



Food Value Chain Road Map (2016-2020) in Myanmar

Prepared by
Ministry of Agriculture, Livestock and Irrigation, Myanmar
and
Ministry of Agriculture, Forestry and Fisheries, Japan

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1. Introduction

1.1. Background

Agriculture, Forestry and Fisheries are the most important industries in Myanmar. Agricultural Sector contributes about 30% of national GDP and more than 60% of the national labor forces engage in agriculture for their livelihood. Myanmar possesses diversified climatic zones and landscapes and, each region produces unique and distinctive products. Myanmar has comparative advantages due to its unique geographical location adjacent to big markets such as China, India and Thailand.

However, agricultural innovations along the supply chain have not been sufficiently adopted in agricultural sector to achieve sizable development. Low productivity, low quality of agricultural products, limited capacity, non-modernized agro-processing industry and insufficient market diversification are major challenges for further development of agricultural sector. Sizable development in agriculture could be achieved through transformation and value addition processes, emphasizing on appropriate quality management systems, improvement of infrastructure for effective distribution and the food processing industry.

The first Myanmar Japan High Level Dialogue on Agriculture, Forestry and Fisheries was held in September 2014, in Nay Pyi Taw, Myanmar. Government official, experts from relevant organizations and private companies from both countries participated in the Dialogue. The Dialogue focused on the integrated development of agriculture, forestry and fishery including food industry of Myanmar. During the Dialogue, both sides agreed to establish the concrete measures for value chain in Myanmar through the cooperation of public and private sectors. .

To establish Food Value Chain Roadmap, Myanmar, it was agreed to develop the Roadmap for Value Chain in line with the **Myanmar Industrial Development Vision** which was handed to president U Thein Sein by Prime Minister Shinzo Abe on July 3, 2015. The senior official of both countries exchanged the perceptive on the structure and contents of the Food Value Chain Roadmap. The Road Map will be used as the guideline for formulation of measures to be taken

by the Government with the assistance of Japan Government and other development partners including private sector investment for agriculture and fishery development in Myanmar.

1.2 Status and utility of the Roadmap

The Roadmap is a consensus scoped by the Government of the Republic of the Union of Myanmar and the Government of Japan. It will be signed by both Governments, and both Governments should make their effort to implement the provisions of the Roadmap.

The Roadmap will be used as a reference for the allocation of human and financial resources, particularly it will serve as guidance for the structural and budgetary rearrangements in line with the country's agrarian policy.

1.3. Development and preparation of the Roadmap

Preparation of Roadmap was a collaborative action of Myanmar and Japanese Governments. A working group was organized with Myanmar and Japan government members. The Myanmar Ministry of Agriculture, Livestock and Irrigation, and the Japanese Ministry of Agriculture, Forestry and Fisheries acted as co-chairs of the working group. In addition, Ministry of Planning and Finance, Ministry of Commerce and Ministry of Industry participated as the members of working group.

The draft of Roadmap was prepared by the working group and was finalized in March 2017 in High Level meeting. In order to facilitate the preparation of the Roadmap, the necessary workshops and seminars were organized for stakeholder consultation.

Revision and improvement of the Roadmap draft will be conducted accordingly during the meetings of Myanmar Japan official meeting (SOM) on the cooperation in the fields of Agriculture, Forestry, Fisheries and Foods.

1.4 Structure of the Roadmap

The Roadmap is composed of two parts; “Measures to be taken for individual products” with 5 sections and “Horizontal measures” with 8 sections. Each section consists of two subsections: “Measures to be taken” and “5 years-Roadmap Tables.” “Analysis of the Actual Situation” of each sub-sector is in the reference part.

2. Measures to be taken

2.1 Rice and Pulses

2.1.1 Production (Short Term Measures)

2.1.1.1 Seed and Variety

Purification of seeds should be conducted for rice and pulses varieties, and a stable seed supply system of genetically purified varieties should be established. In the process of seed multiplication, the seed quality management system should be established by introducing **field inspection** and **seed quality control**. Different seed systems such as formal seed system, informal seed system and commercial seed system should be integrated into seed network. Rice Seed Grower Associations should be organized to encourage seed business related activities through participatory approach for certified seed production.

In order to produce “**Red Grains**” free rice, all rice farmers must get rid of voluntary rice plants bearing red grains from their paddy fields, feeder roads and other adjacent places by collective activities. Promoting use of good quality seeds, removing wild rice around the rice fields, minimizing number of rice varieties in the same field and applying post-harvest technology could contribute to reduction of red grains. Weeding, field inspection roguing should be performed at the growing stage, flowering stage and ripening stage.

In order to reduce **broken rice** ratio, a variety, commonly accepted by farmers for a specific area (a parcel) should be produced in a large scale, and to encourage timely harvesting through mechanization.

Pulses are the second most important crop in Myanmar after rice and are primarily grown by smallholder farmers. It can be grown in upland areas and lowland area after rice. Since it can be grown with minimal use of fertilizers, pesticides, and herbicides, it has potential to increase yield. However, minimal inputs, availability of pest and disease resistant high yielding varieties and timely sowing are major constraints to increase pulses yield. Pest and disease resistant varieties, poor quality of agrochemicals and insufficient post-harvest facilities are important intervention to improve pulses industry. The pulses and

upland crops research farms under Department of Agriculture and Department of Agricultural Research should be upgraded and facilitated with soft and hard elements for varieties improvement research as well as seed production.

2.1.1.2 Irrigation, Drainage and Farmland Infrastructure

Government efforts should be concentrated on the development and rehabilitation of **irrigation and drainage facilities** by efficient utilization of rich water resources potential together with **farmland consolidation**.

The advancement of irrigation water supply technologies with changing time and space encompasses not only building dams, weirs, and sluice gates but also river pumping works and tube wells as comprehensive water utilization strategy since late 1980. In 1994, the government accelerated construction of irrigation infrastructures such as dams, weirs and sluice gates. The areas with low rainfall and but are not near to fresh water sources such as rivers or creek, can be irrigated only by installing pump stations constructed by Water Resources Utilization Department (former WRUD). In the area where ground water potentials are feasible, tube wells are drilled for irrigation. Concerning farmland consolidation, farm ridge should be wide enough for easier transportation of paddy out of the fields. It is also important to construct the bridges over irrigation canals, and farm road properly and wide enough for easy passage of medium-sized agricultural machines.

2.1.1.3 Agricultural Insurance

Government institutions with private partnership should initiate agricultural Insurance System to mitigate crop loss risk against to natural disaster. The initiation of crop insurance system should be in line with the internal procedure of Myanmar Government (Ministry of Planning and Finance). The insurance system could be a powerful tool to stabilize the production as well as improve social protection.

2.1.2 Post-harvest, Processing (Short Term Measures)

2.1.2.1 Farmer level

Farmers' awareness is important for preventing quality deterioration such as **yellow and chalky rice** due to improper pre and post-harvest handling. To reduce postharvest losses and increase quality produce for the consumers through improvement of post-harvest management practices and technologies should be undertaken urgently.

Farm machineries such as combine harvesters, threshers, dryers, rural storage depots should be improved under collaborative management of all stakeholders. Government should assign subject matter specialist for each relevant areas in order to provide technical assistance.

2.1.2.2 Processors

Upgrading the processing technology (milling, drying, sorting, and storage) will enable Myanmar to raise the quality of its rice. Loans for regional rice millers particularly small and medium enterprises (SMEs) are needed to facilitate investment in modern and efficient facilities and equipment for processing. **Quality based procurement system** between farmers and millers is an important initiation for quality management. Only one variety should be milled at a time to ensure quality consistence. Packaging system and branding should be improved for value addition.

In order to promote rice export higher-grade rice, the existing rice mill should be upgraded to commercial scale to supply large volume of higher-grade rice instead of collecting small amount of different quality rice from small enterprises. Small enterprise should mainly focus on domestic market share or enlarge milling capacity and quality by using financial support from Government such as SME loans and technical support for post-harvest handling. Improved branding and highlighting on unique selling points should be encouraged.

In pulses industry, it is necessary to improve skill and knowledge in production and processing of pulses. Moreover, lack of primary processing such

as sizing and grading, under-developed downstream industry and poor access of farm machineries are major constraints for quality improvement. It is almost impossible to add value for pulses without processing industry. Therefore, processing industry should be encouraged by providing financial assistance and processing technology.

2.1.3 Distribution / Export (Short Term Measures)

It is necessary to adopt marketing practices that allow each and every rice variety is distributed and sold separately on variety basis, instead of commingling different varieties. In order to adopt such marketing practices, agencies that have influence on rice market channel such as Myanmar Rice Federation, should take necessary actions and initiative. It is also important to give a certain incentive to distributors.

Growing pulses is more profitable than growing cereals because of a couple of reason such as low production cost, high market demand, and higher market prices. However, pulses farmers have lower profit margin due to price volatility and lack of access to international market information. Therefore, timely information and efficient marketing system are critically necessary for more competitive pulses industry. Market study should be conducted to identify the potential source of value addition.

Private public partnership or contract farming system will be possible approaches to reduce constraints in pulses supply chain such as inefficient resource mobilization, poor market access.

It is essential to establish an efficient and short market chain that links pulses producers to end-buyers that will lead to lower transaction costs in order to make higher prices from producers, lower prices for urban consumers, and facilitate export competitiveness. Large trade volume of pulses calls for the necessity for national and international standards to ensure uniformity in quality, grain size and color of pulses.

The commodity exchange centers (CECs) have played some critical roles for distribution and export. However, pulses marketed through CEC's provide

disincentives for quality improvement due to lack of quality grade specifications, except visual quality check. Ministry of Commerce needs to establish pulses quality grade specification and identification in CECs as soon as possible.

According to the National Export Strategy (NES 2014), stable export designations are more important than export designations purchasing rice at high prices on spot. It is necessary to determine export designation on the basis of consumers' preference toward characteristics and quality standards of rice and pulses. As pointed out by the NES, pulses export should expand to new markets such as EU and UAE through improvement of processed products such as bean flour or packaged beans, aside from raw pulses export to Indian market. Transition cost reducing mechanism should be improved and export policy should be formulated to create conducive environment for exporters.

2.1.4 Medium to Long Term measures

Pulses and rice varieties with extinct Myanmar identity in terms of taste, high yielding, disease and pest resistance characters can be achieved by efficient breeding programs since Myanmar is rich in genetic resources. It is also necessary to identify the top prioritized crop varieties according to the agro-ecological conditions through effective function of seed system.

In order to facilitate the separate handling system for large distribution of high quality rice varieties, it is possible to promote contract rice production areas where a private company can coordinate zoning system for production of selected quality rice varieties.

It is also necessary to encourage and organize **water user groups** to improve water use efficiency and community-led maintenance of irrigation systems. Low-lying areas where growing of paddy cannot create good income due to poor drainage, alternative marketable crops production such as lotus tubers should be introduced.

Table (1) Medium Term Measures for Rice and Pulses

		2016	2017	2018	2019	2020
The Government of Myanmar (ODA)	Development of rice & pulses varieties	DAR Breeding Program (M)				
	Multiplication of rice and pulses seed	Project for multiplication of good-quality seed(Phase1 & 2) (OJ)				
			Project for pulses multiplication of RS to CS by community based seed bank system development (M+ACIAR)			
	Technical Coop.	West Bago TCP (Income-Up) (OJ)				
	Mechanization	SME Two Step Loan for Service Providers (OJ)				
	Irrigation systems	Introduction of irrigation systems in the Bago(OJ) and other regions, IFAD project, World Bank Project, ADB Project (D)				
		Feasibility Survey for Intensive Agriculture in upper Myanmar (OJ)		Agriculture Income Improvement Project (Under consideration)(OJ)		
	Rice and Pulses milling, etc.	Training related to post harvest treatment for rice (J)				
		Training related to post harvest treatment for upland crops (M or D)				
Private Sector	Rice and Pulses seed production	Production and marketing of rice and pulses seed (Include hybrid varieties)				
	Mechanization	Import from surrounding countries (Japanese or foreign investment)				
		Local assemblage and marketing (Local enterprises) promotion of cultivation service providers				
	Agriculture insurance	Already developed : Prototype (subject to recommendation by MOALI & approval by MPF)				
	Rice milling & pulses processing	(Japanese or foreign investment) establishment of rice milling plants, management, rice processing, export				
(domestic enterprises) renovation of rice milling facilities, marketing, export						

M : Myanmar Government

OJ : ODA-Japan

J : MAFF-Japan

D : Other donors

2.2 Oil Crops, Industrial Crops and other Upland Crops

2.2.1 Short Term Measures

Sesame, Sunflower and Groundnut are major oil crops in dry zone farming system. Improvement of oil-crops seed should be conducted through public and private seed multiplication systems. For seed multiplication system, government needs to provide foundation seeds and public and private seed companies need to multiply certified seeds derived from the foundation seeds by encouraging farmers' participation. Quality seeds and cultivation techniques need to be provided to farmers for adoption of appropriate farming system.

An **agricultural insurance** system for sesame in dry areas has been discussed by a foreign private company for the stabilization of farm management against climatic changes such as drought, flood, etc. Comprehensive study should be conducted to adopt sustainable insurance system.

Oil industry is operated by private sectors. Oil extracting facilities and expelling techniques need to be renovated for producing high quality cooking oil that could meet food safety standard. SME Two Step Loan is yet to make available for such oil extracting facility renovation. This could be realized through production of high quality oil crop and improvement of oil extracting and refining process.

Sesame is an important export crop. In order to secure export market, supply consistency is indispensable. It is necessary to establish wide area supply network based on some private sector associations activities. Long-term relationship with importers also needs to be established by such associations.

Sugarcane is an important crop for processing industry. Concrete land use policy and a management mechanism should be formulated in order to ensure consistent supply of raw materials for sugar mills. Contract farming system with an appropriate equity ratio between millers and farmers should be adopted. Capacity of sugar mills in Myanmar should be upgraded in terms of milling capacity and efficient utilization of by-products.

The Government should support the private sector by promoting farm infrastructure development such as farm roads, transportation and machines.

2.2.2 Medium to Long Term Measures

High quality oil consumption will increase in accordance with economic growth. To meet domestic consumption needs, Good Agricultural Practices (GAP) and Good Manufacturing Practices (GMP) need to be applied to ensure high quality of oil. In order to apply GAP and GMP, oil crops **producers' association** needs to play an important coordination role. The GAP oil crop producers need to be linked to high quality value chain actors such as modernized oil extracting processors.

In future, oil crop producers' association need to be engaged in **primary processing** of oil crops in rural areas supported by government loans or subsidies. This could provide more benefit for oil crop producers.

Table (2) Medium Term Measures for Upland and Industrial Crops

		2016	2017	2018	2019	2020
Myanmar Government (ODA)	Management Policy	Operational management . make new clear policy Mechanism for sugarcane production (M)				
	Seed and Seedling	Water-Saving Project (OJ) (Groundnuts seed)				
		Supply of Sugarcane seedling by Sugarcane Research and Seeds Development Farm (M)				
	Cultivation	Water Saving Project (OJ)				
	Loan	SME Two Step Loan for oil extract facilities (OJ)				
Private sector	Seedling and cultivation (Sugarcane)	Introduction of new varieties, Contract Farming				
	Agricultural insurance (Sesame)	Already developed : Prototype (subject to recommendati on by MOALI & approval by MPF)				
	Export	Producers' Associations for Oilseed Crops				

2.3 Horticulture

2.3.1 Production (Short Term Measures)

It is necessary to increase the production of safe and high quality vegetables, flowers and fruits proportionally to meet the increased domestic demand, particularly for the cities. Adoption of GAP to produce safe vegetables and quality assurance should be further strengthened.

To increase and stabilize the production and to improve the products quality, it is necessary to supply high quality seed and appropriate agro- chemicals to farmers. In addition, irrigation and fertigation system should be improved.

Post-harvest handling system, a major component in value chain, such as grading, sorting, cleaning, packaging facilities should be improved.

2.3.2 Distribution (Short Term Measures)

In order to reduce post-harvest loss, the modernization of the distribution system is necessary. It is urgent to equip properly the market places in the producing areas and the consumption areas to establish a **modern distribution system** providing the necessary functions such as price formation, collecting and dividing freight and information transmission.

It is needed to decide necessary measures to establish a pilot-stage wholesale market (e.g., Mandalay and Yangon PPP Wholesale Market) by consensus of different stakeholders on marketing system. In-depth study to analyze current market situation is urgently needed. Currently, only local governments are competent to the management of market facilities. The intervention of the central government will be indispensable for the establishment of a nationwide market system and classification of crop quality and standard.

On the other side, the rationalization through transition of the distribution route is necessary by streamlining route from the producing areas to distributors in consumption areas. It is also necessary to construct not only main roads but also farm to market roads in the procuring areas.

For **potatoes**, through a joint venture between a company from the

Netherlands and a local company, a new attempt is introduced to promote potato production under contract with farmers using designated seed potatoes in the Shan State. Harvested potatoes are conserved in simple cold storage facilities and transported via road to Thailand. Shan State has high potential to promote potato production and if the distribution system via road is improved, it will be a promising export item in future.

Some Japanese companies established joint ventures with domestic firms, by using vinyl houses and high quality vegetable seeds to produce strawberry, spinach and Japanese mustard spinach (*Brassica rapa* var. *perviridis*), with a view to establishing the value chain to respond to the demand of consumers in urban areas. The improvement of the distribution system between the producing areas and Yangon as well as the introduction of the cold chain should be urgently accomplished.

2.3.3 Processing (Short Term Measures)

In the case of highly processed products such as dehydrated and frozen vegetables, it is necessary to encourage foreign investment and to support private entrepreneurs so that a production system with strict quality control system can be introduced. Now one consortium has established a factory to produce frozen vegetable in Nay Pyi Taw. Quality control including pesticide residue management for export is urgently needed.

There are mango varieties of good taste and are highly appreciated by consumers. Fresh mangoes are exported to Singapore, and in the future, if it can be processed into puree and/or high quality dried mangoes; it may become a promising export item, meeting the needs of medium-developed countries. In order to realize exporting processed mango, in-depth study on processing and distribution business is necessary, including long term investment plan with cost and benefit analysis. The plan needs to include ensuring consistent raw material supply based on production areas' distribution situation.

Culinary crops such as ginger, turmeric, cinnamon and hot pepper etc. raw or processed products are exported to India, China and Bangladesh, also re-exported to Japan and Pakistan after primary processing. Thus, spices and

culinary crops processing is also necessary for value addition as well as domestic market stability.

The cultivation of Liquorice (*Glycyrrhizas*) and (*Lithospermum purpureocaeruleum*) and other medical crops are technically feasible in dry areas and Kayin state. It is further necessary to introduce facilities such as nurseries for multiplication and commercial production. Japanese private companies are implementing production and processing of these medicinal plants together with local producers. *In-situ* and *ex-situ* conservation of land races and wild species of medicinal plants and horticultural crops should be encouraged. Such activities need to be supported by public finance and other INGOs.

Nippon foundation is also implementing medicinal plants production project in Kayin state with the state government. They aim to establish model farm and to disseminate production technique to farmers.

2.3.4 Medium to Long Term Measures

Selection of horticultural crops and ideal conditions of agro-climatic requirements for these crops play very important role for successful production and least occurrence of epidemic virus infestation. In comparison to cereals, the selection of appropriate horticultural crops well suited for the specific climatic condition is important. Effective measures should be taken to develop producing areas of various products in different regions. In the vicinity of urban areas, it is desirable to establish a system to enable the seamless supply of high quality leaf vegetables to be delivered to supermarkets at high prices.

In order to introduce wholesale markets with high functionality nationwide, it is necessary to establish a new wholesale market system, which may take a considerably long period. Firstly, a detailed survey should be conducted to analyze the structure and functionality of the existing distribution system in each area. Although mindset of stakeholders involved in the current system may not be easily changed, it is necessary to take measures for changing opinion and mindset of all stakeholders with more transparent engagement aspects along the distribution channel.

After making concerted efforts for development of wholesale markets, an inter-ministerial committee should be organized with major stakeholders i.e. Ministry of Agriculture, Livestock and Irrigation, Ministry of Commerce, Ministry of Health and Sport, City Development Councils, Myanmar Vegetable and Fruit Producers and Exporters Association, etc. for better governance of new marketing system.

In modernization process of distribution system, it is also important to introduce a seamless cold-chain with pre-cooling facilities in collection stations as well as refrigerator tracks and cooling facilities in the markets of production areas and consuming regions.

In order to export fresh mango and other fresh fruits, it is necessary to ensure fruit flies eradication by using Vapor Heat Treatment to meet the phytosanitary requirement of the importing countries. Trials for the introduction of these treatments seem to take a long time for attaining outcomes, and it should be planned as long-term project.

Table (3) Medium Term Measures for Horticultural Crops

		2016	2017	2018	2019	2020
The Government of Myanmar (ODA)	Development of varieties	On-Going Project to select vegetable varieties adapted to tropical climate conditions (VFRDC and AVRDC) (M・J)				
	Seed multiplication	BOP/FS Investigation, Introduction of nurseries for medicinal plants (OJ)				
	Production	<ul style="list-style-type: none">• Functional Extension System (OJ)• Protected Horticulture System(DAR) (M)• Protected Horticulture System (The Netherlands-SAI, Pyinmana) (D)				
	Land Management	Support to management environment such as land use (M)				
	Post-Harvest	<ul style="list-style-type: none">• Post-Harvest Technology Training Center for Horticultural Crops (KOICA) (D)• Post-Harvest Research Institute for Horticulture (KOICA) (D)• Post-Harvest and Processing of Horticultural Crops (Mokpo National University, Korea at YAU) (D)				
	Scientist/ Students Exchange Program	(JICA/ Mokpo National University, Korea) (OJ・D)				
	Food Safety & Quarantine	International SPS Harmonization (TCP) (D)				
	Distribution	Market Study (M)				
Private sector	Production	Construction of perilla field (under consideration) , protected cultivation of strawberry, cultivation under contract				
		Vegetable seed production and marketing				
		Cultivation crops for high-valued functional foods				
	Distribution	Cold-chain low temperature distribution project (starting in 2015, services are being expanded)				
		Introduction of a modernized whole sale market (Mandalay)				
	Processing	(foreign investment + joint venture) , processing of vegetables in the Shan State (frozen vegetables, factory in Nay Pyi Taw (in operation since July 2016)				
		Introduction of facilities for high-valued functional foods made from medicinal plants				

2.4 Livestock

2.4.1 Production (Short Term Measures)

Livestock development is expected to have increased farmer's income, supply of animal protein to people, enhancement of the national economy through increased export of livestock products and high-value added processed goods. There is a large potential to increase livestock production through improved animal breeding, animal health and animal nutrition. Livestock production will be increased both by strengthening small-scale farmers and by encouraging the large-scale livestock farmers and enterprises.

To increase the livestock production the various measures to be taken are ensuring animal health, improvement of feeding management system, improving the natural pastureland, more effective use of agriculture byproducts, more effective use of agriculture land and improving animal breeds.

Since natural breeding is increasing disease transmission and time-consuming, it is important for the promotion of the livestock industry to urgently establish a system for stable and expeditious supply of high-quality breeds through application of artificial insemination and embryo transfer techniques. Recently, the Government constructed a liquid nitrogen plant that distributes liquid nitrogen free of charge, to public breeding farms and private breeders' farms in States and Regions. The Livestock Breeding and Veterinary Department (LBVD), Ministry of Agriculture, Livestock and Irrigation have upgraded the semen-processing laboratory with automatic straw filling and sealing machines. LBVD has already established new Artificial Insemination Center (AI Center) in Mandalay.

For further development of the livestock industry, it is necessary to establish liquid nitrogen plant at the livestock potential area (especially Mandalay, Magwe, Sagaing and Bago Regions) and maintain a system for free distribution of liquid nitrogen, or for granting a loan for a certain period until the stabilization of the livestock industry.

As mentioned above, it must be acted upon with a sense of urgency to

enhance the production of livestock products to meet the increasing demand by improving the productivity. As for the improvement of conventional beef cattle, Brahman has been introduced from Thailand and frozen semen is produced from them. The frozen semen straw is distributed for beef cattle development in public breeding farms that are located in Livestock Production Zones where intensive efforts need to be made for increasing production.

To fulfill the increase population of livestock, animal feed production and feeding system will have to be increased. It is also necessary to improve the productivity of forage crops such as maize and pasture to decrease the costs of feedstuff. Several pastures need to be developed by private sector supported by Government.

The above mentions are cattle development including dairy cattle. Although milk and dairy products demand are very small at present, but domestic demand is expected to increase in future. The Myanmar Government is implementing the school milk program to encourage the milk drinking habits.

In the case of pig sector, a wider application of artificial insemination techniques should be promoted for improvement of breeds.

In order to improve the livestock production in Myanmar, we need the animal population at ground level. The activities of animal census data collection need to be conducted nationwide. At present, LBVD is conducting the pilot project concerning animal census supported by FAO.

2.4.2 Processing / Distribution (Short Term Measures)

There are two slaughterhouses in Yangon and Mandalay. However, the quality and efficiency of the slaughter is insufficient and it is needed to upgrade the existing slaughterhouses. It is important to introduce the cold chain system from the production areas to the consumption areas, and, on this basis, to encourage the slaughtering in the production areas instead of the consumption areas.

This upgraded slaughtering system where meat is transported in the form of dressed carcass in cold storage is more reliable compared with existing system

where animals are transported alive and dressed carcass in market. Precisely, evaluation of the value of the animal is much easier on dressed carcass rather than on live animals in market, those lead to the rationalization of the distribution system. Moreover, the risk of disease outbreak would be minimized by avoiding the transportation of live animals.

Existing livestock markets open weekly in free-space in Region and Division need to be managed to ensure the appropriate sanitation of market area for animal dung and materials. Regional disease diagnosis laboratories need to investigate the livestock markets to control of infectious diseases through the markets.

2.4.3 Animal health (Short Term Measures)

It is necessary to strengthen the capacity of diagnosis ability of various animal diseases including Foot and Mouth Disease (FMD), to expand the production of vaccine, and to reduce use of vaccines supported from OIE and other relevant International Organizations. It is urgently important to produce large capacity of vaccine production and use vaccination programme in wide area. At this moment, it is necessary to strengthen the capacity of FMD vaccine production to control the spread of FMD at specific areas. This could become a basis for the establishment of self-standing mechanisms at the local level and national levels for the elimination of FMD in distant future. The Livestock Breeding and Veterinary Department endorsed a Foot and Mouth Disease (FMD) national plan in 2014.

The veterinary service system should be strengthened by increasing the number of veterinary officials, by cooperating with private veterinarians.

It is necessary to enact the new law, Animal Husbandry and Animal Health Law, which regulates the management of slaughterhouses, so that the appropriate controls will be introduced to slaughterhouses.

2.4.4 Medium to Long Term Measures

In the future, **meat wholesale markets** need to be established in major

consumption area. Dressed carcass needs to be distributed to retail markets through meat wholesale markets.

In order to introduce livestock wholesale markets nationwide with fully functional, it is necessary to establish a new wholesale market system, which may take time to establish. First, it is necessary to conduct a detailed survey to analyze the structure and functionality of the existing livestock distribution system in each area. As the current distribution system has been established among concerned stakeholders, and may not be easily changed, it is necessary to take action to analyze the current system and to collect different opinions of stakeholders and to lead them to the direction of formulating transparent and efficient system between the distribution channels.

Table (4) Medium Term Measures for Livestock Sector

		2016	2017	2018	2019	2020
Myanmar government (ODA)	Animal Production	Establishment of a system for the supply of high-productive animal breeds through the use of artificial insemination techniques (supply of liquid nitrogen and frozen semen straw), training for Artificial Insemination, animal feeding (M)				
	Animal Feeding	Improvement of productivity of feedstuff such as maize, grass and legumes (M)				
	Processing and Distribution	Establishment and management of animal markets Enhancing School milk programme and promoting milk and milk-products market. (M & D) Improvement of Livestock Markets in sanitary and health (M)				
	Animal health	Strengthening the capacity of diagnosis and vaccine production for various animal diseases including Foot and Mouth Disease, dissemination of vaccines, increase of the number of veterinary officials at the scale of producing vaccine at the sale to control the spread of FMD at specific areas (OJ)			Technical Cooperation Project for Diagnostic Capacity Development (OJ)	
		Strengthening the implementation of the Animal Husbandry and Animal Health Law (Management of slaughterhouses, meat quality and hygiene control) (M)				
Private sector	Animal Production	Promotion of chicken/pig and goat farm management under contract				
	Animal Feeding	Introduction of improved maize varieties, pasture grass and legumes, extension and training for pasture development				
	Processing& Distribution	Introduction of the cold chain, production and marketing of processed meat and milk products				
	Animal health	Cooperation with private sector (Private veterinarians)				

2.5 Fisheries

2.5.1 Resource management (Short Term Measures)

In order to promote the fishery sector, the appropriate resource management is necessary and the precise understanding of the situation of resources is fundamental. Therefore, it is desirable to establish a system for the preparation of statistical data on fish catches and fishing efforts and to organize progressively scientific resource surveys so that Myanmar itself can grasp the exact amount of aquatic resources in the country.

For this purpose, it is considered that scientific surveys using research vessels including surveys conducted by the Government of Myanmar supported by the SEAFDEC is useful to clarify knowledge for a more appropriate resource management and to grasp the volume of utilizable aquatic resources and its status.

One of the reasons for the decrease of aquatic resources in Myanmar marine areas is considered the invasion of fishing vessels from the neighboring countries, whereas the insufficient monitoring, control and surveillance by the authorities of Myanmar worsens the situation. Japanese cooperation to strengthen the control is considered effective. A Marine Resources Law needs to be drafted based on modern principles and international requirements. Port control needs to be strengthened to avoid becoming a port of convenience.

2.5.2 Freshwater aquaculture (Short Term Measures)

Inland waters face major environmental challenges. This particularly related to pollution from anthropogenic factors such as waste water and sewage pollution, and cyanide, and sediments from gold and other mining activities especially in upstream areas. One government freshwater fish farm in Mandalay has faced with difficulty to operate because of the degradation of the water source. Environmental monitoring of inland waters is not carried out systematically at the present. Only simple monitoring using water quality test kits are employed. Staff is insufficient for regular sampling. When there is a major pollution even, the regional officer will report to the Head Office, who will

then work with authorities in charge of the offending industry to mitigate the problem. Recommended is the establishment of a laboratory for environmental management of inland waters. Habitat assessment studies in inland waters have been limited. However, habitat assessments of rivers where closed areas and seasons have been declared have been undertaken.

In order to improve the inland fisheries management in Myanmar, better knowledge about the fishery resources base is needed to ensure its sustainable exploitation. Integration of agriculture, irrigation and fisheries under a single ministry is the opportunity to address conflicts and help integrated land/water management. The new legislation can improve the contribution of fisheries to food security and livelihoods at the state/ region level. A new framework Aquaculture Law needs to be drafted based on international standards. Existing fish production systems can be improved, in particular through co-management for greater sustainability and benefit sharing. New fish production system such as irrigation reservoirs can be developed.

For the promotion of aquaculture, in the inland area, the expansion of aquaculture area is not realistic as aquaculture is already in operation in the whole inland water surface. The production of aquaculture should be enlarged by improving the underdeveloped aquaculture techniques, aquaculture infrastructure, aquaculture seed production and fish disease control technique as well by activating extension services and technical cooperation, resulted in the extension of export product production.

2.5.3 Measures for expansion of fishery products export (Short Term Measures)

In the area of trade and processing, there are fishery processing company possessing a HACCP certificate in the country and the **Laboratory Unit for the Export of Fishery Products** has introduced GLP (Good Laboratory Practice) and ISO17025. Thus, there is a certain progress in the field of the hygiene control system, but still nationwide development in this field is not sufficient including the infrastructure and equipment of laboratory. More efforts in this direction should be made. In order to encourage the business expansion of foreign companies in Myanmar in the field of the food processing industry, it is

necessary to establish a system enabling a stable supply of fresh fish for processing through resource management system, infrastructure such as fishing ports and landing facilities. Port management needs to be strengthened to improve ability to market products internationally.

2.5.4 Medium to Long Term Measures

Integrated, ecosystem-based, and spatial approaches need to be improved for the management of inshore and offshore fisheries. Policies and laws need to be modernized to manage fish stock effectively. Institutional reforms could unlock the full potential of inshore and offshore fisheries.

It is necessary to develop the marine aquaculture. The marine aquaculture has still a large potential for promotion and it is expected to increase the production and to develop new export products. For national marine fish cage farming development, aquaculture management practices need to be improved.

Table (5) Medium Term Measures for Fisheries Sector

		2016	2017	2018	2019	2020
Myanmar Government(ODA)	Resource management	Scientific surveys to grasp the volume of utilizable aquatic resources and their status (M)				
	Aquaculture	Improvement of the productivity of inland aquaculture (aquaculture techniques, aquaculture infrastructure, seed production, disease control, extension services) (M) Draft a new framework Aquaculture Law for integrated land/water management (M)				
	Export	Incubation of HACCP certified factories (M)				
Private sector	Resource management	Raise awareness of relevant laws				
	Aquaculture	Improvement of the productivity of inland aquaculture (aquaculture techniques, aquaculture infrastructure)				
	Export	Establishment of a stable supply system of fresh fish for processing				

3. Horizontal Measures

3.1 Agricultural Finances

3.1.1 Short Term Measures

Policy finance for agriculture is quite important in Myanmar rural society for realizing provision of concessional loan to many farmers who are facing difficulties to access sufficient farming fund.

Concerning **Seasonal Loan**, MADB current system could meet some parts of farmer's needs. However, MADB branch network is not nationwide. 208 Townships have MADB branches, while more than 120 Townships have no MADB branches. In order to bridge this gap, other microfinance institutions should provide the agricultural loan where MADB branches cannot operate. Moreover, finance among collaboration of MADB and cooperatives and other MFIs should be initiated through restructuring of existing mechanisms and internal procedures. It will be more beneficial for farmers to provide microfinance for poverty reduction and agricultural credit based on diversified commodities such as industrial and horticultural crops.

Concerning **Term Loan** for capital investment such as machinery, the capacity of MADB need to be highly developed in terms of examination of each loan case and feasibility of borrowers' business plans and other elements, thereby timely delivery of financial services could be realized through the "Agriculture and Rural Development Two Step Loan (TSL) Project". Introduction of **credit guarantee insurance** needs to be considered for farmers without enough collateral. In terms of examination of each loan case, collaboration between MADB staff and land management committee members including DOA extension staffs needs to be considered for better examination of borrowers' farming plans that could be made with technical knowledge on farming. **Diversification** of loan risk hedging measures and weather index insurance need to be considered to mitigate non-functional loan.

In addition, it is necessary to establish a **reserve fund system** utilizing the profit margin of the interest gained from the TSL that could undertake the role of the reserve for the possible loan losses caused by such as the borrowers'

default in case of disease or other inevitable incident.

The advantage and disadvantage of **privatization of MADB** should be well considered because privatization does not always benefit farmers. Most privatized agricultural banks in other countries shifted from farmer's orientated finance to other profitable business oriented finance, because privatized banks have to make their finance profit oriented. As a result, many farmers lost fund sources in other countries. In order to get advantages for small and medium scale farmers, semi-government banking system should be considered. Nevertheless, in that case the investment ratio of government must be more than 50%.

3.1.2 Long Term Measure

MADB finance needs to establish nationwide network to provide their loan for all eligible farmers. Apart from finance services, if agricultural producer groups along the supply chain develop their business capacity, they could conduct collective business and, purchasing and utilization of farm machineries through hired purchased system supported by MADB.

At this moment, MADB savings fund is very limited. As a result, MADB is always facing fund shortage. Saving fund of MADB needs to be expanded by providing better service to rural savers. Collecting savings from each borrower and other relevant investor in agricultural sector might benefit both MADB and borrowers/investors. After finishing the repayment of the fund from the TSL project, MADB needs to manage policy finance by their own fund mostly sourced from Government and savings. Although it is not a purely privatized system as it partly depends on fund from the government, this is common and sound financial system in every country, including developed country.

Table (6) Medium Term Measures for Agricultural Finance

		2016	2017	2018	2019	2020
Myanmar Government (ODA)	Seasonal Loan	MADB primary loan scheme (M)				
		1,700 Billion kyat	2,158	2,248	2,344	2,439
	Term Loan	Additional preparatory study	Fund Disburse for Agriculture & Rural Development TSL (Attn: the repayment period of the TSL is 40 years with the 10-year grace period) (OJ)			
		Capacity Building for MADB (OJ)				
Private sectors	Farmer Association	Collaboration with Farmer Association				
	Banks and Insurances	Development of Credit Guarantee Insurance and Weather Index Insurance for agricultural sector				

3.2 Agricultural Machineries

3.2.1 Short Term Measures

As it is observed that smallholder farmers cannot afford for the purchase of a power tiller, it is necessary to continue to support it by introducing MADB medium term loan with Credit Grantee Insurance that enables famers to purchase machineries without collateral. Agricultural Mechanization Department (AMD) distributes sale of power tiller with installment payment system for three times within two years.

In the case of medium- and large-sized machines such as tractors and combine harvesters, it is necessary to promote mechanization through services of specialized service providers. It is necessary to incubate these service providers as small- and medium sized enterprises, by building management capacity so that they can receive a loan to support small- and medium sized enterprises. Agricultural Mechanization Department (AMD) also distributes sale of tractors with installment payment system for three times within two years.

Private machinery companies imported various types of agricultural machineries i.e. power tillers, threshers, transplanter, combine harvesters and tractors and sell to the farmers in cash, installment system. Poor farmers could not buy some agricultural machinery like tractors, combine harvesters, therefore, financial support from various sources (government sector, private sector, banks, cooperatives) is necessary to buy agricultural machineries.

It is also necessary to incubate farmers' organizations to enable the shared use of tractors and other agricultural machines. Now IDACA (The Institute for Development of Agriculture Cooperation in Asia; www.idaca.or.jp) is implementing a project for collective purchase and use of agricultural machines through farmers' organizations. Success story of the agricultural mechanization project should be scaled out.

In 2015, former Ministry of Cooperatives and Daedong Industrial Company Limited agreed to provide the farm machinery valued at (100) million USD loan to promote the farm machinery utilization in Myanmar. The loan period is (7) years including (1) year grace period. The farm machinery from Daedong Industrial Company Limited includes power tiller, small, medium, and large tractors, combine harvester and implements. The Cooperative Department is selling the farming machines from Daedong Industrial Company Limited to the cooperative members' farmers with hire purchase system.

3.2.2 Medium Term Measures

It is necessary to establish a Machinery Examination System to ensure safety for operation. This system needs to be established under public and private collaboration that could provide technical assistance from private companies' technicians. In order to safe utilization of farm machineries, it is necessary to innovate training course on operation and maintenance of agricultural machineries conducted by AMD at two Training Centers and Agricultural Mechanization Stations.

It is necessary to invite FDI and local private companies to invest their resources in spare parts distribution for farm machineries and to provide Testing Body Center with local products and imported farm machineries before use in the fields.

- **After Sale Service**

Daedong Industrial Company Limited contracted with the local private company to provide the services after sale. The service centers are situated in almost all of the regions and states.

Local machinery companies and dealers are very weak in providing after sale services to customers. AMD provides the after sales services but it does not cover all. The companies should provide after sale services; regular checking, providing the necessary spare parts and maintaining.

Table (7) Medium Term Measures for Agricultural Machineries

		2016	2017	2018	2019	2020
Myanmar Government (ODA)	Shared use	IDACA (Project for the collective purchase and use agricultural machines through building farmers' organizations) (OJ)				
	Introduction of agricultural machines	Agricultural Two Step Loan (MADB medium term loan.) (OJ) AMD distribute with installment payment system and Cooperative Department distribute the farm machineries valued at 100million USD loan(M& D)				
	Safety Examination System	Machinery Examination System. (M& D) Need to modernize the operation and maintenance training. (M& D)				
	Research Center with Testing Body Center	Establishment of research center which is included with testing body center for local and imported farm machineries before introduce and sell to the farmers (M&D)				
Private sector	Introduction of agricultural machines	Introduction of paid service providers(tractors, combines, etc.)				
		Establishment of import and sale's network In Tilawa, distribution centers have been established or being established.				
	After Sale Services	Establishment of after sale services for agricultural machinery				

3.3 Agricultural Inputs

3.3.1 Chemical Inputs Regulation and Product quality control System (Short Term Measures)

The laws for pesticides and fertilizer were enacted in 1990 and 2002, respectively. However, contents of laws have not been updated for a long time and so there are the huge differences between direction and requirement stated in the law and the enforcement. Rules/procedures for the implementation of

laws have not been amended since both laws were first enacted. It is urgent to introduce effective systems for the implementation of the laws, modifying regimes for the control of the quality of agrochemical. The latest scientific knowledge to update the registration and regulation system of pesticides and fertilizer is also indispensable. The laboratories of the Plant Protection Division need to improve their capability for both pesticide formulation analysis (Content of active ingredient and physical/chemical properties) and pesticide residue analysis for contribution to pesticide administration.

Information gap can be found as a result of insufficient pesticide registration administration. In many cases instruction for use of the product on label is insufficient, although it is the most important information for extension/dissemination work and farmers.

In order to determine the appropriate usage of each pesticide product by PPD, it is essential to reform the pesticide administration system, including efficient use of two laboratories under PPD. International technical cooperation to improve capacity of laboratories and pesticide registration administration is urgently needed. Upgrading hardware of PPD is also necessary.

3.3.2 Labels in Myanmar Language for proper use of products

Due to the limited knowledge of farmers, improper use of agro-chemicals and significant risks could be observed in many places. Systematic and effective training on proper use of agrochemicals and raising awareness of farmers and dealers need to be provided through functional extension system and stewardship activities should be conducted by private sector. Private companies need to follow all labeling systems in Myanmar language, and ethnic languages.

3.3.3 Irrigation Water as Inputs

Irrigation is the most important input for agricultural transformation. Currently, irrigated area cannot cover the whole country and construction of new dams and reservoirs need high capital investment. Growing of high valued crops should be encouraged instead of depending on sole crop of rice. Therefore, irrigation strategy for non-rice crops needs to be developed for crop diversification. Research and development of irrigation for crop diversification based on establishment of model farms should be planned to disseminate research outputs to grass-root level for application.

Table (8) Medium Term Measures for Agricultural Inputs

		2016	2017	2018	2019	2020
Myanmar Government (ODA)	Pesticides	Law & management system will be improved. Functional laboratories for pesticide analysis in place (M)				
	Fertilizer	Law & regulation will be improved. Functional laboratories for fertilizer analysis in place (M)				
	Usage	Appropriate use direction for each pesticide will be determined based on scientific data by PPD. (M) Training by Functional Extension System will be conducted. (M)				
Private sector	Pesticide	Contents of labels will be improved and stewardship activities will be conducted				
	Fertilizer	Same as above				
	Factories	Fertilizer Factories will be constructed.				

3.4 Promotion of the conservation and utilization of plant genetic resources and the seed industry

Myanmar is rich in genetic resources and has environmental advantages in maintaining and utilizing them, such as cool and dry climatic conditions in the highland areas. The fact that there is no serious outbreak of plant diseases and pests is an additional advantage. To fully utilize these advantages, the establishment of the Plant Variety Protection System is required by introducing the necessary technology/infrastructure to collect, evaluate, conserve and utilize genetic resources. The improvement of the seed quality for domestic agricultural production on the one side, and for the exportation of quality seed on the other can be expected through the development of the seed industry in collaboration with foreign seed companies and farmers' participation.

3.4.1 Introduction of the Plant Variety Protection System (Short Term Measure)

The development of the seed industry in Myanmar can be achieved through partnership with foreign seed companies; however, foreign seed companies would likely be hesitant to release its seed in Myanmar if there is no effective system for plant variety protection. Without proper protection system, the seed industry cannot invest in the development of improved varieties. The

introduction of a legal framework together with the technical scheme to operate it is required for this purpose. A training program for government officers needs to be initiated to understand the PVP system. Myanmar is a member of the East Asia Plant Variety Protection Forum (EAPVPF), which is supported by the Ministry of Agriculture, Forestry and Fisheries of Japan, and various collaborative programs are foreseen.

3.4.2 Improvement of genetic resource conservation and utilization system (Short Term Measures)

Myanmar lacks institutional and technical infrastructures for the collection, conservation and evaluation of its genetic resources for their use as foundation material for plant breeding. Therefore, it is desirable to organize joint research programs between Myanmar and Japan, which are partly foreseen in the “Project for the Promotion of the Use of Genetic Resources in the Fields of Agriculture, Forestry and Fisheries” of the Ministry of Agriculture, Forestry and Fisheries of Japan. It is also necessary to publish the database of the Seed Bank, which is now closed, for better use of the Seed Bank.

3.4.3 Strengthening a seed production system in collaboration with the private sector (Short Term Measures)

Currently, good seeds for major field crops like rice, black gram, green gram, pigeon pea, maize, sugarcane, cotton, rubber are multiplied in government seed farms. However, the quantity of the seed multiplied in such ways could not meet the demand of farmers even for rice. After the economic reform, the Government encourages the private sector and farmers’ communities to participate in the seed industry. Now many private companies imported seeds for various crops including vegetables in line with the seed law. The global seed companies produces vegetable seeds worldwide such as China, Thailand, the USA, and Europe, and the seed market are continuously expanding. It is recommended that the transfer of the Japanese high-quality vegetable seed production system to Myanmar should be supported in cooperation with private seed companies. Japanese seed companies can find new seed production business in Myanmar

while private seed producing companies can be incubated in Myanmar, which will export produced vegetable seed to Japan and other countries to earn foreign currency. Furthermore, produced vegetable seed is expected to contribute to the improvement of the quality of vegetables produced and consumed in Myanmar.

3.4.4 Implementation of Plant Variety Protection Law (Medium to Long Term Measures)

The draft of Plant variety protection law needs to be approved as soon as possible. After approval by the Parliament, technical guidelines to examine varieties need to be developed for main crops such as rice, maize, cabbage, black gram.

The capacity of examiners needs to be developed for main crops. DUS test fields need to be prepared in DAR or DOA farms.

3.4.5 Improvement of the genetic resource conservation and utilization system (Medium to Long Term Measures)

Wider areas of plant species including medicinal crops need to be collected, evaluated and conserved in the Seed Bank. **Reservation fields** for vegetatively reproduced crops such as pineapple, strawberry also need to be prepared after collection.

3.4.6 Strengthening a seed production system in collaboration with the private sector and farmer participation (Medium to Long Term Measures)

Foreign companies have already introduced some kinds of vegetable seeds production from Thailand, China. Most of them are hybrids. Open pollinated varieties need to be introduced more in a later stage under the established PVP system in conformity with UPOV 1991 Treaty.

Table (9) Medium Term Measures for Plant Genetic Resource and the Seed

Industry

		2016	2017	2018	2019	2020
Myanmar Government (ODA)	Vegetable varieties	Support for the introduction of new vegetable varieties East Asia Comprehensive Strategic Project for Plant Variety Protection (J)				
	Genetic resources	Project for the Promotion of the Use of Genetic Resources in the Fields of Agriculture, Forestry and Fisheries” (J)				
Private Sector	Vegetable seed	Technology transfer for quality vegetable seed production in cooperation with private seed companies (JICA schemes for cooperation with private companies)				

3.5 Food Industry

3.5.1 Strengthening food industry through SME development (Short Term Measures)

Most food processing companies are Small Medium Enterprises (SME) in Myanmar. Accordingly, SME policy could contribute a lot to the development of the food industry. The SME Development Policy (2015) selected food, fisheries and marine products as priority industries in the short time and value-added food production industries as priority industries in the long term.

According to the SME Development Policy, the transfer of technology and knowledge to SME needs to be carried out for SME development. Necessary information dissemination to SME and the capacity of SME development are important. Tax relief and exemption for eligible SMEs need to be carried out.

It is necessary to provide support to encourage private food processing companies to modernize processing facilities using a financial scheme (**Two-Step Loan for SME**) with credit guarantee schemes supporting small- and medium-sized enterprise. It is expected that domestic companies will acquire the capacity of producing primary-processed products (wheat flour, bean flour, cereal flour, ingredients for condiments, etc.) of uniform quality for large-scale foreign and domestic joint food companies, contributing to raise the competitiveness of those joint companies.

It is important to consider the possibility of encouraging joint companies to undertake mango processing such as puree, juice, frozen mango and dried mango paving the way for the export of processed mango products.

3.5.2 Introduction of Foreign Companies Investment with techniques (Short Term Measures)

Considering the current level of the Myanmar food processing industry, it may take a considerable time for development of the domestic food processing companies in Myanmar, by improving processing and distribution techniques with their own efforts, to occupy a certain share of the domestic market of processed food, which is now occupied to a considerable extent by foreign

processed food. It is urgently necessary to raise the level of the domestic food processing industry to acquire competitiveness, to compete with imported processed food and to occupy a certain share of the domestic market; otherwise, the domestic market of processed food would be completely occupied by imported products.

In order to do that, it is necessary to invite foreign investment, to introduce for a short period high-level food processing technology for agricultural products (high-precision powdering technology, freeze-dry technology, packaging material, etc.) and to promote investment for infrastructure to improve expeditiously the production capacity of processed food. Package industry should be encouraged through foreign investment to access local made packing materials.

3.5.3 Processed Food Quality Standard (Short Term Measures)

In order to ensure the high quality and safety of processed food, it is necessary to set a Food Quality Standard by relevant agencies such as FDA. It is necessary to organize a Consumer Protection Association to respond to consumers' needs or claims and disseminate the information of the standard to consumers.

3.5.4 Cluster Formulation (Medium to Long Term Measures)

During the procedure of the modernization of the food processing industry, a strategic approach should be taken to establish a whole value chain system from the production of agricultural products in its upstream to the transportation, storage, processing in factories, distribution and marketing in its downstream, rather than considering solely the modernization of processing factories. According to the agriculture sector second five-year short-term plan (2016-17 to 2020-21), the establishment of special economic zones for agriculture should be integrated to the cluster formulation in the food industry. The development of a wider dimensional area is also a useful approach, where Myanmar-GAP is applied to the production of raw materials, GMP is applied to the factory and a system for the control of pesticide residue and HACCP for food hygiene are

established nearby. Currently, Myanmar-GAP guidelines for fruits and vegetables are adopted by ASEAN-GAP. It should be further considered how a research system could be integrated as a cluster in the area to solve technical problems, which the whole value chain will be facing.

3.5.5 Capacity Building Programs (HIDA) (Medium to Long Term Measures)

During the period when the food industry in Thailand and Vietnam was under development, many specialists from Japanese enterprises working in cooperation were sent with financial support from the Japan Overseas Development Corporation; (JODC, since March 2012: Overseas Human Resources and Industry Development Association (HIDA)) contributing to the upgrading of the food processing industry of the countries. Also in the case of Myanmar, a similar approach should be considered.

Table (10) Medium Term Measures for Food Industry

		2016	2017	2018	2019	2020
Myanmar Government (ODA)	Support Policy	Implement SME Development Policy				
	Tax	Relief and exemption for SMEs (M)				
	Finances	SME-TSL (OJ)				
	Capacity Building	HIDA Schemes (J)				
Private sector	Food safety	MFPEA food analysis				
	Processing	Construction and planning of factories for food manufacturing and processing, through foreign investment				
		Construction of factories for instant noodle through foreign investment				
		Operation of Frozen Vegetable Factories				

3.6 Formation of Farmers' Organization

3.6.1 Short Term Measure

Myanmar Cooperative Society has a long history dated back to (1904) and starting as Saving and Credit Cooperative Society. More cooperative functions focus on selling and buying, bazaar cooperative society, agriculture producer's cooperative society and so on were also formed at different administrative levels from villages to central level. Although purposes of cooperative were proper, mismanagement and inappropriate policy of socialist administration lead failed to meet the requirements of society's members before 1988.

After the second democratic government handed over administrative power, restructuring ministries and new institutional structures were undertaken. Three ministries namely the Ministry of Agriculture and Irrigation, the Ministry of Livestock and Fisheries and Rural Development and the Ministry of Cooperatives were merged into the Ministry of Agriculture, Livestock and Irrigation. Although the new name of the ministry does not include the cooperative, farmer organization or cooperatives play a very important role to the raising of awareness of rural and urban societies. The new institutional structure is favorable to exploit the advantages of collaboration and cooperation among sub-sector related activities so that it is necessary to empower farmer organizations or cooperatives.

In 2013, the former Ministry of Cooperatives agreed with China EXIM Bank to disburse the loans of (100) million USD to the cooperative members' farmers. For these loans, the former Ministry of Cooperatives operated the Cooperative Microfinance to the cooperative member farmers successfully. In addition, China EXIM Bank offered another (300) million USD loan to the ministry. In 2014, the former Ministry of Cooperatives could disburse totally (400) million USD to the cooperative members. Up to the end of April 2016, there were functionally formed over (35,000) agriculture cooperative societies. Within five cycles' disbursements, the repayment rate is (100) percent.

For the time being, the Cooperative Department can only disburse the micro capital loans to the cooperative members. Therefore, the Cooperative Department has limited capacity to contribute along the food supply chain. In

order to remove such kinds of constraints, the awareness, capacity building trainings and other related trainings should be provided to the department employees and the cooperative members. Moreover, the size of the loan from the Cooperative Department is limited for production and marketing activities. Therefore, Two Step Loan from international bank would be an alternative option to solve fund shortage problems and the farmer organization can operate the whole supply chain effectively. The farmers want to extend the loan repayment duration of at least one year instead of original six months.

3.6.2 Long Term Measure

There are many financial institutions; such as, Cooperatives, Financial Institutions including NGOs, and INGOs registered at Financial Regulatory Department, MADB, Emerald Green Project from former Ministry of Livestock, Fisheries and Rural Development, etc. Therefore, assessment of existing financial institutions should be conducted in order to consolidate all functions into the most effective one.

Table (11) Medium Term Measures for Farmers Cooperatives

		2016	2017	2018	2019	2020
Myanmar Government (ODA)	Finance	China EXIM Loan Project (Micro Finance) (D)				
	Capacity Building	Seminar, Workshop & Training for farmers related to FVC issues, Dispatch cooperative members to model cooperative in foreign countries (M& D)				
Private Sector	Capacity Building	Participate in Capacity Building Programs by Government or NGO				
	Management	Develop credit and other business management skill				

3.7 Research and Extension

3.7.1 Agricultural Research

It is urgent to increase the number of researchers. It is very difficult to cover the multifaceted research fields encompassing plant breeding, soil-science, plant

disease and insect pests, agricultural ecology agricultural engineering, genetic resources management with round 50 researchers.

Plant breeding should be accelerated but the introduction of sophisticated breeding methods such as DNA markers seems to be still premature. It is rather necessary to establish a system to use basic techniques and to concentrate research efforts on research areas really bringing benefits to local farmers, such as purification of varieties (increase of the level of genetic uniformity of existing varieties). The number of applied researchers such as soil and water scientists, agronomists, plant pathologists, entomologists, post-harvest specialists, agricultural engineering specialists is very limited, thus, the researchers need to be reallocated in accordance with research needs.

It is necessary to further place emphasis on research areas in satellite farms of States and Regions, which would resolve problems, rose by extension personnel or by farmers. The cooperation between the research units and the extension service units is not easily performed in many countries, but if researchers decide to go close to farmers, cooperation with them would be gradually achieved.

3.7.2 Agricultural Extension Services

It is urgent to increase the number of extension staffs. Extension services play the central role for the training at the farmers' level for the dissemination of knowledge, for example, on plant cultivation, pest control and post-harvest techniques, which are necessary for the improvement of the productivity and the quality of products.

Based on the allocated budget, a **National Extension Implementation Plan** needs to be made by the Ministry of Agriculture, Livestock and Irrigation. The components of the plan include the deployment of Extension Operation Bases (Extension Center), Extension staffs, Roles and responsibilities of Extension Bases, Extension staffs, and Capacity Development Plan for Extension staffs.

It is necessary to equip extension service operational bases (Extension Center/camps, Knowledge Center) with a minimum set of devices necessary for soil analysis and pest and disease diagnosis. Simple soil analysis kit, simple soil

moisture meter, simple grain moisture meter should be provided to TS extension staffs stationed in each TS.

Cooperative action plans for public, private; LNGOs, INGOs and farmers' consortium should be made and shared by all stakeholders for the better extension services for rural development.

It is indispensable to raise the efficiency of extension services to achieve the task of the extension organization with the minimum number of extension staffs. There is a certain limitation of extension capacity of individual extension staffs, dissemination of knowledge, human resource development for new generation of extension staffs should be nurtured. They will also implement extension education programs from contact farmers to nearby farmers by farmers' participatory approach. In the Myanmar rural society where inhabitants are indifferent to each other, interaction among society members is not clear. Therefore, they need to examine carefully which role key farmers would be able to play in the society.

Table (12) Ratio of total Extension Staffs and Farmers in the regions and States of Myanmar (2015-2016)

No.	Region/State	No. of Staffs	Total No. of Villages	Ratio of 1 Staff: Village	Total No. of Villagetracts	Net Sown Area (ac)	Ratio of 1 Staff: Area	Total No. of Household Farmers	Ratio of 1 Staffs & Farmers	Total No. of Extension Camps
1	Nay Pyi Taw	403	796	1.975186	186	573825	1423.883	92655	229.9132	17
2	Saging	559	6019	10.76744	1758	4508213	8064.782	888977	1590.299	68
3	Mandalay	729	4224	5.794239	2001	4939945	6776.331	1069708	1467.364	83
4	Mgway	443	4832	10.90745	2089	3039391	6860.928	761727	1719.474	116
5	Bago	744	6247	8.396505	1490	3600083	4838.821	546839	734.9987	112
6	Ayeyarwaddy	511	11582	22.66536	1962	3702887	7246.354	508537	995.18	96
7	Yangon	208	2315	11.12981	679	1197540	5757.404	132406	636.5673	9
8	Chin	186	1387	7.456989	476	319851	1719.629	60456	325.0323	0
9	Kachin	154	1651	10.72078	521	1066401	6924.682	120487	782.3831	17
10	Kayah	72	511	7.097222	74	218133	3029.625	56386	783.1389	10
11	Kayin	75	1600	21.33333	374	494390	6591.867	76906	1025.413	2
12	Mon	238	1147	4.819328	368	1290443	5422.029	256238	1076.63	15
13	Rakhine	355	3611	10.17183	1047	1099853	3098.177	293999	828.1662	73
14	Tanitharyi	203	1314	6.472906	286	1083283	5336.369	138387	681.7094	3
15	Shan (South)	472	5677	12.02754	422	1825399	3867.371	336410	712.7331	24
16	Shan (North)	121	4740	39.17355	714	1702134	14067.22	316318	2614.198	17
17	Shan (East)	99	2549	25.74747	187	652497	6590.879	106772	1078.505	4
	Total Union	5572	60202	10.80438	14634	31314268	5619.933	5763208	1034.316	666

Source: Office from All Regions and States. Total Extension Staffs-All Technical Staffs from Region and States (not include Clerks and others)

In addition to technical transfer, extension staffs are also expected to extend

their activities to cover the responsibility of conducting the **field inspection** in the case of rice, pulses and some other crops **seed multiplication** and the product quality control to ensure the prescribed seed quality. Furthermore, as mentioned above, for the promotion of GAP, extension staffs should play the role of **GAP Inspector** to check the implementation of GAP at farmers' level.

In order to functionalize the extension system, the following measures need to be taken in medium and long term:

- (1) To review past activities about Extension related projects implemented by several donors and other nationwide. (Past extension activities were conducted in supply driven ways. Conversion from **supply driven to farmer oriented extension** is Key)
- (2) To make **regional technical extension plans** that are suitable for each state and region in consultation with research institutes
- (3) To functionalize the extension organization sustained by necessary budget and competent extension staffs trained in systematic ways for implementing the above regional technical extension plans
- (4) To implement extension activities nationwide by selected effective extension operators such as Knowledge Center, Farmers Labor Union and the like.
- (5) To disseminate agro-technical information through IT technology and devices

It is necessary to establish a **feedback system** between research institutes and extension staffs in local areas. In the system, each extension worker could solve difficult problems, supported by research institutes which provide appropriate resolution for the problems.

Under the current circumstances where farmers' organizations do not work efficiently, extension workers need to cover not only the transfer and dissemination of technology but also the **coordinator's role** for the management of local joint use facilities (for example, post-harvest facilities such as dryer which should be developed locally), and should play the **integrator role** for

linking one value chain actor to another value chain actor.

Table (13) Medium Term Measures for Agricultural Research and Extension

		2016	2017	2018	2019	2020
Myanmar Government (ODA)	Research	National Agricultural Research System (NARS), Research Strengthening Program (M)				
	Extension	Establishment of Functional Extension System (OJ) IFAD project is developing Knowledge Centers to provide extension services. (D)				
	Plant Health	Implement Myanmar Plant Health System Development Strategy (M)				
Private sector	Agricultural in-put material companies	Strengthening of education on GAP in cooperation with the Government				
	Contract	Contract farming to provide farming technique				
	Service Centers	MAPCO provide extension services for farmers in MAPCO business activity areas.				

3.7.3 Livestock Research and Extension

There are following activities to be conducted;

- 1) Design and implement prioritized Livestock Research Programme - emphasizing understanding and respectively dealing with and exploiting the technical, social and environmental constraints and opportunities for livestock development at various stages of the value chain and various areas of the country.
- 2) Compile and maintain national information, inventory and database on animal pastures, fodder and feed systems - with specific breakdown of situation and conditions by area.
- 3) Strengthen physical, human resource and financial capacity of Feed Testing Laboratory of Livestock Breeding and Veterinary Department (LBVD)
- 4) Implement programme to in-build mitigation factors and resilience of livestock farmers to natural disasters and other uncertainties
- 5) Develop value added livestock products based on the One-Village-One-

Product concept

- 6) Train and provide information to build capacity of livestock producers of animal on breed, nutrition, disease control, management and marketing.
- 7) The Japanese Government will support the project for the improvement of Foot and Mouth Disease (**FMD**) **control** in Myanmar through Grant Aid Project in 2016 and technical cooperation in future.
- 8) Support applied research in animal nutrition in conjunction with Livestock Research Programme. A wide range of research and development is required in the establishment of feeding strategy, development of technology for the sustainable use of pastureland and available of feed in dry season.
- 9) Develop Food Standard, Nutrition Standard along Food Supply chain
- 10) To support Small and medium scale livestock production in rural setting and peri-urban setting.
- 11) Integrated Farming system analysis
- 12) Animal value chain analysis
- 13) Social network analysis
- 14) Risk assessment and mitigation strategy

3.7.4 Fisheries Research and Extension

The fact that there is no other information about today's abundance of the marine fish resources, then from the surveys with research vessel Dr. Fridtjof Nansen is a clear indication that the marine fisheries research center does not exist in Myanmar. However, there are three training centers, of which Gyogone Institute of Fisheries Technology (IFT) in Yangon is the one related to marine waters. IFT perform several training courses for fishers and DoF staff during the year, but the number of staff must increase, the type of training must be modernized and the content of the training must be changed in order to increase the level of marine scientific competence in the country.

A considerable increase in **abundance of jellyfish** was observed in 2015 and this was not recorded in any of the previous surveys. It is indicating that lack of

marine ecosystem services and management **measures to reduce the fishing pressure** are required in Myanmar urgently. There are following activities needed to be conducted;

- 1) To carry out institutional reforms with a view to developing an effective Fisheries management system;
- 2) To establish a Centre for Marine Fisheries and Environmental Research with the main responsibility of providing advice to relevant authorities as a part of the above;
- 3) Capacity in stock assessment and various aspects of fisheries research needs to be strengthened, e.g. Fishery data collection including biological sampling, stock assessment including calculation of basic biological and ecological parameters and data bank management.

There is not a good link between the different institutions in Myanmar that are responsible for providing information and those responsible for management. There must be established long term commitments and collaboration between departments in DoF, the regional offices and the Universities (managers, fisheries officers, researchers, academics). There is also a strong need for developing a system for data management (input of data, storage, distribution, access to data, dissemination of results etc.)

Table (14) Roadmap for Five Years in Fisheries Research and Extension

		2016	2017	2018	2019	2020
Myanmar Government (ODA)	Resource Management	<ul style="list-style-type: none"> • Support to scientific surveys to grasp the volume to utilizable aquatic resources and their status • Develop and ecosystem-based fishery management plan for the Myeik Archipelago and begin to establish (Locally Manage Marine Area-LMMAs) at key sites 				
	Aquaculture	<ul style="list-style-type: none"> • Improvement of the productivity of inland aquaculture (aquaculture techniques, aquaculture infrastructure, seed production, extension services) • Promotion of marine aquaculture techniques and research center improved • Establish extension programme for sustainable aquaculture management. 				
	Plant Health	Implement Myanmar Plant Health System Development Strategy (M)				
Private Sector	Export	<ul style="list-style-type: none"> • Incubation of HACCP certified factories • Carry out detailed feasibility assessments and public consultations at priority sites for establishing new LMMAs and MPAs • Develop alternatives to fish feed for domestic aquaculture, including soy based feed • Establishment of a stable supply system of fresh fish for processing 				
	Resource Management					
	Aquaculture					
	Export					

3.8 Agricultural Education

One of the challenges in agricultural development is to do the fundamental changes in how education, research and extension system are to be integrated. Part of the problem arises from the traditional separation among research, education, and extension. There is little connection between those institutions. In addition, in the context of agricultural workforce development, there is still a lack of agreement on the types of occupations needed and how best to prepare and train individuals for those roles. Agriculture as a vocation has historically not been incorporated into the wage-labor economy of the country, and so the concept of skills training for agricultural occupations becomes less clear.

Agricultural extension has historically provided information to farmers about new production techniques and technologies, and especially with the move toward more training-based agricultural services, the lines between agricultural extension and vocational schools are not always clear-cut.

In Myanmar, as for agricultural education Yezin Agricultural University (YAU) is the only one degree level education system such as Bachelor, and Postgraduate programs such as Master, Doctoral Degree, and Master of Philosophy and Postgraduate Diploma are conducted. For agricultural skilled technicians as diploma level, there are 14 State Agricultural Institutes (SAI). These institutions were included under the former Ministry of Agriculture and Irrigation (MOAI). Currently, MOAI became Ministry of Agriculture, Livestock, and Irrigation (MOALI) and therefore one University of Veterinary Science, two cooperative universities, two cooperative colleges, three cooperative commercial training schools, and four cooperative training schools were now involved. Besides them, there are agricultural training centers such as Central Agricultural Research and Training Center, post-harvest technology training center and as agricultural machineries training centers are also included as a part of the agricultural education system.

3.8.1 Linkage between State Agricultural Institute and YAU

Under these circumstances, State Agricultural Institutes (SAIs) or agricultural technical and vocational education and training institutions have played partially for agricultural development and economic growth in Myanmar for several decades. SAIs is considered as secondary or post-secondary in nature, and can focus on direct training for individuals who support farmers and contribute to the post-production process. With a strong desire to change agricultural policies of newly elected government and its focus on strengthening agricultural value chains and investing in workforce development, SAIs should be re-evaluated and assessed for their relevance in a changing agricultural and development setting. Increased access to primary and secondary education, as well as connections to YAU, will shift the employment demands in many sectors of agricultural production and post-production. In order to build upon these changing agricultural realities, public and private sector have to take the

account of the current situation of vocational institutions and approaches, and seek lessons and insights that are most appropriate to changed settings.

On the other hand, the traditional functions of YAU are teaching and research. In teaching activities, YAU is providing the professional training for higher educational level. Research programs of YAU increased the theoretical knowledge as well as its application to practical problems. Research was the privilege of the faculties, determined to a large extent by personal interests and their contacts among each other. For the development of research and education sector, there should be a link between YAU and SAIs. The courses and curriculums being given in SAIs should be standardized with the help of YAU which have rich experience of teaching and research as well as the diversity of expertise of YAU faculty.

In order to foster agricultural technicians, it is necessary to increase the number of (SAI) than currently operated numbers. It is requested to construct State Agricultural High Schools (SAHS) for young people working in farm families under SAI. Educated young people in SAHS are expected to spread agricultural extension services throughout the country.

3.8.2 Capacity Development Program

In order to conduct research activities in line with grassroots needs, in collaboration with the agricultural extension organization, JICA provide capacity development programs for human resources in MOALI.

Table (15) Medium Term Measures for Agricultural Education

		2016	2017	2018	2019	2020
Myanmar Government (ODA)	SAI		1 New Institutes			
	Capacity development for teachers of SAI		*Program (15 staff) to study the Vocational Education System in foreign countries *Program (30 staff) for short term training on subject matters in foreign countries *Program (30 staff) for further study on subject matter in foreign countries *Program (15 staff) for pedagogical and didactical training in foreign countries In country training on subject matters and pedagogical and didactical training			
	Facilities development of SAI		*Improvement of laboratory equipment's *Improvement of teaching and learning materials *Improvement of infrastructure and outdated agricultural mechanization			
	Capacity development		Students Exchange program (30 students) for short term training			
	SAHS					
	Capacity Development	Program(15 staffs from MOALI) for long term training (OJ)				
	YAU	Expanding Organization Structure, Extending the new department and building one more University (M)Technical Cooperation for YAU capacity building (dispatch long & short term experts) (OJ) Endowed course (J)				

4. Additional Study to formulate strategy for profit sharing along the food

value chain development

A value chain is a supply chain made up of a series of actors –from input suppliers to producer and processors to exporters and buyers-engaged in the full range of activities to bring a product from its conception to its end use. From the agricultural value chain point of view, farmers in rural areas play important role to provide fresh produce and food supplies, quality and safety product demanded by traders, agro-processors, supermarkets and exporters. In Myanmar food supply chains, farmers are strategic collaborators in the chains, which are deliberately designed to allow the farms, the distributors, and others involved to earn a profit. Each needs the others to thrive in business so that the whole group can succeed while maintaining their values and delivering the product attributes customers want. An intentional strategic interest in each participant's well-being and performance sets up win-win terms for everyone.

The consolidation and coordination along the value chain is challenging in the developing countries agricultural value chain. To maximize the individual party's expected profit, it is necessary to establish centralized system where decisions are fully integrated for the joint profits as profit measures were typically accounting for profit rates of price cost margins. But in many agricultural products, the lack of coordination among the each and every participant along the supply chain causing the fragmented value chain which leads to decrease the individual profit sharing along the chain. But the farmers, the primary producers, are more vulnerable on price fluctuation getting the lowest share in the value chain in the case of developing countries like Myanmar.

The various crops have their specific supply chain and the profit sharing along the chain differs from crops to crops. However, the common point is that the primary producers' share obtained from the final consumer price in most of the crops is relatively lower compared with other stakeholders along the value chain. This is the indication of the inefficient market structure in Myanmar. A first and most obvious and glaring challenge is the high cost of transport and the poor condition of transport infrastructure; rural roads, rural-urban highways, border crossings, and ports. Myanmar also has to provide its rural producers and traders with more market channel options to the variety of

regional markets and urban market points. A second challenge is the too-sharply seasonal nature of produce supply. There is a large need to invest in affordable small greenhouses in the cool mountain areas, irrigation in the dry zone and hills, cold storage at urban and export market points, and icing facilities in the fish/seafood areas. These will extend the season and allow farmers and traders more bargaining power and flexibility and range of options in selling to domestic and export markets. The counterpart is that there will be a large need for electrification in the rural areas to support this. A final very important challenge is the need to develop both rural and urban wholesale markets. Throughout Asia (and Latin America) the spread of wholesale markets as collection points and conduits to cities has been extremely important to the development of value chains.

Improvements in farm income gained through value chain participation can also lead to enhanced economic activity on a community level. Farmers who retain a higher share of consumer expenditures through food value chain participation tend to have more discretionary income to spend on local suppliers of goods and services. This spending directly benefits ancillary businesses that depend on agricultural producers for a portion of their revenue, such as purveyors of fertilizer, seed, and animal feed; agricultural equipment dealers; and contract labor.

Improving food value chains have tremendous potential to expand access for participants to existing markets and to create new market opportunities. The deliberate inclusion of participant values into the marketing and branding strategies is a strong selling point for like-minded consumers. In the broadest application, with the aim of creating a healthier, more sustainable food system, food value chains can provide benefits that improve community well-being as well as business viability of Myanmar food industry.

In order to clarify various factors to decide profit sharing among stakeholders, in-depth study on each kind of commodity food value chain in Myanmar is indispensable. Based on this study output, a strategy could be formulated for ensuring optimal profit sharing along the food value chain. The strategy implementation could realize inclusive food value chain development.

JICA and MOALI is planning to implement **Strategic Policy Research and Innovation Program** that could conduct in-depth study on each kind of commodity food value chain in Myanmar in collaboration with **GRIPS** (National Graduate Institute for Policy Studies) and MAFF-JPN. The details of this program will be set by relevant organization early 2017.