Working Paper

A Strategic Agricultural Sector and Food Security Diagnostic for Myanmar

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by Michigan State University (MSU) and the
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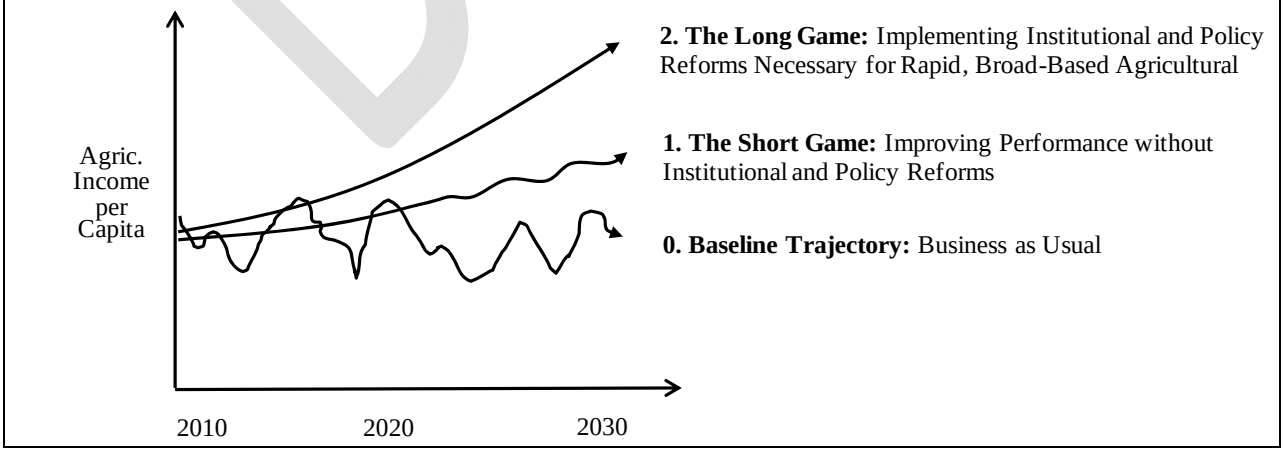
EXECUTIVE SUMMARY

Despite its enormous potential, Myanmar's agriculture has underperformed over the past fifty years. Today, per capita earnings in agriculture average roughly $200 a year, one-half to one-third of the levels achieved by its regional peers. Given that two-thirds of the population works primarily in agriculture, low farm productivity translates into high rates of poverty and food insecurity. Currently, about one quarter of the population falls below the national poverty line. As a result, in spite of national rice self-sufficiency, food security for many households and individuals remains elusive. Poor households spend over 70% of their income on food. In addition, fully one-third of rural households borrow at some point during the year in order to purchase food. Even after shouldering this heavy financial burden, up to one-half of rural households report having to navigate two months each year without adequate food supplies, leaving one-third of the country's children stunted.

Why has Myanmar's agricultural sector performed so poorly? As in other sectors of the economy, ongoing ethnic civil war and violence over the past 60 years, coupled with international isolation, have discouraged private investments and hindered the exchange of technology and know-how. Within the agricultural sector, a series of institutional, policy and structural constraints has hampered agricultural growth and contributed to Myanmar's current high rates of hunger and malnutrition. The most critical of these problems include: • a highly skewed land distribution, which leaves roughly half of rural households landless, • poor water control systems in the presence of global climate change and increasingly unpredictable rainfall, • a high-cost transportation system, • weak rural financial institutions, • unpredictable government policies, • low public investments in agricultural research, and • weak links between extension services and farmers. Fortunately for the two-thirds of Myanmar citizens who work in agriculture, all of these impediments can be remedied through good policies, institutional reforms and key public investments.

Business as Usual. Looking forward, we see three alternative pathways for Myanmar's agricultural sector (Figure 1). Under a Business as Usual scenario, Myanmar's agriculture will continue along its current low-productivity, highly volatile trajectory. Persistently low

Figure 1. Strategic Options for Myanmar's Agricultural Sector



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agricultural productivity stems from five decades of underinvestment in the agricultural support institutions that drive farm productivity growth. Heavy volatility in agricultural production and prices emerges as a result of poor water control in the presence of increasingly irregular rainfall patterns, unpredictable policies, high transport costs, poor rural communications and a lack of diversification among export markets.

But Myanmar can do better -- even within the country's currently considerable policy, institutional and structural constraints. Under a vigorous program of policy and institutional reform, coupled with increases in technical efficiency, Myanmar's agricultural sector can accelerate rapidly. Key decisions by the Government of Myanmar, its supporters and stakeholders will determine which of these three pathways the country will travel.

The Long Game. In order to match the impressive agricultural performance of its regional peers, Myanmar will need to undertake a series of key institutional and policy reforms. Currently, Myanmar invests only 20% as much in agricultural research (per $100 in agricultural output) as its regional counterparts. Not only will Myanmar need to substantially boost the resources it allocates to agriculture, it will also need to restructure its line ministries and departments in order to better support the core public goods and services that drive productivity growth in agriculture. Many decades of socialist command and control systems have left a legacy of over-staffed departments designed to supervise and control farmer decisions. Yet service-oriented systems for listening to farmers, diagnosing problems and finding practical, scientific solutions have atrophied. Propulsion towards a highly productive, competitive, broad-based agricultural growth trajectory will require a restructuring of agricultural support institutions in the three key areas. First are the public goods that drive broad-based agricultural productivity growth: • agricultural research, through the creation of a market-oriented, farmer-centered research system, • extension system modernization and reform, • agricultural education, • a transparent, predictable policy environment • irrigation and improved water management systems, • land administration and access, • deepening of rural financial systems, • improved rural communications and transport, and • support for farmer-based organizations. Second is an accurate, objective statistical data collection and dissemination system. Currently, few stakeholders believe Myanmar's official production statistics -- even for rice, where alternate estimates differ by as much as 50%. Yet transparent, effective policies require a firm empirical grounding, as do private sector investment decisions. Third, is a long-range reengineering of the education, health and nutrition institutions that promote long-term human capital formation among rural children, particularly the children of landless households and other disadvantaged groups.

The Short Game. Options for improving agricultural performance without further institutional or policy reforms center around four strategic axes: • improving productivity of monsoon rice through improved seed quality, better agronomic practices, improved water control, optimized fertilizer and input use, integrated pest management, and improved post-harvest management • promoting diversification into high-value horticulture, poultry, fisheries and small livestock by both small farmers and landless, • preparing the children of landless and near landless households for productive careers in high-productivity agriculture, agribusiness and nonfarm professions by building up their human capital through nutrition programs and enhanced access to improved rural education and, • improving safety nets. As a rough order of magnitude, our

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discussions with local stakeholders suggest that improved practices among rice farmers could increase productivity and earnings from paddy farming on the order of 25% to 50% over the next 5 to 7 years, even under the current policy and institutional environment.

Our team strongly advocates a strategy focused on the Long Game, particularly a set of early actions necessary for enabling key institutional reforms, but complemented by Short Game interventions that help to increase incomes, assets, farmer skills and water management systems in ways that expand productive potential in the Long Game. Myanmar's neighbors and competitors in Thailand, Vietnam, Bangladesh, Malaysia, India and China have all committed to a Long Game involving strong public investments in agricultural research, extension and other public goods required to support agricultural productivity growth. Without similar commitment in Myanmar, we find it difficult to see how the country's farmers will be able to compete in increasingly competitive regional and global markets – including those at home.

Policy reforms begun at the end of the 1980s have moved in this direction, though slowly and at sometimes variable speeds. Continued reforms, coupled with increased resource allocations for agriculture and improved policy implementation capacity will be required to translate these still-unfolding policy changes into sustained, improved conditions on the farm. Promulgating new laws -- as difficult as that appears -- is often the easiest part of a reform process. Mobilizing the political will to increase budget resources, in the presence of many competing constituencies, frequently proves more difficult, as does institutional restructuring, which by definition alters the power base of many vested interests. Myanmar has reached the stage in its agricultural reform process where substantial resource increases and significant institutional restructuring are required to advance an effective reform agenda.

A balanced portfolio, centered around the Long Game but complemented by Short Game interventions, will help to demonstrate to rural communities that the Government and its development partners are serious about improving the agriculture sector. This multi-pronged approach addresses the needs of rural communities for early visible change while at the same time remaining committed to necessary structural re-engineering of institutions and policies.

As a society, Myanmar's government, parliament, private sector and civil society will need to decide whether they are willing to commit the financial resources and organizational recapitalization required to execute a successful Long Game strategy. If not, in a worst case Myanmar risks reversion to a Business as Usual future with its record of stagnation, poverty and food insecurity or, at best, a one-dimensional Short Game with limited upside potential.

The discussion in this document aims to provide a menu of strategic options for improving agricultural performance under both Long Game and Short Game scenarios. For both, the report identifies early actions that will lay the foundation for a successful Long Game under which accelerated, broad-based agricultural growth contributes to faster national income growth, improved food security, and increased political stability going forward.

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ACRONYMS

ACIAR	Australian Centre for International Agricultural Research
ADCs	Agricultural Development Companies
ADB	Asian Development Bank
ADP	Agriculture Development Programme
ADRA	Adventist Development and Relief Agency
AED	Agriculture Education Division
AMD	Agriculture Mechanization Department
AMK	Angkor Mikroheranhvatho Kampuchea
ASEAN	Association of South East Asian Nations
BAAC	Bank for Agriculture and Agricultural Development
BIMSTEC	Bay of Bengal Initiative for Multi-Sectoral Technical and Economic Cooperation
BRAC	Bangladesh Rural Advancement Committee
BRRI	Bangladesh Rice Research Institute
BTI	Bertelsmann Stiftung's Transformation Index
CARD	Center for Agriculture and Rural Development
CARI	Central Agricultural Research Institute
CARTC	Central Agricultural Research and Development and Training Centre
CBM	Central Bank of Myanmar
CBO	Community-based Organization
CESD	Centre for Economic and Social Development
DA	Department of Agriculture
DAP	Department of Agricultural Planning
DAR	Department of Agricultural Research
DfID	Department for International Development
DSLR	Department of Settlement and Land Records
ESCAP	Economic and Social Commission for Asia and the Pacific
FAO	Food and Agricultural Organization
FFS	Farmers' Field School
FSWG	Food Security Working Group
GAD	General Administration Department
GDP	Gross Domestic Product
GMS	Greater Mekong Subregion
GOM	Government of Myanmar

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HYV	High yielding variety
ID	Irrigation Department
IHLCA	Integrated Household Living Conditions Assessment
IMF	International Monetary Fund
IFC	International Finance Corporation
INGO	International non-Government organization
INI	Information Networking Institute
IPM	Integrated Pest Management
IRRI	International Rice Research Institute
ISP	Internet service provider
JICA	Japan International Cooperation Agency
LCG	Land Core Group
LIFT	Livelihoods and Food Security Trust Fund
LUD	Land Use Division (MOAI)
MADB	Myanmar Agriculture Development Bank
MAS	Myanmar Agriculture Service
MDRI	Myanmar Development Resources Institute
MEC	Myanmar Economic Cooperation
MFI	Microfinance Institution
MICDE	Myanmar Industrial Crop Development Enterprise
MICS	Multiple indicator cluster survey
MOAI	Ministry of Agriculture and Irrigation
MOEC	Ministry of Environmental Conservation
MOLF	Ministry of Livestock and Fisheries
MPBSSMA	Myanmar Pulses, Beans and Sesame Seeds Merchants Association
MRIA	Myanmar Rice Industry Association
MSU	Michigan State University
NGO	Non-Governmental Organization
NMB	National Microfinance Bank
NPK	Nitrogen, phosphorus, potassium compound fertilizer
RIMES	Regional Integrated Multi-hazard Early Warning Systems
RSC	Rice Specialized Companies
SAI	State Agricultural Institutes
SEE	State Economic Enterprises
SLRD	Settlement and Land Records Department
UMEH	Union of Myanmar Economic Holding Company
UMFCCI	Union of Myanmar Federation of Chambers of Commerce and Industry
UNCDF	United Nations Capital Development Fund
UNDP	United Nations Development Programme
UNFPA	United Nations Population Fund
UNOPS	United Nations Office for Project Services
UOF	University of Forestry
USAID	United States Agency for International Development
USDA	United States Department of Agriculture
UVS	University of Veterinary Science

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VFVLM	Vacant, Fallow and Virgin Lands Management
WB	World Bank
WRUD	Water Resources Utilization Department
WFP	World Food Programme
WRUD	Water Resources Utilization Department
YAU	Yezin Agricultural University
YCDC	Yangon City Development Council

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MEASURES

1 hectare	=	2.471 acres
1 kg	=	0.61 viss
1 viss	=	1.64 kg
100 ticals	=	1 viss
1 basket of:		
Paddy	=	21 kg
Green gram	=	33 kg
Groundnuts in shell	=	11 kg
Sesame	=	24.50 kg
Currency conversion, December 2012		
US $1.00	=	850 Kyats

1. INTRODUCTION

1.1. Objectives

Despite its enormous potential, Myanmar's agricultural sector has underperformed over the past fifty years. Agricultural productivity remains low in comparison with its international competitors and neighbors. With per capita farm earnings that average roughly $200 per year, Myanmar's farming households earn one-half to one-third of the levels attained by their regional peers (Table 1). The imposition of socialist policies controlling land ownership, agricultural production decisions, and marketing of key commodities, from the 1960s through the 1980s, launched a period of generally declining agricultural competitiveness. Most studies of Myanmar's agriculture highlight the country's descent -- from its position as the world's largest rice exporter in the 1930s, when Myanmar supplied two to three million metric tons annually to the world market, to the stagnation witnessed from the 1960s onwards (Figure 2). As a result of its heavy policy focus on rice and generally favorable growing conditions, Myanmar has remained generally self-sufficient in rice. Indeed, over the past decade, domestic production has permitted a small rice surplus for export, averaging about 450,000 tons annually.

Yet national rice self-sufficiency has not translated into food security for the poor. Given a highly skewed distribution of assets and income, rates of poverty and hunger remain stubbornly high. Roughly one-fourth of the national population – and 29% of rural households – falls below the national poverty line (IHLCA 2011).[2] Stunting affects about one-third of children under five, while malnutrition as measured by underweight affects similar numbers (MICS 2011). Poor households spend over 70% of their income on food, and fully one-third of rural households borrow at some point during the year to purchase food (IHLCS 2010, LIFT 2012). Despite these considerable efforts, up to half of rural households report having to navigate two months each year without adequate food supplies (MICS 2011, LIFT 2012).

Table 1. Indicators of Agricultural Productivity and Food Security

Country	Agricultural Income per Ag. Worker ($ per year)	Poverty (% under $1.25 per day)	Malnutrition (% children underweight)
Malaysia	$6,680	<1	13
Philippines	$1,119	18	21
Indonesia	$730	18	20
Thailand	$706	<1	7
Bangladesh	$507	43	41
Cambodia	$434	23	29
Vietnam	$367	17	20
Myanmar	**$194**	**26**	**32**

Sources: IHLCA (2011), World Bank Development Indicators (2012), MDG Indicators (2012).

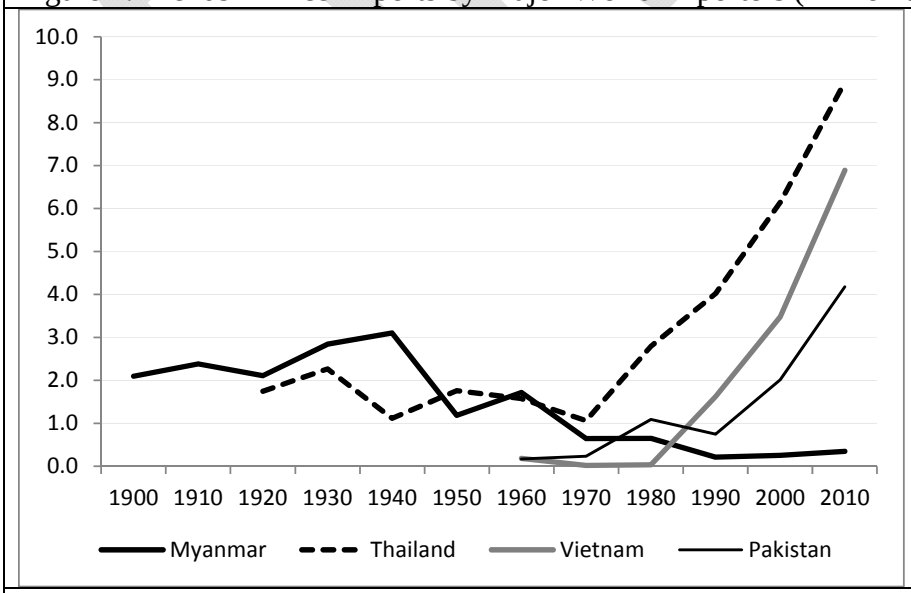
[2] In 2010, ILHCA estimated the national poverty line at 376,151 Kyat per person per year. At the parallel exchange rate of 1,004 Kyat per dollar, this was equivalent to $1.03 per person per day.

Because agriculture employs two-thirds of Myanmar's labor force, and because agriculture affects national food supply, the stability and level of food prices and purchasing power of both the rural and urban poor, broad-based agricultural growth offers a singularly powerful instrument for raising rural incomes and reducing poverty, food prices and hunger. Given the tight complementarities between agriculture and food security, this review assesses opportunities for improving performance in both.

Myanmar's agricultural potential remains considerable given the country's resource endowments and favorable geographic location. Its considerable water resources center around the Ayeyarwady and related river systems which supply 24,000 cubic meters per capita of renewable fresh water each year, over ten times the levels available in China and India and more than double the water resources of Vietnam, Thailand and Bangladesh (ADB 2012). Moreover, three of its four major river systems originate within the country, giving Myanmar exclusive control over these considerable water resources. As growing water scarcity constrains production around the globe, and particularly in neighboring China and India, Myanmar's water resources will offer a significant agricultural competitive advantage. In addition, the country's diverse topography and eco-systems enable farmers to produce a wide range of cereals, pulses, horticulture, fruits, livestock and fish. Combined with its strategic location between two enormous regional markets, in India and China, and easy access to buoyant markets in the Gulf, Myanmar's farmers and agribusinesses find themselves well-positioned to contest both regional and global agricultural markets. This report explores strategic options for charting a more dynamic agricultural and rural sector going forward.

Many pathways are possible. Thailand and Vietnam have claimed Myanmar's position as the world's leading rice exporters (Figure 2), Thailand by sustained support to the smallholder sector and Vietnam by transitioning from a socialist system to a free-market beginning with the shift from collectives to individual contracts in 1981 and broader policy changes liberalizing the rice sector in 1988 (Pingali and Xuan, 1992). Bangladesh, despite land pressure similar to

Figure 2. Trends in Rice Exports by Major World Exporters (million tons)



Sources: Ingram (1955), Young, Cramer and Wailes (1998), FAOSTAT.

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Myanmar's, has defied international experts to become food self-sufficient as well as a major international garment exporter. Malaysia, though far from self-sufficient in rice, has achieved the highest rural income in the region by focusing on support for tree crop exports. Indonesia has combined support for both rice intensification as well as tree crops by tapping its considerable petroleum resources to support agricultural growth.

Given Myanmar's unique culture, history, resource base and timing, the country will need to chart its own pathway forward. In doing so, as it emerges from years of economic and political isolation, Myanmar will be able to draw on lessons learned elsewhere over the past five decades.

This report provides a strategic assessment of the key issues, opportunities, constraints and choices facing Myanmar's agricultural sector. Discussion focuses on pathways that will permit agriculture to contribute meaningfully to broad-based improvements in purchasing power and food security for the country's many landless and vulnerable households. In doing so, it aims to assist public and private stakeholders who will be making the key investment and policy decisions governing future agricultural and food security trajectories in Myanmar.

1.2. Methods

The thirteen-person team conducting this diagnostic review includes members with expertise in a broad range of agricultural disciplines, including research, extension, finance, agronomy, irrigation, marketing, education, policy, food security and safety nets. The team paired its seven international members with six Myanmar colleagues from the Center for Economic and Social Development (CESD) of the Myanmar Development Resources Institute (MDRI) for both the field and analytical work. A series of thematic background papers served to organize individual assignments and focus the field visits and analytical work on a range of cross-cutting issues affecting agricultural performance and food security. In addition to the issues of broad agro-ecological conditions, research and extension systems, rural finance and household food security, the background papers also included a rapid assessment of the rice value chain. More impressionistic field visits aimed to explore activities and issues affecting pulses, oilseeds, poultry and horticulture. Overall, the team produced six for background papers and four sets of field notes that, in turn, provide the basis for the present summary diagnostic report (see Annex A).

This assessment builds on a wealth of existing background studies and survey work – including a recent agricultural sector review commissioned by United Nations Development Programme (UNDP) and conducted by Food and Agriculture Organization (FAO 2005), an Integrated Household and Living Conditions Survey (IHLCA 2011), a country economic assessment conducted by the Asian Development Bank (ADB 2012), an important baseline study and early evaluation reports by the Livelihoods and Food Security Trust Fund (LIFT) (Barca and Riemenschneider 2011, LIFT 2012, Anderson 2012), and a collection of highly informative subject-matter reports and studies by the Land Core Group of the Food Security Working Group (LCG 2012, Obendorf 2012, Woods 2013), the FAO (2000), Okamoto (2008), the Australian Center for International Agricultural Research (ACIAR) (Henning et al. 2007, 2009; Rao et al. 2011) and a series of four reports prepared by the Ashe Center at Harvard University and

commissioned by Proximity Design (Dapice et al. 2009-2012). Private sector trade associations representing the rice industry, poultry, livestock, horticulture, and pulse traders supplied the team with similarly useful market data and in some cases survey results commissioned by their associations.[3]

In order to see farm production, marketing, food security conditions and livelihood options first-hand, the team conducted three weeks of field interviews in the Delta, Dry Zone and in Shan State during two waves of visits running from early October through the end of November 2012. The team also attempted to visit Chin, Mon and Kachin States, but was unable to arrange the necessary travel logistics and permissions (Annex Figure D2). During the field visits, team members consulted broadly with government officials, farmers, traders, agribusiness operators and non-government stakeholders in the NGO community and in civil society using rapid rural appraisal techniques, key informant and group interviews. In each location, we specifically sought out women participants in order to ensure gender balance in the input we received. Following the field visits, the team conducted debriefing meetings with the private sector Union of Myanmar Federation of Chambers of Commerce and Industry (UMFCCI) and agricultural sector donors (LIFT consortium) which proved helpful as a sounding board for initial findings and for clarifying inconsistencies and issues requiring further investigation. In all, the team visited roughly three dozen villages and two dozen markets in towns across these three zones, enough to provide context but clearly insufficient to produce statistically reliable data (Figure 3).[4]

Indeed, data inconsistencies posed consistent challenges throughout the team's investigations. Virtually all of the stakeholders we spoke with – in both the public and private sector – emphasized the frailties of existing agricultural and socio-economic data bases in Myanmar. Even production estimates for paddy – the single most important agricultural commodity produced in Myanmar – differ by 50% to 100%. These uncertainties over basic facts pose vexing problems, not only for assessment teams such as ours but also for government policy makers and private sector investors. Section 2 of this report discusses these issues in some detail.

1.3. Definitions

Agriculture. This paper considers agriculture to include crop production, livestock and fisheries. According to national income statistics, crop production accounts for about 80% of agricultural GDP, while livestock and fisheries account for the remaining 20% (Annex Table C1).

Food security. The Food and Agriculture Organization (FAO) considers that food security exists when all people, at all times, have physical and economic access to sufficient safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life. As a

[3] We are grateful for the valuable insights the team received during these individual meetings and briefings as well for the many helpful written comments we have received on earlier drafts of this report. Many people have suggested amplification in areas related to gender, health, nutrition, natural resource management and education. Where possible, we have complied. However, given our agricultural mandate and limited time for field investigations, this has not been possible in all cases. Annex E suggests some possible topics for further investigation, building on this early feedback.

[4] We are likewise unable to comment knowledgably on conditions in the many border areas we were unable to visit.

result, four key dimensions define food security: • availability, • access, • utilization, and • stability (see Annex Figure D1). Availability addresses the supply side of the food system, referring to the physical availability within a country, of food supplies sufficient to feed its population. Access addresses the demand side of the food system by requiring that all population groups possess sufficient purchasing power to procure the quantity and quality of food their family requires. Utilization refers to the ability of the human body to absorb and retain required nutrients. Health status, disease burdens, feeding practices and water quality all affect food utilization and hence nutritional outcomes. Stability along all these dimensions requires that all household members and the food system be able to maintain adequate food availability and consumption in all seasons of the year as well as during drought or flood periods that may strain supply systems or the income sources of vulnerable populations.

Agriculture governs three of the four determinants of food security. Availability depends on the productivity and efficiency of farmers, traders and food processors. Access depends on incomes and purchasing power. In a country such as Myanmar, where two-thirds of the population earns its living from agriculture, improved agricultural productivity offers a singularly powerful lever for improving purchasing power of broad groups of vulnerable populations. Stability of food supplies, incomes and purchasing power likewise hinges, in large part, on the flexibility, efficiency and responsiveness of water control, farming and marketing systems.

Farmer. Myanmar's land laws consider as farmers those people and corporate entities that have been given rights by the state to cultivate land. Because the government owns all land in Myanmar, under Article 37 of the Constitution, cultivation requires tillage rights that can only be awarded by the state (Oberdorf 2012).

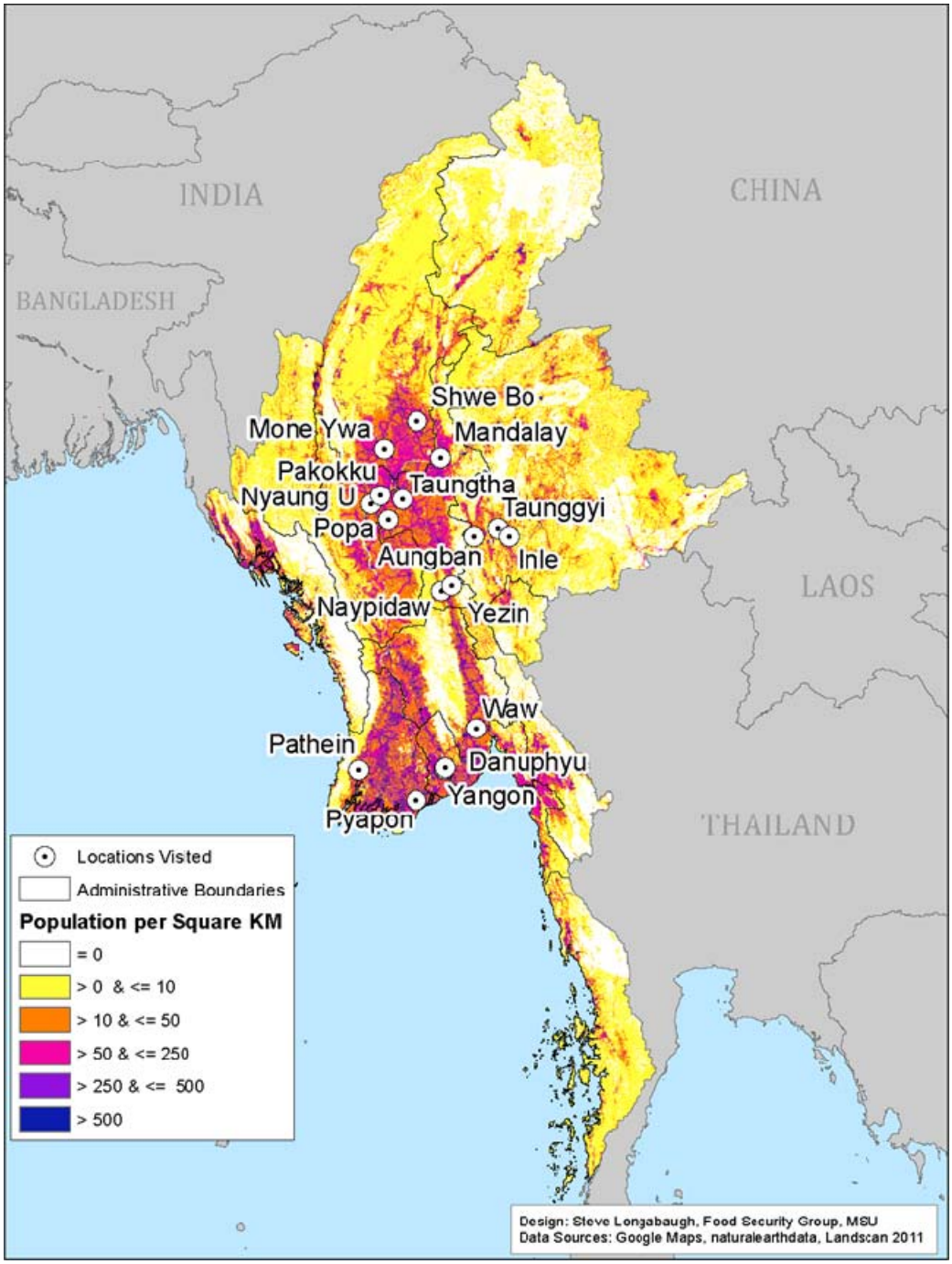
Landless. Rural households without tillage rights to farmland are, by definition, landless. Some own and operate nonfarm businesses although most earn their living as wage laborers, working primarily in the fields of neighboring farmers who hold tillage rights. Although estimates vary regionally and across sources, we estimate that roughly 50% of rural households in Myanmar are currently landless (see Section 3.2).

1.4. Organization

This paper begins with a review of data quality and reliability issues that arose repeatedly during our investigations since these issues affect both our findings and our recommendations. Following that, the paper provides a snapshot of the current status of Myanmar's agricultural sector and of the food security status of its vulnerable groups. This leads to a diagnosis of factors affecting past and future performance. The final section of the paper looks forward to explore three potential trajectories for Myanmar's agricultural sector and key decisions that will affect which pathway Myanmar's rural citizens will travel in coming decades.

This diagnostic report does not claim to provide an exhaustive or statistically definitive overview of Myanmar's agricultural sector. Nor does it aim to. Rather, by comparing Myanmar's current situation, performance and policies with experiences from elsewhere and by benchmarking against best-practices from outside, this review aims to highlight critical issues and key choices that will govern agricultural and food security trajectories in Myanmar over the coming decades.

Figure 3. Field Interview Locations



Source: Annex B.

2. DATA QUALITY ISSUES

Wolfgang Stolper wrote his famous book, *Planning Without Facts*, in 1966. It described his efforts helping to prepare Nigeria's first national development plan at a time and in an environment where reliable data were in chronically short supply. His labors resemble those of current policy makers and potential investors in Myanmar, where reliable data remain similarly elusive even today.

Most stakeholders we spoke with – in the private and public sectors – agree that the quality of Myanmar's agricultural data is generally weak. Production estimates for paddy vary by nearly a factor of two across sources. While official government estimates put paddy production at 33 million tons in 2011, the major alternative estimate from the U.S. Department of Agriculture (USDA) projects production at closer to 17 million tons.[5] For minor crops and livestock, which enjoy less careful attention and fewer monitoring resources, estimates likewise vary widely (Table 2). Optimistic official production estimates, in turn, give rise to implausibly high estimates of annual rice consumption, over 280 kg per person per year, nearly double the levels of other major rice-growing countries in the region (see Dapice et al. 2009 and Denning et al. 2013).

Problems of data quality are not unique to agriculture. More broadly, users of socio-economic data in Myanmar raise regular questions about their reliability and accuracy (see Ware and Clark 2009, U Myint 2010, Dapice et al. 2011, 2012). A recent review by Ware and Clark (2009, p.1) states flatly that, "Accurate statistical data for Myanmar is lacking, and what is available is of questionable validity. This is the result of several factors including the government having limited control over parts of the territory, limited resources for data gathering and analysis, and data being manipulated for internal and external consumption." The United Nation's regional Economic and Social Commission for Asia and the Pacific similarly concludes that Myanmar stands out as having the least capacity in ASEAN "to produce reliable and timely data even for the most basic statistics" (ESCAP 2007). As Dapice et al (2012, p.7) note, 'Myanmar is a very poor country with very misleading official data." Several structural problems underlie these basic concerns about data reliability.

Table 2. Variability in Estimates of Key Socio-Economic Data in Myanmar

Parameter	Estimates		Difference	Alternate
	official	alternate	(of-alt)/alt	source
Population, 2008 (millions)	59	49	20%	IMF, World Bank
GDP growth rate (% per year), 2000-2010	12.2	4.7	160%	IMF
Rice production, 2011 (million tons)	32.6	17.2	90%	USDA
Cattle population, 2011 (millions)	14	10	40%	Livestock industry

Sources: Ware and Clark (2009), Hlaing (2011), USDA (2012), ADB (2012).

[5] Our field visits suggest that the USDA production estimates lie much closer to reality than the official production numbers produced by government and in turn reported without amendment by the FAO. See Denning et al. (2013) for details. Other observers and stakeholders have similarly concluded that official production estimates considerably overstate national rice production. See, for example, Dapice et al. (2011). The Myanmar Rice Federation (MRF) has conducted field studies to estimate rice production since the 2011/12 season. Their estimates fall in between the USDA and MOAI estimates (MRF 2012a, 2013).

In the first place, Myanmar has not conducted a population census for nearly thirty years. Since the last census, in 1983, government statistical agencies have generally assumed a constant growth rate for population. But given internal conflict, intermittent dislocation, temporary migration and differential levels of fertility and maternal and child health across Myanmar, population growth rates likely vary significantly by location and over time. As a result, current estimates of national population range between 50 and 60 million people (Table 2). In turn, the absence of a reliable population census compromises efforts to conduct proper sample surveys of any kind. Without a reliable sampling frame, survey designers struggle to assign proper sampling weights, set appropriate sample sizes and determine standard errors for estimated parameters. Every statistical sample survey conducted in Myanmar over the past several decades remains subject to a cloud of uncertainty over possibly wide but unknown levels of bias and sampling error.

Secondly, administrative estimates of many key statistics amplify questions about data reliability. In the case of agricultural production, the Ministry of Agriculture and Irrigation's (MOAI) Department of Settlement and Land Records (DSLR) has historically served as the agency monitoring land use, assessing land values for tax purposes, recording cropping patterns, setting production targets and estimating output (FAO 2010). Given the understandable motivation to achieve official targets during the socialist period, recorders of these data faced incentives to err on the side of achieving stated goals, while farmers had incentives to understate production to officials imposing sales quotas.[6] Over time, an annual series of upwardly biased, overly optimistic official production estimates compounded errors yearly, leading ultimately to wide disparities between reality and statistical reports.[7] Even after production and marketing controls were relaxed, beginning in 1988 for pulses and more recently in 2003 for paddy and industrial crops, GOM statistical officers inherited a baseline of inflated area and yield estimates which have become difficult to adjust without a major review and explanation.

Over the past decade, upward pressure on production estimates has continued from two sources. In order to achieve Myanmar's ambitious GDP growth targets, major agricultural commodities such as paddy and pulses offer tempting targets for upward revision. In addition, current crop cut systems for estimating yield likely contribute to a continued upward bias in official agricultural production estimates. Although SLRD maintains detailed cadastral surveys of

[6] These upward biases are not limited to agriculture. In discussing Myanmar's highly inflated GDP estimates over the past decade, U Myint (2009, p.11) explains that, "decision-makers in Myanmar have a fixation with high GDP growth rates, which are believed to indicate the country's growing prosperity and well-being. Hence these growth rates have become highly politicized, and in the process, credibility and good sense have fallen by the wayside."

[7] Ware and Clark (2009, p.2) summarize the general situation as follows: "This lack of reliable data and difficulties gaining access mean researchers are often forced to rely on 'informed hunches' (Taylor 2008, 119). Data is 'negotiated more than they are observed in Myanmar' and political incentives favour over-reporting by government officials (Dapice, Vallely & Wilkinson 2009). There is 'a manipulation of data culture' in which International NGOs are advised not to publish real data, but to report figures as provided by government officials. Sometimes key figures released by the government are rejected by the international community as clearly inconsistent with other information – e.g. recent GDP figures for Myanmar were not accepted by the World Bank or IMF (ESCAP 2007). Other data is either not produced at all or the Myanmar government chooses not to make it public (such as numbers of people living on less than US$1 a day)."

agricultural land, at least outside of the conflict areas, they use crop cuts to estimate annual yields. Given the considerable care taken to harvest every grain from the 2 meter by 2 meter test plots, crop cuts typically result in upwardly biased yield estimates compared to what farmers actually achieve. As a result, most stakeholders today consider official estimates for paddy and other major crops significant overestimates (Table 2).

Imprecision on this scale makes it difficult for both government policy makers and private investors to make informed decisions. Unfortunately, even modest levels of imprecision can lead to dramatic errors in policy, as the example in Box 1 illustrates.

The following discussion of agricultural sector performance in Myanmar begins with this long disclaimer. Many of the data cited are of questionable reliability. As a result, wherever possible, we have supplemented official data with evidence from specialized surveys, our own observations and discussions with knowledgeable stakeholders. Looking forward to possible prescriptions for improving agricultural performance, it becomes clear that a rapidly growing, modern agricultural sector will require a firmer statistical foundation to support sound public policy and provide the confidence required to motivate private investment decisions.

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Box 1. The Perils of Administrative Estimates of Agricultural Production: An Example from Malawi

Two general systems exist for estimating agricultural production: a) administrative estimates by extension staff using expert local knowledge, and b) statistical sample surveys of farm households, usually conducted by central statistical offices using census sampling frames. The administrative systems base output projections on an aggregation of estimates by local extension workers and other knowledgeable district staff. Generally, these estimates are considered to be less reliable than survey estimates and also susceptible to political pressures to achieve stated government targets (Jayne and Rashid 2011).

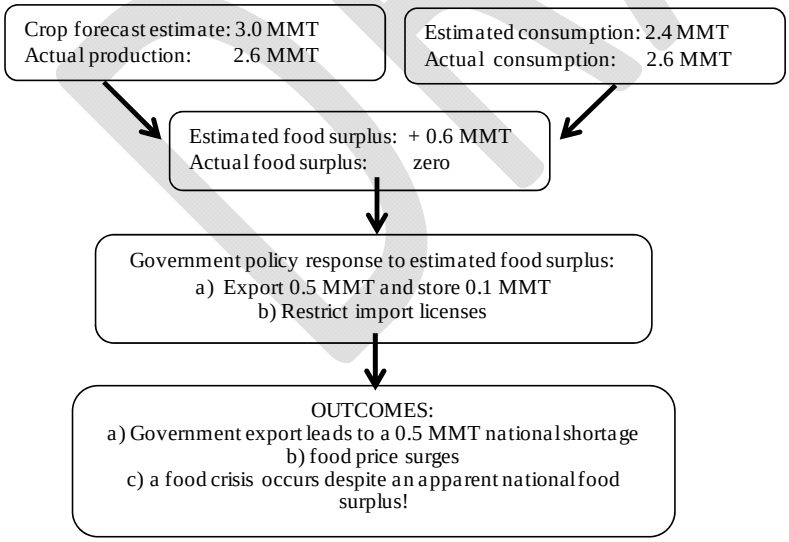
Table B.1. Malawi Crop Production Estimates, 2007

Commodity	Production estimates (MMT)		Difference
	administrative	survey-based	(a-b)/a
maize	3.2	2.1	34%
cassava	3.2	0.4	88%

Malawi uses an administrative system similar to Myanmar's for estimating agricultural output. Malawi's deceased past president won three international prizes between 2008 and 2011 for rapidly boosting food production in Malawi. Not surprisingly in these circumstances, ministry officials charged with estimating annual food production faced unusually strong incentives to issue optimistic estimates of food output. A detailed farm household survey in 2007 provides a point of comparison for assessing this possible upwards bias. This comparison suggests that the official administrative estimates for maize production in 2007 exceeded the survey estimate by roughly one-third, while they overstated cassava production by nearly 90% (Table B.1).

Over-estimates of this magnitude give rise to potentially serious policy distortions. Consider the following hypothetical example provided by Jayne and Rashid (2010).

Figure B1. A Heuristic Example of How Inaccurate Crop Forescasts can Lead to National Food Insecurity



Source: Jayne and Rashid (2010).

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3. A PROFILE OF MYANMAR'S AGRICULTURAL SECTOR

3.1. Agricultural Resource Base

3.1.1. Climate

Wide climatic diversity occurs across Myanmar as a result of the country's broad span of elevation, latitude, temperature and rainfall. Its elongated geography spans 18 degrees of tropical latitude, from 10 to 28 degrees north latitude. Its multiple river basins and the mountain ranges that form them, generate changes in elevation that range from sea level along the country's lengthy coastline to as high 5,900 meters in the mountain states that form Myanmar's border regions. As a result, temperatures vary considerably, with maximum daily temperatures averaging 32 degrees Celsius in the Delta and 21 degrees in the hilly zones. Rainfall ranges from 5,000 mm along the coast, to 2,500 mm in the Delta region and about 600 mm in the Dry Zone. This diversity of conditions gives rise to an enormous variety of micro-climates.

Amid wide diversity, three broad agro-ecological zones dominate the agricultural landscape: the Delta, the Dry Zone and the hilly areas (Figure 4). In the south, the densely populated Delta zone is home to roughly 22 million people who concentrate primarily on lowland rice production, particularly during the monsoon season. Moist monsoon winds off the Bay of Bengal bring seasonal rains to the coastal and Delta regions. In contrast, the middle part of Myanmar lies in the monsoon's rainfall shadow, creating a dry zone in which population clusters along the main river valleys. Farmers in the Dry Zone cultivate a range of rainfed crops and, where water availability permits, summer and monsoon rice. Roughly 19 million people live in the Dry Zone. The third largest agricultural zone lies in the hilly areas of the country, dominated by Shan State in the eastern part of Myanmar (Annex Figures D2 and D3), which are home to another 6.5 million people. Farmers in this zone produce a wide range of rainfed treecrops and horticulture products along with rice, maize and pulses.

Three different seasons enable farmers to cultivate crops at different times of the year, depending on where they farm. The main farming season occurs during the hot, rainy monsoon period which runs from May to October across most of the country. The ensuing dry months begin with a cool, dry winter season running from October to February, while a dry, hot summer season runs from February to April. The structure of crop, livestock and fish production varies considerably across Myanmar's three seasons as well as its three principal agro-ecological zones.

3.1.2. Physical Resources

Alluvial and swampy soils dominate in the Delta, while vertisols are more important in the irrigated rice lands of the Dry Zone. About one million acres of coastal mangroves border the Delta region on the south. To the north of the Delta, alluvial lowlands dominate agricultural production areas in the Dry Zone. The hilly, often forested ethnic border states offer more temperate climates well suited to fruit and horticulture crops.

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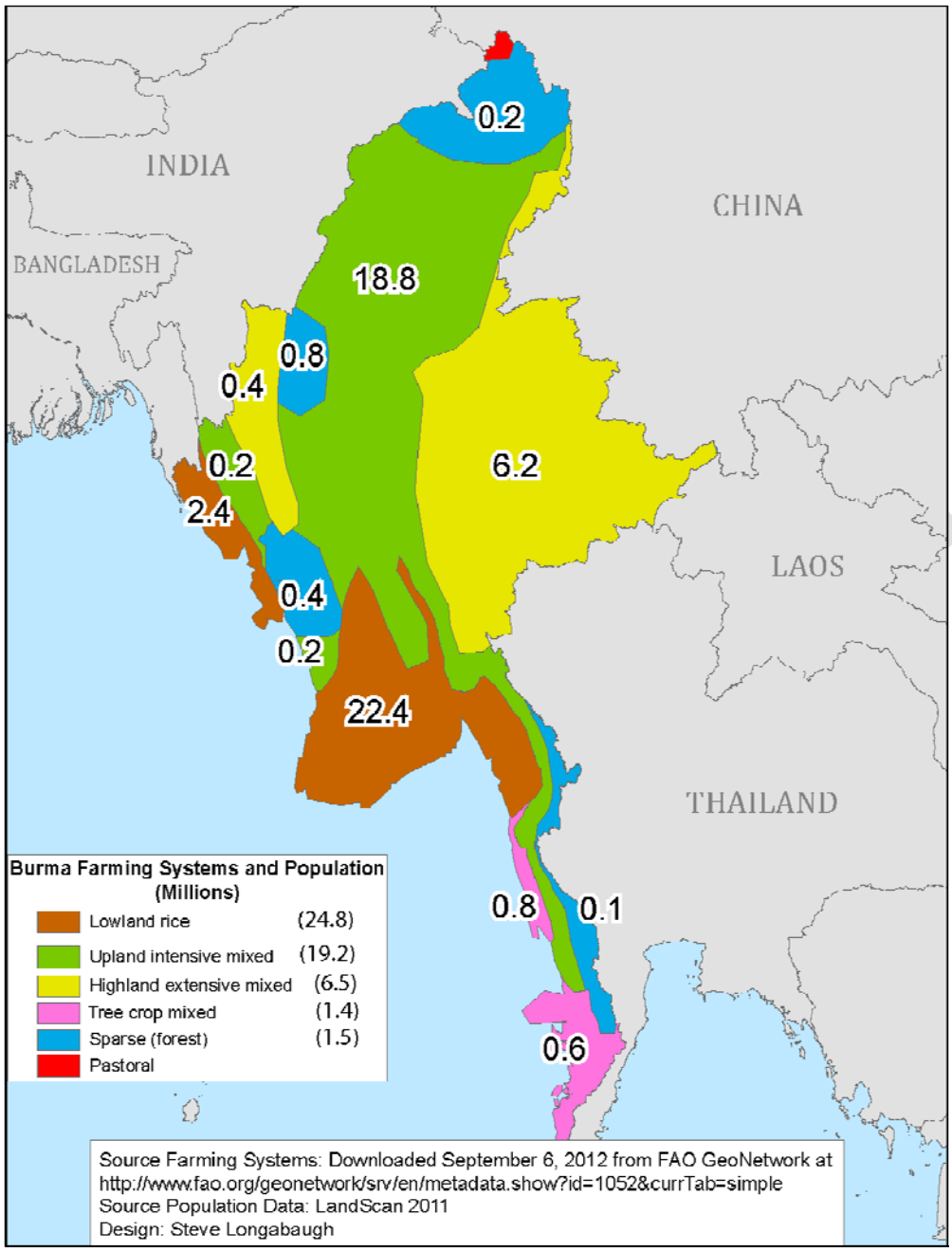
Figure 4. Principal Agro-Ecological Zones of Myanmar



Note: See Annex Figures D2 and D3 for an overlay of farming systems and administrative boundaries.

Although land use data remain the subject of considerable debate, cultivated farm holdings amount to between 21 and 30 million acres (Agricultural Census 2003, MOAI 2012). An additional 14 million acres classified as virgin and fallow land or cultivable wasteland suggests significant potential for expanding cultivation. Indeed, most production gains over the past two decades have come from area expansion rather than increased productivity (see Table 6). Nonetheless, the shifting cultivation and long-term fallow systems historically operated in many of these areas have precipitated conflict over land claims, particularly in the wake of recent large-scale land allocations (LCG 2012).

A further 83 million acres of forest land adds to Myanmar's reputation as a country with surplus land (MOAI 2012). However, Myanmar has been losing roughly 1% of its forest land per year over the past 20 years, with Ayeyarwaddy, Mandalay, Yangon and Rakhine regions experiencing annual rates of deforestation of over 5% (Htun 2009). Following the economic reforms of 1988, rates of deforestation reportedly increased as the forestry sector was opened to private sector use. Forest degradation has been most severe along the north and western areas of the Dry Zone, in the east of the country (bordering Thailand) and the southern tip of the Delta. Large parts of the east and west have degraded forests affected by shifting cultivation. Overall, forests affected by shifting cultivation provide resources for as many as 2 million families (FAO 2005).

Myanmar enjoys abundant water resources with significant coastal access, groundwater and four major rivers which allow for irrigation and hydropower generation. Only about 10% of the total water resources available to the country are utilized, and 90% of that use is for irrigation. Though its water resources are among the largest in the region, availability varies temporally and spatially. Roughly 80% of fresh water flows during the May-October monsoon season with the remaining 20% available during the November-April dry season. Seasonal water scarcity is a particular challenge in areas such as the Dry Zone and Rakhine State in the west.[8] Since 1988 the Government has made large-scale efforts to construct dams (for both irrigation and hydropower), reservoirs and pump irrigation facilities throughout the country. Nonetheless, to date, the country has developed less than 5% of its estimated 40,000 megawatts hydropower potential. Total area under irrigation doubled between 1980 and 2000 due to increasing demand and support from government projects. In recent years, the percentage of irrigated land has remained steady at around 17%, with the highest percentage of irrigated land based in the Delta. Hydrological evidence suggests that a series of both deep and shallow freshwater aquifers lie under the Ayeyarwady Delta and that these could be developed to irrigate a large portion of land in this area, especially during the dry season.

3.1.3. Livestock and Fish

National accounts indicate that livestock and fisheries account for about 20% of total agricultural income in Myanmar, though these estimates may understate the economic and nutritional importance of these sectors (Annex Table C1). Within the livestock sector, recent estimates place the national chicken flock in excess of 170 million birds plus another 15 million ducks. Cattle holdings number about 14 million head with a roughly equal number small livestock such

[8] Our team visited one village in Bago East where residents report that seasonal water shortages often force villagers to rely on donations of fresh water from monks in the adjacent village for two-three months per year.

as pigs and goats (see Annex Table C2). The Dry Zone is especially important for livestock production. About half of the country's cattle are raised in the Dry Zone, while 77% of the sheep and goats are found in this zone (JICA 2010).

Myanmar's coastal and river delta regions provide rich spawning grounds for fish populations, particularly the zones where seasonal transitions occur between saline and fresh water infiltration. As a result, fishing forms a critical part of the national economy and diet. Substantial additional fishery potential exists in the country's major rivers, for aquaculture development in the low-lying river delta areas in the south and center of the country, and for marine fishery resources along the country's 1,900 km coastline and 500,000 ha of mangrove swamps.

3.1.4. Human Resources

Myanmar's 50 to 60 million people constitute one of the country's largest resources. Although total population numbers are subject to some uncertainty, given the thirty years elapsed since the last official population census (see Table 2), population density is clearly highest in the Delta, followed closely by the Dry Zone (Figure 3).

Educational standards, however, have declined over the past five decades. Today, according to the Integrated Household Livelihoods and Consumption Survey (ILHCA) survey of 2010, roughly half of rural household heads have completed primary school, while 8% have no education and a similar numbers have completed secondary or higher education (Annex Table C3). Although staffing, facilities and educational standards are generally low, enrollment rates in rural areas are high, at over 85%, and roughly comparable for girls and boys (IHCLA 2011, UNFPA 2010). Among institutions of higher education, quality has generally declined since the 1996 student demonstrations and the subsequent government crackdown on large student gatherings (BTI 2012).

3.2. Asset Distribution

A signature feature of rural Myanmar is its highly skewed distribution of cultivable farmland. Data on land distribution remain difficult to assemble given acute political sensitivities and large numbers of unrecorded, informal transactions. Even so, available evidence unambiguously suggests that the highest rates of landlessness occur in the Delta region, where field estimates of rural landlessness range from 50% to 80% of rural households.[9] In the Dry Zone and hilly regions, where land pressure is visibly less, the share of landless in total rural households ranges between 25% and 45% (Table 3).

[9] During our fieldwork, the share of landless households living in the villages we visited ranged between 50% and 90% in the Delta area, between 25% and 58% in the Dry Zone and between zero and 40% in the Hilly areas. Field visits by Dapice et al (2009) produced very similar estimates of 50% to 70% landless in the Delta and 25% to 40% in the Dry zone.

Table 3. Land Size Distribution in Rural Myanmar, 2011			
Landholding	Percent of Households		
size (acres)	Delta/coastal	Dry Zone	Hilly
0	72	43	26
< 5	7	37	63
5 - 10	9	12	9
> 10	12	8	2
total	100	100	100
Source: LIFT Baseline (2012), Table 54.			

Although estimates of landlessness differ widely[10], the preponderance of available evidence suggests that roughly half of all rural households are landless in that they have no land use rights to cultivable land. We derive this rough ballpark estimate by comparing the number of *rural households* with number of *agricultural holdings*, defined as households with access to over 0.1 acres of farmland[11] (see Annex Table C4). This 50% estimate accords with our general observations during our village visits and with the much more exhaustive baseline study of 4,000 rural households by LIFT (2012, see Table 3). It likewise corresponds with national estimates derived by using the landlessness rates found in the LIFT baseline survey with population weights derived from Figure 3, which together result in a national landless rate of 53% (Annex Table C5). In a country with unusually weak primary data, we emerge comfortable that this 50% estimate offers a good first approximation of the current rate of rural landlessness.

By these calculations, roughly 3 million rural households out of a total of 6.5 million (or 47%) were landless during the year of the most recently available agricultural census, in 2003.[12] That is, they lived in rural areas but held no land use rights to farmland. An additional half a million rural households (about 8% of rural totals) held tillage rights on holdings under 1 acre, a level commonly associated with functional landlessness. A million and a half rural households (about one-fourth) cultivated landholdings between 1 and 5 acres, while the remaining quarter of rural households hold tillage rights to holdings over 5 acres in size (Annex Table C4). Affecting roughly half of all rural households, landlessness emerges as a critical structural feature of Myanmar's rural economy, one that will centrally influence the design of rural development programs if the country is to achieve broad-based economic growth as well as political stability (see Box 2).

[10] Okamoto (2008) reports landlessness rates between 30% and 50% during the 1990s. The Integrated Household Livelihoods and Consumption Survey (ILHCA) of 2009/10 estimates rates of rural landlessness at 24%, while the FAO team conducting the UNDP agricultural sector review of 2005 estimated landlessness at 30% of rural households. A World Bank team visiting Myanmar in late 2012 has projected rural landlessness at 55%.

[11] Myanmar's Agricultural Census defines an agricultural holding as, "an economic unit of agricultural production" … "raising crops on at least 1/10 (0.10) acre of land which is approximately 4,356 sq. ft., or raising of at least 4 heads of small livestock, or 2 heads of large livestock, or at least 30 heads of chicken or ducks, regardless of the area of the land."

[12] Results from the 2010 agricultural census will become available during the first half of 2013.

Box 2. Landlessness in Neighboring Bangladesh

Like its western neighbor, Bangladesh, Myanmar straddles one of the world's most important natural rice-producing river deltas. During antiquity, rice cultivation emerged along the Ayeyarwady and Jamuna river deltas, as each became home to several thousand indigenous varieties of rice uniquely suited to specific local water, temperature and soil conditions. The rich productive potential of these natural floodplains afforded a source of great wealth around which unique civilizations, wealthy landowners and large farming populations emerged over many centuries. As a result, both delta regions have become among the most heavily populated rural regions on earth.

At the outset of Bangladesh's Green Revolution, in the mid-1980's, land scarcity in their river delta resembled the levels now facing Myanmar, with roughly 40% of rural Bangladeshi households considered functionally landless (owning under 1 acre of farmland). Like Myanmar, rural landlessness had been increasing in Bangladesh over the past decades. But unlike Myanmar, Bangladesh's rigorously precise national statistical system paints a clear picture of the pace of land concentration (Table B1).

Table B2. Changes in the Distribution of Rural Land Ownership in Bangladesh, 1960 - 1983/84

Landholding size (acres)	Share of Rural Holdings (percent)	
	1960	1983/84
< 1	24.3	40.4
1-2.5	27.3	29.9
2.5-5.0	26.3	18
5.0 - 7.5	11.4	6.8
> 7.5	10.7	4.9
All	100	100

Dismissed as a basket case at independence because of these high levels of landlessness, Bangladesh confounded the skeptics by investing in agricultural research (the Bangladesh Rice Research Institute (BRRI) won multiple awards for rice research during the 1980s), liberalizing input markets for tubewells and fertilizer, and decontrolling rice marketing by gradually suspending ration channels (like Myanmar, they favored civil servants and military) and price and marketing controls. To deal with heavy landlessness, policy makers promoted not only rice productivity but also diversification into high-value specialty rice, horticulture, livestock and fish production along with nonfarm activities and labor-intensive export industries. The Grameen Bank and others led massive investments in rural financial systems, while the Bangladesh Rural Advancement Committee (BRAC) pioneered brokering and veterinary support systems for high-value poultry production for rural landless. Agricultural productivity growth triggered lower real food prices and a structural transformation of the rural economy with agricultural wage gains of 30%, rapid growth of high-return nonfarm activities and a decline in low-wage cottage industries.

Although data on rural landlessness remain subject to a large margin of error in Myanmar, it appears that Myanmar may be starting from a less favorable position than Bangladesh if, indeed, half of Myanmar's rural households are currently landless. If so, Myanmar will need to move even more aggressively than Bangladesh to find ways of raising farm productivity and rural wage rates, improving opportunities for high-value, scalable, labor-intensive agricultural activities requiring limited land, and labor-absorbing nonfarm employment.

Source: Hossain (1989), Malhotra and Santer (1994), Ahmed and Haggblade (2000), Dorosh et al. (2004), Hossain et al (2007).

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Table 4. Percent of Households Owning Livestock, by Landholding Size, 2011				
	Landholding Size (acres)			
	Zero	< 5	5-20	> 20
Poultry				
chickens	46%	52%	60%	56%
ducks	10%	2%	12%	22%
Small stock				
pigs	28%	32%	30%	25%
goats and sheep	3%	6%	4%	0%
Cattle	9%	35%	49%	43%
Buffalo	1%	13%	24%	46%
Source: LIFT Baseline (2012), Table 118.				

Over the past decade, the Government of Myanmar has allocated nearly 2 million acres in large-scale commercial land blocks to local agribusiness investors and companies, many with foreign partners and with links to the military (Woods 2013). These large-scale land allocations amount to between 6% and 8% of total agricultural landholdings (see also Annex Table C6) and contribute to the skewed distribution of agricultural land.

Livestock ownership remains similarly skewed for cattle and oxen (Table 4). However, ownership of poultry and small livestock such as pigs, goats and sheep is prevalent among households of all size. Because of their small land requirements, poultry and small livestock offer opportunities for very small landholders. Even among landless households, roughly half raise poultry while another 30% rear small livestock such as pigs and goats (Table 4).

Fishing likewise attracts landless households (see Table 7). Small designated areas are open to all fishermen. However, on most inland water bodies, government awards fishing licenses annually by tender. So, in practice, landless households must generally pay tender holders a fee for the right to fish a small portion of their concession.

3.3. Production and Marketing

3.3.1. Structure of Production

Within the agricultural sector, crop production accounts for about 80% of total agricultural income. And within the crop sector, rice dominates land use. Annually, paddy accounts for roughly half of all planted area, with that share rising to about 60% during the monsoon season and falling to around 40% in the winter and summer seasons when pulses become equally important. Oilseeds, dominated by sesame, account for over one quarter of cropped area during the monsoon season (Table 5).

Most crop production takes place on relatively small plots. As a general rule, lower value crops such as paddy and pulses and oilseeds, are farmed on larger surfaces, while high-value horticulture and fruit crops take place on much smaller landholdings. Paddy farmers cultivate an

average of 5 acres per holding, with pulses and oilseed crops closer to 4 acres. Onions, garlic and potato holdings average about 1.5 acres each, while vegetables and cut flowers are grown on holdings between 0.6 and 0.7 acres in size (Annex Table C7). These high value crops enable small landholders to earn high returns from small holdings.

Horticulture products -- including fresh fruits, vegetables and flowers -- provide earnings for about 15% of rural households in Myanmar (Annex Table C8). Income from horticulture products assumes most importance in the hilly zones of Shan State and other border zones, where roughly one-third of rural households earn some income from horticulture sales and one-sixth depend on horticulture crops as their primary source of income. In contrast, the Delta zone sees the lowest levels of horticulture production because of high incidence of fungal diseases and pests. In addition, a thriving green belt just outside Yangon provides vegetables for much of the city and in the process provides significant incomes and employment.

National accounts estimates suggest that livestock and fisheries account for about 20% of total agricultural incomes in Myanmar, though these estimates may understate the economic and nutritional importance of these non-crop sectors (Annex Table C1). As with high value horticulture products, small stock and poultry attract considerable interest among landless and near landless households because of their high value and low land requirements (Table 4).

In the early 2000s, marine and inland fisheries and aquaculture provided seasonal employment for as many as 12-15 million people (FAO 2005). Fish and shrimp have now become major exports, and the fishing sector provides two-thirds of the animal proteins in the human diets, with per capita consumption of fish and fisheries products estimated at 23 kg/year around 2002. Ayeyarwaddy and Tanintharyi Regions are by far the largest fish producers.

Table 5. Crop Area Planted by Season, 2003

		Area Planted, by Season		
	Total Annual Area Planted	Monsoon Season	Winter Season	Summer Season
Paddy	50%	59%	36%	42%
Oilseed and industrial crops	23%	27%	18%	17%
Pulses	21%	10%	39%	36%
Other cereals	4%	4%	5%	2%
Roots and Tubers	1%	0%	0%	2%
Vegetables	1%	0%	1%	1%
Total (percent)	100%	100%	99%	100%
Total (million acres)	27.1	16.2	7.4	3.5

Source: Agricultural Census of 2003, Table 10.

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3.3.2. Marketing

Despite low levels of urbanization (about one-third of the national population), Myanmar's extremely high rate of rural landlessness results in a large majority of households being net purchasers of staple food. According to the Agricultural Census of 2003, 2.5 million holdings, or about 40% of rural households produced crops primarily for sale. The remaining 60% produced mainly for subsistence. In 2011, less than 10% of landless households sold any crops, while virtually all purchased food (LIFT 2012, Table 84). Because landless rural households and urban households are net buyers of food staples, marketed shares are high for most crops.

For many decades, the Government of Myanmar exercised tight control over these major food and agricultural markets, beginning in 1962. Heavy state controls on production and marketing have given way to gradual liberalization beginning in 1988. Liberalization of pulse production and marketing proceeded most quickly and fully, beginning in 1988, resulting in rapid increase in farmer incentives and hence rapid growth of pulse production and exports (Table 6). Paddy market reform began fifteen years later, in 2003, with the abandonment of compulsory government procurement of paddy and the cessation of ration channel distribution. By 2011, government had sold its rice mills and removed restrictions on private sector domestic trade and export. With oilseeds, cotton and sugar, reform has also proceeded more slowly than with pulses (Wong and Wai 2013). In many cases, government exit from these markets has been replaced by government-approved commercial enterprises. As a result, two military-affiliated conglomerates, the Union of Myanmar Economic Holding Company (UMEH) and the Myanmar Economic Cooperation (MEC), have become the largest economic enterprises in the country, dominating many sectors of the economy (BTI 2012). Until March 2011, when palm oil imports were liberalized, MEC and UMEH accounted more for than 90% of total palm oil imports, together with a handful of other companies (Wong and Wai 2013).

Since the withdrawal of state marketing companies for pulses and rice, large numbers of private traders have emerged to serve as market intermediaries in the assembly, wholesale and export functions. Non-political commodities such as horticulture and poultry products have remained consistently within the province of private sector traders. Generally, the trade groups are well organized into associations that operate trading floors in major production zones and urban markets. Our field observations suggest that women are particularly active in fresh fruits and vegetables and in small livestock production, while men dominate the trading of paddy, pulses and oilseeds.

3.3.3. Trends

Despite the Government of Myanmar's heavy priority for rice, paddy output appears to have grown more slowly than most other crops. Even optimistic official production figures suggest that rice output has grown at about 3% annually over the past two and a half decades, with the bulk of the gains coming from area expansion. More conservative estimates from the USDA suggest paddy output has grown at closer to 1% per year (Table 6). Maize production has grown far more rapidly than rice, on the heels of rapidly growing demand for poultry feed and emerging regional export markets.

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Table 6. Annual Rates of Agricultural Growth in Myanmar, 1985/86 to 2009/10

	Area	Production
Cereals		
paddy, GOM	2%	3%
paddy, USDA	n.a.	1%
maize	3%	6%
Oilseeds	3%	6%
Pulses	7%	9%
Horiticulture		
onion	5%	7%
garlic	4%	7%
chillie	3%	6%
beetle leaves	8%	8%
potatoes	3%	5%
vegetables	6%	n.a.
fruits	4%	n.a.
Poultry meat	n.a.	6%

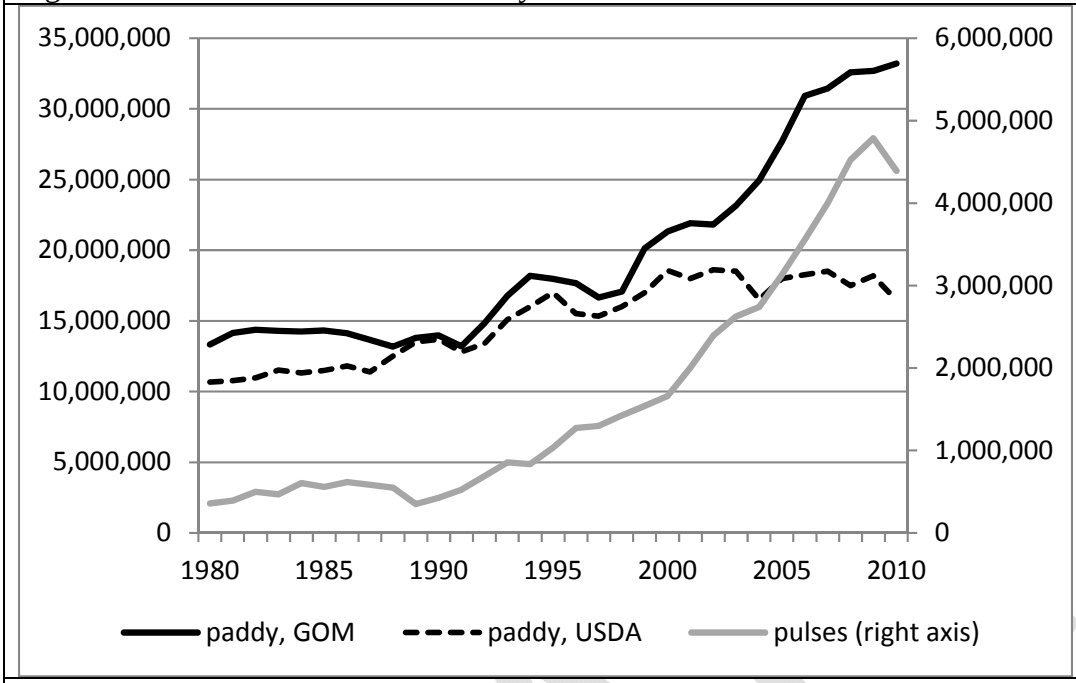
Source: Annex Table C11.

Pulse production has grown more rapidly than any other agricultural commodity group since liberalization in 1988, at a compound annual rate of 9% per year according to official estimates (Table 6). While traders question official estimates of pulse production, they agree with official estimates of export growth. Early liberalization of pulse marketing, fifteen years earlier than rice marketing, resulted in improved incentives to pulse growers and traders, who quickly emerged to contest export markets in India (see Okamoto 2007 and Figure 5). The rapid surge in pulse exports that occurred during the 1990's and early 2000's appears to have peaked in the late 2000s, as domestic production has bumped up against fluctuating demands in Indian markets, where 70% of Myanmar's pulse exports are sent, and competitive pressures from other major exporters from Africa and Australia (Figure 6).

Horticulture and poultry output have grown at 6% to 8% annually over the past two and a half decades, driven by growing urban demand and growing incomes (Table 6). With the removal of international economic sanctions on Myanmar in the summer of 2012, accelerated urbanization and income growth stands likely to accelerate these growth rates in the future. Consequently, opportunities for peri-urban agriculture will become increasingly important as more industrialized zones are created.

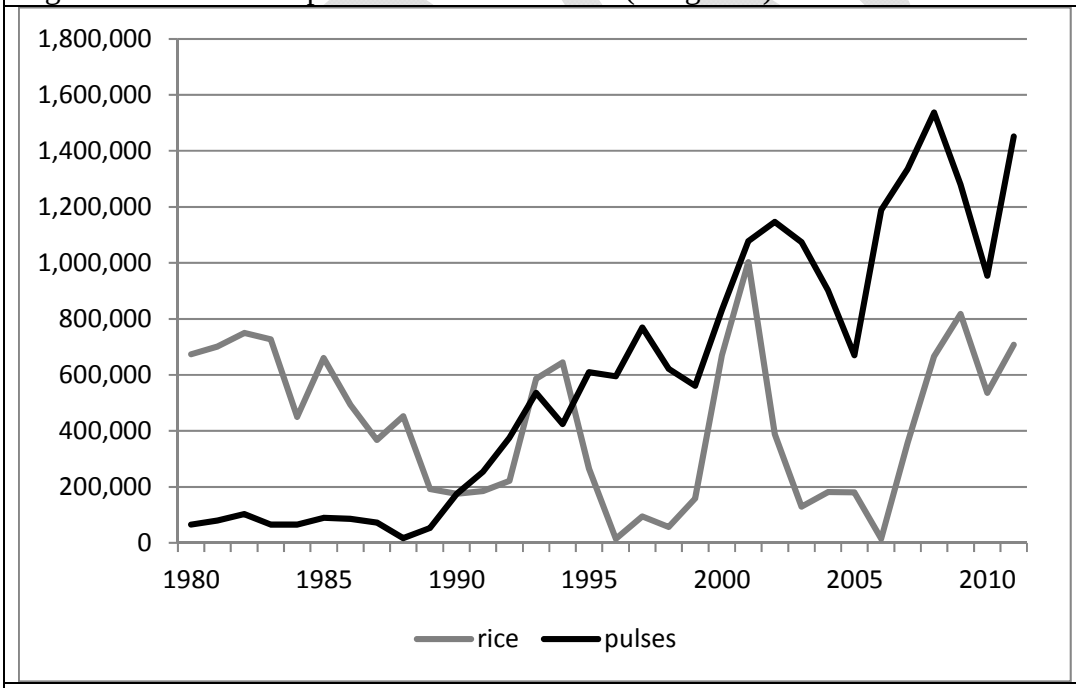
Estimates of total national fish production remain subject to wide margins of error. But most indicators suggest rapid growth over the past decade. Total national fish production doubled in the 15 years to 2000, and may have nearly tripled over the past decade, to a level of 3.2 million tons (FAO 2009). As of 2002, aquaculture had been the fastest growing sector for over a decade (FAO 2005).

Figure 5. Trends in Production of Paddy and Pulses



Source:Myanmar Statistical Yearbooks, USDA, FAOSTAT.

Figure 6. Trends in Exports of Rice and Pulses (kilograms)



Source: Myanmar Statistical Yearbooks, USDA, FAOSTAT.

Several factors underlie the slow growth of rice production. First were the poor production incentives prevailing during several decades of forced government procurement at below-market

prices. Second, domestic and export market liberalization occurred 15 to 20 years later in rice than in pulses, giving paddy farmers a late start at expansion under improving incentive systems. Third, perishable horticultural and livestock products have remained less regulated and have likewise grown faster than paddy (Table 6). Given their high value and perishability, they have been largely been ignored by the large-scale government procurement and state marketing systems. As a result, market growth and farm profitability have driven rapid growth in these high-value horticulture and livestock commodities.

Finally, many specialists believe that government's heavy emphasis on hybrid rice may have diverted resources from the promotion of classic improved varieties. Given the high cost and low value of hybrid rice, coupled with its disease susceptibility, adoption rates for hybrid rice remain low in most tropical countries (Denning et al. 2013). In Myanmar, IRRI reports that hybrids account for roughly 1% of paddy area (Xe 2011). Although conventional breeding offers a more likely quick pathway to rapid productivity gains across most of Myanmar's rice production zones, hybridization offers one of many tools available to breeders seeking to improve productivity across all areas of Myanmar. India's experience, described below, offers perhaps the most interesting scenario for Myanmar to consider as it seeks to identify a pathway towards rapid rice productivity gains using a mix of conventional and hybrid varieties in situations where each proves most viable (Box 3).

Fertilizer use on paddy fields has fluctuated significantly over the past four decades as a result of fluctuating incentives. During the 27-year period ending in 1993/94, when the government heavily subsidized fertilizer prices, per acre use on paddy increased dramatically, from less than 1 kilogram per acre (of NPK fertilizer) in 1966/67 to 57 kg/acre in 1993/94. Over the same time period, the share of HYV seeds used in paddy production increased from zero to just over 50%. From 1994 onwards, the government removed fertilizer subsidies on all crops except those produced by the State Economic Enterprises (SEE) operating under MOAI (Young et al. 1998).

Although, Myanmar produces some urea domestically using its local natural gas resources, volumes are insufficient and so the government allows private traders to import the balance required. Over the past two decades, fertilizer prices have generally followed international price movements, leading to wide swings in relative fertilizer-to-paddy prices and hence substantial swings in fertilizer use.

Currently, about two-thirds of paddy farmers apply fertilizer on their monsoon paddy crop, while over 90% use fertilizer during the irrigated summer season crop (LIFT 2012). Application rates, however, remain low by Asian standards. Limited available survey evidence suggests that farmers apply between 25 and 40 kg of nitrogen per acre. Low fertilizer use on rice, coupled with modest current yield levels, suggest likely benefits to increased fertilizer use in Myanmar. Indeed, research undertaken by IRRI has demonstrated good responses to fertilizer during the summer season (Denning et al. 2013).

Unlike fertilizer, pesticide use appears to have grown sharply in Myanmar in recent years, particularly in the years following cyclone Nargis in 2008. This increased use raises concerns about misuse and possible negative environmental and health impacts. Evidence from several countries in Southeast Asia indicates that inappropriate use of pesticide can lead to worsening of pest problems, most notably planthoppers (Denning et al. 2013). Our interviews with farmers

revealed widespread pesticide use. However, farmers were uniformly unclear about their efficacy and risk. Many noted that instructions on imported pesticides were often printed in Chinese or Thai and so farmers relied heavily on agro-dealers for advice on pesticide use.

Box 3. Hybrid Rice in the Tropics

The development of hybrid rice in temperate zones of China has resulted in major yield gains, with yields in the range of 8 tons of paddy per hectare. As a result, Chinese farmers currently plant about 60% of total paddy land in hybrid varieties. However, efforts to develop hybrid rice varieties appropriate for the tropics have met with several technical difficulties. First, the hybrids have proven susceptible to a broad range of tropical diseases and pests, thus limiting the attainable yield gains in tropical settings. Second, the cost of hybrid seed production is very high given the stringent technical requirements and low seed yields of hybrid rice. Third, hybrids produce rice of inferior grain quality and hence command low market price. The combination of high seed costs, heavy pest and disease damage and low value of the paddy produced has made hybrid rice production less viable than conventional improved varieties in many tropical settings to date. Researchers continue, nonetheless, to work on rice hybridization in the tropics, driven by the possibility of significant potential yield gains and the prospects of motivating investment by private seed companies in agricultural research.

Early experiments with hybrid rice in the Philippines, India, and Bangladesh have produced mixed results, but in general have proven disappointing as a commercial proposition for smallholder farmers. As a result, breeders in these countries remain focused primarily on conventional rice varieties. Only in northern and central Vietnam has hybrid rice outperformed conventional improved varieties. Outside of Vietnam, studies in tropical Asia indicate that, in general, hybrid rice cultivation has not proven profitable for farmers despite varying levels of subsidies (Janaiah and Hossain 2003). Despite low adoption rates, some Philippine seed companies have started developing hybrids for the tropics with modest success in selected growing areas. In the Philippines, "Despite concerted efforts and massive subsidies incurred in the promotion of hybrid rice, there is no strong evidence that currently available hybrid varieties are … commercially viable in the country… (David 2006: 48). Today, hybrid rice accounts for under 10% of paddy land planted in Bangladesh, India, Indonesia and the Philippines and slightly over 10% in Vietnam (Spielman et al 2012). In Myanmar, farmers plant about 1% of paddy land in hybrids (Xe 2011).

The Indian experience offers perhaps the most promising model for Myanmar. Indian seed companies must get government approval to sell new varieties of hybrid rice, but once approved they place no restrictions on where it is grown. The free market allows farmers the choice to grow hybrids where they perform well and where market conditions make them viable. As a result, Indian farmers grow hybrids in the selected areas where they are profitable and can produce reasonable yields.

In Myanmar, the MOAI has actively promoted the hybrid rice in recent years in cooperation with Chinese technicians. The MOAI reported hybrid seed production during the 2011 summer season on over 300 acres using the "Par-le-thwe" variety. Our team observed this variety near maturity at the Gold Delta Company farm in Danuphyu township in November 2012. Production appeared to be comparable with the non-hybrid crop at about 4.5- 5 MT/ha. However, we were informed that a higher rate of fertilizer was used. After consulting with many local and international rice agronomists and breeders, we found limited support for large-scale promotion of hybrid rice in Myanmar at this time. Chinese varieties are not well adapted to Myanmar's conditions. Moreover, grain quality is poor resulting in a low market price. Although hybrids may prove appropriate in certain environments in Myanmar, conventional breeding offers a more likely quick roadway to rapid productivity gains across most of Myanmar's rice production zones. Hybridization, like conventional breeding, offers one of many tools available to breeders seeking to pursue a balanced research program that can successfully improve productivity across all production zones of Myanmar.

Sources: Janaiah and Hossain (2003), David (2006), Xe (2011), Spielman et al. (2012), Denning (2013).

Input credit for purchasing fertilizer, seeds, pesticides and herbicides remains costly in rural Myanmar. In order to improve input access for paddy production, the government initiated a special regime for Rice Specialized Companies (RSC) in 2008 under which large investors were

encouraged to provide inputs under contract farming schemes in return for access to export licenses. Today, 57 rice specialized companies have registered. However, since 2011 export permits have been allocated to trading companies as well, so it remains unclear what the future will hold for these paddy-based contract farming schemes (Box 4).[13] By the 2012 season, industry sources estimate that only 4 of the RSCs were continuing to supply inputs on credit to contract paddy growers (Wong and Wai 2013).

3.4. Agricultural Support Institutions

Agricultural research, extension and education constitute key public goods driving agricultural growth over time.

Currently, Myanmar operates a network of agricultural research institutions. The centerpiece of this system, the Ministry of Agriculture and Irrigation's (MOAI) Department of Agricultural Research (DAR) operates seven major research center and 17 satellite farms across Myanmar covering rice, other cereals, pulses, oilseeds and various horticulture crops. Formerly the Central Agricultural Research Institute (CARI) under the Myanmar Agriculture Service (MAS), DAR became a separate department in 2004. In addition to the 700 research staff at DAR, researchers in a series of specialized units in the Department of Industrial Crops Development (DICD) conduct varietal and agronomic research focusing on industrial crops such as cotton, sugarcane, rubber and jute.

Myanmar likewise operates multiple extension services through the Department of Agriculture (DOA) and a series of specialized units serving fisheries, forestry, rural development, cotton, sugar cane and other cash crops.[14] The largest of these, with about 75% of total MOAI extension personnel, is the DOA focusing primarily on paddy production. Within DOA, women account for about one-third of total extension officers (Cho 2013).

The agricultural education system in Myanmar includes three universities, all under different ministries and focused on different segments of the agricultural sector. The Yezin Agricultural University (YAU), under the MOAI, covers crop sciences and, in addition, offers some courses in animal sciences and fisheries. YAU also operates seven regional research stations where it deploys students to conduct research during their final year. The University of Veterinary Science (UVS), also in Yezin but under the Ministry of Livestock and Fisheries (MOLF) - covers veterinary sciences and fisheries but not crop agriculture. The University of Forestry (UOF) under Ministry of Environmental Conservation (MOEC) specializes in issues of land management, environment and forestry. In addition to these degree-conferring institutions, seven State Agricultural Institutes (SAI) offer post-secondary diploma level training to agriculturalists for careers in extension or agribusiness. Although we do not have gender-

[13] See MRF (2012b) for an assessment of the impact contract farming on rice farmers' performance.

[14] In 2004, MOAI's Department of Agriculture (DOA) reportedly employed 12,000 extension officers, while the ministry's four state economic enterprises (SEEs) responsible for plantation crops such as sugarcane, cotton, mulberry, jute, rubber and oil palm employed an additional 4,000 extension staff (FAO 2005). In 2006, the agricultural SEEs were merged into a single entity, the Myanmar Industrial Crops Development Enterprise (MICDE). In 2012, after selling off most its publicly owned industrial crop processing and production facilities, MOAI transformed MICDE into a line ministerial Department of Industrial Crops Development (DICD). Today, as in 2004, DICD continues to deploy roughly 25% of MOAI extension staff.

disaggregated information from UVS or UOF, women constitute 60% of enrolled students at YAU and three-fourths of the faculty. Slightly over 40% of the teaching staff received master and Ph.D. training abroad, primarily in Japan, Thailand, Germany and the Philippines (Cho 2013).

3.5. Agricultural Performance

Despite its significant resource base and strategic location, Myanmar's agriculture has underperformed over the past five decades. Assessment along three standard performance dimensions– productivity, equity and stability – all disappoint. Myanmar's agriculture is characterized by low productivity, extreme inequality and high volatility.

Low agricultural productivity translates into low levels of value added per worker. Currently, farm earnings per worker in Myanmar range between one half and one third of the levels attained in neighboring countries (Table 1). Reasons for this low productivity vary across commodities but stem in large part from long-term chronic underinvestment in agricultural research, the engine of agricultural productivity growth, coupled with weak extension support and limited access to input credit. Crop yields, though highly variable, remain generally below those of neighboring countries. Lower levels of input use (particularly improved seeds and fertilizer), poor management practices (particularly weed and pest control) and uncertain water control all contribute to dampening paddy yields (Denning et al. 2013). As a result, most output gains have come from area expansion rather than increased yields (Table 6). At an aggregate level, sluggish agricultural productivity growth has resulted in flat per capita farm incomes, while agriculture's share in total GDP has declined from about 57% in the early 2000's to 36% in 2010 as a result of rapid growth in natural gas production and related sectors (Annex Table C1).

A highly skewed distribution of land and other productive assets results in high levels of rural inequality and poverty. Roughly half of rural households hold no tillage rights to cultivable land. As a result, casual wage labor provides the single largest source of earnings for rural households. Although daily wage rates vary by region, season and gender, our field studies suggest that they commonly range between 1,500 and 2,500 Kyat per day ($1.75 and $2.95). Women typically earn at the low end of this range. They specialize in certain tasks such as transplanting and weeding, but even during harvest time, when both men and women work as day laborers, women receive lower wage rates than men (Wilson and Wai 2013). Pronounced seasonality of agricultural employment coupled with seasonal underemployment and low wage rates limit annual earnings and place about one-fourth of the rural population under the poverty line (IHLCA 2011). In addition to lower levels of land ownership, poor rural households typically own fewer livestock assets, fishing rights and have less access to credit. With lower income and fewer assets to cushion against seasonal and episodic health and weather shocks, the average rural household has adequate food supplies about 10 months out of the year. For landless households, this falls to 9.6 months (LIFT 2012, Table 43).

High volatility of agricultural production and prices compounds the risks facing rural and agricultural households. Indeed, many of the farmers and traders we spoke with talked explicitly about the increased unpredictability they face. Following record flooding in 2008, Myanmar has experienced episodes of both drought and flooding in the years since then. As a result, farmers

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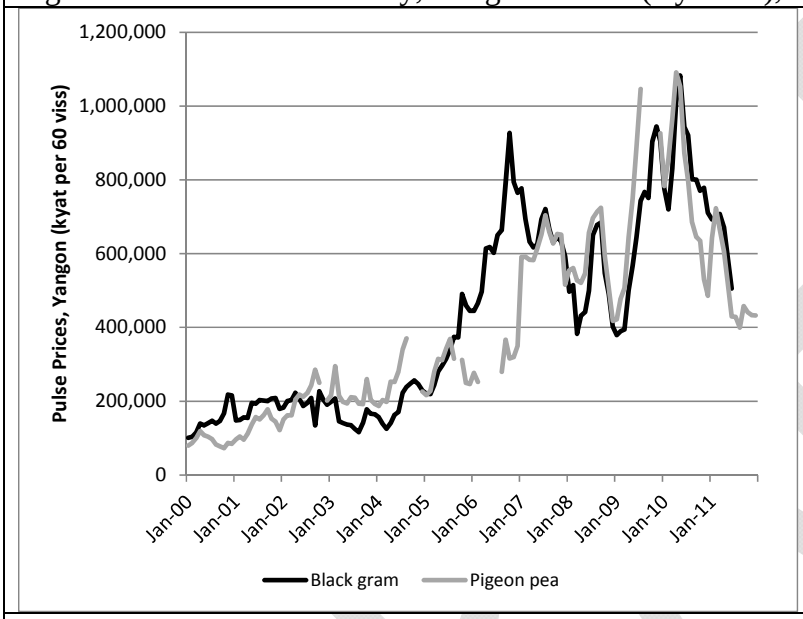
we spoke with are acutely aware of the increasing production risk they face. Most studies of climate change in Myanmar suggest that over the coming decades average temperatures will rise, aggregate rainfall will increase, but the rains may become more sporadic, leading to higher volatility and increased incidence of both flooding and drought (RIMES 2011, World Bank 2012, Wang et al. 2013). Production volatility, in turn, contributes to price volatility for locally traded agricultural commodities. Figure 7 illustrates the level of price volatility affecting several of Myanmar's major pulses, one of the star performing segments of the agricultural economy over the past two decades.

Figure 7. Pulse Price Volatility, Yangon Market (Kyat/ton), 2000 to 2011



Source: Market Information System, Department of Agricultural Planning, MOAI.

Causes of agricultural volatility stem from a number of major structural rigidities. First is increasingly irregular rainfall, coupled with poor water control which leads to increasing frequency of both flooding and drought. Second are unpredictable policies, particularly trade policies. Many of the agribusiness people we interviewed complained about unexpected export restrictions, and in some cases continued land controls, that prevented them from exporting specific crops over the past decade, even when business conditions looked attractive. Reliance on single export markets contributes to volatility of many commodity prices. Currently, Myanmar exports about 70% of its pulses to India and 90% of its watermelons to China. Though most onions are marketed domestically, about 75% of all onion exports are directed to Thailand. As a result, dislocations in the Indian, Thai or Chinese markets generate large price swings in Myanmar's pulse, onion and watermelon prices. When the Chinese watermelon harvest shifts by a few weeks due to abnormal weather, they demand lesser quantities of watermelons from Myanmar. During our field visits in November 2012, sluggish demand for Chinese imports was causing a noticeable price slump in Yangon and Mandalay as growers attempted to offload production in local markets. Limited rural cell phone penetration of only 4% limits farmer information on regional price spreads (Ericsson 2012; LIFT 2012 Table 90). This stands in sharp contrast to the rest of Southeast Asia where penetration is close to 100%. High-cost marketing

and logistics infrastructure, among the least efficient and highest cost in the Association of South East Asian Nations (ASEAN) region (ADB 2012), further aggravate price swings.

3.6. Implications for Household Livelihoods, Poverty and Food Security

3.6.1. Income Sources of Vulnerable Rural Households

For landless and near-landless households, income-earning opportunities center primarily around seasonal casual labor working on landowners' farms, supplemented by small business activity and fishing (IHLCA 2011, LIFT 2012). According to the LIFT baseline survey, roughly half of landless rural households depend primarily on farm labor as their primary source of income (Table 7). Both men and women work as agricultural wage laborers. Women account for 45% of agricultural wage labor days, while men supply the remaining 55% (LIFT 2012, Table 25).

Table 7. Income Sources in Rural Myanmar, 2011

	Income Sources		
	Some	Most important source	
	income*	all households	landless
Casual labor	*54%*	*31%*	*50%*
agriculture	39%	17%	28%
fishing	17%	8%	14%
forest products	8%	3%	3%
other	11%	4%	5%
Crop production	*46%*	*37%*	*2%*
pulses	19%	9%	
maize, wheat, barley, sorghum	16%	8%	
paddy	13%	9%	
vegetables	10%	4%	2%
other	15%	7%	
Livestock production	*8%*	*3%*	*2%*
Fish production	*12%*	*9%*	*11%*
Forest and wild food products	*3%*	*2%*	
Small businesses	*21%*	*11%*	*15%*
trading	8%	5%	7%
manufacturing	7%	4%	5%
services	6%	3%	4%
Regular full-time employment	*5%*	*2%*	*4%*
Regular part-time employment	*2%*	*1%*	
Remittances	*6%*	*3%*	*3%*
Other	*5%*	*2%*	*12%*
Total	161%	100%	100%

'* Multiple responses allowed.

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Source: LIFT (2012), Tables 14-16.

Because of the pronounced seasonality of farm wage employment, landless households require flexible supplementary income-earning activities to fill in during the slack agricultural seasons. Small business activity such as small-scale trading, basket making and weaving provide primary income support for 15% of landless households, while another 11% depend primarily on fishing (Table 7).

In lowlands and along rivers, fisheries play an important role in income generation, as well as providing a source of protein for household nutrition. According to an FAO study, fisheries (marine, inland and aquaculture) directly employ more than 3 million people, and some 12 to 15 million people indirectly benefit from the fisheries and aquaculture sector (FAO 2005). For the landless, fishing represents an important alternative employment which does not require large land holdings. Fishery specialists as well as our own field visits suggest oligopolistic control of fishing licenses, which prevent some landless from accessing this as an income source. In hilly areas and some upland areas, timber and non-timber forest products play an important role in income generation (Htun Khin 2009).

Small livestock and poultry offer a part-time supplementary activity for many landless and near landless households.[15] They, likewise, constitute a critical asset for landless households (Table 4), providing a source of protein in the household diet, and are important assets that can be drawn on in lean times.

Remittances are surely an important income source for some families since an estimated 7 million Myanmar live outside the country. One estimate from 2009 places Myanmar's total remittances at US$137 million (Ratha et al 2011), most of it transmitted from abroad through the informal hundi [16]system. Available evidence suggests that remittances provide an important income source for about 6% of rural households but only for 3% the landless (Table 7).

3.6.2. Inequality, Poverty and Food Insecurity

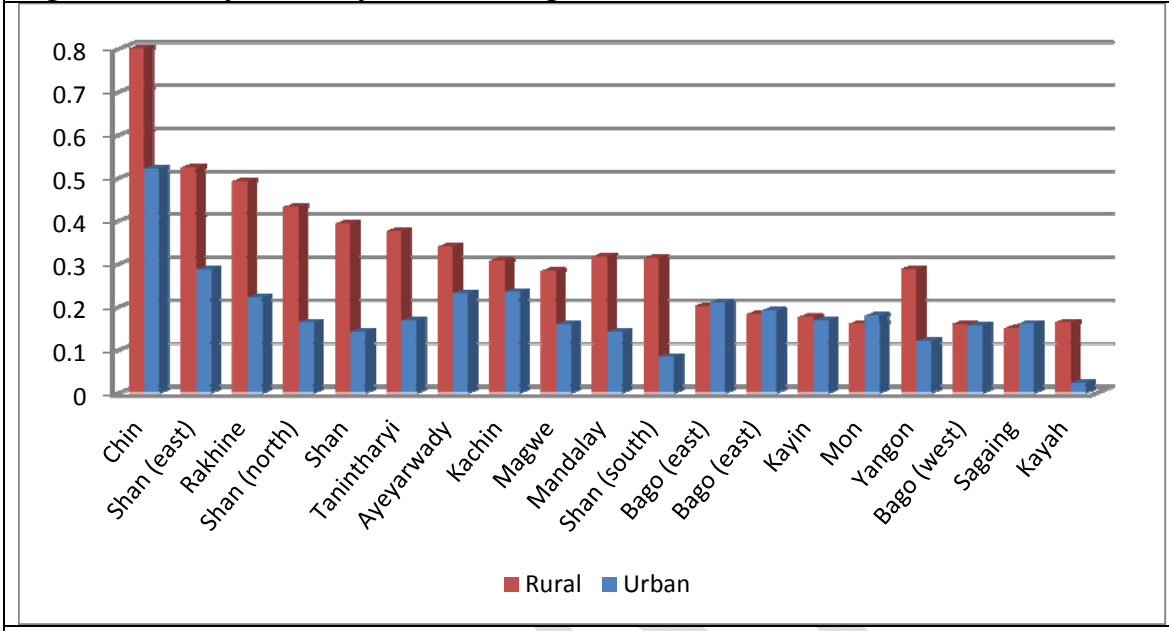
Extreme inequality of rural asset distribution constitutes a singular feature of Myanmar's agricultural economy (see Tables 3 and 4). This asset inequality contributes to wide variation in income levels, a skewed distribution of income and high rates of poverty. About one-fourth of Myanmar's population lives below the poverty line, although considerable differences arise by region. In border areas, such as Chin State to the west and Shan State to the east, rural poverty rates surpass 50% (Figure 8). Because rural poverty rates (29%) exceed poverty rates in urban areas (16%), rural areas account for over three-fourths of the country's poor (IHLCA 2011).

[15] Note that the phrasing of the LIFT income question may have led some respondents to report only cash income sources. If, as a result, these data under-report subsistence consumption, then in-kind livestock income (from home consumption of poultry, eggs and milk) may be under-stated by the figures in Table 7.

16 The hundi system is an informal network of businesspeople who transfer money around the world. Myanmar migrant workers regularly use this network to remit money back to their families. The system is built on trust, which has recently been called into question following a number of reported thefts (Aye Thidar Kyaw 2012).

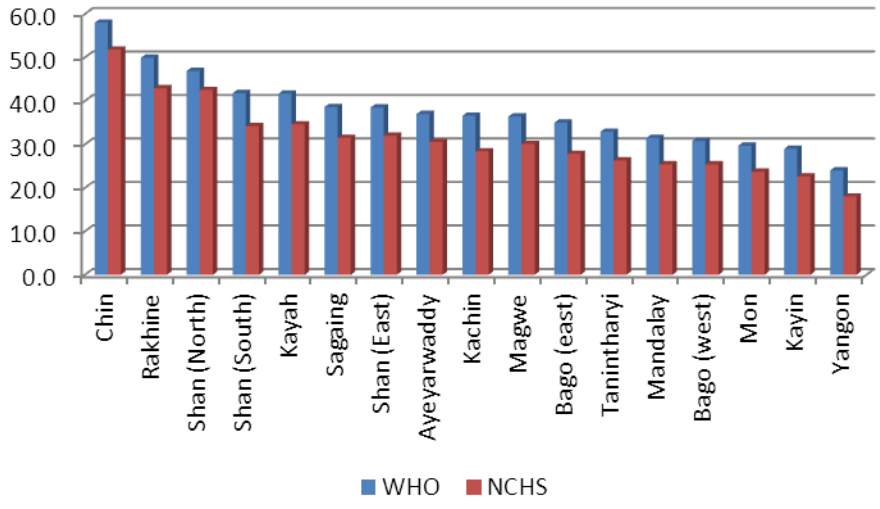
Chronic malnutrition, as measured by stunting rates, affects about one-third of under-five children and follows similar geographic patterns (Figure 9). A similar percentage of children under five are classified as underweight (MICS 2010).

Figure 8. Poverty Levels by State and Region, 2009/10



Source: IHLCA 2011.

Figure 9. Stunting by State/Region, 2009/10



Source: Myanmar MICS 2009-2010.

Hunger, likewise, remains a persistent, unwanted companion of Myanmar's poor. Poor households spend over 70% of their income on food, and fully one-third of rural households borrow at some point during the year to purchase food (IHLCS 2010, LIFT 2012). Indeed, among the poor, borrowing becomes a regular strategy for coping with seasonal hunger. Landless households spend nearly 60% of their borrowing on food purchases, while large landowners spend nearly 90% on agricultural inputs and business investments (Table 8). In spite of these efforts, landless households report that their families have adequate food supplies for only 9.6 months each year on average. They go hungry for the remaining 2.4 months each year (LIFT 2012, Table 43).

Table 8. Most Important Uses of Loans Taken Out Over the Past 12 Months

	Landholding Size (acres)			
	Zero	< 5	5-20	> 20
Food purchases	**58**	**36**	20	5
Purchase agricultural inputs	3	26	**48**	**48**
Business investment	13	14	**20**	**41**
Other	26	23	12	7
Total	100	100	100	100

Source: LIFT (2012), Table 107.

Given problems with data reliability and comparability over time, our understanding of poverty trajectories in Myanmar remains limited. What does seem clear is that skewed asset distribution, high levels of landlessness and the high cost of rural credit result in large numbers of rural households remaining dependent on casual labor and seasonal borrowing to ensure basic food consumption. Some evidence suggests that the percentage of rural households relying on access casual labor earnings may be growing. IHLCA (2011), for example, reports that the percentage of poor rural households relying on access to casual labor markets increased from 23% to 28% in the preceding 5-year period. If so, this trend has worrying consequences for household food security as well as the stability of civil society in the near term.

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4. FACTORS AFFECTING PERFORMANCE

4.1. Macro Policy

Independent estimates put GDP growth at 4.6% for the period 2002-2010, rising to exceed 5% toward the end of the period (IMF 2012). This upward trajectory is likely to continue as a result of improved macro-economic management and wide-ranging reforms under way in Myanmar. Inflation has been brought down from a high of 30% to less than 5% over the last five years. In the past, heavy government borrowing in the absence of a corporate bond market has starved the private sector of loan access through commercial banks. Public debt remains high (47.6% of GDP in 2010 according to the IMF) but fiscal deficits are being kept at 4% - 6% of GDP (ADB 2012).

Recent macro-economic reforms include a new market-determined floating exchange rate regime since April 2012 and operational autonomy for the Central Bank of Myanmar (CBM) since July 2012. Increased exports and foreign direct investment have led to a steady improvement in foreign exchange reserves to the point where they cover an estimated 9 months of imports. Key priority areas for improvement in macro-economic management include tax revenue collection to finance needed infrastructure, education and health service expenditures without incurring excessive deficits, and expansion of the private banking sector to allow greater access to financial services by businesses and rural communities

Myanmar's new foreign investment law and liberalized exchange rate system facilitates foreign direct investment in all sectors of Myanmar's economy, including agriculture and agribusiness. In addition, the new farmland law authorizes large-scale holdings as well as joint and majority foreign ownership of farmland concessions, though land use remains subject to government supervision and control. Lifting of economic sanctions against the country by the United States, the European Union and many bilateral donors has improved the investment prospects for the country.

Myanmar's foreign exchange rate has strengthened in recent years, driven by exports of natural resources, including gas, timber and jewels. From 1,300 Kyat per dollar in 2006, the currency has strengthened to 850 Kyat per dollar at the end of 2012. Exporters and traders we interviewed highlighted this potential problem in Myanmar as particularly relevant for rice, pulse and horticulture exporters. Looking forward, an influx of foreign investment and donor aid would tend to strengthen the Kyat further. In order to avoid the potential disincentive effects on farm exports, domestic prices and incomes, some central bankers and economists have suggested a managed float (Dapice et al. 2012, Tate 2012). Clearly, exchange rate policy will play a powerful role in shaping agricultural incomes, incentives and competitiveness in the coming decades.

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4.2. Rural Infrastructure

4.2.1. Transport infrastructure

Transportation and logistics cost are high in Myanmar as a result of many decades of underinvestment, heavy regulation and limited structures linking the water, road and rail transportation (Wong and Wai 2013). Currently, Myanmar ranks lowest in the ASEAN region in quality of logistics and transport-related infrastructure (ADB 2012).[17] The country's main rivers offer potentially cheap internal transport. Yet the management of intermodal connections, linking water transport, rail, road and air are not well developed. As a result, investments in an integrated intermodal logistics system would help agribusiness to overcome high transportation costs so that Myanmar's agribusiness trading networks becomes increasingly more competitive (Min and Kudo 2012, Wong and Wai 2013). The recent ADB review has concluded that, "Investment in the sector during the last 20 years has focused largely on major highways and new railways, with much less attention on operations and maintenance and improvements in lower level networks. A key challenge now is to improve the lower level networks and link them to the major networks to increase access for regional towns, local communities, and rural areas through lower transport costs and wider service." (ADB 2012, p.23). These investments require urgent attention since they will strongly influence Myanmar's ability to maximize the potential benefits of increasing connections with the region via overlapping regional organizations such as the Association of South Eastern Nations (ASEAN), the Greater Mekong Subregion (GMS) and the Bay of Bengal Initiative for Multi-Sectoral Technical and Economic Cooperation (BIMSTEC), as well as bilaterally with its immediate neighbors.

4.2.2. Telecommunications

Myanmar's telephone system is the least developed in the ASEAN region and its electrical system ranks second to last, behind Cambodia. Internet access is likewise lowest in the region with only 0.2% of the population having access (ADB 2012). Moreover, "The internet in Burma remains tightly controlled through state control of ISPs, state intervention through content filtering and various laws and regulations, and state-sanctioned surveillance." (INI 2012, p.262).

Cell phone penetration varies geographically. Recent liberalization of cell phone access has significantly increased cell phone use in urban areas. In rural areas, however, only about 4% of the population has access to a cell phone (Ericsson 2012; LIFT 2012 Table 90). Our discussions with potential cell phone investors suggest that network penetration could increase rapidly given proper authorizations from state regulatory agencies. Evidence from outside Myanmar suggests that the potential gains to farm households and traders would be very significant in terms of farm prices received, market efficiency and integration, and reducing transaction and search costs in agricultural markets (Mital 2010, Akers 2012).

[17] Among 155 countries worldwide, Myanmar ranks 129th in the World Bank's logistics performance index and 133rd in terms of quality of infrastructure (World Bank 2012).

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4.3. Reforming Public Agricultural Support Institutions

4.3.1. Research and Technology

Improved technology and farm management practices have driven agricultural productivity growth across most Green Revolution Asia. Yet over the past five decades, underinvestment in public research has limited these gains in Myanmar where agricultural research expenditures have lagged far behind those of its regional and international peers. On average, Myanmar spends only $0.06 of every $100 in agricultural output on agricultural research compared to $0.41 by its Asian neighbors (Table 9). As a consequence of these acute funding constraints, MOAI currently conducts no breeding research on improved varieties of green or black gram, the country's two most valuable pulse exports. With agricultural research expenditures averaging only 20% of its peers and competitors, Myanmar's farm productivity and incomes have lagged (Table 1). If this situation persists, it is difficult to see how Myanmar's farmers will be able to compete in international and domestic markets given this level of underinvestment in core public research functions.

Table 9. Agricultural Research Intensity
(public research spending per $100 dollars in agricultural GDP)

	Agricultural research spending intensity	
Location	2000	2008
Developed world	2.40	3.07
Developing world	0.53	0.54
Asia	0.41	0.42
Myanmar, 2003	0.06	n.a.

Source: Stads and Kam (2007), Beintema et al. (2012).

Investment in publicly funded plant breeding and agronomic research is particularly critical, given that Myanmar's farmers allocate the majority of planted area to self-pollinated crops such as rice and pulses for which the private sector seed companies have little incentive to invest. Vegetatively propagated crops such as betel leaf, dragon fruit and grafted fruit trees similarly require public support because of limited incentives for private research investment in commodities and technologies for which companies cannot recoup their research and development costs.[18] Raising productivity in livestock and fisheries, likewise, requires collective action and public investment in the development and introduction new species, control of contagious diseases and regulation of fish spawning and license allocations.

4.3.2. Extension: The Key Link between Farmers and Researchers

A farmer-centered, service-oriented extension system provides the conduit through which common farmer problems get identified and flagged for the attention of researchers so they can help farmers to solve practical problems that limit farm productivity.

[18] Because hybrid maize (or rice) requires annual repurchase of seeds, private seed companies do have a commercial incentive to invest in developing hybrid varieties.

Nonetheless, links between extension and research remain generally weak in Myanmar. "Of particular concern is the absence of operational interaction between staff of CARI's outlying research farms and staff of the extension services. Extension agents rarely come to the research stations and researchers do not routinely visit extension offices or demonstration sites." (FAO 2005, p.112). Our interviews with stakeholders suggest that these links between extension and research still remain weak in 2012.

Links between extension officers and farmers are similarly limited. In part, extension staff find themselves constrained by an acute shortage of transport and field allowances. In addition, institutional tendencies to instruct rather than listen to farmers have become embedded over two generations of command and control management of Myanmar's agricultural sector. Consequently, "The strong extension force of MAS is mostly occupied with achievement of central production targets for pillar crops and especially for rice. To have a more significant impact on improving farm incomes, crop production and the alleviation of rural poverty the service requires re-orientation within a new enabling environment for farm production." (FAO 2005, p.55) A more recent investigation in 2012 similarly finds that, "extension of agricultural advice is virtually non-existent with farmers depending heavily on each other, private suppliers of inputs and wholesale purchasers." (Anderson Irrigation 2012, p.14). As a result of limited travel budgets and cutbacks in extension staff imposed on MOAI in 2006, many of the farmers we met during our field visits had never encountered an extension agent.

Extension system reform thus becomes imperative (Maung 2008; Cho 2013). We believe that the advice offered by the FAO in 2005 remains valid today. "The centrally planned approach that restricts choice, innovation and diversification should be transformed to a 'farmer first approach' … Such transformation would require a sea change in the ethos and approach of concerned government agencies …" (FAO 2005, p.7).

4.3.3. Molding Support Institutions for a Liberalized Policy Environment

Today Myanmar's agricultural sector finds itself in the early stages of a gradual, partially completed policy liberalization. The tight state controls on agricultural land ownership, production decisions, marketing and pricing, initiated during the socialist period in 1962, resulted in diminished incentives and generally poor agricultural performance for nearly three decades. Following head of state Ne Win's public acknowledgement of the failure of the "Burmese Way to Socialism" in 1987 and widespread protests in 1988, the military government began a process of gradual policy liberalization, first with the opening of pulse marketing and exports (Okamoto 2008). Beginning in 2003, the loosening of compulsory marketing quotas for paddy and government withdrawal from rice markets opened considerable space for private traders and agribusinesses. Across a broad range of commodities, agricultural policy liberalization has begun, albeit slowly (Table 10).

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Table 10. Evolution of Agricultural Policies in Myanmar			
	Policies		
Time Period	Land Rights	Crop Production	Marketing
Independence 1948-1952	• private land ownership	• farmer decides what crops to grow	• private traders market agricultural commodities
1953-1961	Land Reform (1953) • state ownership of all land • state grants tillage rights • transfers illegal	Same as above	Same as above
Socialist Period 1962-1987	Same as above	• government mandates farmer cropping plans	• government monopoly on domestic and export marketing for scheduled[19] crops • compulsory procurement quota for scheduled crops: government purchase at fixed price
Early Liberalization 1988-2002	Same as above • informal land transfers due to increased profitability of deregulated crops	• formally, free cropping choice • in practice, government enforces cropping plan for procured crops (paddy, cotton, sugarcane)	• pulses trade liberalized • government markets and exports politically important crops: rice, cotton, sugarcane, sometimes oilseeds • compulsory procurement of above crops at reduced quota
Adjustments 2003-2007	Same as above	• in practice, government enforces cropping plan for paddy	• compulsory paddy procurement abandoned • government withdraws from rice exporting, ends ration channel distribution and allows private rice exports
2008-2009	Same as above	Same as above	• Rice Specialization Companies (RSC) granted export licenses in return for contract farming and developing supply chains
Political Reforms 2011-present	Farmland Law (2012) Virgin and Fallow Land Law (2012) Same as before: • state ownership of all land • state grants tillage rights New provisions: • transfers and mortgages legalized • farmers contest land confiscations in court	Same as above	• From 2011, any registered trader with certified stock level and facilities can apply for a rice export license • RSCs lose preferred access to export permits.
Source: FAO (2005), Okamoto (2008), Wong and Wai (2013)			

[19] Scheduled crops included all major crops: paddy, pulses, oilseeds, cotton, sugar, maize.

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Yet the institutions supporting agricultural growth have reformed more slowly. Despite many policy reforms, the key government institutions supporting agriculture still retain staffing structures embedded in the old system of state controls. Under the socialist system, Myanmar's military government imposed strict land allocation targets and production quotas, fixed purchase prices and monopolized processing. Still today, the Department of Settlement and Land Records – the MOAI department that performs this monitoring and control at village level – retains department-level status along with a large block of manpower in the Ministry of Agriculture and Irrigation. Even under the new Farmland Law of 2012, bylaws state that, "the regional farmland management committee shall have constant supervision of any changes in crop cultivation".[20]

At the same time, limited staffing and budgets prevent extension officers from regularly interacting with farmers and research system from listening to farmer production problems in setting research agendas. In 2006, MOAI lost 3,000 extension positions, further weakening extension system capacity.[21] A recent review of agricultural and extensions services in the Dry Zone summarizes the situation as follows, "The methodology of the farm advisory services has been developed out of the command economy with the weaknesses that derive from this top-down delivery approach with limited participatory contact with their target group, the farmers." (Anderson Irrigation 2012, p.16) [22]

In general, the structure, staffing and incentives of key public support institutions have not changed to reflect the public goods and services needed to support a liberalized agricultural sector. With the integration of the Myanmar Agricultural Service (MAS) into MOAI, an initial restructuring of Myanmar's various research and extension services began around 2005. More recently, in 2012, the MOAI enunciated an agenda of topics for institutional reform going forward (Cho 2013). The success of these efforts will be critical in order to restructure Myanmar's line agricultural ministries in ways that enable them to provide key public goods and services that enable farmers to improve their productivity and competitiveness in an increasingly liberalized agricultural policy environment.

[20] Section 12.f of the Farmland Law of August 2012 states that "farmland shall not be worked without permission of the relevant farmland management committee." The statute continues, in section 12.f, to say that "farmland is prohibited for growing other than regular crops without permission." Amplifying these requirements, the bylaws state that, "the regional farmland management committee shall have constant supervision of any changes in crop cultivation." (Farmland Bylaws, Chapter 9, para 69)

[21] Under new staffing guidelines, MOAI aims to partially recover these personnel losses through the hiring of 700 to 1,000 new extension officers in 2013.

[22] The review continues as follows, "This would indicate that an appreciation of the modern techniques of communicating effectively with farmers is lacking. Model farms and MAS demonstration sites are seen throughout the areas visited, but what is most noticeable is the lack of implementation of ideas and practices onto the immediate neighbouring farms. Discussions revealed that research and farm extension messages are focused largely on increased production of individual crops, with the use of correct techniques and inputs that are often beyond the resources of the disadvantaged farmers. Most extension messages are conceived centrally and are passed down with limited adapted testing, feedback or adaptation. Advice on the full range of crops that are actually being grown is lacking as well as the availability of many of inputs, including quality seeds, and access to seasonal credit. Marketing and farm economics advice are largely absent from advisory messages. It is widely recognised, not least by MOAI itself, that research and farm advisory services are unable to respond effectively to the current needs of farmers, and are certainly not equipped to support the type of farming systems that exist on many of the PIPs. Within MOAI alternative approaches are taking place, such as with MICDE providing support to cotton, but this has yet to be effectively realised in the support provided to the PIPs." (Anderson Irrigation 2012, p.16).

4.4. Private Sector Agricultural Institutions

Private sector traders and agribusinesses are well-organized in a series of professional organizations within the Union of Myanmar Federation of Chambers of Commerce and Industry (UMFCCI). With government encouragement, and sometimes direct enabling legislation, rice millers and traders, pulse and oilseed traders, onion traders, poultry producers and fruit exporters have all formed professional organizations. Our interviews suggest that women play an especially active role in horticulture and livestock associations, though they appear less prominent on paddy, pulses and oilseeds. As part of their professional responsibilities, the various trade groups help to organize and manage wholesale markets in key assembly regions and in final consumer markets such as Yangon and Mandalay. These organizations serve as official conduits between private sector agribusinesses and government. Some observers fear they also provide forums for collusion. Others maintain that these trade associations serve as a vehicle for government monitoring and tacit control. While either or both of these views may house elements of truth, our interviews also suggest that the organizations are highly professional and active in promoting growth of their various industries.

In contrast, farmers are not well organized. Apart from formal government-sponsored cooperatives, we were struck during our field visits at the paucity of farmer-initiated and organized groups. Some of the respondents we asked went so far as to say that farmer-initiated organizations were illegal in Myanmar until a series of recent constitutional and legal changes were introduced, over the past two years, permitting freedom of assembly and labor organizations. Indeed, during previous regimes legislation specifically banned unauthorized gatherings of more than five individuals.[23] Formation and membership in labor organizations was also previously illegal under a number of laws passed by successive Myanmar governments.[24] As a result, farmers did not in practice organize outside of government-sponsored cooperatives established to ensure commodity distribution[25] and to regulate and supervise collective activities[26]. Instead, the multiple prior decades of tight restrictions on farmer gatherings and organization have resulted in a dearth of farmer-initiated collective ventures and a deficit of organizational skills.

[23] Article 144 of the *Penal Code* bans groups of 5 people gathering together. *SLORC Order No. 2* (1988) bans public gatherings on the streets of five or more people and Directive 2/2010, issued on 23 June 2010, prohibits public processions and marching. Although these laws have not been expressly repealed, there is now new legislation which permits public assembly with certain restrictions (as further outlined below).

[24] These include the *SLORC Law No. 6* (1988) on the *Law relating to the Formation of Organizations*, *The Unlawful Associations Act* (1908), *Emergency Provisions Act* (1950), *Printer and Publisher Registration* (1962), *State Protection Law* (1975).

[25] According to the official ministry description, "The Ministry of Cooperatives was first formed as the Ministry of State Cooperative and Commodity Distribution on 5th April, 1951. On 26th March, 1962, it was united with the Ministry of Civil Supply Services and was named as the Ministry of Civil Supply and Cooperatives. On 18th June 1965, it was established as a separate Ministry by the name of the Ministry of Cooperatives."

[26] The Ministry of Cooperatives' official statement of its functions indicates, for example, that "another main function of the Department is that it is empowered to advise and supervise the economic activities of the cooperative societies and keep them to be in line with the Government policy."

Several recent legal enactments now make farmer-initiated gatherings and organizations possible.[27] The new Constitution of Myanmar, approved by national referendum in 2008, became operational on 31 January 2011 when the first session of the elected national parliament was convened, although steps to implement the new state structures and governance system provided for under the Constitution began in 2010.[28] This new constitution provides every citizen of Myanmar the right to assemble and form associations under section 354, Chapter VIII. In addition, Article 38 of the new Farmland Law specifically allows for the formation of farmer groups. Related legislation also protects the rights of assembly and labor organization. These newly promulgated freedoms open up opportunities for farmers to initiate collective ventures in areas such as private irrigation development and water management, input procurement and marketing.

4.5. Markets

4.5.1. Land Markets and Tenure Security

Under the Land Nationalization Law of 1953, all land became the property of the state, and private land ownership and transfers were formally illegal. Nonetheless, land actively traded in rural Myanmar during the socialist era. During our field visits, villagers readily discussed the practice of land sales, though many indicated that these transfers were not recorded officially. In most villages we visited, farmers could readily cite purchase prices for various categories of land.[29] From the 1960's through the 1980's, government land ownership and the annual awarding of tillage rights was closely linked to production quotas for various scheduled crops.[30] As crop planning controls gradually loosened over the past decade, informal land transactions appear to have increased.

The new Farmland Law, passed in the summer of 2012, permits the transfer and mortgaging of land tillage rights while at the same time retaining state ownership and control of all agricultural land. Households as well as private investors can now purchase tillage rights under the new law, though these remain subject to government control over production decisions. Although the newly modified legal system for transferring and mortgaging land offers prospects for relieving

[27] This right, however, is not absolute, it being subject to laws enacted to ensure national security, law and order, community peace, public order and morality. The *Law Relating to Peaceful Assembly and Peaceful Procession* (The Pyidaungsu Hluttaw Law No. 15 of 2011) and the *Decree on the Right to Peaceful Assembly and Peaceful Procession* also came into effect in 2012 setting out a regime for holding public assemblies with prior approval of the authorities. Moreover, the *Labour Organization Law* (The Pyidaungsu Hluttaw Law No. 7/2011) was passed in 2011 permitting the formation of labor organizations and allows workers to join such organizations. The law applies to "workers," which include those engaged in agriculture, and prescribes the categories of labor organizations that can be established.

[28] The establishment of administrative regions, as provided for in the Constitution, began in August 2010. Parliamentary elections took place later that year, in November 2010.

[29] During our visits in October and November 2012, respondents cited land purchase prices on the order of 1.5 million Kyat per acre ($1,800) for irrigated paddy land, 600,000 Kyat per acre ($700) for rainfed lowland farms and 450,000 Kyat per acre for rainfed upland ($700). In contrast, serviced industrial land in Yangon sold for around $450,000 per acre, quadruple the level prevailing two years ago.

[30] "Tillage rights were systematically linked with the compulsory delivery system as well as the planned cropping. If either the quotas or production obligations were not fulfilled, farmers were threatened with losing their annual tillage rights. (Okamato 2008, p.17).

credit constraints for landholding households, state ownership and production controls remain a concern. As one recent review of this new legislation notes, "Under the new laws, farmers still lack land tenure security and are subject to the government's crop prescriptions and production quotas. In contrast, in Vietnam the granting of more clearly defined land use rights in the 1980s was critical to boosting farm productivity and transforming the country into one of the world's top exporters of rice, coffee, pepper, and cashews in less than two decades." (Hiebert and Nguyen 2012, p.1).

Companion legislation, the Vacant, Fallow and Virgin Lands Management (VFVLM) Law of 2012, authorizes allocation of large concessions of 5,000 to 50,000 acres on lands deemed by the state to be vacant or unutilized. Because shifting cultivation or harvesting of forest products may take place on these parcels, the VFLM has led to regular evictions and growing litigation (Oberdorf 2012, LCWG 2012, Woods 2013).

4.5.2. Financial Markets

Myanmar's financial sector and banking system are small and underdeveloped. Only about 10% of the population has access to formal financial services, with a much lower ratio in rural areas. Currently, four state-owned banks, seven semi-government and local government-owned banks and twelve private banks operate, some of them quite recently created at the request of GOM. Foreign banks are at present not allowed to operate in Myanmar or to engage in joint ventures with local banks. However, major regional banks have already set up representative offices with a view towards engaging in banking services once foreign ownership of financial institutions is allowed. In addition, a number of microfinance institutions have begun to operate in Myanmar. Most of them are small, NGO-run and supported by donors. The larger ones, especially those initiated by UNDP and supported by PACT, have the potential to develop into significant sustainable, possibly even nation-wide institutions. The International Finance Corporation (IFC) recently approved an investment in Cambodia's Acleda Bank, a successful microfinance bank which will set up in Myanmar in 2013.

Myanmar's formal rural financial sector is even less developed, and access to agricultural production credit from formal sources is nearly non-existent. Larger trading companies and processors report having access to credit through bank branches of commercial banks in township centers. However, formal credit is not sufficiently available to farmers, particularly smallholder farmers. While the agricultural sector in Myanmar represents 36% of GDP and employs about two thirds of the population, only about 2.5% of all outstanding loans are made to this sector. The Myanmar Agriculture Development Bank (MADB), a department of the Ministry of Agriculture and Irrigation, is the only major financial institution operating in the rural space. MADB is the second largest financial institution in Myanmar by branches (205) and the largest by assets and loans. Until very recently MADB lent a maximum of 50,000 Kyats per acre for paddy production, limited to ten acres per farmer. At these levels, it covers about 25-50% of the overall financing needs per acre at an interest rate of 8% per annum. Farmers finance the balance of their credit needs through informal loans carrying an interest rate between 5 to 10% per month.

In an effort to improve farm input credit, the government instituted a system of Rice Specialization Companies (RSC) in 2008 under which registered firms were encouraged to provide paddy inputs on credit under contract farming schemes in return for rice export permits. Although 57 rice specialized companies have registered, many face difficulties in running viable contract farming schemes for paddy (Box 4). Due to the heavy cost of input financing and poor repayment rates resulting from crop losses, flooding and low paddy prices, only a handful of RSCs continued contract farming in Monsoon crop of 2012 (Wong and Wai 2013).

Box 4. Scope and Limits of Contract Farming

Contract farming appeals to small farmers, governments and donors in settings where weak credit systems and poor input markets make it difficult for small farmers to access productivity-enhancing inputs and high-value markets on their own. Contract farming appeals to agribusinesses in settings where small producers are the most efficient category of producer and where limited local market outlets compel contract growers to sell to their agribusiness contractors (Table B3). Because agribusiness contractors deliver inputs on credit, and sometimes extension support and quality control diagnostics as well, they incur costs in supporting their contract farmers. They must recover these lending and technical support costs, typically by deducting the interest and other costs from farmer revenue at sales time. In situations where many alternative market outlets exist, famers can frequently obtain higher prices from buyers who have not incurred input supply, credit and extension support costs. As a result, side selling and poaching frequently sound the commercial death knell for contract farming schemes. Lessons from outside of Myanmar suggest several emerging lessons

Table B3. Conditions Favoring Contract Farming

	Commodity characteristics	Enabling Environment
Farmer incentives	• high input costs • specialized large-scale processing required prior to consumption	• weak credit systems • weak input markets • strong farmer organizations and bargaining power
Agribusiness incentives	• limited market outlets (or export crops) • small farmers most efficient producers • quality control and certification requires tracking	• strong legal systems for contract enforcement

For basic food staples, contract farming rarely proves viable. Maize, ordinary rice, sorghum and local vegetables, for example, "almost never lend themselves to contract farming" because contractors who finance inputs cannot recover their costs (Tschirley, Minde and Boughton 2009, p.3). In these situations, rampant side-selling forces high-service contractors out of business very quickly. Specialty grains – such as barley for local breweries or high-value rice varieties for niche export markets – can work under contract farming, as can exotic horticulture products, particularly for export markets that require food safety and traceability certification in order to claim premium prices. Currently, contract farming for maize seed production operates profitably in Myanmar, in large part because the contracting company pays hybrid seed growers triple the market price for ordinary maize, providing farmers strong financial incentives to sell the seed they produce to the company proving input credit and extension support. Purely export crops, like cotton, also work well under contract farming because of a limited local market outlets and smallholder advantages in production.

In Myanmar, stakeholders we met frequently proposed contract farming as a solution to weak rural credit systems and weak input markets. While contract farming schemes can work well for highly specialized, high value export commodities, they are unlikely to prove commercially sustainable for low-value commodities with broad market outlets, such as ordinary rice. Hence the heavy losses incurred by Myanmar's rice specialized companies under their contract farming schemes are not surprising.

Source: Tschirley, Minde and Boughton (2009).

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4.5.3. Agricultural Markets

Two general lessons emerge from Myanmar's recent experience with agricultural market liberalization. First, the removal of government production restrictions, price controls and mandatory procurement has generally boosted performance by improving incentives for farmers and traders. Pulses, the earliest and most fully liberalized crops, have performed best over the past two decades. Similarly, non-political commodities such as horticulture and poultry, which the government has never marketed, have out-performed most others. Maize, liberalized fully and early on, has likewise performed well in recent decades (Table 6).

Second, government continues to play an important regulatory role in even the most fully decontrolled markets. In poultry and livestock markets, government veterinarians monitor food safety of day-old-chick supplies and at slaughter houses. Given recent outbreaks of avian influenza, this food safety and public health role is crucial. Major urban wholesale markets operate in zones specially designated and managed by the Yangon City Development Council (YCDC) to improve market integration, ensure traffic flows, minimize losses and permit the delivery of specialized inspection and marketing services. Market liberalization does not imply no role for government but rather a new role for government in supporting and regulating agricultural markets.

4.6. Climate Change and Variability

Farmers we spoke with in Myanmar frequently mentioned extreme weather events they increasingly face. When we enquired about normal production practices, they noted that normal patterns were becoming increasingly difficult to predict, with drought one year and flooding the next.

Indeed, most formal assessments suggest that climate change will affect Myanmar significantly. Major expected changes include rising temperatures, higher rainfall and a possibly a shorter rainy season, which in combination will contribute to considerable increase in flooding. Rising sea levels along the coast are likely to compound these problems by aggravating salt water intrusion and soil salinity in the coastal areas and river deltas. By the end of the century, climate studies project that mean temperatures will rise between 1 and 4 degrees in Myanmar, though outcomes will vary throughout the year and spatially across the country (see RIMES 2011 and World Bank 2012). Average maximum temperatures are likely to increase as well.

The climate studies project that average rainfall will increase by around 10% over the coming decades, particularly in the monsoon season. Combined with a continued shortening of the rainy season, observed over the past 40 years, many climatologists expect greater concentration and variability in rainfall will lead to increased frequency and intensity of flooding (MOAI 2010, RIMES 2011, World Bank 2012). Other studies, however, highlight potentially conflicting information about rainfall totals and extremes, suggests that there may have been no significant trends over recent decades (RIMES, 2011). One recent study anticipates that the rainy season

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will lengthen leading to increased periods of drought (Wang et al. 2013). Together with expected increases in sea level, the changes under way place Myanmar among the most vulnerable countries globally in projected changes in extreme weather, agricultural productivity loss and sea level rise (Wheeler, 2011).

The considerable risks faced by Myanmar's farmers in the past are likely to increase going forward. In order to improve monitoring and forecasting capacity, the Department of Meteorology and Hydrology has developed a proposal for UNDP's Adaptation Fund (UNDP 2011). Looking forward, one critical component of an effective program of public investments in the agricultural sector will revolve around development of strong water management systems, including irrigation and drainage, as well as improved capacity to monitor and forecast weather patterns.

4.7. Factors Affecting Vulnerability

4.7.1. Who are the vulnerable?

The groups most vulnerable to food insecurity in Myanmar include landless and near landless households, ethnic minorities, women (especially mothers), and young children.

Landless and Near Landless. Lack of access to land is clearly a key source of vulnerability to food insecurity. Available evidence also suggests a strong correlation between landlessness and poverty. Poor households hold significantly smaller landholdings than nonpoor (IHLCA 2011, Table 18). Likewise, rates of landlessness are much higher among the poor than the nonpoor. Among the poorest decile of households, 38% are landless. This contrasts with landless rates of only 7% among the richest decile of households (IHLCA 2011, Table 21). As a result of lower incomes and higher poverty rates, landless households are more likely than large landholders to go hungry and to borrow for food purchases (see Table 8 and LIFT (2012), Tables 43 and 107). In addition, because land serves as collateral in widespread informal lending contracts, landless households typically have less access to credit. Debt loads among landholders owning over 20 acres of land average 750,000 Kyat, roughly four times the level borrowed by landless (see Annex Table C9).

Ethnic Minorities. Myanmar's rich ethnic tapestry has played a crucial role in the nation's history and in many of its current crises. Not surprisingly, ethnicity correlates strongly with poverty and food insecurity for a complex set of reasons (Figure 8). The lands on which ethnic groups reside are among the most resource rich areas in the country. The major deposits of oil, jade and precious gems, hardwoods, and some of the richest soil for horticulture all lie within areas dominated by ethnic minorities. As the military and favored corporations have sought to obtain and retain access to these resources, conflicts have taken on economic undertones. This is most prevalent in specific industries, including logging, mining, hydroelectricity and large scale agricultural schemes, according to studies and news articles (Woods 2013). Thus, ethnicity appears tied to vulnerability insomuch as the ancestral lands of ethnic minorities contain resources that other groups want.[31]

[31] The non-profit Stimson Group has produced an interactive map illustrating where ethnic minorities reside overlaid with major infrastructure projects. See http://www.stimson.org/programs/myanmar-map/

Gender Dimensions of Vulnerability. The relationship between gender and vulnerability is an important issue, but especially difficult to untangle in Myanmar. Women enjoy a number of rights which distinguish Myanmar from many other developing countries. Women have the same rights as men to own property, and to equal inheritance. Cultural practices, at least among the majority Bamar ethnic group, suggest that women enjoy more equality than some of their peers in other developing countries. For example, women do not change their names upon marriage; neither men nor women wear wedding rings or other outward symbols of marriage; there is no equivalent for the word "Mrs." (or a married "Mr." for that matter) in the Myanmar language; and marriage does not require a change of residence for the woman. Indeed, it is equally acceptable for newlyweds to live with the bride's parents, the groom's parents, or on their own. This kinship practice has important implication for infant and young child feeding, since there is no one dominant figure (mother or mother-in-law, for example) providing advice to young mothers about feeding practices. Myanmar has also achieved parity of enrollment of girls and boys in both primary and secondary education (UNFPA 2010). For educated, urban women, their socioeconomic status concerning home chores, private business, and joint-decision making, is reportedly almost equal to that of men. Rural women and ethnic minorities, however, do not appear to enjoy this same level of status.

National poverty data suggest that female-headed households account for just over 20% of all households and that they are *less likely* to be poor than are male-headed households (ILHCA 2011). The ILHCA team hypothesizes that lower poverty rates among female-headed households may result from high levels of remittance income received by female-headed households or that only better-off women can afford to form independent households, while the less affluent instead become absorbed as dependents living with relatives following a divorce or the death of their husband (IHLCA 2011, p.34).

Despite legal and cultural practices that encourage gender equality, certain existing gender roles place women in relatively more vulnerable positions. Women have primary responsibility for home and care of children, while still participating in the labor force, often even during pregnancy and nursing of young children. This dual responsibility places women, especially women of child-bearing years, in danger of poor health and nutrition outcomes, especially among landless who rely on daily labor whenever it is available, the burden of childbearing puts women and their young children at particular risk.

4.7.2. Shocks Affecting Vulnerability

The key shocks affecting vulnerability and food security include: • changes in employment and wage rates, • illness and death of working family members, • price volatility of staple foods, which account for 70% of their spending, • natural disaster including seasonal floods and droughts which are likely to worsen with climate change, • loss of access to land, • animal diseases and • conflict. Many of the key shocks that increase vulnerability to food security do so via loss of productive assets, including both physical and human capital, either through indebtedness, confiscation, physical loss of assets, or depletion of assets as a coping strategy.

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Table 11 below summarizes the key sources of vulnerability for landless and smallholder farmers across different zones in Myanmar. Many sources of vulnerability – including lack of access to affordable financial services, climate change and natural disasters –cut across agro-eco zones, and affect both the landless and poorest farmers. Others are unique to particular zones, for example, the seasonal water shortages that many households in the Dry Zone face. Active conflict and displacement continues to occur in two of the seven ethnic states and in the other 5 ethnic states, an uneasy ceasefire is in place and further trust building is underway after 60 years of civil war and anti-government violence.

Table 11. Key Sources of Household Vulnerability

Delta/Coastal		Dry Zone		Hilly	
Farmers	**Landless**	**Farmers**	**Landless**	**Farmers**	**Landless**
• price volatility • lack of access to affordable financial services • sudden loss of access to land • disease • climate change • natural disaster • conflict/ • displacement	• un(der)-employment • lack of access to affordable financial services • disease • climate change • natural disaster • conflict/ • displacement	• price volatility • seasonal water shortage • lack of access to affordable financial services • sudden loss of access to land • disease • climate change	• un(der)-employment • lack of access to affordable financial services • seasonal water shortage • disease • climate change	• lack of access to affordable financial services • disease • sudden loss of access to land • conflict/ • displacement • price volatility	• un(der)-employment • lack of access to affordable financial services • disease • conflict/ • displacement

Source: Wilson and Wai (2013).

4.7.3. Options Available to Rural Households

Landless. Landless and near landless rural households constitute the largest single population group in Myanmar and one of its most vulnerable. As demographic pressure increases, their numbers will in all likelihood continue to grow over time.

For adults trying to support their families in rural areas without tillage rights to farmland, livelihood options revolve around some mix of the following four strategies: • daily wage labor, • high value agricultural activities requiring minimal land (horticulture, poultry, fisheries), • nonfarm businesses (such as basket making, weaving and small shops) and • migration, both temporary and long-term. Currently, daily wage labor dominates choices of the rural landless (Table 7). Yet prospects for future prosperity appear greater along the other three pathways.

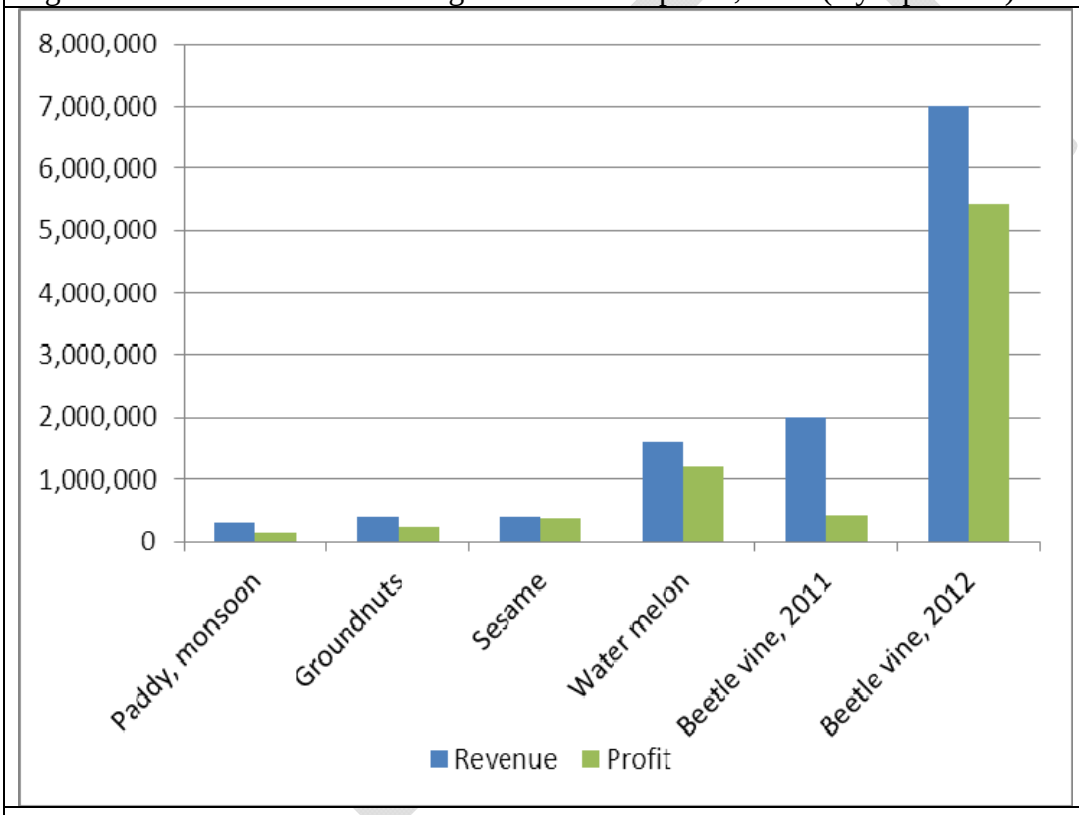
Looking forward, policy makers must ask what the future holds for the children of today's landless households. For landless children, investments in their education and nutritional welfare will be critical to building the human capital necessary for them to launch remunerative nonfarm careers as skilled rural artisans, professionals, employees or small business owners.

Smallholder Farms. Rural households owning 5 acres or more of farmland can aspire to support their family through commercial smallholder agriculture. But in order to do so, they will need to significantly improve productivity, market predictability and reduce risk. For farm households

with fewer than 5 acres of land, a move to high-value crops, livestock and fish farming offers the most ready means of raising productivity and welfare (Figure 10). Risk reduction will require household as well as system-level investments in diversification and water control to manage increasingly unpredictable swings in seasonal rains and drought. .

Some of the children growing up on small farms will continue in farming as a career. To be successful, they will require a quality rural education that equips them to become the modern, highly productive small farmers and agribusiness managers of tomorrow. Over time, as demographic pressure erodes family land holdings, other children from these households will need to learn skills that propel them into viable nonfarm or agribusiness careers. For those transitioning out of agriculture, investments in rural education and nutrition will be central to assuring their long-term productivity and welfare.

Figure 10. Returns to Alternate Agricultural Enterprises, 2012 (Kyat per acre)[32]



Sources. Field interviews, 2012.

[32] Profitability varies considerably across farmers, locations and seasons. Nonetheless, several studies have concluded that paddy production is often less profitable than other crops, particularly when compared to high-value horticulture crops. Dapice et al. (2009) conclude that paddy production was unprofitable in 2009. Anderson (2012, Annex E) finds that in dry land conditions paddy is generally the least profitable crop in both the monsoon and summer seasons. FAO (2005, pp.119-127) reports that paddy generates per acre returns comparable to pulses and oilseeds, while groundnuts are roughly twice as profitable and onions and garlic five times more profitable per acre than paddy.

Large-scale Agribusiness Farming. Over the past decade, the Government of Myanmar has allocated nearly 2 million acres of land in large concessions to local agribusiness companies, many with strong ties to the military (Woods 2013; Annex Table C6). Some of the large concessions have proven commercially successful as farming businesses. Other concessionaires appear to have limited interest in farming and instead gain land rights in order to enable mineral extraction, lumbering or land rental to smallholder sharecroppers. These large land allocations have attracted considerable scrutiny as well as litigation. Under the new Peaceful Protest Law of 2011, farmers have engaged lawyers to press their claims (LCG 2012). In July 2012, Parliament set up a formal parliamentary commission to investigate land confiscations.

For some categories of commercial agriculture and agribusiness, large concessions offer a viable model for meeting the stringent quantity, timing and quality demands of high-value products and niche export markets. However, these large holdings do not offer a feasible exit for the vast majority of Myanmar's landless poor, given common tendencies to mechanize large-scale operations. In practice, overly rapid mechanization on large farms risks displacing labor and thereby depressing rural wage rates, thus further constraining the short-term survival strategies of the rural landless. Under most crops and agro-ecological conditions in Myanmar, smallholder farmers offer significant potential for productivity growth, increased competitiveness and expanded employment for landless households (Box 5).

Box 5. Small Farms and Large Farms: Efficiency and Equity Implications of Agricultural Growth

Alternate models. The Government of Myanmar faces important policy choices in the agricultural sector, in particular whether to focus public resources on the smallholder sector or large-scale commercial farming. This is a policy question on which much can be learned from the development experience of other countries in the region and around the world. Many land-constrained Asian countries – including India, China, South Korea, Japan, Vietnam, Bangladesh and the Philippines – have focused their agricultural development strategies on small-farmer-led growth. Others, including Laos and Cambodia, have followed a mixed strategy that promotes large-scale private agribusiness investment alongside local small farms. At the other end of the spectrum, land-abundant Brazil has centered its agricultural growth strategy on highly mechanized, large-scale farms. Over the past three decades, these large farms have successfully turned Brazil into a highly competitive exporter of soybeans, sugar and meat. Which of these strategies will best suit Myanmar? Available evidence on the efficiency and equity implications of alternate agricultural growth strategies can help to answer to this question.

Small farms. Empirical evidence generally suggests that small farms achieve higher land and labor productivity than large farms. Smallholders can achieve this high productivity for two reasons. First, smallholders' productivity advantage stems from their widespread use of highly motivated family labor and the ability of family farmers to carefully supervise hired labor. Large farms, in contrast, typically face lower borrowing costs and hence are better able to finance equipment and inputs. As a result, smallholder farms generally dominate in early stages of development in locations where equipment is expensive and land scarce. Large farms, in contrast, perform better in later developing countries in with high labor costs and surplus land.

Second, many farm technologies are scale-neutral. The Green Revolution packages of improved seeds and fertilizer can be applied with equal effect on farms of 1 acre or 1,000 acres. Bulk purchasing by large farms, which leads to lower input costs, can be offset by farmer organizations and collective action. The combination of improved technology and good labor management leads to high productivity achievement by smallholders. "The record on the superiority of smallholder farming as a form of organization is striking. Many countries have tried to promote large-scale farming believing that smallholder farming is inefficient, backward and resistant to change. The results were unimpressive and sometimes disastrous." (World Bank 2007, p.91).

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The poverty impact of smallholder farming is also typically greater than from mechanized large farms, which instead tend to displace labor. Rapid reductions in poverty following Green Revolutions in India and China are generally attributed to small farmer led agricultural growth. More generally, Lipton concludes that, "There are virtually no examples of mass poverty reduction since 1700 that did not start with a sharp rise in employment and self-employment due to higher productivity on small family farms." (Lipton 2005, p.9).

Large farms. Large farms are more competitive than small farms in situations where land is plentiful and labor is scarce (like Brazil), where economies of scale in processing lead to high minimum investment costs (as with plantation crops such as palm oil, rubber and sugar cane), where bulky or perishable products require quick processing (like tea and sugar cane) or where highly demanding quality and food safety standards (as in export horticulture and floriculture). Moreover, large farms offer benefits in mobilizing private investment in agriculture, facilitating international technology transfer and developing new markets. Mixed models frequently emerge with plantation crops (such as rubber, palm oil, sugar cane and tea), where large agroprocessors with core plantation farms make initial investments, which smallholder can later supply through outgrower schemes.

On the negative side of the ledger, large farms typically generate an unequal distribution of income. Hence their generally poor record of poverty reduction. Likewise subsidies for large farms, through concessional finance, for example, risk leading to premature mechanization and displacement of labor.

Growth linkages. In irrigated Asian agriculture, every dollar in direct farm income generates roughly an additional 60 cents in indirect income because of farmer spending on local goods, services and inputs. These growth linkages differ substantially between large and small farms. While large farms purchase more equipment, repair services and inputs, small farms spend more on local consumption goods and services. Because consumption linkages (spending on consumer goods and services) dominate growth linkages, small farms generate large local income multipliers. These indirect gains from agricultural growth tend to be large and hence small farm led growth has greater direct and indirect poverty reduction impacts.

Implications for Myanmar. Myanmar requires an agricultural strategy that will generate rapid income growth as well as broad-based poverty reduction. Small and large farms each have a role to play in promoting efficient, rapid income growth. Given Myanmar's current high levels of landlessness and rural poverty, concerted efforts to promote broad-based small farmer growth offers the likeliest source of broad-based rural poverty reduction, especially in the short term and medium term.

References: Deninger and Byerlee (2012), Haggblade, Hazell and Dorosh (2007), Lipton (2005), World Bank (2007).

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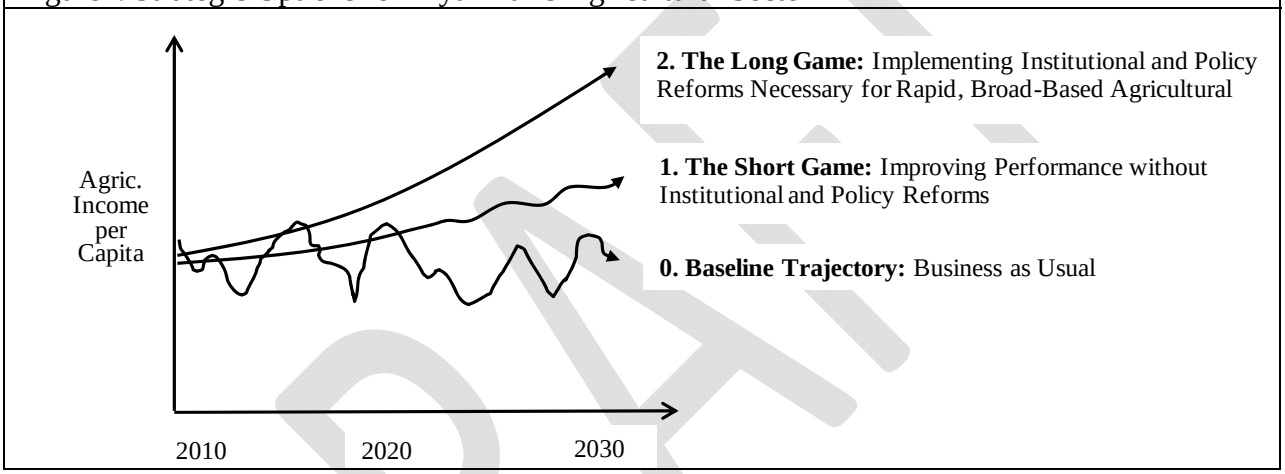
5. FUTURE TRAJECTORIES

5.1. Three Alternative Pathways for Myanmar's Agriculture

Looking forward, we see three alternative pathways for Myanmar's agricultural sector (Figure 1, repeated below). Under a Business as Usual scenario, Myanmar's agriculture will continue along its current low-productivity, highly volatile trajectory. But Myanmar can do better -- even within the country's current considerable policy, institutional and structural constraints. And under a vigorous program of policy and structural reforms, Myanmar's agricultural sector can accelerate rapidly. Key decisions by the GOM, its supporters and stakeholders will determine which of these three pathways the country's farmers will travel.

Figure1. Strategic Options for Myanmar's Agricultural Sector



5.1.1. Business as Usual

Under a "Business as Usual" scenario, Myanmar's agricultural future will look much like its past, characterized by high levels of poverty and vulnerability – outcomes that stem from endemic low farm productivity and high volatility.

Myanmar's low agricultural productivity, in relation to its neighbors and competitors, is the product of many decades of under-investment in agricultural research, extension, rural roads and telecommunications. Its rural roads, telecommunication systems and energy grid all rank among the least developed in Southeast Asia (ADB 2012). In agricultural research, the engine of agricultural sector productivity growth, Myanmar invests only 20% as much as its regional counterparts (Table 9). While its neighbors have invested in agricultural research, extension, modern statistical systems, rural roads and telecommunication systems, Myanmar has not.

High volatility -- of both production and prices -- stems in part from increasingly irregular rainfall accompanying climate change coupled with poor water control and increasingly frequent drought and flooding. As a result of ongoing changes in rainfall and climate, weather-induced shocks seem likely to aggravate patterns of production and price volatility. Unpredictable policies, particularly trade bans on major export commodities, likewise contribute to price

volatility and drive wide year-to-year swings in farmer planting decisions. Reliance on single markets for export crops compound volatility problems. High transport and transaction costs together with the lowest cell phone penetration rates in the region combine to exacerbate price volatility and drive a large wedge between farmgate and consumer prices.

5.1.2. Prospects for Bending the Curve

A pessimist looking at Myanmar's agricultural sector might conclude that the country's farmers currently operate in the worst of all worlds: a low productivity, high risk environment. But a closer look at the underlying causes of Myanmar's low agricultural productivity and its high volatility reveals the bulk of these root problems are subject to remediation. Indeed, many of the underlying structural and policy problems result from self-inflicted wounds. An optimist looking forward would, therefore, focus on the key investments, interventions and institutional reforms necessary for bending the long-run agricultural productivity curve upwards and flattening out its peaks and valleys.

We emerge from this review convinced that Myanmar can indeed alter its agricultural trajectory onto one of two higher performance pathways. The more ambitious of these two alternate pathways involves government and other stakeholders committing to a Long Game of institutional, structural and policy reforms that address the root causes of Myanmar's current low productivity and high volatility. Our team sees this as the clearly preferred trajectory. Given the scale of Myanmar's rural poverty and given the power of broad-based agricultural productivity growth to reach the country's most vulnerable households, we consider these structural reforms both urgent and necessary. At the same time, we recognize that government, parliament, private sector, civil society and donor stakeholders will all need to develop and articulate a common vision and commit to making what will be ambitious but necessary reforms.

In the absence of high-level commitment to structural and policy reforms, Myanmar's second best option lies in a Short Game that promotes productivity improvements within the current institutional and policy framework. The gains attainable under this approach – possibly in the range of 25% to 50% increases in paddy productivity within five to seven years (Denning et al. 2013) – can only be sustained and expanded under a Long Game.[33] The following discussion explores the key elements required to improve Myanmar's agricultural and food security situation, under the more ambitious Long Game and the second best Short Game.

[33] Note that the terminology used here to contrast the Short Game from the Long Game refers to the magnitude of potential gains (fewer in the short game, greater in the long game), not to the time period required for achieving those gains. In order to execute a Long Game successfully, short-run early actions will be necessary to set up long-term structural reforms. Similarly under a Short Game strategy, early actions will be required to set up later, though more limited gains in the longer run.

5.2. The Long Game

5.2.1. Institutional and Policy Reforms Necessary for Broad-Based, Accelerated Agricultural Growth

In order to match the impressive agricultural performance of its regional peers, Myanmar will need to undertake a series of key institutional and policy reforms outlined below (Table 12). Given that three-fourths of the country's poor live and work in rural areas, we consider these reforms essential if Myanmar is to unleash the potential for broad-based growth led by a dynamic smallholder sector and effectively redress its current high rates of inequality and poverty.

a) Increase public resources for agriculture. Myanmar has underinvested for many decades in the public goods required to support agriculture.[34] And historically, much of the government's limited funding has gone to state agricultural enterprises, leaving comparatively little for research, extension and education. As a result, Myanmar has invested only 20% as much as its regional counterparts in agricultural research, in the process systematically depriving the agricultural sector of its major engine of productivity growth. Rural roads and telecommunications are likewise essential for the development of efficient input supply systems, agricultural markets and extension systems. Yet, Myanmar's logistics infrastructure, power and telecommunications systems all rank among the lowest in Southeast Asia (ADB 2012). In order to reverse its decades-long trend of underinvestment in the rural and agricultural sectors, GOM will need to substantially boost funding for the key public goods promoting agricultural growth, including agricultural research, extension, education, rural transport, telecommunications and early warning, climate monitoring and irrigation and drainage control systems.

Long Game Early Action 1: Public expenditure and institutional review of the agricultural sector. As an early action, we propose a public expenditure review focused on allocations to the agricultural sector and clearly separating out the financing of state agricultural enterprises from spending on irrigation and recurrent financing for farmer-centered support functions in research, extension and education. To be most effective, this would take place alongside a thorough needs-based institutional assessment comparing existing ministerial staffing, facilities and organizational structure against likely future needs.

b) Structural reform of agricultural support institutions. Not only will Myanmar need to substantially boost the resources it allocates to agriculture, it will also need to restructure the line ministries and departments in agriculture, livestock and fishing that will drive future productivity growth in agriculture. Today, the legacy of several generations of state control remains evident

[34] During the early years of their Green Revolution, India and other Asian countries spent 10-20% of their government budgets on agriculture, investing heavily in agricultural research, extension, agricultural education, irrigation and rural roads (Hazell 2011, Lipton 2012). In contrast, Myanmar currently spends only about 6-10% of its budget on agriculture and livestock (see Annex Table C11). Yet budget data, like many others in Myanmar, remain the subject of considerable skepticism. In years when budget allocations exceed this threshold, agricultural spending purportedly surpassed spending on defense. Moreover, within the agricultural sector breakdowns between ministry departments and across the various state agricultural enterprises are unspecified.

in the staffing and institutional culture of key government departments. Two generations of farmers and civil servants have operated under government command and control systems, bequeathing an array of relatively well staffed departments built up to supervise and control farmer decisions but with limited capacity to listen and respond to farmer needs and felt constraints. Although Myanmar has begun to liberalize the policies governing agricultural production and marketing, the ministerial structures supporting market-oriented growth have not yet been redesigned for the new policy environment. MOAI has taken several important steps in this direction in the past year, most notably by authorizing the hiring of 700 additional extension officers, adding a horticulture department in DOA to promote crop diversification, elevating plant protection efforts to departmental status, selling off ministry-owned industrial crop processing enterprises and restructuring public support to focus on research, development and extension in a newly structured Department of Industrial Crops Development (DICD). The emergence of a highly productive, competitive, broadly growing agricultural sector will require further restructuring of agricultural support institutions several key areas.

• research: Myanmar needs to create a market-oriented, farmer-centered research system. As part of this effort, increased budgets will be necessary to cater for diagnostic field visits and researcher consultations with farmers prior to setting their research agenda and for field testing and evaluation of new technologies. The culture of professional expectations within the research system will need to adjust accordingly to accommodate and nurture a farmer-centered research program. The first priorities in any institutional restructuring will lie in providing incentives and management flexibility to hire and retain good male and female scientists as well as incentives for them to work with farmers and other value chain actors to solve practical problems facing farmers. Given Myanmar's current evolving array of research organizations, some institutional restructuring of the research system may be required as well. To this end we propose that consideration should be given to the establishment and support of national research centers of excellence for the country's major commodities and farming systems (including, as priorities, a national rice research center and a dry zone center that, combined, could serve over 80% of the farming population). When well-managed, such centers provide research focus, depth, critical mass, international partnerships, resource mobilization, and accountability.

• extension: The extension system will similarly require reforms that increase the mobility of extension officers, improve links between farmers, researchers and extension staff and modernize agricultural extension services through the application of modern cell phone technologies and geographical information systems as vehicles for the provision of diagnostic, prescriptive and monitoring services. Recent efforts to increase extension system staffing and budgets offer a starting point for reconfiguring the current system into a farmer-centered, service-oriented extension service.

• agricultural education: New skills will be required to meet the needs of a new era of global agricultural engagement. This will require updating curricula, investing in human capital of faculty and teachers, improving facilities and exploring new scientific frontiers and ways of imparting information.

Long Game Early Action 2: UDOCs. As an early action, we propose training and deploying a new generation of early career agricultural professionals through a system of post-graduate deployment to rural areas supported by local and international training and diagnostic backstopping. The universities of

Myanmar have suffered from decades of underinvestment and isolation. Yet, these institutions provide the country's future leaders and change agents. We propose an ambitious scheme that would create a new cadre of professional women and men with the knowledge and skills to modernize agriculture and transform rural communities. We call this the University Development Outreach Corps (UDOC). Each year, graduates of the country's agricultural universities would compete for places in a 2-year field-oriented program that would deploy UDOCs in communities throughout the country. As in to the US Peace Corps or Teach for America programs, these young men and women would receive initial training and orientation upon graduation, as well as at strategic times during the program. UDOCs would be paid a basic wage of an agricultural extension officer and provided with appropriate transport and equipment. We suggest that approximately 200 people per year could enter the program. Efforts would be made to ensure a good ethnic and gender balance. After successfully completing the program, UDOCs may then compete for scholarships for a master's program. We believe that the prestige of participation coupled with the potential for higher education scholarships for the best will animate a cadre of highly motivated young professionals .

We believe that such a program would be an appropriate focus for strategic capacity building efforts in the agriculture sector. International and bilateral partners including universities and CGIAR centers could engage this program through training programs. In 10 years, roughly 2,000 graduates of the program would provide the nucleus of strong national capacity in the agriculture sector. We anticipate that the UDOCs would retain important alumni-type connections and alliances that would extend years after completion of the program. Over time, UDOCs would likely fill important leadership roles in research and extension, as well as in the private sector.

c) Land access. High rates of landlessness, coupled with the recent allocation of 2 million acres in large-scale commercial land blocks, have made land access a highly contentious political issue. Current litigation over land confiscation has focused judicial attention on the new Farmland Law (FL), the Vacant, Fallow, and Virgin Land Management Law (VFVLM) and the current implementation of the country's various land use regulations. To investigate the resulting waves of claims and counterclaims, Parliament has established a commission of enquiry on the highly charged subject of land confiscations. Civil society has engaged in this discussion through the establishment of a Land Core Group that promotes transparency, collection of empirical evidence, constructive engagement among key parties and legal education on land use matters. Resolution of the many current conflicts surrounding land litigation will be critical to long term efforts to modernize and raise productivity of Myanmar's agricultural sector while at the same time ensuring viable livelihoods for all citizens. Satisfactory resolution of these highly contentious land claims will also be fundamental to ensuring future political stability.

Long Game Early Action 3: Support ongoing work by the Land Core Group and Parliament. Continuing work by the Parliamentary Commission on Land Confiscations and by the Land Core Group offer the most feasible pathway forward on this critical but highly sensitive topic.

d) Farmer organizations. Basic literacy and numeracy, in turn, make it possible to support the formation of farmer-instigated service organizations that help to manage collective actions such as water control, livestock disease mitigation, input supply and marketing. Many NGOs and

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civil society groups, in Myanmar and outside, have experience in this area that can facilitate these support programs.

Long game early action 4: Micro-irrigation and small-scale water management. A promising entry point in these efforts would involve a focus on water management for farming and village water supply systems using low-cost micro-irrigation technologies. Seed multiplication offers another entry point for productivity-enhancing collective action.

e) Water system management. Given the heightened unpredictability of monsoon rainfall and an increased frequency of both flooding and drought, investments in weather monitoring, forecasting and water control systems will be critical to Myanmar's ability to manage a high productivity agricultural system in the face of global climate change. Satellite-based weather monitoring and physical control systems for managing flooding, drainage and irrigation will form necessary parts of an effective water management system. Because Myanmar's major river systems lie within their country borders, this will not require international agreements but rather focused, internal assessment, deliberation and collective action. In same way that Bangladesh implemented its Flood Action Plan over many years and the Mekong River Commission established protocols and control systems for managing water flows, Myanmar will need to improve its ability to manage its increasingly unpredictable fresh water flows. In view of likely increases in both flooding and drought, investments in improved water management appear fundamental to sustainable agricultural productivity growth going forward.

Long Game Early Action 5: Assessment of climate change evidence and technical options for monitoring, forecasting and managing water control systems.

f) Improve data quality. It is difficult to overstate the importance of reliable agricultural statistics for guiding government policy and private investments (see Box 1). Current uncertainties about production, land allocation, yields and prices make it difficult to debate policy options sensibly. Indeed, many policy disputes center on diverging assessments of basic facts about land availability and use, prices, national production totals and cross-border trade.

A move from the current, highly contested administrative agricultural production estimates will require careful assessment of options before determining what systems make most sense in Myanmar. Alternative estimation methods are all based on various choices, measurement tools and assumptions. None is perfect, and costs of data collection vary along with statistical accuracy. So it will be important to help Myanmar review major alternatives before determining how best to build up its capacity to produce reliable agricultural production estimates.

Structurally, the current coupling of land tax assessment and production estimates by the same officers of SLRD will merit review. Possibilities for de-linking these two functions may exist as part of decentralization efforts, which might reasonably consider devolving land tax assessment functions and staff to local governments. This would free up a smaller but more focused statistical staff that could draw on sample survey methods and satellite monitoring tools to more cost-effectively track production over time. As part of an overall effort to improve agricultural data, MOAI's detailed cadastral map library could quickly be digitized, geo-referenced and

combined with best practice survey methods to lower data collection costs, increase speed and improve precision, early warning and forecasting capacity.

Long Game Early Action 6: Statistical systems review and upgrading. A useful first step in this direction would involve establishment of a working group on agricultural statistics charged with reviewing alternative systems currently in use in the region and assessing alternative methods for estimating production of crops, livestock and fish, including survey-based forecasting systems and possible complementary use of satellite-based RDR and geographical information systems for monitoring water resources, plot sizes, planted area and production.

g) Predictable policies. Many of the stakeholders we interviewed complained about arbitrary and unpredictable policies affecting agricultural trade, production and investment. Despite recent relaxation of production and land allocation controls at the farm level, many farmers spoke of continued government "encouragement" to plant certain crops, while a few complained explicitly about non-paddy crops being ripped out and plowed under by disapproving local authorities. Clarity about land use choices are particularly critical for farmers wishing to diversify into high-value horticulture, fruit, poultry and fish farming. The new Farmland Law (2012) continues to stipulate that farmers require government authorization before planting individual plots. Yet it remains unclear how future enforcement of these new provisions will differ from the controls practiced under similar past land utilization control provisions.

Table 12. Strategic Options for the Long Game

Food system components	Long Game Early Actions	Long Game Reforms
Farming	1. agricultural sector budget and institutional review →	+ budget resources for agriculture
	2. agricultural graduate deployment (UDOC) →	+ institutional reform (agricultural research, extension, education)
	3. land policy monitoring and support →	+ land access
	4. access to micro-irrigation for farmer organizations →	+ farmer organizations
	5. climate change and water control assessment →	+ water system management
Post-farm value chain	6. upgrade agricultural statistical systems →	+ improve data quality + predictable policies (land use, input quality, trade)
	7. rural cell phone expansion →	+ rural finance
	8. MADB assessment →	+ intermodal transport system logistics
Landless and near landless	9. pilot efforts to improve enrollment, curriculum and nutrition →	+ education reform + rural nutrition, health and sanitation

Trade policies likewise elicited concern among the farmers and traders we interviewed, since abrupt refusals to allow export exposes them to considerable price risk. Many reported having to negotiate for export or import licenses. And in many instances, these debates centered on divergences in views about the quantities of local production and availability. As a result, many key policy discussions will require a firmer statistical foundation. Therefore, we see the data investment in improved data systems (item c above) as a key enabler of more transparent, empirically based policy discussions going forward.

h) Rural cell phone expansion. The explosion of cell phone access elsewhere in the developing world suggests that three major benefits await Myanmar farmers should cell phone penetration rates increase from their current negligible level.[35] First, cell phones empower farmers by making price information widely available, thus overcoming the information asymmetry that traders can otherwise exploit to take advantage of farmers. Empirical studies suggest that widespread rural cell phone access enables farmers to target the timing and markets for their purchases and sales, leading to increased prices received by farmers and reducing price differentials across markets as well as price variability. Second, mobile phone offer access to weather, disease and extension advice. Third, the mobile phones offer a low-cost platform for money transfer. This enables relatives to easily transfer funds to rural family and friends, alleviating credit constraints and lower cost of funds. Over time, the development of phone-based savings and banking services provide vehicles for cash management and safeguarding rural savings.

Long Game Early Action 7. Support efforts to facilitate private sector investment in rural cell phone networks. Our discussions with private sector investors indicate that regulatory reforms will be required to enable companies the confidence to build out rural cell networks. Given the significant potential gains to farmers and to the agricultural sector, efforts to accelerate this roll out offer potentially significant gains and merit high priority in government reform agenda.

i) Rural financial systems. Weak rural financial systems, high levels of indebtedness and heavy dependence on informal financing at high interest rates hamper farmer efforts to finance agricultural production and marketing. Efforts to build up local savings instruments, credit systems and institutions that intermediate between borrowers and lenders will require investments in long-term institutional development. Ongoing efforts to register and launch savings-based community financial institutions in rural areas can help in this effort. Although many micro-finance programs are not well-suited to agricultural lending, they do provide savings vehicles as well as opportunities for permitting highly indebted rural households to manage their debt loads by refinancing high-cost consumer loans at more manageable rates of interest.

Long Game Early Action 8: MADB assessment. In addition, given the widespread footprint of MADB in rural areas, and given many lessons from outside Myanmar on ways to reform state-owned rural development banks, a formal assessment of the prospects for restructuring or reforming MADB as a commercially managed sustainable bank could prove highly productive (see Kloeppinger-Todd and Tun Min Sandar 2013).

[35] See Aker (2000), Labonne and Chase (2009), Muto and Yamano (2009) and World Bank (2012a).

j) Rural education. Given high rates of rural landlessness, a key pathway out of poverty for the children of currently landless households will center on building up human capital required to launch productive careers in agribusiness and in professions outside of agriculture. While food for education and related short-term programs can dramatically increase enrollment rates of poor children, successful programs require simultaneous investments that increase the capacity and quality of rural education systems.

Long Game Early Action 9: Pilot rural education reforms. As an early action to explore practical options and to lay a foundation for prospective rural education reform, we envision a set of small-scale pilot efforts linking increased enrollments (through scholarships, school feeding or food for education programs aimed at covering the cash and opportunity costs of attracting landless children to schools) with expanded teacher staffing and supplementary curricular and extra-curricular learning opportunities aimed at improving the relevance and impact of rural education on the career trajectories of children of the rural poor.

5.2.2. Trade-offs among different stakeholder groups during the reform process

Structural and policy reforms of this magnitude require high-level political commitment, broad internal support from a coalition of interest groups who stand to benefit from the reforms, and support from allied outside groups of donors and civil society that stand ready to provide financial, technical and moral support. Absent these conditions, reform efforts risk foundering on the pressures and resistance posed by entrenched vested interest groups.

Currently, we see two groups of stakeholders who may perceive their interests to be threatened, at least in the short run, by a program of broad agricultural policy and institutional reforms. The first of these include large landholders who may feel threatened by an open political system that permits legal challenges and threatens the retention of their large land holdings. Second are groups of politically well-connected businesspeople, who may benefit in the short run from opaque decision-making, favoritism and policy-induced rents. In the long run, however, a transparent, rules-based system for land use rights and policymaking is also in the interest of large investors in agribusiness and land development, and will improve their access to international capital.

Farmers of all size benefit from improved public research and extension, predictable policies, good infrastructure and well-functioning financial markets. Agribusinesses, input suppliers and traders similarly stand to benefit from broad rural productivity and income growth. Expansion of economic opportunities for vulnerable groups -- in the short run focusing on employment opportunities for landless adults and in the long run on viable career trajectories for their children -- will be essential for reducing Myanmar's current high levels of inequality, poverty and social conflict. As a result, serious investments now in human capital, productive assets and high-productivity livelihood options for Myanmar's rural landless and poor constitute a vital insurance premium for securing political stability going forward.

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5.3. The Short Game: Improving Performance in the Absence of Structural and Policy Reforms

Options for improving agricultural performance and food security in the absence of institutional, structural or further policy reforms will center around four strategic efforts (Table 13).

The first involves improving the productivity of monsoon rice through improved seed quality, better agronomic practices, improved water control, optimized fertilizer and input use and integrated pest management. As a rough order of magnitude, our discussions with local stakeholders suggest that improved practices could increase productivity and incomes of paddy producers on the order of 25% to 50% within five to seven years, even under current conditions. Improved water management at the farm level through low-cost micro-irrigation and water user groups will be central to achieving and amplifying these gains. Updating and enforcing pesticide regulations, such as the 1991 requirement to print instructions in Myanmar language, offers an additional quick opportunity to reduce pesticide misuse, thereby reducing cost and improving profitability of paddy production.

Short Game Early Action 1: Synthesize best practices. Useful early actions for launching this work would involve efforts to synthesize expert opinion on current best practices for specific farmer settings and the economics of alternative cropping systems for different agro-ecologies building on ongoing work by IRRI and others.

The second major effort involves promoting diversification into high-value horticulture, fresh fruits, poultry, fisheries and small livestock by both small farmers and the rural landless. In the Delta area, monsoon agricultural opportunities center around rice. But in the Dry Zone and in the dry season, farmers enjoy many alternative opportunities. Under conditions of increasing land pressure, small farmers and near-landless will need to consider high-value activities that raise returns to increasingly scarce land access. Poultry, ducks, horticulture, small livestock, fishing and fish ponds all merit special attention given the small land requirement and scalable, high-productivity technology. Making this viable for landless and near landless often requires special intermediaries that can help to broker input supply, extension support and veterinary services, and marketing support for small producers. The Bangladesh Rural Advancement Committee's (BRAC) rural poultry support programs offer one such example (Malhotra and Santer 1996).

Short Game Early Action 2: Examine regional experience promoting commercially viable high-value activities for landless households. Early actions for moving forward in this area might involve bringing in BRAC or others groups with long experience in supporting commercially viable, high-value agricultural value chains for landless and near-landless households.

A third set of interventions revolves around post-harvest opportunities for reducing losses and increasing market access for Myanmar farmers. Post-harvest losses are potentially high in Myanmar, especially in paddy. Monsoon paddy is prone to losses during harvesting (shattering) and as a result prolonged exposure in the field after harvest when farmers prioritize land preparation for winter crops over threshing (resulting in "sun cracking"). Summer paddy is also prone to losses as a result of early monsoon rains. However, the extent of such losses has not been accurately measured.

Short Game Early Action 3: Post-harvest loss assessment. As an early action we recommend a study of post-harvest losses in paddy for the major rice production systems, and an assessment of the expected costs and benefits of alternative approaches to reducing post-harvest losses (e.g., through mechanization of harvesting and threshing, improved drying facilities at rice mills, as well as field-scale assessment of the susceptibility of improved varieties to harvest/post-harvest loss).

The fourth major axis under a Short Game would focus on landless and other vulnerable rural households. One segment of this effort will focus on preparing children of landless and near landless for productive career trajectories in high-productivity agriculture, agribusiness and nonfarm professions. In order to complement the productive packages and value chain models that accommodate participation by landless and near landless households (in items 1 and 2 above), this component would focus on building up the human capital of landless children through pre-natal monitoring and nutrient supplementation for pregnant women, promotion of breastfeeding, post-natal monitoring and nutrition education for mothers and improved access to rural education for landless children. Given the nutrient-dense composition of many high-value horticulture and livestock products, the diversification efforts described in item 2 above offer highly complementary nutritional spillovers.

Table 13. Strategic Options for the Short Game

Targets	Short Game Early Actions	Short Game
Farming a) improve productivity of monsoon rice	1. summarize best practices and economics of alternate cropping systems	+ agronomic practices + seed quality + farm-level water management
b) promote dry season and Dry Zone diversification	2. assess lessons from elsewhere on promotion of high value activities for vulnerable groups	+ diversification: high-value, scalable (horticulture, poultry, fish ponds)
Post-farm value chain	3. post-harvest loss assessment	+ post-harvest handling + target niche markets
Landless and near landless	4. pilot programs promoting school attendance, improved nutrition and health (link with high-value diversification)	+ high value agriculture + nonfarm income + education access + nutrition packages (horticulture, poultry, education, public health)
	5. test pilot safety nets to reduce indebtedness following livelihood shocks	+ scale up safety nets and insurance options for landless households

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Short Game Early Action 4: Pilot rural education, nutrition programs. Early actions in this arena could include pilot efforts to promote packages of high-value agriculture, nutritional support and educational scholarship programs focused on the rural landless.

In addition, improved safety nets will be critical in a Short Game scenario where continued climate risk and continued high volatility in agricultural production and prices weakens smallholder farmers and subjects landless to wide swings in food prices, which currently account for two thirds of their spending.

Short Game Early Action 5: Pilot safety net systems. Early actions in this area involve design and testing of safety nets for different types of risk that lead to high levels of indebtedness among landless or near landless households.

5.4. Key Decisions Going Forward

Myanmar's government, parliament, private sector and civil society must decide collectively whether they aspire to pursue a Long Game or a Short Game agricultural growth strategy. By definition, government commitment to key structural and policy reforms constitutes a pre-requisite for a Long Game strategy. So the first question any potential donor must ask is whether or not the Government of Myanmar is prepared to increase public funding for agricultural support institutions and at the same time ramp up the process of institutional and policy reforms necessary to raise productivity, lower volatility and increase predictability.

Private sector, civil society and donors can then adjust their aspirations accordingly. In the absence of government commitment to key institutional and policy reforms, the private sector, civil society and donors will be confined to Short Game interventions. Within the Short Game, early actions in the areas outlined above can help to lay the foundation for quick gains while at the same time providing a bridge to Long Game structural reforms. As a result, gains in a Short Game can help to pave the way for much greater gains in a Long Game.

Our team strongly advocates a strategy focused on the Long Game, particularly a set of early actions necessary for enabling necessary structural reforms, but complemented by Short Game interventions that help to increase incomes, assets, farmer skills and water management systems that expand productive potential in the Long Game. By piloting models for effective bottom-up research and extension, actions in a Short Game can help to set up a successful Long Game. A balanced attack, centered on the Long Game but complemented by Short Game interventions, will likewise help to demonstrate to rural communities that the GOM and its development partners are seriously committed to improving the agriculture sector. This multi-pronged approach addresses the needs of rural communities for early visible change while at the same time remaining committed to necessary structural re-engineering of institutions and policies. Myanmar's neighbors and competitors in Thailand, Vietnam, Bangladesh, Malaysia, India and China have all committed to high-productivity Long Game strategies. Without similar commitment from Myanmar, we find it difficult to see how Myanmar's farmers will be able to compete in increasingly competitive regional and global markets – including those at home.

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Because two-thirds of Myanmar's population and three-fourths of its poor live and work in rural areas, broad-based agricultural growth offers a uniquely powerful instrument for accelerating economic growth and improving the welfare and food security of vulnerable households. Myanmar's current highly skewed distribution of land, its growing levels of landlessness and increasingly contentious disputes over land access not only pose dangers to vulnerable household welfare but also risk inflaming social tensions and conflict. As a result, we consider the Long Game reforms outlined here imperative for agricultural productivity growth as well as long-term political stability.

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ANNEX A. BACKGROUND PAPERS

1. Agro-ecological Systems in Myanmar, by Kye Baroang and Glenn Denning
2. Rice Productivity: Opportunities for Improving Competitiveness in Rice Production, by Glenn Denning, Ye Myint Kyaw, and Tun Min Sandar
3. Rural Financial Institutions: Savings, Insurance and Credit, by Renate Kloepplinger-Todd and Tun Min Sandar
4. Food and Nutrition Security in Myanmar, by Shannon Wilson and Naw Eh Mwee Aye Wai
5. Agricultural Education, Research and Extension Institutions, by Khin Mar Cho
6. Rapid Value Chain Diagnostic Assessment: Structure and Dynamics of the Rice Value Chain in Mynmar, by Larry Y.C. Wong and Naw Eh Mwee Aye Wai

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ANNEX B. SCHEDULE OF FIELD VISITS

Date	Team member	Region/State	Town/Markets	Villages
Oct 8-9	Boughton, Wong, Cho	Yangon	Yangon	
Oct 10	Boughton, Wong, Cho	Mandalay	Nay Pyi Taw	
Oct 11	Boughton, Wong, Cho	Mandalay	Yezin	
Oct 12-17	Boughton, Wong, Cho	Yangon	Yangon	
Oct 18-20	Boughton, , Cho	Ayeyarwaddy	Pyar Pone	• Poe Swar
Oct 22-24	Boughton, Wong	Yangon		
Oct 25-26	Boughton, Wong	Sagaing	Shwebo	• Chipa • Kar Boe Dam • Kinn Tut Dam • Thapann Seik Dam
Oct 27	Boughton, Wong	Sagaing	Moneywa	
Oct 28-29	Boughton, Wong	Magway	Pakokku	
Oct 30-31	Boughton, Wong	Yangon	Yangon	
Nov 1	Denning, Haggblade, Wilson	Ayeyarwaddy	Danuphyu	
Nov 2-3	Denning	Ayeyarwaddy	Pathein	• Kani • Kyaung Mann Gone • Thit Mont Kone • Ein Chaung Lay
Nov 2-3	Haggblade	Ayeyarwaddy	Pathein	• Za Yat Ein • Tun Pa Lun • Nyaung Thar Yar • Tike Kyi Kone
Nov 2-3	Wilson	Ayeyarwaddy	Pathein	• Kyaung Pann Gone • Moe Goke • Thar Yar Gone •Nga Kwa
Nov 4-5	Wilson	Yangon	Yangon	
Nov 4-6	Denning, Haggblade	Yangon	• Thiri Mingalar • Bayint Naung	
Nov 7	D,H,W	Bago	Waw	• Pyun Zu • Inn Daing Zu • Moe Youn Gyi Dam • roadside watermelon village
Nov 8	D,H,W	Mandalay	Nay Pyi Taw Yezin	
Nov 9-10	Denning	Sagaing	Shwebo	• Tha Pan Seik Dam • Kar Boe Dam

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Nov 9-10	Haggblade	Sagaing	Shwebo	•Leik Chin • Naw Maw
Nov 9-10	Wilson	Sagaing	• Schwebo • A Yar Taw	• Chipa North • Chipa village tract • Kywe Chan • Ye Chin • Bone Let Kut • Naung Gyi Ei
Nov 11	D,H,W	Mandalay	Mandalay	
Nov 12	Denning, Haggblade	Mandalay	• Popa • Taung Tha	• Hsee Mee Kan • Thar Zi
Nov 12	Wilson	Shan State	Inle	• Hei Yarr Ywa Ma • Pann Pei
Nov 13	Wilson	Shan State	• Naung Shwe, Southern Shan	• Payah Phyu • The Le Oo • Naung Lane Gone • Thein Gone • Taung Ni
Nov 13-16	Denning, Haggblade	Yangon	• poultry wholesale market	
Nov 14	Wilson	Shan State	Aung Bann	
Nov 15-17	Wilson	Yangon	Yangon	
Nov 17	Kloeppinger-Todd	Mandalay	• Mandalay • Pathein Gyi	
Nov 18	Kloeppinger-Todd	Sagaing	• Monywa	• Kin Mon
Nov 19	Kloeppinger-Todd	Sagaing	• Ayar Taw	
Nov 20	Kloeppinger-Todd	Shan State Mandalay	• Kyauk Mae • Pyin Oo Lwin	• Pa Gar • Kyauk Mae Gyi • Kyaung Kone • Inn Htake Oo
February 5, 2013	Boughton	Yangon	• Tone Gwa	• A Le Gwin
February 13	Boughton, Haggblade	Bago		• Painne Kon
February 16	Boughton, Haggblade	Shan State	• Taun Ggyi	• Taung Chae • Pali Lin • Lay Lwei • Naung Yaung
February 17	Boughton, Haggblade	Shan State	• Aumben • Nyaung Shwe	• Saik Pyoe • Chaung Sauk

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ANNEX C. SUPPLEMENTARY TABLES

Annex Table C1. Agricultural Share of GDP in Myanmar, 2002 and 2010

	2002	2010
Crops	48%	29%
Livestock and fisheries	8%	7%
Total agriculture	56%	36%

Source: Myanmar Central Statistical Organization statistical yearbooks.

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Annex Table C2. Estimated Livestock Holdings in Myanmar, 2003 to 2012

	2003	2007/2008	2011/12
Poultry	*25.6*	*119.7*	*189.2*
chickens	20.8	107.2	172.6
ducks	4.8	11.1	15.3
Small livestock	*2.3*	*9.8*	*14.9*
pigs	1.8	6.9	10.3
goats	0.4	2.4	3.8
sheep	0.1	0.5	0.8
Cattle	*6.4*	*12.6*	*14.0*
Buffaloes	*1.1*	*2.8*	*3.1*

Source: MOAI Agricultural Census of 2003. FAO/WFP, 2009; Ai Thank Kyaw (2012).

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Annex Table C3. Completed Educational Level of the Household Head, 2009-10

Area	Never attended school/KG or 1st standard	Monastic School	Primary School (2nd to 4th std)	Middle School (5th to 8th std)	Secondary School (9th to 10th std)	Post-Secondary Education
Kachin	18.5	7.9	35.7	23.4	10.4	4.1
Kayah	20.2	3.6	34.1	29.9	8.6	3.6
Kayin	10.8	8.2	49.9	20.8	8.2	2.2
Chin	14	0	46.3	23.5	12.5	3.7
Sagaing	3.2	11.8	59.6	15.7	6.4	3.2
Tanintharyi	8.9	15.4	48.2	17.4	8.4	1.7
Bago	3	5.9	60.4	20.3	7.8	2.6
Bago E	4.9	7.1	54.2	22.3	8.1	3.3
Bago W	0.9	4.6	67	18.1	7.5	1.9
Magwe	4.2	12.2	59.3	15.6	6.1	2.5
Mandalay	6.7	13.2	46.1	20.8	9.3	4
Mon	6.9	6.4	47.3	22.8	12.4	4.1
Rakhine	16.7	14.4	37	17.5	10.7	3.7
Yangon	4	4	27.2	27.6	26.4	10.7
Shan	23	17.1	36.6	16.3	5.8	1.3
Shan S	18.3	8.9	42.7	22.5	6.6	1
Shan N	22.7	24.5	33.7	11.2	5.8	2.1
Shan E	41.3	21.1	23.9	11.2	2.4	0
Ayeyarwady	2.4	5.6	58.3	20.9	9.4	3.4
Urban	4.9	3.8	28.4	27.1	24.2	11.6
Rural	7.8	11.5	55.3	17.8	6.1	1.4
Poor	12.5	13.3	52.8	15.9	4.7	0.7
Non-Poor	5.6	8.4	46.9	21.5	12.6	5.1
Union 2010	7.1	9.5	48.1	20.3	10.9	4.1
Union 2005	11.9	19.8	34.8	19.4	10	4.1
Change (%)	-40.7	-52.1	38.3	4.4	9	1.6

Source: IHLCA 2011.

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Annex Table C4. Estimated Share of Rural Households without Agricultural Landholdings, 1993 and 2003

	1993	2003
Rural Households		
National population ('000)	40,986	45,844
Rural population ('000)	30,590	32,427
Average persons per household	5.0	5.0
Number of rural households ('000) a	5,665	6,485
Agricultural holdings, by land size		
zero land	195	11
< 1 acre	188	513
1-5 acres	1,277	1,448
5-10 acres	759	819
10-20 acres	414	510
20-50 acres	91	157
> 50 acres	2	6
total holdings ('000) b	2,925	3,465
Estimated share of landless rural households		
rural households without any landholdings (a-b)	2,740	3,021
landless holdings	195	11
total landless households	2,935	3,032
Estimated land size distribution		
landless share of rural population	52%	47%
functionally landless (< 1 acre)	3%	8%
marginal smallholers (1-5 acres)	23%	22%
commercial farmers (over 5 acres)	22%	23%
total rural households	100%	100%

Sources: MOAI Agricultural Censuses of 1993 and 2003; FAOSTAT (rural population).

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Annex Table C5 Alternate Estimate of Landlessness, 2011

	Delta/coastal	Dry Zone	Hilly	Total
Landlessness (%)	72	43	26	
Population (millions)	24.8	19.2	9.4	53.4
Population shares	46%	36%	18%	100%
Weighted average*	33	15	5	**53**

* Landlessness % x population share

Source: LIFT (2012), Table 54 and population shares from Figure 3.

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Annex Table C6. Land Distribution, by Region and State

Region/State	Agricultural Land Area	
	all holdings 2003	large corporate allocations 2011
Region		
Areyarwaddy	4,768	193
Yangon	1,158	31
Bago	2,615	20
Magway	2,451	202
Mandalay	3,101	10
Sagaing	3,408	100
State		
Kachin	386	596
Chin	195	
Rakhine	928	
Shan	1,256	117
Kayah	57	2
Mon	781	
Tanintharyi	349	672
Kayin	97	
Total	21,550	1,943

Source: MOAI Agricultural Census 2003; Woods (2013).

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Annex Table C7. Area Planted and Average Plot Sizes for Major Crops, 2003

	Total Annual Area Planted (acres)	Average Plot Size (acres)
Rice	13,624,248	4.9
Pulses	5,691,489	3.9
Oilseeds (sesame, groundnuts, mustard)	5,120,999	3.7
Industrial crops (cotton, sugar)	1,714,747	3.7
Maize and other cereals	1,041,107	2.3
Roots and tubers (onion, potato, garlic)	144,856	1.6
Treecrops (cashew, betel nut, banana, mang	413,544	1.1
Vegetables	155,111	0.6
Flowers	6,678	0.7

Source: Agricultural Census of 2003.

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Annex Table C8. Regional Differences in Horticultural Earnings by Rural Households, 2011 (percent of households earning income)

	Delta	Dry Zone	Hills	Total
Earn some income				
vegetables	6%	9%	17%	10%
tubers and rootcrops	0%	3%	14%	4%
fruits	1%	0%	2%	1%
total horticulture	7%	12%	32%	15%
Most important source of income				
vegetables	2%	4%	9%	4%
tubers and rootcrops	0%	1%	8%	2%
fruits	0%	0%	1%	0%
total horticulture	2%	5%	17%	7%

Source: LIFT (2012), Tables 14,15.

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Annex Table C9. Rural Debt Loads, by Landholding Size, 2011

	Landholding Size (acres)			
	Zero	< 5	5-20	> 20
Household debt levels ('000 Kyat)				
none	3	4	3	3
under 100	48	33	11	2
101-500	43	51	47	26
over 500	6	13	38	69
Estimated indebtedness* ('000 Kyat)	184	269	522	751

* Estimates based on midpoints of the 11 debt ranges and 1 million as the average for the over 500,000 category.
Source: LIFT (2012), Table 110.

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Annex Table C10. Myanmar Union Government Budget Expenditures, by Sector 1990 to 2010

		Current Budget					Capital Budget				
	Sector	1990/91	1995/96	2000/01	2005/05	2009/10	1990/91	1995/96	2000/01	2005/05	2009/10
1	Agriculture	3.8	16.4	6.2	7.4	5.6	5	17	23	9	6
2	Livestock and fisheries	1.3	0.9	3.6	0.4	0.4	1	0	0	0	0
3	Forestry	3.8	3.2	1.3	1.1	1.0	3	1	1	0	0
4	Mines	1.8	1.7	0.1	0.2	0.1	1	0	0 *	*	
5	Industry	11.9	8.8	0.8	0.8	1.2	5	1	9	2	3
6	Energy	10.9	10.2	*	0.7	0.4	8	3	4	7	8
7	Construction	8.0	10.5	6.5	4.4	2.4	10	12	14	14	9
8	Transport and communi	4.7	5.0	0.6	0.6	0.6	12	15	7	14	4
9	Social Services 1/	13.6	7.0	23.3	20.2	26.1	20	11	10	3	3
10	Finance	5.7	7.5	1.1	1.2	1.7	3	2	1	0	0
11	Trade	18.3	13.3	0.7	0.6	0.6	3	2	1	0 *	
12	Defence	7.9	8.6	26.2	27.1	25.9	16	32	26	16	10
13	Administration 2/	6.1	6.9	29.6	35.3	33.9	6	4	3	34	56
14	Development committee	2.2	*	*	*	*	8	*	* *	*	
	TOTAL (percent)	100.0	100.0	100.0	100.0	100.0	100	100	100	100	100
	TOTAL (million Kyatt)	48,771	124,523	133,822	343,818	1,158,659	10,210	41,035	109,158	663,898	950,894

Source: Budget Department

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Annex Table C11. Agricultural Production in Myanmar, 1985 to 2010

Crop	1985-86	1990-91	1995-96	2000-01	2005-06	2009-10
Production ('000 tons)						
Paddy, GOM	14,091	13,748	17,670	20,987	27,246	32,166
Paddy, USDA	11,800	12,800	15,517	18,000	18,276	16,450
Maize	294	184	270	359	904	1,226
Oilseeds	805	685	979	1,389	2,063	2,958
Pulses	611	544	1,316	2,113	3,743	4,987
black gram	93	99	365	523	1,005	1,485
green gram	30	62	332	511	930	1,315
pigeon pea	51	42	142	315	600	760
Horiticulture						
onion	231	171	186	584	999	1,092
garlic	36	37	39	81	146	198
chillie	32	30	33	55	109	133
beetle leaves	31	34	50	71	148	163
potatoes	180	134	184	314	471	554
vegetables	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
fruits	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Area harvested ('000 acres)						
Paddy, GOM	11,517	11,762	14,907	15,573	18,246	19,952
Maize	422	309	399	520	789	897
Oilseeds	3,881	3,801	3,550	4,640	4,912	8,376
Pulses	1,888	2,129	4,712	6,574	8,658	10,024
black gram	233	337	1,170	1,510	2,014	2,528
green gram	130	269	1,128	1,744	2,342	2,660
pigeon pea	191	170	592	884	1,319	1,523
Horiticulture						
onion	56	57	66	145	179	178
garlic	27	25	29	46	60	70
chillie	147	161	147	243	321	326
beetle leaves	4	6	8	10	19	21
potatoes	42	36	48	72	86	94
vegetables	342	339	444	732	1,094	1,297
fruits	422	454	492	687	936	1,103

Source: Myanmar Statistical Yearbooks, USDA.

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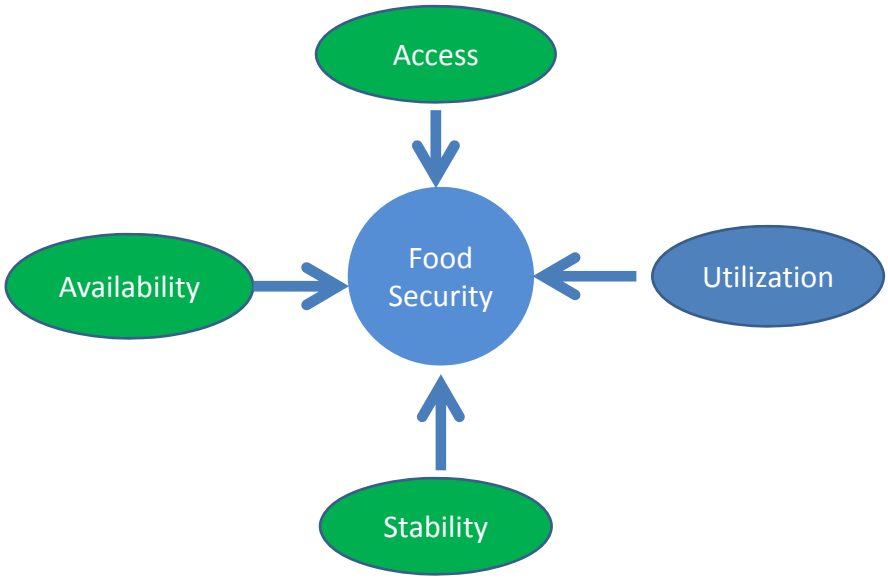
Figure D1. Four Dimensions of Food Security



Note: Green ovals indicate dimension of food security governed in large part by agriculture.

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Figure D2. States and Regions of Myanmar

Source: FAO Geonetwork.

Figure D3. A Mapping of Farming Systems and Administrative Borders

Source: FAO GeoNetwork.

ANNEX E. TOPICS FOR FUTURE RESEARCH

1. Agricultural sector public expenditure and institutional review. Institutional reforms leading to a service-oriented research, education and extension system will require a careful audit of existing spending and staffing in agricultural ministries (agriculture, livestock and fisheries) and related state economic enterprises. This agricultural public expenditure review will need to focus on past and current allocations for specific agricultural functions, clearly separating out the financing for state agricultural enterprises from spending on irrigation investments and facilities and recurrent financing for farmer-centered support functions in research, extension and education. Crop agriculture, livestock and fisheries should be included in this review. Because significant restructuring has occurred in the line ministries and state economic enterprises since the FAO (2005) Agricultural Sector Review (FAO 2005), Myanmar will likewise require a thorough needs-based assessment comparing existing ministerial staffing, facilities and organizational structure against likely future needs.

2. Landless trajectories. High levels of landlessness have persisted in Myanmar over many generations. Though fragmentary, data generally suggest that landlessness has increased over time. Yet it remains unclear what forces are primarily responsible for driving these trends: • demographic pressure, • land confiscation, • forced land sales triggered by rural indebtedness, • or some other forces.

Looking to the future, we consider the trajectories of the children of currently landless households to be central to equitable growth and also to political stability in Myanmar. Therefore, we would encourage retrospective research looking carefully at inter-generational trajectories among currently landless households in various regions. This work would need to consider all the hypotheses mentioned above, including current debt loads, the structure of rural financial systems and possible links between indebtedness and landlessness. A set of case studies akin to those produced by the Land Core Group (2012) on land evictions could offer a valuable set of observations that could perhaps lay the foundation for a more careful mapping of hypotheses and priorities for action going forward.

3. Comparative agricultural development strategies in Cambodia, Laos, Thailand and Vietnam. Myanmar policy makers would benefit from a comparative review of alternate regional experience in managing agricultural transitions. Cambodia, Laos and Vietnam have transitioned out of socialist agricultural systems, with Vietnam focusing on small farmers while Cambodia and Laos have placed heavy emphasis on large farms and international investors. Thailand's consistently market system has focused resources on improving productivity of smallholder farmers. Comparative studies followed by local seminars for policy makers in Myanmar could prove helpful to local decision makers in crafting a unique pathway for Myanmar while drawing on the rich experience available in the region.

4. Rice market performance under trade liberalization. As Myanmar moves to an increasingly open trade regime, import and export parity prices will set upper and lower bounds on domestic rice prices. Therefore, an empirical look at domestic price movements as well as monthly imports and exports in relation to international prices will offer an important window into implicit rates of protection, trade incentives and levels of price transmission from international to

domestic markets. Myanmar's movement away from a policy regime of strict trade controls to a system of implicit quotas instituted through the allocation of annual export permits offers an opportunity to examine the impact of alternate trade policies on domestic prices, production, import and export incentives. A simple empirical simulation model, developed in collaboration with MRIA and local researchers, could offer a valuable tool for exploring the consequences of alternate trade policy decision rules. In the process, these analyses and discussions would provide vehicles for transparent ongoing market monitoring and for focusing policy discussions on trade issues affecting Myanmar's principal food staple.

5. High-value value chains: poultry, horticulture and fisheries. Our team made a cursory attempt to observe the structure and dynamics of the poultry and selected horticultural value chains. Though we have prepared informal field notes on these systems, much more detailed and focused investigations will be necessary to establish a clear snapshot of current quantities and alternative supply channels, identify technical and economic parameters governing alternate production technologies, carefully measure trends in domestic markets, delineate key opportunities and constraints, and evaluate opportunities for expanding access by vulnerable groups to these high-value, land-conserving agricultural opportunities. Comparative studies of efforts elsewhere, by BRAC and others, to broker systems that enable landless participation in high-value value chains would be especially valuable (see Santer and Malhotra 2002).

Fishing likewise merits serious, focused investigation. Specialists tell us that fish ponds are considerably underdeveloped in Myanmar compared to regional peers. It will be important to verify this hypothesis and to understand why differences have emerged. Inland and capture fishing likewise merit careful attention, given apparent inequities in the allocation of fishing licenses that possibly limit access by landless households to this valuable natural resource.

In all of these cases, land allocation decisions require special attention. Conversion of paddy land to fish farming or mixed poultry/fish farming apparently remains very difficult in many areas given continued government restrictions on alternate uses for paddy land. In some localities, duck rearing by landless households requires negotiation of foraging rights on paddy fields held by neighbors.

6. Gender dimensions of agricultural productivity growth and food security. Our current report does not systematically examine how gender differences influence agricultural productivity and overall growth. Although roughly 20% of rural households are headed by females, difficulties in exploring intra-household relations greatly complicate this task. Even so, given widespread evidence from elsewhere about the importance of gender roles on economic opportunities and welfare outcomes, this will be an important topic to pursue in Myanmar.

Moreover, the LIFT baseline survey alludes to prospects for exploring this issue in more depth. In their discussion of gender differences in agricultural wage labor, the report states "Without studying the gender division of labour within the households and household economies in each region in greater detail it is difficult to determine the respective influences of the major crops grown, the agricultural technologies used, the opportunity costs for men and women undertaking agricultural casual labour, the local social norms, and competing household responsibilities. It should be noted that household size and composition also varied between zones as reported

earlier and may also influence the gender division of casual labour." (LIFT 2012, p.21). If the LIFT data offer further room for exploring gender issues, then a focused exploration of these data could offer a quick window into general hypotheses about gender roles in agriculture, including asset holdings, access to land, livelihood strategies, agricultural input use, credit access, coping systems, food security, nutritional status and other welfare outcomes.

7. Deforestation, shifting cultivation and trends in agricultural land use. Agricultural expansion, shifting cultivation, and large scale land allocations are placing Myanmar's forests under increasing stress. Deforestation, in turn, affects water recharge rates, runoff and soil erosion. Yet the scale of these processes and its impacts on rural household livelihoods remain imperfectly understood. A careful assessment of available spatial data, coupled with focused, in-depth case studies in selected zones, would provide useful guidance on key issues and options for managing agricultural and forest lands going forward.

8. Nutrition. We are not aware of any available analyses on the determinants of early childhood malnutrition in Myanmar. Such analysis could shed light on the role of maternal education and customary dietary restrictions during the pre-natal and post-natal periods on household nutrition outcomes. Given the rich ethnic and cultural diversity, the determinants of malnutrition may differ in important ways across ethnic groups.

9. Infant and Young Child Feeding practice. Taboos about the consumption of certain foods, especially during pregnancy, exist in Myanmar. However, documentation of these taboos is lacking (at least in the English language). Effective design of policies and programs to improve food consumption patterns of subgroups (whether increasing quantity or quality of calories) will require a thorough understanding of food taboos.

10. Education. It will be important to better understand current barriers to school attendance and educational attainment and how such barriers may differ across different socio-economic groups, ethnic groups and geographic areas. It is also unclear whether official literacy rates in fact translate into functional literacy; and whether high official literacy rates mean most people are also numerate. Learning outcomes depend on many features of the educational system as well as on the health and nutritional status of children in school. Unraveling these myriad influences will be important to efforts aimed at improving the human capital of children from poor and vulnerable households.

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