These projections reflect the reality that climate change will reshape the rice sector’s physical production constraints. However, they need to be put in perspective. *For one*, the projected climate impacts do not preclude a future of higher rice yields, on average, and in strategic rice-producing areas in particular. Average yields have increased for the past two decades, albeit at a declining rate, rising by 2.87 percent per annum over the 1996 to 2005 period and by 1.72 percent per annum between 2006 and 2010. Under a pessimistic scenario in which average rice yields would grow only by 1 percent per annum over the coming two decades, this would take the average rice yield to 6.47 tons per hectare by 2035, from a base of 5.3 tons per hectare in 2014. Even if climate change resulted in a 10 percent decrease in yields from that trajectory, by 2035 the average yield would still be 5.82 tons per hectare, which is 10 percent higher than the current average and higher than the current average in any other Southeast Asian country. One also has to factor in the sector’s potential to adapt. The development of rice breeds with higher tolerance to flooding, salinity, or heat could partially mitigate the loss of rice-land, while the cultivation of floating rice could be a strategy in areas experiencing more extended flooding conditions.

34 They also do not account for the potential positive effects of CO2 fertilization on crop yields.

35 Analysis in this field continues to evolve with refinements in broad impact analysis and then drilling down to examine the specific prospective impacts for particular regions and crops. For example, two publications released in 2010 and involving overlapping work teams, report somewhat different estimates for expected climate change impacts on Vietnamese and Mekong Delta rice production. That work did not take into account distinctive rice production patterns within the Mekong Delta and thus the prospective impact of sea level rise, salt water intrusion, and flood inundation in the core growing zone vs. supplementary growing areas. See Economics of Adaptation to Climate Change, World Bank, and Impacts of Climate Change on Agriculture and Policy Options for Adaptation: The Case of Vietnam by Yu et al., IFPRI Discussion Paper 01015.

36 A 1-meter rise in sea level would directly result in a loss of more than 5 percent of the country’s land area, more than 7 percent of its agricultural land and 28 percent of its wetlands (Dasgupta et al. 2007 cited in IFAD 2014).

Figure 31: Mekong River Delta Suitability for Rice under a 17 cm Rise in Sea Level



The baseline is 1980–1999. Source: NIAPP 2014.

Meanwhile, average rice yields already mask stark contrasts within the subsector (relating both to growers' geography and sophistication), and climate change may amplify those contrasts, with very different implications depending on whether one is concerned with commercial or subsistence production. Today, Vietnam's rice growers range from highly productive commercial ones, concentrated in the Mekong Delta, to household subsistence ones (in every region).³⁷ The core production areas are currently in the midst of processes of land consolidation, mechanization, shifts to lower input (including water) practices, and increased collective action in post-harvest handling, storage and sale. The demographics and the management of rice production in these areas will continue to change for economic reasons. This will influence future capacities—financial and technical—to manage emerging risks. Average yields in the core rice areas of the Mekong River Delta during the winter-spring season are currently between 6 and 7.5 tons per hectare, depending upon the district. It is that core area which has accounted for virtually all of the region's rice production growth since 2000 and which accounts for a dominant proportion of the marketable rice surplus. A changing climate will probably drive rice production to concentrate further in areas which are especially suitable for multi-cropping and in the winter-spring season where the growing conditions and the harvested rice quality are the best. This would be a continuation of the trend—at least within the Mekong Delta—since 2000 (Jaffee et al. 2012 b).

It is also important to note that the impacts of upstream development could have impacts on production patterns and rice yields that outweigh those of climate change. In particular, the upstream damming of the Mekong River in neighboring countries will influence water and sediment flows. While a more even annual flow of water could make more water available in the dry season and counteract the likely flood inundation effects of sea level rise during the wet season, the reduced sediment flows could adversely impact soil fertility plus have a strong negative impact on fisheries (International Centre for Environmental Management 2010).

A second consideration is that the macro-economic implications of potential decreases in Mekong Delta and national rice production will largely depend on their broader context, including future trends in domestic consumption and export opportunities. Per capita rice consumption in Vietnam is expected to decline by 10 to 30 percent over the coming two decades, with that higher level of decline placing consumption at a level which is similar to that of China, Malaysia, India, and South Korea today. Factoring in an aging population and slower population growth, this would result in an absolute decline in rice consumed within Vietnam. The country presently has a very large exportable surplus cushion. Thus, the expected impacts of climate change—at least over the next several decades—would not pose a threat to national food security.³⁸ Reference is often made to the potential loss of rice-land. yet, what might happen to such land? If that land is shifted to aquaculture production then there could be both private and social benefits from this change, in the forms of higher income, improved nutrition, and higher export levels in an industry in which Vietnam has a clear comparative advantage. How the food security of individual households or specific communities will be affected (in a distributional sense) is a different matter. yet this too needs to be seen from the wider perspective that agricultural productivity (as it will be impacted by climate change) is only one of several key factors—including factors outside the agricultural sector altogether—that will shape the prospects of current rural households.

The future of aquaculture in Vietnam generally looks promising, making the subsector look as much like an adaptation solution as a source of vulnerability, at least in the near-term. There is evidence that

37 Most of the analytical work dealing with the potential climate change impacts on rice production has focused on the Mekong Delta region. Examining potential impacts in other regions should like-wise take into account the changing roles of rice in farming systems and livelihoods.

38 See Jaffee et al. 2012a for an elaboration on various rice supply and demand scenarios for Vietnam until 2030.

rising temperatures and increased inundation during the wet season, within a range, could improve aquaculture productivity, though higher temperatures could also result in unwelcome pressures, such as eutrophication and disease (De Silva and Soto 2009, JICA 2013). More importantly, in the longer-term, parts of the subsector are in a strong position to adapt to some of the real climate threats that lie ahead (marine fisheries may be harder pressed to adapt to a loss of natural habitat). Over time, certainly, maintaining aquaculture productivity will rest on significant investments in R&D, namely (though not only) to breed aquatic species varieties that are adapted to higher temperatures and salinity. Adapting shrimp and catfish aquaculture to changing conditions in the Mekong River Delta (which accounts for over 70 percent of Vietnam’s aquaculture production) could prove very costly (Kam et al. 2012, Cheung et al. 2010) and, again, should be considered against the benefits of those investments and the availability of alternatives. Structural factors also need to be taken into account. Vietnam’s aquaculture sector is currently experiencing a consolidation—a process which is quite advanced for *Pangasius* and incipient for shrimp. Aquaculture enterprises in the future may have stronger management capabilities and financial resources, facilitating a smoother process of adaptation than might otherwise occur.

Coffee production, which mainly occurs in the Central Highlands, could be hard hit by the effects of climate change on evapotranspiration, the frequency of hot days and nights, pest and disease incidence, the occurrence and intensity of droughts (all expected to increase), and the availability of irrigation water (expected to decrease in the dry season) (Haggard and Schepp 2012). Coffee’s reliance on irrigation, and continuing expansion onto lands that are marginally suited to the crop, make it particularly vulnerable to disruptions in water resources and temperature stress. A decade or two from now, climate change could create pressure on forested land as coffee growers seek to migrate to higher and cooler altitudes. Carried by half a million weakly organized smallholders, moreover, the sector has limited capacity to mount a coordinated response—though this may be changing (Havemann et al. 2015). In a more positive light, however, the rampant over-irrigation of coffee observed in the Central Highlands to this day suggests that there is ample room to use water resources more efficiently (D’Haeze 2008 in Amarasinghe et al. 2015). Furthermore, climate change may strengthen farmers’ incentive to use resources more judiciously, while weakening the attraction of already marginal land. Managing incursions into forested highlands, meanwhile, is consistent with the government’s plans to reign in coffee’s uncontrolled expansion. In fact, the coffee master plan anticipates a reduction in the coffee planted area from over 625,000 hectares today to 500,000 hectares.

Livestock systems are also expected to suffer—not just from temperature change, but also more significantly from disease-related impacts of climate change. Here too, proactive investments—such as ones geared to strengthen early warning and veterinary services—will help mitigate anticipated losses. In this case, moreover, the challenges ahead may have a silver lining, as they may help to moderate the anticipated increase in meat consumption and production, and thus mitigate the human health and environmental costs associated with these.³⁹ As with the other production systems discussed above, climate change may not be the greatest risk that the livestock subsector faces. One important vulnerability that Vietnam’s livestock may need to contend with, for instance, is its increasing reliance on imported feed (i.e., coarse grain, soybean meal) and increased competition from meat product imports under the Trans-Pacific Partnership.

39 Meat consumption is associated with heightened risk of cancer, cardiovascular and other disease, and meat production is a major source of climate and other environmental pollutants.

Anticipating Vietnam Agriculture: Circa 2030

While Vietnam has its own distinctive features, it is instructive to consider the trajectory of agro-foodsystems in other middle-income countries, especially in Asia, as urbanization and per capita income rise from Vietnam's current levels. Given the current trends and available evidence, the share of primary agriculture can be expected to decline over the coming two decades, perhaps by 0.5 percent per annum. By the early 2030s primary agriculture would then account for some 8-9 percent of Vietnam's GDP. However, agro-industry, together with food distribution and logistical (and other services), could account for nearly double this share (15 percent).⁴⁰ The agro-food complex would then still account for nearly one-fourth of total GDP.

The expectation is that primary agriculture (including fisheries and forestry) will provide the major source of direct livelihood or employment for between 25 percent and 30 percent of the population (down from the current 47 percent), with the lower end of this range representing the current pattern in Turkey, and the upper end representing what China is likely to experience later this decade. The share of employment in agro-industry and agro-food services will likely be just below its share of GDP. Hence, the overall agro-food complex would still account for a minimum of 35 percent of employment in the early 2030s. It will be higher than this if the structural transformation of rural areas does not accelerate and many people still find themselves trapped between inflexible land markets and irrigation services on the one hand, and a lack of remunerative jobs or business opportunities in manufacturing and especially services on the other.

Increasingly, Vietnamese agriculture is likely to become spatially specialized. The further development of beverage and industrial crops will concentrate in the South-East and Central Highlands, as would the associated agro-industrial investments. Forestry production will be further developed in the Northern Mountainous areas, in the upland portions of the central region, and in the ecologically critical areas in the Central Highlands and Mekong Delta. Horticulture, floriculture, and medicinal plants will gain more prominence in peri-urban areas, and in specific sites in the upland or mountainous areas where the agro-ecological conditions are most suitable. Poultry and pig production will shift further away from Vietnam's large cities.

The future trajectory for agriculture in Vietnam's different regions will depend upon many factors. Of course, each region's natural resource endowment and the legacy pattern of agricultural development will be influential. Also influential will be demographic trends, including out-migration and the likely average aging of the household heads engaged in farming in the future. The competition for resources from other sectors will also, increasingly, come into play. For example, while there is potential for further aquaculture development in Vietnam's Central Coast, that area will see increased investment in energy services and possibly accelerated industrial, real estate and tourism—all of which may compete with or impinge upon aquaculture expansion. Climate change will call for improvements in adaptive management capacities, new technologies, and land-use changes to address changes in weather patterns, and new and heightened production risks.

About one-third of the current paddy-land will likely have shifted to alternative agricultural land uses or ecosystem services by 2030.⁴¹ Paddy-land affected by saline intrusion will be converted to aquaculture, involving more diverse species than at present. Much of the paddy land in peri-urban areas will be converted to vegetable or

40 In 2011, food and beverages accounted for some 20 percent of Vietnam's industrial output. Its growth in output and output per worker over the 2000–09 were quite similar to that of many of industrial subsectors (Nguyen et al 2014).

41 This will help to accelerate agricultural growth as simulated by Gisseke et al (2013).

ornamental plant production. Paddy land near the coast and ecologically sensitive sites will take on more multi-functional roles, such as ones that maintain or revive biodiversity and support eco-tourism. Where drainage services are improved, some paddy land will be converted to maize production.

Remaining rice-based production systems will also change. These will increasingly incorporate rotation crops to improve soils and manage pests, and tend to specialize—notably in fragrant varieties of rice and organic or other ecological production methods. Despite the decline in the rice growing area, Vietnam will continue to produce a significant exportable surplus with, hopefully, a larger share consisting of high quality and specialty variety products that generate higher profits for farmers and agro-enterprises.

With regard to sectoral performance, one needs to be cautious in identifying specific quantitative targets as the outcomes will be affected by important developments outside of agriculture, including international factors over which Vietnam may have little capacity to influence. Still, it is certainly possible to outline a set of aspirations for the sector relative to its past performance and relative to that of its international competitors and regional peers.

The following represent a set of ambitious yet realistic outcomes that Vietnamese agriculture can achieve in the 2025–2030 time range. While not exhaustive, these illustrate the range of accomplishments that are within Vietnam’s reach, taking into account expected conditions in international commodity markets, changes in domestic food demand, climate change impacts, and past performance.

Sustainable Agricultural Productivity and Growth

- The **agricultural growth** rate will cease its ten-year decline and revert to the pace experienced in years just after the turn of the millennium at between 3.0 and 3.5 percent.
- This acceleration of growth will come primarily from **growth in total factor productivity (TFP)** and the reversal of its recent decline. Akin to patterns observed in other high performing middle-income countries, more than 80 percent of growth will be due to TFP growth. Agricultural **labor productivity** will increase substantially, and this will close the gap which currently exists between Vietnam, Thailand, and China. It will also close the gap between Vietnam’s agricultural sector and its labor-intensive manufacturing subsectors.
- The current gap in **water productivity** in Vietnam’s large irrigation schemes (vis-à-vis those in China and other middle-income Asian countries) will be closed as a result of land-use changes and improved water management and irrigation services.
- The reality and reputation of Vietnamese agriculture as **eco-unfriendly** will fundamentally change. In large portions of the sector, the monitoring of agronomic practices against sustainability standards, natural resource management, waste management, and energy efficient methods will have been mainstreamed. Vietnam will be among the leading developing countries in the effective **utilization of agricultural wastes**—for energy, feed, composting, and other purposes. Dimensions of Vietnamese agriculture will be domestically and internationally recognized for their **multi-functionality**—including their protection of landscapes and contribution to eco-tourism.

- The sector will continue to play a major role in meeting national **food security**, servicing increasingly diverse food demands and meeting domestic consumer expectations for safety, quality, and price. And Vietnam will meet or exceed all of the World Health Assembly **nutrition** targets for 2025, including those related to under-nutrition (i.e., child stunting), micro-nutrient deficiencies, and obesity. While this is a multi-sector challenge, the agricultural sector will help promote a healthy and diverse diet.

Competitiveness in Domestic and International Markets

- Vietnam will rank in the top 10 to 20 percent of developing countries in terms of the proportion of its agricultural commodity export volume which is derived from production areas which are either internationally certified or otherwise recognized for **compliance with a broad range of environmental and social standards**.
- More than 50 percent of Vietnam's **agro-food exports** will consist of processed and other value-added products, more than double the current proportion. More than two dozen brands of Vietnamese companies that make **agro-food products will be well-recognized in major regional and international markets**. In the process of this recognition, the current discrepancy between the high international regard for Vietnamese cuisine and the invisibility of most Vietnamese foods and raw materials abroad will be resolved.

These aspirations reflect a combination of economic, social, and environmental considerations. This sustainable development (triple bottom line) orientation was emphasized in the 2013 Agricultural Restructuring Plan (ARP). In it, economic goals were articulated in terms of “maintaining robust agricultural growth and improving sectoral competitiveness primarily through advances in productivity, efficiency, value-addition and better meeting the needs and preferences of consumers.” Social goals reflected broader rural development aspirations in terms of “continuing to raise farmer incomes and rural living standards, address lagging regions; reduce the incidence and severity of rural poverty and ensure national and household food and nutritional security.” Goals related to the environment were conveyed in the ARP as “improving natural resources management, reducing the sector’s adverse environmental impacts, contributing environmental benefits and improving capacities to manage weather-related hazards.”

A photograph of a flower market stall. The stall is filled with a variety of potted plants and flowers, including orchids, gerberas, and other colorful blooms. The plants are arranged in rows, and the stall is covered with a white tarp. In the background, there are buildings and other market stalls. A sign on the right side of the stall reads "DC 4 HAI LONG" and "ĐT: 3943.009".

Chapter 4. Institutions for a Modern Food Economy: Realizing the Vision via Policy Change and Institutional Innovation

Vietnam's agricultural sector now sits at a crossroads. While there are several very dynamic elements within the sector, this report has highlighted some trends and contextual realities that demand new approaches. These include declining rates of agricultural GDP and productivity growth; a growing gap between farm and non-farm incomes; and an erosion of natural capital that can no longer be ignored. They also include growing competition for land, labor, water, and other resources; booming domestic demand not just for more food, but also for more choices, more diversity, and more safety; and intensifying competition and pressure from buyers in international commodity markets—all of this in context of a changing climate.

Public investment and various forms of government support have played very important roles in Vietnam's agricultural development. A recent OECD report (2015) provides a very good historical review of agricultural policies in Vietnam, spanning three phases (see Box 6).

Box 6: The Policy Context for Vietnamese Agriculture

Reunification (1976–1986)

Following the 1976 reunification of the country, the Communist Party took a centrally planned approach to the economy. The government hoped to achieve food self-sufficiency and to supply inexpensive rice and other staple crops to a growing industrial sector. Small farms were consolidated under cooperatives growing annual crops while perennial crops like coffee were grown on state farms. State-owned enterprises (SOEs) provided inputs and managed markets. Goals were centrally managed and prices mandated.

Collectivization, well established in the North, did not take hold in the South and about 75 percent of farming households remained outside of the newly established cooperative system (Wolz and Pham 2010 in OECD 2015). Farmers looked to sell their output on unofficial private markets, where prices were substantially higher. By 1980, the agricultural sector was in disarray. In early 1981, the centralized cooperative system gave way to an in-kind contract arrangement under which households were allowed to farmland managed by the cooperative (and owned by the state) in exchange for meeting production quotas. Water, seeds, fertilizer and other inputs were provided by the cooperatives as part of the contract. Surplus production belonged to the farmer and could be sold to the state or to private buyers. Prices paid by the state were slowly raised to match informal market prices.

Following a brief period of success, the contract system started to break down. Cooperatives were often unable to provide the inputs contracting farmers required. In-kind quotas were often raised, cutting in to farmers' incentives (Kirk and Nugyen, 2009 in OECD 2015). Agricultural growth slowed and turned negative in 1987 (Pham, 2006 in OECD 2015). At the same time, a bout of hyperinflation gripped the country. Near-famine conditions and widespread food shortages spread to large areas of the country (OECD 2015). Around the same time, the Soviet Union announced an end to economic aid to Vietnam.

Renovation (1986–1993)

At the historic VIth Communist Party Congress in 1986, the government abandoned the central planning model of economic management and took a series of steps to renovate (*doi moi*) the country's economic institutions (OECD 2015). The decision was driven in part by the worsening of the economy; yet occurred in a context in which many developed and developing countries were undertaking reforms, particularly in agriculture. Relevant were China's successful market-based reforms in agriculture following the failed Great Leap Forward (Akiyama et al. 2003).

The new policy framework benefitted the agricultural sector and farming households in many ways. First and foremost, agriculture was no longer viewed as a way to provide cheap food for Vietnam's industrialization; instead, the development of agriculture became a primary objective of government policy. In addition, independent household farms, rather than

Continued to next page.

Box 6 continued.

directed cooperatives, became the basic economic engine of rural development (OECD 2015). Resolution No. 10/1988/NQ-TW directed agricultural cooperatives to provide farming households with long-term leases (15 years for annual crops, 40 years for perennial crops). Even at the time of the reforms, the practice of leasing paddy fields to individual farmers took place in some villages (OECD 2015). Farmers were also able to buy and sell animals and machinery. Cooperatives were left in place to provide inputs and manage services, especially irrigation and marketing services, but as a practical matter many ceased to exist. Although the cooperative structure had never taken hold in the South, there were over 110,000 cooperatives in the North covering 98 percent of the farms in 1980. By 1994, there were an estimated 16,243 cooperatives in the entire country (Wolz and Pham 2010 and Riedel and Turley 1999 in OECD 2015).

Initially, farmers remained obligated to meet production quotas at prices set by the state. This changed in 1992 with the issuance of Decision No. 1237/1992/HDBT by the Committee of Ministers. The decision freed markets to set the prices for goods and services, with the notable exception of strategic commodities and inputs including sugar, rice, and fertilizer. A series of steps also opened the economy to trade. Import tariffs were cut in 1988 and trade with China resumed in 1989. Private firms and state-owned enterprises (SOEs) were licensed to trade with foreign firms (OECD 2015). During this time, the exchange rate regime changed as well, from one based on a fixed rate to one in which the exchange rate was allowed to fluctuate within a range. As was often the case in developing countries at the time, the fixed-exchange-rate regime had over-valued the dong, effectively taxing agricultural exports (Krueger, Schiff and Valdés 1988). The effects of the reforms were dramatic. Vietnam, which had imported rice in 1987 and 1988, became the world's third largest exporter in 1989.

Expansion (1993–2000)

During this phase, many more market-reliant policies took shape as the logic of *Doi Moi* continued to play out. Chief among these was a greater reliance on output markets and the introduction of an institutional framework for land markets. The 1993 land law extended land-use rights for annual crops to 20 years and those for perennial crops to 50. Households were granted certificates in the form of red books that formalized their land-use rights. The assigned rights could be leased, inherited, and used as collateral for loans. Decree No. 14/1993/ND-CP established a credit policy that allowed households to borrow, and credit was extended via increased government funding to the Vietnam Bank for Agriculture and Rural Development. A contemporaneous Law on Agricultural Land-Use Tax gave farmers greater say in marketing their production by dismantling the compulsory quota system and the agricultural output tax, and instituting a land-use tax in their place. Internal trade restrictions, which had prevented rice produced in the South from moving to the North, were relaxed (Benjamin and Brandt 2002 in OECD 2015).

Overseas trade restrictions were loosened as well. Vietnam signed a preferential trade agreement with the European Economic Community in 1992, and in 1995, it joined the Association of South East Asian Nations (ASEAN) and became a member of the ASEAN Free Trade Area. In response to large gains in rice production, export quotas were raised to 4.5 million tons by 1998; however, participation in the export business was still limited to a handful of national and provincial SOEs (Abbott et al. 2006 in OECD 2015). It would not be until the late 2000s that private sector involvement in this export trade would be encouraged.

Yet if one looks across an array of factor- and goods-markets, one sees a common pattern of too much state and too little governance constraining the effectiveness of those markets. The following examples illustrate this pattern.

- **The government is the owner of all agricultural land, and it has placed restrictions on the size of farms and the uses of agricultural land, and engaged in extensive land-use planning at multiple levels.** yet farmers pay no rent or land tax, face high transaction costs in all land transactions, and encounter lax enforcement to protect against land degradation or forest encroachment. Long-standing restrictions on the use of paddy-land helped to ensure food security in the past, yet are now a barrier to investment in agriculture.

- **The government controls bulk water delivery via irrigation SOEs**, yet there is no transparency in the performance of these companies, no pricing of irrigation water, and little or no monitoring of water-use or misuse. These conditions have given rise to low water productivity and an increased level of vulnerability to the impacts of climate change.
- **The dominance of public institutions in agricultural research, and multiple ministries allocate research funds in a setting in which intellectual property rights are difficult to protect**, agricultural machinery is readily cloned or cannibalized, multiple steps are needed to initiate a research activity, and competitive or venture funding for research is scarce if unavailable.
- **SOEs continue to play a very significant role in many commercial areas where the private sector would normally invest.** This includes seed and fertilizer supply, rubber production, commercial forestry, rice trade, and dairy processing. Where the state is directly involved in agribusiness activity, the playing field has generally been uneven. And many state farms and plantations have low productivity. Despite (or maybe because) of relatively heavy direct involvement by the state in agricultural value chains, there is generally weak strategic planning and limited collective action to govern and resolve problems in these industries. For example, Vietnam is the world's third largest rice exporter yet has no commercial rice trade strategy.
- **The agricultural sector has developed within the context of multiple quantitative targets, at the subsectoral and aggregate levels.** Nevertheless, the sector still features underdeveloped systems for quality, food safety, and environmental management, creating concerns among consumers and exacerbating operational, livelihood, and/or reputational risks for farmers and firms. While coastal provinces set export targets and compete to attract more fish processing investments, hundreds of thousands of fishers lose their primary livelihood as the near-shore fishery resources are depleted.

Vietnam's Agricultural Restructuring Plan of 2014 already recognizes many of these challenges and opportunities, and signals a shift in thinking about roles of government and spending priorities. Specifically, the government has begun to shift from a supply-oriented focus on agricultural production, to a focus on market- responsiveness and sustainability. With this comes the recognition that changes are needed in how government intervenes in the sector. Going forward, this reorientation will need to be put into practice and translated into policies and programs that allow Vietnam to realize its ambitious vision for the sector—the vision articulated in Chapter 3.

How does Vietnam get from here to there? While Vietnam will need to custom-design approaches that fit the country's political values as well as its institutional, economic, physical, and socio-cultural realities, this final chapter offers some general direction, and presents approaches that have been tried elsewhere. Vietnam may be able to borrow from these and many others not covered here.

Role of the State: Cross-Cutting Considerations

The following are cross-cutting considerations on the roles and approaches of government.

Looking Beyond Traditional Agricultural Policy

Many of the challenges that Vietnamese agriculture faces as it transitions to an efficiency-based and higher value-added sector cannot be addressed exclusively through changes in agricultural policies. Addressing the sector's transitional and longer-term competitiveness and sustainability challenges requires broader, economy-wide reforms, especially in relation to land (ownership/tenure and usage rights), the role and operating conditions of state-owned enterprises and banks, policies and institutions associated with science and technology, and approaches to government decentralization and coordination. Many of the recent special initiatives to support structural and behavioral changes within the agricultural sector have become necessary to countervail the constraining effects of non-agricultural policies, regulations, administrative practices, and so forth.

Likewise, supporting the business of agriculture entails government functions not normally considered the mandate of ministries of agriculture. For example, there is a need to facilitate good corporate governance; provide a level playing field for market participants and potential entrants (e.g., efficient, transparent processes for business licensing and establishment); create a regulatory environment suited to local business and cultural standards and the relevant level of industry development; and establish a transparent system of business and trade taxation, and a clear legal code and redress processes for contracts. There is need for coordinated roles for public institutions. Elsewhere in Asia, ministries of agriculture have found it very challenging to develop capacity for effective, proactive support to agricultural diversification and inclusive agribusiness.⁴² Guiding the modernization of agriculture thus involves numerous ministries beside agriculture: trade and industry, environment, health. Getting these ministries to coordinate effectively is a challenge.

Leading Less and Facilitating More

To achieve the lofty aspirations laid out in Chapter 3 and otherwise support the modernization of Vietnamese agriculture, the government will need to lead less and facilitate more. This is true in relation to many of the outcome areas the government would like to influence for the better. For illustration, Table 23 identifies some areas where changes are possible in how the government intervenes in relation to agriculture and agribusiness development.

The above also implies that the government will need to invest more selectively, focusing on core public goods and services.⁴³ In Vietnam, this might mean continuing to invest in rural infrastructure, early warning

42 FAO (2014) commissioned six Asia case studies of the institutional models used to provide public sector support for inclusive agribusiness development (Bangladesh, Indonesia, Malaysia, Nepal, the Philippines, and Vietnam). All conclude that the departments or agencies created under MOAs in these 6 countries have largely failed to live up to expectations in terms of moving the ministries into effective, proactive roles in off-farm agribusiness. In most cases, weaknesses in staff and budget are major constraints. In some cases, the agencies created within MOA have mandates that overlap with other ministries, e.g., of industry. In several cases, it appears that the agencies were created under externally financed projects, but subsequently find themselves under-staffed and under-funded when these projects close, only to re-emerge when new donor projects start up.

43 Including non-agricultural investment to enhance the rural institutional environment and improve human wellbeing; such investments relate to education, sanitation and clean water supply, and health care.

Table 23: Shifts in Government Roles in a More Market-Led Vietnamese Agriculture

Less of...	More of...
<ul style="list-style-type: none"> • Long-range land-use planning • Managing farms and plantations • Being a leading source of agricultural research and advisory services • Technology push • Investing directly in supply chains • Being the market for farmers • Direct commercial role in agro-trade • Bearing agricultural risks 	<ul style="list-style-type: none"> • Facilitating innovation, including but not limited to R&D, tech transfer, and advisory services • Facilitating and regulating land markets • Providing a conducive enabling environment for agribusiness and logistical investment • Facilitating farmer-agribusiness linkages • Facilitating, monitoring, and regulating trade • Providing information • Facilitating production and commercial risk management • Co-managing natural resources and co-regulating food safety

Source: Authors.

weather systems, land administration services, basic agricultural research, pest and disease surveillance and reporting, institutional capacity to enforce environmental and input regulation, or to support certification systems, food safety inspection and related regulatory functions, and the provision of safety nets.

In addition, by focusing on improving the enabling environment, the government will better be able to leverage public funds to encourage and enable much greater investment by farmers and the private sector. In higher income countries, agro-food chains largely consist of private sector businesses. The levers of intervention for government are limited and essentially exist to create and maintain a supportive enabling environment. As discussed next (and reflected in Vietnam’s low score on the OECD’s agricultural growth enabling index, see below), this is not necessarily what policies in Vietnam currently do.


In its regulatory actions meanwhile, the government may find it more effective, in some cases, to proceed incrementally and with significant consideration for the day-to-day realities of firms of different natures and sizes. With regard to food safety and environmental standards for example, the government may at times allow players to adopt or remove practices in incremental stages over time, rather than introduce abrupt measures and demanding compliance tomorrow. Distinctions might be made between firms of different sizes, with varied implementation deadlines. Pushing things along may involve capacity building interventions, technology transfer schemes, and targeted subsidies. These measures may be preferable than simply de-licensing the laggards.

Moving in the direction of a modern, market-responsive food system needs a foundation of greater trust in market processes, a greater degree of comfort with mistakes, and acceptance that these are not an overall sign of failure. The government exhibits a tendency to intervene more deeply in inter-firm relations—as in picking winners, match-making, and engineering market relationships. While this often reflects the best intentions of pushing things along and spending public resources wisely, it can distort market signals and prices, drive out lagging players prematurely, and stifle private sector experimentation and entrepreneurship.

One cross-cutting area in which these (re-)orientations of government will imply significant changes in Vietnam is that of innovation policy (as discussed again below). Building the sector’s capacity for innovation—that is, for continuous, and sometimes breakthrough improvement in how the business of agriculture is carried out—will be vital for achieving nearly all of Vietnam’s aspirations for the sector. And doing so will generally call

upon the government to retreat from a number of functions it has proactively filled, including in research and technology transfer, and to assert leadership by helping to draw out the best in the multiplicity of actors now seen as central to innovation. In Vietnam's case, this will involve shifting more resources and effort into, among things, building the capacities of and connections among people, organizations, and systems.

This is in the same vain as recent reforms that have sought to make research institutions more demand-responsive, and firms more engaged in developing and absorbing technology. The launch in January 2015 of the National Technology Innovation Fund, for example, is expected to promote competitive research by moving away from a system of annually assigned research missions to one based on flexible projects that can evolve faster to match demand. And MARD is developing a circular (implementing Decree 15 on public-private partnerships) that will support the efforts of enterprises that invest in research, demonstration, and technology transfer.

 Thematic Sheet A discusses current thinking on agricultural innovation systems at greater length, Thematic Sheet B, Thematic Sheet C, and Thematic Sheet D exploring the related topics of research, extension, and incubation.

The rest of this Chapter is devoted to exploring and illustrating ways in which governments elsewhere have promoted sustainable agricultural productivity and growth as well as competitiveness in international and domestic markets. A series of annexes offer more in-depth treatment and illustrations of the approaches discussed below.

Sustainable Agricultural Productivity and Growth

Agricultural growth and development over the past decade was based upon very intensive use of human resources, natural resources, and production inputs. Physical output (and trade) grew at a fast pace, yet at high cost to the environment, with mixed or uncertain product quality, with declining rates of productivity gain and with limited value-addition. Given these developments and given the evolving roles of agriculture in a country experiencing broader demographic, spatial, and economic structural changes, a unifying motto for the sector can be achieving more from less. That is, the sector will yield greater producer, consumer, ecosystem, and broader economic benefits, yet with less (or less intensive) use of labor, land, water, other natural resources and environmentally harmful inputs. This will require the better realization of economies of scale and scope at the farm level and within value chains, much greater efficiency in land and water-use, and a shift toward more knowledge-intensive and skill-based agricultural practices. And these imply significant shifts in the functions (and performance of those functions) by government.

Facilitating More Efficient Use of Agricultural Land

In order to improve farmer welfare, meet the changing needs of domestic consumers, and reverse the pattern of a declining rate of agricultural growth, much more efficient use will need to be made of Vietnam's agricultural

land. Inefficiencies in land-use, at least in the lowland and delta areas, stem from various factors, including (i) the structural legacy of earlier egalitarian land allocation policies; (ii) legal, regulatory, and administrative barriers to a more active (transfer and leasing) land market; and (iii) the restrictions placed on land-uses, for the large area of land designated as paddy-land.

Land consolidation, in various forms, will be critical for upgrading production systems and product quality, reducing transaction costs within value chains, and enabling households to gain and maintain a middle living standard based at least partly on agriculture. A more active market for agricultural land will facilitate land consolidation in some areas, allow those farms and firms wishing to invest further in agriculture to pursue their plans and enable many households to reduce their livelihood risk, by gaining guaranteed lease income while focusing their labor or entrepreneurial efforts elsewhere. Land consolidation will also allow for increased mechanization, a process which will become increasingly important as labor costs rise.

I Vietnam can learn from international experience about ways to facilitate the development of mechanization services in a farming structure still dominated by small-scale farms, a topic discussed further in Thematic Sheet E.

Enabling greater choice and flexibility in land-uses will be critical for improving farm household welfare, better managing weather, other production and market risks, and spurring investment in agriculture. The government is rightly concerned about widespread and uncontrollable conversion of agricultural land for other purposes. And it wants to ensure that large areas of lowland suitable land continue to cultivate Vietnam's leading staple food—rice. yet, the paddy-land designation policy has resulted in Vietnam far overshooting its food security objectives and generating a massive exportable surplus whose international sale generates only modest incomes for farmers and net returns to the country overall. The costs of the restrictive paddy-land policies have been recognized. The government has set goals for the conversion of some paddy-land and with Decree 35 has set out rules which should provide farmers and local leaders with much greater scope to convert land to other agricultural uses or introduce rotations between seasons. Active technical and other support by government for crop diversification may be needed during the transition phase given lower levels of knowledge and technology availability for the alternative crops and different types of risk which farmers may face. The changes being brought should be carefully monitored. The revised policy still restricts farmers from converting paddy-land for more permanent purposes—i.e., the planting of tree crops. This restriction should be reconsidered after the impacts of the current reform are observed. As noted earlier, over the longer term we might expect upward of one-third of the current paddy-land being shifted over to alternative agricultural land-uses and ecosystem services. Gisseke et al. (2013) project that this type of change will bring very significant benefits and increase the future pace of agricultural growth.

Facilitating More Efficient and Sustainable Use of Irrigation Water

Irrigation facilities have been the government's biggest investment in the agricultural sector. Since the mid-1970s, some \$6 billion (present value) have been invested in irrigation—about 80 percent of the government's capital investment in the sector. While irrigation schemes have played a major role in Vietnam's impressive progress with respect to food security and poverty reduction, their utility will come under a stronger spotlight as farmers seek

to diversify land-uses and in the face of intensifying competition for land, water and budgetary resources. Irrigated agriculture needs to increase overall factor productivity and better account for its water-use. And the existing infrastructure will need to deliver a range of multi-functional water services—not just irrigation and drainage. Water supply to municipalities, rural centers, industry and maintenance of flows for aquaculture, fluvial transport and environmental services are becoming increasingly important (see Error! Reference source not found. on public-private water services and quality protection in Latin America in Thematic Sheet F).

In 2014, an irrigation restructuring scheme was announced, calling for an array of sustainable development objectives and pointing toward a combination of technical advances and institutional reforms. As the subsector is fully decentralized, the focus of change and modernization will be at the provincial level. The provinces are responsible for irrigation investment planning, implementation of the investment, and operation and maintenance. yet MARD—working with provincial and user agencies—will need to play a major role in promoting a facilitating a more service oriented approach to irrigation. The implementation of reforms in the subsector will be a long-term effort that needs to be accompanied by measures to:

- Resolve the long-term financing of IDMCs, improve their accountability (and oversight), and improve their incentives to deliver requested and reliable irrigation services. Various approaches are being pursued including changes in corporate governance arrangements, use of performance contracts, basing funding on the implementation of business plans, and using improved tools for monitoring the performance of schemes in relation to both technical and higher level objectives.
- Strengthen the relationships between IDMCs and WUOs in order to improve irrigation service delivery. Good practices locally seem to involve a shift from a hierarchical top-down approach to one of regular communications, joint problem solving, and an overall orientation of co-managing the irrigation schemes.

Strengthening Green Agriculture Policies and Implementation Capacities

Vietnam, as previously noted, has achieved high rates of growth in agricultural output over the past decades, but this accomplishment has been at a heavy cost to the environment. The sector’s increasing use of land and synthetic inputs has accelerated deforestation, biodiversity loss, land degradation, water pollution, and greenhouse gas emissions. Today, this pattern is not only gaining attention but may be reaching its limits as natural resource degradation is starting to have an observable effect on farmers’ bottom lines. Saddled as it is with high expectations, Vietnamese agriculture will need to produce more from less going forward. Maintaining high output growth under changing climate and economic conditions may require a strategy of intensification, sparing not only time and labor, but also land and water, pesticides and fertilizer.

The government has recently turned its attention to environmental challenges, Vietnam’s Green Growth Strategy—which touches upon agriculture-related themes—being emblematic of the attention being paid to the matter at the highest levels of government. However, Vietnam’s agricultural policies and public expenditures are still primarily driven by production output objectives (Khoi et al. 2015). Several agricultural promotion policies moreover appear to conflict with environmental protection goals. For example, efforts to conserve fisheries and promote fishery resource (co-)management occur in the same locations where fuel and/or boat-building subsidies are offered to expand local fish processing capacity. Efforts to restrict farmers from cutting trees and cultivating

steep slopes may be undermined by the promotion of new investments in nearby ethanol plants with large feedstock requirements. Government waivers and subsidies for water and irrigation service fees temporarily increase farmer incomes, but contribute to improper water management, often in ways that increase greenhouse gas emissions.

In Vietnam as in many other countries, meanwhile, primary attention has been given to putting in place effective regulatory solutions to agro-environmental problems. yet, regulatory enforcement is often challenging, especially in circumstances like that in Vietnamese agriculture where primary production is highly fragmented. Scherr et al. (2015) highlight a wider range of policy instruments that governments may use, often in combination, to provide the incentives and controls needed to prevent environmentally destructive agricultural activities and otherwise induce sustainable farming and natural resource management practices. These instruments set and allow enforcement of the rules, raise awareness and provide needed information, and enable, through various means, better behavior and technologies.⁴⁴ Through incentives and information, whether these surface through procurement, R&D, extension, or quality systems, government can enable and encourage private action. It can directly invest in environmentally protective infrastructure or activities, or help others to mobilize such resources. Table 24 provides examples of some of the specific instruments governments can and have used in this space.

Many of these may be relevant to Vietnam, though the suitability of different instruments depends upon the type and scale of the environmental problem and the prevailing institutional context. In this regard, it is helpful that a wealth of international experience exists in the use of all these instruments.

I Market-based approaches. The past decade, for instance, has seen tremendous growth in market-based approaches to environmental management, namely in the form of payment for ecosystem services (PES) programs. These encompass a range of programs that involve the direct compensation of land stewards to maintain specified ecosystem services, usually through conservation and restoration activities. Government roles in support of PES range from paying for the ecosystem services, to convening stakeholders, and establishing the legal framework and soft infrastructure that have proven essential to the success of these programs. Several examples of payment for ecosystem service schemes are developed in Thematic Sheet F.

Another market-based approach that is rapidly developing (though some see it as a form of PES) rests on the use of eco-certification. Public sector support for this approach has spanned working with private sector stakeholders to develop standards, to regulating the use of such standards, supporting their adoption through capacity building, and ensuring consumer protection when it comes to their use.

I Thematic Sheet G develops examples of eco-certification and eco-labeling programs.

Multi-stakeholder initiatives. Despite their growth in recent years, meanwhile, market-based approaches are not the only ones to have proven effective. In fact, one key lesson that is emerging from transactional approaches to environmental protection is the importance of the institutional, social, and cultural fabric in which these are


44 Scherr et al (2015) highlight and draw lessons from the applications of many such instruments in a series of commodity landscape case studies in East and Southeast Asia.

Table 24: Government Roles and Instruments in Agro-Environmental Mitigation

Role	Instrument
Definer	<ul style="list-style-type: none"> • High-level political endorsement and advocacy for Agriculture Green Growth strategy and specific goals • Mechanisms for ministerial coordination across agriculture, environment, and related sectors • Designation of decision-making authority across national, state, and local government levels • Institutional support for multi-stakeholder landscape dialogue, planning, and coordination
Enabler	<ul style="list-style-type: none"> • Promotion of supply chain eco-standards, eco-certification, pre-competitive action • Institutional frameworks for private payments for ecosystem services • Public procurement of sustainably sourced commodities • Technical assistance for land managers and businesses • Research for technology innovation and adaptation • Information systems (e.g., land and soil maps; climate risks) • Incorporate environmental action in large, multi-sector green growth initiatives
Funder	<ul style="list-style-type: none"> • Producer subsidies to reduce cost of investments or transitioning to improved practices • Organizational subsidies to reduce cost of collective action/investment • Public payments to landowners/land managers for ecosystem services • Preferential access to bank finance for environmentally friendly producers/processors • Improved practices adopted in state-owned enterprises
Regulator	<ul style="list-style-type: none"> • Land-use regulation • Establish norms for human and ecosystem health • Direct regulation of private land-use or management practices and processing industry • Zoning and land-use planning, including generating spatial information at granular scale • Tenure and access rules for land and resources (including concession policy and conservation reserves) • Monitoring of environmental management and ecosystem health • Financial and market regulation • Market and trade rules • Taxation of environmentally harmful practices or products • Environmental screening or review of agricultural investments • Liability systems (i.e. legal liability, enforcement incentives, damage liability)
Advocate	<ul style="list-style-type: none"> • Raising awareness of resource managers or users • Public media campaigns to educate citizens/consumers/buyers/investors • Public dissemination of monitoring data and evidence • Mobilizing and supporting allies and advocates

The items *in italics* are approaches which Vietnam is now making common use of in agriculture and the items that are not in italics are areas where some experimentation has begun. Source: Scherr et al. 2015.

imbricated. A range of approaches that can be grouped under the umbrella of multi-stakeholder initiatives have also been used with success. While these range in nature, these tend to leverage non-monetary currencies, such as social recognition, belonging, status, favors, or community acceptance, to provoke behavior change.

 Several examples of multi-stakeholder initiatives that have helped to protect natural resources and the environment are analyzed in Thematic Sheet H.

General lessons on government roles in the greening of agriculture. More generally, Vietnam's and other countries' experience in the greening of agriculture point to the following lessons.

- **The need for pro-active agro-environmental strategies which anticipate likely or potential environmental risks and aim to prevent the degradation from occurring in the first place.** More commonly in developing countries, agro-environmental policy continues to be reactive to outside pressure (from buyers or external regulators) and rehabilitative, with measures taken only after serious environmental consequences have manifested.
- **Benefits from mobilizing multiple stakeholders for green agriculture initiatives.** Whether or not monetary or other economic incentives intervene, public-private partnerships have been effective in implementing many schemes as have initiatives involving collective action at the industry or community levels. The needed roles for government should be tailored to the specific circumstances.
- **Opportunities for interventions at multiple levels.** At the farm and community levels, efforts can focus on mainstreaming the adoption of good agricultural practices and promoting the multi-functionality of farming areas (production; ecosystem services; eco-tourism). And, at a landscape level, multiple stakeholders can be mobilized to develop sustainable agro-based ecosystems, such as one for industrial crops and agro-forestry in the Central Highlands.
- **The need to strengthen green agriculture capabilities, including data, knowledge, skills, management systems, physical assets, and institutional relationships.** These must be present among supply chain actors, among national and sub-national government agencies, research/training institutes, and civil society organizations. To effectively manage agro-environmental risks, investments are often needed in hard infrastructure (i.e. testing laboratories), hard competencies (i.e. technical skills) and soft competencies (i.e. facilitative skills).

Managing Climate Change Risks to Vietnamese Agriculture


Growing recognition that climate change risk will interfere with the pursuit of near-term and long-term agricultural development objectives has led a growing number of countries and development partners to embrace climate-smart agriculture. The concept reflects a desire to integrate or mainstream adaptation and mitigation objectives into ongoing sector development efforts, reorienting these as necessary. Less than a preconceived approach or outcome, climate-smart agriculture implies the embrace, at multiple levels, of processes to identify context-relevant policies and actions that will enable the agriculture sector to better fulfill its multiple functions in a changing climate (e.g., as they relate to production, food security, livelihoods, economic growth, and ecosystem health). As defined by the Food and Agriculture Organization (FAO), climate-smart agriculture “seeks to support countries in putting in place the necessary policy, technical and financial means to mainstream climate change considerations into agricultural sectors and provide a basis for operationalizing sustainable agricultural development under changing conditions” (FAO 2013).

In Vietnam, agriculture is expected to be significantly affected by climate change through sea level rise, salinity intrusion, higher temperatures, modified rainfall patterns, and heightened storm intensity. Short of

concerted adaptation efforts, these changes will impact the risks and productivity of crop, livestock, and aquaculture production. yet a significant number of adaptations *are* likely to occur spontaneously, that is, as the result of farmer rather than public sector initiative (JICA 2013, World Bank 2010). Examples include delaying planting of winter-spring rice in the Red River Delta; switching to drought-resistant crops such as cassava, maize, and groundnut in the Central Region; shifting to salt-tolerant aquaculture as salinity creeps into the coastal parts of the Mekong River Delta; and stepping up the capacity of veterinary services to respond to a higher incidence of vector-borne disease in the livestock sector. Many of these changes can already be observed in Vietnam today. And taken together, shifts such as these can go a long way toward averting the worst sector impacts suggested by “business-as-usual” modeling results, which usually assume zero adaptation. That said, the rapid pace and extent of change that could transpire as global greenhouse gas concentrations rise could test farmers’ and other agricultural actors’ ability to cope.

This points to a critical need for the government to help bolster the sector’s ability to manage both the foreseeable challenges that climate change will bring (such as salinity intrusion, temperature stress, dry season water scarcity, heightened flood and extreme weather risk, and so forth), as well as the significant amount of uncertainty or unpredictability that climate change implies (e.g., with respect to rainfall, pests, and disease). In fact, the uncertainty that is intrinsic to climate change points to the relevance of at least three mutually reinforcing approaches when it comes to planning adaptation and other climate-smart agriculture strategies. These are (i) to embrace the tenets of adaptive management; (ii) to strengthen the capacity for learning and innovation within government as well as in the private sector; and (iii) to favor “no regrets” adaptation strategies.

Adaptive management is an approach to making decisions that deals with a context of uncertainty by making learning central to the process (i.e., by making learning about a given system a central objective of decisions that otherwise intend to improve that system). Adaptive management represents the deliberate and systematic use of best available knowledge to guide policy decisions and management practices. Its effectiveness can reflect such things as the quality of leadership; the skills, attitudes and social capital of individuals; the aptness of institutional incentives and culture; and the strength of data and knowledge management systems. Particularly fundamental to its success over time—and the ability to adapt to climate change—is the capacity for innovation and learning, at every level of government, and much more broadly throughout the economy.

 The concept of adaptive management is further discussed and illustrated in Thematic Sheet I. Separately, Thematic Sheet A goes into the concept of agricultural innovation system.

This adaptive management approach is consistent with the idea of prioritizing no-regrets strategies—actions that can be justified from economic, social, and environmental perspectives whether a given climate change scenario unfolds or not, or actions that are relatively reversible in case of unforeseen developments. Many of these have already been identified and are actively being pursued in Vietnam, as illustrated in Box 7.

Box 7: Examples of Planned Adaptation Measures that Vietnam is Unlikely to Regret

Planned adaptation measures are generally understood to involve the public sector, whether it intervenes as a coordinator, advocate, investor, funder, law-maker or regulator, or in another capacity. The following are examples of measures that are likely to pay off irrespective of how climate change progresses—and that could be redirected if needed (JICA 2013, World Bank 2010, authors).

- Increasing the availability of timely weather information and seasonal climate forecasts, along with the knowledge to use this information (e.g., climate information systems and extension-type services)
- Funding research and extension to develop and diffuse new crop or animal varieties tolerant to changing conditions (e.g., resistant to higher temperatures, salinity, prolonged or deeper flooding, prolonged water scarcity, etc.); or management practices that reduce waste and increase efficiency (if possible while reducing climate and environmental pollution)
- Supporting lower-income farmers diversify into higher value farm products, for instance, by helping them access financing including to manage risk (e.g., by participating in the development of crop and livestock insurance); and into non-farm income-generating activities
- Developing frameworks for or directly designing or funding payment for ecosystem service programs
- Incentivizing water savings (namely in irrigation systems) by introducing water charges by requiring better monitoring, introducing charges, or improving management systems
- Rehabilitating or upgrading irrigation infrastructure as needed to reduce system losses (e.g., in the Red River Delta); potentially expanding irrigation infrastructure and/or climate proofing at-risk infrastructure in select areas (e.g., in the Central region)
- Funding education, training, and research to strengthen veterinary services
- Restoring mangrove forests (lost to aquaculture) as a natural barrier to flooding and storm surges in coastal areas (“green dykes”); incentivizing producers to abandon intensive aquaculture (e.g., intensive shrimp farming) in favor of extensive, agro-ecological aquaculture (e.g., mangrove-shrimp polyculture)
- Developing plans for more integrated management of coastal zones, and improved collaboration among Mekong states to manage water quality and availability—and only potentially investing in coastal embankments (in many cases, this may not qualify as “no regrets”)
- Strengthening innovation systems, with a broad focus on fostering a dynamic, multi-stakeholder, multi-directional ecosystems, rather than on scientific research exclusively
- Continuing to build an institutional architecture to coordinate and prioritize climate change response through all of government, at the national and sub-national levels


Fostering Learning for Knowledge-Based Agriculture

Vietnam’s ability to respond to both environmental and market pressures in years ahead will require it to incorporate increasingly sophisticated levels of knowledge into decision-making, production techniques, and management processes at the farm level and beyond. For example, farmers will be in a better position to compete, while generating more from less, if they are able to base what they grow and how they grow it on a strong, evidence-based grasp of the resources they have to farm with, of weather, phytosanitary and other risks they face, and of consumer preferences (including for greener production processes) and price dynamics. And they will better be able to compete if they can do this with access to the best solutions science has to offer to the specific challenges

they face. Shifting from a resource-intensive to knowledge based agriculture will, among other things, require major changes in the ways in which farmers learn and gain access to technical and commercial information. This has particular implications for Vietnam’s extension and advisory services, the training and educational opportunities it offers individuals working in the sector, as well as data management systems, as discussed below.

Agricultural extension. Agricultural extension in Vietnam has traditionally been top-down and supply driven. Large numbers of public extension officers continue to work at provincial, district and local levels, providing training, organizing demonstration models (related to new varieties or different agronomic practices), help farmers to respond to outbreaks of pests or diseases, and supporting the implementation of a variety of localized schemes. The government has recognized the need for and value of socializing advisory services, encouraging the involvement of universities, private enterprises, and NGOs in advising farmers, and encouraging a more multi-directional flow of information. Central government funding for certain extension programs have established a competitive bidding process, enabling non-state entities to increase their activity.⁴⁵ Recent projects supported with development assistance funding have also sought to encourage private extension work. Agro-enterprises which are entering into contracts or partnerships with farmer groups are likewise fielding staff to serve advisory and monitoring functions. This will become increasingly important where companies will be needed to have an effective traceability system for their products and raw materials. yet despite these developments a broader rethink is needed regarding the objectives (i.e. beyond crop yields), approaches, and methodologies for extension.

The government and traditional public sector extension services may still have an important role to play, though less as the main provider of centralized advisory services and more as a broker, mobilizer and funder of services provided by others. For many extension agencies, moving into these roles will rest on an embrace of structural and cultural changes, both internal and external to their organization. In particular, integrating brokerage functions into traditional extension services will often require these institutions to build new skillsets, reframe their mission, and modify staff incentives by changing performance measurement criteria. Brokering requires specific facilitation skills for managing group processes and building trust; and it cannot be judged by traditional performance indicators such as publications or numbers of trainings. Vietnamese policy-makers might consider how approaches from elsewhere could be applied locally.

 For example, Thematic Sheet C unveils the concept of extension-plus and how it has been implemented in other countries.

Competitiveness in Domestic and International Markets

A 2014 OECD study (Diaz-Bonilla et al. 2014) found the enabling environment for agricultural growth and competitiveness to be (far) less favorable in Vietnam than for an array of countries—including Brazil, Chile, China, Colombia, Mexico, Thailand, and Turkey—with which Vietnamese agriculture competes in regional

⁴⁵ Recent projects supported with development assistance funding have also sought to encourage private extension work. Agro-enterprises which are entering into contracts or ‘partnerships’ with farmer groups are likewise fielding staff to serve advisory and monitoring functions. This will become increasingly important where companies will be needed to have an effective traceability system for their products and raw materials.

or international markets. The study developed an agricultural growth enabling index (AGEI) based upon multiple indicators that were clustered in four groups: economy-wide governance, human and physical capital availability, market operations (for goods, labor and financial services), and agriculture/rural institutions (and public spending). Twenty low and middle-income countries were rated using this index. Overall, Vietnam ranked in 14th place, ahead of only Pakistan, Egypt, and a number of African countries. In each of the AGEI's four sub-categories, Vietnam scored at or below the average for the twenty countries—suggesting that its agricultural sector currently faces head-winds in its efforts to modernize and compete globally.


Just as the AGEI intends to capture a multi-dimensional reality, the levers for improving competitiveness—in both domestic and international markets—are many and diverse. Those explored below include the institutions and processes involved in research and innovation, food safety control, collective action, and market creation. In these and other domains, Vietnam will need to intervene proactively considering the towering domestic market opportunity that is currently Vietnam's to lose; the squeeze of declining prices and multiplying competitors in international commodity markets—and the challenges of responding convincingly to the evolving (and ever-more exacting) demands and concerns of consumers.

Stimulating Innovation throughout Agro-food Value Chains

How effectively it can seize domestic demand opportunities, compete in commodity markets and remain food secure—in a changing climate—will depend upon how well Vietnam innovates. As has already been argued, this will call for continued reforms in Vietnam's innovation policy to sharpen the country's research and absorption capabilities.

Research. While Vietnam's agricultural strategy has come to embrace a broad set of themes—including post-harvest management, climate change adaptation, advances in quality and value-addition, and so forth—the focus of most publically funded programs has remained on agricultural production. In addition, research priorities remain are still identified centrally, to a large extent, and may not be aligned with regional or local (business) needs. Public funding for agricultural research is provided through MARD, provincial governments and the Ministry of Science and Technology, and although the size of the envelope has increased—it rose from some \$10 million in 2000 to \$40 million in 2012—it is small in comparison to that of Asian peers as a fraction of agricultural GDP.⁴⁶


In recent years, competitive processes have gained favor as a means of allocating research funding, as they are seen as a means of encouraging research institutes to become more autonomous, responsive to demand, and commercially driven. yet, the reform process of the agricultural research system is still at an early stage. In this respect, Vietnam may find merit in placing increasing emphasis on more demand-responsive and multi-disciplinary research, and on multi-stakeholder consortium models involving research institutes, universities, industry, and farmers.

 Thematic Sheet B provides views on roles of research and development institutes and universities in innovation processes.

⁴⁶ In 2008, Vietnam spent the equivalent of 0.2 percent of its agricultural GDP on research. The comparative shares for China and Malaysia were 0.5 and 1.0 percent, respectively.

Absorption. Vietnam will also want to gravitate toward more effective technology absorption—not only by farmers (see previous section on knowledge-based agriculture and Thematic Sheet C on extension), but also by agro-enterprise SMEs. The absorption of technology by producers and agro-food enterprises is a weak link in many transitioning agricultural innovation systems, including Vietnam’s. A lack of dynamism in firms’ embrace of improved processes or tools can be symptomatic of innovation systems in which the development of new technologies or improved ways of doing things is separate from firms’ activities, or includes limited involvement of these in innovation processes. It can reflect the notion and reality that technology absorption is separate from innovation, and a resulting weak capacity on the part of firms to absorb technology that they played little role in conceiving or developing. This separation limits firms’ opportunities to learn-by-doing, or to shape technology developments that are well-tailored to their day-to-day business needs. Other factors that contribute to weighing down technology absorption by firms include a lack of investment and especially venture funding, inadequate support for the development of business plans and marketing strategies especially, and a lack of tools and appetite for risk-taking.

Over the past 15–20 years, agribusiness incubation has developed as one means of stimulating technology absorption—generally focusing on young enterprises and entrepreneurs—and enabling constructive risk-taking. Agribusiness incubators directly engage with startups to help them grow, usually offering them a range of advisory and business development services geared to improving firms’ competitiveness and access to markets. Several have a track record in transforming comparative advantages in commodity markets into competitive advantages in differentiated product markets (Goletti/World Bank 2011).

 Thematic Sheet D discusses the principles and models of agribusiness incubation at greater length, and provides examples of these.

Strengthening Systems and Capacities for Managing Emerging Food Safety Risks

The processes of urbanization, industrialization, and income growth, and changes in the composition of consumer diets (favoring animal products and other high value and processed foods) have simultaneously increased the exposure of Vietnamese consumers to food safety risks and increased demand for higher standards of food safety. At stake is the Vietnamese agro-food sector’s ability to maintain and gain relevance in the rapidly evolving and growing domestic market—in short, to stake out increasing market share.

Vietnam has responded to these challenges by revamping its food safety regulations and investing in laboratories. It has also streamlined institutional structures by reducing the number of ministries in charge of food safety from the previous six to the current three. Having moved to a model that privileges decentralized support for agriculture, with some three fourths of public agricultural expenditure occurring at the provincial level, Vietnam will need to look at ways to make a devolution of food safety responsibilities work well. The government wants to utilize its existing capacity to address food safety, and plans to task agencies that were previously in charge of export food safety to take increasing responsibility for domestic food safety control. As it proceeds with these and other reforms, international experience and global trends in food safety control systems can inform the strategies it employs.

In terms of food safety governance, international experience highlights a move toward the judicious sharing of responsibilities—among levels of government as well as with private sector entities—and proactive, risk-based approaches to protecting consumer safety. Notable trends include the following.

- **Consolidation and coordination.** While a majority of OECD countries maintain several agencies in charge of food safety, the trend in emerging economies has been to consolidate food safety within one government agency (as in China and Kazakhstan). This reflects the desire to reduce barriers for collaboration between multiple agencies. In emerging economies, more than in developed economies, collaboration between government institutions is a major challenge. Through such consolidation governments expect to reduce institutional battles for spheres of influence. That said, high level coordination bodies have become common in many countries (e.g., Germany, South Korea, China) and offer an alternative to single or integrated agency structures.
- **Devolution of authority.** To address the challenge of oversight at the sub-national level, some countries have opted to entirely devolve food safety authority to regional bodies (e.g., Australia), while others—usually small ones—have opted to centralize authority without attempting to replicate national structures at the sub-national level. In the latter case, even local food safety inspectors report to a central national authority as opposed to a regional or local one. There are several trade-offs to consider in deciding between these two approaches. The devolution model allows for greater integration of food safety with other regulatory functions yet also creates the potential for inconsistent applications of national laws and regulations. It can also suffer from a lack of adequate resources being devoted by sub-national government to this function.
- **Pro-active prevention.** Many countries have moved toward approaches to food safety management that give precedence to the prevention of hazards over the inspection of finished products. While this approach has been spearheaded in developed countries, it is of high relevance to more resource-constrained countries. When it comes to prevention, the hazard analysis and critical control points (HACCP) approach is one of the best known and most widely adopted. HACCP is a management system developed in the U.S. in which food safety is addressed through the analysis and control of biological, chemical, and physical hazards from raw material production, procurement and handling, to manufacturing, distribution and consumption of the finished product (U.S. Food and Drug Administration). Its principles require that (identified and realistic) food safety hazards be prevented, eliminated, or reduced to acceptable levels.
- **Risk-profiling.** One of the defining pillars of pro-active prevention (i.e., HACCP) is the principle of hazard monitoring. One practical way to go about doing this involves auditing and assigning risk profiles to enterprises. Risk-profiling generally entails a shift from the retrospective recording of food safety breaches, to the more pro-active assessment of how likely future problems are going forward. And risk-profiling generally places less emphasis on the safety of end-products than on that of business facilities and practices. Ideally, risk-profiling also takes into account risks that arise through sourcing and primary production of the foods that firms use.

Ultimately, the governance of food safety is only as successful as its ability to widely, consistently, and durably change the behavior of the many: of consumers, of farmers, small food processors, food service workers, and of those working in agro-enterprise more broadly. And the key lesson from international experience in this respect is that it is not effective to manage risk strictly through policing. The public sector needs to seek to influence all of these players to, in essence, motivate them to in large part police themselves. Box 8 illustrates a number of ways in which government has tackled this vast challenge elsewhere.

Box 8: Approaches to Changing the Behavior of Farmers, Firms, and Consumers to Improve Food Safety

Agricultural best practices. It is common in many developed and emerging economies for public extension services to develop and disseminate agricultural best practices that are designed with food safety in mind. These exist for both crop and livestock production. In the U.S., for example, state extension services public good agricultural handbooks, and offer farmers support in applying these within the specific context of their operations.

Safe food handling protocols. In some countries, other public agencies regularly publish protocols and instructions on safe food handling in the manufacturing and service sectors. One example is the U.K.'s Safer Food, Better Business program that provides instructional materials to restaurants and small and medium food business operators.


Professional training and certification. Developed countries universally offer training and capacity building programs for small and medium enterprises. Not only do these impart knowledge on safe food handling and the serious risks associated with departures from protocol, but they also (presumably) build a professional identity and ethic that can be instrumental in changing the behavior of individuals employed in firms, even in the absence of public scrutiny. Other approaches that encourage individuals to adopt pro-social behavior can also be effective at relatively low cost.

Public disclosure of risk profiles. In restaurants, the public posting of food safety inspection results in visible places—using intuitive ratings such as smiley faces or A/B/C/D grades—has worked well across a host of cities, including Singapore, Shanghai, Beijing, and New York. For agro-food firms that do not have end-consumer-facing operations, risk-ratings carry less direct reputational risk but can still inform business-to-business transactions.

Financial support. Some countries provide matching grants or low-cost loans to companies for upgrading their food safety capacities and infrastructure.

Consumer education. Most developed countries have strong consumer education programs for food safety (e.g. U.S., EU member states). In these countries, industry and industry associations also run consumer education programs. The Grocery Manufacturing Association in the U.S. runs consumer education programs for middle-school children in less-advantaged counties and towns for instance.

Meanwhile, despite its renewed focus on food safety, the Vietnamese government has not yet identified new financial and human resources to put to task and this is putting severe resource pressure on the regulatory agencies. From this perspective, one approach—or rather collection of approaches—that the government may find informative is one in which the public sector fosters close cooperation between government and industry.

 Some of advantages of food safety co-regulation, as it is known, and applications of it in different parts of the world, are discussed in Thematic Sheet N on food safety governance.

Fostering Collective Action for Competitive and Inclusive Agricultural Value Chains


Although processes of consolidation have begun, Vietnamese agriculture remains largely characterized by fragmented production and value chain structures. Comparatively low levels of collective action have often prevented the realization of economies of scale, inhibited the development of quality management and product traceability systems, and served to weaken overall subsector governance and coordination. In Vietnam, common types of collective action organizations—including cooperatives and industry associations—have often served political rather than technical or commercial functions. yet, in recent years, the government has recognized

the importance of various forms of institutional collaboration for fostering innovation and improving industry performance. The Agricultural Restructuring Plan advocates for the broader application of public-private partnership and contract farming models.

International experience points to the multiple approaches and benefits of strengthening collective action in its many possible incarnations. Three of these are discussed in this report: producer organizations, contract farming arrangements, and agro-based clusters.

Producer organizations. While Vietnam is home to a healthy number of producer organizations, a closer look at these reveals that these are in large part made up of water management and extension-oriented cooperatives. Only a small share of cooperatives serve a commercial function on either the input or the output side. For a sector that is largely smallholder-based and increasingly but already very much market-oriented, this represents a missed opportunity to tame high transaction costs that arise across a variety of agricultural activities. The aggregation of supply, record keeping, short-term storage, negotiation and coordination with downstream buyers and upstream input suppliers are examples of a range of functions in which Vietnamese producer organizations have yet to meet the full potential for economies of scope and scale.

Government can support producer and industry organizations in two broad ways: it can invest in institutional strengthening, and it can use its legal and regulatory authority to create a supportive environment. The public sector can help build stronger organizations by funding technical assistance for such efforts as participatory institutional assessments, administrative and governance reforms, leadership building, and the development of learning and information exchange mechanisms. It can also directly fund targeted activities, or personnel such as organizational facilitators and brokers; and deploy economic incentives for businesses and research organizations to work with these organizations, increasing their relevance in the value chain.

 A more detailed account of the different functions producer organizations can take on, and where this can lead, is offered in Thematic Sheet K.

Contract farming. Besides being mentioned in the ARP, contract farming is relevant to Vietnamese in as much as the sector boasts a paucity of regularized relationships between suppliers and downstream buyers. This makes things like tracing products and ensuring the reliability and quality of supply difficult. Along with the development of systems that support these, the development of more formal relationships in the value chain will become increasingly valuable as aspects such as quality come to the fore in targeting certain consumers.

While contract farming is primarily private-sector led, government support for such arrangements is not uncommon on the grounds that these can contribute to meeting broader policy objectives such as inclusive growth, food security, or the protection of natural resources. Besides improving the enabling environment (e.g., the rule of law, the quality of infrastructure, health, and education, political stability, financial markets, and so forth), the public sector can encourage contract farming by facilitating interactions and brokering transactions among potential counterparts, establishing a legal framework for farming contracts, putting economic incentives in place, building technical and institutional capacity, and educating counterparts about potential benefits and risks. That said, the public sector needs to tread carefully. A number of contract farming arrangements have owed

their failure to facilitators in the public or non-profit sector getting ahead of value chain actors and pushing for arrangements that were not in line with existing capacities, ambitions, risk-preference, or levels of trust; or that put development objectives ahead of business viability.

Thematic Sheet L covers contract farming in greater depth and discusses an East Asian variant of this model.

Clusters. Agro-based cluster development will be an appropriate strategy in a number of Vietnamese contexts in which important gains could come from strengthening (cooperative and competitive) linkages among farmers and various commercial players, as well as the infrastructure that underpins these. Cluster development lends itself to incremental forms of public sector support. In an initial phase, the public sector can be involved in sowing the seeds of institutional reform by building trust, encouraging collaboration, and helping to strengthen local infrastructure. And it can focus on supporting a series of small value chain initiatives that accompany process and later product upgrading, and build confidence in cluster activities. In subsequent phases, support can focus on access to finance, incentives for startups, and measures to attract and develop entrepreneurs, and potentially the creation of special economic zones.

Thematic Sheet M takes a look at examples of agro-based clusters in Latin America.

Repositioning and Rebranding Vietnamese Agriculture in International Markets

The bulk of Vietnam’s agricultural exports consist of primary commodities which are often invisible to their users or end-consumers. From this perspective, it is instructive to draw insights from the experiences of other countries where competitive pressures and market opportunities have stimulated shifts, in various parts of agro-industry, to differentiated commodities or higher value-added products. These repositioning strategies have invariably been multi-pronged and involved government in varied roles. Examples include investing in human capital, including in higher technical education; establishing a legal space in which intellectual property is recognized and protected; requiring that producers abide by certain production practices, namely in the name of social, environmental, or reputational/label protection; and working closely with industry to help package and possibly orchestrate the marketing of such things as cultural heritage, environmental protection and product quality

Thematic Sheet O provides examples in which agro-industry has successfully been supported in efforts to move toward higher-value, more differentiated products, thus shifting its product mix.

For Vietnam, there would also be benefits in constructing a (more) positive national brand in certain industries. This could help in attracting FDI and tourism and more generally promote exports and domestic sales. There are a number of international examples of public-private collaboration in this endeavor. These cases illustrate

how the national or regional branding of a product—combining elements of marketing, legal protection, and quality management—can have a transformative effect on both domestic and international markets.

↑ The examples highlighted in Thematic Sheet P relate to Pu'er tea from the yunnan province of China, Mexican tequila, market check-off programs in the United States, and single-origin coffees and teas from multiple countries.

Conclusions

Over the past quarter century, Vietnam’s agricultural sector has made enormous progress. Steady advances in smallholder rice productivity and intensification through the 1990s and beyond played a central role in the Vietnam’s successes in poverty reduction, national food security, and social stability. Over a relatively short period, Vietnam emerged as a major global supplier of a broad range of food and agricultural commodities. In these and some other areas, Vietnam’s agriculture has matched or outperformed that of many other developing countries.

Nevertheless, there are growing concerns related to the quality and sustainability of Vietnam’s agricultural growth and related patterns of development. This report has provided evidence which supports these concerns—pertaining to low smallholder farmer profitability, low agricultural worker productivity, low or mixed product quality, and low value-addition. A large proportion of Vietnam’s agricultural growth has stemmed from expanded or more intensive use of land and other natural resources and relatively heavy use of fertilizer and agro-chemicals. As a result, aspects of Vietnam’s agricultural success have come at the expense of the environment, including processes of deforestation and fishery resource depletion, and a growing incidence of land degradation and water pollution. Hence, Vietnam’s agricultural growth has relied very heavily on human, natural, and chemical factors of production. For the most part, more output has come from more and more inputs and increasing environmental costs.

Vietnam’s agriculture now sits at a critical turning point. While there are several very dynamic elements within the sector, recent aggregate trends have included declining rates of sectoral GDP and productivity growth and a growing gap between farm and non-farm incomes. Some environmental problems are now adversely impacting both productivity and the international position of Vietnam’s commodities. Administrative controls on land, and direct state involvement in both input and output markets have been important factors in the sector’s stability and inclusive growth over recent decades. yet these policies and certain legacy institutions seem now to be delaying or stunting the agricultural sector’s transformation in directions needed to serve a continued important role in a modernizing middle-income country.

The agricultural sector now faces growing domestic competition—from cities, industry, and services—for labor, land and water. Rising labor costs are beginning to inhibit the sector’s ability to compete globally as a low cost producer of bulk, undifferentiated commodities. The consequences of over-intensive input- and natural resource-use—both for the environment and for farmer profitability—are being increasingly recognized. Vietnam’s agriculture will need to generate more from less. That is, it will need to generate more economic value (and farmer and consumer welfare) using less natural, human, and other forms of capital. Future growth will need to depend upon increased efficiency and innovation.

Major opportunities will be available both in the domestic and international market, yet effectively competing in these markets will depend upon the ability of farmers and firms to deliver products on a reliable basis, with predictable quality, assured food safety, and clear evidence of sustainable practices. This was recently highlighted in the Agricultural Restructuring Plan, approved by the Prime Minister in June, 2014. The ARP outlined a conceptual and strategic re-orientation, with sectoral goals to be set in the framework of the triple bottom line of sustainable development (i.e. economic, social and environmental) and with major changes expected in the roles and spending patterns of the government in the sector. There are currently many initiatives aiming in these

directions. yet achieving the shift on a large, sector-wide scale will require changes in some important economy-wide and sectoral policies and, over time, major changes and additions to the core institutions servicing agriculture. This report has argued that the modernization of Vietnamese agriculture will necessitate that the government lead less but facilitate considerably more. Numerous illustrations of effective facilitative roles of government and of effective collaborative initiatives of the public and private sectors—from both high income and emerging countries—have been provided to help further inform Vietnam’s agricultural policy and institutional reform process.

References

- Agrifood Consulting International. 2014. "Scoping Study on the Challenges for the Animal Feed Complex in East Asia." Paper prepared for the World Bank.
- Amanor-Boadu, V., M. Boland, and D. Barton. 2003. "Ocean Spray Cranberries at the Crossroads." Arthur Capper Cooperative Center Case Study Series No 03-01. Agricultural Marketing Resource Center. http://www.agmrc.org/media/cms/oceanspray_4bb99d38246c8.pdf
- Amarasinghe, U.A., C.T. Hoanh, D. D'haeze, T.Q. Hung. 2015. Toward Sustainable Coffee Production in Vietnam: More Coffee with Less Water. *Agricultural Systems* 136 (2015) 96–105. doi: 10.1016/j.agsy.2015.02.008 http://www.researchgate.net/profile/Dave_Dhaeze/publication/273790736_Toward_sustainable_coffee_production_in_Vietnam_More_coffee_with_less_water/links/5562ea5908ae86c06b65ff18.pdf?inViewer=true&pdfJsDownload=true&disableCoverPage=true&origin=publication_detail
- Barham, J., D. Tropp, K. Enterline, J. Farbman, J. Fisk, and S. Kiraly. 2012. *Regional Food Hub Resource Guide: Food Hub Impacts on Regional Food Systems, and the Resources Available to Support Their Growth and Development*. United States Department of Agriculture, Washington D.C. <http://dx.doi.org/10.9752/MS046.04-2012>
- Benett, M., M. Echavarria, K. Fierro, and H. Huber-Stearns. 2013. "Charting New Waters: State of Watershed Payments 2012." Ecosystem Marketplace, a Forest Trends initiative. http://www.forest-trends.org/documents/files/doc_3308.pdf
- Biodiversity and Agricultural Commodities Program of the International Finance Corporation website (on Alianca da Terra). http://www.ifc.org/wps/wcm/connect/regprojects_ext_content/ifc_external_corporate_site/bacp/projects/projsummary_aliancadaterra
- Bord Bia. Origin Green Ireland website. <http://www.origingreen.ie/>
- Bordey F., Moya P., Beltran J., Launio C., Litonjua A., Manalili R., Mataia A., Besenio J., Macalintal F., Malasa R., Marciano E., Milanes M., Paran S., Redondo G., Relado R., San Valentin M., Tanzo I., Tulay E., Valencia S., Viray C., yusongco C. 2014. Benchmarking the cost and profitability of paddy production in selected Asian rice bowls. Presented at 8th meeting of Asian Society of Agricultural Economics, Dhaka, Bangladesh.
- Brandt. 2015. Land and Property Rights in Vietnam: Perspectives from the 2014 Land Module. Unpublished note.
- Briones, R. and J. Felipe. 2013, "Agriculture and Structural Transformation in Developing Asia: Review and Outlook", ADB Working Paper Series, No. 363.
- Burke, J. and multiple associates. 2015. East Asia Irrigation Modernization – A Synthesis of National Assessments from China, Indonesia, Malaysia, Thailand & Vietnam. Collaborative World Bank/FAO/ADB study.
- Carey, C. 2008. "Governmental Use of Voluntary Standards Case Study 9: Tunisia's Organic Standard." ISEAL Alliance. London. http://www.isealalliance.org/sites/default/files/E054_Tunisia_Organic.pdf
- Cebeco India Ltd. for the Kerala Department of Agriculture. 2003. Setting Up of Agricultural Export Zones in Kerala for Selected Horticultural Products." <http://www.keralaagriculture.gov.in/html/aez/Aez%20Kerala.pdf>
- Center for International Forestry Research. 2006. "What are 'payments for environmental services'?" http://www.cifor.org/pes/_ref/about/index.htm
- Cestti, R. J. Srivastava, and S. Jung. 2003. "Agriculture Non-point Source Pollution Control Good Management Practices: Chesapeake Bay Experience." World Bank. Washington D.C. <http://lshs.tamu.edu/docs/lshs/end-notes/agricultural%20nps%20pollution%20control%20good%20management%20practices-2134197531/agricultural%20nps%20pollution%20control%20good%20management%20practices.pdf>

- Cestti, R. J. Srivastava, and S. Jung. 2003. "Agriculture Non-point Source Pollution Control Good Management Practices: Chesapeake Bay Experience." World Bank. Washington D.C. <http://lshs.tamu.edu/docs/lshs/end-notes/agricultural%20nps%20pollution%20control%20good%20management%20practices-2134197531/agricultural%20nps%20pollution%20control%20good%20management%20practices.pdf>
- Chesapeake Bay Program website. <http://www.chesapeakebay.net/chesapeakebaywatershedagreement/page>
- Chesapeake Bay Program. 2008. "Chesapeake Bay 2007 Health and Restoration Assessment: A Report to the Citizens of the Bay Region." United States Environmental Protection Agency. EPA-903-R-08-002. http://www.chesapeakebay.net/documents/cbp_26038.pdf
- Chesapeake Bay Program. 2013. "The Chesapeake Bay Program 2013: A Report to Congress." United States Environmental Protection Agency, Annapolis. http://www.chesapeakebay.net/documents/cbp_rtc_2013.pdf
- Cheung, William W. L., Lam, V. W. y., Sarmiento, J. L., Kearney, K., Watson, R., Zeller, D., & Pauly, D. 2010. Large-scale redistribution of maximum fisheries catch potential in the global ocean under climate change. *Global Change Biology*, 16(1), 24–35. doi:10.1111/j.1365-2486.2009.01995.x <http://onlinelibrary.wiley.com/doi/10.1111/j.1365-2486.2009.01995.x/abstract?systemMessage=Wiley+Online+Library+will+be+disrupted+on+24th+October+2015+at+10:00-10:30+BST+/-+05:00-05:30+EDT+/-+17:00-17:30+SGT++for+essential+maintenance.+Apologies+for+the+inconvenience>
- Christiaensen L. 2012. *The Role of Agriculture in a Modernizing Society: Food, Farms and Fields in China 2030*. World Bank, Washington, D.C.
- Climate and Land-use Alliance. 2014. "Disrupting the Global Commodity Business: How Strange Bedfellows Are Transforming a Trillion-Dollar Industry to Protect Forests, Benefit Local Communities, and Slow Global Warming." http://www.climateandlandusealliance.org/uploads/PDFs/Disrupting_Global_Commodity.pdf
- Convertino, M., C.M. Foran, J.M. Keisler, L. Scarlett, A. LoSchiavo, G.A. Kiker, I. Linkov. 2013. Enhanced Adaptive Management: Application to the Everglades Ecosystem. *Scientific Reports (Nature Publishing Group)* 3, Article number: 2922. doi:10.1038/srep02922 <http://www.nature.com/articles/srep02922>
- D’Haeze, D., Decker, J., Raes, D., Phong. T.A., Chanh, N.D.M. 2003. Over-irrigation of *Coffea canephora* in the Central Highlands of Vietnam revisited – simulation of soil moisture dynamics in Rhodic Ferralsols. *Agricultural Water Management* 63(3):185-202.
- Dasgupta, S, Meisner, C., Wheeler, D., xuyen, K., Lam, N. T. 2007. Pesticide poisoning of farm workers – implications of blood test results from Vietnam. *International Journal of Hygiene and Environmental Health* 210(2):121–132.
- Dawe, D. 2015. "Agricultural transition in the context of structural transformation." Background paper prepared for the World Bank.
- Dawe, D., Jaffee, S., and N. Santos, eds. 2014. *Rice in the Shadow of Skyscrapers: Policy Choices in a Dynamic East Asian Setting*. FAO. Rome.
- De Silva, S.S. and Soto, D. 2009. Climate change and aquaculture: potential impacts, adaptation and mitigation. In K. Cochrane, C. De young, D. Soto and T. Bahri (eds). *Climate change implications for fisheries and aquaculture: overview of current scientific knowledge*. FAO Fisheries and Aquaculture Technical Paper. No. 530. Rome, FAO. <http://www.fao.org/docrep/012/i0994e/i0994e04.pdf>
- Development Analysis Network. 2003. *Off-farm and Non-farm Employment in Southeast Asia Transitional Economies and Thailand*. Development Analysis Network. <http://www.cdri.org.kh/webdata/download/dan/ddan3.pdf>

- Development Economics Research Group, University of Copenhagen and Central Institute for Economic Management (CIEM), Ministry of Planning and Investment of Vietnam. 2010. *The Fisheries Sector in Vietnam: A Strategic Economic Analysis*. Report commissioned by Royal Embassy of Denmark in Vietnam Fisheries Sector Programme Support (FSPS) II. [CIEM 2010]
- DHAN Foundation. 2013. "Urea Deep Placement Technology." <http://www.dhan.org/development-matters/2013/02/urea-deep-placement-technology/>
- Diaz-Bonilla, E., D. Orden, and A. Kwieciński. 2014. *Enabling Environment for Agricultural Growth and Competitiveness: Evaluation, Indicators and Indices*. OECD Food, Agriculture and Fisheries Papers, No. 67, OECD Publishing. <http://dx.doi.org/10.1787/5jz48305h4vd-en>
- Diaz Rios, L. 2013. "Evolving Role of Commodity Authorities in Coffee, Cocoa and Tea Sectors." World Bank, Washington D.C.
- Diaz Rios, L. 2015. *Market Promotion Initiatives: Experiences from Cocoa, Coffee, and Tea Sectors*. Prepared for the Ministry of Trade, the Republic of Indonesia through the World Bank Technical Assistance on Competitiveness and Sustainability of Beverage Crops in Indonesia, funded by the Multi Donor Trust Fund for Trade and Investment Climate. Working Paper #4, February 2015.
- Diaz Rios, L. and S. Jaffee. 2012. "Enhancing Competitiveness via Sustainable Practices and Product Differentiation in Agricultural Value Chains: Lessons for Vietnam and Other Middle-income Country Experiences." The World Bank Group, Washington D.C.
- Easton, P. on behalf of the SAI Platform Water & Agriculture Working Group. 2013. "Water Stewardship in Sustainable Agriculture: Beyond the Farm Towards a Catchment Approach." <http://www.saiplatform.org/uploads/SAI%20Platform%20Water%20Stewardship%20report.pdf>
- Food and Agriculture Organization (FAO). 2010. "'Climate-smart' Agriculture: Policies, Practices and Financing for Food Security, Adaptation and Mitigation." Prepared for the Hague Conference on Agriculture, Food Security and Climate Change held on October 31 to November 5, 2010. http://www.fao.org/fileadmin/user_upload/newsroom/docs/the-hague-conference-fao-paper.pdf
- Food and Agriculture Organization (FAO). 2013. "Guidelines to Control Water Pollution from Agriculture in China: Decoupling Water Pollution from Agricultural Production." FAO Water Reports 40. Rome. <http://www.fao.org/docrep/019/i3536e/i3536e.pdf>
- Food and Agriculture Organization (FAO). 2013. *Climate-smart Agriculture Sourcebook*. Washington, D.C. <http://www.fao.org/docrep/018/i3325e/i3325e.pdf>
- Food and Agriculture Organization (FAO). 2014. *Public Sector Support for Inclusive Agribusiness Development*. Country case studies for Bangladesh, Indonesia, Malaysia, Nepal, the Philippines, and Vietnam.
- Food and Agriculture Organization. 2010. "'Climate-smart' Agriculture: Policies, Practices and Financing for Food Security, Adaptation and Mitigation." Prepared for the Hague Conference on Agriculture, Food Security and Climate Change held on October 31 to November 5, 2010. http://www.fao.org/fileadmin/user_upload/newsroom/docs/the-hague-conference-fao-paper.pdf
- Food and Agriculture Organization. 2013. "Guidelines to Control Water Pollution from Agriculture in China: Decoupling Water Pollution from Agricultural Production." FAO Water Reports 40. Rome. <http://www.fao.org/docrep/019/i3536e/i3536e.pdf>
- Food and Agriculture Organization. 2013. *Climate-smart Agriculture Sourcebook*. Washington, D.C. <http://www.fao.org/docrep/018/i3325e/i3325e.pdf>
- Forest Trends, The Katoomba Group, and UNEP. 2008. "Payments for Ecosystem Services - Getting Started: A Primer." http://www.unep.org/pdf/PaymentsForEcosystemServices_en.pdf

- Fuglie, K. 2012. "Productivity Growth and Technology Capital in the Global Agricultural Economy." *Productivity Growth in Agriculture: An International Perspective* (Keith O. Fuglie, Sun Ling Wang and V. Eldon Ball, eds.). Oxfordshire, UK: CAB International.
- Galvez-Nogales, E. 2010. "Agro-based Clusters in Developing Countries: Staying Competitive in a Globalized Economy." Agricultural management, Marketing and Finance Occasional Paper 25. Food and Agricultural Organization, Rome. <http://www.fao.org/docrep/012/i1560e/i1560e.pdf>
- Gaytan, M.S. 2014. *Tequila! Distilling the Spirit of Mexico*. Stanford University Press, Stanford. <https://books.google.com/books?hl=en&lr=&id=as7ZBAAQBAJ&oi=fnd&pg=PP6&dq=mezcal+commercialization+brand&ots=UmSFQz2MZx&sig=1gJh9wtQlclx79mazdtTQx89vUI#v=onepage&q&f=true>
- Giesecke, J., Tran, N. and Jaffee, S. 2013. Rice-land Designation Policy in Vietnam and the Implications of Policy Reform for Food Security and Economic Welfare, *Journal of Development Economics*.
- Giovanucci, D. 2015. Opportunities for Adding Value: The Coffee, Cocoa and Tea Industries of Indonesia. Prepared for the Ministry of Trade, the Republic of Indonesia through the World Bank Technical Assistance on Competitiveness and Sustainability of Beverage Crops in Indonesia, funded by the Multi Donor Trust Fund for Trade and Investment Climate. Working Paper #5, February 2015.
- GlobalG.A.P. 2013. "New Member Joburg Fresh Produce Market, South Africa's Premier Food Hub, Endorses IcalG.a.p. & GlobalG.A.P." [http://www.globalgap.org/uk_en/media-events/news/articles/New-Member-Joburg-Fresh-Produce-Market-South-Africas-Premier-Food-Hub-Endorses-localg.a.p.-GLOBALG.A.P./](http://www.globalgap.org/uk_en/media-events/news/articles/New-Member-Joburg-Fresh-Produce-Market-South-Africas-Premier-Food-Hub-Endorses-localg.a.p.-GLOBALG.A.P/)
- Goletti, F. with R. Kopicki, E.R. Hansen, and J. Thaller. 2011. *Growing Food, Products, and Businesses: Applying Business Incubation to Agribusiness SMEs*. infoDev, World Bank, Washington D.C. https://www.infodev.org/infodev-files/resource/InfodevDocuments_1139.pdf
- Haggard, J. and K. Schepp. 2012. Coffee and Climate Change Impacts and options for adaption in Brazil, Guatemala, Tanzania and Vietnam. NRI Working Paper Series: Climate Change, Agriculture and Natural Resources, Natural Resources Institute No. 4. http://www.nri.org/images/documents/promotional_material/D5930-11_NRI_Coffee_Climate_Change_WEB.pdf
- Hall, A., Dijkman, J., and Sulaiman, R. 2010. Research Into Use: Investigating the Relationship Between Agricultural Research and Innovation. UNU-MERIT. <http://www.merit.unu.edu/publications/wppdf/2010/wp2010-044.pdf>
- Havemann, T., Nair, S., Cassou, E. and Jaffee, S. 2015. Coffee in Dak Lak, Vietnam. In Scherr, S., Mankad, K., Jaffee, S. and Negra, C., Steps toward Green: Policy Responses to the Environmental Footprint of Commodity Agriculture in East and Southeast Asia. Co-editor with S. Scherr, K. Mankad, and C. Negra. EcoAgriculture Partners. Washington, D.C.
- Herbel, D., E. Crowley, N. Ourabah Haddad, M. Lee. 2012. *Good Practices in Building Innovative Rural Institutions to Increase Food Security*. Food and Agriculture Organization, Rome. <http://www.fao.org/docrep/015/i2258e/i2258e00.pdf>
- Hoang, T.x., C.S. Pham, and M.A. Ulubasoglu. 2014. Non-Farm Activity, Household Expenditure, and Poverty Reduction in Rural Vietnam: 2002-2008. *World Development*. doi:10.1016/j.worlddev.2014.06.027 http://ac.els-cdn.com/libproxy-wb.imf.org/S0305750x14001934/1-s2.0-S0305750x14001934-main.pdf?_tid=f61b0a00-79d8-11e5-8aaa-00000aacb361&acdnat=1445641025_e86bf7f35f4ab964a3b2f8af7b397383
- Holling, C.S., editor. 1978. Adaptive Environmental Assessment and Management. John Wiley and Sons, London.
- Hutchison, S. with L. Aquino. 2011. "Making a Pact to Tackle Deforestation in Paraguay." World Wildlife Fund-UK. <http://internationaltreefoundation.org/wp-content/uploads/2011/04/Paraguay-FINAL-30-march-2011.pdf>

- IFPRI. 2008. Reducing poverty and hunger in Asia. Asian food market transformation: Policy challenges to promote competitiveness with inclusiveness. IFPRI Focus 15, Brief 7 of 15.
- Imai, K. S., Gaiha, R., and Thapa, G. 2015. "Does non-farm sector employment reduce rural poverty and vulnerability? Evidence from Vietnam and India." *Journal of Asian Economics* 36, no. 2 (2015) : 47-61. eScholarID:244719 | DOI:10.1016/j.asieco.2015.01.001 http://ac.els-cdn.com/S1049007815000020/1-s2.0-S1049007815000020-main.pdf?_tid=5a270076-79d9-11e5-964b-00000aab0f26&acdnat=1445641193_3bcb9276f96d66ad7ee9f81d3611a147
- International Center for Tropical Agriculture (CIAT). 2012. Future Climate Scenarios for Vietnam's *Robusta* Coffee Growing Areas. [CIAT 2012] http://www.coffeeandclimate.org/reports_studies.html?file=tl_files/CoffeeAndClimate/Future%20Climate%20Scenarios/CIAT_Vietnam_Future%20Climate%20Scenarios_ENG.pdf
- International Centre for Environmental Management. 2010. Strategic Environmental Assessment of Hydropower on the Mekong Mainstream, Final Report. Prepared for Mekong River Commission.
- International Fund for Agricultural Development (IFAD). 2014. Comprehensive environment and climate change assessment in Vietnam. http://www.ifad.org/climate/asap/cc_vietnam.pdf
- Jacobs, A. "A County in China Sees Its Fortunes in Tea Leaves Until a Bubble Bursts." *The New York Times*, January 16, 2009. http://www.nytimes.com/2009/01/17/world/asia/17tea.html?pagewanted=all&_r=1&
- Jaffee, S. 2004. *Delivering and Taking the Heat: Indian Species and Evolving Product and Process Standards*. World Bank, Washington D.C.
- Jaffee, S. with Gordon, P. 1992 "Exporting High-value Food Commodities: Success Stories from Developing Countries." World Bank Discussion Paper 198, Washington D.C.
- Jaffee, S., Nguyen, D., Nguyen, Q., Dao, T.A., Nguyen, D., Nguyen, M., Nguyen, V. and Nguyen, P. 2012. Moving the Goal Posts: Vietnam's Evolving Rice Balance and Other Food Security Considerations. Vietnam Rice, Farmers and Development: From Successful Growth to Sustainable Prosperity. World Bank. Hanoi. [Jaffee et al. 2012a]
- Jaffee, S., Nguyen, S., Le Canh, D., Vo, L., and Nhan, D. 2012. From Rice Bowl to Rural Development: Challenges and Opportunities Facing Vietnam's Mekong Delta Region. *Vietnam Rice Farmers and Rural Development: From Successful Growth to Sustainable Prosperity*. World Bank. Hanoi. [Jaffee et al. 2012b]
- Jamora, N. and Labaste, P. 2015. "Overview of food demand trends and prospects in East Asia." Background paper prepared for the World Bank.
- Jesse, E.V., and R.T. Rogers. 2006. "The Cranberry Industry and Ocean Spray Cooperative: Lessons in Cooperative Governance." Food System Research Group Monograph Series #19. <http://www.uwcc.wisc.edu/pdf/case%20studies/19cranberryjan06.pdf>
- JICA. 2013. Agricultural Transformation & Food Security 2040: ASEAN Region with a Focus on Vietnam, Indonesia, and Philippines – Vietnam Country Report. http://open_jicareport.jica.go.jp/pdf/12145546.pdf
- Jingtin, S. "Tempest over Tea: What Is the True Puer?" *China Daily*, June 15, 2006. http://www.chinadaily.com.cn/bizchina/2009-06/15/content_8286028.htm
- Joburg Market website. "Introduction: Joburg Market – South Africa's Premier Food Hub." http://www.joburgmarket.co.za/aboutus_intoduction.php
- Joburg Market website. "Joburg Market Now a R4 Billion Business." <http://www.joburgmarket.co.za/news-Joburg-Market-turnover-brake-through-R4-billion-mark.php>
- Joburg Market website. "Joburg Market Promote Good Agricultural Practices (GAP)." <http://www.joburgmarket.co.za/news-Quality-Mark.php>

- Joseph, G. "India Turns Net Importer of Pepper." *Business Standard*, February 21, 2013. http://www.business-standard.com/article/markets/india-turns-net-importer-of-pepper-113022100810_1.html
- Kam, S. P., Badjeck, M., Teh, L., Teh, L., & Tran, N. 2012. Autonomous adaptation to climate change by shrimp and catfish farmers in Vietnam's Mekong River Delta. http://pubs.iclarm.net/resource_centre/WF_3395.pdf
- Keyser, J., Jaffee, S. and Nguyen, T. 2013. The Financial and Economic Competitiveness of Rice and Selected Feed Crops in Northern and Southern Vietnam, World Bank. Hanoi.
- Khoi Dang, Chinh Kim, Nhung Nguyen, My Bui, Thinh Pham, Trang Le, Dao Nguyen, and Oanh Pham. 2015. Vietnam's "Green Agriculture" Strategies and Policies: Closing the Gap between Aspirations and Application. Center for Agricultural Policy. Hanoi.
- Kissinger, G. 2013. "SABMiller case study. Reducing Risk: Landscape Approaches to Sustainable Sourcing." EcoAgriculture Partners, on behalf of the Landscapes for People, Food and Nature Initiative. Washington, D.C. http://peoplefoodandnature.org/wp-content/uploads/sites/4/2014/06/reducing_risk_sabmiller_case_study.pdf
- Kuo, I. "Of All the Tea in China, 'Puer' Is the Hottest." *The Wall Street Journal*, October 2, 2007. <http://www.wsj.com/articles/SB119127746956745626>
- La, H. A., & Leung, S. 2012. Remittances from Migrants: Experience of Vietnamese Households. *Journal of Vietnamese Studies*, 7(4), 10–31. <http://www.jstor.org/stable/10.1525/vs.2012.7.4.10>
- Labaste, P., and Jaffee, S. 2015. The Transformation of Agri-Food Systems in East and Southeast Asia: Assessment and Policy Implications. World Bank. Washington, D.C.
- Le Canh Dung and Shigeki yokoyama. 2012. Dyke farming systems in An Giang province. Unpublished paper of MDI-CTU.
- Liu, C. and B. Wu. 2010. "'Grain for Green Programme' in China: Policy Making and Implementation?" Briefing Series Issue 60, April. The University of Nottingham China Policy Institute. <http://www.nottingham.ac.uk/cpi/documents/briefings/briefing-60-reforestation.pdf>
- Martinez, M.G., A. Fearn, J.A. Caswell, S. Henson. 2007. "Co-regulation as a Possible Model for Food Safety Governance: Opportunities for Public-Private Partnerships." *Food Policy* 32 (2007) 299–314. doi:10.1016/j.foodpol.2006.07.005.
- McSweeney, C., New, M. & Lizcano, G. 2010. UNDP Climate Change Country Profiles: Vietnam. [McSweeney et al. 2010 a] <http://www.geog.ox.ac.uk/research/climate/projects/undp-cp/index.html?country=Vietnam&d1=Reports>.
- McSweeney, C., New, M., Lizcano, G. & Lu, x. 2010. The UNDP Climate Change Country Profiles Improving the Accessibility of Observed and Projected Climate Information for Studies of Climate Change in Developing Countries. *Bulletin of the American Meteorological Society*, 91, 157–166. [McSweeney et al. 2010 b]
- Milder, J. C., S. J. Scherr, and C. Bracer. 2010. "Trends and future potential of payment for ecosystem services to alleviate rural poverty in developing countries." *Ecology and Society* 15(2): 4. <http://www.ecologyandsociety.org/vol15/iss2/art4/>
- Minang, P. M. van Noordwijk, O. Freemand, C. Mbow, J. de Leeuw, D. Catacutan, editors. 2015. *Climate-Smart Landscapes: Multifunctionality in Practice*. World Agroforestry Centre, Nairobi.
- Moore, K. ed. 2009. *The Sciences and Art of Adaptive Management: Innovating for Sustainable Agriculture and Natural Resource Management*. Soil and Water Conservation Society. Ankeny, Iowa. http://pdf.usaid.gov/pdf_docs/Pnads392.pdf

- Nair, S. 2015. Shrimp Aquaculture in Ca Mau, Vietnam. In Scherr, S., Mankad, K., Jaffee, S. and Negra, C., Steps toward Green: Policy Responses to the Environmental Footprint of Commodity Agriculture in East and Southeast Asia. Co-editor with S. Scherr, K. Mankad, and C. Negra. EcoAgriculture Partners. Washington, D.C.
- Narciso, G. 2015. Labour and migration in rural Vietnam. WIDER Working Paper 2015/095. United Nations University World Institute for Development Economics Research. Helsinki. http://www.wider.unu.edu/publications/working-papers/2015/en_GB/wp2015-095/_files/94641549952024585/default/wp2015-095.pdf
- National Institute for Agricultural Planning and Projection (NIAPP) 2014. Data on coffee plantings and coffee suitability maps provided to the World Bank as part of the preparation of the Sustainable Agriculture Transformation Project. [NIAPP 2014]
- National Research Council of the National Academies, Committee on the Evaluation of Chesapeake Bay Program Implementation for Nutrient Reduction to Improve Water Quality. 2011. *Achieving Nutrient and Sediment Reduction Goals in the Chesapeake Bay: An Evaluation of Program Strategies and Implementation*. ISBN 978-0-309-21079-9. National Academy of Sciences. Washington D.C. file:///T:/Agriculture/Operations_Portfolio/EAP%20Agriculture/VN2035%20Agri%20Notes/Vn2035%20for%20sorting/Chesapeake.pdf
- Newman, C. and Kinghan, C. 2015. Economic transformation and the diversification of livelihoods in rural Vietnam. WIDER Working Paper 2015/064. United Nations University World Institute for Development Economics Research. Helsinki.
- Nguyen, T. D. 2011. Land conversion for industrialization and its impacts on household livelihood strategies in Hung yen province, Northern Vietnam. Rural Economics and Development. Liege, Liege University. Doctoral dissertation, Ph. D dissertation: 190.
- Nguyen, T., Lebailly, P., Vuc, D., and Peemansd, J. 2014. The Determinants of Household Agricultural Land-use Strategies in Red River Delta, Vietnam. Le Foncier Agricole Usages, Tensions, et Regulations. June 11–12, Lyon, France.
- Nyberg, B. 1999. An Introductory Guide to Adaptive Management for Project Leaders and Participants. Forest Practices Branch, British Columbia. http://www.robinsonrancheria.org/environmental/images/New_Folder/BCIntro.pdf
- Ocean Spray Cranberries website. "Cranberry History." <http://www.oceanspray.com/Who-We-Are/Heritage/Cranberry-History.aspx>
- OECD. 2015. Vietnam: Review of Agricultural Policies. OECD, Paris.
- Organization for Economic Cooperation and Development (OECD), and Food and Agriculture Organization of the United Nations (FAO). 2015. *OECD-FAO Agricultural Outlook 2015*. OECD Publishing, Paris. [OECD/FAO 2015] http://dx.doi.org/10.1787/agr_outlook-2015-en
- Ortiz-Monasterio, J.I. and W. Raun. 2007. "Reduced Nitrogen and Improved Farm Income for Irrigated Spring Wheat in the yaqui Valley, Mexico, Using Sensor Based Nitrogen Management." *Journal of Agricultural Science* (2007), 145, 215–222. doi:10.1017/S0021859607006995. Cambridge University Press, United Kingdom. <http://repository.cimmyt.org/xmlui/bitstream/handle/10883/1495/89962.pdf?sequence=1> ;
- Peterson, G., G.A. De Leo, J.J. Hellmann, M.A. Janssen, A. Kinzig, J.R. Malcolm, K.L. O'Brien, S.E. Pope, D.S. Rothman, E. Shevliakova, and R.R.T. Tinch. 1997. Uncertainty, Climate Change, and Adaptive Management. *Conservation Ecology*. 1(2): 4. <http://www.consecol.org/vol1/iss2/art4/>
- Pham, M.H., Zita, S., Tu, B.M., Pham, H., Fabrice, G.R. 2011. Pesticide pollution in agricultural areas of Northern Vietnam: case study in Hoang Liet and Minh Dai communes. *Environmental Pollution* 159(12):3344-3350.

- Pham, T.A., Carolien, K., Simon, R. B., Arthur P.J.M. 2010. Water pollution by Pangasius production in the Mekong Delta, Vietnam: causes and options for control. *Aquaculture Research*.
- Projections Committee. Long-term Projections Report OCE-2015-1. http://www.usda.gov/oce/commodity/projections/USDA_Agricultural_Projections_to_2024.pdf
- Rapidel, B., F. DeClerck, J.-F. Le Coq, and J. Beer, editors. 2011. *Ecosystem Services from Agriculture and Agroforestry: Measurement and Payment*. Earthscan, Washington D.C.
- Reardon, T. 2015. "The Hidden Middle: The Quiet Revolution in the Midstream of the Agrifood Value Chains in Development Countries". *Oxford Review of Economic Policy*, 31 (1).
- Reardon, T. and Timmer, C.P. 2014. "The five inter-linked transformations in the Asian agrifood economy: Food security implications." *Global Food Security*.
- Scherr, S., Mankad, K., Jaffee, S. and Negra, C. 2015. Steps toward Green: Policy Responses to the Environmental Footprint of Commodity Agriculture in East and Southeast Asia. Co-editor with S. Scherr, K. Mankad, and C. Negra. EcoAgriculture Partners. Washington, D.C.
- Scherr, S.J., J.A. McNeely, editors. 2007. *Farming with Nature: The Science and Practice of Ecoagriculture*. Island Press, Washington D.C.
- Scherr, S.J., K. Mankad, S. Jaffee and C. Negra, with case studies by T. Havemann, J. Kijitkhun, U.E. Kusumajaya, S. Nair, and S. Rosenthal. Forthcoming 2015. "Steps Toward Green: Policy Responses to the Environmental Footprint of Commodity Agriculture in East and Southeast Asia." EcoAgriculture Partners and World Bank, Washington D.C.
- Sewadeh, M. and S. Jaffee, editors. 2015. *Shades of Green: Multi-Stakeholder Initiatives to Reduce the Environmental Footprint of Commercial Agriculture*. EcoAgriculture Partners as part of the Greening Export Agriculture in East and Southeast Asia initiative, Washington D.C. http://ecoagriculture.org/documents/files/doc_695.pdf
- Socialist Republic of Vietnam Ministry of Natural Resources and Environment. 2010. Vietnam's Second National Communication to the United Nations Framework Convention on Climate Change. <http://unfccc.int/resource/docs/natc/vnmnc02.pdf>
- Spices Board of India. Export statistics. http://www.indianspices.com/html/maj_impcon.htm
- Technoserve. 2013. A Business Case for Sustainable Coffee Production in Vietnam. Report prepared for IDH. Hanoi.
- The Nature Conservancy. "Working with Companies: SABMiller." <http://www.nature.org/about-us/working-with-companies/companies-we-work-with/sabmiller.xml>
- Tidd, J. 2006. A review of innovation models. Imperial College London, 16. <http://ict.udlap.mx/projects/cudi/sipi/files/Innovation%20models%20Imperial%20College%20London.pdf>
- Timmer, C.P. 2008. "A World without Agriculture: The Structural Transformation in Historical Perspective." The Henry Wendt Lecture Series. American Enterprise Institute. Washington, DC.
- Tran Thu Ha. 2015, April 15. Dissemination and regional policy dialogue workshop on low emission and sustainable rice cultivation. A presentation of the Vietnam Low carbon Rice Project (VLCRP), supported by DFAT the Australia Government.
- Trejo-Pech, C.O., C. Lopez-Reyna, L.A. House, and W. Messina. "Appellation of Origin Status and Economic Development: A Case Study of the Mezcal Industry." *International Food and Agribusiness Management Review*, Volume 13, Issue 2. http://www.ifama.org/files/MezcalIndustry_20091043.pdf
- United Nations Educational, Scientific and Cultural Organization (UNESCO). "World Heritage List." <http://whc.unesco.org/en/list/>
- United Nations Educational, Scientific and Cultural Organization. 2013. "Ancient Tea Plantations of Jingmai Mountain in Pu'er." <http://whc.unesco.org/en/tentativelists/5810/>

- United Nations Environment Programme (UNEP). 2012. *Avoiding Future Famines: Strengthening the Ecological Foundation of Food Security through Sustainable Food Systems*. Nairobi. <http://mahb.stanford.edu/wp-content/uploads/2013/02/2012-UNEP-Avoiding-Famines-Food-Security-Report.pdf>
- United Nations, Department of Economic and Social Affairs, Population Division. 2014. *World Urbanization Prospects: The 2014 Revision*.
- United States Agency for International Development (USAID). 2013. *Mekong Adaptation and Resilience to Climate change (Mekong ARCC) Synthesis Report*. http://www.mekongarcc.net/sites/default/files/mekongarcc_draft_synthesis_report.pdf
- United States Department of Agriculture Farm Service Agency (USDA). Conservation Reserve Program website. <http://www.fsa.usda.gov/programs-and-services/conservation-programs/prospective-participants/index>
- United States Department of Agriculture, Office of the Chief Economist, World Agricultural Outlook Board. *USDA Agricultural Projections to 2024*. Prepared by the Interagency Agricultural Projections Committee. Long-term Projections Report OCE-2015-1 [USDA 2015] http://www.usda.gov/oce/commodity/projections/USDA_Agricultural_Projections_to_2024.pdf
- Vegetable and Fruit Promotion Council Keralam website. <http://www.vfpck.org/noticeboard.asp?ID=2>
- Verhofstadt, E., Maertens, M., and Swinnen, J. 2014. "Scoping Study on Inclusiveness in Agri-Food Supply Chains in East and Southeast Asia." World Bank.
- Vu, M.Q., Le, Q.B., Vlek, P.L. 2014. Hotspots of human-induced biomass productivity decline and their social-ecological types toward supporting national policy and local studies on combating land degradation. *Global and Planetary Change* 121(2014):64–77.
- Wichelns, D. 2014. Do estimates of water productivity enhance understanding of farm-level water management?. *Water*, 6(4), 778-795. doi:10.3390/w6040778
- Will, M. 2013. *Contract Farming Handbook: A Practical Guide for Linking Small-scale Producers and Buyers through Business Model Innovation*. GIZ. <http://www.giz.de/expertise/downloads/giz2013-en-handbook-contract-farming-manual-low-resolution.pdf>
- Williams, B. K., and E. D. Brown. 2012. *Adaptive Management: The U.S. Department of the Interior Applications Guide*. Adaptive Management Working Group, U.S. Department of the Interior, Washington, DC. <http://www.usgs.gov/sdc/doc/DOI-Adaptive-Management-Applications-Guide-27.pdf>
- Williams, G.W., O. Capps, and M. Palma. 2007. "Effectiveness of Marketing Order 906 in Promoting Sales of Texas Grapefruit and Oranges." Texas Agribusiness Market Research Center Commodity Market Research Report No. CP-01-07. <http://ageconsearch.umn.edu/bitstream/90752/2/CP%2001%2007%20TexCitrus.pdf>
- World Bank and Ministry of Planning and Investment of Vietnam (MPI). 2016. *Vietnam 2035 : Toward Prosperity, Creativity, Equity, and Democracy*. Washington, D.C.: World Bank. <https://openknowledge.worldbank.org/handle/10986/23724> License: CC By 3.0 IGO
- World Bank. 2008. *Agriculture for Development*. World Development Report. Washington, D.C.
- World Bank. 2010. *Vietnam - Economics of adaptation to climate change*. Washington, DC: World Bank. <http://documents.worldbank.org/curated/en/2010/01/16441103/vietnam-economics-adaptation-climate-change>
- World Bank. 2011. *ICT in Agriculture: Connecting Smallholders to Knowledge, Networks, and Institutions*. World Bank report number 64605 (e-Sourcebook). Washington D.C. [World Bank 2011 b]
- World Bank. 2011. *Vietnam Development Report 2011: Natural Resources Management*. Vietnam Development Information Center. [World Bank 2011 a] <http://siteresources.worldbank.org/INTVIETNAM/Resources/VDR2011EnglishSmall.pdf>
- World Bank. 2012. *Agricultural Innovation Systems: An Investment Sourcebook*. World Bank, Washington D.C.

- World Bank. 2012. Revising the Land Law to Enable Sustainable Development in Vietnam. World Bank, Hanoi.
- World Bank. 2013. *Turn Down the Heat: Climate Extremes, Regional Impacts, and the Case for Resilience*. A report for the World Bank by the Potsdam Institute for Climate Impact Research and Climate Analytics. Washington, D.C. http://www.worldbank.org/content/dam/Worldbank/document/Full_Report_Vol_2_Turn_Down_The_Heat_%20Climate_Extremes_Regional_Impacts_Case_for_Resilience_Print%20version_FINAL.pdf
- World Bank Group. 2015. Commodity Markets Outlook, October 2015. World Bank, Washington, DC. License: Creative Commons Attribution CC By 3.0 IGO <http://pubdocs.worldbank.org/pubdocs/publicdoc/2015/10/22401445260948491/CMO-October-2015-Full-Report.pdf>
- World Bank Group. Forthcoming 2016. Enabling the Business of Agriculture 2016: Comparing Regulatory Good Practices. World Bank. Washington, D.C.
- Zhiyong, L. 2003. "A Policy Review on Watershed Protection and Poverty Alleviation by the Grain for Green Programme in China." In the *Proceedings of the Workshop Forests for Poverty Reduction: Opportunities with Clean Development Mechanism, Environmental Services and Biodiversity*, 27–29 August 2003, Seoul. <http://www.fao.org/docrep/008/ae537e/ae537e0j.htm>

Thematic Sheets



Thematic Sheet A - Agricultural Innovation Systems (AIS)

Long equated with research and development (R&D), innovation is now seen as the process of learning for continuous improvement. The paradox of research without innovation—and the recognition that entrepreneurship is a driving force for innovation—have led research to be viewed as a necessary but not sufficient condition for innovation. This has given rise to the innovation systems approach. An innovation system can be defined as a set of “networks of organizations or actors—together with the institutions and policies that affect their innovative behavior and performance—that bring new products, new processes and new forms of organization into economic use” (Hall et al. 2010).

The concept of building capacity [to innovate] through innovation systems represents a departure from the previously dominant technology transfer approach. Traditional technology transfer assumes a linear process whereby new technologies are developed by research agents (primarily scientists), and are then delivered to end-users, or adopters, by dedicated transfer agents (primarily extension workers). In a review of innovation models (ways of conceptualizing innovation processes), and how these have evolved over time as a result of empirical research, Tidd (2006) highlights the following pitfalls of past approaches, or what he calls forms of “partial thinking”:

- “Seeing innovation as a linear ‘technology push’ process (in which case all the attention goes into funding R&D with little input from users) or one in which only the market is relied upon to pull through innovation
- Seeing innovations simply in terms of major ‘breakthroughs’—and ignoring the significant potential of incremental innovation
- Seeing innovation as a single isolated change rather than as part of a wider system
- Seeing innovation as product or process only, without recognizing the interrelationship between the two.”

The innovation systems paradigm, by contrast to the technology transfer one, holds innovation—that is, the development and adoption of better ways of doing things—as the product of interactions among people, organizations, institutions, markets, technologies, information—or innovation ecosystems. In 2012, a comprehensive review of agricultural innovation systems (AIS) by the World Bank concluded that the ability to innovate is often related not only to research and development (R&D) capacity, but also to collective action, coordination, knowledge exchange among diverse actors, and partnership and business development incentives.

The public sector has a critical role to play in building out the systems that support the capacity to innovate. Innovation systems literature sheds light on some of the leading justifications for public support. Due to the public good characteristics of some forms of innovation, for instance, the private sector cannot always fully appropriate the full value of the return on its efforts to innovate. Thus, even high return investments may not be worthwhile investing in for privately held entities. Asymmetries of information between the supply of and demand for solutions can also dampen potentially mutually beneficial transactions. Similarly, imperfect information about challenges and solutions can also limit potentially beneficial transactions. In some instances, the public sector can help overcome coordination failures which can stand in the way of disruptive innovation in particular.

Looking beyond the above rationales, the public sector can be seen as being a part of innovation ecosystems and having a role to play (though not necessarily a monopolistic or unique one) in fostering connectedness, the flow of information, and risk taking among others. Looking beyond market failures, then, a more positive

take on public sector roles emerges from the following description of innovation systems in Hall (2010). Innovation systems comprise “a combination of linkages or networks and institutional settings that [foster] a dynamic process of interaction and learning among scientific and entrepreneurial actors in the public and private sectors in response to evolving economic and technical conditions.” “The focus is on interaction between actors and their embeddedness in an institutional and policy context that influences their innovative behavior and performance.”

This understanding of innovation systems underscores a place for explicit innovation policy that goes beyond public funding for scientific or public interest research, and suggests a role for public sector in, *inter alia*:

- Nurturing interactions, linkages, and networks among scientific and entrepreneurial actors in the public and private sectors;
- Fostering information sharing and learning;
- Inciting research into use / R&D commercialization; and
- Institutionalizing these functions.

In separate thematic sheets, further consideration is given to three aspects of agricultural innovation systems: agricultural research, extension, and agribusiness incubation (Thematic Sheet B, Thematic Sheet C, Thematic Sheet D).

Thematic Sheet B - AIS II: Agricultural Research

The systems perspective described in Thematic Sheet A on agricultural innovation displaces research institutions as innovation systems' primary center of gravity, redistributing roles to a wider and more diverse set of actors. Nonetheless, the need for both theoretical and market-oriented research has arguably never been greater as the climate changes, and demand for food and quality soars. In other words, while the focus on research as a driver of innovation has been reassessed, its importance is not diminished in absolute terms. The expected returns on public and private investment in research are as high as ever.

Internationally, types of organizations that play central and complementary roles in research are universities and research and development institutes (RDIs). Whereas the primary focus of universities is usually research and teaching, the core business of RDIs is to provide services to industry—particularly SMEs that lack the means for internal R&D yet have sufficient absorptive capacity. RDIs are typically involved in a broad range of innovation-related activities spanning research, experimental development, design engineering, standards development, technical and certification services, and technology diffusion (World Bank 2009). Compared to universities, RDIs are generally better at providing short-term, practical services to industry. They are often easier and less risky for the private sector to collaborate with as they are more structured than universities, and often make use of management processes and norms of confidentiality (World Bank 2009). That said, they tend to be more constrained than universities when it comes to stability and consistency, and are under less pressure to regenerate their capabilities and remain at the cutting edge of research to secure grant financing. Universities provide critical human resources for projects that are risky or require advanced problem-solving skills (World Bank 2009).

Funding sources and conditions play a determining role in research institutions' market-orientation as well as their efficiency. Government strategies that increase these include allocating research funding on a competitive basis, and restricting the amount of unconditional core funding they allocate to these as this forces institutions to seek funding from non-government sources. Ensuring predictable funding streams with fewer conditions attached, by contrast, is one way in which government can enable research shaped less by commercial motives than by scientific and theoretical inquiry (i.e., “public good” research with more potential for spillovers). Within research institutions, key influences include incentives for personnel (e.g., ones linked to salary and promotion), as well as management and governance structures (e.g., professionalization, checks and balances, autonomy, reliance on contracts).

Thematic Sheet C - AIS III: Agricultural Extension

Agricultural extension has evolved significantly as a concept and practice since the 1970s when it spread widely to developing countries. At the time, agricultural extension was by and large a public sector service focused on raising yields and productivity by providing technical training to farmers. Today, the vision for effective agricultural extension is less that of a public technology transfer service, than that of a pluralistic system of public and private sector actors offering technical and non-technical services, not only to help raise farm-level productivity, but also to improve business, health, social and environmental outcomes in the sector more broadly.

Extension-plus, as it is sometimes referred to, is bent as much on the brokerage of relationships and the facilitation of reciprocal knowledge flows, as on the direct, one-way provision of information and technology from knowledge-institutions to end-users. In its broader quest to improve sector performance by boosting its capacity to innovate, it is meant to enhance value chain actors' access to knowledge, information and technology, and their interactions with research, education, agribusiness and other institutions. In the same vein, enhanced extension systems strive to help value chain actors develop their own technical, organizational and management skills, as well as the capacity to continuously absorb new knowledge and technology. Extension-plus tends to involve multi-directional information flows, and involving multiple disciplines, methods, and stakeholders. In the Indian state of Kerala, the system supporting fruit and vegetable growers offers one illustration of extension-plus that has engaged the public and private sectors in evolving roles (see Box 9).

Box 9: Public-Private Provision of Technical and Other Services: An Indian Example

Since the early 1990s, a key actor in the Indian state of Kerala's extension system started out as the Kerala Horticultural Development Programme (KHDP), a joint-venture between the European Union and the state of Kerala. When the program ended in 2001, it reinvented itself as the Vegetable and Fruit Promotion Council (VFPC), a for-profit company held jointly by producer groups—with a majority stake (50 percent)—the state of Kerala (30 percent), and private financiers. The VFPC's objective, not unlike its non-profit predecessor's, is to "improve the livelihood of vegetable and fruit farmers by empowering them to carry on vegetable and fruit production, value-addition and marketing as a profitable venture in a sustainable way." The company also purports to continue the work of the KHDP, key to which was the promotion of farmer self-help groups. These became the program's backbone, and later, the VFPC's majority shareholders. Within these groups, the KHDP trained master farmers as well as extension staff to demonstrate production methods, uses of credit, and approaches to marketing that would help increase and stabilize their incomes. To generate and access locally relevant technical knowledge, KHDP contracted with the local agricultural university system, and also introduced farmers to participatory technology development methods.

Today, the VFPC is a public-private vector of enhanced extension services. It continues to organize horticultural farmers in self-help groups (it claims to have formed over 8,900 of these), to engage in technology development trials (including to develop improved planting material), and to train extension staff and master farmers in production techniques—demonstrating that in a commercial context such as this, a privately, mostly farmer-controlled company can take on the functions of a conventional extension agency, and possibly enhance these. Indeed, the knowledge and technology it promotes are highly tailored to producers' needs, and developed with their participation. In less commercial production settings, the public sector may need to play a greater role.

Continued to next page.

Box 9 continued.

Like the KHDP's moreover, the VFPC's training and other services do not focus on farm-level production exclusively. The organization engages with value chain activities more broadly, and in some cases directly (going a step beyond its predecessor which did not have the large commercial presence of the VFPC). It is active, for example, in advising producers on marketing strategies, allocating land and building space, in developing credit and insurance products, and in organizing collection centers and retail outlets, including farmers' markets, which it sets up to enhance producers' bargaining power. It is also promoting linkages and integrating diverse actors within the value chain. For example, it is making efforts to develop a cluster around urban horticulture, and separately, running a program to link tribal producers to market opportunities. Meanwhile, through its retail arm, Krishi Business Kendra, the VFPC has become one of Kerala's top sellers of seeds, seedlings, and a variety of tools and inputs. The company has also invested in packing, cut-vegetable processing, soil testing and other facilities.

Thematic Sheet D - AIS IV: Agribusiness Incubation

Agribusiness incubation has emerged over the past 15–20 years as a means to stimulate commercial agriculture and transform comparative advantages in commodity markets into competitive advantages in differentiated product markets (Goletti/World Bank 2011). A defining characteristic of agribusiness incubators is that they directly engage with startups to help them grow, usually offering them a range of advisory and business development services geared to improving firms' competitiveness and access to markets. Box 10 describes and provides examples of various types and roles of agribusiness incubators.

Government involvement in agribusiness incubation varies significantly, and incubators enjoy different degrees of financial and political autonomy. Many are non-profits and start out with public sector and other external sources of funding from which they wean themselves to varying degrees. Incubators are generally able to cover some if not all of their operating costs by charging firms for access to their services and facilities, i.e., by charging consulting, business development, marketing, franchising, rental, and other fees. Over time, certain incubators invest in the firms they incubate as well as their intellectual property, allowing them to share in their profits and royalties.

Box 10: Types and Examples of Agribusiness Incubators

Some incubators are dedicated to accelerating technology commercialization or technology transfer. The former typically have strong ties with agricultural research institutions; oftentimes they are arms or spinoffs of such institutions. Examples include the ICRISAT-affiliated Agribusiness Incubator (ABI) in India—now the country's largest agribusiness incubator—IAA-IPB, affiliated with the Bogor Agriculture University in Indonesia, and Brazil's CENTEV/Technology Based Business Incubator, affiliated with the Federal University of Vicosa. Though their ties to research are to some degree these incubators' strength as they provide privileged access to, and understanding of, the latest research, these carry certain risks.

Examples of incubators that focus on technology transfer—at the grassroots and high-tech levels respectively—are Villgro in India, and the Malaysian Life Sciences Capital Fund. Villgro accelerates the uptake of indigenous technology with activities involving knowledge creation and sharing, competitions and awards, brokerage between innovators and entrepreneurs, and retail, mostly at the village-level. These activities aim to build rural confidence and networks. MLSCF, a public-private venture fund, is focused on importing technologies that can be adapted to the national oil palm industry. Incubators transfer technology across national and corporate borders in various ways, including through intellectual property markets, manufacturing contracts, and joint ventures.

Some incubators go beyond technology commercialization and provided a broader set of support services. Timbali Industrial Incubator in South Africa, and Fundacion Jalisco in Mexico—focused on high-end floriculture and packed fresh berries respectively—are examples of incubators that specialize in developing value chains as well as providing market access to small-scale farmers. Both have developed farm-level business models that large numbers of small-scale producers can adopt, along with a suite of supportive farm-level and supply chain services (e.g., the identification of new inputs, cropping methods and handling technologies, marketing, packing, order fulfillment, logistics, cash management). They allow what are generally low-asset, low-capacity, risk-averse producers to access distant and high-value niche markets that they would not be able to access on their own, or even through existing farmers' organizations. Timbali specifically recruits and nurtures black, female agro-entrepreneurs to launch franchises. Both organizations have cultivated internal competencies and relationships to undertake or outsource market research and the testing of products before their launch.

Thematic Sheet E - Economies of Scale and the Mechanization of Smallholder Agriculture

Mechanization is a central component of agricultural modernization, not least because of its power to increase land, input, and labor productivity on and off the farm, and reduce the drudgery of farming. Going forward, moreover, it could play a central role in enhancing the sector’s sustainability. Historically, mechanization has often been detrimental to the environment and farming resources by contributing to soil compaction and erosion, tillage, and chemical pollution. However, different choices and uses of labor-saving technology have demonstrated potential to facilitate sustainable farming practices, having already enabled the spread of no-till agriculture, precision farming (reducing water and chemical use), and improved labor conditions in parts of the world. Sustainability-enhancing mechanization, be it in the form of automated, data-intensive, or lower-tech approaches to farming (and post-harvest handling), is still in its early days, and regional experience suggests that government has a continued role to play.

In leading East Asian economies such as Japan, Korea, Taiwan (PoC), and China, agricultural mechanization has been a joint product of structural transformation and direct public sector support. Mechanization has generally accelerated where the pull of industrial and urban employment has led farm labor to dwindle. Rising labor costs make farm machinery more financially attractive. And outmigration can aid mechanization by increasing rural incomes and the size of farming operations, and thus farmers’ ability to invest in and recoup the costs of machinery—though empirical evidence of this is mixed (Luo and Escalante 2015). In South Korea, for illustration, mechanization took off in the 1970s, even as rapid industrialization drew manpower away from farms. In China, the use of tractors and other machinery rose rapidly in the 1980s and 1990s in possible response to farm-labor constraints thought to have preceded the rural population’s outright decline starting in the mid-1990s (yang et al. 2013). In Japan, cultivators became prevalent in the late 1950s, when post-war industrialization drove agricultural wages up (Pingali 2007).

However, mechanization has rarely been purely spontaneous. Rather, governments have directly intervened to promote it, often in the name of sector modernization and competitiveness, but also food security. Notwithstanding national differences, a recurrent motive has been the perceived need to compensate for labor shortages in order to prevent food production decline. Furthermore, mechanization has meant confronting a range of challenges classically associated with technology diffusion—related to risk aversion, information asymmetries, and coordination failures. In East Asia, governments have used a combination of supply- and demand-side interventions to address these (see Box 11 on Korea’s mechanization plan). The first have sought to stimulate the domestic production, absorption, distribution and servicing of agricultural machinery (i.e., supply), while the second have been geared to stimulating the adoption and use of machinery by agricultural producers (i.e., demand). What follows are examples of each.

On the supply side, even if a country can rely primarily on imported equipment, mechanization cannot progress without investing in national capacity to adapt machinery to local needs and conditions, as well as to operate and service equipment over its useful life. Accordingly, East Asian governments have resorted to a range of measures to develop a domestic machinery industry. Examples include training a class of specialized engineers and technicians; shielding national firms from competition (e.g., restricted market entry, fiscal advantages, subsidized debt, guaranteed sales); and courting foreign technology transfer through various arrangements. In China, notably, the government has pursued a policy known as “exchange of market for technology,” which consists of facilitating the entry of foreign firms (relaxing restriction on foreign investment, offering fiscal advantages) involved in

domestically-beneficial joint ventures (e.g. John Deere-Jalian) (Wang 2013). China now sports a healthy machinery industry that caters both to home and export markets (Gao 2006).

On the demand side, one impediment that is specific and central to the adoption of agricultural machinery—everywhere but particularly in East Asia—lies in its high fixed costs. Although machines come in different sizes and levels of sophistication, their indivisibility can represent a barrier to the adoption of costly equipment. This is particularly problematic in regions such as East Asia where landholdings or farming operations have remained small, limiting individual farmers' ability to recoup a large investment. To address this issue, one approach has been to support direct equipment purchases by farmers, using such instruments as price subsidies, concessional credit, and extension services (while simultaneously fostering the development of machinery adapted to small farms and their environment). In China, for example, short-listed machinery has been eligible for subsidies since 2004. By one account, however, only 2-3 percent of (larger) farmers have taken advantage of it (sources cited in Gale 2013). (The opening up of land rental markets in China (see Box 3) has given rise to larger farming operations able to take advantage of machine services (Wang et al. 2014).)

A complementary and potentially more effective approach has been to promote equipment sharing arrangements such as joint ownership, leasing, and farming services. The Chinese government, for example, aided the development of now widely used combine service enterprise clusters by subsidizing the price of machines and warehouse space; exonerating them from road tolls while improving roads; and offering them market intelligence (e.g., harvest calendars) that helped them to develop viable service areas spanning multiple provinces (across which they can spread high fixed costs). The government also helped these entrepreneurs develop cooperative relationships that have enabled them to share the costs of maintenance and coordinate their service areas—for instance, by paying for their cell phone communications for a time (yang et al. 2013).

Box 11: Korea's Agricultural Mechanization Plan: Combining Supply- and Demand-Side Components

Korea's first Five year Agricultural Mechanization plan, dating to 1970, can be used to illustrate this combination of supply and demand components. Focused on promoting the uptake of small-scale machinery (such as power tillers) in rice farming, the plan supported research and development to adapt equipment to Korean conditions, favored Korean-made machines, and strengthened machinery inspection and quality control services. It also required manufacturers to develop far-reaching sales networks and after-sale services, and to collaborate with public extension services that were put in place to train farms in the use of machines. The National Agricultural Cooperative Federation, present across the country, also took part in promotional efforts. Meanwhile, farmers were given access to concessional credit to purchase machinery or lease equipment purchased by a joint-use organization put in place for this purpose. By the 1990s, and several plans later, the mechanization of Korea's rice sector could be considered complete, and Korea had become an exporter of agricultural machinery to developed countries; after which the government's focus shifted to the uptake of machinery to support value-addition (e.g., in horticulture) (yun Jin Ha and Kim Kyeong Uk 2013; Kang jung-il 2006).

Thematic Sheet F - Greening Agriculture I: Payment for Ecosystem Services

Payments for ecosystem services (PES) offer a market-based approach to environmental management that involve the direct compensation of land stewards to maintain specified ecosystem services, usually through conservation and restoration activities. Defining features of PES transactions are that they are voluntary⁴⁷, and contingent on the continued of a well-defined ecosystem service (or a form of land-use likely to secure that service) (CIFOR 2006). Payments can refer to direct cash payments, or other forms of compensation, and can be used, for example, to incentivize landowners to grow trees to sequester carbon, restore vegetative cover to filter and clean water, conserve landscapes so to preserve cultural and aesthetic value, or preserve biodiversity to minimize the need for fertilizers and pesticides. In the context of agriculture, PES are typically used either for farmers to retire land from production, or to adopt production systems that preserve or contribute to ecosystem services.

Although PES are part of a market-based mechanism, their proper functioning depends on policies and institutions (whether at the local, national or international level), and hence, on investment in these. Experience with PES has demonstrated that national institutional capacity for the valuation of services, the collection of fees and compensation of providers, and the redistribution of value are essential elements for success

Box 12: Public-Private Water Services and Quality Protection in Latin America

In several countries, including Ecuador, Colombia, Bolivia, and Brazil, companies have partnered with municipal authorities and environmental non-profits (notably The Nature Conservancy) to put in place water funds that aim to offer participants a cost-effective means of securing the clean water resource on which they depend. These funds are used in large part to incentivize land owners, farmers, households, or communities to adopt better land management practices, often in connection with farming. In Latin America, at least 23 local water funds invested \$3.8 million in watersheds in 2011, affecting an estimated 125,000 hectares of land (Benett et al. 2013).⁴⁸ Contributions to these are mostly voluntary, though some (e.g., in Ecuador) benefit from earmarked water-user fees and municipal contributions. Several receive contributions from agribusinesses, including sugar mills and breweries (e.g., in Colombia). Though some offer cash payments, several offer in-kind incentives such as training, agro-inputs, finding that these can be better perceived by and more motivating to stewards of the land. It is also common for these programs to work with and build the capacity of community-based organizations. In fact, these programs often prefer to refer to themselves as reciprocal watershed agreements or cost-sharing programs rather than as payment for ecosystem services programs (PES), with their more market-oriented overtone.

In Colombia, a global beverages company has used PES to help protect the water resources on which its operations depend. The impetus came partly from rising water fees. With operations on the outskirts of Bogota, the company depends on the public water supply, the quality of which was being negatively impacted by upstream agriculture and related land clearing and degradation. And water-users were bearing the burden of escalating water treatment costs. The company has partnered with the water utility company, the national parks agency, and an international conservation organization to address the problem at the root. It now pays into a water fund that is used to support stewardship activities designed to keep sediment out of the waterways that supply Bogota. Under one of the company's initiatives, farmers are paid to adopt modified farming practices, to restore degraded lands, or to relocate their activities—in particular, to graze livestock on less steeply sloping pastures.

⁴⁷ Although the motivation for transacting may be rooted in regulatory requirements in some instances (e.g., wetland or greenhouse gas emission mitigation requirements).

⁴⁸ PES programs, more broadly defined, are estimated to have made at least \$84 million in payments in the region in 2011 (Bennett et al. 2013). More PES programs are in place in the region, including large national programs in Mexico and Costa Rica.

(based on Rodriguez in Rapidel et al. eds. 2011). Moreover, PES programs are most effective when they are couched in broader policy objectives (e.g., pertaining to rural development or the environment), and when those policies call for the use of economic incentives (based on Rodriguez in Rapidel et al. eds. 2011). PES, in that respect, are best understood as more than a financial mechanism or tool, and rather as a package of policy, legal, and institutional arrangements. Framed this way, PES programs require broad involvement on the part of government and private sector stakeholders, and the elaboration of a shared vision or framework that clarifies expectations and responsibilities (e.g., as they relate to the legal framework, monitoring, enforcement, standard-setting, knowledge management, finance, technical work, and so forth).

Over the past decade, PES programs have grown tremendously, driven in part by increasing private sector participation on the buyer side, and by the rise of formal markets for specific ecosystem services such as carbon, water, and biodiversity. Various PES programs dedicated to protecting water quality in Latin America have, as Box 12 illustrates, been possible thanks to public-private partnership. However, while private conservation groups and companies are important players in PES programs, public agencies remain the leading buyers of ecosystem services (UNEP 2012). In fact, government willingness to pay for ecosystem services seems to be growing in the developing world; some of the largest PES programs, in Mexico, Costa Rica, Colombia, and China, are primarily or fully funded with domestic resources (e.g., revenues from general taxes, or water- and electricity-use fees) (Milder et al. 2010). China’s Grain for Green program, and the United States’ Conservation Reserve Program, are two examples of government-funded PES programs that have been deployed on a wide scale—in both case, to mitigate and prevent soil erosion among other forms of environmental degradation linked with agriculture (see Box 13).

Box 13: Examples of Government-Led PES in China and the United States

China’s Grain for Green Program. The government of China launched the Grain for Green program in 1999, in the wake of the calamitous flooding of the yangtze, Songhua and Neijing rivers, which brought the extent, severity, and significance of soil erosion to the public’s attention.⁴⁹ The program started in the western provinces of Sichuan, Shaanxi and Gansu, where soil erosion was particularly pronounced due to forest clearing and over-logging on sloping lands. In 2002, the program went national, and by 2008, it had succeeded at converting over 8 million hectares of erosion-prone cropland to forest (Liu and Wu 2010). To achieve this, the program incentivized farmers to retire and afforest cropland using mostly cash and some grain subsidies. The program also substantially covered the costs of afforestation activities.

In early years, the program faced the challenge of gaining households’ trust—a challenge it overcame by mobilizing local leaders. And in many cases, the economic incentives exceeded what farmers could earn from business-as-usual activities. In that respect, it is possible that the size of subsidies was not fully optimized, and indeed, the program fell short of its targets, converting only 56 percent of the total land it set out to convert. The program has been criticized for accentuating inequality by transferring the most resources to families holding the most land. However, even in peak conversion years, the program did not negatively affect grain production.

Continued to next page.

⁴⁹ The floods affected over 25 million hectares and the livelihoods of 230 million people, and killed over 3,000 people (Li and Wu 2010, <http://www.nottingham.ac.uk/cpi/documents/briefings/briefing-60-reforestation.pdf>).

Box 13 continued.

The United States Conservation Reserve Program. Since 1985, the United States government has administered a similar conservation program that pays farmers to remove environmentally sensitive land from agricultural production and instead plant species that improve water quality, prevent soil erosion, and provide wildlife habitat. The Conservation Reserve Program (CRP) involves 10–15 year-long contracts under which farmers receive annual rental payments from the government. The program also defrays the costs of eligible conservation practices, including for example shelter belts, wetlands buffers, contour grass strips, and salt-tolerant vegetation. Though managed through local Farm Service Agency offices, the CRP is national in scope and farmers compete nationally to enroll. Their applications are scored and ranked on the basis of both their costs and environmental benefits, factoring in the sensitivity of the land, the practices that farmers propose to adopt, the sustainability of these practices beyond the duration of the contract, and the annual rental payments and cost-sharing farmers require to implement these. The program considers multiple areas of environmental impact, including benefits to wildlife habitat, water quality, erosion, and air quality.

Thematic Sheet G - Greening Agriculture II: Eco-certification and Eco-labeling Programs

When it comes to taking up sustainable agricultural practices, producers need and respond to market signals. In this respect, ecological or sustainability standards and certification programs can be helpful in sending a clear market signal. Moreover, the active promotion over the past twenty years of sustainable agriculture and related standards by organizations such as the Rainforest Alliance (RA), the Sustainable Agriculture Initiative (SAI), and the International Social and Environmental Accreditation and Labeling Alliance (the ISEAL Alliance), as well as by commodity roundtables (e.g., for sustainable soy, palm oil, biofuels, cocoa, sugar, and rice), has led to a dramatic increase in market demand for eco-certified agricultural products. As of 2010, the market for certified agricultural products was worth over \$64 billion, and estimated to be growing by around 15 percent per year (in UNEP 2012). Business-to-consumer certification is generally accompanied by product labeling, and examples of eco-labels include those of the RA, the Marine Stewardship Council (MSC), and various organic certification programs. Examples of business-to-business certification programs are SAI and GlobalGAP.⁵⁰ Over time, many sustainable sourcing programs have become increasingly oriented to sourcing from small-scale producers (UNEP 2012, Famine). Sustainability certification can, in some cases, help small-scale farmers reach more lucrative markets and generate higher margins (Blackmore et al. 2012 in UNEP 2012).

Box 14: Building a Legislative Framework for Sustainability: Organic Agriculture in Tunisia

In Tunisia, the public sector has played a central and proactive role in developing standards and a certification system for organic agriculture. In 1999, the government put a comprehensive legal framework in place (a law and over 15 decrees and orders), followed by a national action plan. The law emerged from a highly consultative process involving multiple government ministries and sector stakeholders and draws selectively on elements of European laws and standards while responding to Tunisian priorities.

The Ministry of Agriculture, in charge of its implementation, houses several bodies and oversees multiple programs dedicated to supporting organic agriculture. The National Commission of Organic Agriculture, for example, sets policy direction and facilitates the uptake of organic production and certification for export. The National Bureau of Organic Certification is responsible for monitoring organic certification (including accrediting certifiers); manages a database of organic certifiers, certificates, product traceability, crops, volumes, markets and exports; and participates in bodies dedicated to harmonizing organic standards. The Technical Centre of Organic Agriculture undertakes applied research to support organic farming (e.g., it experiments with crop rotations, composting, rearing of insects for biological pest control, and so forth), and offers technical advice and training to farmers and researchers. Meanwhile, the Tunisian government also supports organic agriculture with tax breaks and other financier incentives (as of 2008, these could cover up to 70 percent of the costs of certification). In the 2000s, the number of certified organic farms and exports both experienced a leap of significant proportion as a result of these and other interventions. As of 2008, Tunisia had the largest area of certified organic land on the African continent (Carey 2008).

Though the private, non-profit sector has been the motor behind the growth in eco-certification, the public sector can and has in some cases played a role in developing, and enabling this form of market signaling. In Tunisia, for example, government involvement in the development of standards illustrates how the public sector can

⁵⁰ Though intended to ensure food safety, GlobalGAP has strengthened its environmental criteria over time.

play a key role in defining what sustainable means (see Box 14). In Ireland, the public sector is building the entire food sector's brand and credibility as a sustainable food exporter by enlisting suppliers in a rigorous and certifiable process of measurement and continuous improvement (see Box 15). In Brazil, a non-profit is helping an increasing number of soy producers progress toward sustainability certification—under private, voluntary standards—by building knowledge and trust, illustrating an enabling and supportive role that the public sector can also play (see Box 16).

Box 15: Building a Business Case for Sustainability: Ireland's Origin Green Program

In Ireland, the national food promotion agency (affiliated with the Department of Agriculture), Board Bia, has had broad success involving agricultural producers as well as food and beverage manufacturers in the national sustainability program that it put in place in 2012 (building on its previously existing quality assurance programs). The program aims to cover the entire Irish food and beverage sector. Roughly two years after inception, some 60 percent of Irish food and drink exports came from verified program members. To qualify as members, food manufacturers must develop a multi-annual sustainability plan with targets pertaining to raw material sourcing, resource efficiency, and social sustainability, and report annually on their progress against those targets. Both the plan and annual reports are third-party audited. Farmers, for their part, undergo sustainability audits every 18 months and receive advice on how they can mitigate the environmental impacts of their operations. So far, the program has focused on enrolling beef and dairy farmers and its audits look among other things at greenhouse gas emissions, animal and herd performance, feed, traceability, and agro-chemical use efficiency.

Several factors have contributed to the program's success to date. One is that the program has benefited from broad public sector support and national visibility. Indeed, it was put in place as part of a broader national strategy targeting increased exports by 2020, specifically to build the reputation of the Irish food and drink sector as supplier of high quality and sustainably-produced products. The program has also attracted producers by making a business case for adopting greener practices. On a macro level, Irish farmers widely recognize sustainability as a strength of Irish agriculture and perceive Origin Green as a vehicle to communicate this to international markets. On an individual business level, the significant savings that the program has helped participants identify through its audits—particularly for manufacturers—has been key to building participation.

Related to this last factor, a key aspect of the program is that it provides participating farmers and manufacturers with feedback and advice. It lets farmers know, for example, how they are performing relative to their peers, both in relation to the environment and their bottom line. In order to become members, farmers must open their operations to audits, which among other things, calculate farmers' carbon footprint. High rates of participation in this data-intensive process have been made possible by information-sharing agreements among participating organizations, and the use of smart handheld technology for on-farm data collection.

Box 16: Building Capacity for Sustainability: Certified Soy in Brazil

In Brazil, the non-profit organization Aliança da Terra (AT) is helping soy producers gradually work toward Round Table on Responsible Soy (RTRS) certification, a label that promotes the sustainable use of land, natural biosphere protection, and social responsibility. In many cases, rural producers lack awareness of or a firm grasp of the technical requirements of certification. AT addresses this by helping farmers acquire and apply knowledge related to sustainable practices, helping them to design and implement cost-effective, social and economic improvements on their property. Meanwhile, AT's own Registry of Socio-Environmental Responsibility (RSR) guides and encourages landowners to improve their production practices in steps. For this, the RSR measures and records landowners' progress against a range of criteria related namely to water quality, biodiversity, and vegetation productivity. Based on farm-level assessments against such criteria, AT works with landowners to structure commitment plans to bring operations up to RTRS standards. The organization claims that farms in the registry incur 25–55 percent lower certification costs than those that are not.

In addition to playing a knowledge-transfer function, AT also plays a brokerage role, acting as a conduit among those seeking, granting and requiring certification. The ability to play this role is largely a function of trust, and AT has worked at developing and maintain credibility. In 2012, for example, AT signaled its commitment to rigor when it excluded 108 properties from its registry for non-compliance.

Thematic Sheet H - Greening Agriculture III: Multi-Stakeholder Approaches to Greening Agriculture

Many successful green agriculture initiatives have involved close collaboration among an array of public and private entities. Vietnam has been moving in this direction with some of its agricultural public-private partnerships. Three international examples are highlighted here. Landcare is an example of a grassroots movement to promote sustainable practices. The movement originated in and is most developed in Australia (see Box 17). Paraguay's success, over the past decade, at curbing rampant deforestation in the eastern part of the country offers an example of how multi-stakeholder involvement in implementing well-designed legal and institutional measures can keep the environmental damage of a booming agriculture sector in check (see Box 18). In addition, the central role of forest policy in this case, illustrates how greening agriculture can rest on the adoption of policies in other sectors. In Italy's La Marche region, the Valdaso agro-environmental agreement also illustrates the power of landscape-level collective action—involving multiple stakeholders across the public and private sectors—to mitigate agriculture's impact on the environment (see Box 19). This case differs from that of Paraguay, however, in that collective action developed on a purely voluntary basis.

Box 17: The Landcare Movement in Australia and Beyond

Landcare is a grassroots movement that originated in Australia in the 1980s to curb the degradation of farmland, public land and waterways. The movement acquired national support and recognition in the 1990s in Australia, and has spread to multiple other countries including South Africa, the Philippines, Kenya, Uganda, Fiji and Sri Lanka. Landcare groups promote sustainable agricultural practices and undertake a range of restoration activities. Examples include promoting practices to combat soil erosion and salinization, rehabilitating waterways, wetlands and coastal ecosystems, planting trees, shrubs and grasses, and protecting species.

Defining features of Landcare include its emphasis on people and communities finding and implementing solutions for natural resources management, as well as on communities building the capacity and ethic to pursue these (based on Catacutan et al. in Minang et al. eds. 2015). The Landcare approach is more bent on the development of social norms around conservation, than on the monetization of conservation benefits or on the development of economic incentives for conservation more generally. In this respect, the growing prominence of programs which tie economic incentives to the conservation behaviors of local people may represent a challenge for the Landcare movement. These incentive-based programs, which include monetary compensation, revenue-sharing schemes, and conservation concessions, can fall short in their ability to generate broad community support, for example, or to maintain benefits over the long-term (based on Catacutan et al. in Minang et al. eds. 2015).

In Australia today, Landcare designates a network of around 6,000 groups—Landcare, Coastcare, Bushcare, Rivercare, Indigenous, and other related community and farmer groups—and over 100,000 volunteers, working to support farmers and fishers adopt sustainable production and resource management practices. These groups are organized in regional-level organizations known as Catchment Management Authorities or Integrated Natural Resource Management groups. While initiative continues to come from the community level, the Australian government now substantially supports this structure at the local, regional, and national levels. The department of agriculture supports Landcare in a variety of ways, including by training Landcare facilitators and leaders, financially supporting regional Landcare and other organizations, sponsoring knowledge-sharing activities, financing or rewarding farm-level innovation, and directly funding certain environmental restoration activities.

Box 18: Getting to Zero Deforestation in Paraguay

Prior to 2004, lucrative opportunities to grow soy and cattle had driven the eastern part of Paraguay and its Upper Parana Atlantic Forest—one of the earth’s most biologically important—to experience the second-fastest rate of deforestation in the world. Seven million hectares of tropical forest were destroyed in 40 years, leaving only 13 percent of the original forest standing. In 2004, the government passed a forest conversion moratorium known as the zero deforestation law that made it illegal to clear protected forest land. By 2009, the rate of deforestation had declined by 90 percent compared to a 2002 baseline. Since 2004, the law has been extended twice, and as of 2011, reforestation rates were at an all-time high.

Robust enforcement systems certainly played a role: satellite monitoring, and the threat of fines, forced social work, and jail time were key factors. However, the reversal that was observed would not have been possible had these sticks been developed from the top-down, or used alone. Instead, results on the ground coincided with the development of grassroots coalitions that mobilized numerous and disparate interest groups to voluntarily support the law’s implementation. One coalition that played a key role was the Social Pact for the Conservation of the Atlantic Forests. Although it took shape with international support from the UNDP and WWF, the Pact rallied 139 organizations—from the weak to powerful—around the zero deforestation goal. Importantly, it brought soy producers onboard by demonstrating to them that the law need not halt the industry’s growth, thanks to the potential for expanding production on existing fallow lands. By bringing the timber industry, major soy producers, farmers, unions, indigenous communities, national and regional government, and other parts of civil society around the same table, the Pact facilitated the development of effective systems of control.

Of note, the government, in 2006, passed a law that was meant to enable trading among land owners with compliance obligations under the zero deforestation law—in essence, a forest conservation cap-and-trade program. Once implemented, it will allow large land owners to meet the requirement that at least 25 percent of their land be forested, by paying other land owners—large or small—with forested lands in excess of their requirements (those with less than 20 hectares do not face the 25 percent requirement). Some see payments for ecosystem services as one tool that will facilitate continued forest conservation in the longer term.

Box 19: An Agro-Environmental Pact to Cut Agro-Chemicals in Italy

While aesthetically well preserved, the Valdaso area in La Marche region of Italy has suffered from intensive agriculture and in particular from the heavy use of pesticides in fruit orchards. Since 2009, however, this situation has been improving as the result of the Valdaso agro-environmental agreement—a private sector agreement reached with public sector funding. The agreement has broadened farmers’ awareness of the impacts of their practices on natural resources, and increased their adoption of sustainable farming practices. The agreement notably specifies targets for cutting the aggregate use of agro-chemicals (within five to seven years), and identifies alternative management practices—such as integrated pest management, organic farming, and soil protection techniques—that farmers can adopt to reach their stated goals. A concrete result is that many farmers are taking practical measures to curb their use of agro-chemicals.

The early impetus for the agreement came from a small group of concerned farmers, who in 2007 formed an association to promote more sustainable practices. As the process gained momentum, farmers continued to play a key role, namely in identifying alternative farming techniques that are adapted to local needs and conditions. The public sector also played a significant role from an early stage, ultimately funding and brokering much of the process leading to agreement. Different levels of government were involved in different ways. The regional government and EU, for example, funded and gave structure to much of the process leading to agreement, while provincial authorities and the regional agricultural advisory agency (ASSAM) played a significant role in working with farmers to broker and define, and later to promote and implement, the agreement.

Thematic Sheet I - Adaptive Management and Climate Change

Climate change is often thought of as the embodiment of well-defined risks such as those brought by extreme weather and sea level rise (e.g., more intense droughts, floods, heat waves, cold fronts, and storms, resulting in crop stress and damage, the loss of suitable agricultural land, and so forth). While this is an accurate view, climate change is in equal part a conveyor of uncertainty, in that it is raising the level of unpredictability with respect to both the nature and magnitude of future risks.

The high degree of uncertainty that is intrinsic to climate change has renewed interest in adaptive management, a structured learning-by-doing-approach which takes as its starting point the idea that coping with novel situations requires the capacity to learn (Moore ed. 2009). Adaptive management was first embraced as a concept in ecology during the 1970s (Holling 1978), as a means to reduce the ecological, social, and economic costs of learning (Peterson et al. 1997). Indeed, waiting for better-established information to materialize to take action can be more costly than acting on imperfect information, provided that this course of action build in stock taking and flexibility.

Adaptive management guides policy decisions or management practices to reflect best available knowledge, but also to monitor system responses, and to respond to new opportunities and risks (based on Moore ed. 2009). This requires a rigorous approach to monitoring and analyzing management outcomes, and a willingness to update management practices and priorities, but also objectives and learning processes (see Box 20 on its application in the U.S.). U.S. government guidance on the application of adaptive management notes that it can be useful to interrupt the technical learning cycle of decision-making, monitoring, assessment and feedback, with an institutional learning cycle that reconsiders overall objectives (those established at an earlier stage), or even aspects of the learning-and-adaptation process (Williams and Brown 2012). In practice, all of the above often requires involved organizations to transition from traditional, top-down organizational structures to more inclusive, collaborative, flexible, and risk tolerant ones (Gunderson 1999, Stankey et al. 2005, in Williams and Brown 2012).

Box 20: Applications of Adaptive Management in the United States

Adaptive management has been used in many contexts. In the U.S., for example, it has been used to manage river flows, the breeding habitat and food supply of endangered species, acid rain pollution, wetlands restoration, and much more (Nyberg 1999, Williams and Brown 2012). And multiple government agencies are increasingly turning to or even in some cases requiring adaptive management as a means to address climate change uncertainty, given the recognition that optimal courses of action cannot be developed for all possible scenarios (multiple sources cited in Convertino et al. 2013). Climate change, moreover, is only one source of uncertainty—other sources of it coming from political, budgetary, and stakeholder preference change. One key lesson from this experience is that monitoring outcomes, analyzing alternative scenarios, and drawing lessons from observations, can all be challenging and costly. Noting this, Convertino et al. (2013) conclude that “without a framework that links results of modeling and monitoring to management decisions, the degree of learning from the results of monitoring and ability to use those results to refine the monitoring plan will be limited.”

Thematic Sheet J - ICT in Agriculture

Adaptive management, the greening of agriculture, and other competitiveness-boosting transformations discussed in this report can be a knowledge- and data-intensive endeavor, as well as one that involves complex, non-linear interactions among a multiplicity of actors. While the examples above highlight some of the institutional requirements to support this reality, the following examples highlight how advances in information communication technology (ICT) are supporting approaches that previously would have been too time consuming or too costly to undertake.

ICT refers here to computing, cellular and internet-enabled connectivity, and communication platforms more broadly.⁵¹ In Uruguay and Ireland, for example, ICT is facilitating the flow of information between farmers and authorities and enabling data-intensive, evidence-based approaches to sustainable land management and farming (see Box 21, and Ireland’s Origin Green Program discussed in Thematic Sheet G, Box 15). By providing highly tailored, relevant, and timely meteorological information to farmers, the government of a province in Turkey has enabled farmers to drastically reduce their use of pesticides in fruit orchards (see Box 22). In all three cases, ICT is arguably enabling a gradual move toward a kind of precision-farming at the service of sustainability.

Box 21: Data-Driven Planning: Uruguay’s Agricultural Information and Decision-Support System

Already well-known for its national livestock traceability system, Uruguay has been making intensive use of data and traceability systems to support the sustainable intensification and resilience of agriculture across the country. One notable initiative that relies heavily on ICT has involved the establishment of an agricultural information and decision support system, known as the SNIA (its Spanish acronym). Conceived of in the wake of extreme weather in 2008-2009, the SNIA was originally thought of as part of an early-warning system, as well as a planning tool for farmers. The data system publicly launched in 2014 and collects data on climate, soil, and crop production.

The SNIA rests on but also enables two-way information flows between the system and farmers. On the one hand, much of the SNIA’s data flows up from farmers; since 2013, those with more than 100 hectares have been legally required to submit annual soil-use and -management plans for example. On the other hand, its database—which brings together data from multiple other sources including remote sensing—forms a substrate for a range of public information and advisory services, and decision-support tools, geared to supporting farmers make land-use and production choices, as well as to better access markets. For example, a recently developed indicator will use data from the SNIA to capture the impact of weather events on production variability—using bottom-up data from the soil plans in combination with real-time weather and other nationally available data. The indicator is meant to serve both policy-level and farm-level decisions.

The entire system—from data collection to use—is heavily reliant on ITC. Farmers, for example, submit all of their data electronically, via an online interface. Farmer soil plans, which need to be certified by accredited experts, are verified against the results of an erosion simulation model; and the execution of these plans is overseen using satellite imagery. The extension agents being trained to help farmers draw up and execute these plans are being trained not only in-person but also via an online platform. While institutional factors are likely to be the biggest determinant of the system’s success over time, its use of ICT is fundamental to the system’s architecture and scalability.

⁵¹ The World Bank sourcebook on ICT in agriculture (2011) defines ICT as “any device, tool, or application that permits the exchange or collection of data through interaction or transmission. ICT is an umbrella term that includes anything ranging from radio to satellite imagery to mobile phones or electronic money transfers.”

Box 22: Information-based Farming: Actionable Weather Forecasts in Kastamonu Province, Turkey

Agricultural pesticides can be a significant contributor to non-point source water pollution. At the same time, orchards are highly susceptible to pests, the comings and goings of which are extremely sensitive to weather conditions. An additional challenge is that differences in humidity, precipitation, temperature, and other relevant variables can be significant (from a pest perspective) from one farm to the next, such that national weather forecasts are generally insufficiently correlated with farm-specific conditions to be of much help to farmers in managing pests. This is especially true when national forecasts are based on data collected in warmer, urban areas. The timing of national forecasts can also come too late for farmers to take precautionary measures.

This was the case in the Kastamonu Province in Turkey, until province-level authorities established a local meteorological forecasting service that better served farmers' needs. In order to collect more relevant data, the province put in place several rural weather stations, as well as multiple reference farms at which weather conditions were measured and pest cycles monitored. With these data, the weather service began to generate higher-fidelity and therefore more relevant weather forecasts. What more, it delivered these to farmers on a daily basis via SMS, in time to take preventive measures. Within two years of this program being put in place, pesticide applications dropped by 50 percent in one year, saving farmers the expense of chemicals, and keeping these out of the soil and runoff (World Bank 2011).

Thematic Sheet K - Collective Action I: Producer Organizations

Producer organizations can play a key role in fostering inclusive innovation and competitiveness in value chains.

They can also take on an important role in activities traditionally dominated by the public sector, such as input provision, research and extension, and natural resource management. Ekboir (in World Bank 2012) identifies four types of farmer organizations:

- **Traditional, commodity-based** farmer organizations such as the Colombia Coffee Growers' Federation, India's dairy cooperatives, or the Kenya Tea Development Agency, play a role in diffusing technical innovations and in coordinating large numbers of farmers. These often carry out research internally.
- **Nontraditional, market-oriented** farmer organizations such as Papa Andina aim to improve market access by fostering collaboration among key actors in the marketing chain. They usually take interest in social and commercial innovation as well as the technical kind, and foster it through a combination of participatory processes and affiliations with universities and research centers.
- **Innovation-oriented** farmer organizations, such as no-till farmer associations in Latin America, explicitly focus on developing and diffusing technical, commercial, and organizational innovations. They often proactively build and coordinate diverse networks involving local farmer organizations, research institutes, private firms, and public agencies; and they usually use a combination of top-down and bottom-up (participatory) research methods.
- **Service-oriented** farmer organizations, such as Mexico's Produce Foundations, aim to offer farmers a range of services—financial, extension, training, advocacy, research and others—and usually do so through the development of local organizations, partnerships, and networks.

There is no recipe for creating innovative producer organizations, and effective organizations have different origin stories—involving various levels of donor or government support. Nonetheless, strong producer organizations generally exhibit several common attributes including a clearly articulated purpose; effective and transparent governance structures; active engagement of members; leadership that is prevented from being captured by narrower interest groups; social cohesion; an organizational culture that embraces change; the ability to learn and adapt, and to identify and address the organization's needs; strong technical capabilities; and the ability to mobilize resources and participate to in networks (based on Ekboir in World Bank 2012). Innovative producer organizations also tend to have federated structures—that is, they are composed of small, linked farmer groups—as strong roots in communities facilitate upward participation and downward accountability (Ekboir in World Bank 2012). In many cases, they benefit from financial support from government, donors, or lead firms; it is not the norm for producer organizations to be fully self-financing.

Strong producer organizations can also spur product innovation and market development. The case of Ocean Spray Cranberries illustrates how market innovation can lead a cooperative to assume a leading role in a commercial value chain (see Box 23).

Box 23: From Cooperation to Product Innovation: the Case of Ocean Spray Cranberries

From its humble beginnings in 1930, when it was formed by three cranberry farmers, Ocean Spray has become the US' leading commercial supplier of high value-added cranberry products—largely products of its own creation. Its feat has been to transform the cranberry, a seasonal fruit with limited distribution, into a “superfruit” renowned for its health benefits and entire line of processed, differentiated and branded products that are widely consumed year-round.

Cranberry Cannery, the predecessor of Ocean Spray Cooperative, was initially formed to process unsuitable or surplus cranberries. It labeled these products Ocean Spray, the name the cooperative would assume in 1957. The cooperative's efforts to expand consumer demand for processed cranberry products paid off in the 1950s, when sales of cranberry products initially overtook those of fresh cranberries. Cranberry products took off in earnest the following decade as yields and harvesting technology improved, and the cooperative started introducing new products such as Cran-Apple and other juice blends that rapidly gained popularity. Later, the cooperative actively promoted research on the multiple health benefits of cranberries. The cooperative's sustained product innovations and involvement in industry-wide efforts to manage production levels were critical in turning around a sharp decline in cranberry sales in the late 1990s.

Thematic Sheet L - Collective Action II: Contract Farming

Contract farming is a transaction-based approach to coordination in agro-food value chains. Though contract farming is centuries old and its track record is mixed, there is rising interest in its potential to address traditional as well as emerging challenges related to food production and marketing. These include increasing demand for quality, sustainability, traceability, and certification, and growing competition for agricultural land and labor (based on Will/GIZ 2013).

On the most basic level, contract farming offers a potential means to reduce the transaction costs involved in sourcing agricultural products, and conversely, getting these to market. Though there is no single contract farming model, it generally involves a formal agreement—often between a multiplicity of producers and at least one buyer such as a processor or trader—to buy/sell agricultural products on terms established in advance. In addition, it is common for contract farming agreements to address market failures surrounding the provision of agricultural inputs, technology, and services such as finance, extension, training, transportation, and logistics—by involving buyers or third parties in delivering these to farmers.

Contract farming has also become a growth strategy for a number of processing and trading firms facing tightening land, labor, or other resource constraints, as well as increasing pressure to meet more rigorous or restrictive environmental, labor, social, land-use, food safety, quality, and traceability standards. In some contexts, smallholders can become a source of competitive advantage by providing access to ever scarcer land and labor resources, and local farming knowledge (Will/GIZ 2013). And comprehensive, forward-looking arrangements with such producers can help lower the costs and increase the feasibility of meeting higher standards. Buyer involvement ranges from providing or dictating the use of certain inputs (e.g., specific varieties), to controlling or investing in most aspects of production from land preparation to harvesting (e.g., land, machines, staff, management). The latter is often true when large volumes of a commodity need to be of a uniform quality for processing (e.g., sugar cane, cotton, coffee, tea, dairy, poultry, and so forth); and when buyers source from their own estates as well as contracted farmers (e.g., outgrower schemes involving perennials, Will/GIZ 2013).

When it goes well, contract farming can offer buyers greater consistency in terms of quality and volumes, a better alignment of supplies and customer requirements, and lower operating risks and costs. For smallholders, central benefits of successful contract farming include enhanced access to markets along with higher and more stable incomes. Under some arrangements, producers negotiate an equity stake (i.e., become joint owners) of productive assets such as land and processing facilities.

While contract farming is primarily private-sector led, government support for such arrangements is not uncommon on the grounds that these can contribute to meeting broader policy objectives such as inclusive growth, food security, or the protection of natural resources. Besides improving the enabling environment (e.g., the rule of law, the quality of infrastructure, health, and education, political stability, financial markets, and so forth), government can encourage contract farming by facilitating interactions and brokering transactions among potential counterparts, establishing a legal framework for farming contracts, putting economic incentives in place, building technical and institutional capacity, and educating counterparts about potential benefits and risks. India, Vietnam, Morocco, Thailand and other countries have developed policies aimed at promoting it (Will/GIZ 2013). Box 24 offers an example of a public-sector led approach to contract farming that has taken root in China. That

said, the public sector needs to tread carefully. A number of contract farming arrangements have owed their failure to facilitators in the public or non-profit sector getting ahead of value chain actors and pushing for arrangements that were not in line with existing capacities, ambitions, risk-preference, or levels of trust; or that put development objectives ahead of business viability.

Box 24: The Dragonhead Enterprise: An East Asian Take on Contract Farming

A public sector-led variant of contract farming, China's dragonhead enterprise model has become a core part of the government's strategy to promote vertical coordination in agricultural value chains and help farmers access higher-value markets by connecting them to leading agro-enterprises. It accomplishes this by offering subsidies, such as fiscal incentives, to lead firms that formally qualify to receive the dragon head label. For this, firms must meet certain requirements, including that they source at least 70 percent of the material they use in processing or distribution from external, small-scale farms. Farmers, for their part, must join cooperatives to deliver their products to these firms. Meanwhile, the government actively supports farmer cooperatives, which it sees as improving small-scale producers' ability to meet food safety and quality requirements. It does so not only financially, by offering credit, fiscal advantages and direct support, but also by organizing mobilization meetings, providing land and office space, and giving out awards (Verhofstadt et al. 2014).

The dragonhead enterprise model resembles the agricultural cluster model (see related thematic sheet) in that it promotes formal contracts and informal relationships to connect actors in the value chain. Unlike the cluster model, however, the dragon head model centers around one or few, rather than a multiplicity, of firms to organize collective action. In that sense, it is more akin to contract farming. The central place of the value chain construct in these approaches—which actively seeks to link and promote cooperation and competition among value chain actors—is relatively new in China. Until recently, different parts of the value chain fell under the purview of different government bodies and were treated as separate. Now, the ministry of agriculture has been empowered to support value chains as a whole, as the government has downgraded or abolished the role of other ministries (Galvez-Nogales/FAO 2010).

Thematic Sheet M - Collective Action III: Agro-based Clusters

Agro-based clusters⁵² foster interactions among all actors in a value chain, including public institutions, to help innovation and competitiveness. Public sector promotion of agro-based clusters has emerged as one response to the productivity and market pressures on agro-industry that are being shaped by globalization, standardization, high-value production, massive growth in demand, retail and packaging innovations, and a ramp up in efficiency (Galvez-Nogales/FAO 2010). They have been particularly helpful to export agriculture by improving productivity, value-addition, and access to high-value markets. They have also benefited small producers by allowing them to participate in economies of scale and share costs related to training, quality management, market information, and capital-intensive assets. Another benefit of clusters, in some cases, has been their contribution to creating a regional or brand identity, often with links to other clusters such as tourism (Galvez-Nogales/FAO 2010).

The public sector can support clusters in multiple ways that include investing in human capital through education and training, promoting cooperation among firms, strengthening applied research institutions, and adopting industry-friendly policies. Box 25 provides examples of this through examples of agro-based clusters in Latin America.

Box 25: Public Sector Support for Clusters: Examples from Latin America

Clusters do not usually emerge spontaneously, but take shape through the efforts of agents such as government, large local firms, foreign direct investors, and universities, often working in concert. In most cases, clusters are shaped by public-private collaboration. The flower cluster in Ecuador and apple cluster in Santa Catarina, Brazil, for example, were the product of public collaboration with lead firms. In some cases, the private sector has played a driving role and government has only become involved at a later stage as in the case of the Rio Grande do Norte melon cluster in Brazil (Galvez-Nogales/FAO 2010).

Chile's salmon cluster offers an example of a cluster in which government has played a significant, supporting role. That cluster is known for having turned Chile, previously a minor player in the salmon industry, into the world's second largest producer. In this case, government helped by building trust and facilitating joint action among different industry players. It also funded and collaborated in research and program design efforts to overcome a wide variety of challenges related to upgrading (e.g., fish health and genetics, supplier management and certification, vaccine registration, coastal zoning, fisher registration, regulatory enforcement, and clean production). As in Chile's multiple fruit clusters, an integrated territorial program that sits within a key industry association helped to align regional government efforts with business needs.

In some cases, as in the Chilean and Argentine wine clusters, government support has been decisive. In both cases, the government played a pivotal role in liberalizing grape and wine production and exports, as well as in enabling collective marketing and export promotion efforts. The public sector in Chile also supported technology absorption, especially by small producers, while in Argentina, the government promoted public-private partnerships and participatory governance which engaged industry in mutual monitoring. However, examples of government, alone, creating clusters from scratch are extremely rare; the Brazilian Petrolina-Juazeiro mango and grape clusters are exceptional in this respect. This is because clusters build upon the co-location of their actors, and the formal and informal linkages between them—elements that develop organically, over time, even if they are later encouraged.

52 Agro-based clusters are a concentration of producers, agro-industries, traders and other private and public actors engaged in the same industry inter-connecting and building value networks, either formally or informally, when addressing common challenges and pursuing the same opportunities (FAO 2010).

Thematic Sheet N - Food Safety Governance

High profile outbreaks and increases in the recorded incidence of food-borne illness have led many governments to tighten food safety regulations and oversight. At the same time, industry has increasingly taken food safety into its own hands and developed private food safety control mechanisms (whether voluntarily or as directed by regulation or cooperative agreements). In several countries and regions including Canada, New Zealand, and the EU, the public sector has fostered close cooperation between government and industry, an approach broadly known as co-regulation.

While a purely market-driven control system may not yield socially efficient outcomes, Martinez et al. (2007) note the benefits of co-regulation by highlighting how the alternative—an approach based solely on coercion—“can breed minimalist approaches to compliance resulting in sub-optimal improvements to public health alongside significant expenditure of resources on enforcement and monitoring.” Greater coordination of public and private sector efforts can be beneficial (in terms of efficacy or efficiency) when it comes to setting food safety standards, but also when it comes to implementation, monitoring, and enforcement.

Co-regulation typically involves cooperation between the public and private sectors to create new rules, whether these take the form of mandatory, binding, or purely voluntary food safety standards or agreements. In several countries, the public sector has come to rely increasingly on standardized risk and cost-benefit assessment methodologies to objectively evaluate specific risks before taking regulatory action. In this context, co-regulation has represented an attempt to remedy the fact that oftentimes, these assessments have involved industry too little or too late (see Box 26). In some instances, the government has encouraged industry to develop and implement its own codes of good conduct.

Box 26: Examples of Co-regulation of Food Safety

Examples involving the development of standards. In Canada, for example, the impetus to develop on-farm HACCP⁵³ programs came from a number of commodity organizations (especially for pork, chicken, and eggs); these started developing voluntary codes of safe practices. Recognizing these efforts, the government stepped in in the capacity of facilitator and coordinator, eventually leading to the formal recognition of individual commodity programs by the Canadian Food Inspection Agency.

By contrast, the development of national, voluntary organic standard by the U.S. Department of Agriculture in the early 2000s illustrates how the absence of co-regulation can result in the duplication of effort and slow progress. In this case, although 50 organic certifiers operated prior to the national standards being put in place (by the U.S. Department of Agriculture), the national standard did not attempt to build on these and the labeling program took ten years to develop (Martinez et al. 2007).

Continued to next page.

53 According to the U.S. Food and Drug Administration, HACCP is: “a management system in which food safety is addressed through the analysis and control of biological, chemical, and physical hazards from raw material production, procurement and handling, to manufacturing, distribution and consumption of the finished product.” <http://www.fda.gov/Food/GuidanceRegulation/HACCP/>

Box 26 continued.

Examples involving implementation. In Ontario (Canada), the province-level government has accompanied producers in moving to a system of more stringent and mandatory standards (e.g., from Good Agricultural Practice (GAP) to mandatory HACCP) (Martinez et al. 2007). Meanwhile, the province promulgated a voluntary standard for HACCP implementation, HACCP Advantage, in meat and poultry processing that was developed in close collaboration with these sectors. Since, the government body responsible for the regulatory inspection of processing facilities has played no role in the verification process (certification is ensured by the Standards Council of Canada) and focused instead on promoting the voluntary standard, developing training materials, and assessing its costs and benefits.

In the EU, the legislative framework for food safety generally shifted, with the adoption of the General Food Law of 2002, from a command-and-control approach to one that enshrines an enforced, self-regulatory approach; and this approach was embraced more fully in regulatory changes dating from 2006. It requires businesses to determine and implement their own internal rules and procedures to fulfill regulatory obligations. One benefit of this approach is that it has allowed the rapid adoption of new monitoring technologies by industry—an example being the use of radio frequency identification data (RFID) (Martinez et al. 2007).

Challenges with uptake of co-regulation. For the time being, co-regulation remains limited in scope in many parts of the world. This is partly largely due to a lack of trust in the private sector to have the motivation or capacity to take the necessary precautions to ensure food safety. In addition, shifting responsibility onto the private sector requires a greater degree of public-private coordination and a more complex system of public incentives and controls (Henson and Hooker 2001 and Hobbs et al 2002 in Martinez et al. 2007). It can be a formidable challenge to ensure a balance between industry participation (and influence over regulations and standards), and consumer protection (consumer groups having less resources than industry ones). Nonetheless, co-regulation could have its place in more countries, specifically when the costs of regulatory requirements (and their enforcement) outweigh their potential benefits, and for products that carry lower risk.

Thematic Sheet O - Repositioning I: Shifting Product Mix

More than 80 percent of Vietnam’s agro-food exports consist of primary commodities. This is not intrinsically bad—it can be profitable—and the country enjoys a strong competitive advantage in the sale of bulk commodities. Still, there may be missed opportunities to add value domestically. Selling intermediate or final consumer products can create increased job opportunities and may enable firms to experience less volatility in the prices of their exports. Cited here are two examples of this. One relates to India’s spice industry (see Box 27; the other to Taiwan’s overall agro-food trade (see Box 28).

Box 27: Knowledge-Intensive Value-Addition in the Indian Spice Industry

Historically the leading producer and exporter of spices, India has responded to increasing price competition—namely from Vietnam—by moving into high value-added products including branded, packaged consumer products, as well as spice oils and oleoresins. Knowledge- and technology-intensive, the latter displaced black pepper as India’s leading spice-export in value terms in the early 2000s. While multiple factors enabled this shift, this scenario would not have been imaginable without India’s heavy investment in quality infrastructure, applied research, and higher education.

India began to face increasing competition in the world market for bulk spices in the 1990s. The rise of low-cost producers such as Vietnam, China, and Indonesia has undermined India’s ability to compete on price, but also to a large extent on quality. Although Indian spices often meet higher standards, international sourcing of bulk spices has become increasingly price-driven. A growing number of Indian enterprises have confronted this challenge by shifting to and promoting higher value-added spice products. This strategy has not prevented India from losing ground to more price-competitive exporters in certain segments, but has allowed Indian exports to reach record value. The public sector has played an instrumental role in this achievement, in particular through the Spices Board of India. This industry regulator doubles as a research, extension and export promotion agency, supporting product and market development, and coordinating privately-held trade bodies.

India’s high value-added spice exports fall broadly into two categories: packaged consumer products, and spice-derived products used in manufacturing. India’s focus on branding, quality certification, and less demanding markets have over time improved its presence in foreign markets for packaged spices, particularly in the Middle East. More transformational have been its investments in highly specialized, technology-intensive export products such as spice oils and oleoresins. India now holds a major or dominant position in the international markets for these products, the exported value of which, in 2000-2001, overtook that of black pepper—the commodity that has historically dominated India’s spice trade. The export of black pepper, in bulk, has more generally given way to trade in higher value pepper products including pepper powder, dehydrated green pepper, brined pepper, and pepper oil and oleoresin. India crossed a symbolic turning point in 2012 when it became a net importer of black pepper.

Box 28: From Commodities to Value-Added Products: Taiwan, China

Taiwan's farm and food sectors were able to respond and take advantage of shifting patterns of domestic consumption to climb their way up the value-addition ladder and move into high value food exports, even as rising labor and raw material costs threatened to thwart their price-competitiveness in increasingly competitive raw and process food markets. Though this shift was achieved by private farmers, cooperatives and companies, government provided significant financial and technical support.

In the space of a few decades, Taiwan's profile as a food producer and exporter changed dramatically, with its focus shifting first from raw to canned products, and then from canned products to frozen and prepared foods. In the 1960s, Taiwan's exports were dominated by sugar, canned pineapple, and bananas. By 1980, nearly 60 percent of its agricultural exports were of canned vegetables and processed seafood. High value-added frozen and prepared meals began gaining ground in the 1990s as the canned foods market grew increasingly competitive. Food manufacturing has remained relatively important in Taiwan's economy even as the contribution of agriculture to GDP has shrunk notably.

Part of the explanation for this pattern is that Taiwan's farm and food sectors proved responsive to domestic market changes. Starting in the 1960s, sustained income growth, urbanization and westernization led domestic consumers to increasingly substitute protein- and vitamin-rich foods for starchy ones, and demand convenience or ready-to-eat packaged foods. The government of Taiwan, moreover, intervened proactively to enable the private sector to accompany these trends. Thus, farmers wishing to shift out of rice production benefitted from different forms of technical and financial support.

Cooperatives and farmer associations received subsidies to invest in marketing facilities. The government sponsored the development of a market information system that supported fruit and vegetable cooperatives market fruit. Pork production benefited from a production credit, technical assistance, price guarantees, and marketing support via cooperatives. The government invested in the development of a food processing machinery industry. Its investments in education and training supplied the industry with large numbers of trained technicians, and experienced managers. Also helpful were the country's strong business ties to Japan and macroeconomic stability.

Thematic Sheet P - Repositioning II: Branding Strategies

Constructing a positive national or sub-national brand can help attract FDI and tourism, but also promote exports and domestic sales while raising their price point. Vietnam, however, has not succeeded at associating its agricultural export success with a national brand image helpful to differentiating its exports for non-price competition. The success in domestic and international markets of products such as Pu'er tea from the yunnan province of China, Mexican tequila, single-origin coffees and teas from multiple countries, and other countries, illustrate how the national or regional branding of a product—combining elements of marketing, legal protection, and quality management—can have a transformative effect on both domestic and international markets (see Box 29, Box 30, Box 31, and Box 32).

Box 29: Pu'er Tea in China

The recent success in domestic and international markets of Pu'er tea from the yunnan province of China illustrates how the national or regional branding of a product—combining elements of marketing, legal protection, and quality management—can have a transformative effect on a market. Pu'er tea went in the 2000s from being a relatively unknown product to one that enjoys broad recognition and distribution in China and increasing presence overseas. Long prized by connoisseurs as a refined and healthful elixir, the beverage is now mass-marketed both as a premium eco-product, and the symbol of an ancient regional tradition. Chinese consumers widely believe it to improve digestion and promote weight loss. In a context where the multiplication of labels bearing safety guarantees, together with health-scares, have led to confusion and distrust among consumers [of Chinese products], Pu'er has risen above the fray, capturing the imagination and confidence of [domestic] consumers.

The brand owes its success to the joint efforts of national and local government, growers, and industry, and their investments not only in marketing, but also in legal protection and environmental and quality management. Though rooted in history, the distinctive shape and packaging, and the vibrant images of ethnic minorities and traditional agricultural landscapes now associated with Pu'er tea-cakes, have been crafted by leading brands such as Dayi with support from yunnan province and Pu'er City. Meanwhile, industry and government have taken measures to substantiate claims to authenticity and quality. The Chinese government, in 2008, codified Pu'er as a geographic indicator for tea. Though not immune to counterfeiting, the Pu'er-labeled tea is now subject to stringent standards and quality-testing performed in local facilities. In addition, subsidies and training to promote ecological farming practices have helped to keep tea off of unsuitable lands, biodiversity protected, and agro-chemical use in check.

Box 30: Mexican Tequila

The story of tequila's rise in the 1990s illustrates how a cultural branding strategy can, in conjunction with legal protection, vastly widen a product's horizons. Tequila is named after its town of origin in the northwestern Mexican state of Jalisco, where the blue agave plants from which the alcohol is derived grow. Once considered a cheap and low-brow drink, this regionally-branded mezcal is now seen as a quality-alcohol and symbol of Mexican identity, both domestically and abroad. In the 1990s, global sales of Mexican tequila doubled, making it the fastest growing liquor category in the world. Underscoring the power of branding, the boom in tequila consumption carried on through a three-year price spike, after the severe winter of 1997 and a fungal plague put half the blue agave population out of production. If anything,

Continued to next page.

Box 30 continued.

high prices helped the drink by attracting global media attention and placing tequila in the price range of premium spirits. Surging interest in tequila also contributed to the development of regional tourism centered on the beverage.

Tequila's take-off was the result of joint efforts, on multiple fronts, by industry, government, and cultural organizations. On a legal front, tequila obtained protection in over 40 countries and was registered as an appellation of origin under the World Industrial Property Organization. No less pivotal were a host of initiatives that contributed—many with government backing—to legitimizing and elevating the drink's image. UNESCO's recognition of the "agave landscape and ancient industrial facilities of Tequila" as a world cultural heritage site, for example, resulted from the joint efforts of a cultural institute, an industry association, and the State of Jalisco (the National Institute of Anthropology and History, the National Chamber of Tequila Industry, and State of Jalisco). Other efforts included the launch of a professional organization of tequila tasters, a tequila studies degree by a major Mexican university, tourism initiatives, and tequila associations.

Box 31: Marketing Undifferentiated Products in the USA

In the United States, many agricultural commodities are promoted by mandatory marketing programs funded through commodity-specific sales taxes. The famed "Got Milk?" publicity campaign, for example, started as the product of such a program—in this case, a marketing order issued by the state of California at the behest of milk processors. Marketing agreements and orders, and commodity research and promotion programs, are the main types of mandatory marketing mechanisms that can be put in place under state or federal law. These allow the government to intervene in an agro-industry—often at industry's request—to enable it to fund its own research, promotion and other efforts. Without government intervention to mandate full participation on the part of producers or handlers, coordination failures linked to the potential for free-ridership can hamper such efforts and even prevent them from getting off the ground. That risk is particularly pronounced when it comes to promoting relatively undifferentiated and weakly-branded commodities, since it is difficult to prevent non-participating producers from benefitting from the efforts of others (e.g., from benefitting from generic advertising).

Mandated marketing programs typically include provisions for research, minimum quality standards, regulation of packaging and containers, quantity controls, and generic advertising and promotion (Carman 2007). However, programs are tailored to specific commodities and conform to the different laws under which they are created. Commodity research and promotion programs, also known as check-off programs, enable industry actors to "pool their funds and develop a coordinated program of research, promotion and consumer information to improve, maintain and develop markets for their products," according to the US Department of Agriculture (USDA). They are also meant to yield public health, nutrition, and other public benefits. These programs are created under federal law,⁵⁴ and are both requested and funded by industry. Fees are assessed on commodity sales at different points along the supply chain.

Marketing agreements and orders help to "provide stable markets" and "maintain the quality of produce being marketed, standardize packages or containers, and authorized advertising, research and market development," again according to the USDA. Although they are initiated by industry, and tailored to industry's marketing needs, these programs become binding for all industry participants once they are enacted. They can be put in place at the federal and state levels, though the process and range of eligible commodities differ.

⁵⁴ A law passed in 1996 gave the USDA broad authority to establish national generic promotion and research programs for nearly commodities without the need to pass commodity-specific legislation (Carman 2007)

Box 32: Geographic Indicators for Tea and Coffee

Seeking legal recognition of a geographic indicator as a form of intellectual property—both domestically and overseas—is a widely-used means of restricting the production of a commodity in a legally enforceable way. It can be part of an effective strategy to limit competition for the supply of products that possess distinctive (sensory) qualities attributable to a specific geography. However, it requires bona fide interest and capacity on the part of producers and public authorities to protect those distinctive qualities. Legal protection is typically sought for geographic indicators that have a long-standing tradition and broad reputation. Antigua coffee from Guatemala, Blue Mountain coffee from Jamaica, Kona coffee from Hawaii, Narino coffee from Colombia, Assam tea from Sri Lanka, and Ceylon tea from India, were all renowned before they were codified. (Diaz-Rios 2015)

However, not all protected geographic indicators have emerged on the basis of long-standing tradition. For example, coffee produced in Brazil's Cerrado region achieved protection in 2005, though it was introduced as recently as the 1970s and its production is highly mechanized. In some cases, cultural importance and recognition have been the product of deliberate marketing campaigns. Mexican Veracruz coffee was not widely known prior to obtaining legal protection. Moreover, geographic indicators that already enjoy broad recognition often do so because of past efforts to market and distribute products differentiated on their basis. Antigua coffee, for example, initially gained recognition in the early 20th century through the efforts of a single producer. It was not until the 2000s that multiple farmers formed the Antigua Coffee Producer's Association to protect the authenticity, quality and reputation of this specific coffee, and trademark the label. More indispensable than tradition and prior renown, then, are a product's distinctiveness from a sensory perspective, and effective marketing strategies.

Giovannucci (2015) reviewed international experience with geographic indicators. He noted that successful applications depended upon (i) having a consistent supply of the product with specified/desired qualities; (ii) having strong coordinating organizations for promotional and other efforts; and (iii) working closely with downstream market players to ensure commercial success. While geographic indicators are increasingly seen as a key tool for value creation at the farmer level, there are pros and cons of using this tool, compared with alternative approaches.

