

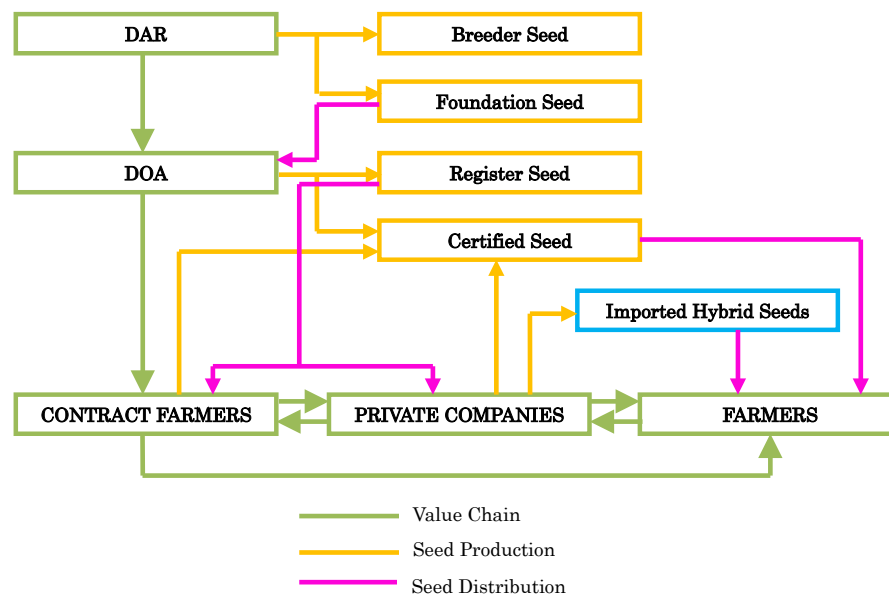
(Reference) Analysis of the Current Situation

1. Rice

(1) Production

Rice is cultivated approximately by 6 million farmers in the Ayeyarwady Delta region as well as Yangon, Bago and Northern Sagaing districts. 65% of the rice production is carried out by small-scale farmers with less than 4ha of land. According to the statistics of the Ministry of Agriculture and Irrigation (MOAI), the average yield of rice is slightly less than 4ton/ha, but USDA estimates that the average yield should be 2.5ton/ha. Thus the productivity of rice in Myanmar is considered to be lower than that in other Asian countries.

A rice seed supply system has been established in cooperation with the Government research centers producing breeder's seed, foundation seed, registered seed and certified seed. It has been found, however, that breeder's seed of a considerably large number of varieties shows the lack of uniformity in relation to the period of maturity (difference of 10 to 14 days), meaning that those varieties are not genetically stabilized. No field inspection is organized during the production of registered and certified seed; consequently off-types are not eliminated. Many varieties are contaminated with each other thus the quality of seed supplied is not satisfactory. As the result, the productivity remains low and the quality of produced rice grain is low because of the high ratio of broken rice grains (90% of rice produced is graded as the low-quality rice with 25% broken grains). Accordingly on the export rice market rice produced in Myanmar is sold at a price 30 to 40 % lower than that produced in Thailand.



A significant portion of harvested rice contains “Red Grains” that derived from wild rice, red-colored varieties of rice and other grass grains. According to a study conducted in Myanmar by JAICAF in 2015, 73% of the samples collected from 6 millers include “Red Grains”. Red Grain-contaminated rice is usually traded at prices 20-30% lower than that of normal rice. Millers refuse to buy highly contaminated Red Grain Rice.

Some hundred tons of seed of hybrid rice is produced based on the male-sterility lines introduced in the form of foundation seed from China, in the Governmental rice seed

multiplication fields and is sold at a low price (3000Kyat/Kg). Some farmers decided to use hybrid varieties (sowing such a low quantity of seed as 20Kg/ha) but their taste does not meet the requirement of Myanmar consumers and are not well sold on domestic markets. (DAR is now developing good-taste varieties of hybrid rice) As male-sterility lines are not domestically produced, it is necessary to buy them from China paying royalties every year.

Farmers use many several kinds of varieties in their fields. There are cases where Even in only one single plot is planted with different varieties selected in accordance to different water levels caused by uneven surface of the plot. This leads to atomize one variety production lot. As a result, it is very difficult to bring the size of a trading lot to the size required by trading partners collect one trading lot (usually 400-1000ton consisting of one) by single rice variety rice).

The right to land use can be sold to other farmers. However, the usual practice is that the right to land use is inherited from the parent to the first child (Equal inheritance is not a common practice in Myanmar.) However, if a child other than the first child wishes to cultivate the land, that child can also inherit a part of the parent's land. Thus after generations the land cultivated by a farmer tends to become smaller. As it is rare in Myanmar for a farming family to completely abandon farming, it is unlikely for a land lord to accumulate land by buying the right to land use from farmers having abandoned farming. But since the Land Law was amended in 2012, "Form 7", a certification of Land Use, has been distributed to rural areas. Under these circumstances land markets are expected to be activated.

In the low-land rice producing areas such as the Ayeyarwady Delta Region, a two-crop cultivation system is being rooted where pulses are introduced after the rice cultivation during the rainy season. As the profitability of export crops (for China and India) such as pulses is higher than that of the rice cultivation during the dry season, the cultivation of pulses is widely spread. However, the cultivation of pulses during the rainy season is not popular because of the difficulty of the cultivation of pulses during the rainy season. In the irrigated paddy fields, some farmers transplant rice from December to January and harvest it in April (Summer Season Rice).

Farmers possess certain knowledge on rice cultivation. However, they are not capable of utilizing agricultural chemicals and fertilizer properly; as their label is written only in the language of the producing country and farmer themselves do not have sufficient knowledge on their utilization. The Government also could not provide farmers with necessary information and training as the extension system is not working.

The mechanization of rice cultivation is limited. Farmers (land owners) hire farm workers seasonally for rice transplantation, weeding and harvest. However, in regions remote from Yangon some farm workers begin to move to cities such as Yangon for work or they will find another job locally in the other sectors such as service industries and manufacturing, thus individual farmers have difficulty in hiring farm workers according to their need. Power Tillers (from China or Thailand) sold at lower prices are being introduced. However, the introduction of tractors and combines is very limited. Recently, farmers possessing tractors or specialized farming companies start to offer services to undertake land cultivation against payment. Because of the increasing labor shortage in rural areas, the mechanization of agriculture is considered to be urgent. However, the lack of medium-sized agricultural financing institutions

providing a long-term credit with a modest interest does not allow average farmers to purchase agricultural machinery.

The Myanmar Agricultural Developing Bank (MADB under the MOAI) offers a small credit up to 100,000Kyat for 1Acre of rice cultivation, contributing for farmers to receive financial resources for their farming.

The farm income is unstable because of the unstable rice production caused by the cultivation of rice in rain-fed paddy fields and low selling price of paddy at farm gates. This is in particular the case in the Northern dry regions. Now 20 % of paddy fields are equipped with irrigation facilities, however almost half of the facilities are not functioning because of poor management. Most of irrigation associations do not work. For each end of the irrigation canal a head of irrigation management is nominated and undertakes the management of the irrigation system under the guidance/supervision of an irrigation engineer of the MOAI.

(2) Post-harvest and processing

The majority of the paddy rice fields are not consolidated. The width of ridge, dividing individual parcels, is too narrow to walk thereon only with difficulty, so that the transportation of harvested rice is difficult. Consequently, there are cases where harvested rice is left in paddy fields for a long period until all rice fields in the area have been harvested. This is considered as a cause for the appearance of moldy yellow rice. The rice including Yellow Rice could never be sold to any Export Market. Mechanized drying is applied very rarely and solar drying of rice grain on road surface is the common practice. The Too extremely late harvesting time could lead to the enhanced occurrence of more broken rice grains due to fragile characteristics of rice grains with less than 24% moisture paddy. Millers receive paddy whose white grain part has been already broken inside hull. Although very rarely observed recently, some farmers still thresh rice by using cows stepping on dried rice placed on a dry surface and remove dirt from threshed unhulled rice by applying wind to that rice which is falling from the height. Recently, the use of simple pedal threshers or motor-driven fixed threshers has been generally introduced.

While a small number of rice millers have introduced recently a modernized milling plant, the majority of them continue to use a small traditional milling machine. As dry-season rice is normally harvested in the rainy season, the drying is technically difficult. Rice grains with high humidity are brought to the rice millers, leading to a low milling rate. Millers receive rice grains consisting of different mixed varieties paddy from brokers or farmers. This means some of the collected rice grains are paddy that includes premature grain and others are extremely mature grains. This could cause produce a high broken rice rate. Most of the trading lots of milled rice grains in Myanmar contain 25% broken rice grains. Registered Millers in Ministry of Commerce are receiving training from the Ministry of Commerce but not sufficiently. Flat-type dryers burning rice hull are starting to be introduced but their use is still limited. No farmer groups are organized for the shared use of post-harvest related facilities. While individual farmers have almost no possibility of possessing their own post-harvest facility, it is necessary to consider how to introduce the collective management of post-harvest related facilities.

(3) Distribution / Export

The distribution system of rice is not so complicated in Myanmar. Rice grains are sorted in

accordance to the conventional sorting system called “**Beale classification system,**” where rice grains are sorted morphologically into 5 categories (such as long-grain, medium long grain, short grain, etc.). This system has been used for many years and different varieties with different cooking characteristics may be grouped into a same category. The grouping of different varieties into one single category is considered to be the cause for a high ratio of broken rice grains. More than 200 varieties are on the market and this situation may be the reason for different varieties to be commingled.

Beale Classification in Rice Marketing in Myanmar

Group	Varieties	Dimensions (rice)		Description
		Length (mm)	Length/Width (ratio)	
Emata	Aye yar Min, Hmawbi 2, Kyaw ZeYa, Shwe War Htun, Sin Thwe Latt, Sin A Kari 3, Thee Dat Yin	=>7.00	=>3.00	Long-grain, slender, translucent
Letyezin	Manwthukha, Shwebo Manaw	6.00-7.00	2.40-3.00	Long-grain, slender, translucent
Ngasein	Kamakyi, Kamar, Shewe-ta-soke	5.60-6.40	2.00-2.40	Short- and medium-grain, usually translucent
Byat	Lin Pan Chaw	6.40-7.35	2.00-2.50	Long-grain, broad, kernel opaque and chalky
Meedon	Ka Ma Kyi, Paw San Hmwe, Paw San Yin, Shwebo Paw San	5.00-6.80	1.60-2.00	Short-grain, broad, kernel opaque and chalky

✱ Each Variety has different cooking characteristics

The export of rice is carried out in many cases by small exporters who handle less than 1000 tons per year. Export contracts should be concluded each time with foreign importers; being the reason for export costs to be increased.

Export contracts for rice are concluded on an irregular and ad hoc basis. This makes it difficult for Myanmar to ensure a stable position on the international market, and there is no consistent business flow from the producer through collectors to consumers/export. Consequently, Myanmar rice, as commodity, is not competitive on the international market.

2. Pulses

(1) Production / Distribution

In the low-land rice production areas, such as the Ayeyarwady Delta, the two crop system that is pulses after rain season rice. As export crops such as pulses (for China and India) are more profitable than dry-season rice production, many farmers choose this two crop system. However, pulse cultivation during the rainy season is not popular because of its difficulty caused by heavy rain in lower Myanmar but in upper Myanmar pulses is main crop in raining season.

In the case of crops other than rice, farmers use seeds of local varieties, or partly modern varieties introduced from abroad without conducting a variety adaptability evaluation test; consequently the productivity remains low. (In the case of ground nuts, the multiplication of high quality varieties is underway through technical cooperation programs (water saving agriculture

project). As the quality of foundation seed was not appropriate, its purification requires more than three years.)

Among pulses, soybeans are produced mainly in the Shan State rather than in lowland areas.

For the production of pulses in the year 2015-2016 the production of Black gram, Green gram and the rest of other pulses were 1,668,011 tons, 1,591,947 tons and 3,116,725 tons, respectively. Their yield is stagnating.

The marketing of pulses is conducted through the Commodity Exchange Center between collectors and exporters. There are cases where the origin of products is not made clear and the quality of the product does not correspond to the quality shown by its sample.

(2) Marketing / Export

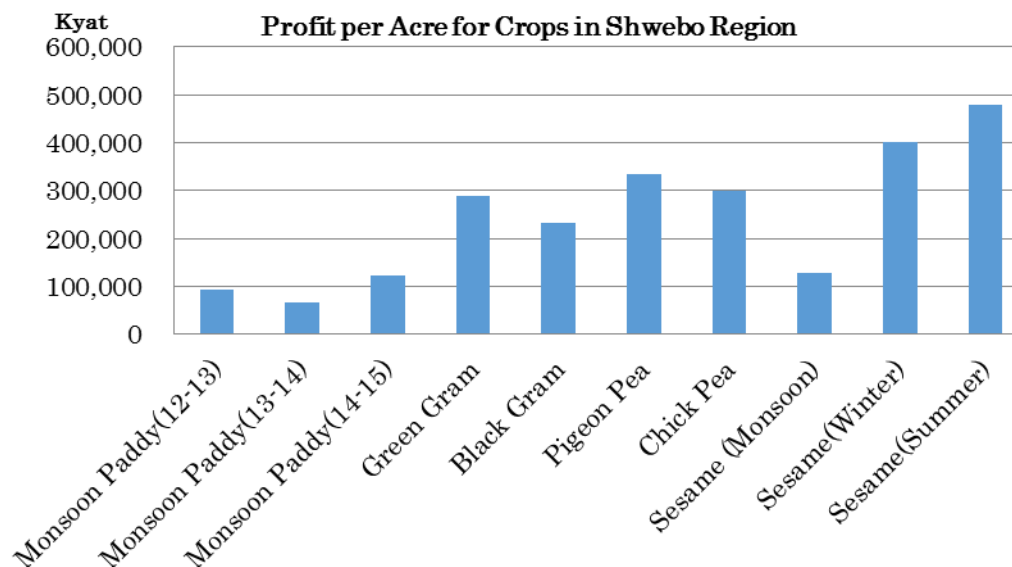
The export of pulses to India is now stagnating and consequently the total amount of export does not increase. The export of Black gram and Green gram and other pulses are 660,000 tons, 380,000 tons and 490,000 tons, respectively

3. Sesame

In the central dry areas, draught occurs with an interval of several years, and the precipitation varies from year to year. Plants tolerant to dry climatic conditions including oil seed crops such as sesame, ground nut, sunflower as well as vegetables such as onion are cultivated. Recently, the production of sesame remains 800,000 to 900,000 tons. Sesame is often planted together with other pulses such as pigeon pea. In the dry areas the production is not stable; a system for agricultural insurance has been developed by a foreign (Japanese) company and is subject to approval by the Government.

The export of sesame increased in the year 2012/2013, and reached 180,000 tons (of which 40,000 tons for oil extraction). The main destination countries are Japan, China and Taiwan. With the exception of China, of which the import has dropped recently, the demand of sesame on export markets remains stable. The yield of sesame in Myanmar is low and some improvement should be made.

In northern dry areas, sesame is more profitable than rice.



(Source: Preparatory Survey for Intensive Agriculture Promotion Program 2015)

Oilseed Crops Production (Plan) by DOA, MOALI

Sr		2015–2016	
	Name of	Sown/harv	Yield
	Crops	(Ac)	(bsk/ac)
1	Groundnut(total)	2235	61.6344519
	Groundnut(mon)	1015	53.59211823
	Groundnut(win)	1220	68.32540984
2	Sesame (total)	4073	10.86913823
	Sesame (mon)	2954	9.190589032
	Sesame (win)	933	14.77813505
	Sesame (summer))	186	17.91935484
3	Sunflower(total)	1828	27.92067834
	Sunflower(mon)	295	27.29491525
	Sunflower(win)	1533	28.04109589
4	Mustard	224	14.27232143
5	Niger	385	11.98181818
	Total	8745	

4. Industrial crops

In the Shan Plateau Region tea has been cultivated for many years. Tea leaves are processed first in the tea production areas and then transported to Mandalay and/or Yangon for final processing for sale all over the country. Recently medium-to large-sized tea processing factories have been introduced. Corporate management has been introduced to some tea producers, which is observed as an evidence of the sixth industrialization in the field of tea production.

Sugarcane production is mainly conducted using conventional varieties and therefore its productivity remains low. Harvested sugarcanes are purchased by former Government sugar factories whose operation has been commissioned to private companies for sugar production, but their performance is not very successful. Government sugar factories are being sold to private companies. Now a foreign enterprise has constructed a new factory and concluded a contract on the sugarcane cultivation on 1200ha of land.

Sugar Crops Division under DOA of MOALI has been implementing Sugarcane Programs such as seeds production, training and education, research and development through managing 3 research farms and 9 seeds development farms.

Coffee is also one of important industrial crops. The production data is as follows;

Coffee production over the past 10 crop years (2006-2007 to 2015-2016)

Year	Sown (ac)	Production (ac)	Total yield(MT)
2006-07	53759.01	20655.99	4923
2007-08	57639.99	22678.99	6043
2008-09	59230.01	24002.99	6388
2009-10	60220.99	26340.01	7143
2010-11	60794.99	26920.99	7368
2011-12	62060.99	27452.99	7687
2012-13	60794.99	26980.01	7441
2013-14	49863.84	29217.26	8080
2014-15	49953.01	29230.99	8485
2015-16	49192.00	29028.00	8431

2015-16 States / Regions Coffee Production

No.	States / Regions	Sown (ac)	Production (ac)	Production (Rate)	Total Yield (mt)
1.	Nay Pyi Taw	396	396	0.17	71.13
2.	Ka chin State	1680	1399	0.22	308.66
3.	Ka yah State	1738	919	0.22	211.18
4.	Ka yin State	9812	5705	0.30	1763.94
5.	Chin State	568	477	0.18	89.65
6.	Sagaing Region	572	508	0.32	163.54
7.	Taninthary Region	279	42	0.26	11.05
8.	Bago Region	631	105	0.27	28.89
9.	Magwe Region	987	137	0.09	13.18
10.	Mandalay Region	4851	2283	0.22	524.61
11.	Shan State	27635	17057	0.30	5245.82
-	Shan (South))	10691	7035	0.22	1562.71
-	Shan (North	15061	9591	0.37	3594.58
-	Shan (East)	1883	431	0.20	88.53
12.	Ayeyawaddy Region	43	-	-	-
	Total	49192	29028	0.29	8431

2016-17 States / Regions Coffee Production

No.	States / Regions	Sown (ac)	Production (ac)	Production (Rate)	Total Yield (mt)
1.	Nay Pyi Taw	396	396	0.17	71.13
2.	Ka chin State	2106	1912	0.22	432.80
3.	Ka yah State	1738	990	0.30	244.93
4.	Ka yin State	9817	6700	0.28	1881.79
5.	Chin State	540	463	0.18	87.20
6.	Sagaing Region	580	572	0.32	184.92
7.	Taninthary Region	279	42	0.25	10.88
8.	Bago Region	631	105	0.27	29.36
9.	Magwe Region	989	200	0.11	22.53
10.	Mandalay Region	4851	4851	0.10	524.58
11.	Shan State	28628	17400	0.30	5349.85
-	Shan (South)	10675	7042	0.22	1559.61
-	Shan (North)	16070	9919	0.37	3700.02
-	Shan (East)	1883	439	0.20	90.22
12.	Ayeyawaddy Region	43	-	-	-
	Total	50598	33631	0.26	8840

Over the past 10 crop years (2006-2007 to 2015-2016)

Year	Sown (ac)	Production (ac)	Total yield(MT)
2006-07	53759.01	20655.99	4923
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2014-15	49953.01	29230.99	8485
2015-16	49192.00	29028.00	8431

5. Horticultural crops

(1) Production,

In 2012, the production of fresh vegetables and fresh fruits reached 4,000,000 tons and 1,420,000 tons, respectively, and continues to increase. These figures are much higher than those of Thailand (1,120,000 tons and 500,000 tons, respectively) but are the halves of those of Vietnam (7,800,000 tons and 3,010,000 tons, respectively). The quantity is still increasing to a certain extent (FAOSTAT) but the production of processed product is limited.

Most of these horticultural products are produced in areas remote from Yangon (Shan State in the North-East and Sagaing State in the North-West). In particular in the Shan State, various vegetables and fruits are produced under its cool climate. While most of the products are consumed on local markets, some are exported to Chinese markets or brought to the Bhamo market in Yangon (in a distance of 36 to 48 hours by truck from the Shan State) or to markets or super-markets in Mandalay. A wide range of products are produced, including leaf vegetables, cabbage, cauliflower, leaf mustard, chayote, watermelon, citrus, pineapple, dragon fruit, pear, Chinese quince, plum, chestnut, strawberry, walnut. These crops are cultivated mainly as intercrops after the cultivation of rice (paddy-rice and upland-rice), maize and sugarcane. Some farmers are specialized in producing vegetables (specialized vegetable producers running 1ha cabbage field). Some horticulturists are enthusiastic in farm management; however, they do not have sufficient horticultural knowledge, and many training programs for techniques such as soil management using organic substances should be organized. Some farmers possess a basic knowledge for example of how to prepare and transplant seedlings of cabbage, but there are other farmers cultivating potatoes without hilling. Thus the levels of knowledge vary from farmer to farmer.

In the lowland cultivation areas, surface soil is easily eroded during the rainy season because of a high temperature and heavy rain and the occurrence of disease is very frequent because of high humidity. Thus the open-air cultivation of vegetables is difficult and, even though produced, a large portion of vegetables produced faces a risk of being rotted. Consequently, many vegetables are facing the risk of insufficient supply to meet the demand in the rainy season (in particular leaf vegetables).

It is the normal practice to cultivate vegetables in the flat field surface without hilling. In the rainy season, a large number of diseases and insects damage the product. In the case of mango, black spots appearing on the surface of fruit skin (in most cases caused by fruit flies) cause the rotting of fruit flesh, degrading the quality of the product. Consequently, a considerable amount of pesticide is applied to mango.

Most of the horticulturists have very limited experiences. They are enthusiastic but do not possess the basic knowledge of production. Consequently, they are not able to select the right variety, and do not apply basic operations such as hilling and pruning, thus allowing an improper growth of plants and unsatisfactory cultivation. At this moment, farmers do not receive training on such basic production techniques.

Low quality seed or seedling is used for many vegetables, for example potato seed tubers are not virus free.

(2) Distribution

Most horticultural products are brought from the production areas to consumers, through a very complicated distribution route known as “Dendritic Marketing System (brokers in the

production areas, markets in the production areas and whole sale markets in cities)” taking many days under unsuitable conditions for collecting (sorted according to size but not according to quality), conservation (lack of sufficient space necessitates the open-air piling of the products or in the case of excessive production products should be disposed of), transportation via degraded farm roads (packaged in simple nets or baskets or sometimes in plastic containers). Consequently, a lot of products are degraded and lost. A lot of products are degraded on the consumer market and period of sale is limited, causing additional losses in the consuming region. In the case of frozen vegetables, a disconnected broken cold chain causes the degradation of quality during the transportation from remote areas, thus among products displayed in a supermarket there are observed leaf vegetables wilted, onions germinated, and potatoes rotted.

The market and distribution system is not yet well established. Many farmers think about the destination of their products after harvest. Thus fresh products produced should be sold quickly to middlemen coming to the production areas. Farmers sell their products to middlemen who offered at the farm gate the highest purchase price, and the products will be brought to the consuming region through a very complicated distribution route. It is necessary to introduce a cold chain system connecting the producing areas to the consuming regions through unbroken transport roads, involving a pre-cooling facility in the producing areas, refrigerator trucks, storage in the consuming regions equipped with cooling facilities. Since 2015 a low-temperature transportation system has been introduced by a private company between Mandalay and Yangon. Farmers receive market information from middlemen they know through mobile phone or from local market in their vicinity and they deal with more than one middleman, in many cases they do not sell their product just following the price offered by a middleman. However, as information on the quantity of products on the market is not shared by all stakeholders concerned, the balance between demand and supply on the market is disturbed from time to time, causing drastic price changes on the market. Because of insufficient storage capacity, products in excess should be sold off expeditiously, causing a quick drop of the sale price. Moreover, in the retail market, sales prices are the results from repeated sales between middlemen at different levels, containing a lot of margins and consequently tend to be high for consumers.

Wholesale markets both in the producing areas and consuming regions are used as mechanism to collect product physically. But many other market functions such as the spreading of market information are not provided. Price formation is not through auction but is made confidentially through face-to-face bilateral negotiation. For this reason there is sometimes a drastic change of prices on the market where it is unknown whether the price change results from the change of the amount of products supplied as the result of meteorological disasters or from price manipulation made by speculators. There is no particular measure for the management of market distribution to prohibit such price manipulation. Markets are under the supervision of local Governments, of which the management is limited to the use of physical facilities and does not control individual trade activities.

Supermarkets buy almost half of the fresh products from the above-mentioned conventional markets but buy also from importers of imported products or buy specific products (for example high-price strawberry) directly from farmers in the producing areas under contract.

(3) Processing

While the majority of horticultural products are distributed as fresh product, a small portion thereof is processed into pickles and sold in the market. Some producers produce dried mango by using a simple electric heater and export the product to Singapore. There is also sun-dried

mango but its quality is not so high (skin color is darken), thus not suitable for export. The export of fresh products, such as mango, is subject to plant quarantine and its designation is limited.

Foreign companies are constructing a factory for the production of frozen vegetables. Frozen vegetables produced will be exported mainly to other Asian countries. Areas with stable electricity supply are limited; the possibility of the construction of such factory is limited. The location of a factory remote from the production areas is a negative factor for profitability, thus the electrification in local regions should be also promoted.

6. Herbal medicine

Experimental cultivation of herbal medicinal plants (*Glycyrrhizas*, *Lithospermum purpureocaeruleum*) is conducted principally in the Northern dry areas by foreign companies for introduction in Myanmar. *Glycyrrhizas*, in particular, is adapted for dry areas. Not only the cultivation but also the primary processing is undertaken in Myanmar with a view to future domestic sale and export. Training for local farmers is carried out to transmit the knowledge on the cultivation of these crops.

7. Livestock

(1) Production

In Myanmar, the following quite important number of farm animals and poultry is reported in Myanmar Livestock Statistics 2015: 15,992,000 head cattle, 3,540,000 head buffalo, 15,055,000 head pig, 269,285,000 chicken, 6,324,000 head goat and 1,321,000 head sheep.

Livestock Population in Myanmar (2014-2015)

Sr. No.	Livestock	Number in Thousand
1	Cattle	15,992
2	Buffalo	3,540
3	Pig	15,055
4	Chicken	269,285
5	Sheep	1,321
6	Goat	6,324
7	Duck	21,804

This indicates the importance of farm animals and poultry in the farm management in Myanmar. Currently, as the result of the cross breeding between indigenous and foreign breeds, many farmers hold slightly more productive animals or indigenous breeds. The artificial insemination technique had been once applied quite frequently, but its application has decreased because of limited liquid nitrogen supply even though the demands need of artificial insemination at the past. At present, the liquid nitrogen plant in Yangon and Nay Pyi Taw are operating well. The new liquid nitrogen plant will require for Mandalay to supply the liquid nitrogen sufficiently nationwide.

Even under the circumstances where mechanization is progressing, cows continue to largely contribute to the life of farmers, being used as draft animal for land cultivation and transportation and producing manure for compost. It is forbidden to slaughter draft cows earlier than 16, slaughtered cows are used for meat but the meat supply on the basis of such old animals cannot reach a significant level. In remote areas beef cattle are reared in herd. Also

the improving the beef cattle rearing and try for export.

20 years ago, the utilization of milk was very limited, where some farmers did not even know how to milk cows. In many villages the only dairy product available to villagers was condensed milk produced in nearby cities. And for religious reasons, many people did not eat cows and pigs; consequently, the main source of meat supply was poultry. As other source of meat, in addition to pigs and poultry, goat is important, and especially is an important source of income for land-less farmers.

In farming villages, each farming family normally possesses two cows as draft animals. Farmers scarcely hold cows purely for meat production purposes. (Sometimes, beef cattle are reared in herd.) In the Central Dry Zone, beef cattle is fed with sorghum, but in other areas cattle is fed with the mixture of broken rice, rice straw and mineral (salt), so-called “fluid mash feeding.” Pigs and poultry are kept in a small scale where farmers purchase compound feed and use leftovers from the households.

Approximately 1.5million tons of maize is produced mainly for animal feed, and private company has distributed an improved variety called especially CP 880 and is encouraging the production of this variety by providing training. The utilization of the other forage crops is limited, and soy meal used as ingredient of compound feed is imported. Maize, broken rice, rice bran and residue of minced fish are also widely used as ingredients of compound feed.

(2) Processing / Distribution / Marketing.

The distribution of animal product is usually achieved by transporting live animals. Both large and small animals are traded alive on the livestock market. Animals are brought to the slaughter house and slaughtered and processed and brought to the consumers market.

Current cattle markets are weekly operated by District Offices. Once a week cattle and buffaloes for slaughtering and draft are traded in the same open air spaces together. Usually each farmer bring one or two cattle/buffaloes to the market and negotiate with middlemen. The markets have no animal health laboratory and equipment. Veterinarians in the markets check health of each cattle before entering the trading spaces by visual observation. However, hygiene of trading space is not ensured on ground with full of mud and dung.



Each cattle and buffalo is traded by visual size due to no difference on quality of individual cattle & buffalo that are raised in the same condition. Buffalo is usually more expensive than cattle, because buffalo is heavier than cattle.

Recently, the number of small dairy farming farmers is increasing in rural areas where in each family some 5 cows are kept. Milk collectors or “milkers” (person who milking cow manually) hired by a processing factory are roving from farmer to farmer to milk cows individually and purchase raw milk bring it to a factory for example producing condensed milk. In Myanmar, almost drinking habit of milk is not tradition in Myanmar of urban areas. Usually people drink coffee and tea with condensed milk. Accordingly, the distribution channel of raw milk from the rural areas to Yangon is not important, and raw milk is supplied by medium-sized or larger dairy farmers in the suburb of the city dairy companies in city areas. In Yangon, domestic dairy companies produce and sell raw milk, yogurt and condensed milk to supermarkets, whole sale markets and retail markets.

As is the case in other countries, commercial poultry farmers, under contract with Charoen Pokhand (CP) Thailand, can receive prescribed chicks and feed from the CP, and after rearing, sell matured chicken to the CP. CP processes poultry meat for example into meat balls and sell them to supermarkets in the form of frozen food. The backyard poultry farmers are producing the native poultry meat, consumers prefer the native chicken and price is higher than CP broiler meat type.

On the other hand, in Myanmar many newly opened supermarkets are now selling raw milk and it is expected that the consumption of raw milk will be increasing. It is observed that the consumption of dairy products other than raw milk is also increasing. Furthermore, because of the increase of income of middle and upper classes of the urban dwellers, the consumption of meat is expected to increase, where not only the consumption of chicken but also pork will be increasing. However, the dairy products currently sold in supermarkets (butter, long-life milk – UHT milk) are imported from Thailand, Australia and New Zealand. Recently, the cold-chain is being established by foreign companies in the vicinity of Yangon, where Australian beef transported in containers is landed at the Port of Yangon and is transported to refrigerators and then is brought to supermarkets in the city.

Livestock Production (2008-09 to 2014-15)

Unit-'000 MT

Year	Beef	Pork	Poultry Meat	Milk	Egg(Million)
2008-09	176.7	466.9	793.4	1314.4	6146.2
2009-10	208.0	530.7	917.3	1464.6	7165.3
2010-11	232.6	581.2	996.5	1602.5	7764.0
2011-12	252.1	614.9	1050.9	1665.2	8266.2
2012-13	275.9	668.1	1156.7	1818.9	8997.2
2013-14	301.1	737.6	1265.3	1962.6	9800.4
2014-15	327.7	830.3	1389.2	2164.8	17432.0

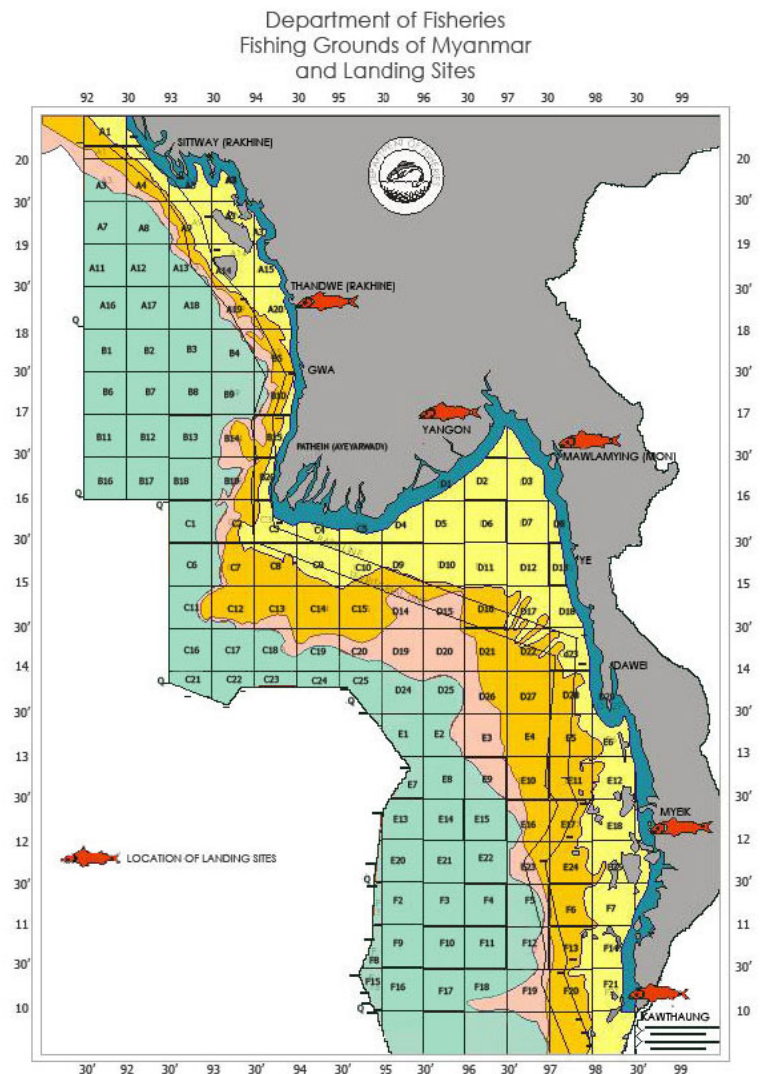
(3) Animal health

In the field of animal health, there is not strength so much in the diagnostic capacity and the research of animal diseases, especially Foot and Mouth Disease (FMD). The capacity of FMD vaccine production is still low, about only 200,000 doses per year. However, the population of FMD susceptible animal is about 17-millions. In addition to, Myanmar is a FMD endemic country and found FMD outbreak in every year. FMD is not noticeable disease for farmer because of low mortality rate. Therefore, farmer is weak cooperation in FMD control processes such as reporting system for FMD outbreak, objecting to vaccinating to their cattle. Myanmar is an agricultural based-country and still use draught cattle in agricultural production. 70% of human population lives in rural area and they possess mostly draught cattle. The draught cattle are used not only agricultural production such as cultivation but also transporting agricultural products, supporting meat and milk for local market. Therefore, combating FMD is very important for the main economical production chains in Myanmar. The Livestock Breeding Veterinary Department (LBVD), with only 1342 veterinary officials, including assistant veterinary officials, is not capable of taking whole responsibility of animal health issues of the country. As mentioned above, animals are transported alive to slaughter houses in the consuming regions and slaughtered, processed and brought to the consumer market. Meat processed under unsanitary conditions cannot undergo sufficient control by veterinary officials.

8. Fisheries

Myanmar is the largest country in main land Southeast Asia comprising a land area of over 676,577 square kilometers and geographically located between 9° 32' and 28° 31' N latitude and 92° 10' and 101° 11' E longitude stretching over 2280 kilometers. It share common maritime boundaries with Bangladesh in the north-east of the Bay of Bengal and with Thailand and India in the Andaman Sea which is a part of the Bay of Bengal. Myanmar continental shelf covers approximately 230,000 sq.km with a relatively wider portion in the central and southern parts. The Exclusive Economic Zone (EEZ) is about 486,000 sq.km. The coastal zones of Myanmar can be subdivided into three main areas, namely Rakhine Coast, Ayeyarwady Delta and Tanintharyi Coast. Many rivers flow into the coastal zones such as the "Mayu" and "Kaladan" rivers in the Rakhine Coastal area; the "Ayeyarwady", "Sittaung" and "Thanlwin" rivers in Delta coastal area and the "Ye", "Dawai", "Tanintharyi" and "Lenya" rivers in the Tanintharyi coastal area.

In Myanmar national average consumption of fish and fish products based on the *Myanmar Household income and consumption survey* was 21.0 kg per capita per year (2006). This represents 22.6 percent of total dietary protein consumed and underlines the importance of fish and fishery products in the diet. The accessibility to inland fish in Myanmar and its importance in the diet, compared with that of marine fish (available mainly in dried or salted forms in inland areas), is similar to that found in the Mekong Basin. Four of the top six items consumed are processed fish (fish paste, fish sauce, shrimp paste and dried fish). Fermented fish paste "ngapi" is noted as one of the most important source of calcium in the diet throughout Myanmar. The species of fish used for "ngapi" are both freshwater, estuarine and to a lesser extent, marine. Fermented fish paste was the most commonly consumed product followed by the fresh water species such as mrigal carp, striped snakehead and rohu carp. Of the marine species hilsa shad was the most commonly consumed.

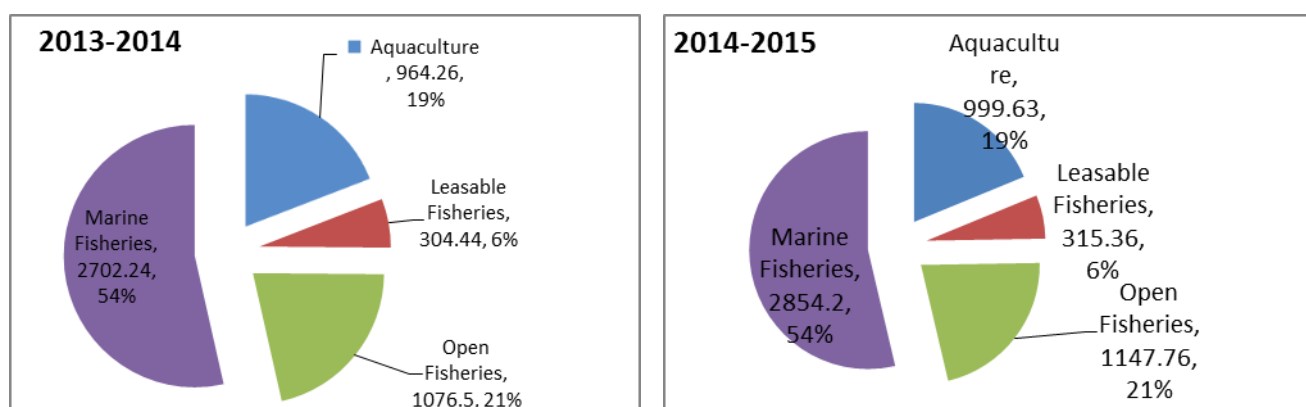


Coastal Divisions tended to have the highest consumption of fish, although the strong contribution of freshwater species over marine species is worth noting. Kayin had an extraordinarily high consumption (67.7 kg per capita per year) and this may be largely attributable to fish paste consumption. There is relatively little difference in overall fish consumption between rural and urban populations. Urban dwellers consume more fresh fish (53 percent) than rural dwellers (45 percent).

Marine fisheries provide substantial economic and subsistence benefit and the economic value of commercial fisheries is high.

- Capture fish sector contributes around 3.5 % to the national GDP
- Export value of marine fishery products \$500 million (main markets China and Thailand \$328 million)
- Generates employment for about 3 million people
 - marine fisheries 1.4 million
 - freshwater fisheries 1.6 million

Fisheries components (Production)



Fishery Product Exported



	2005-2006	2006-2007	2007-2008	2008-2009	2009-2010	2010-2011	2011-2012	2012-2013	2013-2014	2014-2015
Quantity(MT-000)	271.07	343.42	351.65	324.71	375.09	373.89	386.981	376.845	345.267	338.291
Value(Million)	359.19	466.15	561.02	483.23	496.59	555.51	653.83	652.84	536.274	482.252

The impacts of climate change, including variability, are already demonstrated for Myanmar and can be summarized as:

- General increase in temperatures across the whole country (most notably in the northern and central regions)
- General increase in total rainfall over most regions, (with notable decreases occurring in certain areas e.g. Bago Region)
- Decrease in the duration of the south-west monsoon season as a result of a late onset and early departure times
- Increases in the occurrence and severity of extreme weather events, including cyclones/strong winds, flood/storm surges, intense rains, extreme high temperatures and drought

Climate change and variability will exacerbate the vulnerability of the marine/coastal fisheries and aquaculture sector. Increase in sea water temperature is a major trigger of disturbance of the marine/coastal ecosystem including:

- Acceleration of potential occurrences of harmful algal blooms (HAB)
- Less availability of dissolved oxygen
- Damage to coral reef systems
- Altered species composition of fish stock



El Niño Southern Oscillation (ENSO) events cause changes in ocean currents, which alter distribution of pelagic fish species and juvenile fish resources recruitment; affecting productivity of coastal and inland aquaculture. Sea level rise also threatens coastal fish breeding and nursery habitats composed of mangroves and coral reefs, and increases vulnerability to waves and storm surges, posing risks of near-coast inland fisheries and aquaculture inundation.

Since that time, available fishery indicators have indicated a declining trend in marine resource abundance. The size composition of the catch of some commercially important fishes, such as pomfret and hilsa shad, have shown a reduction of the average length of captured fish, and the Catch Per Unit of Effort (CPUE) for bottom trawl fisheries has also declined steadily. In 2013 & 2015, a major survey by the **research vessel Dr. Fridtjof Nansen** was able to provide a new picture of the state of the ecosystem and fishery resources. The 2103 and 2015 survey indicates that the ecosystem in general has strong signs of overfishing and other changes in stock composition. This is indicated by a general lack of long-lived species and considerable lower biomass estimates compared with the findings from the four surveys in 1979 and 1980.

The marine fishery of Myanmar is separated into two main parts the inshore fishery and the offshore fishery:

- The marine inshore fishery (below 16 meter depth and up to 5-10 nm from shore depending upon the region)
- The marine offshore fishery comprises vessels operating beyond the outer limit of the inshore fishing zone up to the outer boundary of the 200 nm EEZ.

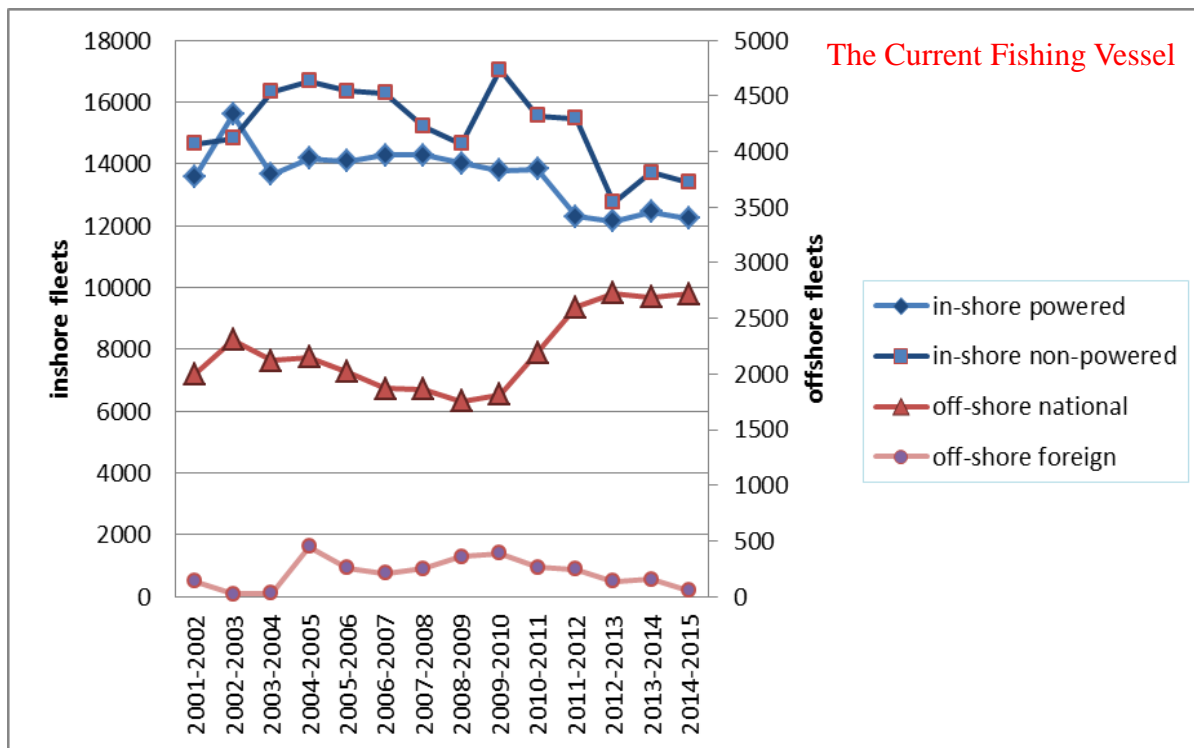
Marine inshore fisheries have been carried out for a long time by traditional vessels, with a length up to 10 meters and a motorization up to 12 HP. The fishing grounds for the inshore vessels are located within 16 meter depth areas at lowest low tide which generally is 5 nautical miles offshore in Rakhine to 10 nautical miles off shore in Ayeyarwady and Taninthayri. Inshore fisheries are generally small-scale fisheries and use a variety of gears such as hook and line, gill nets, traps, anchovy purse seines and trammel nets. According



to the official statistics the number of inshore vessels gradually increased to about 30,800 in 2004/2005 and since then has ranged between 25,000-29,700 vessels (2010-2014) and it seems that the rate of motorization is not changing in the last ten years. The target species are pelagic species and high value species such as lobsters, shrimp, grouper, mud crab, clams etc. Some of the catch is used for local consumption, but the high valued species are mostly bought by middlemen for export.

Marine Offshore fishery vessels are more than 30 feet long and/or use more than a 12 HP engine. The offshore vessels are classified by the gears used as:

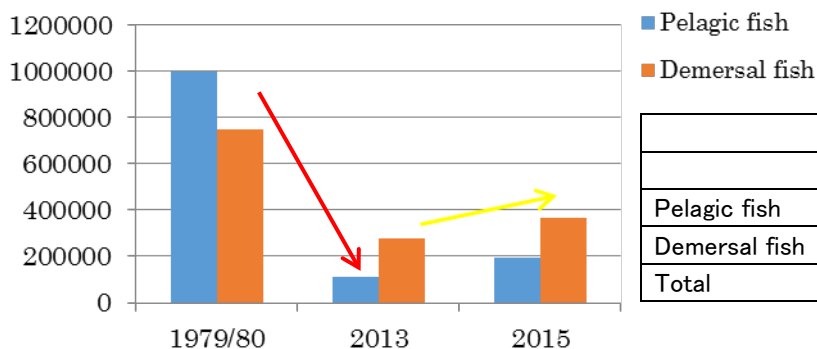
- Trawlers (pelagics, demersal and shrimp)
- Purse seiners, (pelagics)
- Drift netters (large pelagics)
- Long liners (large pelagics, and high value demersals)
- Trappers
- Vessels/rafts with falling nets. The majority of the offshore fleet consists of trawlers, mainly fishing in Tanintharyi region and drift nets mainly fishing in Mon and Ayeyarwaddy region.



One of the main issues on the international fisheries agenda for a last decade has been to combat IUU fishing, which is identified as a major threat to fisheries conservation and marine biodiversity. It can lead to collapse of a fishery, which in turn may cause adverse consequences for the livelihood of people depending on them. It occurs in all fisheries, whether they are conducted within areas under national jurisdiction or on the high seas. A number of initiatives have been taken by global organizations, by many regional bodies and states to counteract such activities, for example the FAO Port State Agreement, the IPOA-IUU and the recently adopted FAO guidelines on flag State performance.

Myanmar has been collaborating with ASEAN members' countries combating IUU fishing through the project on the promotion of Sustainable Fisheries and IUU fishing -related Countermeasures in the Southeast Asia. One of the main activities of the project focuses on the Promotion of Fishing license, Boats Registration, and Port State Measures in Southeast Asia which is being carried out through a series of regional meeting. Department of Fisheries has been collaborating with SEAFDEC in establishment of the Regional Fishing Vessel Record - RFVR which is agreed by the regional countries.

Fish biomass and changes



	Year/Metric Tonne		
	1979/80	2013	2015
Pelagic fish	1000000	110000	193000
Demersal fish	750000	280000	367000
Total	1750000	390000	560000

Myanmar has signed the Agreement on Port State Measures to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated Fishing which was approved by FAO for instrument of accession. Myanmar has been practicing the Port State Measures for all fishing vessel in accordance with Myanmar Marine Fisheries Laws and the Law relating to the Fishing Rights of Foreign Fishing vessels. Existing Fisheries laws include provisions to implement the port state measure.

Trade Development Programme, under the SPS component, is implementing a series of support activities to strengthen IUU fishing compliance and certification activities in meeting ASEAN and EU market requirements. The approved activities are:

- Advice, guidance, and training for the competent authority on the implementation of a traceability system for indirect exportation under the EU IUU Regulation.
- Development of a National Plan of Action to Combat, Deter and Eliminate Illegal, Unreported and Unregulated Fishing (NPOA-IUU).

NPOA is to formulate pertinent and achievable, additional measures, necessary to close gaps in the existing framework addressing IUU fishing. The ultimate objective of the NPOA-IUU is to reduce in a planned and concerted manner the incidence of marine IUU fishing in Myanmar to a minimum.

The aquaculture industry in Myanmar has developed rapidly over the past 15 years. It covers freshwater culture, brackish-water systems, ornamental fish production and fingerling production. The sector covers a production area that increased from about 50,000 ha in 2000/01 to 190,000 ha in 2013/14, and provides employment for an estimated 214,000 people. Department of Fisheries (DOF) introduced aquaculture of tilapia, common carp species, and freshwater finfish in 1950s. In spite of promising market potential, the aquaculture contributed to a small amount in production, and there are only 3 000 fish ponds established by 1989.

The expansion of aquaculture has no doubt increased fisheries production. But in many cases, it has also resulted in damaging sensitive ecosystems like mangroves and wetlands. There is a clear need for an assessment of environmental impacts of future aquaculture projects.

Coastal aquaculture to date is mainly focused on shrimp farming, which started in the mid-1970s. Traditional shrimp farms of about 10,000 acres (3,620 ha) have been in operation since 1978 along the banks of Naaf River in Rakhine State, bordering with Bangladesh. People in the northern Rakhine States started with "trap and hold" farming practices in areas with large inter tidal zones with abundant shrimp juveniles. There were some initial attempts to introduce more "scientific" shrimp culture in 1984-85 with loans from the Asian Development Bank and was marginally successful. In 1995, the department of fisheries encouraged the development of shrimp farming, and private investments in intensive and semi-intensive shrimp farming gradually emerged after the promulgation of the Aquaculture Law. Marine and brackish water fish farming is found in Ayeyarwaddy delta area, Rakhine and southern parts of Myanmar. There are around twenty species of groupers in Myanmar waters, but so far only four species have been cultured commercially. The main species are orange spotted grouper (*E. coioides*), greasy grouper (*E. tauvina*), black spotted grouper (*E. malabaricus*) (Myanmar name Goung Lone AnetPyauk) and *E. bleekeri*, duskytail grouper (Myanmar name Bather Pyauk). So far all raised from wild caught fry as there are no commercial grouper fry hatcheries. Myanmar has no experiences or technologies of farming oyster mussels, cockles, or clams. Marine seaweed culture (e.g. *Eucheuma* for carrageenan production) is being tested in the southern part of coastal area.

(1) Inventory of fisheries resources / Resource management

The DoF has undertaken some preliminary research on hilsa, neritic tuna supported by the BOBLME project. This has also covered issues such as MPA, shark management and policy consultations.

The DoF is involved in research programs on endangered species and ecosystems such as marine turtles and Irrawaddy dolphins. They oversee some conservation areas such as the marine component of the ThamihlaKyun Wildlife Sanctuary and the KhaingThaung Island Reserve Forest and work closely with stakeholders to manage these areas.

The EAF-Nansen project carried in the period 1979-1980 out four surveys with the old research vessel Dr. Fridtjof Nansen in cooperation with the Burmese (today Myanmar) Government, the Norwegian Institute of Marine Research and FAO.

The results from these surveys were the only existing estimates of MSY for marine resources on the shelf (20-500m) of Myanmar. However, these estimates were 33 years old, and there was a great need to update information of the marine resources in the region. This was the basis for the survey by RV Dr. Fridtjof Nansen in 2013 and 2015.

The results from this last survey with RV Dr. Fridtjof Nansen have provided valuable insights and information on the state of Myanmar marine ecosystems and resources. In particular, there seems to be evidence that fish stocks may be overfished, although it is noted that it would be important to carry out another survey during a contrasting season considering that productivity and fish abundance may be subject to seasonal cycles and or migrations.

The survey also shows evidence of strong separation between three main ecological regions, both in relation to oceanographic characteristics, fish distribution, sediment type and depth. The conclusion is that reliable abundance estimates and strict management is necessary in order to make the most out of the remaining resources on the shelf of Myanmar. The anthropogenic drivers with largest effects on the ecosystem are most probable fisheries and climate change.

Negative impact from fisheries includes overfishing of several of the smaller stocks in the area and damage to benthic communities caused by bottom trawling. Failing reproduction and negative population trends could be effects of anthropogenic induced climate change.

All results are presented in a survey report, but during the 30 days at sea, the vessel collected a lot of data that can be used further studies. These data belongs to Myanmar and were handed over by the end of the survey. It thereby lays a big responsibility on Myanmar's scientist and government to find a sound way of using this data further. Hopefully the data can be used to start research projects which will focus on the sea and how it best should be managed to create a sustainable fishery.

(2) Increase of productivity in inland aquaculture and promotion of sea-surface aquaculture

Inland fisheries in Myanmar are associated with riverine and estuarine water bodies, such as natural lakes, reservoirs, river systems, streams and ponds. These water bodies collectively cover an area about 8.1 million hectares, of which 1.3 million are permanent and the others are seasonally inundated floodplains. Inland fisheries play an important role in supplying freshwater as well as brackish water fish in the country.

In 2012-2013, inland fisheries supported approximately 787,000 fishermen, of which 61.9% were full time (487,000 persons) and balance 38.1% were part time (30,000 persons). The number of fishermen includes those operating within leasable as well as open waters.

The fishing gear employed for the inland fisheries include refuge devices, lances, hooks and lines, long lines, barriers, stake fences with sloping platform, floating prawn traps, fish pots, shuttle traps, jumping traps, scoop nets, cast nets, drop nets, drift nets, seines, fillet nets, stow nets and drag nets. The most common fishing gears were drift net, seine, cast nets, long lines, traps and barrier nets.

Leasable fisheries is a fishery leased through a bidding process, and winning bidder is granted the right to harvest the fishery resources in demarcated "inns" commonly from September to April. The character of the water bodies given out for lease is highly variable. Most are confined waters, but some open waters are offered as well. Auction prices have increased 10% last few years. When production goes down, funds are provided to improve habitat and stock enhancement. Most of fishermen operated non-powered boats. Even where there are powered, engine sizes were limited. The most fishing gear employed include, traps, cast net, long lines, beach seines, purse seines, stow nets and pen culture. Leasable fisheries are semi-managed fisheries because of the practice of stocking seed of selected fish species. The most common species stocked at leasable area was indigenous fish species such as Rohu (*Labeo rohita*) and Catla (*Catla catla*). No comprehensive assessment of inland fisheries has apparently been undertaken thus far.

(3) Measures for export restriction by developed countries

-Food safety Policies-There is no comprehensive national policy on food safety and food control in DOF, Myanmar.

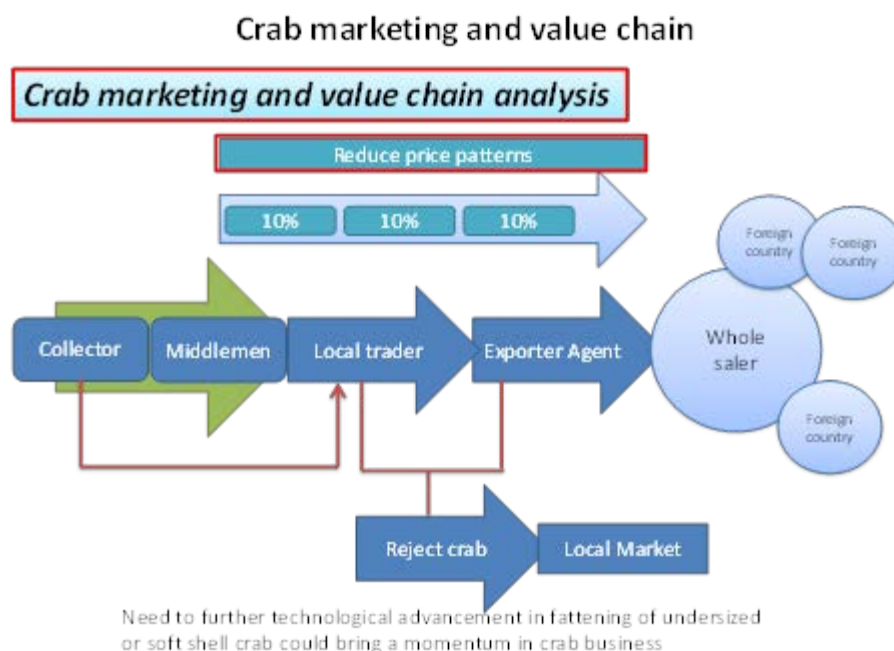
- Legislation- Myanmar has many laws covering food but limited regulations. The legal framework does not cover a risk-based, Comprehensive food chain and preventive approach. DOF has promulgated Directive No. 2/2015, regarding Technical Regulations for Export and Import of Fishery Products. Legislation applicable to quarantine, biosecurity and health certification for live

- Standards and Norms-There is a need to make standards mandatory and enforceable by being developed as technical regulations

- Sanitary and Phyto-Sanitary (SPS) Measures-

- (a) Inspection - routine, import, export- is not risk-based and does not cover farm to table (in place for some export streams)
- (b) Testing - currently DOF's testing Laboratory was already accredited, but capacity of testing facilities are not cover for Importing countries requirement to be accredited for disease diagnose laboratory
- (c) Residue/ Contaminant Monitoring Program – Implemented the National Residue Monitoring Program for aquaculture products not cover for wild catch
- (d) Control for quarantine pests and diseases of aquatic animal
- (e) Capacity , resources, competencies for skillful person.

Crab business is promising and active for exporting through exporter agents. Crab marketing and value chain is analyzed as follows;



9. Agricultural Finance

The Study Report written by Dr.Koichi Fujita andDr.Ikuko Okamoto in 2015 described this sector as follows;

“The rural financial sector including agricultural finance is one of the major weaknesses in the development of the agricultural/rural sector in Myanmar. The Myanmar Agricultural Development Bank (MADB), first established as the State Agricultural Bank in 1953, is the largest financial institution serving the agricultural and rural sector of Myanmar, with 206 township-level branches nationwide (208 branches in 2016, its services cover 249 townships). But before 2008/09 the loan rate per acre of MADB was very small, just enough to purchase a bag (50 kg) of chemical fertilizer. The microfinance program was initiated under the Human Development Initiative Program of the United Nations Development Programme (UNDP) in the three regions of the Central Dry Zone, the Ayeyarwady Delta, and Shan State since the early 1990s, but with a rather limited scale.

The Myanmar government started to emphasize strengthening and expanding microfinance programs for poverty alleviation and livelihood development after the democratization in 2010, with support from major donor agencies. The Livelihoods and Food Security Trust Fund (LIFT) is a multi-donor fund established in 2009 to improve the lives and prospects of poor and vulnerable people in rural Myanmar, particularly through promoting microfinance. MADB also started to very rapidly raise the loan rate in 2009/10, reaching 100,000 kyat per acre (for rice) and 20,000 kyat per acre (for other crops) by 2013/14. (In 2016 the rate reached 150,000 kyat for rice and 8.0% annual interest rate. Its repayment period is 1 year) However, it seems that there

still remain lots of problems to be tackled in the agricultural/rural finance sector in Myanmar, exemplified by the fact that loans from “exploitative” informal sources still persist to the present.”

Since 1990, MADB has been providing the current agricultural finance schemes that consisted of Seasonal Loan for agricultural inputs and wages and Term Loan for the purchase of agricultural machines. In 2011, MADB provided Term Loan with amount 13 billion kyat, but since 2012, MADB finance has focused only to Seasonal Loan for agricultural inputs and wages due to limited fund sources provided by MEB..

Besides MADB finance, the former Ministry of Cooperatives that has been merged into MOALI in March 2016 also has provided public rural finance since 2012. Each household could receive 100,000 kyat at an interest rate of 1.5% per month for agricultural and other business. Its repayment period is half year.

According to the MOALI document about MADB, its Seasonal Loan Disbursing System and Collecting System are as follows;

MADB's Seasonal Loan Disbursing System

Every year, in May, the Seasonal Loan Instruction for the current financial year is issued by MADB(H.O). This instruction consist the principle of disbursing loan system, defining the disciplines of disbursing loan, composition village – Tract loan screening committee and their tasks, disbursing loan procedures, loan per acre rate, disbursing interest rate, penal interest rate, loan disbursing period, loan collection period, loan fund divide and allow process and other noticeable facts.

After having seasonal loan fund from MADB(H.O), the States and Regional Banks divide and allow their loan fund for their concerning branches according to their loan demand. After that, these branches are drafting allowed to their village-tracts in line with their demand. Both State and Regional Bank and District or Township Branches have to compose their respective seasonal loan's advising Committee. They usually discuss how to disburse their Seasonal Loan Fund and how to collect these loans with coordinating and cooperation. At the same time, all of MADB's operational branches deliver loan contract forms to their village-tract loan screening Committee. These Committee deliver the (3) loan contract forms to the farmer group. The farmer group fills-up these forms with the proposal loan amount. For a new client, the farmer needs to make credit proposal to the village-tract Loan Screening Committee. This person also needs to find least 2 friends to be a group not more than three person and make election of the group leader. This loan requires a Joint guarantee of borrowers. Each farmer can get this loan for a maximum of 10 acres.

The farmer also needs to save at least 3000 Kyats to open a saving account at the bank. After that, all clients in the village-tract who have the land use right certificate, repayment capacity and right proposal loan demand, the Loan Screening Committee submit the village-tract total credit proposal amount to the concerning bank. After making necessary check, the Bank Manager makes an appointment that the date of disbursing the loan for that village-tract. Finally, the bank directly disburse loan to client group of 2 to 3 members at the bank counter. At the same time, Individual Farmer, the two witness, the farmer group leader and bank loan

official sign together on the credit contract. The farmer must settle this within 12 months. If a client can't settle his debt, he and his group don't have another chance to borrow our bank loans.

MADB's Seasonal Loan collecting System

In harvest time, we start to collect our disbursed loan according to the instruction period. All the State and Regional Manager, usually make a loan collection meeting with their branches Managers. And then, all the township branches usually make a collection meeting with their village-tracts loan screening committee. Both State and Regional Manager and Township Branches Managers use to be held with their respective loan advising Committee to collect their loan. They also make coordination and cooperation with their respective regional authorities. They always attend monthly, mid-monthly meeting which is held by regional authorities and report their difficulties. They also make coordination and cooperation with their village-tracts Administrators to collect their disbursing loan. On the other hand, and at the start of collection time, they make announcement on TV, in Newspapers, Journals and Radio. They also deliver notices to their individual client through their village-tract administrators to settle their loan and individual farmer settle his loan at the bank branch counter. In this way, MADB's operational branches collect their seasonal loan.

Rate Per Acre (Kyats)

	F.Y 2005-2006	F.Y 2010-2011	F.Y 2011-2012	F.Y 2012-2013	F.Y 2013-2014	F.Y 2014-2015	F.Y 2015-2016	F.Y 2016-2017
Paddy	8,000	20,000	40,000	50,000/ 80,000	100,000	100,000	100,000	150,000
Other	4,000	10,000	10,000	10,000	20,000	20,000	20,000	20,000

Capital, Source of Fund and Saving Mobilization

- Authorized capital - 10.00 billion kyat.
- Paid up capital - 9.5 billion kyat.
- Reserved fund - 5.813 billion kyat.
- Loanable funds
 - Capital
 - Reserves
 - Customer deposits and
 - Short term borrowing of Government funds through MEB
- Voluntary savings mobilization scheme was launched in 1993.
- In(2013-14) Financial Year

These systems have been functional so far in terms of high repayment rate. Peer pressure system through group lending and the village-tract loan screening committees could play an important role not only in screening but also monitoring borrowers in their villages and avoiding default. As a result, the MADB branches have limited capacity to examine borrowers in provision of seasonal and term loans, because most examination work of their finance has been commissioned to the village-tract loan screening committees. Each MADB branch has a balance sheet, but did not disclose it.

MADB Ratios

		F.Y 2000-01	F.Y 2005-06	F.Y 2010-11	F.Y 2011-12	F.Y 2012-13	F.Y 2013-14	F.Y 2014-15
1	Reserve Ratio	18.10%	0.56%	29.19%	5.14%	54.92%	41.73%	92.47%
2	Liquidity Ratio	13.98%	45.48%	25.42%	17.46%	44.92%	67.55%	110.74%
3	Capital Adequacy Ratio	80.05%	35.68%	26.12%	10.91%	12.86%	10.30%	10.95%
4	Loans To Deposit Ratio	77.49%	98.43%	61.10%	96.13%	117.46%	3656.52%	4843.15%

10. Agricultural Machineries

In remote rural areas, agricultural workers are beginning to move to large cities such as Yangon or to find a job in other sectors (services and small assembly industries), consequently individual farmers are losing the possibility of hiring freely labor forces and, therefore, the mechanization of agriculture needs to be promoted.

Rice harvested using a combine, of which the output rate of milled rice is higher than manually harvested rice, can be sold at higher prices accordingly, meaning that also from the consumers' viewpoint, mechanization is desirable.

As far as mechanization is concerned, low-price power tillers (made in China or Thailand) are beginning to be utilized by average farmers. A considerable number of farmers use a threshing machine. The introduction of tractors and combines is now starting because of AMD is implementing in technical cooperation programs with International Organizations such as JICA, KOICA, IFAD, World Bank, etc. The amount of loan provided by the Government to an individual farmer is too low to enable the purchase of agricultural machinery. A medium-level loan until 20,000 USD for more than 5 years is not available. In some locations cultivation services are provided against payment by specialized service providers and under certain circumstances the use of this kind of services is less expensive than using temporal workers, of which the wage tends to increase as the result of the shortage of workforce in rural areas. The fact that the majority of farmland is not consolidated and is not suitable for use of agricultural machines such as tractor is a further reason for the delayed mechanization of agriculture. Recently the area on which two crops are planted yearly is expanding and there are increasing cases where still solid land should be ploughed before the beginning of the rainy season. Such land is hard to be ploughed by cow and for this reason the mechanization is required. As the yearly farming schedule is becoming tight and rainfall is becoming more irregular, it is now an important factor to ensure timely farm work through the mechanization of agriculture for the stabilization of agricultural production.

Under the above situation, AMD is implementing the mechanization program with Vision & Mission as follows:

VISION

To ensure the transformation from conventional to mechanized agriculture

Mission

To increase the farm mechanization services

To develop the systematic mechanized farmlands and transform from shifting cultivation to terrace farming in hilly regions

To provide more utilization of farm machinery and implements in agriculture

To conduct the training and educational programs on technical know-how and to implement the research and development activities of farm machinery

AMD has the following functions;

- 1) Provision of farm mechanization service with custom hiring system to small scale farmers for land preparation and harvesting
- 2) Extension of utilization of farm machinery and implements in agriculture
- 3) Promotion of mechanization for upland reclamation in hilly regions
- 4) Conducting of training course on operation and maintenance of farm machinery
- 5) Establishing of research and development on agricultural machinery and dissemination of technical know-how to local farmers and private industries
- 6) Implementing in technical cooperation programs with International Organizations such as JICA , KOICA ,IFAD ,World Bank , etc

AMD owned their farm machineries as follows;

Situation of Farm Machineries Owned by AMD in Myanmar

No	State/Region	No of AMS	Tractor	Combine Harvester	Transplanter
1	Kachin	4	70	3	
2	Kayah	1	35	3	
3	Kayain	1	26	4	
4	Sagaing	14	171	60	5
5	Tanintharyi	2	13	1	
6	Naypyitaw	3	94	47	8
7	Bago	20	378	79	4
8	Magwe	7	121	19	3
9	Mandalay	17	226	46	4
10	Mon	4	71	11	
11	Rakhine	3	56	2	
12	Yangon	5	100	18	3
13	Shan	5	185	3	1
14	Ayeyarwaddy	15	273	74	
	Union Total	101	1819	370	28

AMD distributes farm machineries as follows:

Distribution of power tiller, tractor and other farm machinery by instalment payment system with three times within two years

No	Machinery	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17(Up to end of June)	Total
1	Tractor	19	80	141	122	125	1	488
2	Power Tiller	3545	5788	6104	5222	9074	2612	32345
3	Thresher	622	482	343	134	75	19	1675
4	Transplanter	24	9	8	11	5	1	58
5	Mono Wheel	150	123	29	3	5	1	311

AMD implemented Farmland Consolidation as follows:

From (1995-96) to (6/2016)

No	State / Region	Implementer Acres By AMD	Implemented Acres By other organizations	Total Implemented Acres
1	Kachin	953	960	1913
2	Kayah	807	10	817
3	Kayain	1530	1367	2897
4	Sagaing	1724	615	2339
5	Tanintharyi	460		460
6	Naypyitaw	8385.29	1641	10026.29
7	Bago	4789	5908.5	10697.5
8	Magwe	1788.66	257	2045.66
9	Mandalay	2982.575	2069.18	5051.755
10	Mon	1560	45	1605
11	Rakhine	978.75	100	1078.75
12	Yangon	21093.51	5785.5	26879.01
13	Shan	879.15		879.15
14	Ayeyarwaddy	4765	5800.77	10565.77
	Union Total	52695.935	24558.95	77254.885

AMD implemented Farmland Reclamation projects as follows:

Implementing of systematic terrace cultivation to eliminate the shifting cultivation in hilly regions

No	Location	Condition of finish of terrace farmlands (From 2002 to 2016)		
		Department	Farmer	Total
1	Farmland Reclamation Project(1), Shan State (North)	8324.5	3801.28	12125.78
2	Farmland Reclamation Project(2), Shan State (East)	3552.17	3085.28	6637.45
3	Farmland Reclamation Project(3), Chin State	3353.4	4366.07	7719.47
4	Farmland Reclamation Project(4), Shan State (South)	5094.36	2863.15	7957.51
5	Farmland Reclamation Project, Kayah	100	300	400
	Total	20424.43	14415.78	34840.21

11. Agricultural Inputs

All chemical fertilizers used in Myanmar are imported, and lately their demand is increasing among farmers. Imported fertilizers are repackaged by importers, who attach their brand names on the sack, making the origin of fertilizer unclear. In the case of packaged fertilizer, urea and compound fertilizer (15-15-15) are distinguished. Users tend to buy fertilizer on the basis of its brand name rather than on the basis of its composition. Labels on the package are not written in Myanmar nor in ethnic language; it would be hard to consider that the fertilizer is used properly corresponding to its ingredients. Sometimes, the actual components do not correspond to the information appearing on the label consequently; farmers cannot enjoy the expected effects and, in many cases, must suffer from the loss.

Similarly to the case of fertilizers, all most all pesticides are also imported and information on labels regarding proper handling and safe use of products is not-sufficient. In addition, there is a language barrier for farmers in county side (remote area). Farmers cannot use pesticides properly, because the essential information is lacking in Myanmar at present. As a result, level of agrochemical residues in/on crops could not be managed. Therefore agrochemical residues of harvested crops in Myanmar might be serious food safety issue. Due to lack of proper management system for agrochemical utilization, deterioration of crop quality, food safety and yield are possibly negative impacts which are higher than that of expected benefits.

Dissemination of appropriate and suitable information on use of fertilizers and pesticides are really indispensable and urgently implemented.

Land is one of agricultural inputs. LAND USE DIVISION I has been organized in DOA, MOALI . The outline of the Division is as follows;

A. Introduction of Land Use Administration

Land Use Division (LUD) was established under the supervision of Land Record Department in January 1957, with the objectives of analyzing and assessing soil fertilities of the entire country; which was initiated since then with the assistance of experts from the Union of Soviet Socialist Republic. At present, land use division under the Department of Agriculture are supporting technical know-how in the areas of soil surveying, mapping using GIS, conducting fertilizer researches for each types of crops and soil. In addition, Land Use Division is also responsible for conducting the laboratory analysis of fertilizer samples other than soil and water samples to issue the registration cards whether specifications is in accordance with the stipulations or not because the government enacted the fertilizer law in 2002 to control properly the quality of the fertilizers to be able to carry out the fertilizer business.

B. Objectives

1. Exploration of actual cultivable land resources.
2. Soil classification.
3. Cropping recommendation based upon soil types of different agro- ecological zones.
4. Recommendation on fertilizer management for each type of crops and soil.
5. Recommendation on irrigation frequencies for different crops based upon physical characteristics of the soil and meteorological conditions.
6. Undertaking soil conservation and reclamation measures.

C. Regional Offices

Nowadays, Regional offices of LUD have been established in all States and Divisions to implement land use activities.

Regional office -	1:	Yangon
Regional office -	2:	Mandalay
Regional office -	3:	Sagaing
Regional office -	4:	Magway
Regional office -	5:	Taunggyi
Regional office -	6:	Bago
Regional office -	7:	Patheingyi
Regional office -	8:	Sittway
Regional office -	9:	Mawlamyaing
Regional office -	10:	Kyaukse
Regional office -	11:	Nay Pyi Taw
Regional office -	12:	Myittha
Regional office -	13:	Laoikaw
Regional office -	14:	Hpa-an
Regional office -	15:	Htaw
Regional office -	16:	Hakha
Regional office -	17:	Lashio

Generally, each regional office of LUD is actively engaged in the following activities:

- Studying soil-plant relationship, fertilizer management
- Studying soil and water management in collaboration with International Institutions
- Solving localized soil problems.
- Dissemination of soil and water management technologies.
- Demonstration soil conservation measures.

D. Strength of Staff

The number of total employee in LUD at present is (24000) out of the whole staffs of DOA (108). The staffs of LUD comprise of technicians (51) and other staffs (57).

E. Conservation Section

Wind and water erosion are the most extensive and pronounced land degradation. The areas affected under wind and water erosion are sloping areas. Due to lack of crop covers and undulating topography, these areas face severe erosion problems. Undulating land composed of sand and sandy loam with low soil fertility in dry zone area is also subjected to wind erosion. Wrong agricultural practices, such as shifting cultivation, ploughing along the slope particularly the area near the river bank accelerated such water erosion. For this reason, depletion of soil fertility became worse in those areas. Conservation activities are to be done in sloping areas. Contour cultivation and strip cropping, terracing and slopping agricultural technology are adopted and pretty demonstration sites are established to educate the farmers and permanent agriculture are being encouraged. Conservation activities in cooperation with UNDP/FAO were carried out as the pilot project and funded by the above mentioned organizations.

The functions of the conservation section are as follows:

- (1) to establish wind breaks
- (2) to construct contour bunds, terraces
- (3) to establish demonstration sites of conservation activities for education
- (4) to conduct the experiments of erosion measurements

F. Soil Fertility Section

Fertile soils have the characteristics which are capable of maintaining sustainable crop production. They are in high organic matter content and free from soil borne pathogens. They have better healthy environment for plant growth. If the soils have poor fertility, the target yield could not be obtained at all. For that reason, continuous addition of organic matter to the soil as compost, green manure and chemical fertilizers maintain the soil fertility. Due to increasing prices and scarcity of chemical fertilizers, utilization of organic fertilizers alone or in combination with chemical fertilizers is essential for the farmers. In this case, fertilizer management plays a key role in increasing the economic crop yield. Hence, the fertilizer source, time and application methods and fertilizer requirements are also considered in fertilizer management.



G. Soil Survey Section

Land Use Division is responsible for soil survey for farms of Departments and Enterprises of Government and Private Companies as well to identify soil types due to diverse agro climatic conditions, characteristics of soils, soil fertility status, chemical and physical properties and land use situations based on land capability. Emphasis is placed on developing land type and land use map, texture map and so on. Soil survey activities amounted to approximately 20000 acres is undertaken annually.



H. Land Use Planning Section

The functions and duties of land use planning are as follows;

- Formulating land use planning
- Monitoring and evaluation of land use activities
- Conducting soil and fertilizer management experiments in close collaboration with regional offices.



I. Soil Physics Water Management

At present little activities, particularly water management could be done although this section plays a key role for the increase of crop production due to insufficient technicians.

The main activities of the section may be summarized as follows:

- Estimation of water requirement of crops for different soil types.

- Giving recommendation on appropriate cropping pattern based upon climatic condition and soil type of the region.
- Demarcation of agro-ecological zones to facilitate land use planning and management.
- Experimentation on soil physical properties.
- Provision of technical assistance for irrigation projects.
- Dissemination of soil and water management techniques through training and demonstration.

J. Fertilizer Law and Registration Section

Agriculture plays a key role in the national economy and consequently plenty of natural, bio-, and chemical fertilizers have been utilized to increase crop production. In this respect, the government enacted the fertilizer law in 2002. The main objectives of the fertilizer law are as follows

- to enable growers to use fertilizer of quality in conformity with specifications;
- to enable supervision and control the fertilizer business systematically;
- to support the conservation of soil and environment by utilizing suitable fertilizer;
- to enable carrying out of educative and research works extensively for the systematic utilization of fertilizer by the agriculturalist;
- to cooperate with government departments and organizations regarding fertilizer business.

The Ministry of Agriculture and Irrigation, with the approval of the government shall form the Fertilizer Committee and the Committee started to carry out its functions in 2008-09. Land Use Division has been conducting the laboratory analysis of fertilizer samples to issue the registration cards whether specifications is in accordance with the stipulations or not.



K. Research and training Section

As it is aware the fact that the yields of agricultural crops cannot increase if the soil is by no means fertile although the crop yields depend upon other factors, for instance, climate, variety, pest control and mechanization and so on. Due to diverse climatic constraints, the soil types differ from place to place. As a result, the problem soils occur with varying degree. The problem soils do not occur due to nature alone, mismanagement of agricultural practices leads to soil problems and soil fertility deterioration. For the purposes of this, researches are ever needed to be conducted in the following areas: (1) how to minimize and /or prevent soil problems (2) how to ameliorate problem soils at the current situation (3) how to achieve and maintain soil fertility (4) fertilizer management for the yield increase from the efficient and balanced utilization and

economical point of views. In addition, care must be taken with regard to hazards of the utilization of the chemical fertilizers on environments.



L. Soil Laboratory Section

The main functions of soil laboratory are as follows;

- Analyzing soil, water and fertilizer samples.
- Giving recommendation based upon the analytical results.

Nowadays, attention on conducting analysis of fertilizer samples for the applications of the government departments and organizations, international organizations local and foreign non-governmental organizations has been paid to obtain the registration certificate regarding fertilizer business.

M. Conclusion

Land Use Division is one of the technical supporting sections under Department of Agriculture. Soil improvement through manuring play a prominent role in increase of crop of production. On the one hand, control of erosions, amelioration of the soil problems and to prevent soil degradation shouldn't be neglect. Conducting training is of great importance to enable for sustenance agriculture and not to have negative impact on environment.

(A) Staff Resources from Land use division

Sr.	Resource Degree	Amount	Remark
1	Bachelor Degree Holder	27	
2	Master Degree Holder	9	
3	Ph.D Degree Holder	5	
4	Bachelor + another Diplor	10	
	Total	51	

There are a lot and sufferance staff resources

(B) Land Use Laboratory

The main functions of soil laboratory are as follows;

- Analyzing soil, water and fertilizer samples.
- Giving recommendation based upon the analytical results.

The following items can be analyzed at Land Use Division.

No.	Item
1.	Moisture
2.	pH
3.	EC
4.	Texture
5.	Organic Matter
6.	Total Nitrogen (N)
7.	Available Phosphorus (P_2O_5)
8.	Exchangeable Potassium (K)
9.	Exchangeable Ca + Mg
10.	Exchangeable Sodium (Na)
11.	Exchangeable Al + H
12.	Water Soluble SO_4
13.	Water Soluble CL
14.	CEC (Ex. Ca + Mg + K + Na + Al + H)
15.	Soil Water Extraction (CO_3 , HCO_3 , SO_4 , CL, Ca, Mg, Na)
16.	Complete Water Analysis (pH, EC, CO_3 , HCO_3 , SO_4 , CL, Ca, Mg, K, Na, TDS, SAR, RSC)

Staff of Land Use Laboratory in Yangon Region Division

No.	Designation	Number
1.	Deputy Director	1
2.	Staff Officer	1
3.	Deputy Staff Officer	6
4.	Assistant Staff Officer	2
5.	Deputy Assistant Staff Officer	3
6.		5
7.		4
	Total	21

Staff of Land Use Laboratory in Mandalay Region Division

No.	Designation	Number
1.	Assistant Director	1
2.	Staff Officer	2
3.	Deputy Staff Officer	3
4.	Assistant Staff Officer	-
5.	Deputy Assistant Staff Officer	4
6.		1
7.		1
	Total	12

Staff of Land Use Laboratory in Bago Region Division

No.	Designation	Number
1.	Deputy Staff Officer	1
2.	Assistant Staff Officer	2
3.	Deputy Assistant Staff Officer	2
4.		-
5.		2
	Total	7

Staff of Land Use Laboratory in Kayin State

No.	Designation	Number
1.	Deputy Staff Officer	1
2.	Assistant Staff Officer	1
3.	Deputy Assistant Staff Officer	1
4.		-
	Total	3

Shan State (10 staffs) and Magway Division (7 staffs) are purchasing all instruments for soil laboratory now but staffs are already took the training for soil analysis.

(C) Fertilizers' registration in Land Use Division from 2010 to 2016

No	Item	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	Total
1	Manufacturing	83	72	28	30	142	84	439
2	Import	242	287	329	140	601	628	2227
3	Export	-	-	-	1	3	-	4
	Total	325	359	357	171	746	712	2670

(D) Foreign Projects involved with Land Use Division

No.	Project Title	Project started year	Project ended year	Project type	Supported Agencies / Institutes
1	Management of nutrients for improved profitability and sustainability of crop production in Central Myanmar	April 2016	March 2020	Grant	Australian Centre for International Agricultural Research (ACIAR)
2	Land resource evaluation for productive and resilient landscapes in the Central Dry Zone of Myanmar	April 2016	March 2020	Grant	Australian Centre for International Agricultural Research (ACIAR)
3	ASEAN Sustainable Agri-food System: Soil and Nutrient Management	December 2014		Grant	GIZ
4	Early Warning and Climate Services	March 2016	March 2020	Grant	ASEAN Climate Resilience Network
5	Drought Mechanism	June 2016	March 2018	Grant	UNESCAP

6	Soil Survey and Land Use Planning	July 2016	September 2020	-	Land Development Department, Thailand Government
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(E) Human Resource Development in Land Use Division

No.	Training	Location	Year
1.	Water Use Efficiency and Irrigation Management	CARTC	2011-12
2.	Efficient Use of Nutrients in Rice (Workshop)		2011-12
3.	Soil problems and amelioration in crop production, Climate Smart Practices in Crop Production		2011-12
4.	Soil Survey, Classification and Conservation Practices		2011-12
5.	Utilization of Chemical Fertilizers, Organic Fertilizers and Bio-fertilizers		2011-12
1.	Water Use Efficiency and Irrigation Management	CARTC	2012-13
2.	Soil problems and amelioration in crop production		2012-13
3.	Soil Survey, Soil Classification and Soil Conservation		2012-13
4.	Utilization of Chemical Fertilizers, Organic Fertilizers and Bio-fertilizers		2012-13
5.	Climate Smart Practices in Crop Production		2012-13
6.	Efficient Use of Nutrients in Rice (Workshop)		2012-13
1.	Maintainability of Fertilizers' Quality (1/2013)		2013-14
2.	Land Use Staff's Advanced Training		2013-14
(1)	Fertilizers' Law and Regulation, Fertilizing crops and human health, Soil conservation practices, Basic of soil and plant nutrients, Soil problems and amelioration in crop production	CARTC	2014-15
(2)	Soil problems and amelioration in crop production, Basic of soil and plant nutrients, Fertilizers' Law and Regulation, Fertilizing crops and human health, Soil conservation practices,		2014-15
(3)	Water Application, Right timing and Balanced Use of Fertilizer Application		2014-15
(4)	Basic of soil and plant nutrients, Soil problems and amelioration in crop production, Fertilizers' Law and Regulation, Fertilizing crops and human health		2014-15
(5)	Dry Systems for Crops		2014-15
(6)	Soil Survey and Soil Classification		2014-15
(7)	Basic training for nutrients analysis		2014-15
1)	Inspector training for fertilizers' quality (1/2015)		2015-16
2)	Advanced training of staff (No. 11)		2015-16
3)	Basic training of staff (No. 15)		2015-16
4).	Advanced training of staff (No. 12)		2015-16
5)	Basic training of staff (No. 16)		2015-16
6)	Basic training of staff (No. 17)		2015-16
7)	Good Agricultural Practices (GAP)		2015-16
8)	Production and marketing of vegetables, fruits and seeds		2015-16
9)	Basic training of staff (No. 18)		2015-16
10)	Land Use Staff's Advanced Training (2/ 2015)		2015-16

11)	Basic training of staff (No. 19)		2015-16
12)	Basic training of staff (No. 20)		2015-16
13)	Basic training of staff (No. 21)		2015-16
14)	Sustainable crop production technologies (Workshop)		2015-16
15)	Basic training of staff (No. 22)		2015-16
16)	Soil Classification, Soil Survey and Land Resource Management		2015-16

12. Seed Industry

One of the political goals of the Government of Myanmar in the area of agriculture is to enhance the diversity of agriculture by promoting horticulture (vegetables and fruits). However, it is still difficult to ensure the stable supply of high-quality seeds and seedlings, and improvement is sought in this field. In particular, in the case of vegetables, there have not been local breeding activities and the seed supply relies upon the seed of local varieties produced by local farmers, seeds imported from China and other countries, and the production of high-quality seed is highly required.

Myanmar possesses cool and dry climatic conditions and contamination with plant diseases and pests is not yet been observed. Therefore, Myanmar is considered to be suitable for seed production. Currently, systematic seed production does not take place, and it is desirable to introduce a system for the production of high-quality seed. Indeed Myanmar has attracted the attention of the world seed industry, as a potentially promising seed producing country.

Breeder Seed Distribution of Rice Varieties from DAR to DoA Seed Division (Basket)

Sr	Rice Variety	2012	2013	2014	2015
1	Manaw Thukha	18.5	6	8	7
2	Sinn Thukha	22	21.5	21.5	22
3	Mhaw Be-1	12.5	9	8	4.5
4	Sinn Ayekari-3	4	1.5	4	2
5	Shwe War Tun	8	1.5	7.5	1
6	Sinn Thwe Latt	20	7.5	8.5	9.5
7	Kyaw Zay Ya	8.5	3	3	1.5
8	Aye Yar Minn	16	9	16	10.5
9	Thee Htut Yin	17.5	3	3.5	3
10	Paw Sann Yin	3	3	11.5	1.5
11	Shwe Myanmar	4.5	-	1	2
12	Shwe Thwe Yin	6	3	5.5	1
13	Sinn Thwe Latt (Salt Tolerance)	1.5	1.5	1.5	-
14	Yadanar Toe	10	8.5	13	17
15	Sawana-sub 1	0.5	1.5	1.5	1.5
16	Nhan Kar	4	3	2	-
17	Paw sann Beakyar	6.5	1.5	-	4
18	Nant Thar Mhwe	1	3	-	-
19	Shwe Yin Aye	1	1.5	1.5	-
20	Shwe Pyi Htay	1	-	3	-
21	Shwe Pyi Tan	-	-	-	1.5
22	Yezin Lone Thwe	2	-	-	1
23	Sinn New Yin	7.5	-	-	-
24	Days-90	0.5	-	-	-
25	Inma Yebaw	1.5	-	-	-
26	Thukha Yin	2	-	-	-
27	MR 9	1.5	-	-	-
	Total	181	88.5	120.5	90.5

The following kinds of crop seeds are certified by National Seed Council.

Seed Certificates for commercialization by National Seed Council

Sr	Crop	Total
1	Rice	125
2	Wheat	11
3	Corn	47
4	Sweet Corn	12
5	Waxy Corn	6
6	Sorghum	12
7	Ground Nut	15
8	Sesame	7
9	Sunflower	6
10	Cotton	40
11	Jute	9
12	Sugarcane	12
13	Rubber	2
14	Tomato	16
15	Egg Plant	1
16	Squash Melon	4
17	Green Pea	3
18	Gourd	2
19	Calliflower	4
20	Cabbage	1
21	Chilli	9
22	Lady finger	6
23	Cucumber	7
24	Bitter Gourd	4
25	Sweer Gourd	2
26	Raddish	1
	Total	364

Source : DoA (TSC)

In Myanmar, JICA conducted a Seed Bank Project to collect, evaluate and conserve genetic resources of useful crops for future breeding purposes, and established at the end of 2001, a collection of 7200 accessions (base collection) and of 7300 accessions (active collection). Two-thirds of the accessions are rice genetic resources. However, after the completion of the Seed Bank Project, the collected genetic resources were not effectively utilized. The fact that, with the exception of rice, no systematic breeding is carried out and that real users of the Seed Bank such as seed companies do not exist is considered to be the reason.

Cold Storage of the Seed Bank

	Short-term Storage	Medium-term Storage
Temperature	10°C	-5°C
Relative Humidity	30-40%	30-40%
Conservation Life	3-5years	20-30years
Container	Polyethylene bottle	Aluminum foil
Storage Seed Weight (gm)	300-500	40-100
Storage Capacity (Accession)	21600	20000

The achievement of Seed Bank activities is as follows;

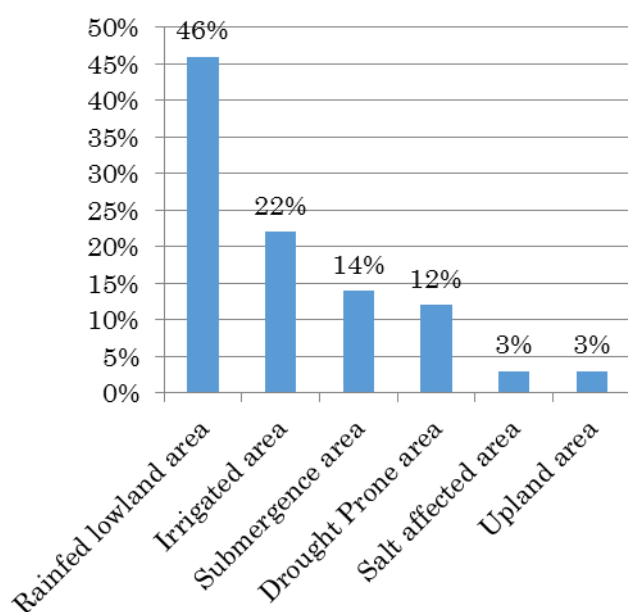
**Number of accession in Medium-term of Myanmar Seed Bank
(up to 2016, March)**

no.	Crop group	2015, March	2015-2016	2016, March
1	Rice	7,370	359	7,729
2	Wild Rice	180		180
3	Legume	1,577		1,577
4	Cereal	2,049	173	2,222
5	Oilseed	711	86	797
6	Vegetable and other	86	21	107
	Total	11,973	639	12,612

**Germplasm distribution from Myanmar Seed Bank
(March 2016)**


Crop group	Abroad	Domestic	Total
Rice	9,321	6,626	15,947
Wild rice	600	104	704
Legume	808	1,584	2,392
Wild Vigna spp.	70	86	156
Other cereal	479	380	859
Oilseed	111	80	191
Vegetable and other	616	1	617
total	12,005	8,861	20,866

The use of rice germplasm in breeding program for adverse environmental condition



Abiotic stress	Biotic stress
Drought-prone	BPH
Flood-prone	Stem borer
Salt-affected	Gall midge
Low input	Bacterial Leaf Blight
Lodging	Bacterial Leaf Streak
Fresh seed dormancy	Rice Blast
	Sheath Blight

Horticultural Seed Production

Sr no.	Crops	Production Site
	Hybrid Varieties	
1	Tomato	VFRDC Hlegu, Shwe Nanthar, Yangon Region Naung Cho Farm, Nauog Cho Township, Northern Shan State
2	Egg Plant	VFRDC Hlegu,
3	Pumpkin	VFRDC Hlegu, Shwe Nanthar Yangon Region,
4	Muskmelon	VFRDC Hlegu, Shwe Nanthar Yangon Region,
5	Zucchini	VFRDC Hlegu,
6	Water melon	VFRDC Hlegu, Shwe Nanthar Yangon Region,
7	Feed Corm	Namtlatt Farm Southern Shan State
	High O.P Varieties	
8	Tomato	VFRDC Hlegu,
9	Egg Plant	VFRDC Hlegu,
10	Pumpkin	VFRDC Hlegu,
11	Water melon	VFRDC Hlegu, Shwe Nanthar YangonRegion
	O.P Varieties	
12	Okra	VFRDC Hlegu,
13	Yard Long Bean (Mahuyar)	VFRDC Hlegu,
14	French Bean	VFRDC Hlegu,
15	Bottle Gourd	VFRDC Hlegu,
16	Snake Gourd	VFRDC Hlegu,
17	Cucumber	VFRDC Hlegu, Shwe Nanthar Yangon Region, Naung Cho Farm Nauog Cho Township, Northern Shan State
 Done and signed MoU and LoI between Department of Agriculture(DOA) and Sein Enterprises Co.,Ltd, and, DOA and Nangwoo Myanmar Co.,Ltd for hybrid vegetable seed production.		

Seedling Production for Horticulture Crops

Sr.	Crops	Production Site
1	Mango	VFRDC, Matehtilar, Poppa, Saepauk, Myanadi, Nanshae, Nyaungoo, Indyther, Hlaingtat (1), Namtlatt Farm, Htonebo,
2	Dragon Fruit	VFRDC, Matehtilar, poppa, Htonebo,
3	Guava	VFRDC
4	Pumelo	VFRDC, Pathichaung, Kantheryar, Ingabo,
5	Orange	VFRDC
6	Banana	VFRDC, Pathichaung,
7	Grape	Saepauk
8	Lychee	Pathichaung, Nagahlae,
9	Durian	Nagahlae,
10	Mangosteen	Nagahlae,
11	Cardamom	Nagahlae,
12	Jujube	Naungoo.
13	Fundamental Plant	Nanshae Farm,

Seedling and seed actual production of each year from 2011 to 2015

No	Varieties	Count	Seedling and seed production on each year(actual)				
			2011-12	2012-13	2013-14	2014-15	2015-16
1	Seedlings	Plant	217340	116696	108919	113224	126500
2	Seeds						
	Vegetables	Kilo	4814.760	311.518	733.765	975.450	662.592
	Peas, Oil crops and cereal crops	Basket		220	3549.330	3810.523	1863.500
	Potatoes	Viss		4929	12000	12000	

Note: There were (56) farms in 2011-2012 and (20) farms were transferred under the budget of state and region in 2012 – 2013.

Seeds and Seedlings Production Plan Within Year, 2016

No	Varieties	Count	2016-17 plan
1	Seedlings	Plant	239103
2	Seeds		
	Vegetables	Kilo	2372.1
	Peas, Oil crops and cereal crops	Basket	5029.9
	Potatoes	Viss	3000

Name, Location, Number of agriculturists, Area and Brief Functions of laboratories under Horticulture and Plant Biotechnology Division

No	Name of Lab.	Location	Num. of agriculturists	Area (L×W×H)	Brief Functions	Remarks
1.	VFRDC	Yangon Region, Hlegu Township	36	300'× 45'× 15'	Vegetables/Fruits Research works (Variety selection, variety comparison, yield comparison, seed viability, shelf- life treatments,	
2.	Plant Bio technology Center	Yangon Region, Mingalardone Township Pearl Myo Thit (Shwenathar)	57	226'×46' × 12'	Research and Development (Genetically identification of rice crop by using molecular markers,production of new rice varieties by using anther culture , DNA classification ,production of diseases resistant rice varieties , plant tissue culture productions of orchid ,banana,strawberries, potato and GMO identification)	
3.	Mingalardone (Orchid Farm)	Yangon Region, Mingalardone Township	7	48'× 24'× 16'	Maintenance of orchids, orchid breeding, production of orchid seedlings, function as recreation and education zone	
4.	Doekwin Farm	Mandalay Region, Pwin Oo Lwin Township	6	(50'×24'× 17') (27'×24'× 12')	Production of tissue culture medicinal orchids seedlings	Two buildings
5.	Heho	Shan(North) Kalaw Township	9	32'× 26'× 10'	Production of tissue culture potato seedlings	

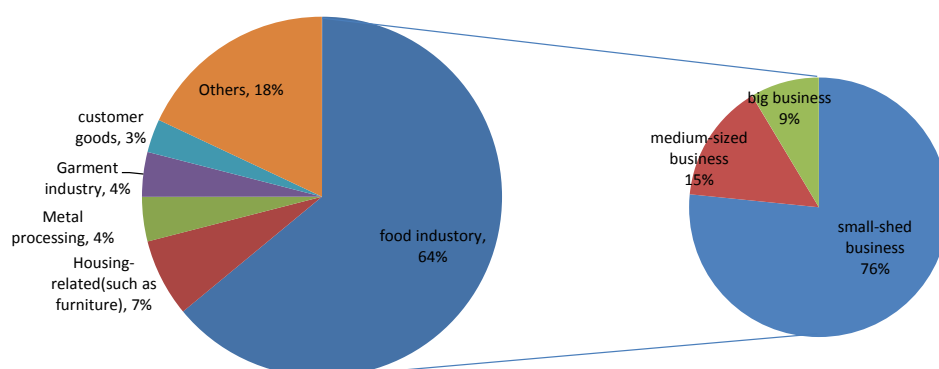
13. Food Industry

In the field of fisheries, the **Ayeyarwaddy Fisheries Company** has stated to export frozen products such as fried fish and shrimps, and the **Myanmar Macro Industry Company** produces canned fisheries products, thus the food processing industry is gradually developing.

Myanmar Bell sells Korean and Japanese food material through collaboration with Korean supermarkets and Japanese enterprises. Such domestic companies importing and selling foreign high-grade food materials are emerging.

27,000 Food Processors out of 43,000 Manufactures

Number of companies classified by type of business in Myanmar (MOI's jurisdiction)



More than 90% manufactures are SME

Source : Myanmar Industry Directory 2013-14

Approximately 60% of the producers (43,000 companies in 2013) under the statistic survey of the Ministry of Industry are food processing companies, thus the food processing industry is one of the most important industries in Myanmar. Most of them are small- and medium-sized enterprises. Few companies are capable to produce final products for markets, many are limited to primary processing. There are two flour milling companies, but the quality of flour produced by them is low and does not attain the level required in developed countries, because of their unsatisfactory milling techniques, infrastructure, storage and transportation methods after milling. Some companies planning its expansion in Myanmar are hesitating currently the local procurement of flour.

While domestic agriculture and fisheries products are abundant, condiments / seasonings material for canning and packaging are not easily obtained and need to be imported from Thailand and Vietnam. On the other side, some enterprises are, in cooperation with European and American enterprises, introducing the most advanced technologies (such as powder technology, diversifying their products for development of value added high quality products, such as a beverage producer introducing the most modern facilities from France. So some companies show a high level management

mind and this is evidence that the food processing industry has entered the era of sophistication through the introduction of foreign investment.

As the result of a JETRO project to support the development of the food processing industry since 2009, a food analysis laboratory and food quality standards have been introduced, enhancing the food hygiene level. However, a system for the analysis of pesticide residues which is the prerequisite for the implementation of Global GAP and/or JGAP has not yet been introduced. Consequently, for the export of products to developed countries it is necessary for exporting companies to send a sample to an internationally accredited organization such as foreign ISO 22000 certified laboratories to receive analytic data of pesticide residue, which requires additional costs and time.

With the changing lifestyle accompanied by the increased income level and the increased number of people adopting eating out lifestyle because of both husband and wife earn for income, the domestic demand for dried food, frozen or chilled food which can be prepared quickly is increasing, and will continue further, in particular in urban areas. In accordance with such an increasing demand, imported processed food, such as frozen potatoes, brought from China and Thailand are sold in supermarkets. After the ASEAN economic unification was materialized at the end of 2015, the import of processed food from abroad is expected to further increase. It is necessary to take counter-measures against the increase of imported food, by raising the level of domestic food processing companies to avoid negative impact upon the domestic food processing industry in Myanmar.

14. Farmers' Organization

(1) Background

Myanmar lags behind in the export of agricultural products due to various reasons including inadequacy of general infrastructure, post-harvest infrastructure scale of operation, high freight cost, price fluctuation, lack of implementation of quality and food safety management systems (GAP, GMP, etc). In order to improve quality of agricultural produces, strong institutional structure and quality assurance mechanisms should be strengthened. Although a large number of producer associations were already formed for particular crops, linkage among all stakeholders along the value chain is rather weak. Further, in recent years the demand for quality processed food; organic food and health food along with attractive packaging has increased significantly. The interventions are required not only in the production sector, but also in the related sub-sectors such as infrastructure, quality, logistics, packaging, marketing, etc.

Farmer Organizations or Agriculture Producers' Cooperative Societies (As of July, 2016)

- ◆ Regions and States – 15
- ◆ Townships – 307
- ◆ Societies – 36,002
- ◆ Members – 3,340,866 (One member per Household)
- ◆ Beneficiaries – 16,704,330 People (Out of 51 Million)
- ◆ Shares – 20,120.913 Kyat Million
- ◆ Saving – 144,636.709 Kyat Million

(2) Importance of farmers' organization

Farmers' voice cannot be obtained without farmers' organizations. To engage in any sensible dialogue with the rest of society, farmers need their representative organizations, the farmers' organizations, structured from grassroots to the international level, as their legitimate voice. It should be encouraged farmers' movement to activate farmers' organizations, thus in turn leads today's rural society.

Farmers' organizations are critical foundation for rural development and create productivity along with income contribution in both rural and national development. Any effort at increasing production and improving quality should be coupled with the development of social infrastructure for the farmers. Quality, production and market of agricultural products should also represent the income generation of rural populace and food security and nutrition for consumers. In order to produce quality products, farmers need sufficient investment along their supply chain. Informal moneylenders fleeced them through exorbitant interest rates and traders take advantage during harvest season with low price. Most farmers fall prey to merciless players in the market. These market realities leave the farmers perennially in debt and without resources to start the next season. One of the relevant responses to this situation is to consolidate the small farmers into an organization that will enable them to be one of the players in the market. At present, producers' associations have limited financial support from both government and development partners for value added crops.

Production, financing and post-harvest and marketing is three basic elements in food value chain where farmers' group have to manage them effectively. Farmer's organizations, either as associations or cooperatives, when provided with appropriate tools and strengthened through capacity building programs can be developed to manage the business of agricultural sector. At present, there are limited strong farmers' organizations in the country that can do this function (Myanmar Farmer Association, 2015).

(3)Challenges of farmers' organization

3.1. Production not market oriented

Farmers will exert efforts to get better productivity and safety when there is incentive for them to do so. If the backbreaking work in the fields will not provide the financial returns that will satisfy them, they will either change crops or look for other sources of income. Only with a motivated workforce will the agriculture industry succeed to generate surplus. Reduced the steps of brokers or middlemen along the supply chain, farmers or producers' group will get the higher farm-gate prices. Formation of farmers' group is crucial, if not, there will have several layers in the value chain where brokers/middlemen will take advantage of the situation, getting all the gains and leaving the farmers holding an empty sack.

In the experience of other Asian countries, organizing the farmers' associations also facilitates efficient transfer of technology and delivery of extension services. In Thailand, the Philippines, Vietnam and Indonesia cooperatives form the backbone of a vibrant rice industry. With a farmer's organization, efficient production can be done by ensuring that they have the right seeds and other inputs, bought in bulk at more reasonable price. Use of tractors and other machines are scheduled ensuring access of all the members when they need it. Consolidation of products during harvest also allows quality processing and higher prices.

3.2 Weak bargaining power

Small scale producers generally lack the knowledge, information and resources to meet quality standards and formal markets specifications. And the usual lack of formal contractual arrangements might disincentive them to invest to meet these requirements. Along the food supply chain, the other intermediaries' associations such as wholesalers association, miller associations, traders' association and exporter associations have strong organizational structure than farmers' association. On the other hand, farmers have to sell their production soon after the harvest when the price is generally low as they have to pay back loan and immediate family expenses need. The traders can take this advantage and individual farmers have no market power to compete the buyers.

The farmers have to face the problems not only in the output market but also input markets. The individual used to buy the inputs retail shops or companies as individual basic causing the high price without any discount and credits. If they can buy the inputs through farmers' group or association, they can directly contact the wholesale dealers and can get with the wholesale prices and credit systems. The cost of transportation also saved from collective actions of buying. Although they know the advantage of

buying large quantity, the individual farmers cannot manage for the better way.

(4)Formation of farmers group and their sustainability

Forming the farmers' organization is the most appropriate way to solve the problems such as quality assurance consistency of supply and farmers' social improvement along the supply chain. The main issue is to maintain the sustainability in the long run. The government have to support the initiative of forming organization in line with the procedures of cooperatives. Moreover, it needs to assist the technical and financial to form successfully. On the other hand, the farmers have more awareness for organization which should be raised up through capacity building program and extension services. The success story of producers' association or farmers' group are related with systematic rules and regulations setting up for each type of commodity for its production, marketing and profit sharing.

Sustainability for the farmers' organizations is focus on producing for the markets. At the start, FOs produces products that they have the best experience; this makes production for the markets easier. Availability of market opportunities and the demand for high quality produce makes members to work hard and support one another to meet the market standards.

(5)The policy environment: Constraints and opportunities

5.1 Decentralization in government can promote triggered a similar shift in farmers' organizations which had been highly centralized and lacked transparency and accountability. The policy which need to support demand-driven and farmers –led agricultural service delivery should be introduce which can empower farmers by encouraging them to work together and build their demand for both research and agricultural advisory services.

5.2 Credit

The Myanmar Agriculture and Development Bank (MADB) or other non-government organizations may be providing production loans and micro-credit at present, but it is limited in the sense that it cannot provide for all financing requirements of the rice industry. There will be areas that will not be covered with the limited resources of the bank. Financing individual farmers will be very costly even for a government bank through cooperation and collaboration of farmers' organizations.

5.3Capacity building among farmers

To ensure professionalism in FOs, the extension officers and volunteer leaders in the communities should train to get special skills in formation of farmers' organization. The knowledge sharing programs, knowledge centre, mindset change for farmers to be work hard with corporative spirit and effective use of finance and technology in their farming is crucially important. Through the trained extension officers, key farmers and volunteers can support to their groups.

5.4. Promoting market-oriented production

To promote the marketing of their products, the farmers' organization can help to trade part of their produce collectively by themselves, or they bulk their produce

through the groups or associations which can hinder the buyers' oligopsony market power. And they can arrange the revenue of their groups themselves.

5.5. Creation of social capital

Beyond the economic enterprises they undertake, the farmers group pool their labour to help one another for their farming activities such as rouging for seed production fields with collective force, building structures for rainwater harvesting etc. Farmers group can strengthen social bonds in such manner. It can also provide an opportunity for members to discuss social matters. Human resource development and investment agreement can also be easily negotiated in this society.

(6) Gaps and opportunities for intervention

6.1. Policies and laws

Regarding the past experiences of the decline of cooperatives, some farmers have negative attitudes towards groups. To overcome such skepticism, there is need for policies and laws that give members to be in control of their organization and protect them from exploitation.

6.2 Production and market linkages

Now-a-days, some private companies and associations (eg. Myanmar GP for mango export) collect local growers and penetrate export markets to Singapore, Thailand, and middle east for their export quality products. Market linkage between producer and exporter are bilaterally attempted. Some of the challenges in there is the volume of the commodity, sometimes, cannot cover the demand. It is critical to identify markets and strengthen links to services for farmers before starting production. There is essential to provide timely market information for farmers and traders to be effectively link producers to local, national and regional markets. In addition, to expand the farmer-market linkages, governments should accelerate development of the private sector and encourage contract farming as well as value-addition.

6.3 Promotion of a savings culture

Rural finance scheme is paramount for the sustainability of farmers organization. Farm household are faced with informal credit system at present, interest rates are too high for small-scale farmers. So, within the organization the members can develop effective saving schemes but to run efficiently, there is need to educate farmers' organizations in microfinance and for governments to ensure laws and regulations favor the establishment of village agricultural bank.

(7) Conclusions

Collective action can therefore be a way in which to address these obstacles and mitigate transaction costs in agricultural supply chain in Myanmar. In the context of globalization, characterized by more instability and competition, small scale farmers in agriculture sectors are confronted with an increased need to enhance their competitiveness, and hence their productivity and ability to take advantage of economies of scale.

15. Research and extension

(1) Agriculture Research Stations

The Agricultural Research Institute was founded in 1954 in Yangon, which moved to Mandalay in 1971 and later to Nay Pyi Taw. It was renamed as the Department of Agricultural Research (DAR) in 2004. The Department of Agricultural Research plays the role of the research organization to develop and disseminate plant varieties and plant production technologies adapted to the region-specific conditions to meet the needs of producers, distributors and consumers.

The Department of Agricultural Research is composed of 5 Divisions (Division of Rice and Cereals, Division of Oilseeds and Pulses, Division of Industrial and Horticultural Crops, Division of Soil, Water Use and Agricultural Engineering, Division of Agricultural Economy), and possesses 7 crop research stations (Mandalay, Magway, Ayeyarwady, Bago, Shan) and 17 satellite farms. It is organized in such a way to enable agricultural researches in various areas of the country. For each satellite farm research objectives are set individually to solve region specific problems around major crops of the region concerned.

The Department of Agricultural Research is currently manned with 713 personnel, of which 53 researchers, 448 research assistants. Out of 1150 officially admitted posts, 437 posts are not yet filled, caused by the difficulty of recruiting qualified personnel. 23 researchers have obtained PhD. There are 8 rice breeders and at least one breeder for other crops (pulses, oilseed, vegetables and industrial crops)

Research activities are concentrated on plant breeding. The Gene Bank Project which was supported by Japan in 1988 still continues and more than 20,000 accessions of genetic resources (mainly rice) are conserved in refrigerators. The refrigerators were renovated in 2004, and are operating properly. Genetic resources conserved are being properly replicated. The passport data attached to genetic resources are made available in database but they are not accessible from outside. Consequently, from outside it is now possible to know about the genetic resources conserved, which are used internally for breeding purposes or share with outside researchers (for example Tsukuba University) visiting the Gene Bank. Intensive use of the Gene Bank should be encouraged.

There are a lot of research activities in collaboration with FAO, ACIAR, IRRI and JICA. The Project for the Diversification and Identification of Rice Based Systems in lower Myanmar is underway in cooperation with ACIAR-IRRI, for the diversification and adjustment of rice cropping patterns.

Current Activities of Research and Development Institute under DAR Laboratory Testing

1. Preparation to produce bacterial blight resistant of hybrid rice variety
2. Changing of Double haploid (DH) rice seed from haploid seed and testing to them to harvest and maintain annually by farmers
3. Preparation to produce new good yielding Pawsanmhwe varieties
4. Backcrossing bacterial leaf blight resistant rice variety Sinthukha X Manawthukha variety to Sinthukha can be expected to lead to the similar eating quality improvement of Manawthukha variety
5. Testing of green gram genetic characters by using with Molecular marker

6. Testing of soybean genetic characters by using with Molecular marker
7. DNA Markers Analysis on aroma gene and aroma content in rice, Pawsanmhwe varieties
8. Mass propagation and hardening of hybrid orchid varieties, orchid mhwe (*Holeoglossum amessiana*) , medicinal orchid; armellattanto (*Dendrobium fibriatum*), armellattanshae (*Dendrobium chrysanthum*),, htlepeae (*Dendrobium officinae*) produced from tissue lab, Mingalardon.
8. Mass propagation and hardening of hybrid orchid varieties, orchid mhwe (*Holeoglossum amessiana*) , medicinal orchid; armellattanto (*Dendrobium fibriatum*), armellattanshae (*Dendrobium chrysanthum*),, htlepeae (*Dendrobium officinae*) produced from tissue lab, Mingalardon,
9. Production of banana tissue culture plantlets; Khonwar, Shweni, Brazil and Philippine varieties
10. Potato hybridization for true seed and to lead rejuvenated good quality and high yield young seedlings from true seed potato

Current activities of Research on farm

- Effective of rain-fed cultivation and grafted plant cultivation on yield and yield components for tomato
- Comparison on zucchini hybrid combinations and parental line
- Evaluation of biochemical effect on pest incidence in tomato and green gram
- Investigation of varietal trial and drought resistance on green gram
- Evaluation of tomato varietal trial
- Investigation of bagging effect on mango quality
- Various fertilizer effect on mango flowering for Sein ta lone variety (N,P,K, KNO₃ and paclobutrazol), (Mango offseason production experiment will be conducted at VFRDC)
- Organic fertilizer effect on harvested okra quality
- Effect of hot water treatment on controlling fungi disease (tomato, mango and papaya)
- Evaluation of ethereal dipping effect on harvested banana quality

The following table shows the current researchers number of DAR with details of academic background

Sr.	Degree	Number	Remark
1.	Ph.D	15	
2.	M.Sc	17	
3.	B.Ag/ B.Agri.Sc	145	
	Total	177	

The following table shows the number of Technicians from Horticulture and Plant Biotechnology Division

Farm name, Location and Agriculturists Under Horticulture and Plant Biotechnology Division

No	Farm Name	Location(State and Region)	Agriculturists	Total (ac)
1	Myitkyina	Kachin , Myitkyina	1	9.97
2	Kyawbote	Chin , Hakha	1	75.00
3	Yatthit	Bago , Pauk Khaung	2	43.04
4	Nanshae	Mandalay,Aung Myaythar Zan	2	1.18
5	Htonebo	Mandalay, Pathein Gyi	2	228.45
6	Doekwin	Mandalay, Pyin Oo Lwin	5	40.46
7	Thatkant	Mandalay, Pyin Oo Lwin	1	358.59
8	Pwetaung	Mandalay, Pyin Oo Lwin	1	71.20
9	Sepauk	Mandalay, Kyaukpadaung	8	192.60
10	Nyaung Oo	Mandalay, Nyaung Oo	5	184.31
11	Meiktila	Mandalay, Meiktila	3	36.58
12	Poppa	Mandalay, Kyaukpadaung	4	32.73
13	Hlaingtat(1)	Mandalay, Thazi	5	277.46
14	Hlaingtat(2)	Mandalay, Thazi	6	490.20
15	Intaingthar	Mandalay, Thazi	3	1000.58
16	Myanadi	Mandalay, Myitthar	5	1116.98
17	Ingabo	Mon , Kyikehto	6	132.61
18	Kyoneka	Mon , Paung	4	231.31
19	Kankalay	Mon , Mudon	5	179.58
20	Azin	Mon , Mudon	4	311.82
21	VFRDC	Yangon , Hlegu	36	286.17
22	Kantharyar	Yangon , Tikegyi	5	361.00
23	Parshan	Shan (East) , Tarchileik	2	38.87
24	Minein	Shan (South) , Pintaya	3	102.09
25	Nantlat	Shan (South) , Taunggyi	9	400.00
26	Heho	Shan (South) , Kalaw	9	408.87
27	Pinlaung	Shan (South) , Pinlaung	1	129.67
28	Naungcho	Shan (North) , Naungcho	3	94.82

Projects Conducted by Horticulture and Plant Biotechnology Division (2011-2015)

Year	Project Title	Cooperative Agency
2009-2012	Production of Certified Fruit and Vegetable for Export from Lao PDR and Myanmar through Integrated Supply Chain Management” (TCP/ RAS/ 242/ CFC)	FAO
2011-2013	The Project for the Rural Development and Farming Technology Transfer in Myanmar	Korea Rural Community Cooperation (KRC)
2011-2014	The Project for the Post-harvest Technology Assistance for the Myanmar Agricultural Products	KOICA
2013-2014	Tele Food Project	FAO
2014-2017	The Project for the Post Harvest Research Institute	KOICA

On going Projects which are Conducting by Horticulture and Plant Biotechnology Division (2011-2015)

Year	Project Title	Cooperative Agency
2014-2017	The Project for the Post Harvest Research Institute	KOICA

Training Course were conducted by Horticulture and Plant Biotechnology Division during 2015-2016 Fiscal Year

	Title	Designation	Duration	Trainee
1.	Commercial Orchid Production	Myanmar Flower Hobbyist Association Hall, Yangon Region	18.5.2015 to 29.5.2015	
2.	Poppy Substitute Crops Production	Nyaung-Shwe, Taunggyi, Southern Shan State	5.6.2015	(300) Farmers
3.	Poppy Substitute Crops Production	Pin-Laung Township, Phal-khone Township, Taunggyi District, Southern Shan State	20.6.2015 21.6.2015	(60)Farmers (300)Farmers
4.	Postharvest Technology	Postharvest Technology Training Center, Htone-Bo	2.7.2015 to 3.7.2015	(30) Staffs from State and Region
5.	Good Agricultural Practices (GAP Workshop)	CARTC	20.7.2015 to 24.7.2015	(28) Staffs from State and Region
7.	High Yield Production Technology of Tea and Value Added Products for Tea	Htee-Paung village, Pin-laung Township	10.6.2015	(30)Tea Growers

8.	Vegetables Production, Seed Production and Market Distribution	CARTC	28.9.2015 to 2.10.2015	(30) Staffs from State and Region
9.	Good Agricultural Practices (GAP Workshop)	De-Pe-Yinn-Kwel village, Sagaing Region	26.10.2015 to 27.10.2015	(67)Mango Growers from Sagaing Mango Association and (27)Staffs
10.	Good Agricultural Practices (GAP Workshop)	Postharvest Technology Training Center, Htone-Bo	16.11.2015 to 20.11.2015	(36) SAI Demonstrators from State and Region and (3)Staffs from Horticulture and Plant Biotechnology Division
11.	Good Agricultural Practices for Mango	U-Mhin village, Ta-Dar-Oo Township	23.11.2015	(56) Business Men and Farmers and (21) Staffs
13.	Safety and Good Quality Vegetables and Fruits Production, Seed Production and Market Distribution	National Herbal Park, Nay Pyi Taw	21.12.2015 to 31.12.2015	(31)Staffs from Sat-Sat-Yo Organic Farm
14	Biotechnology	CARTC	8.2.2015 to 11.2.2016	(30)Staffs from DOA
15.	Food Processing Technology	CARTC	22.2.2016 to 26.2.2016	(27)Staffs from State and Region
16.	Postharvest Technology	Postharvest Technology Training Center, Htone-Bo	13.3.2016 to 18.3.2016	(30)Staffs from State and Region
17.	Postharvest Technology	Postharvest Technology Training Center, Htone-Bo	21.3.2016 to 25.3.2016	(30)Staffs from State and Region

Number of Extension Centre (Education Camps) in Different Regions and States

No.	Region/State	No. of	Remarks
		Extension Centre	
1	Nay Pyi Taw	17	
2	Saging		
3	Mandalay	83	1 -Heired, 1 - No building
4	Mgway	116	
5	Bago		
6	Ayeyarwaddy	96	
7	Yangon	9	2 Good, 7 Bad
8	Chin		
9	Kachin		
10	Kayah	10	
11	Kayin	2	
12	Mon	15	
13	Rakhine	86	
14	Tanitharyi	3	
15	Shan (South)		
16	Shan (North)		
17	Shan (West)		
Total		437	

Note- The rest data will send soon.

(2) Livestock research and extension

Although there is **no research center for livestock and fishery sectors** like agriculture sector, laboratories are operating under LBVD and DoF. Livestock Breeding and Veterinary Department has 5 divisions, research and disease control division, animal health and development division, planning and budget division. Under the research and disease control division, and animal health and development division, there are research laboratories for animal disease investigation, vaccine production and inspection of animal feed and animal products. In Livestock sector, KOICA supported the FMD laboratory for investigation and control of FMD disease in Myanmar. This laboratory is located in near ShweMyo Livestock zone, Nay pyi Taw.

Myanmar is agriculture-based country and livestock farming is crucial for farmers to increase income generation by provision of draft power, meat and meat products, and some saving. Thus livestock farming is important to reduce poverty of rural people. Majority of livestock farming in Myanmar is small-scale or backyard, while some areas have experienced larger commercial farms. Despite the fact that plenty of agricultural by-products can be used as livestock feed, farmers largely rely on locally or seasonably available feedstuff and still practice traditional feeding systems that sometimes cannot

be economic. In this sense, sound knowledge about availability and nutritional composition of locally available materials must be identified, and feed standards and feeding strategies for livestock animals by region, or by season must be established.

It is necessary to strengthen capacities and targeted venture programmes for small scale livestock producers adopting improved technological innovations and practices.

(3) Fisheries Research and Extension

For fishery sector, the **ISO 17025 certified laboratory** is functioning for investigation of fishery products under the DoF's guidance. The fishery sector is considered as the most important one after the agriculture sector to fulfill the protein requirement of the people in Myanmar and to provide the food security as well as to get the opportunity for the employment to a large number of fisher communities and rural dwellers. Myanmar is endowed with rich natural resources both in freshwater and marine fisheries. Nowadays, the increasing pressures from industrial and urban development and increased demand for fish and fishery products owing to population growth as well as global climate change can cause damage and degradation of ecosystems including fisheries resources.

As part of this commitment in the Vision, the Department of Fisheries, Myanmar has been cooperating with INGO, NGO and Institutes to assess the status of marine fishery resources in the Myanmar water. The first assessment of Marine Ecosystem Survey in Myanmar has been conducted during 1979-1980, using the Research Vessel Dr. Fridtjof Nansen. The results from those two surveys were estimated a Biomass and Maximum Sustainable Yield. After more than 30 years, the R/V Dr. Fridtjof Nansen returned to Myanmar and conducted two more surveys in 2013 and 2015 to assess the status of Marine resources. When compared the two period survey results, The pelagic fish has decreased from 1 million tons to only 190,000 tons, and demersal fish also has decreased from 750,000 tons to 320,000 tons within three decades respectively.

Fishery resources in Myanmar waters are typical of Southeast Asia with a large quantity of fish and shrimp in the EEZ. However, studies on marine wildlife in their natural habitats in terms of population's size, distribution, migratory patterns, threats and conservation status are rather limited. Most existing studies have been based on reported sightings and by-catch. Historically, the EAF-Nansen project carried out four surveys with the present vessels predecessor, also named RV Dr. Fridtjof Nansen, in the period 1979-1980 in cooperation with the Burmese (today Myanmar) Government. These surveys have been used as reference points until recently. In 2013 a new survey was carried out in Myanmar by the Dr. Fridtjof Nansen. The result indicated among others that fish biomass had declined substantially and species composition dramatically changed since the historic surveys, in 1979 and 1980. As a consequence, this second (2015) survey in Myanmar came about after a request from the Ministry of Livestock, Fisheries and Rural Development, Myanmar, to FAO to verify the results from the 2013 survey and to check seasonal changes in species composition and abundance. This survey is considered a critical component to identify threats to the ecosystems and to monitor the early effect of the management measures put in place. The survey will also provide capacity building of trainees and young scientists in Myanmar.

The results from the Dr. Fridtjof Nansen survey in 2013 provided up to date data on fish distribution, their population and oceanography. This information was applied by the Myanmar government in sustainable planning, management and development in relation to coastal and marine ecosystems. As a direct consequence of the survey, Myanmar has increased their attention on fisheries resources, conservation and sustainable development. Management measures put in place by the government since 2013 include closed season for all fishing gears for all marine waters in Myanmar (May-June, 2014, and May-July in 2015), reduction in the numbers of fishing rafts in the Delta region, banning of foreign fishing vessels (all trawlers) and prohibition in respect to construction of local fishing vessels. The purpose of these measures has been to reduce the fishing pressure.

The cause of loss and unsustainable use of coastal and marine fisheries resources in Myanmar are related with a number of different aspects involving for example limited knowledge and understanding by different stake holders; capacity constraints; lack of environmental safeguards; under-valuation of resources; lack of comprehensive land-use policies and plans; gaps in legislations and weak enforcement; poverty and subsistence needs; lack of grassroots support for conservation; and global climate change. The Department of Fisheries in Myanmar also has limited staff and budgets to regularly patrol for illegal fisheries in the offshore areas of Myanmar, except in partnership with the Myanmar Navy.

This second ecosystem survey was designed to be executed during a different season of the year cycle from the 2013-survey. Assessed comparatively these two surveys should identify seasonal differences, which is crucial for understanding the fish abundance and distribution on the shelf and slope. The study will cover important levels of the food chain such as the demersal and pelagic fish, zoo- and phytoplankton as well as investigate factors representing the physical environment.

The Fisheries Research and Development unit supports the mandated vision of the DOF in undertaking sustainable fisheries management to reach food fish security, improve fisheries livelihoods and to increase earning from fisheries exports, Research and Development Division is organized into the following sections:

- Fisheries Resources Conservation Section & Research Unit
- Environment and Endangered Species Conservation Section
- International Relations and Projects Section
- Supervision of Fisheries Technologies Training Institutes
- Institute of Fisheries Technologies (Gyogon, Yangon Region)
- School for Fisheries Technologies (Sagaine Region)
- School for Fisheries Technologies (Pyapon, Ayeyarwady Region)
- Computer Unit and Library

The need to strengthen the marine research in Myanmar is large. Today, there seem to be little or no effort to monitor the oceanographic conditions, biodiversity and abundance of marine resources on the shelf of Myanmar. Previously (before 1990) it used to be more than 100 persons working in marine resources monitoring, but today the staff is reduced to less than 10 persons. Previously it was also conducted some

standard marine monitoring onboard fishing vessels, but this ended in 2000 and since then nobody have measured fish out in the open sea. Today the few remaining staff has no equipment, stays in rundown facilities and nobody is requesting their knowledge in fisheries. Based on this, one could argue that the **marine research** today, is **totally absent** (no scientist, no research vessel, no laboratories, no data, no stock assessment, and no advice to the ministry).

(4) Agricultural Extension Services

Agriculture extension services are operating under the responsibility of the Department of Agriculture (DOA) of the Ministry of Agriculture and Irrigation. Technical specialists are allocated in the Department of Agriculture, as the central administrative body of extension services and extension service centers are established in the form of Regional Offices and City Offices. General extension staffs are placed in extension service centers and individual extension staffs are deployed in each TS one by one respectively. There are 666 extension staffs deployed all over the country. (The placement of extension staffs is similar to that of Japan in the 1980's.)

In 1984 the Central Agriculture Research and Training Center (CARTC) was established in Hlegue Yangon, supported by Japan, and plays the role of the center of extension training of the country. Main objectives of the CARTC are the training of officials of the Department of Agriculture and extension workers. The CARTC provides directly farmers with training opportunities.

The Department of Agriculture is composed, inter alia, of the Crop Division, Horticulture Division, Plant Protection Division, Seeds and Seedlings Division and, to which corresponding specific technical specialists are nominated for support to extension service centers in the Regions. Technical specialists, if necessary, form a team for the solution of a specific problem at the level of Region. Technical specialists are also responsible for the training related to individual crops such as sugar cane, coffee, rubber and cotton. Extension workers are generalists. However, with support from pig production technical specialists, general extension workers are also capable of giving training on plant production combined with livestock production.

The CARTC provides primarily extension workers with training collaborates with relevant foreign organizations (FAO, SEARCA, IRRI, CIRDA, Israel, AVRDC, KOICA etc., organizing workshops and other activities.

The CARTC also organizes joint seminars for example on pesticide utilization in cooperation with seed companies such as Syngenta and East West. It conducts also applied researches on the use of effective microorganism (EM). It further produces TV programs on farm management and broadcasts them for farmers.

However, the number of extension workers is insufficient (The number of extension workers in the Bago Region is around 500.) and the budget for activities of extension workers is also small. Therefore, farmers cannot easily receive services of extension workers. Although extension activities take into account the importance of the development of the food value chain, extension staffs and farmers do not grasp the needs of the rice export markets thus they cannot bring rice to the export market purchasing rice at high prices. Consequently, the activities of extension can do a few contribute to the increase of farm income. Also when foreign companies conclude a

contract with farmers for crop production, they complain that farmers do not possess basic knowledge on plant production (especially soil management). Therefore it is evident that extension services do not reach the local farmers' level.

Ratio of Total Extension Staffs, Growing Areas and Farmers at Myanmar Different Regions and States (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 Clacks&others)

In the past, most extension activities were to provide available technology for farmers without considering receiver farmers' farming situation. For example, irrigated rice cultivation techniques were provided for farmers in rainfed areas.

IFAD has been implementing the project, "Fostering Agriculture Revitalization in Myanmar (FARM)" since 2015. This project is on the process to establish "Knowledge Centers" to play multifunctional roles supporting farmers. One of their roles is Extension Services Stations to provide extension services for farmers.

16. Agricultural Education

A. Yezin Agricultural University (YAU)

Yezin Agricultural University (YAU) is the only one degree level University in Myanmar. The major functions are teaching, research and extension in order to improve the human resource development for agricultural sector. In conferring agricultural technology, the following seven major departments are the major responsible departments viz.,

- (1) Department of Agronomy
- (2) Department of Plant Breeding, Physiology and Ecology
- (3) Department of Soil and Water Science
- (4) Department of Plant Pathology
- (5) Department of Entomology and Zoology
- (6) Department of Horticulture and Agricultural Biotechnology
- (7) Department of Agricultural Economics

There also supported by the six minor subject departments such as

- (1) Department of Animal Science
- (2) Department of Agricultural Engineering
- (3) Department of Myanmar
- (4) Department of English
- (5) Department of Physics, and
- (6) Department of Mathematics.

Currently, YAU-JICA Technical Cooperation Project supported “The Project for Capacity Development of YAU”. Under the project the construction of the buildings and laboratories and lab equipment are included. JICA also started its support for human resource development especially in the management, education and research areas.

Although YAU is the only one agricultural University in Myanmar, the organizational structure of YAU still have many requirements to upgrade as an advanced University in other countries. At present, both of the academic and admin staffs number are not enough with the growing demand of the students. Moreover, as all known Myanmar is agricultural country and the students demand for YAU form the whole country is insufficient. As medium term measure, the expanding of the new faculties such as Department of Agricultural Extension and Social Science, Department of Microbiology, Department of Food Science Technology etc. needed to be considered.

If possible, each of agricultural University for upper and lower Myanmar is needed to build in order to meet the whole country demand with as a long term measure.

In August 2015, a food industry laboratory was established in YAU through Grant Aid project.

B. State Agricultural Institutes (S.A.Is)

1. Introduction

The Republic of the Union of Myanmar is an agro-based country. For the development of Agriculture, middle level agricultural technicians are playing a very important role.

SAIs are vocational institutions which train and produce middle level agricultural technicians. The SAIs are institutions where the students are produced to carry out the agricultural development activities of Myanmar.

The State Agricultural Institutes and State Agricultural High Schools were under the Ministry of Education before 1997. But they were shifted from the Ministry of Education to Ministry of Agriculture and Irrigation in January 1997. Among them all Agricultural High Schools were being transformed into specialized training institutions under some enterprises of Ministry of Agriculture and Irrigation.

2. The objectives of establishing the SAIs.

- (a) To train and produce the middle level agricultural technicians and skill labours needed for the development of agriculture sector.
- (b) To establish the model farms.

- (c) To disseminate modern scientific agricultural technologies among the farmers.
- (d) To increase the farmers' income and to help in community development.

3. Number of SAIs and their location:

There are 14 SAIs in Myanmar .The SAIs are situated in different areas.

They are ; 1.Pyinmana	SAI in Nay Pyi Taw
2.Thaton	SAI in Mon State
3.Myaungmya	SAI in Ayeyawady Region
4.Shwebo	SAI in Sagaing Region
5.Patheingyi	SAI in Mandalay Region
6.Pwintbyu	SAI in Magway Region
7.Tharyarwady	SAI in Bago Region
8.Dawei	SAI in Taninthayi Region
9.Heho	SAI in Shan State
10.Myitkyina	SAI in Kachin State
11.Demorso	SAI in Kayar State
12.Zwekabin	SAI in Kayin State
13.Longpi	SAI in Chin State
14.Kyauktaw	SAI in Rakhine State

Honemalinn S.A.I is being prepared to be opened in Nov,2017. Pyinmana SAI is the earliest institution of its kind.It was opened in 1954.The last founded SAI is Kyauktaw SAI which will be opened in 2015.

4. Duration

Duration of the course is 3 years.Each course year is divided into 2 semester, first and second semester.The academic year begins in November and ends in October in the next year.

5. Entry requirement

The students who apply for the SAI require to meet the following requirements.

1. A pass in Basic High School Final Examination
2. Myanmar citizenship
3. Under 20 years of age
4. Satisfactory character record
5. Good health to carry out field works

6. Strength of students and staff

There are 120 students in each year, 75% of them are boys and the remaining 25% are girls. There are 130 members of staff, out of which 34 are teachers and the remaining are office and field staff members.

7. Lodging and Boarding

The students can lodge and board in the dormitory on the campus or in nearby wards and villages. Most of the students are boarding students. The boarding fee is 20000 kyats a month.

8. Subjects taught

The students have to study 12 subjects, namely Agronomy, Horticulture, Animal Husbandry, Agricultural Chemistry, Agricultural Extension, Farm Management and Accounting, Plant Protection, Farm Mechanics, Botany, Physics, Maths and English.

9. Activities

The students have to learn the above mentioned subjects theoretically and practically in the classroom and in the fields. The curriculum is developed on the basis of 40% theory and 60% practical ratio.

The vegetable and field crop growing projects are also assigned to them to acquire practical skill in crop production.

They have to participate in extra curricular activities such as sports and games, arts and literature activities and students' welfare activities.

10. Certificate offered

At the successful completion of the course the "Diploma in Agriculture" certificate is offered.

11. Continuation of education

10% of the most outstanding graduates can take entry examination to join the Yezin Agricultural University.

Graduates who work as government servants can also take the entry examination after 3 years of service to join YAU on deputation.

12. Carrier opportunities

Up to now, a total of 17447 students have graduated from all the S.A.Is. Most of the graduates work as middle level technicians in Agricultural Extension Services. Some of them are occupied in private enterprises and companies as field supervisors. Some of them are served as field assistants in S.A.Is. A few of them undertake farming business on their own land.

A few of graduates from S.A.Is have the opportunity of working in Israel for about 1 year as on job trainees.

13. Student evaluation

In evaluating student's performance, continuous assessment is practiced throughout the course for the development of reliable and consistent work habits.

All the students are assessed continuously to decide whether they pass or fail in the course. The marks are allocated for lab works, field works, tutorials, informal tests, practical exam, mid-term exam and final exam. All the marks are taken into consideration in deciding on the student's pass or failure in the course.