



# Myanmar Rice Sector Development Strategy





Building the foundation of a  
modern, industrialized nation,  
through inclusive agricultural and  
rural development

May 2015



The vision of the Ministry of Agriculture and Irrigation is to achieve higher “per capita income” and “standards of living” of the rural populace relying on agriculture than neighboring countries and be on a par with developed nations.

The MOAI mission is to attain maximum market share in regional and global markets for agro-based, value-added agricultural and specialty food products; improve food security and alleviate poverty, particularly in rural areas; and, manage green growth.

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# Foreword

The Ministry of Agriculture and Irrigation (MoAI) of Myanmar, together with the International Rice Research Institute (IRRI), the Food and Agriculture Organization Regional Office in Asia-Pacific (FAO-RAP), and The World Bank carried out the major and noble task of formulating the Myanmar Rice Sector Development Strategy (MRSDS). The strategy will be an invaluable complement to Myanmar's food and agricultural development policy under a new government and during this transformation period for the country.

The MRSDS is an outcome of the efforts of MoAI and its partners in response to the rapid changes taking place in the agriculture sector. Its context is well aligned with the Myanmar Comprehensive Development Plan and takes into account eventualities expected from climate change, manmade disasters, population increase, rapid urbanization, emergence of new markets, and the potential of the rice sector to become a major driver of economic development in Myanmar.

The MRSDS presents a clear vision of success and strategic objectives linked to Millennium Development Goal-1, which is eradicating extreme poverty and hunger. As a strategy, the MRSDS will guide the government in prioritizing its investments and improve the structural weaknesses along the rice value chain. It will help international donors and partners align their agricultural development initiatives to complement government efforts. It will also guide the government in the review and revision of current policies that stifle the sector and in formulating new ones to stimulate investment from the private sector as well as from foreign investors, thereby transforming "Paddy for Poverty" to "Paddy for Prosperity" through knowledge-intensive rice farming systems.

Seventy percent of the rural population of Myanmar engages in rice farming for their livelihood; rice is thus our life, our economics, and our politics. It is vital to keeping peace and tranquility in the country.

MoAI is determined to promote growth in the rural economy through sustainable development of the rice sector, the ultimate goal of which is a food-secure nation. It also envisions smallholder farmers to triple their household incomes, including income derived from rice and rice-based farming systems, and thereby enjoy a decent standard of living comparable to urban communities.

As Myanmar aims to regain its past position as a huge contributor to regional and global food security through rice, sustainable rice intensification is thus seen as the corner stone for achieving this goal

by 2030. Continuous efforts are being made to achieve sustainable rice intensification using effective and efficient natural resource management while aiming for higher productivity and profitability.

We believe that the concerted efforts of rice researchers and scientists in Myanmar, with the continuous support of IRRI and its experts and those of other international organizations, will play a vital role in the development of the Myanmar rice sector. It is also very crucial for government in the long run to provide strong support, commitment, and political will to this very important sector.

We are taking aggressive measures to disseminate Good Agricultural Practices (GAP) through our extension services, adoption of good-quality high-yielding varieties (including hybrids) in favorable ecosystems, transformation of conventional farming into mechanized production system, and conversion of rainfed farms into irrigated lands to intensify rice farming and achieve higher production by promoting labor productivity, water productivity, and input-use efficiency. We have also taken several measures to encourage local and foreign private sector participation in developing a sustainable rice seed system in Myanmar.

We aim to enhance the local rice value chain—from production to processing and marketing—to provide our people access to affordable food and boost our competitiveness in the domestic and international rice markets. Moreover, we envision that improved production will create employment along the rice value chain and in related sectors, resulting in better livelihoods and better nutritional and health status of the rural population.

I believe that rice sector development can be an engine for economic growth and will contribute to reducing extreme poverty and raising the social wellbeing of the people of Myanmar.

Through a clear road map for sustainable rice sector development, it is possible to break the cycle of rural poverty and hunger by strengthening rural resilience, achieving social protection, and sustaining agricultural development.

I would like to extend my sincere appreciation to the Myanmar-IRRI cooperation for formulating the MRSDS, and urge IRRI and resource partners to work very closely with MoAI and continue efforts to help implement the MRSDS for our farmers in Myanmar.

Nay Pyi Taw, 2015  
H.E. Dr. U Myint Hlaing

# Acknowledgment

The Myanmar Rice Sector Development Strategy (MRSDS) is a product of the efforts of the Ministry of Agriculture and Irrigation to seek effective strategies to boost rice production to ensure that we have enough rice to feed our growing population while taking a greater share of the export market just as we had done a couple of decades ago. The formulation of the MRSDS is made possible through the technical assistance provided by the International Rice Research Institute, Food and Agriculture Organization of the United Nations, and World Bank.

The MRSDS highlights 10 key themes that ought to guide our efforts at developing the rice sector. These themes are (1) sustainable increase in rice productivity, (2) increased farm mechanization, (3) adaptation to climate change, (4) efficient and sustainable management of natural resources, (5) postharvest loss reduction, (6) increased access to credit, (7) capacity building, (8) increased investments in agriculture, (9) quality control and safety in rice production and marketing, and (10) enhanced rice research and development. In the short term, actions and policies along these themes will result in enhancing the farmer's income and creating more job opportunities in the rural areas. In the long term, it will result in poverty reduction and rural development in Myanmar, and in the country playing a major role in the regional and international rice markets and Myanmar rice recognized as a world brand.

We would like to express our sincere thanks to His Excellency Union Minister of MoAI, U Myint Hlaing, for his strong encouragement and interest, very useful insights, and invaluable suggestions and guidance throughout the period of the MRSDS formulation

We are grateful to IRRI management led by Director General Dr. Robert Zeigler, Deputy Directors Dr. Bruce Tolentino and Dr. Matthew Morell, and the IRRI scientists and experts for their overwhelming support, encouragement, and invaluable technical inputs. We also thank Dr. Madonna Casimero, IRRI Representative, and the staff of the IRRI Myanmar Office for diligently coordinating and facilitating the meetings and writeshops we needed to have.

We are thankful to the FAO Regional Office and World Bank for their energetic efforts and contributions in sharing valuable knowledge.

We also thank the Myanmar Rice Federation for their contributions in our analysis of the rice value chain and for their projections of the targets and future landscape of Myanmar rice exports.

Lastly, we thank the local experts from the different divisions and departments of MoAI who are part of the team that worked long hours with the national consultant in drafting the MRSDS document.

We strongly believe that through the implementation of the MRSDS, we can further strengthen the collaboration and cooperation among MoAI, IRRI and other partners toward the development of the Myanmar agriculture sector.

U Kyaw Win  
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## **Acronyms**

CARTC - Central Agricultural Research and Training Centre

CURE - Consortium for Unfavorable Rice Environments

DoA - Department of Agriculture

FAO-RAP - Food and Agriculture Organization Regional Office in  
Asia-Pacific

FAPRI - Food and Agricultural Policy Research Institute

FESR - Framework for Economic and Social Reforms

GAP - Good Agricultural Practice

GRiSP - Global Rice Science Partnership

IRRC - Irrigated Rice Research Consortium

IRRI – International Rice Research Institute

MoAI - Ministry of Agriculture and Irrigation

MPPA - Myanmar Paddy Producers Association

MRF - Myanmar Rice Federation

MRIA - Myanmar Rice Industry Association

MRMA - Myanmar Rice Millers Association

MRPTA - Myanmar Rice & Paddy Traders Association

MRSDS - Myanmar Rice Sector Development Strategy

NCDP - National Comprehensive Development Plan

RSC - Rice Specialization Companies

SHY - Special High Yielding

SME - small and medium enterprise

USDA - US Department of Agriculture

WB - World Bank

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# Executive summary

The Government of Myanmar has positioned agricultural development as one of seven key pillars supporting and enabling inclusive and sustained economic growth. To achieve agricultural development, the Ministry of Agriculture and Irrigation (MoAI), with technical assistance provided by the International Rice Research Institute (IRRI), developed the Myanmar Rice Sector Development Strategy (MRSDS) that seeks to boost rice production and thus better ensure food self-sufficiency and a larger share in the international rice trade for the country.

The MRSDS is anchored on improving farm productivity, raising rice farmers' incomes, and enhancing the global competitiveness of Myanmar's rice industry. Higher farm incomes, so crucial to poverty reduction and sustained food security, rely on increased productivity. Moreover, improved farm productivity enables affordable food supplies and competitive wage rates across the economy, thereby generating employment that enables the absorption of plentiful rural labor in off-farm and non-farm occupations, thereby accelerating the growth and modernization of the economy as a whole.

## Vision, goals, and targets

By 2030, Myanmar envisions food-secure farmers and consumers enjoying the economic benefits provided by a transformed, dynamic, environmentally sustainable, and internationally competitive rice sector.

The ultimate goal of the rice sector strategy is a food-secure nation where smallholder farming households have tripled their household incomes, including income derived from rice and rice-based farming, thereby enjoying a decent standard of living comparable to that of urban dwellers. The sustainable intensification of rice production, using efficient and effective natural resource management methodologies for higher rice productivity and profitability is the cornerstone for achieving this goal by 2030.

It is envisioned that Myanmar's future rice system will be characterized by market-oriented rice production where the farmers

and the private sector are actively engaged in a transparent and vertically integrated rice value chain. It is also envisaged that the government of Myanmar will establish a level playing field in the industry through well-coordinated programs and sound policies that offer incentives and protection to local and foreign private investors in the rice sector. Development in the rice sector will contribute to “building a progressive agriculture sector that will propel economic development in other sectors and eventually transform Myanmar into a modern, industrialized nation.”

The MoAI targets production growth that satisfies both domestic and export requirements<sup>1</sup>. By 2030, production must reach at least 19.40 million metric tons (MT), about 60% of which is for local food consumption and 40% for international trade. The target will be achieved by maintaining 7.70 million hectares (ha) of rice area harvested with an annual average yield of at least 4.20 MT/ha per cropping season. Rice of varying quality and form will be produced to meet both domestic and foreign market demand.

## Raising rice productivity for food sufficiency and export

The government has consistently accorded the highest priority on the rice sector because of its crucial role in food security, as well as its social and political importance to the country, Myanmar being self-sufficient in rice and also a major rice exporter in the 1950s and 1960s. The country’s recent re-engagement with the international community has set the stage for renewed and reinvigorated attention to agricultural and rural development, responsive to domestic food security and the opportunities offered by international trade, thus serving to reduce poverty and boost broad economic growth.

Myanmar is well-endowed in resources and is, therefore, positioned to not only regain its place as a major exporter of rice, but to also increase its share of the global rice market. The country’s geographic location straddles major trade and economic corridors across Asia and this makes it an ideal point-of-origin and transshipment hub for a very substantial flow of international rice trade. Its rich natural resources include lands ideally suited for rice cultivation and vast

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<sup>1</sup>Exported surplus will be comprised of high-quality rice sold at a premium price.

water resources for irrigation. It has a rich array of traditional rice varieties with high branding and marketing potential. All these endowments can be harnessed with appropriate development investments and an enabling policy environment.

The MoAI has set its target - from the current 1.3 million MT, milled rice exports are estimated to reach about 5 million MT by 2019-2020,<sup>2</sup> enabled by a more open trade policy regime, but based largely on current infrastructure. Major infrastructure investments will be required to sustain and further boost exports into the long-term, targeting a modest level of milled rice exports of at least 6 million MT by 2029-2030,<sup>3</sup> To effectively and successfully compete in the international rice market, Myanmar is developing short- and long-term strategies to achieve a vertically integrated value chain that will reduce transaction costs and enhance efficiency throughout that chain, from production to marketing.

## Challenges and opportunities

The principal challenges that Myanmar needs to address to develop its rice sector are: 1) the worsening effects of climate change, which increase farmers' vulnerability to drought, flooding, salinity, heat, other stresses, and extreme weather events; 2) limited availability of, and farmers' constrained access to, improved technologies and management practices;<sup>4</sup> 3) a weak extension and education system; 4) limited access to financial services; 5) limited facilities for postharvest handling and processing; 6) inadequate infrastructure, particularly for irrigation, power, and transport; 7) uncertain security of land tenure; 8) volatility of paddy price that contributes to low farmer income; 9) a poorly integrated value chain, from rice production to trade and markets; and 10) policies that hamper investments in the rural and rice sectors. These challenges are not unique or unfamiliar to Myanmar. Many other rice-producing and -exporting countries, such as Thailand, Cambodia, and Vietnam face similar problems. The MoAI intends to learn lessons from the experiences of neighboring countries.

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<sup>2</sup>As indicated in the Myanmar Rice Sector Export Strategy

<sup>3</sup>Extrapolation of exports for 2029-30 is based on Myanmar Rice Sector Export Strategy targets for 2019-2020, as well as on production, consumption, and surplus targets of MoAI.

<sup>4</sup>Technology innovations include land development, machinery and tools for land preparation and leveling, stress tolerant high-yielding varieties with desirable grain characteristics, quality seeds, agronomic practices adapted to local conditions such as site-specific nutrient management, integrated pest management, efficient water management, and appropriate decision tools to guide farmers.

Toward meeting these challenges, Myanmar has enormous opportunities and potentials, including: 1) rich natural resources, particularly land areas suitable for rice cultivation; 2) a rich diversity of traditional rice varieties with high branding and marketing potential; 3) a fast-growing private sector actively engaged in the rice value chain; 4) strong potential for increasing rice yield and producing quality rice; 5) strong interest and presence of development and funding institutions; 6) increasing demand for rice in the international market; 7) excellent relevant examples among neighboring countries in sustainable intensification of rice production; (8) willingness to create a positive policy environment favoring a market economy; and 9) an ideal geographic location for serving the Asian and global rice markets.

## Strategic objectives of the MRSDS

Five (5) strategic objectives guide the key themes and actions to achieve Myanmar's vision of its rice sector by 2030:

### **1. Increase rice productivity and improve rice quality and nutritional value**

The competitiveness of Myanmar's rice in both domestic and international markets will be improved through increased productivity. This will be done through cropping intensification, the use of high-yielding and stress-tolerant varieties, and the promotion of sustainable resource management practices and systems, including cropping systems suitable to varying production conditions by agro-ecological zones.

### **2. Adapt to, and mitigate the effects of, climate change and reduce risks, while protecting rice ecosystems and the environment**

The adaptation of rice farming to the effects of climate change will be improved and farmers' capacity to cope with associated risks will be enhanced. Moreover, the environmental impacts of rice farming will be minimized while conserving the diversity and richness of rice ecosystems and preserving rice heritage and culture.

### **3. Promote Myanmar rice as a quality brand to enhance its competitiveness in international trade**

Rice food quality and safety will be improved and competitiveness and fairness in domestic and international markets will be promoted. Moreover, equitable access to rice will be provided for all consumers.

### **4. Improve the well-being and capacity of smallholder farmers**

The well-being and capacity of smallholder farmers, including women and children, will be improved in the context of long-term changes in demography, farm size, and labor supply.

**Table 1. Mapping strategic objectives to identified challenges.**

	Strategic objective	Identified challenges
1.	Increase rice productivity; improve rice quality and nutritional value	Limited availability of, and access of farmers to, improved technologies and management practices; inadequate infrastructure, particularly for irrigation, power, and transport
2.	Adapt to, and mitigate the effects of, climate change and reduce risk, while protecting rice ecosystems and the environment	The worsening effects of climate change that increase the vulnerability of farmers to drought, flooding, salinity, heat, other stresses, and extreme weather events
3.	Promote Myanmar rice as a quality brand to enhance its competitiveness in international trade	A poorly integrated value chain, from rice production to trade and markets; policies that hamper investments in the rural and rice sectors
4.	Improve the well-being, and enhance the capacity of, smallholder farmers, including women and children	Limited availability of, and limited access of farmers to, improved technologies; weak extension and education system; limited access to financial services; volatility of paddy price that contributes to low farmer incomes; policies that hamper investments in the rural and rice sectors
5.	Enhance efficiency in the rice value chain and reduce postharvest losses	Limited facilities for postharvest handling and processing; inadequate infrastructure, particularly for irrigation, power, and transport; volatility of paddy price; a poorly integrated value chain, from rice production to trade and markets; and policies that hamper investments in the rural and rice sectors

## **5. Enhance efficiency in the rice value chain and reduce postharvest losses**

Weaknesses along the rice value chain will be reduced, thus improving efficiency and minimizing postharvest losses, all to increase the market value of rice production and improve rice food quality.

# Key themes and interventions

The MRSDS identifies 10 key themes to raise productivity, improve competitiveness, enhance economic incentives, and establish enabling mechanisms for the rice sector.

## **1. Sustainable increase in rice productivity**

- 1.1 Accelerate expansion of irrigated rice areas, land development and leveling, improvement of services and water management by user groups;
- 1.2 Breed and promote higher-yielding and stress-tolerant rice varieties appropriate to farmer and market preferences, and suited to different rice environments;
- 1.3 Provide adequate supply of breeder and foundation seeds to support the proliferation of private suppliers of certified and good-quality rice seed;
- 1.4 Ensure supply and adoption of good-quality seeds, appropriate fertilizer formulations, pest management alternatives, and other integrated crop management practices (Good Agriculture Practice); and
- 1.5 Strengthen delivery extension services.

## **2. Increased utilization of farm mechanization**

- 2.1 Promote provision by government of public infrastructure that enables implementation of appropriate mechanization strategies and their adoption by farmers;
- 2.2 Create a policy environment that encourages consolidation of small farms to achieve a farm size suitable for mechanization;

- 2.3 Encourage acquisition of farm machinery by farmers<sup>5</sup> or organized farmer groups to provide custom service;
- 2.4 Implement policies that encourage the private sector to provide farmers custom service at affordable rates for operations, such as land preparation, transplanting and harvesting, threshing, drying, and storage;
- 2.5 Establish a credit facility with loan equity to enable the private sector and farmers to buy farm machinery and assist service providers to develop viable business models; and
- 2.6 Support local agricultural machinery and tool manufacturers.

### **3. Adaptation to, and mitigation of, the effects of climate change and capability improvement to cope with risks**

- 3.1 Develop and promote high-yielding and stress-tolerant varieties;
- 3.2 Develop and promote climate-smart management options for stress-prone environments;
- 3.3 Promote cultivation of “special traditional rice varieties” with natural tolerance to deep water, prolonged flooding, salinity, or drought;
- 3.4 Promote diversified farming systems;
- 3.5 Develop seed systems to conserve, multiply, and promote sharing and exchange of traditional and, if applicable, modern varieties in remote areas;
- 3.6 Conduct awareness campaigns and education programs and strengthen weather information delivery and early warning systems; and
- 3.7 Map areas vulnerable to floods, salinity, and drought to identify and plan adaptation measures.

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<sup>5</sup>Includes smallholders and progressive farmers

#### **4. Efficient utilization and sustainable management of natural resources**

- 4.1 Effectively manage irrigation systems and improve irrigation services;
- 4.2 Promote soil conservation practices in hilly and upland areas;
- 4.3 Maximize utilization of farm wastes and locally available biomass;
- 4.4 Promote efficient nutrient management through proper application and timing of appropriately formulated fertilizers;
- 4.5 Promote integrated pest management practices and develop a framework on appropriate use of pesticides; and
- 4.6 Generate maps of rice growing environments, soil fertility, and cropping patterns for use in planning and targeting of technologies.

#### **5. Postharvest loss reduction and value chain improvement**

- 5.1 Upgrade existing mills or acquire new units to bolster efficiency, lower unit costs, and improve milled rice output and packaging capacity;
- 5.2 Improve existing infrastructure and build new ones to facilitate connectivity;
- 5.3 Collaborate with line ministries to establish formal agreements with rice-importing countries;
- 5.4 Establish a wholesale rice market;
- 5.5 Conduct aggressive market research and product development; and
- 5.6 Provide more information to market participants.

#### **6. Improve credit schemes for farm investment**

- 6.1 Improve current credit schemes for smallholder farmers; and
- 6.2 Improve credit schemes for the private sector.

## **7. Capacity building**

- 7.1 Develop a new generation of rice scientists;
- 7.2 Develop a new generation of agriculture extension specialists;<sup>6</sup>
- 7.3 Develop a new generation of skilled mechanics for agricultural machinery and equipment;
- 7.4 Train farmers on rice and rice-based farming systems; and
- 7.5 Empower women and youth in rice farming.

## **8. Sound policy environment to increase investment in agriculture**

- 8.1 Review and adapt Foreign Direct Investment rules and regulations;
- 8.2 Adopt a minimum rice and seed stock policy for emergency relief during disasters;
- 8.3 Enforce seed, plant variety protection, fertilizer, and pesticide policies; and
- 8.4 Initiate crop insurance systems on a pilot basis with the private sector or funding institution.

## **9. Quality control and safety**

- 9.1 Establish grain quality standards for Myanmar brands following international standards, and develop protocols for enforcing such;
- 9.2 Develop GAP to ensure quality and compliance with the certification standards in the domestic and export markets; and
- 9.3 Encourage the private and public sectors to build rice storage and packaging facilities.

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<sup>6</sup>Includes subject matter specialists

## **10. Rice research and development**

- 10.1 Develop and sustain a comprehensive and well-defined national rice research and development program<sup>7</sup> implemented by a rice R&D center;
- 10.2 Strengthen partnerships with other countries within the region;
- 10.3 Engage with the private sector, non-government organizations, and regional and international partners on rice research and development, especially the International Rice Research Institute (IRRI); and
- 10.4 Strengthen partnerships with regional and international research and development institutions for capacity enhancement.

## **Mapping the way forward**

The rice strategy builds on Myanmar's enormous potential to become more competitive in the international rice market. As the Government explores and seizes new regional and global opportunities for international trade, these engagements will stimulate growth in the rural and agricultural sectors, which in turn will generate jobs and reduce poverty, raising the living conditions of the people. The Government deeply values the importance of rice in Myanmar's economy and culture, and is learning from the experiences of neighboring countries, particularly the ways in which rice sector growth triggered broad economic growth in Vietnam, Cambodia, and China.

In the face of enormous challenges, the strategy will guide the government in prioritizing investments to improve structural weaknesses along the rice value chain. It will also serve as a guide for international donors and partners in aligning their agricultural and rural development initiatives and resource allocation to complement and support the developmental priorities of the Government

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<sup>7</sup>Research and development areas include market-driven breeding for rice varieties that are high-yielding, nutritious, and tolerant of biotic and abiotic stresses; natural resource management; postharvest management; rice-based farming systems; grain quality; rice-based products; knowledge management; and policy, social science, economics, marketing, and impact assessment research.

of Myanmar. This way, the limited resources of the Government and development partners are deployed more strategically and efficiently.

Finally, the MRSDS will inform the periodic assessment of the performance of all stakeholders in Myanmar's rice sector, in the process facilitating the review and revision of sector policies and measures to stimulate investments from the private sector and foreign investors.

Guided by the MRSDS, the formulation of consistent enabling economic policies and the alignment of public investments with strategic objectives are keys to achieving a transformed, dynamic, and internationally competitive rice sector.

Three main actions are suggested to achieve the MRSDS vision by 2030:

- Increase investments in capacity building, research and development, and extension;
- Increase investment in rural infrastructure; and
- Formulate and implement institutional and policy reforms and innovations

## Governance, monitoring and evaluation

Effective governance and implementation are keys to achieving the vision by 2030.

The MoAI will lead, coordinate, and facilitate the implementation of the MRSDS. It will work closely with regional and state directors in formulating regional and local plans and targets. Appropriate bodies, committees, and teams will be constituted to provide guidance and support to the MRSDS. The Department of Agricultural Planning will establish a comprehensive monitoring and evaluation system to ensure the timely and efficient implementation of the MRSDS.

# The Formulation of the Myanmar Rice Sector Strategy

Myanmar was one of the world's leading exporters of rice in the 1950s, but its role in world rice markets declined considerably starting in the 1960s (Dawe 2002). From the 1980s and until recently, it was largely absent from international trade except for limited exports to China.

Since 2011, the country's leaders have started ambitious efforts to shake off its recent history of isolation and restrictive policies, with a major focus on economic reforms. The reforms have focused on the removal of economic distortions, including the floating of the currency, the rationalization of taxes, and the development of the private sector and stimulation of foreign direct investment (World Bank 2014a).

Since 1960, when it was founded, the International Rice Research Institute (IRRI) has had an uninterrupted program of work in Myanmar. Even through the years of Myanmar's long isolation from international engagement beginning in 1970, IRRI offered a steady stream of training opportunities to rice scientists from Myanmar. The rice institute's continuous engagement with Myanmar has built strong relationships of trust and collaboration with Myanmar's leaders, particularly those of the Ministry of Agriculture and Irrigation (MoAI) and related agencies.

The new period of openness was the overall setting for the close collaboration between the MoAI and IRRI in the preparation of the MRSDS beginning in 2013. The purpose of the MRSDS is to formulate and establish the nation's strategy, objectives, program, and activities to achieve rice-based food security. It will also enable the government and people of Myanmar to take advantage of its competitive advantage in rice as the basis for rural sector growth as well as overall economic advancement. In this regard, the government of Myanmar has taken inspiration from the successful experiences of other Asian countries – including China and Vietnam – that have deployed the strengths of their rice sectors to enable not only food security but also rural development and overall economic growth.

Initial discussions around the need for major changes in the rice sector began in 2006 with a meeting of IRRI and Myanmar experts to outline a way forward for opening up the country's rice sector. In 2013, the MoAI, together with IRRI, initiated the formulation of the MRSDS. To appropriately launch the process, a two-day conference and workshop was conducted on September 9-10, 2013 at the Department of Agricultural Research in Yezin, Nay Pyi Taw. The activity aimed to: 1) review the status, recent trends, and ongoing development activities in the rice sector of Myanmar; 2) identify major challenges and opportunities for rice sector development and recommend actions to take advantage of the opportunities; and 3) identify priority areas for collaboration and cooperation between MoAI and its development partners in conducting research and development and capacity building, and making investments to improve the rice value chain and enhance the country's competitiveness in regional and global rice trade. The outputs of the conference and workshop were used as inputs in crafting the MRSDS.

Immediately after the conference and workshop, the MoAI constituted a team to develop the MRSDS. The team was composed of technical staff members from the different departments and divisions of MoAI and representatives from the private sector through the Myanmar Rice Federation.

The Minister of MoAI, His Excellency U Myint Hlaing, assigned the Director General of the Department of Agriculture (DoA), U Kyaw Win, as Chair, and the Deputy Director General of DoA, U Aye Tun, as Co-Chair. IRRI supported the effort by enabling the engagement of a national consultant who led in gathering relevant data, information, and references; facilitating discussions during the round table meetings; and writing up the strategy. IRRI scientists provided technical inputs by sharing their expertise in various areas of the strategy. IRRI was also involved in the editing, packaging, and publishing of the document. The IRRI Myanmar Office coordinated the meetings and hosted the national consultant during the writing of the drafts. The Food and Agriculture Organization Regional Office in Asia-Pacific (FAO-RAP) and the World Bank Regional Office also provided technical inputs.

A series of round table discussions ensued after the MRSDS writing team was created. The first round table discussion was held on March 22-23, 2014 at the DoA. During this meeting, the outline was

developed and initial inputs on the rice sub-sectors were collected from the team members. These inputs, together with the outputs during the rice conference and workshop on September 9-10, 2013, were used as materials to write the first draft of the document.

The second round table discussion and writeshop took place on May 22, 2014 when the first draft developed by the consultant was presented to the team. During this meeting, two technical staff members, Drs. Bui Ba Bong and David Dawe from the FAO Regional Office in Bangkok, participated in revising the first draft and provided invaluable inputs to improve the document. The revised draft produced after the second round table meeting and writeshop was circulated to key officials of MoAI, FAO-RAP, IRRI, and World Bank to gather more inputs for further improvement. The inputs from IRRI, FAO, and World Bank were incorporated into the second draft that was then presented to the members of the writing team during the third roundtable meeting on December 10, 2014. DoA Director General and Chair of the writing team U Kyaw Win participated and provided invaluable suggestions to the document as well.

The MRSDS is the first attempt of MoAI to craft a rice strategy for the country. This living document lays down the foundation for a progressive rice sector by 2030. It is expected that the MRSDS will be reviewed and revised as the implementation of the strategy progresses.

The MRSDS has six main parts. The first part is a contextualization of why there is a need to develop the rice sector, catalyze growth in agricultural productivity, and increase rice production toward strengthening Myanmar's position in the international rice market. This part of the document describes the role of agriculture in Myanmar's economy and how improving the productivity of the sector can drive rural transformation that will result in the overall economic development of the country.

The second part is a general description of the state of rice production and consumption, the performance of Myanmar rice in the international market, the global demand for rice, and the potential of Myanmar in international rice trade. The third part covers the challenges besetting the rice sector and the opportunities that can be tapped to boost productivity and improve the rice value chain.

The fourth part covers the rice sector strategy itself—the vision, goal, targets, objectives, and main themes outlining the actions to be taken and the prioritization of these actions. The fifth part summarizes the key points of the strategy and the way forward. The sixth and last part discusses governance, monitoring and evaluation during the process of implementation of the MRSDS.

# Why develop the rice sector?

The agricultural sector of Myanmar contributes 24% to GDP and 24.6% to export earnings,(MoAI 2013 a) and employs 61.2% of the labor force. The sector being the biggest contributor to the growth of the national economy, the government places agricultural development at the center of its efforts to build a modern industrialized Myanmar. Its Vision of Agriculture, as set by the MoAI, is “Achieving per capita income and standards of living of the rural population that rely on agriculture higher than the neighboring countries and keep abreast with developed nations” (MoAI 2013 b). Rice is the most important commodity in the agricultural sector and MoAI is investing on rice sector development to raise agricultural productivity.

## Boosting agricultural productivity for economic development

As indicated in the Framework for Economic and Social Reforms (FESR) released in 2012, the development of the agriculture sector is among the ten pillars set by the government for the national economic growth of Myanmar (ADB 2014).

Agriculture has a pivotal role in ushering economic development (Johnston and Mellor 1961, World Bank 2007, Timmer 2009). This framework for economic development takes the premise that boosting agricultural productivity would lead to the transformation of rural areas that are highly dependent on agriculture to a thriving economy fueled by incomes from the commercial, services, and industrial sectors.

Dercon and Grollin (2014) explained how development, using this framework, can happen in two types of economies. Growth in agricultural productivity in a closed economy would lead to positive outcomes such as higher incomes in rural areas, lower food prices in urban areas, higher savings in rural areas which, in turn, will allow the mobilization of capital for domestic industry and domestic market for non-agricultural goods.

The additional benefit in an open economy would be reduced food prices in urban areas and lower nominal wages for workers

in manufacturing, resulting in higher competitiveness of non-agricultural exports (Dercon and Grollin 2014). The successful structural transformation of the agriculture sector gives birth to urban and industrial sectors that generate new technologies, products, and services. These sectors create more job opportunities and higher incomes for some segments of the population, thus contributing to the overall reduction of poverty in the rural areas (Timmer 2009).

Rural transformation has been recommended as the pathway to achieve national economic development in Myanmar (ADB 2014). Neighboring countries in the region have taken the path of capitalizing on agricultural growth to drive economic development (Department of Agriculture, Philippines 2012, Dapice *et al.* 2010). Myanmar, a largely agriculture-based country endowed with rich natural resources, is treading the same path by developing the rice sector to raise agriculture productivity, reduce poverty, and achieve long term economic development.

Gender equality is also critical to sustainable development and efforts to achieve poverty reduction, food and nutrition security for all, and economic growth, in particular in the agricultural sector. Seventy percent of women in Myanmar are active in the agricultural sector, comprising 48.3% of the agricultural labor force and they make important contributions to agriculture (FAO 2011).

To achieve agricultural development, particularly in the rice sector, substantial investments in supporting infrastructure and policy formulation are needed. After a long time of underinvestment and neglect, the agricultural sector must be at the forefront of the national agenda for development. However, poverty reduction cannot be achieved through the agricultural sector alone. Corresponding development needs to happen in the industrial and service sectors, which are linked with agriculture, to achieve economic growth and to reduce poverty in the country.

## Aiming for food security and surplus production for export

Throughout Myanmar's history, successive governments had set their policies to support the rice sector because of its critical role in food security, and its social and political importance in the country

(Tun Saing n.d.). In the late 1970s, the first Green Revolution in Myanmar was launched through the Special High-Yielding Program (SHYP) to boost rice production, leading the path from self-reliance to rice exportation. The cultivation of high-yielding varieties was combined with appropriate agricultural practices and high inputs of agrochemicals with state subsidies. Rice marketing and trade were solely under state management, with a quota delivery system in procuring paddy from farmers and in exporting rice to the international market.

In the early 1990s, the program expanded the cropping area of paddy, used high-yielding varieties, and introduced summer paddy technology in areas where water resources were available. Private sector involvement also advanced and became significant after the liberalization of rice export in 2003. Since then, various reform measures, such as lessening control on economic activities, relaxing price controls, deregulating export and import restrictions, opening border trade, reducing government subsidies, and establishing industrial zones and private banks, were taken to promote the active participation of the private sector in the national economy.

Through the Rice Specialization Companies (RSCs), private sector involvement through contract farming arrangements with rice farmers was encouraged. As a temporary solution to limited access to affordable seeds and other inputs, credit, and extension, the RSCs provided these support to farmers. Other private sector groups, such as the Myanmar Rice and Paddy Traders Association (MRPTA), were also actively engaged in paddy trading and milling. In 2012, the Myanmar Rice Federation (MRF) was formed by restructuring and upgrading the Myanmar Rice Industry Association (MRIA). MRF is the umbrella organization representing the six private sector group of millers, traders, farmers/paddy producers, fertilizer, seed, and pesticide entrepreneurs, and the RSCs.<sup>8</sup>

In 2011, the country opened its doors to democratic and economic transformation. One of the development goals set by the present government is to increase rice exports while maintaining domestic food security. It is envisaged that increasing rice exports will generate the needed income to fuel agricultural development, revive the economy, and alleviate poverty pervading in rural areas (MRF 2014b).

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<sup>8</sup> <http://myanmarricefederation.org/content/about-myanmar-rice-federation-mrf>

## Myanmar rice in the international and local markets

Myanmar was one of the biggest exporters of rice until its isolation for more than 40 years which led to the stagnation of its rice sector. The country has to catch up with other countries in the region by significantly investing in the whole value chain to remove the barriers hampering its development. Myanmar also needs to produce a stable volume of rice for export.

The private sector, composed of farmers, input suppliers, traders, millers, processors, and exporters, drive the extensive rice value chain. The capacity of the private sector to effectively and successfully compete in the international rice market thus needs to be improved by putting in place short- and long-term strategies. Becoming competitive with other exporting countries, such as Thailand and Vietnam, and gaining a significant share in the international rice market essentially demands a comprehensive rice strategy and program to achieve a vertically integrated value chain that will reduce transaction costs and enhance efficiency throughout the chain, from production to marketing.

Myanmar's rice exports consist mostly of low value 25% broken rice, as well as white rice. The bulk of these exports is sold to Ivory Coast, Guinea, and Burkina Faso in Africa and to Indonesia, Bangladesh, and the Philippines in Asia (*Table 2*). A large volume of rice is also exported to China through border trade. Myanmar's rice is US\$10-US\$20 cheaper per ton than rice of comparable quality from Viet Nam, India, or Pakistan, and this has allowed the sector to double its exports from 750,000 tons in 2012 to 1.5 million tons in 2013 (MRF 2014a).

**Table 2. Myanmar rice export by grade, '000 tons.**

	Fragrant	100% S	5%	10%	15%	Parboiled	25%	Brokens	Others	Total
2010	*	2	12	9	5	0	456	0	*	485
2011	*	5	20	1	12	1	737	39	1	816
2012	*	1	53	0	6	8	504	30	2	605

*Note: \* Less than 500 tons. Rice 15% broken means 85% head rice and 15% broken rice, and so on. The category "Brokens" does not include any head rice.*

*Source: Slayton & Associates (2013)*

Myanmar's rice exports receive the lowest market prices because of its low quality. For example, Myanmar earns only US\$330- US\$340 per mt, while Thailand earns US\$545 per mt for the same kind of 25% broken rice.<sup>9</sup> Myanmar rice is also the cheapest among rice from Viet Nam, India, and Pakistan(Asian Correspondent 2014). The World Bank (2014b) reported that "although some farms produce high-quality aromatic rice such as Paw San and more of such rice could be produced in high-value segments of the rice market, due to poor post-harvest management, lack of investment in modern rice mills and other problems along the rice value chain, 92% of Myanmar's export over the last three years were of 25% broken, a low quality rice."

The government aims to enable Myanmar to regain its status as a major rice exporter as in the past. Realizing the country's vast potential to respond to the increasing global demand for rice, it and the private sector are now engaged in improving the value chain to produce more and better-quality rice so that Myanmar can increase its share in the more lucrative high-quality export market.

## Global rice demand and Myanmar's potential in the export market

The world population continues to grow and is expected to reach 9 billion (IFPRI n.d.) in 2050, with the Asian population reaching 5.2 billion (Wikipedia 2014). It is thus necessary to increase rice production in the region even as rising income and urbanization will result in a decline in the per capita consumption. The Global Rice Science Partnership (GRiSP) projected total milled rice consumption to increase to 496 M mt by 2020 and further to 535 M mt by 2030 (FAO 2014).

Myanmar is located between two of the most highly-populated countries in Asia, India and China, which are vast markets that can be tapped for rice and rice-based products. India's Food Program, particularly in its Northeast region, which provides subsidized rice to the poorer segments of the population, is a potential market for Myanmar rice. It is cheaper to import rice from Myanmar rather than transport local Indian rice from the South/Northwest to the Northeast. China informally imports about 0.8 M mt of rice from

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<sup>9</sup>With the end of the Thai mortgage scheme in mid 2014, the differences between Thai and Myanmar has changed.

Myanmar across the border, mainly for noodles and rice wine. This market can grow further once Myanmar reaches a signing agreement with AQSIQ<sup>10</sup> on an import quota. Moreover, demand for rice in Africa is increasing and Myanmar, with its traditional foothold in that market, is expected to benefit from this trend (*Table 3*).

This increasing trend in demand for rice provides an opportunity for Myanmar to increase rice production for regional and global export. However, the country must not only aim to continue producing low-quality rice but to also diversify the type and quality of its rice for export to include aromatic, jasmine, glutinous, and parboiled rice. It also needs to produce different types of grains for other value-adding rice and rice-based products (Myanmar Rice Federation 2014).

<sup>10</sup>AQSIQ is a ministerial administrative organ directly under the State Council of the People's Republic of China in charge of national quality, metrology, entry-exit commodity inspection, entry-exit health quarantine, entry-exit animal and plant quarantine, import-export food safety, certification and accreditation, standardization, as well as administrative law-enforcement.

**Table 3. Myanmar milled rice export by destination in 1995-2012, (in '000 tons).**

Destination	1995-99	2000-04	2005-09	2008	2009	2010	2011	2012
EU	0	15	*	*	*	0	12	28
Former Soviet Union	0	0	*	0	2	11	19	44
AFRICA	43	195	261	196	899	318	506	460
of which								
Burkina Faso	0	11	9	10	29	64	71	82
Cameroon	2	13	14	25	24	15	37	21
Guinea	7	31	70	44	246	85	125	173
Ivory Coast	2	49	73	25	252	95	122	125
Sierra Leone	5	18	18	20	44	0	4	9
Togo	0	4	13	22	40	11	33	8
ASIA	170	264	129	403	150	156	276	72
of which								
Bangladesh	10	108	99	385	70	116	215	0
China	0	1	0	0	1	0	0	13
Indonesia	122	132	5	0	11	5	2	10
Philippines	27	2	9	0	47	16	13	33
TOTAL	222	484	391	598	1,052	485	816	605

Note: \* less than 500 tons

Source: Slayton & Associates (2013). (in World Bank. 2014. Myanmar Capitalizing on Rice Export Opportunities, Report Number 85804)

# Rice production and consumption

## Agro-ecological zones

Myanmar is composed of 7 regions and 7 states (*Figure 1*). The 7 states are located mostly in the mountainous areas and represent the areas of the main ethnic races. The regions are located in the plains, except for Sagaing, Bago, and Thanintharyi. The country is divided into three major agro-ecological zones namely: 1) central dry, 2) coastal, and 3) hilly. These are further subdivided into eight physiographic regions: 1) northern hilly, 2) central dry, 3) Rakhine coastal, 4) western hilly, 5) eastern hilly (Shan plateau), 6) Ayeyawaddy delta, 7) Yangon deltaic, and 8) southern coastal (Thanintaryi coastal strip) (*Figure 2*) (Ministry of Environmental Conservation and Forestry 2012).



Figure 1. Map of Myanmar.

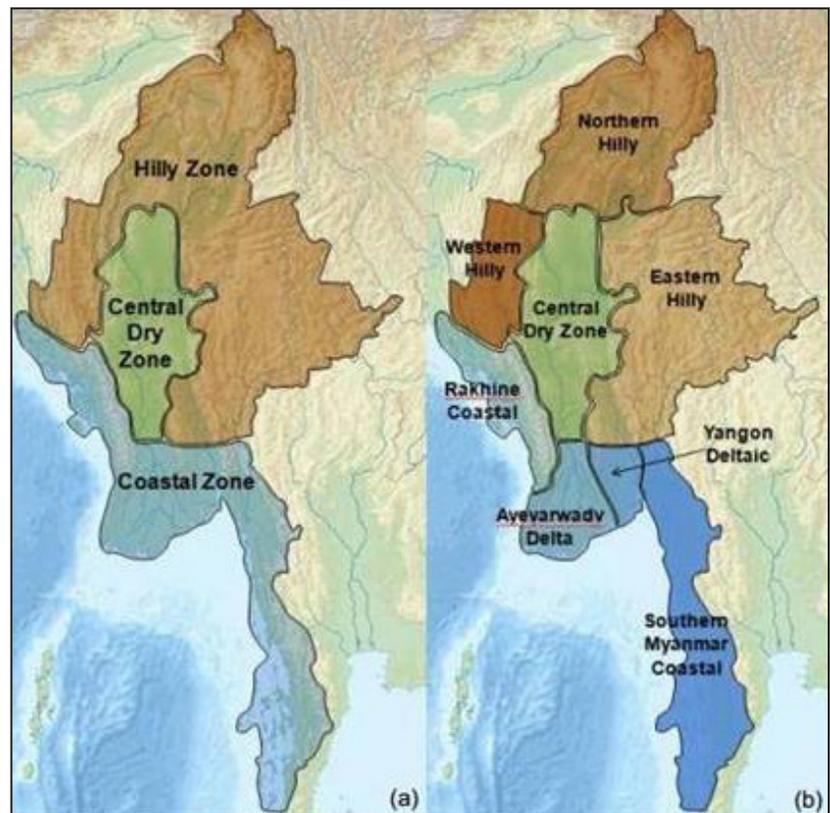


Figure 2. Map of Myanmar's agro-ecozones (a) and the eco-physiographic zones (b) (Adopted from NAPA, 2012)

Agriculture is the main source of livelihood of the Myanmar people. Rice is the major agriculture commodity grown in almost 50% of the cultivated area. The Ayeyarwaddy delta, central dry zone, Yangon deltaic, and Rakhine coastal areas are the major rice producing ecophysiographic regions (MoAI 2013).

## Major rice-growing areas

Myanmar's rice-growing areas can be categorized into two agro-ecosystems namely, favorable lowlands, which accounts for 68% of the 7.59 M ha sown area in 2012-2013, and unfavorable rainfed, which comprises 32% of the rice area (DoA 2013). These two agro-ecosystems are further divided into seven rice sub-ecosystems. The favorable lowland is comprised of the rainfed lowlands (48%) and irrigated lowlands (20%). The unfavorable rainfed area is subdivided as drought prone, deep-water, submerged, salt affected and uplands (*Table 4*). In 2012-2013, the total harvested rice area was 7.24 M ha (MoAI 2013).

**Table 4. Rice ecosystems in Myanmar.**

Agro-ecosystems	% of total sown area
Favorable lowland	68
a. Irrigated lowland	20
b. Rainfed lowland	48
Unfavorable rainfed	32
a. Drought prone	12
b. Deep-water	5
c. Submerged	9
d. salt-affected	3
e. Upland	3

*Source: Agricultural Extension Division Annual Report 2012-13. Department of Agriculture*

The **Ayeyarwaddy delta**, the rice bowl of Myanmar, covers 35,032 km<sup>2</sup> (Driel and Nauta 2013, MoAI 2013). Three regions occupy the delta — Ayeyarwaddy, Yangon, and Bago. Most areas are favorable for rice cultivation while some are prone to flooding in the monsoon and salinity intrusion toward the end of monsoon and during the summer season. Of the total 2.89 M ha of rice area in the delta, 371,880 ha are classified as flood-prone, 22,416 ha are salt-affected, and 64,941 ha are drought-prone (Department of Agricultural Research unpublished data). The delta has a monsoonal climate which delivers an average annual rainfall of 1,500 mm–2,000 mm in the north, increasing to 2,500 mm in the southeast and 3,500 in the southwest. More than 90% of the rain falls between mid-May and mid-November (Driel and Nauta 2013). Seeding for the monsoon cropping commences in late May to June, followed by transplanting

in July to August (Table 5). In deepwater areas, cropping begins in September when the water begins to recede, making it possible for farmers to prepare the land. The harvest season is from October to November for the regular monsoon crop and January for late monsoon crop.

There is limited fresh water available in most parts of the lower delta during summer. Rice is mostly grown in the middle and upper part of the delta, near rivers and small dams. Summer cropping usually starts in late October until January and harvest period is from February to April.

Rice production in the delta increased significantly from 1976 to 1988 with the implementation of the Paddy Land Development Projects 1 and 2 by the World Bank and the Asian Development Bank. The construction of polders provided with embankments, sluice gates, and drainage systems protected the rice farms from salt water intrusion (Driel and Nauta 2013). However, the polders degraded and cyclone Nargis damaged many of the polders, resulting in the uncontrolled entry of salt water and, thus, reducing rice yield. Many of the damaged rice areas remain prone to salt water intrusion even in the monsoon season.

The Ayeyarwaddy delta is home to 21 million people, with the majority depending on rice production for livelihood. The average farm size per household is about 4.5 ha, which is the largest in the country. However, the delta is also the place of many landless people with low levels of income (Driel and Nauta 2013, Denning *et al.* 2013).

The **central dry zone** covers approximately 54,390 square kilometers or 10% of the country's total land area. It is considered a vulnerable region with poor natural resources. It stretches across the southern part of Sagaing Division, the middle and western part of Mandalay Division, and most parts of Magway Division (Ministry of Environmental Conservation and Forestry 2011).

Drought is a major problem of farmers in the zone. Inland salinity is also present in some areas. Of the 1.17 M ha rice area, 149,081 ha are drought-prone and 4,900 ha are saline-affected (DAR unpublished data). Soil erosion is also a huge problem. Finally, the land, mostly sandy loam, has low fertility and thus, thin vegetation.

The dry zone has a bimodal rainfall pattern. Most of its rainfall comes with the southwest monsoon, ranging from 508 mm to 1016

mm per annum with high variability and uneven distribution. The monsoon season is from mid-May to October, but the onset is erratic with prolonged dry spells (Aung H 1997). Farmers begin planting in July until October, depending on the availability of irrigation water from dams and reservoirs and on rainfall. Harvesting period is from November to January for monsoon paddy. Summer cropping begins in January and lasts until April. Harvest season is from April to June (*Table 5*).

In areas near irrigation systems, rice is grown during the monsoon and summer season. In areas far from irrigation systems, annual crops such as pulses, sesame, sunflower, and groundnut are cultivated in summer. Other farmers support their living by rearing livestock and collecting products such as fuel wood, posts, and fodder.

There are 14.5 million people living in the dry zone, giving the region a population density of 123 people per square kilometer (Ministry of Environmental Conservation and Forestry. 2011). According to the LIFT Baseline Survey Results (2012), the average farm size is 1.82 ha, 60% smaller compared to the 4.5 ha in the Ayeyarwaddy Delta, and the average household size is 5–7. Chronic poverty is found in the dry zone and this level of poverty is directly correlated with the effects of drought and dry spells. About 39% of the population is landless, working as seasonal laborers in farms (Integrated Household Living Conditions Assessment Project, 2005 and 2010).

**Table 5. Paddy production calendar in Myanmar.**

Area	May	June	Jul	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul
<b>Wet season paddy (Monsoon paddy)</b>															
Lower Myanmar	S	S/G	S/G	S/G	S/G	G/H	G/H	H	H						
Central Myanmar			S	S/G	S/G	S/G	H	H	H						
Southern Shan		S	S	S/G	S/G	H	H	H							
<b>Dry season paddy (Summer paddy)</b>															
Lower Myanmar						S	S/G	S/G	S/G	H	H	H			
Central Myanmar										S	S/G	S/G	S/H	H	H
Southern Shan											S	S	G	H	H

S: Sowing G: Growing H: Harvesting

Source: Agricultural marketing in Myanmar (TCP/MYA/8821), FAO MIS project, Oct. 2000 and DAP

## Rice area and production

Among the nine largest rice producers in the world, Myanmar ranks sixth in area sown to rice and seventh in total production (FAOSTAT 2014).

Rice is grown during the monsoon and summer seasons in four growing zones: the delta, dry zone, coastal zone, and mountainous areas. About 80% of the annual production is harvested during the monsoon season and the remaining 20% during the summer season. About 50% of the total production comes from the delta comprised of the Ayeyarwaddy, Bago and Yangon regions (**Table 6**). About 25% is produced in the dry zone, including Mandalay, Sagaing, and Magway regions. The rest is produced from the coastal and mountainous areas (World Bank, 2014). More than 60% of the summer season production comes from the delta. The area sown to rice and harvested area increased from more than 6 million hectares in 1995 to more than 8 million hectares in 2010 (**Table 7**). Rice production showed a similar increasing trend (**Figure 3**) because of the expansion of irrigated areas and the government program to promote the use of high-yielding varieties and fertilizers (Tun Saing 2004; Kyaw, Kyaw D and Hninn Yu Lwin 2012; FAOStat 2014).

The Ayeyarwaddy region accounts for more than 50% of the total rice area sown in 2011 and 2012. The rice area began to decline in most regions except eastern Shan, Mandalay, and Magway in 2011 and continued to 2012 (Kyaw D & Hnin Yu Lwin 2012).

About 70 high-yielding varieties (HYVs) had been developed by Myanmar rice breeders in collaboration with IRRI (Tin Tin Myint 2013). Twenty-eight of these are widely grown by farmers. These HYVs are used in more than 40% of the 8 M ha rice area in the country (**Figure 4**). The top five varieties grown in 2011-2012 were Manawthukha (Mahsuri mutant), Sin Thwe Latt (IR 53936-90-3-2-1), Shwe War Thun (IR 5 mutant), Aye Yar Min (Maclardo), and Thee Dat Yin (IR 13240-3-2-1) (**Figure 5**).

Rice yields in 2001/02 averaged 3.3 mt/ha, which was lower than the 4.0 mt/ha in Indonesia and Vietnam. By 2010-11, the average paddy yield had reached 4.07 mt/ha, but declined to 3.84 mt/ha in 2012-13 (**Table 8**).

**Table 6. Paddy production by crop and province, 2004/05-2011/12 ('000 tons).**

Region/ Province	2004/05-2008/09			2009/10			2010/11			2011/12		
	Wet	Dry	Total	Wet	Dry	Total	Wet	Dry	Total	Wet	Dry	Total
<b>Delta</b>												
Ayeyarwaddy	5,563	2,303	7,866	4,844	2,563	8,507	5,944	2,563	8,507	5,972	2,510	8,482
Bago	4,259	585	4,844	4,790	791	5,581	4,790	791	5,581	4,803	630	5,433
Yangon	1,625	283	4,844	1,709	333	2,042	1,709	333	2,042	1,710	320	2,031
Sub total	11,447	3,171	4,844	1,709	3,687	16,130	12,443	3,687	16,130	12,485	3,461	15,946
<b>Dry Zone</b>												
Nay Pyi Taw	NA	NA	NA	NA	NA	NA	NA	34	34	287	43	329
Magwe	1,162	271	1,433	1,467	262	1,729	1,501	322	1,823	1,524	33	2 1,856
Mandalay	1,401	435	1,836	1,298	346	1,644	1,307	369	1,675	993	331	1,324
Sagaing	2,746	751	3,497	3,131	874	4,005	3,179	865	4,044	3,109	745	3,855
Sub Total	5,309	1,457	6,766	5,896	1,482	7,378	5,986	1,590	7,577	5,913	1,451	7,364
<b>Coastal</b>												
Mon	1,206	181	1,394	1,278	222	1,500	1,278	222	1,500	1,294	213	1,499
Rakhine	1,638	31	1,669	1,825	31	1,856	1,825	31	1,856	1,697	29	1,727
Tanintharyi	534	43	577	544	24	568	544	24	568	510	25	535
Sub Total	3,385	255	3,640	3,647	277	3,924	3,647	277	3,924	3,501	260	3,761
<b>Mountainous</b>												
Chin	103	*	103	120	*	120	120	*	120	127	*	127
Kachin	680	27	707	925	45	970	925	45	970	945	18	963
Kayah	123	15	138	137	17	154	137	17	154	140	17	156
Kayin	595	173	768	721	215	936	721	215	936	755	217	972
Shan	2,099	171	2,269	2,394	160	2,554	2,394	160	2,554	2,409	154	2,563
Sub Total	3,600	386	3,986	4,297	437	4,734	4,297	437	4,734	4,374	407	4,781
<b>Total</b>	<b>23,742</b>	<b>5,269</b>	<b>29,010</b>	<b>26,283</b>	<b>5,883</b>	<b>32,166</b>	<b>26,283</b>	<b>5,882</b>	<b>32,165</b>	<b>26,346</b>	<b>5,718</b>	<b>32,06</b>

Source: The World Bank, Myanmar: Capitalizing on rice export opportunities, 2014

**Table 7. Paddy sown area and harvested area (1995-2013).**

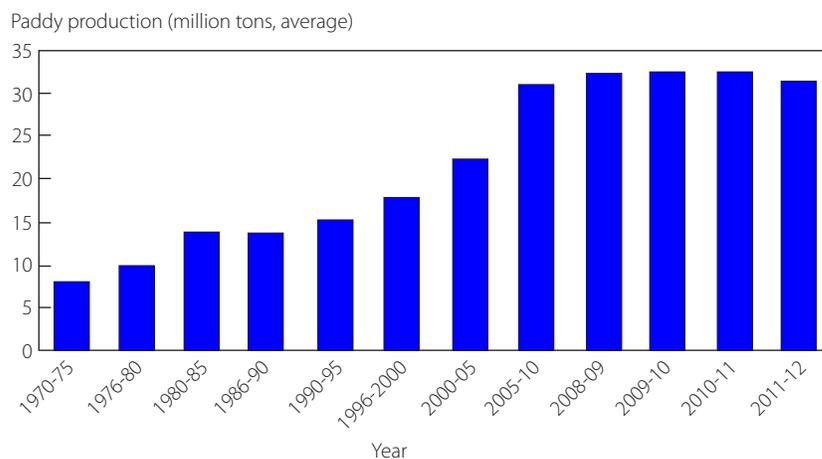
Year	Sown area (‘000 ha)	Harvested area (‘000 ha)
1995-1996	6,138	6,033
2000-2001	6,359	6,302
2005-2006	7,389	7,384
2009-2010	8,067	8,058
2010-2011	8,047	8,011
2011-2012	7,593	7,567
2012-2013	7,241	7,208

Source: Myanmar Agriculture at a Glance, 2013

**Table 8. Paddy yield (mt/ha/season) (1995-2013).**

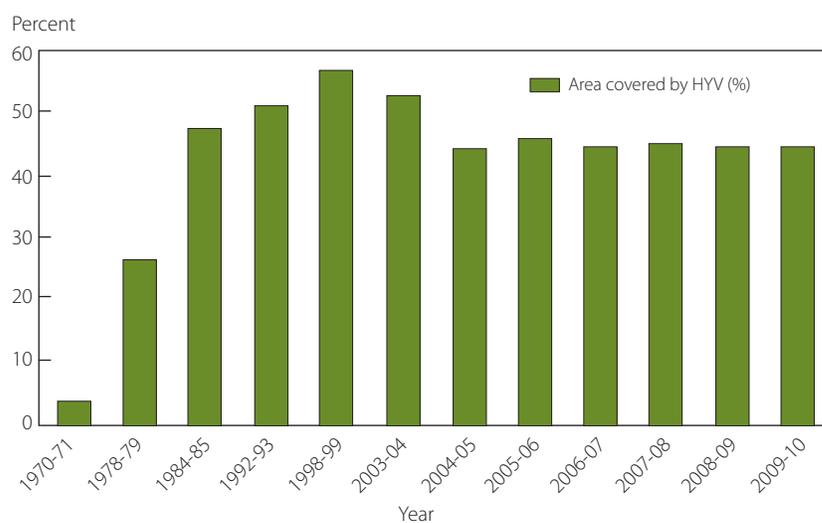
Year	Average Yield (mt/ha)
1995-1996	3.08
2000-2001	3.38
2005-2006	3.75
2009-2010	4.06
2010-2011	4.07
2011-2012	3.83
2012-2013	3.84

Source: MoAI, Myanmar Agriculture at a Glance, 2013



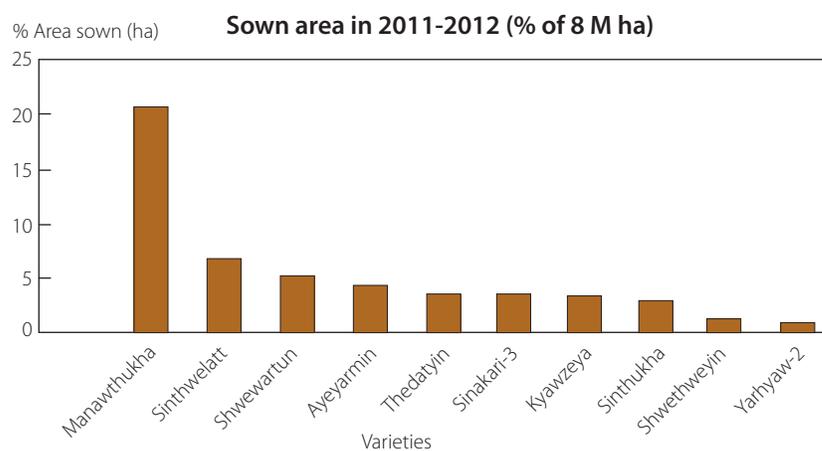
**Figure 3. Paddy production in Myanmar.**

Source: FAOStat 2014; World Bank, 2014



**Figure 4. Area covered by high-yielding rice varieties.**

Source: DOA, MOAI



**Figure 5. Top ten high-yielding rice varieties grown in Myanmar.**

Source: Rice Division-DAR, MoAI

## Consumption and use

Rice is the staple food and main energy source of the Myanmar people. It accounts for about two-thirds of calorie intake and 68% of daily protein consumption. It contributes less in the dietary energy supply of the people in the urban areas (73%) than of those in rural areas (80%) because the former can afford to buy other energy sources. Almost two-thirds of household expenditure is spent on food, 17% of which is spent on rice (World Bank, 2002). This suggests that a major percentage of the budget for low-income families constitutes rice cost.

Myanmar's population was estimated at 51.4 million and belonging to 10.9 million households in 2014 (Department of Population-Ministry of Immigration and Population, 2014). Seventy percent of the people live in the rural areas. The annual per capita consumption of the Myanmar people is estimated at 175 kg,<sup>11</sup> the highest in Asia. The MoAI estimated that seed utilization by farmers is 98.8 kg/ha and waste and postharvest loss is 148 kg/ha. With these estimates, domestic utilization was reported to be 10.44 M mt for food, 0.49 M mt for seeds, and 0.74 M mt for waste.

In 2010-11, Myanmar had 7.70 M mt surplus rice although not all of these were internationally marketable because of poor quality. The regions with the biggest surplus were Ayeyarwaddy, Bago (east and west), and Sagaing. The majority of the regions is self-sufficient but Chin and Mandalay were deficit regions and became net importers (**Table 9**). Prior to 2010-11, all regions had sufficient rice supply (**Figure 6**). The national self-sufficiency has remained stagnant at 150% for the last 5 years.

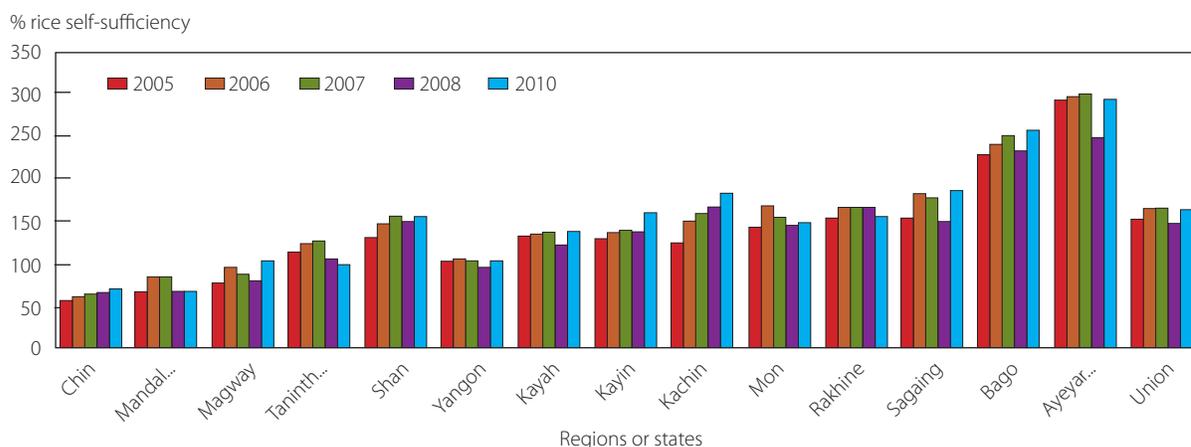
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<sup>11</sup>Rural consumption rate: 15 bsk paddy x 0.75 population=10.5 bsk; urban consumption rate: 12 bsk paddy x 0.25 population= 3.6 bsk. The estimated per capita consumption is 14 bsk=644 lb=292 kg x 0.60= 175 kg milled rice (milling outturn is 60% of paddy)

**Table 9. Production, domestic use, and surplus of milled rice, 2010/11 (Million tons).**

Region/ Province	Population Million		Production		Domestic utilization			Surplus/ Deficit
	Urban	Rural	Paddy	Rice	Food	Seed	Waste	
<b>Delta</b>								
Ayeyarwaddy	1.52	6.52	8.54	5.13	1.44	0.12	0.19	3.37
Bago (East)	0.88	2.49	3.17	1.90	0.59	0.05	0.07	1.19
Bago (West)	0.77	2.02	2.30	1.38	0.48	0.04	0.05	0.82
Yangon	5.44	1.58	2.05	1.23	1.10	0.03	0.05	0.04
Sub total	8.61	12.62	16.06	9.64	3.61	0.24	0.37	5.42
<b>Dry Zone</b>								
Magwe	1.06	4.56	1.84	1.10	1.01	0.03	0.04	0.03
Mandalay	2.85	5.58	1.72	1.03	1.46	0.02	0.04	-0.49
Sagaing	1.24	5.31	4.07	2.44	1.17	0.06	0.09	1.13
Sub Total	5.15	15.44	7.63	4.58	3.64	0.11	0.16	0.67
<b>Coastal</b>								
Mon	1.09	2.04	1.51	0.91	0.54	0.02	0.04	0.30
Rakhine	0.66	2.65	1.74	1.04	0.59	0.03	0.05	0.38
Tanintharyi	0.53	1.19	0.54	0.32	0.30	0.01	0.01	0.00
Sub Total	2.28	5.88	3.79	2.27	1.43	0.06	0.10	0.68
<b>Mountainous</b>								
Chin	0.12	0.43	0.13	0.08	0.10	*	0.01	-0.03
Kachin	0.45	1.13	0.97	0.58	0.28	0.02	0.02	0.26
Kayah	0.12	0.24	0.16	0.09	0.06	*	0.00	0.03
Kayin	0.28	1.54	0.98	0.59	0.33	0.02	0.03	0.22
Shan (South)	0.60	1.61	0.91	0.55	0.39	0.02	0.02	0.12
Shan (North)	0.66	1.88	1.00	0.60	0.45	0.01	0.02	0.12
Shan (East)	0.25	0.67	0.67	0.40	0.16	0.01	0.02	0.21
Sub Total	2.47	7.49	4.81	2.89	1.76	0.08	0.12	0.93
<b>Total</b>	<b>18.51</b>	<b>41.43</b>	<b>32.29</b>	<b>19.37</b>	<b>10.44</b>	<b>0.49</b>	<b>0.74</b>	<b>7.7</b>

Source: The World Bank, Myanmar: Capitalizing on rice export opportunities, 2014 MOAI, using milling rate of 60 percent

**Figure 6. Rice self-sufficiency (%) in the regions and states**

Source: Yezin Agricultural University, 2012

## Projected production, consumption, and surplus

Food security is important in all states and regions of the country and the government has prepared a rice production plan to meet the requirements of the population which is expected to reach 60.67 million in 2030. Rice consumption in Myanmar is expected to decrease by 0.19 % annually (Wailes EJ & Chavez EC 2012) because of increasing income and higher replacement of carbohydrate sources among middle-income families.

Under this plan, the sown areas will reach 7.59 M ha in 2020-21 and 7.70 M ha in 2030-31, with yields averaging at least 3.90 t/ha/season and 4.20 t/ha/season, respectively. With an annual reduction of 0.19%, per capita consumption is projected to go down to 171 kg in 2020/21 and 166 kg in 2030/31 from the current 175 kg. Using the same assumption of seed utilization by farmers at 98.8 kg/ha and waste and postharvest losses at 148 kg/ha, it is projected that Myanmar will have a rice surplus of 7.22 M mt in 2020-2021 and 8.12 M mt in 2030-31 (*Table 10*).

**Table 10. Projection of paddy production and surplus of rice for the years 2020-2021 and 2030-2031.**

Year	Sown* area (M/ha)	Yield* (mt/ha)	Paddy Production (M mt)	Population (M)	Rice consumption (M mt)	Seed & rice losses (M mt)	Surplus rice (M mt)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(4-6-7) (8)
2012/13	7.24	3.84	27.70	50.92	8.91	1.11	6.59
2020/21	7.59	3.90	29.60 (16.62)**	55.03	9.41	1.15	7.22
2030/31	7.70	4.20	32.34 (17.78)** (19.40)**	60.67	10.13	1.15	8.12

\* Based on past trends, the area sown to rice and grain yields have been decreasing after 2010/11. The sown area has little possibility to expand and will likely be declining in the future

\*\* Milled rice

Note: Projection of population based on the population 50.92 million in 2012-13 with an annual growth rate of 0.98 %/annum; export target 5 Mil MT in 2020 (MRF 2013).

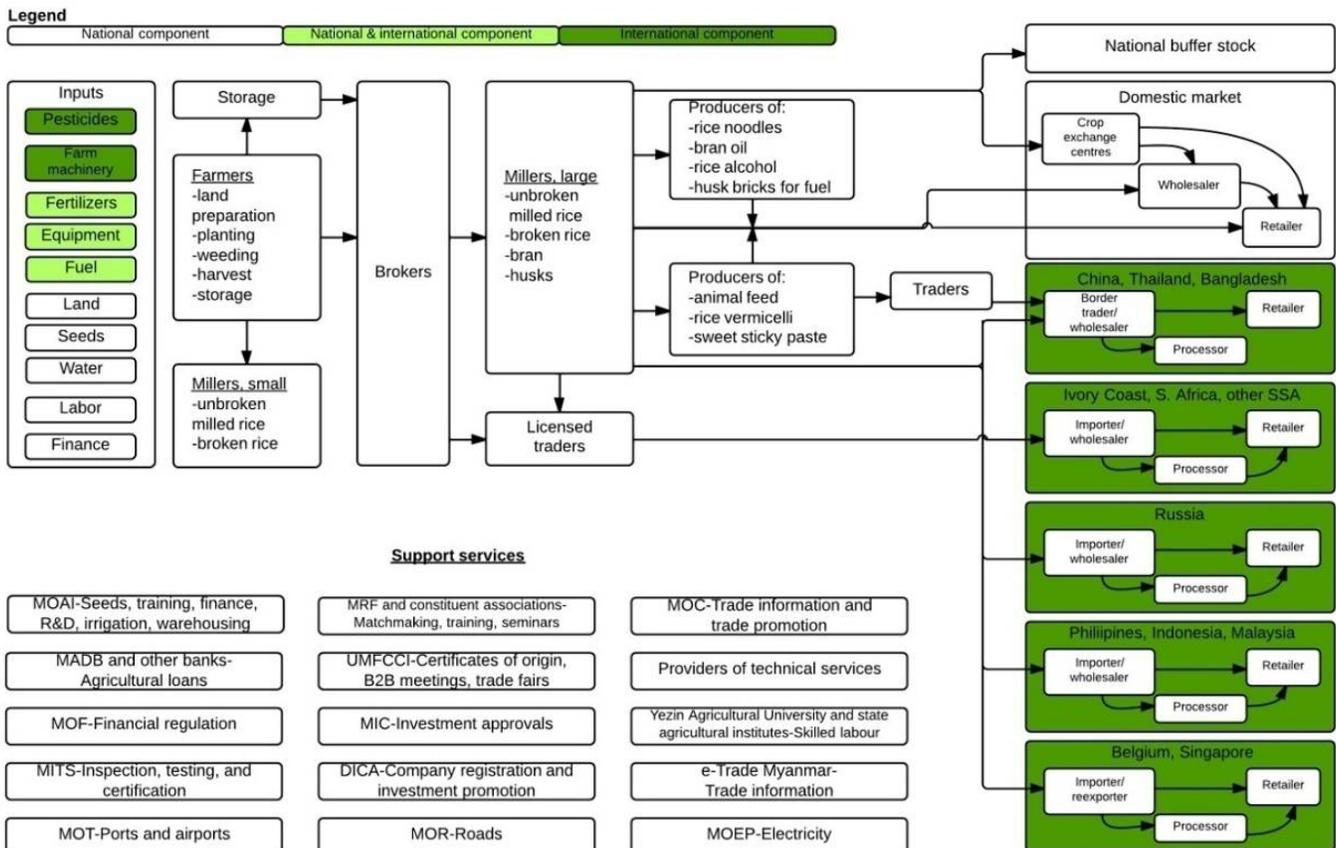
\*\*Assumptions:

- 1) Per capita consumption will decrease by 0.19%, from the existing 175 kg of rice, to 171 kg in 2020/21 and 166 kg in 2030/31.
- 2) Rice recovery is assumed as 60% of paddy by volume.
- 3) Two baskets of paddy for seed and three baskets for postharvest losses/acre. (1 basket = approximately 20 kg; 1 acre = 2.47 ha)
- 4) Irrigated rice areas is projected at 20% growth

# The rice value chain

The Myanmar Rice Federation (MRF) has done a thorough analysis of the rice value chain (**Figure 7**) (MRF 2014). The rice value chain is composed of a wide range of players, both national and international agents that actively participate along each node of the chain. Individual entrepreneurs to large wholesalers and exporters are involved in production, collection, processing, marketing, and distribution. These stakeholders are aided by both private and public sector support institutions.

Myanmar's rice value chain is far from perfect and marred by weaknesses that render it inefficient, resulting in high transaction costs for all stakeholders. At the input area, the supply of quality seeds and inputs is a big bottleneck that needs to be resolved. At the processing area, antiquated mills, all of which are inefficient, abound and millers have no sufficient supply of electricity to run the mills optimally. Transportation, which is critical at each node of



**Figure 7. Schematic diagram of the Myanmar rice value chain**

Source: MRF, 2014: Myanmar Rice Export Strategy 2014-2020 (Draft)

the value chain, is expensive because of the poor condition of roads and waterways. Moreover, the cost of loading rice per 20,000-ton vessel at the port and the procedure to export is the highest among exporting countries (World Bank 2014). In 2010, the cost of exporting one ton of rice reached 66,000 kyats (USD 66) (Table 11).

As Myanmar becomes increasingly integrated into regional and global markets, improving the weaknesses to increase efficiency in the value chain becomes imperative. Some important steps in improving the value chain had been initiated. Apart

**Table 11. Cost of exporting a ton of rice from Myanmar, 2010.**

Description	Kyats
Transportation	28,800
Labor	8,000
Milling and processing	16,000
Packaging	8,000
License and port	5,800
Total	66,600

*Source: Study of rice marketing cost and transaction cost for export market, Agribusiness and Rural Development Consultants, October 2010*

from measures to strengthen production and boost productivity at the farm level, a new institutional structure has emerged over the last few years in which the private sector is taking the lead, in close partnership with the public sector, to encourage investment and modernization throughout the value chain.

Improving postharvest management and upgrading processing technology (milling, drying and storage) will enable Myanmar to raise the quality of its rice exports (The World Bank 2014). Loans for domestic enterprises, particularly small and medium enterprise (SMEs), are needed to help facilitate investment in modern and efficient facilities and equipment for drying, milling, and storage. Also, foreign investment is needed in the rice processing sector to set up and supply equipment for processing facilities.

# Challenges and opportunities

## Challenges

The principal challenge areas that Myanmar needs to address to develop its rice sector include 1) the worsening challenges of climate change which exposes the vulnerability of farmers to drought, flooding, salinity, heat, and other stresses, as well as extreme weather events; 2) limited availability of, and access to, technological innovations; 3) weak extension and education system; 4) limited access to financial services; 5) limited facilities for postharvest handling and processing; 6) inadequate infrastructure, particularly for irrigation, power, and transport; 7) uncertain security of land tenure; 8) volatility of paddy price which contributes to low farmer incomes; 9) the poorly integrated value chain, from rice production to trading and marketing; and 10) policies that hamper investments in the rural areas and rice sector.<sup>12</sup>

These problems are not unique or unfamiliar to Myanmar. Other rice-producing countries, such as Thailand, Viet Nam, and Indonesia, faced similar problems and lessons can be learned from their experiences.

### Climate change

Myanmar is vulnerable to natural disasters and sensitive to climate change effects because of its perilous geographic location. Part of its border sits along the coast of the Bay of Bengal and the Andaman Sea where cyclones develop and from where these enter during monsoon. A large proportion of the population and infrastructure is located in coastal and river deltas that face great risks from the impacts of natural disasters and climate change. In 2008 and 2010, cyclones Nargis and Giri devastated much of the lower Ayeyarwaddy delta and the Rakhine state, resulting in severe losses in agriculture, infrastructure, and livelihoods. Nargis alone claimed the lives of more than 200,000 people in the delta.

The effects of climate change can already be observed in the country. There is an increased frequency in the occurrence of intense

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<sup>12</sup>These challenges were identified in a workshop during the Myanmar Rice Sector Development Strategy and Program Conference and Workshop, Yezin, Nay Pyi Taw held on September 9-10, 2013 and during the succeeding round-table meetings and discussions to formulate the MRSDS.

cyclones along the coastal areas, shorter monsoon duration, and rise in temperature. Some of the impacts of climate change include rise in the incremental sea level, salt water intrusion into fresh water areas and rice farms, loss of mangroves and biodiversity in these ecosystems, higher incidence of drought, and loss of land resources (Hninn Nei Thiam 2010).

Rice production is expected to be negatively impacted by the predicted rise in temperature; more frequent occurrences of drought, flooding, salinity, heat, and other stresses; and extreme weather events. Water shortages at critical rice stages can critically affect growth and yield. The dry zone will be particularly vulnerable as water will be less available and hence, greater competition between domestic water use and crop production. The delta is also exposed to flooding and intense rains, and the low lying rice fields will be inundated with salty water as a result of sea level rise (RIMES 2011). These are all expected to contribute to the decline in rice production which, in turn, means reduced agricultural productivity and food security. In previous extreme weather events, many lives, properties, and livelihoods were lost. The negative impacts of climate change will also make it more urgent to develop early warning systems as well as to enhance the Myanmar people's skills in disaster preparedness and knowledge on climate smart agriculture practices, thus making them resilient and adapt better to climate change.

### **Limited availability of, and limited access of farmers to, technological innovations**

Rice is grown in various environments that require varieties and crop management options suitable to the variable conditions in the field. Myanmar's continuing 30-year collaboration with IRRI has resulted in the development of 70 high-yielding varieties suited to the country's different rice environments (Tin Tin Myint 2013). However, much still needs to be done to make these varieties accessible to farmers and enable them to grow varieties that meet quality requirements for a vibrant presence in the higher-end international rice trade. Moreover, the volume of quality seeds available at planting time is less than 5% of the total seed requirement of farmers. To rapidly increase the volume of available seeds, it is imperative to revive and extend seed networks, and a seed certification and marketing system that is inclusive of government seed farms, farmer groups, and private seed companies.

Rice breeding had been strong but research and development of appropriate preharvest and postharvest crop management options had been lagging. The few recommendations for rice are adapted from other countries brought by IRRI to Myanmar through the Irrigated Rice Research Consortium (IRRC) and the Consortium for Unfavorable Rice Environments (CURE). As such, there are limited defined management recommendations for varieties in different growing environments in the country. These are important for farmers to optimize the yield benefits that the new rice varieties offer.

Fertilizers are applied by most farmers but the fertilizers are often not available when farmers require them. Farmers often lack skills and knowledge about proper plant nutrient management. The most common fertilizer applied is urea and often the rates applied are low and not done at the right crop stage (Denning *et. al.* 2013). Fertilizer management through site- specific nutrient management can significantly increase yields by improving nutrient use efficiency as the fertilizer is applied at the right time and at the right amount.

Weak implementation of regulations and the certification system make it possible for unregistered, low-quality fertilizer products and formulations to enter the market. The Fertilizer Law needs to be implemented to regulate registration and entry of products into the market and to ensure that quality standards are met by fertilizer companies.

The occurrence of major pest problems has, in general, been low in rice fields, except for weeds, but the trend in pesticide use is increasing as farmers have limited knowledge on integrated pest management and the proper use of pesticides (Aung *et al.* 2012). The implementation of the country's pesticide regulations is likewise weak, and this has resulted in the entry of unregistered and/or banned products. The lack of policy regarding pesticide use, weak regulation and monitoring of pesticide entry in the market, and farmers' lack of knowledge of proper pest management will likely result in pesticide misuse and the eventual occurrence of pest problems and loss of biodiversity in the rice ecosystem.

Myanmar is at a critical juncture where the pesticide use is low, but on the edge of abusive levels. It need not experience the pitfalls of pesticide misuse by adopting best practices and learning from the mistakes and successes of other countries. By doing this, the country

will benefit by being able to sell quality and safe rice grown using sustainable and best management practices.

In irrigated areas, water-use efficiency and water management are still weak. Myanmar is endowed with abundant water resources but less than 10% of these resources are presently used. Water-use efficiency in farms is low and, in some irrigated areas, only 40% of water supply is effectively used for cultivation (Hla Baw 2013). Educational awareness programs on water management are required for local communities to enhance their knowledge on saving water. Fair distribution of irrigation water at the right time and according to the needs of water users through a participatory water management scheme remains to be implemented. A water users association also needs to be established to introduce the demand management practice in the agriculture sector.

Meanwhile, the level of farm mechanization is low for various reasons: 1) farmers have no capital to buy or rent farm machinery; 2) farmers are not willing to invest in machinery because they do not have secure land tenure; 3) small rice paddy size is not suitable for large machines such as four wheel tractors and combines; and 4) service providers for mechanized farm operations are lacking. Land preparation tools and machinery with the appropriate attachments for more effective soil tillage are limited in number in the villages.

Harvesters, threshers, dryers, and warehouses for storage, which are important to reduce crop losses and improve the quality of harvest, are also few. It is common to see harvested rice stacked in bunds for more than four weeks in some regions because of the limited number of threshers available. Large combines were recently promoted but use is limited in bigger rice paddies and farms that are near main roads. Recently, smaller rice combines with rubber tracks commonly used in the Greater Mekong Sub-region (GMS) countries have been introduced in some areas and are becoming increasingly popular.

Broader use of combines need farm roads and the rice fields have to be transformed into paddy sizes suitable for mechanization. The government has initiated land consolidation and transformation of small rice paddies (rice paddy size is not less than 250 m<sup>2</sup>) in some villages to demonstrate the benefits of mechanized rice farming in reducing postharvest losses and in resolving the lack of labor during land preparation, transplanting and harvesting. Such developments

in mechanized harvesting need to be matched by the availability of appropriate grain drying facilities.

### **Weak extension and education system**

The agricultural technology extension network of Myanmar is extensive—from the national down to the village level. More than 4,700 extension staff members are deployed all over the country (Agricultural Extension Division, Department of Agriculture unpublished data). Nonetheless, with more than 3.4 M farm households (Myanmar Census of Agriculture 2003), each extension staff has to manage over 1,200 ha during monsoon cropping, twice the optimum capacity and reach of the staff (Personal communication with Extension Division officials at DoA).

Extension staff members immediately undergo a season-long training after they are hired by the government. Training opportunities are, however, hard to come by when they are already in service, resulting in limited knowledge of the staff on the latest developments in rice technology.

The current modality of extension uses demonstration farms in specialized areas and farmers' TV/ radio channel to educate farmers. Though this method has its own strengths, it needs to be combined with other approaches to provide timely crop advice and to reach farmers in remote villages. Other critical issues that need to be addressed to achieve better delivery of extension services include 1) weakness in the delivery of appropriate technologies adaptable to the ecological condition, 2) limited or weak technological skills and knowledge of extension staff, 3) weak logistic support for mobility, 4) limited budget to support the field work of extension staff, 5) not clearly defined extension and delivery platform to provide the necessary information and technologies to farmers, and 6) limited extension materials for farmers.

### **Limited access to financial services**

Although the average landholding of farmers is larger than those in other countries in the region, rice productivity and farmer incomes are low because of limited financial resources. The current loan program of the Myanmar Agricultural Development Bank (MADB) for rice farmers allows them to borrow 240,000 kyats/ha (about USD 247/ha). With the maximum area that can be used for each farmer is 10 acres (4 hectares), this amount is insufficient to cover

production costs estimated to be USD 320/ha in the monsoon and USD 511/ha in the summer season (Department of Agriculture unpublished data). As most farmers do not have savings to cover the remaining costs, they borrow from informal sources of credit at high interest rates of at least 5% per month. This aggravates the already widespread problem of deeper debt, making it almost impossible for farmers to escape the debt trap and poverty.

### **Limited facilities for postharvest handling and processing**

There are government policies on mechanization and the application of modern postharvest technologies. Demonstration farms using mechanized harvesting and threshing through combines were established in strategic sites in major rice-growing regions. Farmers are aware of the merits of mechanized postharvest operations, but most of them cannot afford to buy machinery because they lack capital. With the limited number of threshers in the villages, farmers have to wait for from 2 weeks to 2 months before their rice can be threshed.



**Mechanization is one of Myanmar government's priorities.**

Moreover, modern drying facilities are not available, thus farmers rely on sun drying which is often not possible during the monsoon season. Insufficient supply of labor and farm machinery in villages during the peak seasons of harvesting, threshing, and drying lead to high losses, both in quantity and quality, of rice. Poor quality paddy will also result in poor quality milled rice.

Many rice mills in Myanmar are old models that have low milling recovery rates and produce poor-quality milled rice (World Bank, 2014b). The mills often do not have the technology or capacity to mill export-quality rice. When the milled rice is refined for the export market, loss is high compared with the rice milled for domestic use. Upgrading the mills requires huge investments for owners but the credit facility for equipment loans is limited.

In 2013, there were 1,362 rice mills with more than 15 tons/day capacity that were registered across regions and states, making the country's total milling capacity reach 34,605 ton/day. Sixty-four rice mills were suitable for super 5% to 100% (grade A), 265 rice mills for 15% to 10% (grade B), 640 rice mills for 25%, and 393 rice mills for 35% brokens milling (*Table 12*). Of these, 348 rice mills were from 30 years to 64 years of age and 68 were more than 65 years old. These rice mills need to be upgraded or replaced with new ones to improve capacity and efficiency. Also, more rice mills need

**Table 12. Rice mills in the regions and states.**

Region/ State	A grade		B grade		C grade		D grade		Total	
	No.	Milling capacity* (ton/day)	No.	Milling capacity (ton/day)	No.	Milling capacity (ton/day)	No.	Milling capacity (ton/day)	No.	Milling capacity (ton)
Yangon	17	1,564	46	2,327	135	2,386	27	405	225	6,682
Ayarwaddy	15	635	124	3,860	268	6,110	180	5,049	587	15,654
Bago(east)	8	282	14	619	30	890	79	1,719	132	3,510
Bago(west)	16	479	34	874	48	943	55	859	153	3,155
Mandalay	-	-	-	-	21	315	-	-	21	315
Mon	-	-	2	45	30	562	-	-	32	607
Sagaing	8	416	45	1,203	62	1,074	48	1,049	163	3,742
Thanintaryi	-	-	-	-	-	-	4	70	4	70
Kachin	-	-	-	-	6	90	-	-	6	90
Kayar	-	-	-	-	39	780	-	-	39	780
Total Milling Capacity/day	64	3,376	265	8,928	640	13,150	393	9,151	1,362	34,605

Source: MRF, 2013 \* Milling capacity per day assuming 24 hr operation

to be built in strategic locations that will provide services, not only for milling and processing, but also for custom drying and storage services to farmers.

### **Inadequate infrastructure**

One of the biggest constraints to Myanmar's economic prospects is inadequate infrastructure in the rural areas.

Investment in irrigation was instrumental in boosting rice production in the 1980s. The MoAI, with its limited budget, had been doing its best to maintain and repair damaged structures. However, most of the polders that protected rice lands from salty water intrusion were damaged during cyclone Nargis and have yet to be repaired or rebuilt. There is a need to repair and dredge the main canals and build secondary and tertiary canals to easily bring water to rice fields. Moreover, drainage canals need to be built to minimize flooding in rice fields.

Connectivity in all its forms is important for the growth of the rice sector (Tin Maung Shwe and Volkes 2013) and in enhancing market integration (World Bank 2014c). Farm-to-market roads, as well as critical links between rural markets and urban centers, are not yet present in many of the villages, contributing to the high cost of transport and high losses. Digital connectivity and access to mobile phones is low in the rural areas. These are important in enabling farmers to gain quick and easy access to market information, while also providing a cost-effective means of improving extension.

Electricity supply in villages and townships is insufficient and has poor connectivity to the national grid. Ample supply of electricity is essential to digital communications and connectivity to support the introduction of other innovations, such as tube well irrigation, and the growth of agro-processing and manufacturing. Alternative sources, such as solar cells, can be tapped to power communication facilities and household appliances to improve the access of farmers to information about market prices and rice production technologies.

### **Uncertain security of land tenure**

Landlessness is a chronic problem in Myanmar. It is observed to be highest in the Delta and in the Dry Zone where agricultural potential and population density is highest (World Bank 2014b). In 2010,

the landless rate reached 38%, up from 34% in 2005 (IHLCA 2005). In 2012, it has increased to 50%, with the majority of the landless coming from the Ayeyarwaddy delta and the coastal zones (LIFT 2012).

The landless people are hired as agricultural labor but they had been seeking out non-farm jobs in other rural and urban areas or even abroad. In some areas, this has resulted in the increasing scarcity of farm labor, especially at peak periods. Farm labor may be particularly difficult to access for female-headed households, which comprise 15% of all agricultural households (Myanmar Census of Agriculture 2010). The lack of labor hinders the correct timing of planting, weeding, and harvesting, thus resulting in decreased crop yield and increased postharvest losses.

### **Paddy price volatility, contributing to low farmer income**

There are about 3.4 M rice farming families (FAO 2010) that are actively engaged in the rice value chain. Similar to other countries, the majority of rice farmers consists of smallholders and the resource-poor. Roughly one-third of rice farms is below 2 ha in size and another 30% is between 2-4 ha. Net income from rice production is 217 USD/ha in the monsoon and 227 USD/ha in summer (Department of Agriculture Unpublished data) which is not enough to support and pay the debts of farming families. The net annual income, estimated to be around 220 USD/year from one rice crop and 440 USD/year from two rice crops, is way below the USD 456 (1.25 USD/day) income limit set by World Bank for extreme poverty.

Rice price volatility between peak harvest time and slack seasons is a major impediment for small farmers. At peak harvest season, paddy rice price is low but farmers are forced to sell paddy because of the lack of drying and proper storage facilities and the need for cash to pay debts and cover the other needs of the family. During slack seasons, the price of rice is at its peak but smallholder farmers do not benefit from this as their rice had been sold immediately after harvest. The beneficiaries of price fluctuations at harvest and during slack seasons are largely the traders and millers that have the facilities to store rice and the capacity to wait for higher prices.

Rice types also dictate rice price variations (*Table 13*). Among the three rice varieties, farmers get the least price at wholesale market and at harvest time from Ngasein, compared to Ngakwe and Pawsan. Pawsan has the highest market price at 610,000 kyats<sup>13</sup> in the local market, two times more than Emata and Ngasein. However, Pawsan rice can only be planted in limited areas because of its long cultivation period and specific climatic fitness in the lower Ayeyarwaddy delta.

Over the medium term, rice price volatility needs to be addressed to encourage farmers to invest on inputs such as good quality seeds and fertilizers to produce higher yields, increase profitability of rice production and, at the same time, avoid huge impacts on exported rice.

**Table 13. Price gaps between wholesale price and price at harvesting time by rice varieties (USD/ton).**

Year	Ngakwe (whole sale price)	Pawsan (whole sale price)	Ngasein (whole sale price)	Ngakwe (price at harvest time)	Pawsan (price at harvest time)	Ngasein (price at harvest time)	Price gap in Ngak- we	Price gap in Pawsan	Price gap in Nga sein
2007	305	na	233	93	na	86	212	na	146
2008	375	603		121	498	112	254	105	127
2009	336	460	222	227	380	129	109	80	93
2010	407	444	270	308	366	172	99	78	98

Source: Dolly Kyaw & Hnin Yu Lwin, YAU; Rice Marketing and Transaction cost, ARDC

### Poorly integrated value chain from rice production to trade and market

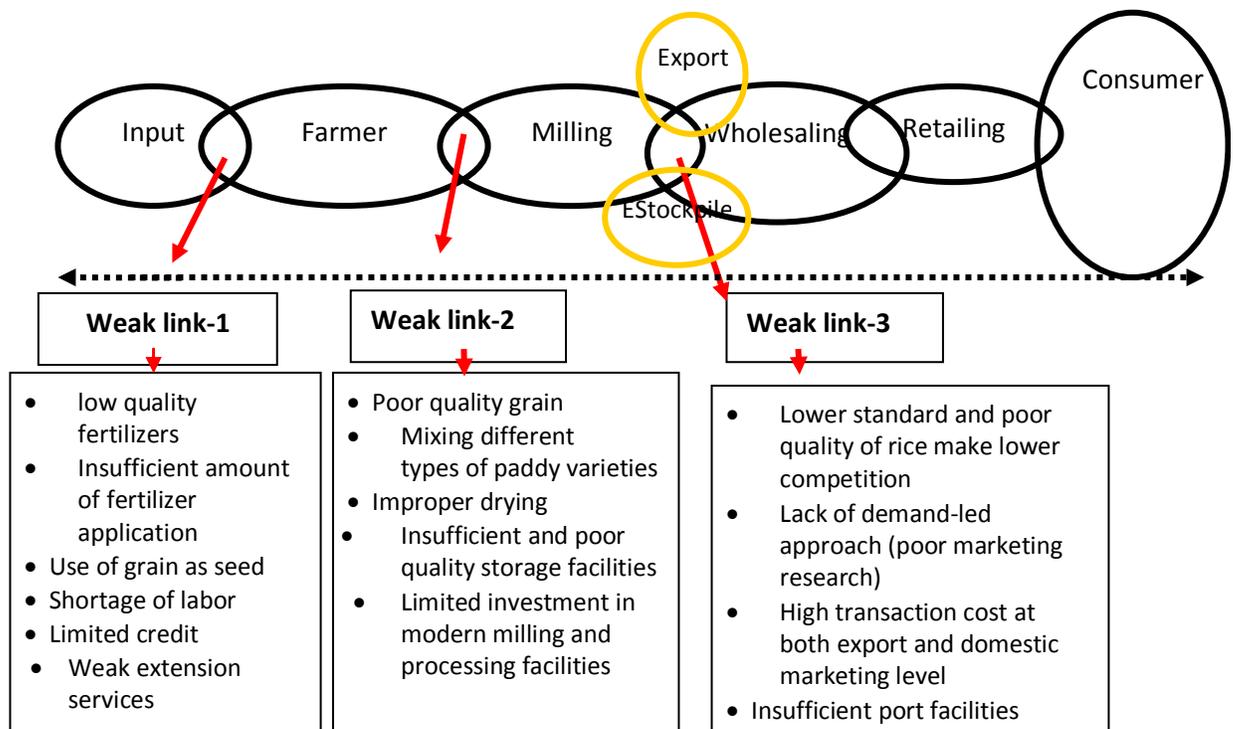
The weak links along the rice value chain (*Figure 8*) constrain productivity and profitability of the stakeholders in the rice sector (Tin Maung Shwe and Vokes 2013; Wong and Eh Mywe Aye Wai 2013). The weak link between the input supplier and farmer is found in the low quality of inputs such as seeds, fertilizers, and pesticides. Once harvested, rice is dried, stored, and/or transported to rice mills. Farmers, transportation providers, and, sometimes, village brokers are involved in these stages. The more remotely located farmer is served by more intermediaries, affecting the price of rice that he gets. The additional cost of transport is borne by farmers, as traders would account their transport cost in pricing.

<sup>13</sup>Paddy price is traditionally set for 100 baskets or about 2 tons

Millers are also burdened by the poor milling efficiency of their antiquated machineries, poor quality of the paddy, lack of storage facilities, insufficient and unstable supply of electricity to run mills, and the poor condition of farm-to-market roads. All of these suboptimal conditions contribute to low-quality products, low-priced milled rice, and high transportation costs.

Moreover, poor port facilities hamper rice exporters from attaining a good profit margin because of the lengthy time taken by stevedores in loading rice, especially during rainy season. There are also limited storage facilities near the port for rice to be stored while waiting for the loading and shipping schedule.

Finally, the lack of formal agreement on quality product assurance and import quota between Myanmar and other importing countries constrain the country from negotiating for a fair market price of rice.



**Figure 8. Weak links in the rice value chain**

Source: Tin Maung Shwe and Richard Volkes, *Enhancing Agricultural Productivity in Myanmar: Agenda for Reform*, CLMV Project Country Paper, ADB Institute, No.11, November 2013

## **Policies that hamper investments in the rural and rice sector**

The World Bank (2014b) stated that the successful value chain modernization and stimulation of farm supply response will ultimately hinge on the quality of rice policies. The government had made significant efforts to abolish various barriers to trade, but it is unclear how potential conflicts among export promotion, rice price stabilization, and food security objectives will be handled. These uncertainties hamper investments in the value chain, which in turn puts at risk Myanmar's export targets and eventually the sustainable development of the rice sector.

## **Opportunities**

### **Rich natural resources**

Myanmar is well endowed with natural resources, such as vast cultivable land, water resources, and generally favorable climate for rice production.

There are four major river systems, namely Ayeyarwaddy, Chindwin, Thanlwin, and Sittaung, which are major sources of water for irrigation. These river systems cover about 737,800 km<sup>2</sup>. The total estimated surface water potential in Myanmar is about 1,082 km<sup>3</sup>/annum and the total groundwater potential is estimated to be 494.713 km<sup>3</sup>/annum. There are altogether 11 different types of aquifers observed in Myanmar. Groundwater is extracted for domestic, irrigation, and industrial uses by means of deep tube wells and shallow and dug wells (Hla Baw 2013).

As of 2012, the country has 11.92 M ha of net sown area. It also has the potential to expand this area from 0.32 M ha of fallow lands and 5.37 M ha of cultivable waste land (MoAI 2013). Most of the agricultural land (8.02 M ha) is cultivated by small-scale farmers. As an initial step towards a more vertically integrated rice production system, the government is encouraging the development of modern large-scale rice farming by the private sector. These companies and associations in the private sector are granted the right to develop virgin land and fallow land for cultivation of paddy and other crops.

## **Rich diversity of traditional rice varieties with high branding and marketing potential**

Compared with other countries, Myanmar farmers use less amounts of chemical inputs, making the rice farm far less polluted while maintaining the diversity of the rice ecosystem at still high levels.

In the lower Ayeyarwaddy delta, farmers still grow traditional rice varieties and are less likely to apply inorganic inputs because of the high risks associated with flooding. This is also a distinct geographic area where the Pawsan rice, a high-quality variety and the “Best Rice in the World” awardee in 2011, is cultivated. This low-input farming practice can be encouraged to continue and used as an opportunity to add value to the rice produced by these farmers. Although yields are lower, Myanmar can put a positive spin to this by branding and selling its rice as a “green and safe rice grown with natural rice-farming methods.” Consumers are becoming more discerning and concerned with the quality of food they eat because of increasing incomes, particularly in Asia, where rice is a staple food of the majority of the people. Also, Europe is a big market waiting to be tapped for “green rice.”

## **A fast growing private sector that is actively engaged in the rice value chain**

Significant changes have also been taking place in this area in Myanmar in recent years. In 2009, the Myanmar Rice Industry Association (MRIA), now known as the Myanmar Rice Federation (MRF), was established with 44 Rice Specialization Companies (RSCs) as members to improve coordination in the industry. Under the supervision of the MRIA, the Myanmar Paddy Producers Association (MPPA), Myanmar Rice Millers Association (MRMA), Myanmar Rice & Paddy Traders Association (MRPTA), and the RSCs work together to ensure effective paddy and rice marketing for both the local and export markets (MRF 2014b).

The public sector also cooperates with the private sector in setting a minimum rice buffer stock for emergency food supply during natural disasters and to stabilize the domestic rice market if the price becomes unusually high or low in the global market. Currently, a few private companies have started providing farm mechanization rental services to increase production and reduce postharvest losses. The private sector is also heavily involved in the fertilizer and pesticides industry.

## **Strong potential for increasing rice yield and producing quality rice**

The national average rice yield of 3.84 tons/ha is still low considering the potential yield that can be achieved when farmers would plant good-quality seeds of high-yielding varieties and apply improved crop management practices. The MoAI has recently introduced hybrid rice varieties for cultivation during summer cropping in irrigated areas to further boost rice productivity. Hybrid varieties can increase yields and provide economic benefits to farmers (Jiming Li, Yeyu Xin, Longping Yuan 2009). These hybrids, together with inbred high-yielding varieties and high-quality traditional varieties, offer a vast selection of germplasm that farmers can choose from, depending on their environment and capacity.

Rapid development in information and communication technology offers a number of options for the government to develop good extension and communication strategies, in addition to current extension ones. Training extension staff is crucial and, thus, the government needs to invest in honing their skills and providing logistical support to motivate them to become effective in providing timely and sound crop management advice to farmers. Also, the government must invest on training farmers for them to learn new technologies and develop their management skills to become highly productive and profitable.

Some farmers already produce high-quality aromatic rice, such as Paw San, and more can be produced to capture higher value segments of the market (World Bank 2014). In Asia, the rapid economic growth and increase in the income of consumers are leading to the emergence of a new market for safe, high-quality rice. Moreover, Europe has opened its doors by giving preferential treatment to Myanmar rice through the “Everything but Arms” Agreement.

## **Strong interest and presence of international development and funding institutions**

The international community of donors and development institutions has converged in Myanmar to help the country develop its agricultural sector and alleviate poverty among rural households that depend on rice for livelihood. However, to effectively utilize resources and harmonize development efforts, Myanmar has to lay out its programs and plans for agricultural development. Developing

a country strategy to develop the rice sector can help donors align their investments for more positive impacts on the rural poor.

### **Increasing demand for rice in the international market**

As reported by the US Department of Agriculture (USDA), the international rice market has expanded sharply over the last several decades (*Table 14*). The USDA recently reported that world rice trade jumped by 3 M tons in 2012 to over 39 M tons (World Bank 2014b).

**Table 14. World rice trade ( Million mt).**

Decade	Quantity
1970s	8.8
1980s	11.9
1990s	18.2
2000s	27.0
2010	31.5
2011	36.2
2012	39.2
2013	38.3

*Source: USDA February 2014*

The global demand for rice, using population projections of the United Nations and the Food and Agricultural Policy Research Institute (FAPRI), is estimated to reach 496 M mt by 2020 and will further increase to 555 M mt by 2035 (GRiSP 2013). This is equivalent to an average growth rate of approximately 1% per year relative to the total consumption of 439 M mt in 2010 (FAO 2014).

These global rice demand projections are good signals for Myanmar to develop its rice sector to gain a significant share in international trade. By 2020, China is expected to import 4 M mt of rice. Being a close neighbor, Myanmar has a natural advantage to be able to respond to this demand through formal and border trade.

The EU has likewise offered an incentive for Myanmar to enter the European market to sell high-quality rice. As of July 19, 2013, the EU restored duty-free imports to Myanmar under the “Everything but Arms Agreement”, retroactive to June 13, 2012 (Wong 2013). The Agreement’s waiver for milled rice at current exchange rates is worth US\$235 per ton (€175). Also, the rising demand for rice in Africa gives Myanmar the signal to continue its increasing trade with the region for 25% white broken and to diversify its products towards high-quality white rice and parboiled rice which are in demand among African consumers (MRF 2014).

### **Government willingness to create a positive policy environment favoring a market economy**

In March 2012, the Myanmar parliament passed two new land laws, namely the Farm Land Law and the Vacant, Fallow and Virgin

Land Management Law. While land ownership remains vested in the state, the Farm Land Law enables farmers to use the land use rights certificate as collateral for loans. With this certificate, farmers can also sell or transfer their land use rights (Farm Land Law 2013). Although clearly intended to encourage farmers to invest more in crop production, there has been growing concern that the new law is undermining the security of tenure of small farmers. The Vacant, Fallow and Virgin Land Management Law allows individuals and private companies awarded with vast tracts of land to undertake large-scale and modern farming.

In December 2012, the Government released the Framework for Economic and Social Reforms (FESR), which embodies the policy priorities for 2012-2015 toward the long-term goals of the National Comprehensive Development Plan (NCDP) (MNPED 2012). The priority areas are finance and revenue, relaxation of restrictions on trade and foreign investment, development of the private sector, education and health sectors, food security and development of the agricultural sector, transparency in government, the mobile phone and internet systems, and development of the basic infrastructure.

Recognizing the importance of good policies to attract investments in the rice sector, the government initiated economic reforms



Myanmar targets production for domestic use and export.

and policy adjustments in the agricultural sector that triggered a significant increase in rice exports. These include 1) reducing the export tax from 10% (8% commercial tax and 2% income tax) to 2%; 2) unifying the official and parallel currency markets; 3) dropping the requirement that exporters maintain 50% of the rice in stock for which an export license is sought; and 4) removing priority privileges from RSCs in the issuance of export licenses.

### **Ideal geographic location for serving the Asian and global rice markets**

Myanmar shares borders with five countries in Asia, namely Thailand, Bangladesh, India, Laos, and China. India and China have the largest populations in the world and would require large amounts of rice imports to augment domestic rice production. Other markets outside the region, such as Europe, have also opened up for Myanmar rice by offering a preferential treatment in the “Everything but Arms” agreement. Africa will continue to be a large market for Myanmar rice. Myanmar can also exploit its strategic geographic location as a point-of-origin for rice exports as well as a transit point for exported rice to other parts of the world. However, investments in infrastructure, such as port facilities, good roads, and communication and electricity networks, need to be in place to reduce transaction costs and enhance logistics efficiency.

# Scope of the Myanmar rice sector development strategy

## Vision

Given the above challenges and opportunities, the vision for Myanmar is by 2030 to comprise “food-secure farmers and consumers enjoying the economic benefits provided by a transformed, dynamic, environmentally sustainable and internationally competitive rice sector.”

The ultimate goal of the rice sector is to achieve an overall food-secure society and for smallholder farming households in rural areas to triple their income derived from rice and rice-based farming and enjoy decent standards of living comparable to urban dwellers. Sustainable rice intensification using efficient and effective natural resource management for higher rice productivity and profitability will be the cornerstone in achieving this goal by 2030. It is envisioned that the future rice system will be highly market-oriented rice production where the farmers and the private sector are actively engaged in a transparent and vertically integrated rice value chain.

It is also envisaged that the government will lay down the foundation for a level playing field in the industry through the implementation of well-coordinated programs and sound policies that offer incentives to the private sector and foreign companies to invest in rice sector development. Development in the rice sector is foreseen to be the cornerstone in “building a progressive agriculture sector that will propel economic development in other sectors and eventually transform Myanmar into a modern, industrialized nation.”

Achieving this vision does not only benefit Myanmar as a nation. A progressive Myanmar rice sector will significantly contribute in achieving food security in the region, especially in times of disasters and natural calamities.

Myanmar is in transition and the time is ripe to lay down the foundation for the development of the rice sector in particular, and the agricultural sector in general. The 15-year time frame to fully implement the Rice Sector Development Strategy, starting in 2015, is reasonable to build up the capacity and skills of the human capital, improve existing and build new infrastructure, reform or formulate relevant policies and programs to attract investments in the sector,

and establish relevant institutions that will pave the way toward achieving a modern agricultural nation. Technological innovations in agriculture, including those in information and communication, need to be harnessed to enhance the farm management skills of Myanmar farmers.

Myanmar can learn from the experiences of its neighbors that had been faced with similar challenges and issues in their respective rice sectors.

## Targets

The main target is to produce the domestic requirement of Myanmar and meet the required rice surplus for export. By 2030, milled rice production must reach 10.13 M mt for local food consumption and at least 6 M mt for international trade. This will be achieved by maintaining 7.70 M ha of rice area, with an average yield of at least 4.20 mt/ha per cropping season.

## Strategic objectives

The five strategic objectives listed below will guide the key themes and actions in achieving the vision for the rice sector. These objectives are not independent of each other but complementary and necessary to achieve the vision by 2030.

### **Objective 1: Increase rice productivity and improve rice quality and nutritional value**

Increase productivity through cropping intensification and sustainable resource management. Improve rice quality and nutritional value to ensure food security and enhance Myanmar rice's competitiveness in the international market.

### **Objective 2: Adapt to,/mitigate the effects of, climate change and reduce risk, while protecting the rice ecosystems and environment**

Improve the adaptation to climate change of, and mitigate the effects of climate change on, rice farming. Enhance the farmers' capacity to cope with risks from climate change. Minimize the environmental impacts of rice farming and conserve the diversity and richness of the rice ecosystems. Preserve Myanmar's rice heritage and culture.

### **Objective 3: Promote Myanmar rice as a quality brand and enhance competitiveness in international trade**

Improve food quality and safety, promote competitiveness and fairness in domestic and international market, and provide equitable access for all consumers.

### **Objective 4: Improve the well-being and capacity of smallholder farmers, including women, youth, and children**

Improve the well-being and capacity of smallholder farmers, including women and children, by improving adjustments to long-term changes in demography, farm size, and labor supply.

### **Objective 5: Enhance efficiency in the rice value chain and reduce postharvest losses**

Reduce weaknesses along the rice value chain to improve efficiency and minimize postharvest losses to increase rice production while improving food quality.

## **Key themes and interventions**

This section will discuss the key themes and interventions and how these can contribute to the achievement of the objectives of the rice sector. The linkage between objectives and themes is summarized in Table 15. The major linkage by a key theme to a specific objective is signified by the capital letter "X" in bold front. Linkages with other objectives are shown by the lower case letter "x".

### **Theme 1. Ensure sustainable increase in rice productivity**

Myanmar's harvested rice area measured about 7.5 M ha in 2011-2012 and decreased to 7.2 M ha in 2012-2013 (DRP 2013). The majority of these areas has low cropping intensity, with yields lagging behind those of other countries. The potential to intensify cultivation and improve productivity is thus high with the expansion of irrigation and drainage facilities. Myanmar's irrigated area is barely 20% of its total area, hence, most rice areas are planted only once a year. This problem is compounded by the suboptimal performance of the irrigation facilities as most of these need repair and regular maintenance, including the dredging and cleaning of main canals that are full of silt and weeds. Secondary and tertiary canals also need to be constructed to facilitate delivery of water and the drainage of rice fields when floods occur. Low yields are attributed

**Table 15. Matrix of linkages between key themes and objectives.**

Key Themes	Objectives				
	1	2	3	4	5
1 Sustainable increase in rice productivity	X	x	x	x	x
2 Increased practice of farm mechanization	x		x		X
3 Adaptation to,/mitigation of the effect of, climate change and capability improvement to cope with climate change risks	x	X		x	
4 Efficient utilization and sustainable management of natural resources	X	x	x	x	x
5 Reduction of postharvest losses and value chain improvement	x	x	x		X
6 Improvement of credit schemes for farm investment	X	x	x	x	x
7 Capacity building	X	x	x	x	x
8 Sound policy environment to increase investment in agriculture	x	x	x	x	X
9 Quality control and safety	x		X		x
10 Rice research and development	X	x	x	x	x

**Mission (Objectives):** 1. Increase productivity, improve quality and nutritional value; 2. Adapt to/mitigate the effects of climate change and reduce risk, while protecting the ecosystems and environment; 3. Promote Myanmar rice as a quality brand to enhance competitiveness in international trade; 4) Improve well being and enhance capacity of smallholder farmers, Tincluding women and children; and 5. Enhance efficiency in the rice value chain and reduce post-harvest losses.

to the use of low-yielding traditional varieties, poor-quality seeds, suboptimal fertilizer and pest management, and high postharvest losses.

Intensified yet sustainable rice production is possible as there are available high-yielding varieties (improved traditional, high-yielding inbred, and hybrid rice) suitable for the unique agro-ecological environments in the country. Better pre- and postharvest options are also available and can be promoted to farmers through an effective extension and delivery system.

However, intensification of rice cultivation will entail the application of more inorganic inputs and double cropping, resulting in higher

demand for irrigation water and more intensive use of the land. The rice farmers still use lesser chemical inputs for rice production, but with the opening up of the market and the increasing visibility of chemical companies, it is likely that pesticide use will rise; hence, the need to properly educate and train farmers on sustainable pest management. It is imperative that Myanmar avoid the same pitfalls experienced by other countries as a result of abusive and intensive pesticide applications.

Sustainable increases in rice productivity will be achieved through the following interventions: 1) accelerated expansion of irrigated rice areas and improvement of services and management of irrigation systems; 2) development and promotion of varieties that are appropriate to the rice environment and market demand; 3) provision of sufficient supply of good-quality seeds; 4) ensuring of the adoption of good-quality seeds, fertilizers, pest management and other integrated crop management practices; 5) strengthening of the delivery of extension services; and 6) sustaining of research on, and development of, rice varieties and crop management options. These interventions aim to increase productivity, improve cost-efficiency and competitiveness, and optimize income from rice farming.

### **1.1 Accelerate expansion of irrigated rice areas and improve irrigation services and the management of irrigation systems.**

This intervention aims to increase the irrigated rice areas that can be double-cropped by boosting investments to improve the efficiency of current systems, build new irrigation projects, and enhance the capacity of water users to manage irrigation facilities and raise system efficiency.

**1.2 Breed and promote high-yielding and stress-tolerant rice varieties appropriate to the farmer and market preferences and suited to the different rice environments.** Myanmar has a rich diversity of rice varieties suitable for different rice-growing environments such as irrigated lowlands, rainfed lowlands, uplands, and the stress-prone areas. Breeding for high-yielding varieties appropriate for these rice environments will be strengthened and focused on good grain quality demanded by the market. The initial array of such varieties released by the Department of Agricultural Research (DAR) will be added to. Stress-tolerant varieties will be promoted in submergence-prone (flooded from 4 to 14 days), salinity-prone, and drought-prone rice fields. In deepwater areas and in areas where there is prolonged flooding, farmers will be advised to plant the tall, traditional varieties. Varieties that are highly demanded



**Government targets expanded irrigation, and improved irrigation services.**

in the market will also be promoted to farmers. Hybrid rice will also be strategically promoted in the irrigated rice areas, particularly during summer cropping.

**1.3 Provide adequate supply of breeder, foundation, and registered seeds to ensure the proliferation of private suppliers of certified and good quality rice seed.** This intervention is most critical and will be the first priority for quick action from the government.

The following actions will be prioritized to facilitate the sufficient and timely supply of good-quality seeds:

- a) Improve the facilities and performance of seed farms
- b) Form a seed network composed of government breeding institutions, seed farms, private seed companies, and organized farmer seed groups and strengthen linkages among these groups
- c) Improve/upgrade the facilities and services of the Department of Agriculture-Seed Division to strengthen seed certification activities
- d) Accredite seed producers from the private sector and organized farmer groups to increase the volume of available quality seeds

- e) Train seed inspectors and seed producers
- f) Implement the Plant Variety Protection Law, Seed Policy, and the Seed Law
- g) Establish additional seed laboratories in strategic locations
- h) Develop and promote alternative quality seed production systems in remote villages
- i) Maintain a buffer seed stock to ensure the availability of quality seeds during disasters

**1.4 Ensure the supply and adoption of good-quality seeds, appropriate fertilizer and pest management alternatives, and other integrated crop management practices.** This intervention aims to raise yield through a wider adoption of integrated and locally adapted crop management practices. An integrated approach to crop management takes advantage of the synergy that each option can provide in boosting yields. Farmers will be encouraged to adapt these options to fit their actual farming conditions and management capacity.

Among the crop management options, the most critical areas to be improved are fertilizer and pest management. The current application rates of farmers are way below the optimal rates needed for high rice yields. Hence, demonstration trials and promotion of efficient fertilizer management will be a priority activity of the extension staff. Credit will continue to be made available to enable farmers to buy and use the correct fertilizers at the correct amounts and at the times their use will result in optimal yields. The promotion of integrated pest management will be intensified to train farmers on environment-friendly practices such as harnessing natural enemies for pest management and minimal and judicious use of pesticides.

To ensure the quality of traded fertilizers and chemical inputs, the following activities will be undertaken:

- a) Encourage the private sector to engage in the fertilizer marketing
- b) Accredite and certify fertilizer and pesticide dealers
- c) Establish fertilizer and pesticide-testing laboratories in strategic locations
- d) Implement the Fertilizer and Pesticide Law

- e) Strengthen the DoA-Plant Protection and Land Use Divisions as fertilizer and pesticide regulatory offices of the government tasked to accredit, certify, and monitor fertilizer and pesticide dealers

### **1.5 Strengthen technology delivery and extension services.**

Strengthening extension services aims to enhance the adoption of technologies and provide an avenue for farmers to learn and innovate to make these technologies fit their farming conditions. Many technologies are generated by research institutions based on general scientific principles. Recently, the private sector had been active in generating and promoting technologies which need to be adapted to local conditions to make them more suitable to specific conditions in the various rice-growing areas and acceptable to farmers. A participatory and inclusive approach to assess priority constraints and adapt technologies to local conditions will be undertaken.

This intervention will be approached in two stages.

- a) To strengthen the extension network and delivery system
  - i. Strengthen research and extension linkage
  - ii. Recruit new extension staff, proactively reaching out to women, to achieve a near optimum extensionist-to-farmer ratio and ensure gender equity among extension staff
  - iii. Develop a critical mass of well-trained subject matter specialists and extension agronomists
  - iv. Conduct training activities on participatory approaches in working with farmers, women and men, on new rice technologies and updates to upgrade knowledge, and on enhancing facilitation skills of subject matter specialists and extension agronomists
  - v. Adapt the farmer field school approach and develop other extension modalities/approaches to fit the technological and information needs of farmers, paying particular attention to the diverse needs and constraints that different people, including women, youth and ethnic minorities, may have
  - vi. Establish a Myanmar Rice Academy that will serve as a central training facility and information and knowledge hub for rice specialists and farmers

- vii. Strengthen the farmer channel to achieve a broader viewership
- viii. Develop IT-based extension platforms
- ix. Provide sufficient support in terms of budget, equipment, and extension tools and mobility of field staff
- x. Develop a national extension and delivery platform to validate, adapt, and integrate new technologies in rice production and rice-based farming systems
- xi. Develop a market information system to provide real-time information and advice to farmers on rice prices and varieties in demand
- xii. Explore opportunities for private sector driven extension support

*b) To enhance the capacity and skills of farmers*

- i. Demonstrate best management practices in the villages through participatory and socially inclusive approaches
- ii. Conduct training of farmers, women, men and youth, using an adapted farmer field school approach
- iii. Provide effective extension materials on new varieties and best management practices in rice production and rice-based farming systems
- iv. Conduct field visits and cross-learning activities in government-established demonstration farms and in private farms

## **Theme 2. Increased utilization of farm machineries**

Farm mechanization plays an important role in improving the quality of paddy and reducing postharvest losses. The scarcity of labor during transplanting, weeding, and harvest time results in losses, both in the quantity and quality of the rice output. Raising farm efficiency, lowering unit costs, and reducing postharvest losses will increase rice production and thus the profits of farmers. Increasing mechanization in the farms will be achieved through the following interventions:



Strengthening extension services will give farmers access to technologies that help increase their rice yield.

**2.1 Promote the provision by government of public infrastructure that enables the implementation of appropriate mechanization strategies and the adoption of mechanization by farmers.** The average farm size in Myanmar is still big, especially in the Delta, which makes mechanization a viable option for increasing the efficiency of farm operations in view of the decreasing availability of farm labor and the increasing cost of hired labor. The government will build farm and village roads to make the farms and villages accessible to farm machinery and for products to be easily transported to markets.

**2.2 Create a policy environment that encourages consolidation of small farms and fields to achieve a cropping synchrony and farm size suitable for mechanization.** A land consolidation policy will be formulated and implemented to support and facilitate the consolidation of small farms into field sizes suitable for mechanization. The policies will consider the social impacts of land consolidation and ensure that rights and ownership of farms are upheld. Smallholder farmers will be organized and encouraged to synchronize their crops and grow the same varieties so that harvesting and other operations can be mechanized easily. Another option can be the actual consolidation of several smaller fields using laser assisted land leveling to increase field sizes that are suitable for mechanization

**2.3 Encourage the acquisition of farm machinery by farmers and organized farmer groups.** Information and advocacy campaigns on farm mechanization, especially the ways of achieving it and the benefits that can be derived from it, need to be intensified and made to reach as many farmers and farmer groups as possible. These campaigns should involve both information dissemination and the implementation of demonstration farms that showcase how farm machinery can make farm operations less costly and more efficient.

**2.4 Implement policies that encourage the private sector to provide custom services at affordable rates for operations such as land preparation, leveling, transplanting and harvesting, threshing, drying and storage to farmers.** This can be done by developing enterprise specific business models of contract service provision and piloting these with first adopter service providers. Service providers can also be provided complementary skills enhancement support such as training on the organizational, financial, and management aspects of operating an enterprise that provides custom mechanized services. Tax incentive can likewise be offered to them.

**2.5 Establish a credit facility with loan equity to enable private sector groups and farmers to buy farm machinery and assist service providers to develop viable business models.** The Myanmar Agriculture Development Bank (MADB) is undergoing restructuring to expand its crop loan portfolio to include agriculture machinery loans. It will be sought to provide training to farmers and farmer groups to enhance their skills in business operation and management.

**2.6 Provide support to local agricultural machinery and tool manufacturers.** An assessment of the local agricultural machinery and tool industry will be conducted with the objective of identifying manufacturing potential, problems and support needs. Capacity building measures in manufacturing processes, workshop organization and management, and financial management will be designed and implemented, either in Myanmar or with suitable partners abroad. Local manufacturers will also be assisted in sourcing suitable technologies based on farmers needs and in ensuring that their own innovations improve the quality and performance of the technologies.



Support towards increased accessibility and use of machineries will be implemented.

### **Theme 3. Reduce risks to natural disasters, mitigate/adapt to climate change effects, and enhance capacity of farmers to cope with risks**

To cope with the impacts of natural disasters and climate change, the National Adaptation Program of Action (NAPA) has outlined the priority thrusts that include: 1) adoption of locally relevant technologies; 2) crop diversification in rice-based systems; 3) promotion of diversified and intensified home gardens through solar-power technology and of the cultivation of high-income fruit crops; 4) promotion of climate-smart agricultural approaches; 5) sharing of climate-resilient rice varieties; and 6) ex/in-situ conservation of plant genetic resources.

A comprehensive climate change adaptation strategy in agriculture is yet to be developed. In the interim, interventions will be taken to reduce the risks of farmers and communities to natural disasters, mitigate/adapt to climate change effects, and enhance farmers' capacity to cope with risks.

**3.1 Develop and promote high-yielding and stress-tolerant varieties, improve the quality and yield of traditional varieties, and develop climate-smart management options for stress-prone environments.** Collaboration with international research institutions such as IRRI will be pursued and sustained to enhance

research and development efforts on new varieties that are tolerant of single-stress and multi-stress environments. Moreover, efforts will continue to incorporate stress-tolerant genes into popular varieties of exported rice. Research and development will likewise be sustained to develop climate-smart crop management options for stress-prone areas.

**3.2 Develop and promote high-yielding and stress-tolerant varieties combined with climate-smart management practices through demonstration, training, and other appropriate extension modalities.**

In the participatory variety selection trials of IRRI in the delta, dry zone and in Rakhine coastal areas, a number of high-yielding varieties tolerant of submergence (4-17 days), salinity, and drought have been selected by farmers (IRRI 2013). Best management and climate smart practices for these stress-prone rice ecosystems have also been developed with farmers. Seeds of these varieties will be produced by the government and other seed producers. These varieties, coupled with the best management and climate smart practices, will be promoted to other parts of the country by collaborating with partners in the field, including non-government organizations and the private sector. In the drought-prone areas, Alternate Wetting and Drying (AWD) is one options that can be promoted to save water and reduce pumping costs.

**3.3 Promote the cultivation of “special traditional rice varieties” with natural tolerance for deep water, prolonged flooding, or drought.**

In the flood prone areas in the delta region, indigenous special rice varieties planted in local areas will be selected and tested



**Stress-tolerant rice varieties, grown in participatory varietal selection trial plots in the delta, were selected by farmers and will be promoted to other parts of the country.**

with locational demonstration plots. The seed of selected traditional varieties will be multiplied under the certified seed program and distributed to the adapted areas. Similarly, adaptation research on drought-resistant varieties will be extended in DAR and the seeds of the subject varieties will be distributed in the drought areas of the central dry zone.

**3.4 Promote diversified farming systems.** In the rainfed and upland rice areas, diversified rice-based systems will be promoted to ensure sufficient food at household level and to reduce the risks due to effects of disasters and climate change. Diversified farming systems espouses the integration of various crops, livestock, fish (when possible), and permanent crops to provide more diversified food sources, increase income, and enhance diversity in the farm.

**3.5 Develop seed systems to conserve, multiply, and promote sharing and exchange of traditional and, if applicable, modern varieties in remote areas.** Community-based seed systems will be established to promote seed exchange and encourage farmers to plant traditional and modern varieties. Protocols for the selection and purification of these varieties, and the collection and storage of the seeds these varieties will be developed and taught to farmers.

Farmers planting modern varieties located in vulnerable or high-risk areas will be linked to the seed network in the regions or states so they can readily access seeds in case they lose their crops.



**A diversified farming systems demonstration farm promotes the integration of various crops, livestock, fish, and permanent crops.**

### **3.6 Conduct awareness campaigns and education programs and strengthen weather information delivery and early warning systems.**

Awareness campaigns and information-sharing programs on climate change effects and impacts and on mitigation/adaptation strategies will be conducted. Education programs that enhance the capacity and skills of farmers to cope with natural disasters will be undertaken in close collaboration with other relevant government agencies, nongovernment organizations, and development partners. Coordination between the MoAI and the Department of Meteorology and Hydrology will be strengthened to facilitate the timely delivery of information on weather and of early warning on weather disturbances.

### **3.7 Map areas vulnerable to floods, salinity, and drought to identify and plan adaptation measures.**

In collaboration with international development partners, mapping of the high risk and vulnerable areas will be done for better planning and targeting of interventions, implementation of mitigation and adaptation measures, and quick identification of areas needing emergency relief and support during natural disasters and calamities.

## **Theme 4. Efficient use and sustainable management of natural resources**

Myanmar is endowed with vast, fertile lands and abundant water resources. Compared with those of its neighboring countries, its land and water resources are not yet overexploited. The rice fields are still rich in diverse species and continue to provide ecosystems services to farming communities. With the rapid pace of development in agriculture, the entry of commercial large-scale farming, the development of other industries, and the increasing demand of people for housing and domestic uses, these resources will soon be depleted if not properly used and managed sustainably.

The improper and excessive use of pesticides and, particularly, insecticides will destroy the diversity and balance of the rice ecosystem and encourage the resurgence of insect pests such as plant hoppers. It is also expected that more chemical fertilizers will be applied. The over-application and improper timing of fertilizer application can lead to ground water contamination and higher greenhouse gas emissions. These are problems already observed in other countries and Myanmar need not experience the same if its farmers are well-informed and knowledgeable and adopt the best practices in managing natural resources and farm inputs.

The efficient use and management of natural resources and the implementation of sustainable pest management practices will sustain

high crop yields and conserve these for the future generation of farmers. The following interventions will be implemented to achieve better resource-use efficiency, reduce the environmental footprint of rice production, and preserve ecosystems services of rice fields to farmers and communities.

**4.1 Effectively manage irrigation systems, improve irrigation services, and promote participatory water management involving farmer users and irrigator groups.**

The systematic management and efficient use of surface and ground water will be promoted to maintain both water quantity and quality. Damaged irrigation systems will be rehabilitated, including the renovation of supply and drainage canals, with support from funding institutions. The maintenance and management of irrigation systems, as well as the allocation of irrigation water will be implemented following participatory schemes to inculcate ownership among communities and water-user groups.

**4.2 Promote the use of efficient water management technologies.**

Improved on-farm water management will enhance water-use efficiency without reducing crop yields. The use of water-saving technologies (e.g., alternate wetting and drying or AWD), repair of field bunds, cleaning of canals, and use of water impounding techniques will be promoted to enhance adoption by farmers. AWD will be complemented with good weed management practices to prevent yield loss due to weeds.

**4.3 Promote soil conservation practices in hilly and upland areas.**

Sloping land agriculture technologies such as contour plowing, terracing, use of hedge rows, and agroforestry will be promoted in the hilly and upland farming communities.

**4.4 Maximize the use of farm wastes and locally available biomass,** including non-burning rice straw and other farm and livestock wastes, as well as green manure, as organic fertilizers.

**4.5 Promote efficient nutrient management through proper application and timing.** Fertilizer will be applied at the right time and at the right amount to increase fertilizer-use efficiency and minimize costs.

**4.6 Promote integrated pest management practices and develop a framework on the appropriate use of pesticides to conserve the biodiversity of rice ecosystems.** Integrated pest management will be the approach for sustainable pest management and the production of “safe rice” for domestic consumption and export. A framework on the appropriate use of pesticides will also be developed and implemented. This framework will include

registration of pesticides; accreditation of dealers; and training of dealers, extension and Plant Protection Division staff, and farmers on the safe and judicious use of pesticides.

**4.7 Generate maps on rice-growing environments, soil fertility, and cropping patterns.** Better targeting of suitable varieties, fertilizer recommendations, and other crop management options will be achieved with the availability of resource maps.

## **Theme 5. Postharvest loss reduction and value chain improvement**

The rice value chain is largely traditional in nature and involves many stakeholders. The adoption of mechanized operations, such as harvesting, threshing, and drying, is low and this results in large losses and low quality in milled rice. Improving the efficiency and quality of postharvest operations aims to reduce postharvest losses and improve the quality of the rice output, which will result in increased production of rice for domestic and export markets. The following interventions will be undertaken.

### **5.1 Upgrade existing mills or acquire new units to bolster efficiency, lower unit costs, and improve milled rice output.**

As milling facilities require sizeable amounts of investment from operators, this intervention will be implemented with a parallel credit facility from the financial sector. Loans will be provided to upgrade older mills or to acquire new milling systems, including rice mills, warehouses, mechanical dryers, and other milling facilities. A formal credit system with appropriate incentives to borrowers will be revitalized.

### **5.2 Improve existing infrastructure and build new ones to facilitate connectivity.**

Road networks, bridges, ports, information and communication networks, and electricity are crucial for the improvement of the value chain. The MoAI will collaborate with concerned line ministries and departments in the government and with international funding institutions to fast-track and prioritize the upgrading or building of the needed infrastructures in the rural areas to facilitate the transport of products from farms to processing zones and markets.

### **5.3 Collaborate with line ministries to establish formal agreements with rice-importing countries.**

More than half of the rice exports to China flows through Myanmar's borders without a formal importation agreement existing between the two countries. As a consequence, rice is sold at low prices, imposed with high tariffs, and remain unrecorded in the country import data. The MoAI, in partnership with the Ministry of Commerce (MOC), will expedite the

processing of bilateral sanitary and phytosanitary (SPS) agreements with China to ensure that Myanmar gets a fair price for its exported rice according to the WTO Rules. Parallel to this, farmer organizations will be strengthened to enable them to link with rice-exporting companies or directly export rice themselves.

**5.4 Establish wholesale rice markets.** Wholesale rice markets will be established in strategic sites in major growing regions to allow farmers and millers to directly sell their rice to traders and millers. This will facilitate healthy competition and compliance with quality standards.

**5.5 Conduct aggressive market research and product development.** Research for quality rice and rice-based products will be done to expand and diversify markets for Myanmar rice. In the short term, efforts will be focused on high-quality white and parboiled rice, fragrant rice such as Pawsan, and other traditional rice varieties. Research on new innovative products that make use of rice as a major ingredient will be undertaken for added value. Parallel development in the facilities, human resources, and industry dynamics will be initiated in the long term. The government's trade promotion offices and the private sector will conduct proactive and systematic research and matchmaking of traditional and novel products in the international market.

Research and product development will be initiated with the Yezin Agricultural University (YAU), MoC, MRF, and the private sector. The grain quality laboratory at DAR will be upgraded to strengthen grain quality testing and research for high-quality rice. Similarly, the breeding activities of DAR will focus on developing varieties with high yield and good-quality grain demanded by consumers and markets. A rice chemistry and rice-based products laboratory will be established at YAU for the development of new rice and rice-based products for local and export markets. A systematic targeting of markets for current products and shifting focus to high-quality rice, and eventually new products, will be done to prepare the short-term, medium-term and long-term investments on human resources, facilities, and institutions.

**5.6 Provide more information to market participants.** Timely and accurate market information provided by the government on production, consumption, exports, prices, and stocks will facilitate the smooth operations of the rice market and will enable sound policy decision-making. Data gathering from the field on production and consumption will be improved and strengthened in collaboration with partner institutions such as the FAO and IRRI. Intelligent market information will be gathered and disseminated in a timely manner in collaboration with MOC and MRF.

## **Theme 6. Improve credit scheme and availability**

Farm mechanization and fertilizers use are low in Myanmar because most farmers are smallholders and lack enough capital to buy these on their own. To bolster the mechanization of farm operations and increase the use rates of fertilizers, the current formal credit scheme will be improved. The following interventions will be implemented:

### **6.1 Improve current credit scheme for smallholder farmers.**

The current credit scheme for farmers to avail of agricultural loans will be strengthened by improving the loan repayment terms and expanding loan coverage to include the purchase of small farm machinery and equipment. Access to credit for women and youth farmers will also be facilitated and strengthened. Moreover, the government is fast-tracking the release of land rights certificates so that farmers can use these as collateral for agricultural loans.

**6.2 Improve the credit scheme for the private sector.** The private sector has played a significant role in providing services to farmers and in the marketing of rice. This role will be enhanced to enable the private sector to facilitate a more vertical integration of the rice value chain. The credit facility for the rice companies and other players in the private sector will be improved by lifting the rules limiting maturity of commercial loans and broadening the type of assets that can be pledged as collateral to access credit. More financial services to agriculture and agribusiness will be provided by the government and banking sector to comply with good international practices.

## **Theme 7. Capacity building**

Human resources are valuable assets of the country that need constant development to improve productivity in the agricultural sector. Government will prioritize its investments on human capacity building by providing more opportunities to rice scientists and agricultural and extension staff for degree and non-degree training in local and international learning institutions and universities, in collaboration with global and regional partners in rice science. Similarly, investments will be enhanced to train the extension staff and farmers.

**7.1 Develop new generation of rice scientists.** Myanmar needs to catch up with other countries in its rice research and development initiatives to create new varieties sought by consumers, to generate new technologies for rice production, and to develop new rice and rice-based products for niche markets. A new generation of rice scientists is thus needed in various disciplines to conduct research on rice breeding, crop management, seed technology, postharvest handling, grain quality, rice and rice-based products, rice markets,

socioeconomics, policies, and future rice systems that would reduce the risks and mitigate the impacts of climate change. The government will provide the necessary investment and support to allow rice scientists, women and men, to pursue degree and postgraduate degree courses at YAU and at international universities. Collaborations for scholarships will be forged with international research and development institutions and universities.

The MoAI, through YAU, and with the help of international development partners and fund donors will establish the Rice Breeding Academy to develop and hone the skills of future rice breeders. The agriculture course at YAU will be improved and broadened to include more fields relevant to rice science. More support and investment will be provided to the university to hone the skills of the faculty and academic staff and to improve facilities for learning and research.

Rice scientists in Myanmar will be likewise be encouraged to participate in international scientific forums, meetings, and conferences to be updated on new developments in rice research and technologies, and to hone their skills in sharing research results.

**7.2 Develop a new generation of subject matter specialists and extension agronomists.** Extension agronomists need the right skills and competence to provide advice to farmers to accelerate the adoption of new technologies. Regular and intensive training activities for extension staff will thus be conducted. Support will also be provided to deserving extension staff for trainings abroad in collaboration with the private sector and local and international development partners.

New training courses for extension staff and subject matter specialists on rice production technologies, seed production and certification, and on enhancing technical and facilitation skills to effectively work with farmers will be developed. Outstanding and good-performing extension staff will be selected to train as rice specialists. These staff members will undergo an intensive specialized training on rice production to provide a link between R&D and extension, serve as technical resource persons on rice production and rice-based farming systems, and facilitate the adaptation and integration of new rice technologies to local conditions. These rice specialists will also link farmers to sources of technology, information, and support services.

The Myanmar Rice Academy will be established to serve as a central training facility to hone the skills of extension agronomists, subject matter specialists and farmers on rice production and rice-based

farming systems and serve as knowledge and information hub on rice and rice-based farming systems

Facilities of the Central Agricultural Research and Training Centre (CARTC) will also be improved to better serve as a training center for extension staff and farmers.

**7.3. Develop a new generation of skilled mechanics for agriculture machinery and equipment.** A private sector-public sector partnership will be developed for the training of a new generation of skilled mechanics for agricultural machinery and equipment. Linkages will be developed with vocational training schools which would be expected to offer technical courses on the repair and maintenance of farm machinery and equipment.

**7.4 Train farmers on rice and rice-based farming systems.** Training courses for farmers on new rice production and rice-based farming systems will be developed to raise their productivity and income. Farmer field schools and other extension modalities will be adapted to fit the technology and information needs of farmers, paying particular attention to the diverse needs and constraints that different people, including women, youth and ethnic minorities, may have.

**7.5 Empower women and youth in rice farming.** The migration of men farmers to seek off-farm employment in other areas and abroad has resulted in more women and youth engaged in rice farming. Education programs will be developed and tailored to fit the needs of women and youth to enable them to acquire the necessary knowledge and skills in rice production and farm management.



**Women play important roles as scientists, extension workers, and as farmers in the advancement of Myanmar's rice sector.**

## **Theme 8. Policy environment to increase investment in agriculture**

An open-policy environment is needed to allow the rice milling sector, rice traders, and rice exporters to be competitive in the international market. In collaboration with the MoC and other line ministries and government offices, policies that affect the rice sector will be reviewed and necessary changes will be made to those that need minimal revisions. These efforts will be undertaken immediately and the policy changes that will result from them will be used strategically to attract investments in the rice value chain. New policies will also be developed and implemented immediately. Some of the interventions proposed toward these ends are the following:

**8.1 Review and adapt the foreign direct investment rules and regulations.** Foreign investment rules for rice milling, warehousing, and trading will be reviewed and revised accordingly to make these clearer, more welcoming, and attractive to investors.

**8.2 Adopt a minimum rice stock policy for emergency relief during disasters.** The government, in coordination with the Myanmar Rice Federation, will maintain 100,000 mt of rice for a defined period that will serve as a food buffer stock for the country during disasters to support the food security of poor households in vulnerable areas and to stabilize domestic market prices when needed. The rice stock will be under the management and supervision of the MRF. In the absence of disasters or the need for distribution, the stock will be exported. However, the minimum volume of the buffer stock will be reviewed annually and determined based on domestic food security requirements, expected export volumes, and the possibility of disasters.

**8.3 Enforce seed, plant variety protection, fertilizer and pesticide policies.** The Seed Law passed in 2013 embodies the rules and regulations on seeds and plant variety protection. The seed policy, which is embedded in the implementation guidelines of the Seed Law, is undergoing final review and will be released soon. The fertilizer and pesticide policies will be fully implemented to ensure that agricultural inputs sold in the market meet product standards and are of high quality. The Plant Protection and Land Use Divisions of the DoA and the Myanmar Agricultural Products Trading will work closely in implementing the two policies.

**8.4 Initiate crop insurance for rice farmers on pilot basis with private sector or funding institution.** Farmers face high risks in rice production, especially during monsoon cropping, because of cyclones, floods, and drought. Crop insurance aims to reduce risks

by providing farmers an opportunity to recoup losses in times of disasters and calamities. A crop insurance system will be initiated on a pilot basis with the private sector or with development partners and funding institutions.

## **Theme 9. Quality control and safety**

More than 90% of the rice exported by Myanmar is low quality. Improving quality control and food safety will make Myanmar rice more competitive in the international market. The following interventions will therefore be undertaken.

### **9.1 Establish grain quality standards for Myanmar brands (following international standards) and the means to verify and enforce them.**

To increase the incomes of farmers and for Myanmar rice to receive a fair and competitive market price, quality standards for physical appearance, taste, consistency, aroma, and health characteristics will be established and implemented to comply with national and international product standards. Testing and certification facilities will be established in strategic sites. Staff training will be conducted to enhance skills and competency in testing, certification, and monitoring product quality. Promotion and awareness campaigns to explain how to meet product standards and the benefits of producing high-quality rice will be carried out for farmers, millers, and traders. The MoC, MoAI, and MRF will develop a certification marker similar to Thai Hommali rice and then establish rules and regulations on the use of the marker. These agencies will work closely to ensure compliance with the set standards for high-quality rice.

**Good Agricultural Practice** for rice will be developed in compliance with the set certification standards of the international market on food safety to enhance the competitiveness of Myanmar rice. Collaboration with other exporting countries in the greater Mekong sub-region will be developed to facilitate the development of GAP for Myanmar rice.

**9.2 Encourage public and private sector partnership to build rice storage facilities.** Rice storage facilities will allow farmers and traders to store grains after harvest to avoid supply gluts in the market and the consequent reduction in the price of rice at peak harvest periods. The storage facilities will be available at an affordable cost for farmers and traders that don't have storage houses.

## Theme 10. Rice research and development

Innovations on new production technologies have led to significant improvements in rice yields. The increase in yields can be attributed to the development of new high-yielding varieties and better crop management practices, as well as to the application of modern inputs, all of which are products of research and development. Interventions will thus be undertaken to step up R&D to generate technological innovations that will increase yields and profits, improve value chain efficiency, and develop value-adding products.

**10.1 Develop and sustain a comprehensive and well defined national rice research and development program.** A Myanmar rice research and development program will provide focused and well-directed activities to generate technological innovations for the rice sector. The program will be led and implemented by a dedicated national rice R&D institution. Substantial and sustained investments in R&D for research, training of rice scientists, and acquisition and rehabilitation of facilities are needed to generate new varieties with multiple tolerance for abiotic and biotic stresses, better pre- and postharvest crop management options, and new products from rice. Resources from the government, the private sector, and development institutions will be pooled and a prioritization scheme for research and development activities will be established and implemented to ensure the efficient use of financial resources.

R&D aims to sustain yield growth by developing new inbred and hybrid varieties, improving the traditional special rice varieties of Myanmar (e.g., Pawsan), developing high-value products from rice to add to farmers' income, and developing and adapting yield-boosting



**Development of high-yielding and stress-tolerant hybrid and inbred varieties is one of the goals of strategy.**

and sustainable pre- and postharvest management practices. The following R&D activities will form part of the national rice R&D program:

- a) Development of new inbred and hybrid varieties with higher yield potential, are well adapted to the different environments, are more nutritious, and possess high-quality traits that match market and consumer demands. The stacking of stress-tolerant genes into popular varieties will also be pursued.
- b) Improving of the traditional special rice varieties of Myanmar (e.g., Pawsan) for high end and niche markets.
- c) Development of high-value products from rice to add to farmers' incomes. Organic rice, brown rice, rice-based food products, industry and cosmetic products are among the products that can be developed for new markets.
- d) Development and adoption of yield-boosting and sustainable pre- and postharvest management practices. Improved crop management practices in land preparation, seeding, water use, soil management, nutrient management, water and pest management, harvesting, drying, milling and storage in irrigated, rainfed, uplands, and stress-prone areas will be developed and integrated using appropriate adaptive research platforms

Other fields such as social science, economics, impact assessment, policy research, rice and rice-based products development and marketing, and knowledge management and technology promotion will be included in the future national rice R&D program.

**10.2 Strengthen partnerships with other countries within the region.** Myanmar is an active member of the Greater Mekong Subregion and the Association of South East Asian Nations (ASEAN). These partnerships will be strengthened and sustained to share knowledge, technologies, infrastructure, facilities, and information systems, facilitate connectivity, have reserves for emergencies, and be the future market for rice. Also, Myanmar will continue to participate in regional trade and engage in government to government sale of rice at a fair price.

**10.3 Engage with private sector, non-government organizations and regional and international R&D partners** on areas such as breeding for new rice varieties (multiple stress-tolerant inbred rice, hybrids, green super rice, and nutrient-dense rice); climate change mitigation, adaptation and risk reduction; climate smart agriculture; sustainable management of natural resources; future rice systems

under limited resources; new products for emerging markets; and other relevant areas related to quality rice production.

**10.4 Strengthen partnerships with regional and international research and development institutions for capacity enhancement.**

Myanmar hosts a number of regional and international research and development institutions and has signed partnership agreements with world-renowned academes and universities. These partnerships will be strengthened to support the training of a new breed of rice scientists in fields that will spur the development of new technologies to further boost yields and generate novel products from, and uses of, rice, such as pharmaceuticals, health and nutrition, and beauty products for emerging markets and industries.

Scientist exchange programs will be undertaken with partners to hone the skills of Myanmar rice scientists in new developments and innovations in rice science.

# The way forward

To achieve the vision for the rice sector, the strategic objectives, key themes, and interventions were discussed in the previous sections. The themes discussed are cross-cutting in nature and support one or more strategic objectives. Some of the interventions are complementary to each other and support one or more key themes that lead to the attainment of the objectives.

In accordance with the national goal of achieving economic development and alleviating poverty, the government aims to develop the rice sector to ensure food sufficiency and increase export to generate income needed to fuel economic growth.

Myanmar has the potential to become competitive in the international market. If the new regional and global opportunities for export are taken, it will eventually stimulate growth in the agricultural sector which, in turn, will reduce poverty and raise the living conditions of its people.

In the face of enormous challenges, the Myanmar Rice Sector Development Strategy (MRSDS) will guide the government in prioritizing its investments to improve the structural weaknesses along the rice value chain. The MRSDS will help international donors and partners align their agricultural development initiatives to complement government efforts. This way, the limited resources of the government and development partners will be used more efficiently. The MRSDS will also guide the government in reviewing and revising current policies that stifle the sector and formulate new ones to stimulate investments from the private sector and foreign investors. The recent review of the World Bank (2014) on the potentials and opportunities of Myanmar showed that policy reforms will go a long way toward improving the prospects for profitable farming and stimulating rice exports.

Guided by the MRSDS, the formulation of consistent enabling economic policies and the alignment of public investments with strategic objectives are the keys to achieving a transformed, dynamic, and internationally competitive rice sector. Three main actions are suggested to achieve the vision by 2030:

- a) Increase investment in capacity building, research, development and extension;
- b) Increase investment in rural infrastructure; and
- c) Implement institutional and policy reforms and innovations.

# Investment in capacity building, research, development and extension (R, D & E)

## *Capacity building*

Well-equipped scientists and modern facilities are needed to generate technological innovations for the rice industry. The Yezin Agricultural University needs to significantly modernize and transform its facilities, update and revise its agriculture course, and focus the attention of its highly trained academic staff to produce the well-equipped and highly skilled rice scientists Myanmar needs to modernize its rice sector. Investments in the Rice Breeding Academy will be prioritized to enable Myanmar to produce highly skilled rice breeders who will lead in breeding for rice varieties that are high-yielding and nutritious, climate tolerant, responsive to the demands of consumers in both the domestic and international markets.

Farmers will also require new skills in farm management and agribusiness, which could be provided through targeted education programs, especially for women who are increasingly taking on the role of farm managers. The new generation of farmers who are young and innovative could similarly benefit from such programs. It is necessary to establish training facilities and formulate and offer regular training programs to enhance the technical skills of extension staff, farmers, and the youth. In the last 30 years, DOA has had experience with farmer training programs conducted in seed farms in rice-growing areas. Enough efforts should be exerted to create a cadre of subject matter specialists who have the technical skills and knowledge required by farmers and be able to visit fields and meet farmers and staff through training and visiting programs. It is an effective way to solve specific field problems and share knowledge and skills.

## *Research, development and extension*

The adoption of technological innovations in the 1970s boosted rice production which made Myanmar self-sufficient in rice and the world's biggest rice exporter. For the country to achieve similar substantial improvements in the long term, investments in research, development and extension will be made.

Institutional transformation will be prioritized, coupled with the development of a comprehensive and focused rice R&D in the long term. Given the vast potential of the country for rice production,

a Myanmar Rice Research and Development Institute that has a well-defined and market-oriented national rice research and development program will be created and then fully and sustainably supported.

Substantial and sustained investments in the R&D program will create a new generation of rice varieties (hybrids and inbreds) and management options for sustainable intensification in irrigated areas, new varieties with multiple tolerance for stresses, crop management technologies to overcome low yields in the rainfed areas and stress-prone environments, innovations to develop new quality products from rice, and identify markets for quality Myanmar rice as a global brand. A reorientation of both research and extension to a rice-based farming systems approach, in the meantime, will generate options to make farming communities more resilient to the impacts of climate change. Adaptive research will be part of the R, D & E approach to make technologies more suitable for local farming conditions.

Investments in improving the extension system and enhancing the capacities of the extension staff and farmers through the establishment of a national capacity building institution such as the Myanmar Rice Academy will play a central role in developing, coordinating and implementing training programs, as well as communication and promotion strategies. Appropriate technology extension platforms will be developed using conventional and ICT tools and approaches to reach more men, women and young farmers, real time, for needed crop management advice.

## Investment in rural infrastructure

Connections between rural and market areas is important for the development of agriculture and the improvement of rural livelihoods. Roads and bridges in main highways connecting the delta in the south up to the mountainous regions in the north have been built, resulting in easy access and transport of products from one region to another. There is also good connection from the regions to the border areas, making trade with neighboring countries easy. However, connections from farms to villages, and from villages to towns, are poor, which makes transport expensive and difficult. And many villages are not yet connected with the larger part of the market.

Investments are also needed to rehabilitate irrigation systems and to connect fields with the main canals. Poor maintenance and lack of a

good participatory management system has rendered the irrigation systems inefficient in delivering water to the fields. Improving the irrigation system and water delivery services will lead to higher efficiency in the irrigation systems, thus expanding the irrigated areas and benefiting more farmers.

The other important rural facilities that need substantial investments include electricity, mobile phone services, hospitals, and schools. These facilities are all important and have large effects in promoting overall development by improving connectivity to information and markets, enhancing skills, and improving the health of the rural population.

## Institutional and policy reforms and innovations

The future rice systems envisaged for Myanmar is one that is highly commercialized where farmers and the private sector are engaged in a transparent and well-integrated value chain. For its part, it is important for the government to establish a good foundation of a level playing field in the industry through sound policies, implementation of well-coordinated programs, and incentives for the local and international investors to get them “on board” and invest in the rice value chain.

Since the opening up of Myanmar, the government had eliminated some trade barriers and initiated policy reforms such as the Land Use and Land Ownership law. New policies, such as the Seed Policy, are being formulated. Other policies that will be considered in the short and medium terms include provision of incentives for farmers to adopt better technologies that increase yields and income, land ownership, credit and microfinance, and the participation of private financing institutions to provide loans to farmers and small and medium scale entrepreneurs to encourage growth in other sectors.

# Governance, monitoring, and evaluation

Effective governance and implementation are keys to the success of achieving the vision by 2030. The government needs to substantially and sustainably invest in the Myanmar Rice Sector Development Strategy (MRSDS) to develop the rice sector. Incomes generated from natural resources can be channeled to the rice sector to drive agricultural development. Parallel development in the service and industry sectors need to happen as well to provide off-farm employment in the rural areas.

Political governance in Myanmar, as stated in the Constitution, is decentralized. Managerial and decision-making powers in states and regions lie on local government heads. Accordingly, the agriculture sector in each state and region falls under the managerial authority of the regional government.

The Union Government's Ministry of Agriculture and Irrigation (MoAI) is the lead agency in implementing the MRSDS. The ministry coordinates and facilitates the implementation of the MRSDS with the regional directors, and moderates over disputes among regions, if there are.

Given this decentralized nature of governance in the country, it is expected that regions and states will formulate their own rice sector development strategies. Future policies, projects, and programs will be aligned with the national MRSDS and, in accordance with regional preferences, needs, priorities, and capacities of governments, regional strategies and implementation modalities will be developed and executed. The local authorities at the district, township, wards, and villages will lead in developing and implementing their local activities and in ensuring that regional targets are met. The concept of "bottom-up approach" promoted by the new government empowers local governments in leading development efforts in the rural areas.

The themes and interventions stated in the national MRSDS serves to guide the leaders in formulating concrete action plans for each state and region. A central institutional body/coordinating team will be formed and will be composed of stakeholders in the rice sector,

including concerned departments, representatives from state and regional governments, and the MRF to guide the formulation of regional and local activities and targets.

The long-term program and strategic action plan will be organized by the coordinating team and submitted to the central government body for approval and publication.

An advisory body composed of senior experts drawn from the rice sector groups, MoAI, and MoC will be formed to advise the central institutional body in streamlining the strategic actions.

The Department of Agricultural Planning (DAP) will establish a comprehensive monitoring and evaluation system. It will guide the monitoring team in consolidating progress reports and preparing summaries of accomplishments from the townships, districts, states, and regions.

The monitoring of the progress of action plan implementation and preparation of progress reports will be led by monitoring teams from the departments under the MoAI and MoC.

An annual conference and discussion on the results of evaluations will be conducted.

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## Framework for Theme 1: Sustainable increase in rice productivity

Interventions	Priority	Beneficiaries	Time frame	Implementing/ co-op Agency
<b>1. Accelerate the expansion of irrigated rice areas and improve irrigation services</b>				
Improve the efficiency of current irrigation systems	I	Farmers	Medium term	Dept. of Irrigation (DI)
Build new irrigation projects	III	Farmers	Long term	DI
Enhance the capacity of water users	I	Farmers	Medium term	DI
<b>2. Promote varieties appropriate to the rice environment</b>				
Promote hybrid rice in irrigated rice areas	I	Farmers	Long term	DAR, DoA
Promote high yielding inbred varieties in all rice environments	I	Farmers	Long term	DAR, DoA
<b>3. Ensure sufficient supply of good quality seeds and fertilizers</b>				
Form a seed network	II	Seed growers	Medium term	DoA, DAR, MRF
Upgrade the facilities of Seed Division to strengthen seed certification activities	I	Seed growers	Short term	DoA, DAR
Train seed inspectors and seed producers	I	growers, farmers	Medium term	DoA, DAR
Establish additional seed laboratories in all states and regions	II	Seed growers, farmers	Medium term	DoA, DAR
Maintain a buffer seed stock	I	Farmers	Long term	DoA, DAR
Establish fertilizer & pesticide testing laboratories in strategic locations and develop pesticide & fertilizer test kits	II	Farmers, agricultural supply traders	Medium term	DoA, MOC
Enforce the Fertilizer & Pesticide Law	I	Farmers, agricultural supply traders	Long term	DoA,
<b>4. Promote the use of good certified or good quality seeds, and integrate other appropriate crop management practices</b>				
Conduct farmers' field schools	I	Farmers	Long term	DoA
Conduct demonstration & field days	I	Farmers	Long term	DoA
<b>5. Strengthen the delivery of extension services</b>				
Recruit new extension staff	I	Farmers	Long term	DoA
Develop a critical mass of well-trained rice production specialists and extension agronomists	I	Extension staff, farmers	Long term	DoA

Interventions	Priority	Beneficiaries	Time frame	Implementing/ co-op Agency
Conduct training events on participatory approaches to working with farmers	I	Extension staff, farmers	Long term	DoA
Adapt the Farmer Field School scheme and develop other extension modalities/ approaches	I	Farmers	Long term	DoA
Strengthen the Farmer Channel to achieve a broader viewership	I	Farmers	Long term	DoA
Develop IT-based extension platforms	II	Extension staff, farmers	Long term	DoA
Provide sufficient logistical support in terms of budget and mobility to field staff	I	Extension staff	Long term	DoA
Develop a market information system to provide “real time” advice to farmers on rice prices	II	Farmers	Long term	DoA
Develop a national extension and delivery platform	I	Extension staff, farmers	Long term	DoA
Demonstrate best management practices in the villages	I	Farmers	Long term	DoA
Conduct training events and field visits for farmers to improve capacity and skills	I	Farmers	Long term	DoA
<b>6. Sustain research and development (R&amp;D) of new varieties and crop management technologies</b>				
Develop new inbred and hybrid varieties with higher yield potential, more nutritious content, and high quality traits demanded by the consumers	I	Farmers	Long term	DAR
Improve the traditional special rice varieties of Myanmar	I	Farmers	Long term	DAR
Develop high-value products from rice	II	Farmers and rice-based products entrepreneurs	Long term	DAR, MoAI, MRF, MAPCO
Develop and adapt yield boosting and sustainable preharvest and postharvest management practices	I	Farmers and traders	Long term	DAR, DoA, MRF, MAPCO

*Note: Short Term: 1 to 3 years; Medium term: 3 to 5 years; Long Term: Over 5 years  
Priority I=First, II=Second, III=Third*

**Annex Table 2. Framework for Theme 2: Increase utilization of farm machineries**

Interventions	Priority	Beneficiaries	Timeframe	Implementing/ co-op Agency	Means of verification
1. Establish appropriate mechanization strategies	II	Farmers	Long term	AMD	Report by AMD
2. Consolidate small farms to achieve cropping synchrony and a farm size suitable for mechanization	II	Farmers	Long term	AMD, DOA	Report by AMD
3. Encourage the acquisition of farm machinery by progressive farmers or organized farmer groups to provide custom service	I	Farmers	Medium term	AMD, MADB, MOAI	Report by AMD
4. Encourage the private sector to provide custom services to farmers at affordable rates	I	Farmers & Investors	Medium term	MOAI, MOC, MOF	Report by AMD
5. Establish a credit facility to enable the private sector and farmers to buy farm machinery	I	Farmers	Long term	MOAI, MADB, AMD	Report by AMD
6. Support local agricultural machinery and tool manufacturers	I	Farmers and entrepreneurs	Long term	MoAI, MOC. AMD	Report by AMD

*Note: Short Term: 1 to 3 years; Medium term: 3 to 5 years; Long Term: Over 5 years  
Priority I=First, II=Second, III=Third*

**Annex Table 3. Framework for Theme 3: Mitigate/adapt to climate change and enhance capacity of farmers to cope with risks**

Interventions	Priority	Beneficiaries	Timeframe	Implementing/Co-op Agency	Means of verification
1. Promote high-yielding and stress tolerant varieties combined with climate smart management practices through demonstration, training and other appropriate extension modalities.	I	Farmers	Long term	DAR, DOA	Report by DOA & DAR
2. Develop new high-yielding varieties and climate-smart management options for stress prone environments	I	Farmers	Long term	DAR	Report by DAR
3. Promote the cultivation of "special traditional rice varieties" with natural tolerance to deep water, prolonged flooding, or drought	II	Farmers	Long term	DAR, DOA	Report by DOA & DAR
4. Promote diversified farming systems	II	Farmers	Long term	DOA	Report by DOA
5. Develop alternative seed systems to conserve, multiply, and promote the sharing and exchange of traditional and, if applicable, modern varieties in remote areas	III	Farmers	Long term	Seed Division (SD)	Report by SD
6. Conduct awareness campaigns and education programs and strengthen weather information delivery and early warning systems	I	Farmers	Long term	DOA	Report by DOA
7. Map areas vulnerable to floods, salinity, and drought to identify and plan adaptation measures	I	Farmers and communities	Short term	Land Use Division, DoA	Report by LUD

*Note: Short term: 1 to 3 years; Medium term: 3 to 5 years; Long term: Over 5 years  
Priority I=First, II=Second, III=Third*

**Annex Table 4. Framework for Theme 4: Efficient utilization and sustainable management of natural resources**

Interventions	Priority	Beneficiaries	Timeframe	Implementing/ co-op Agency	Means of verification
1. Effectively manage irrigation systems and improve irrigation services	I	Farmers	Long term	ID	Report by ID
2. Promote efficient water management technologies	II	Farmers	Long term	ID	Report by ID
3. Promote soil conservation practices in hilly and upland areas	III	Farmers	Long term	AMD &DOA	Report by AMD  Report by DOA
4. Maximize the use of farm wastes and locally available biomass	II	Farmers	Long term	DOA	Report by DOA
5. Promote efficient nutrient management through proper application and timing	I	Farmers	Long term	Land Use Division (LUD), DoA	Report by LUD
6. Promote integrated pest management practices and develop a policy framework on the appropriate use of pesticides	I	Farmers	Long term	Plant Protection Division, DoA	Report by PPD
7. Generate maps on rice growing environments, soil fertility, and cropping patterns	III	MOAI staff	Long term	LUD	Report by LUD

*Note: Short term: 1 to 3 years; Medium term: 3 to 5 years; Long term: Over 5 years  
Priority I=First, II=Second, III=Third*

**Annex Table 5. Framework for Theme 5: Reduction of postharvest loss and value chain improvement**

Options/Tactics	Priority	Beneficiaries	Timeframe	Implementing/ co-op Agency	Means of verification
1. Upgrade existing mills or acquire new units to bolster efficiency, lower unit costs, and improve milled rice output	I	Rice millers & traders	Medium term	MOC, MRF	Report by department concerned under MOC
2. Improve existing infrastructure and build new ones to facilitate connectivity	II	Farmers, traders & rice millers	Long term	MOC, MOE, MOAI, MRF	Statistical Year Book
3. Collaborate with line ministries to establish formal agreements with rice importing countries	I	Farmers & traders	Long term	MOAI, MOC	Reports by departments under MOAI & MOC
4. Establish wholesale rice markets	II	Traders	Long term	MOC	Report by Trade Promotion Department (TPD)
5. Conduct aggressive market research and product development	III	Exporters & traders	Long term	MOC	Reports by (TPD)
6. Provide more information to market participants	II	Policy makers, exporters & traders	Long term	MOC	Reports by (TPD)

Note: Short Term: 1 to 3 years; Medium Term: 3 to 5 years; Long Term: Over 5 years  
Priority I=First, II=Second, III=T

**Annex Table 6. Framework for Theme 6: Improve credit scheme and availability**

Options/Tactics	Priority	Beneficiaries	Time frame	Implementing/ co-op Agency	Means of verification
1. Improve current credit schemes for smallholder farmers	II	Farmers	Long term	MOAI, MOF	Reports by AMD
2. Improve credit schemes for the private sector	II	RSCs & farmers	Long term	MOAI, MOF, MRF	Report by MRF

Note: Short term: 1 to 3 years; Medium term: 3 to 5 years; Long term: Over 5 years.  
Priority I=First, II=Second, III=Third

**Annex Table 7. Framework for Theme 7: Capacity building**

Options/Tactics	Priority	Beneficiaries	Timeframe	Implementing/ co-op Agency	Means of verification
1. Develop a new generation of rice scientists	I	Rice scientists	Long term	DAP, YAU, DOA, DAR	Report by DAP
2. Develop a new generation of extension agronomists	I	Extension staff	Long term	DOA, DAP	Report by DAP
3. Train farmers on rice and rice-based farming systems	I	Farmers	Long term	DOA, DAR, YAU	Report by DOA

Note: Short Term: 1 to 3 years; Medium Term: 3 to 5 years; Long Term: Over 5 years.

Priority I=First, II=Second, III=Third

**Annex Table 8. Framework for Theme 8: Policy environment to increase investment in agriculture**

Interventions	Priority	Beneficiaries	Timeframe	Implementing/ co-op Agency	Means of verification
1. Review Foreign Direct Investment Rules & Regulations	I	Foreign & domestic investors	Long term	MOC, MIC	Report by MIC
2. Government-owned stocks and minimum farm prices	I	Farmers, consumers, trader & exporters	Medium term	MOAI, MOC, MRF	Report by MRF
3. Seed policy	I	Farmers, consumers, trader & exporters	Long term	Land Use Division, MOAI	Report by Land Use Division
4. Enforce fertilizer and pesticide policies	II	Farmers	Long term	DOA, MRF, MADB, MOF	Report by MADB
5. Initiate a crop insurance system on pilot basis together with the private sector or funding institutions	III	Farmers	Long term	DOA, MRF, MADB, MOF	Report by MADB

Note: Short term: 1 to 3 years; Medium term: 3 to 5 years; Long term: Over 5 years.

Priority I=First, II=Second, III=Third

**Annex Table 9. Framework for Theme 9: Quality control and safety**

Interventions	Priority	Timeframe	Implementing/ co-op Agency
1. Establish grain quality standards for Myanmar-brands (following International standards)	I	Long term	MOC, MRF, MOAI
2. Promote Good Agricultural Practice (GAP) for Myanmar rice	I	Short term	MOC, MRF, MoAI
3. Encourage private sector to build rice storage facilities	I	Long term	MOC, MRF,

*Note: Short Term: 1 to 3 years; Medium Term: 3 to 5 years; Long Term: Over 5 years.  
Priority I=First, II=Second, III=Third*

**Annex Table 10. Framework for Theme 10: Rice research and development**

Interventions	Priority	Beneficiaries	Timeframe	Implementing/ co-op Agency	Means of verification
1. Develop a national rice research and development program	I	Farmers	Long term	DAR, DAP, DOA	Report by DOA
2. Strengthen partnerships with other countries within the region	I	Rice researchers	Long term	DAR, DOA, YAU	Report by DAR
3. Engage regional and international R&D partners	II	Rice researchers	Long term	DAR, YAU, DOA	Report by DAP, DOA, DAR
4. Strengthen partnerships with regional and international research and development institutions for capacity enhancement	II	Rice scientists	Long term	DAP, DOA, DAP, YAU	Report by DAP, DAR

*Note: Short term: 1 to 3 years; Medium term: 3 to 5 years; Long term: Over 5 years.  
Priority I=First, II=Second, III=Third*

**Annex Table 11. Utilization of tractors and power tillers in Myanmar 1995-2013.**

Particular	Unit	1995/ 96	2000/ 01	2005/ 06	2009/ 10	2010/ 11	2011/ 12	2012/ 13
Tractors	Number	7948	8687	9773	10110	10650	11804	12491
- Agricultural Mechanization Department	"	2820	3151	2873	1772	1466	1314	1372
- Tractors owned by peasants	"	5128	5536	6900	8338	9184	10490	11119
Power Tillers	Number	17000	49473	100000	132730	156977	206263	227489
- Power Tillers owned by peasants	"	17000	49473	100000	132730	156977	206263	227489
	'000							
Total tillage hectare-turn by AMD	Hectare-turn	3166	3380	1993	3788	4146	5987	6524
- Tractors used in total tillage hectare-turn	"	2341	1670	848	821	858	1091	1092
- Power Tillers used in total tillage hectare-turn	"	826	1710	1145	2967	3288	4897	5431

Source: *Agricultural Mechanization Department, Ministry of Agriculture and Irrigation*





