Democratic Socialist Republic of Sri Lanka

Data Collection Survey on Agricultural Sector in Sri Lanka

Final Report

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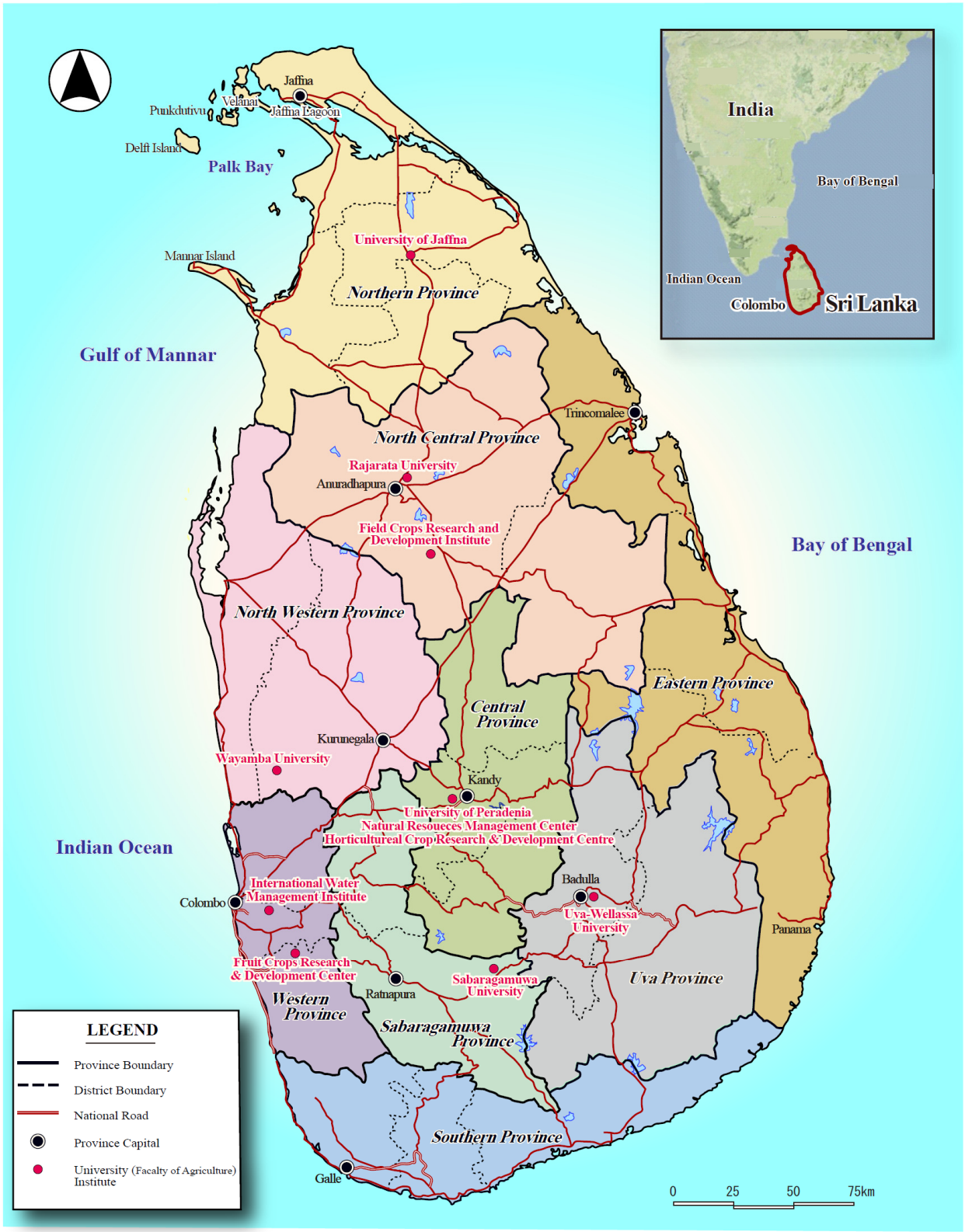

Location Map of Survey Area

SUMMARY

Chapter 1 Basic Survey Policy

1.1. Background of the Survey

The Democratic Socialist Republic of Sri Lanka (Sri Lanka) is an island country with a population of 21.44 million (World Bank Report 2017). The gross national income per capita in 2018 was estimated at USD 4,102 (World Bank National Income Statistics), which categorizes Sri Lanka as an upper-middle-income country (with income of USD 3,996 or more). In recent years, the share of agriculture, forestry, and fisheries in the gross domestic product (GDP) of Sri Lanka has been declining and was reported to be at 7.7% in 2017. The "Public Investment Program" issued by the government pointed out the following issues: (1) improvement of food self-sufficiency through import substitution, and (2) promotion of export of agricultural products with international competitiveness. The fraction of agricultural workers in the labor force was 32.6% and 26.1% in 2008 and 2017, respectively. It was decreasing yearly (Central Bank Report 2018). The ratio of poor population in 2016 was 4.1% for the national average, 4.3% for rural areas, and 8.8% for estate areas (large-scale plantation areas) (Department of Senses and Statistic of Sri Lanka, 2016). The improvement of agricultural productivity is a development issue resulting from the high poverty ratio in the rural and estate area.

In Sri Lanka, floods and drought damages caused by record heavy rains occurring between 2016 and 2017 severely affected agricultural areas in the northern, eastern, and north central provinces. In order to improve the agricultural and rural development in Sri Lanka, Japan has given assistance, such as the improvement of rural infrastructure, agricultural productivity, and income through ODA loans and technical cooperation. For the implementation of future cooperative activities, it is necessary to study the policies and issues of the Sri Lankan government on the agricultural and rural development sector, the responds to risks of climate change, the measures for improving agricultural productivity and agricultural income, the promotion of appropriate usage of fertilizers and agricultural chemicals, the measures to improve the quality of agricultural products, and others. In addition, the Government of Sri Lanka is currently requesting support from Japan for the production of safe agricultural products (fruit and horticultural crops) through proper use of pesticides and chemical fertilizers and establishment of a system for inspection of residual pesticides for import and export. In order to do this, it is necessary to understand the current status of this matter.

1.3. Purpose and Scope of the Survey

The objective of this survey was to examine and propose a future direction of JICA's cooperation in the Sri Lankan agricultural sector by collecting basic information on agriculture and rural development, by studying the current situation in the field of fruit and horticultural crops, and by analyzing the needs for cooperation.

Chapter 2 Outline of Sri Lanka

2.1. Population

The total population of Sri Lanka was 20.24 million and 21.44 million in 2008 and in 2017, respectively. The average annual population increase was 0.6%. The share of the agricultural sector in the labor force was decreasing, with values reported at 32.6% and 26.1% in 2008 and in 2017, respectively. The unemployment rate in urban areas was 5.3% and 4.4% in 2007 and in 2017, respectively. The unemployment rate in rural areas was decreasing, with values reported at 5.4% and 4.2% in 2007 and in 2017, respectively. The poverty ratio in urban areas was 5.3% and 1.9% in 2010 and in 2016, respectively. In rural areas, the poverty ratio was 9.4% and 4.3% in 2010 and in 2016,

respectively. It was decreasing in both areas. However, in the plantation area, it minimally decreased, with values at 11.4% and 8.8% in 2010 and in 2016, respectively. The areas with high poverty population are the Mullaitivu District (12.6%) and the Kilinochchi District (17.4%) in the Northern Province and the Batticaloa District (11.1%) and the Trincomalee District (9.8%) in the Eastern Province.

2.2. Economic Situation

The GDP of Sri Lanka grew at an average annual rate of 7.2% by taking the average GDP from 2007 to 2009 and from 2016 to 2018. However, the GDP growth rate in the agricultural sector in the same period was only 1.9%. The GDP share of the agricultural sector decreased from 12.6% to 7.6% over the same period. The economic contribution of the agricultural sector is decreasing yearly. Looking at the GDP per labor force by industry, it doubled from USD 5,149 per person to USD 10,503 per person from 2008 to 2017 for all industries. However, for the agriculture sector, it increased by 46% from USD 2,113 per person to USD 3,094 per person.

2.3. Household Income and Expenditure

The annual average rate of change of the household income and expenditure from 2009 to 2016 was estimated by converting the figures into 2013 prices. In the urban areas of Sri Lanka, the income and the expenditure increased per year by 9.9% and 7.7%, respectively. In rural areas, the income and the expenditure increased per year by 6.52% and 8.13%, respectively. In the estate area, both income and expenditure increased by less than 3% per year, and both were extremely stagnant. In urban areas, there is excess in household economy, and there is a tendency for income to be used for savings, investment, etc., especially in high-income households. On the other hand, in rural areas, it is considered that the amount of expenditure in excess of income is covered by borrowings.

2.4 Land Use

The land use by district was tabulated based on the district land use plan statistics from 2013 to 2017. The total land area is 6,651,000 ha, and that for cultivated land is 225,000 ha, which is around 34% of the total area. Of this, 976,000 ha is for paddy fields, and 1,229,000 ha is for other fields. There is 114,000 ha of fallow land (5% of cultivated land area). Labor shortage and farm retirement could be the reasons for this, although there may be statistical inadequacies.

Looking at changes in the area from 2013 to 2017, paddy fields, upland fields, and forests have expanded by 250,000 ha, and urban areas have expanded by more than 210,000 ha, although there may be a problem on statistical inaccuracy. Looking at changes over time in the cultivated land area (the total of paddy fields and other croplands) by province, the cultivated land in the Central Province has decreased, and there has been no change in the North Central, Western, and Sabaragamuwa Provinces. It increased in other provinces yearly, with annual variation. This could be caused by the change of classification from fallow land to cultivated land.

Chapter 3 Agriculture in Sri Lanka

3.1 Related Ministries and Agencies

Agriculture-related organizations of Sri Lanka are diverse, including the Ministry of Agriculture, Ministry of Plantation Industry, Ministry of Irrigation, Water Resources Management and Disaster Management, Ministry of National Policy and Economy, and financial institutions (Central Bank of Sri Lanka, government, and private banks). (As of June 2019)

3.2 Major Agricultural Policies and Laws

(1) Agricultural Policies (after 2019)

The Government of Sri Lanka has adopted the "National Food Production Program 2016-2018", which is directly controlled by the President, focusing on protected agricultural policies, such as import substitution, food safety, and increase of production, as the main measures for agricultural development. In parallel, various measures aimed at commercialization and export promotion under the "Public Investment Plan", formulated by the Ministry of National Policy and Economy, have been implemented. Food and Agriculture Organization (FAO) has supported the development of agricultural policies (NAPs) since 2019, and a draft reflecting the opinions of relevant agencies was submitted to the Ministry of Agriculture at the end of 2018 and is awaiting approval. However, as of August 2019, when the presidential election was scheduled for the end of December 2019, NAP has not yet been approved.

The following items in the NAP draft are relevant to this survey:

- NAP is focusing on further market development and at the same time will maintain production increase, import substitution, and food safety. In addition, the agricultural sector aims to achieve the Sustainable Development Goals (SDGs) by 2030.
- Regarding the subsidy system for fertilizers, NAP aims to reduce input by improving cultivation methods and land use.
- NAP said GAP (Good Agricultural Practice) contributes to safety and quality improvement of agricultural products, modernization of agriculture, and export of agricultural products, and also promotes the proper use of fertilizers and agricultural chemicals.
- NAP said agricultural mechanization is important and that the public and private sectors cooperate to develop low-priced and highly efficient agricultural machinery. NAP aims to promote market-competitive farm machinery business for smallholders.
- NAP proposes market research to revitalize agricultural-related corporate activities, improve competitive environment, improve market information, engage in government market activities, implement regulations, and regulate market monopoly and collusion.
- Regarding the extension of agriculture, NAP said that the current inadequate extension system should be strengthened, and the need to promote the diffusion of useful technologies and market information is cited.

Each responsible organization is supposed to concretize the above policy measures. However, since the national budget for 2019 is a provisional budget every four months, full-scale implementation is expected after 2020.

(2) Budget of the Ministry of Agriculture

1) Actual Expenditure from 2014 to 2018

The expenditure and budget of the Ministry of Agriculture were tabulated for each subordinate organization, such as the Department of Agriculture (DoA) and the Department of Agrarian Development. Looking at the average amount from 2017 to 2019, development expenses account for 45% of the total expenditure. It should be noted that the chemical fertilizer subsidy budget accounts for 31% of the total budget. The budget of the Department of Agriculture is 6% of the total, and that for the Department of Agrarian Development is 9%.

When comparing the average expenditure budget from 2014 to 2016 with the one from 2016 to 2018 for organizations under the DoA and directly related to food safety, the expenditure in recent years has been on the rise, except for the Seed Certification Center. The expenditure of Horticultural Crop Research and Development Centre (HORDI) and the Pesticide Registration Office (PRO), which operate testing equipment, has increased by more than 16% in recent years.

2) Budget Proposal for the New Policy (after 2019)

The budget proposal for the new agricultural policy has not yet been prepared because the approval of the new policy is delayed. The budget proposal may be postponed until the presidential election at the end of 2019 and the formation of a new administration.

(3) Import and Subsidy Policy of Chemical Fertilizer

The fertilizer subsidy policy was started in 1962. The subsidy rate, kinds of fertilizer, and crop for subsidy were changed thereafter. Fertilizers were formerly imported only by the Ceylon Fertilizer Corporation; however, private importers have recently entered the market. Centralization of fertilizer administration by the National Fertilizer Secretary (NFS) was started in 1978. Fertilizer subsidies were changed from in-kind issuances to cash grants for the 2016 Yala Season. Cash grants were deposited to the farmers' bank accounts. This was carried out three times until the 2017/18 Maha Season. The fertilizer subsidy system by bank transfer was originally aimed at simplifying administrative procedures, suppressing excessive inputs of fertilizer by paying a limited amount, and reducing subsidy budgets. However, provision of cash grant was stopped due to the opposition by some farmers and the delay in importing and distributing fertilizer.

Table S-1 Comparison of Fertilizer Subsidy System- In-kind Issuance and Cash Grant

Item	In-kind supply (2019)	Cash Grant (Bank Account Transfer)
Implementation period	・ 1962 – 2015 Maha ・ Re-started in 2018 Yala	・ 2016 Yala－2017 Maha
Content of subsidy (latest) • Rice	• 215 kg to 320 kg/season/ha • Farmers bear INR 350/bag (50 kg) for all types of fertilizers	・ INR 12,500/ha/season ・ Area limit: 2 ha or less
• OFC (potato, onion, chili, soybean, corn)	• Single fertilization: INR 1,000/50-kg bag • Mixture: INR 1,150/50-kg bag	・ INR 10,000/ha/year/ farmer in max
Advantages	・ Required amount can be purchased at a reduced price ・ Necessary fertilizer can be inputted ・ Assistance is timely (no delay) ・ Significant benefits for senior farmers	・ Available when needed ・ No work load for documentation
Problems	・ Making application documents is complicated ・ Applicant may be too busy to apply ・ Fertilizer quality is low ・ Prone to excessive input of fertilizer	・ Subsidy account transfer can be delayed ・ Grant can be used for other purposes ・ Fertilizer cannot always be purchased when needed

Both systems have advantages and challenges, but neither has led to the suppression of excessive fertilizer inputs and expansion of the use of environmentally friendly organic fertilizers, although they are agricultural policy issues. The fertilizer subsidy budget was reduced by changing to cash grant in 2016; however, it exceeded INR 325 million in 2018 due to the change to the old system. The actual expenditure amounted to INR 382 million, and according to the NFS, accrued debts to importers were incurred. This debt has been repaid by the government as a loan.

The ratio of fertilizer costs to crop production costs is 10.4% to 15.4% for rice, and 5.4% to 15.6% for vegetables based on the DoA crop production cost survey. The ratio of the fertilizer subsidy for the production cost is estimated to be 8.8% to 11.3% for rice and 1.1% to 8.1% for vegetables. The effect on sustaining production and increase of productivity caused by the reduction of producer’s burden on production cost due to the fertilizer subsidies is very

limited.

Domestic fertilizer demand is estimated by the Fertilizer Import Committee based on a survey on fertilizer demand compiled by the Department of Agrarian Development of the Ministry of Agriculture. NFS is arranging fertilizer imports according to this decision. Two fertilizer import companies under the umbrella of the Ministry of Agriculture have monopolized the import of rice fertilizer. Other crop fertilizers are imported by two public corporations and privately registered companies. It has been reported that fertilizer supply may not be available in time due to delays in import procedures.

As for distribution of fertilizers to farmers, rice fertilizer is sold at the agricultural service center under the jurisdiction of the Department of Agrarian Development, and other fertilizers for crops are sold by private fertilizer dealers.

(4) Rice Purchasing Policy

The Paddy Marketing Board (PMB) was established in 1972 based on the Paddy Marketing Board Act, 1971. The Standing Committee consists of two chairpersons appointed by the Minister of Agriculture and commissioners in the fields of agriculture development, cooperative development, and food.

In 1999, the dissolution of PMB was proposed to the Cabinet, and its activities were suspended from 1999 to 2008. PMB operated rice milling facilities between 1975 and 1984, but PMB now engages only in i) the purchasing of rice at the government-designated price to control the decline in farmers' selling price during the rice harvest season and ii) selling rice bran to rice millers during the off-season to limit the rise in market prices.

PMB has problems, such as loss due to poor management of PMB warehouse, politically influenced sales of paddy, and loss due to export instructions, and its intended role is not fulfilled. In 2016, the cumulative deficit amounted to INR 5,894 million, the highest deficit ever recorded. Regarding the future role of PMB, an audit report was prepared in 2018 and is waiting for political decisions. The audit report pointed out that the financial status of PMB had become worse as a result of price setting by the government, market sale of storage paddy, government intervention in PMB activities, and complete privatization of the rice milling business (the profit of rice milling has been lost). Furthermore, the audit report mentioned the problem of lack of quality control in the storage of rice done by PMB.

(5) Policies and Price Control of Imports of Other Agricultural Products

The Cabinet Livelihood Committee chaired by the Minister of Agriculture is held every Tuesday, with members from organizations under the Ministry of Agriculture (Agricultural Bureau, Socio-Economic Planning Department, PMB, HARTI, etc.), MITI, Ministry of Finance, and others. The committee analyzes the trends in producer prices and market price of agricultural products and discusses the increase or decrease of tariffs on items where market prices are rising, in order to control imports when producer prices decline during the peak harvest season. According to the decision of the committee meeting, tariff change is implemented on the same day or the next day (HARTI information).

According to the hearing from HARTI, the control of import tariff has certain effects on domestic producers and market prices. Often, there were noticeable changes in import tariff from May to July during the harvest season, when the producer price tends to go down.

(6) Agricultural Finance

1) Central Bank of Sri Lanka

The Central Bank, in cooperation with private banks, provides low interest loans (6% to 7% annual interest) for crop production, processing and livestock promotion, and interest compensation for agricultural loans of private banks. It also promotes the increase of loan amount. Along with the decline in the repayment rate of agricultural

loans, the amount of agricultural loans accounted for less than 4% of the total amount of land issued by private banks in 2014, falling below 4% in 2014 (Central Bank Statistics). A change in agricultural monetary policy that began in 2015 is aimed at expanding agricultural financing and is providing debt exemption measures and low-interest loans to small farmers in the plantation sector.

The average annual loan amount for crop production from the 2014/15 Maha Season to the 2017 Yala Season were as follows: the amount of loans to rice and OFC, which is subject to the subsidy of chemical fertilizer, was INR 120 billion a year, and the repayment rate was 67%. The loan amount to the non-subsidized crops averaged INR 2.8 billion a year, and the repayment rate was 70%.

2) Other loan programs

The Department of Agrarian Development operates farmers' banks, whose members are the farmers' organizations in each division. As an example, they provide loans of up to INR 150,000 for a half year, with an annual interest rate of 9%.

3.3 Agricultural Production and Consumption

For the main agricultural products in Sri Lanka, the average production from 2010 to 2012 and from 2015 to 2017 were calculated, and the annual average rate of change for those five years was calculated. The production of rice (paddy), tea, and rubber is declining. On the other hand, the production of cereals, such as corn, vegetables, fruit, livestock, and fish production, is increasing.

Looking at the trends in domestic consumption of rice, the amount of rice that can be consumed per person has rapidly decreased to 109 kg/year due to the reduction of domestic production in 2017 and the compensation by rice imports. The average consumable amount of rice from 2010 to 2012 is estimated to be 133 kg/year per person, and similarly, the consumable amount from 2015 to 2017 is estimated to be 139 kg/year.

3.4 Import and Export of Agricultural Products

Regarding the trends in exports of major agricultural products in Sri Lanka, the average value from 2007 to 2009 was compared with that from 2015 to 2017, and the annual average rate of change for the five total years was calculated. The annual average decline is 15% to 16% for rubber and coffee, and there is a slight decline of 0.5% for tea. This is supposed to be due to the international prices and slower growth of market. The production of vegetables and coconuts has increased significantly at a yearly average of 6.7% and 5%, respectively.

When looking at the import trends of major agricultural products, import of rice is on a rapid increase at an average annual rate of 21.5% (in 2017 due to the influence of drought in 2017) and fish at 12.5%. Dairy products, such as milk and processed dairy products, has increased at 4.3%. Wheat (grain) has increased at 2%. This reflects the changes in eating habits and preferences of urban consumers.

Looking at changes in the export and import values of agricultural products in the same period, the export value has increased by an average of 3.9% annually during the same period, while the import value has increased by an average of 7.4% annually. The increase in agricultural imports was significant. Wheat grain imports fluctuate from a minimum of 935,000 tons (2013) to a maximum of 1,326,000 tons (2011), which is the largest import gain in both quantity and value. Rice imports were 6,000 tons in 2006 and 600,000 tons in 2014, with values largely fluctuating annually.

3.5 Assistance of Other Donors

Assistance of other donors closely related to this survey includes FAO's “Development of Appropriate Fertilization System for Sustainable Crop Production”, and ADB's “Production of Priority Specific Fruit Trees,

Value Chain Development Support" for food value chain. The World Bank "Agriculture Sector Modernization Project" is targeted at specific areas and has the characteristics of comprehensive agricultural development support. Activities for this include cultivation technology dissemination, small scale production infrastructure development, agricultural mechanization, distribution development, financial support to farmers, and others.
FAO is supporting proper fertilization techniques for rice, and World Bank supports all crops grown in the project target areas. There are many assistances for fruit.

Chapter 4 Productivity Improvement (Agricultural Mechanization)

4.1 Government Policy on Agricultural Mechanization

Policies and strategies for agricultural mechanization have not been developed in Sri Lanka, and the government policy on agricultural mechanization can be confirmed in the National Agriculture Policy as well as the National Plantation Industry Policy. The National Agriculture Policy (draft) aims for efficient agricultural machineries with affordable price to be promoted based on public and private partnership and for competitive agricultural machinery service to be promoted against inefficient agricultural machinery service.

Among the agricultural products, tea, rubber, coconut, etc., are under the Ministry of Plantation Industry, and agricultural mechanization of these crops is promoted by organizations under the Ministry of Plantation Industry. The National Plantation Industry Policy Framework 2007-2016 aims to increase the productivity, profitability, and sustainability of the plantation industry. Agricultural mechanization is deemed important because it improves productivity and profitability.

4.2 Current Situation of Agricultural Mechanization

(1) Rice

Operations which can be mechanized in rice production are mainly land preparation, ban making, sowing (rice planting), weeding, and harvesting. Agricultural machinery hiring services are common in Sri Lanka. The tractor usage rate for land preparation is 81% in irrigated areas and 78% in rainfed areas, while the combined harvester usage ratio for harvesting is 97% in irrigated areas and 89% in rainfed areas. On the other hand, ban making, rice planting, and weeding, which are mechanized in Japan, still depend on human power.

(2) Horticulture crop

Land preparation is done by a tractor or a power tiller, but harvesting, fertilizing, weeding, and pest control are mostly done manually. Maize and black beans need threshing after harvesting, and threshing is 97% mechanized for maize and 100% mechanized for black beans.

(3) Tea

Production costs for tea (made tea) have risen sharply from the early 2000s to 2013/14 but have remained at the same level since then. Looking at the tea leaf production cost per unit area (1 ha) of small-scale producers, tea plucking work accounts for a large portion of the total cost, or 64.27%. In Japan, the riding-type of tea plucking machines are widely used, but in Sri Lanka, tea gardens are mainly located in hilly areas, so it is difficult to introduce those machineries. Because of this, the riding-type tea plucking machine is rarely used in Sri Lanka.

4.3 Activities and Owned Machineries of the Farm Mechanization Training Center and the Farm Mechanization Research Center

The Farm Mechanization Training Center (FMTC) and the Farm Mechanization Research Center (FMRC) under

the Department of Agricultural work as a government agency for agricultural mechanization. The outline of those centers is summarized in the table below.

Table S-2 Outline of FMRC and FMTC

	Role	Facility
FMRC	・ Design and development of agricultural machinery ・ Dissemination of the developed agricultural machinery to private manufacturers ・ Inspection and certification of agricultural machinery ・ Provision of agricultural machinery technology (training)	・ Located in Maha Illuppallama, District Anudharapura (about 35 km from central of District Anudharapura) ・ No accommodation facility
FMTC	・ Provision of training on operation, maintenance, and repair of agricultural machinery to government officials, farmers, students, etc.	・ Located in the center of Anudharapura District ・ Accommodation facility available

Source: JICA Study Team based on the meeting with FMRC and FMTC

4.4 Business Operation of Japanese Companies

Agricultural machineries produced by Japanese manufacturers have a certain share in Sri Lanka. Given the high usage rates of tractors and combine harvesters, it can be said that tractor and combine harvester markets are gradually maturing in Sri Lanka. On the other hand, ban making machines, which are attached to the tractor, are rarely used in Sri Lanka. Rice planting machines were promoted by the government, and those made by Japanese manufacturers were introduced on a trial basis. However, since there are several issues in implementing the use of rice planting machines in Sri Lanka, these machines have not been widely used yet.

Mechanization of tea plucking is important, and its demand has been increasing because of the lack of labor and pressure from international price competition. The two-person-powered tea plucking machine of Kawasaki Kiko Co., Ltd. are sold through distributors in Sri Lanka on a commercial basis. In order to introduce a riding-type tea leaf plucking machine, which is widely used in Japan, tea gardens have to expand the furrow to 180 cm, so it may take time until those machines become popular in Sri Lanka.

4.5 Financial Needs and Conditions of Private Financial Institutions for Agricultural Machinery

Loans from commercial banks or leasing companies are available in Sri Lanka when needed for purchasing agriculture machineries. Commercial banks generally do not have a financing scheme specialized for purchasing agricultural machinery, so personal loans are availed. Although the interest rate of leasing companies is generally higher than that of banks, it also has advantages, such as covering a wider range of customers than the bank and having a short time to decide on the provision of loans.

The Department of Development Finance, the Ministry of Finance initiated a scheme called Enterprise Sri Lanka, and it has been providing low-interest loans through 19 financial institutions since 2017. Enterprise Sri Lanka includes schemes to subsidize 50% to 100% of interest rates, as well as three donor projects. Schemes for the agriculture sector are Govi Navoda and Ran Aswenna. Enterprise, according to the Department of Development Finance, the Ministry of Finance, Sri Lanka, will continue until the government's medium-term goals of per capita income of USD 5,000, 1 million new jobs, doubling of export, and 5% GDP growth are achieved. In promoting loans, collateral and guarantor required by financial institutions is a bottleneck. To overcome this, the Department of Development Finance, Ministry of Finance plans to establish a guarantee fund under Enterprise Sri Lanka.

Chapter 5 Climate Change Risks in Agriculture

5.1 Disaster Risk of Agricultural Crop and its Monitoring

Meteorological information is collected by the Department of Meteorological, the Ministry of Disaster Management and is provided to the Department of Agriculture, the Ministry of Agriculture. The Natural Resource Management Centre analyzes the impact on crops based on the given information and provides the information to the National Agricultural Information Communication Center. The National Agricultural Information Communication Center disseminates such information to each relevant organization and agricultural instructors (AI) in various locations and provides information to farmers.

Regarding the assessment of damage, the Agricultural Research and Production Assistants (ARPA) assigned by the Department of Agrarian Development, the Ministry of Agriculture at the village level confirm the damage. Information on crop damage is summarized at each Agrarian Service Center, and AIs report it to their supervisor and finally reaches the Social Economic Planning Center.

In addition to the above information flow, the Department of Agriculture developed a database called "Crop Look" in February 2018. AI, ARPA, and Mahaweli field staff collect data, such as planting time, planting area, harvesting time, and harvesting volume, on rice and major crops (27 kinds of vegetables, etc.) at each farm every two weeks. Collected data is summarized at each Agricultural Service Center, Department of Agrarian Development, and then sent to the Department of Agriculture. In addition to collecting and entering information manually, notepads are given to field staff for them to input information digitally on a trial basis. Based on the collected information, the district-wide planted area (target value, current status) of rice and major crops, the cultivation damage of droughts and wild animals, and the recommendation of crop to be planted based on such information can be viewed in the website.

5.2 Agriculture (Weather) Insurance

Agricultural and Agrarian Insurance Board (AAIB) provides agricultural insurance as a government agency. The amendment in 1999 made it possible for private companies to enter the field of agricultural insurance. However, agricultural insurance is recognized as a risky business for insurance companies, and the only one private company, Sanasa Insurance Company Ltd., provides agricultural insurance on a commercial basis in Sri Lanka.

5.3 Support of Other Donors for Disaster Risk Management

The support of other donors for disaster risk management is summarized in the below table.

Table S-3 Outline of Donor Support

Organization	Support
AAIB	・ The World Bank provided technical support for index insurance to set up index and plans to commercialize weather index insurance within three years. ・ GIZ supports to develop farmers' database.
Sanasa Insurance Company	・ In 2012, the World Bank supported index insurance[1]. ・ As of 2019, GIZ is planning a project related to price index insurance for rice and onion. ・ In 2016, Développement International Desjardins (DID), a Canadian cooperative organization, supported the introduction of community-based weather stations which collect information on rainfall, temperature, barometric pressure, humidity, and wind every 30 minutes. There are 14 stations that have already been installed as of 2019, and an additional 21 will be introduced by the project of Moratuwa University in Sri Lanka.

Source: JICA Study Team

[1] http://www.indexinsuranceforum.org/project/sanasa-insurance-sri-lanka

Chapter 6 Food Safety

6.1 Policies and Implementation Agencies on Improvement of Food Safety

The supervision of food safety in Sri Lanka is carried out by the Food Management Bureau of the Ministry of Health. Primary agricultural products, livestock and dairy products, coconut products, teas, etc., are inspected and approved by respective departments in charge according to the standards set by Sri Lanka Stanadards Institute (SLSI). Many of the SLSI standards comply with the standards of international organizations, and food safety standards are set in Sri Lanka based on the Food Act (No. 26, 1980).

6.2 Rules and Regulations of Imports and Specifications of Pesticides and Chemical Fertilizers

(1) Chemical Fertilizers

Chemical fertilizers are regulated by the Chemical Fertilizer Regulation Law established in 1988. The approved chemical fertilizer components are three types of rice (urea, lime heavy per phosphate, and potassium chloride) and ten types for other crops (three types of rice, kieserite, ammonium sulfate, diammonium phosphate, magnesium sulfate, calcium ammonium nitrate, potassium sulfate, and zinc sulfate). For approved chemical fertilizers, SLSI sets standards for the content of major elements, trace nutrients, and heavy metals.

Table S-4 Component Requirements for Chemical Fertilizers in Sri Lanka

Fertilizers	N (Min)	P_2O_5 (Min)	K_2O (Min)	Biuret (Max)	Free P_2O_5	$NaCl_2$	Arsenic (As)	Cadmium (Cd)	Lead (Pb)	Chromium (Cr)	Mercury (Hg)
Urea	46% (Dry weight)	−	−	0.1% (Dry weight)	−	−	0.1 ppm	0.1 ppm	0.1 ppm	0.3 ppm	0.1 ppm
Heavy superphosphate lime	−	46%	−	−	80%	−	0.1 ppm	3.0 ppm	30 ppm	50 ppm	1.0 ppm
Potassium chloride	−	−	60%	−	−	3.5%	0.2 ppm	0.2 ppm	0.2 ppm	10.0 ppm	0.2 ppm

Source：NFS

Table S-5 Quality Inspection Process of Chemical Fertilizer

Implementing Organization	Content	Required Period/Time
Foreign certification laboratory	The importer encloses the certificate of acceptance issued by the certification laboratory at the time of import.	Depend on countries
National Fertilizer Secretariat	Upon receiving notification of cargo entry, the staff visits the importer's warehouse in the port and collects samples of the entire volume. The sample is anonymized by code and sent to the laboratory.	1 to 2 days
6 certified laboratories in Sri Lanka (SLSI, Industrial Technology Research Institute (ITI) and 4 private laboratories)	Inspections against SLSI standards are carried out, and only those that passed are allowed to be exported. Inspection costs are borne by the importers and can be re-inspected up to two times.	Days to weeks

Source: Confirmed with the National Fertilizer Office of JICA "Use and Regulation of Agricultural Chemicals and Chemical Fertilizers in Sri Lanka"

The NFS, which is under the Ministry of Agriculture, does not have its own fertilizer inspection function, and fertilizer inspection is outsourced to SLSI and private inspection companies. NFS expects to have its own inspection facility because of mismatch in outsourced inspection results, shortening of inspection period, and reduction of costs. However, NFS does not have staff with testing technology. Therefore, they have to employ necessary personnel. There are many problems in setting up their own inspection facility, such as purchasing of expensive inspection equipment and budgeting of operating expenses.

(2) Registration of Pesticide

The registration of pesticides is carried out by the Agricultural Chemical Registrar's Office in accordance with

the Agricultural Chemical Regulation Law established in 1980 (revised in 1994 and 2011). Currently, 190 kinds of pesticides are registered. Subsidies are not provided for pesticides, unlike those for fertilizers. Approval of a new pesticide takes three years or more, including field inspection.

6.3. Chemical Fertilizer and Agrochemical Inspection System, and Market Distribution

(1) Chemical fertilizer

There is no fertilizer production plant in Sri Lanka, and all fertilizers consumed in the country are imported. NFS manages the import and distribution of fertilizers in the country. Two approved fertilizer public corporations import fertilizer for subsidized rice production, and two public corporations and 92 private enterprises import fertilizers for subsidized production of Other Field Crop (OFC) and plantation crops. NFS undertakes sampling at port facilities, and inspection agencies conduct component testing.

The number of samples of imported fertilizers tested by NFS was 1,056 and 11,721 in 2017 and 2018, respectively. The subsidized rice fertilizer is sent by the importer to the agrarian service centers located in 515 locations nationwide, under the umbrella of the Department of Agrarian Development, and is then distributed to farmers. Fertilizers with subsidies for crops other than rice are distributed to farmers at agricultural service centers and retailers of private companies.

Fertilizer importers mix single fertilizers (NPK) that have import certification then package and sell fertilizers for vegetables, fruits, and other crops. In recent years, there are problems with mixtures of fertilizer and organic matter, mixtures containing prohibited ingredients, and distribution of illegal products not registered by the National Fertilizer Secretariat.

For fertilizers distributed in the country, NFS inspectors collect samples from fertilizer warehouses and test them; however, there were only 75 annual test samples. No investigation has been conducted as to whether the prohibited ingredients are mixed into the fertilizer after import. It is necessary to develop laws and regulations concerning the domestic fertilizer mixture, notification system, and inspection obligations by NFS.

(2) Pesticide

The PRO has received only four types of pesticide certification tests out of the 190 types of active pesticide components currently certified. Currently, only three types of tests are conducted. The office has been certified for 15 types of composition testing, including tests for pH values and floatability. It obtained certification for four types of heavy metal tests, mercury, lead, arsenic, and cadmium.

NFS has introduced and installed new testing equipment, and they will be able to conduct 14 types of analysis of pesticide ingredients in 2019. The number of tests was highest at 1,833 in 2010 and lowest at 253 in 2017. The test room of the Agrochemical Registration Office was too narrow, and the exhaust facilities were insufficient. Therefore, the PRO test equipment was moved to a renovated building, where HORDI has a test room. A new high-performance liquid chromatography (UHPLC-UPLC: Ultra High-Pressure Liquid Chromatography) was installed.

The introduction cost of the UHPLC was INR 65 million (JPY 37 million), including training expenses and others. There are many issues for the Ministry of Agriculture to operate the equipment efficiently, such as securing budget for operating expenses.

(3) Test Equipment and Expenses

The test equipment operated by HORDI (soil, fertilizer) and PRO (pesticide) are as follows:

Table S-6 Inventory of Test Equipment

Organization/Equipment	Product/Country	Introduction Time		Purpose of Usage
		Month	Year	
HORDI				
EC Meter	HACH/USA	Dec	2017	Electrical conductivity
Flame Photometer	Sherwood/UK	Dec	2017	Determination of K and Na
Spectrometer	HACH/USA	Dec	2017	Total av. P, Bo, Ammonium
Ball Mill	Fritsch/Germany	July	2016	Preparatory grinding
Plant Grinder	Fritsch/Germany	July	2016	Preparatory grinding plants
Centrifuge	Sigma/Germany	Dec	2014	Nutrient extraction
De-ionizer	TKA/Germany	Dec	2014	All analyses
Block Digester	Hanon/China	Dec	2017	Digestion of samples
Microwave Digester	CEM/USA	Dec	2013	Digestion of samples
Kjeldhal Distillation Unit	Hanon/China	Dec	2017	Digestion of samples
Atomic Absorption Spectrometer	Varian/ Australia	Dec	2017	Trace elements, Cu, Mn,、Zn, Pb, Cd, As and Ni
Fume Cupboard				All analyses
pH Meter	HACH/USA	Dec	2017	pH measurement
PRO				
6890N Network GC System	USA	Dec	2006	Analysis of pesticides formulations
GC-MS	USA	Dec	2008	Analysis of pesticide residue in vegetables and fruits
1100 HPLC	Germany	Mar	2003	Analysis of pesticides formulations
ICP-MS	Germany	July	2015	Analysis of heavy metals
UHPLC-UPLC	USA	July	2019	Analysis of pesticides formulations

Source：DOA, HORDI, PRO

There was a comparison of the cost of test per sample of RRO, HORDI, and SLSI. Depreciation expenses of the test equipment was not included for all institutions. The cost of PRO and SLSI includes personnel expenses, and the cost of HORDI excludes personnel expenses. The unit cost of PRO is more than four times of SLSI, although there are differences in the number of tests, available equipment, and contents of certification. HORDI does not use expensive testing facilities. However, if labor costs are included, their cost is more than that of SLSI.

6.4. Differences amongst the Testing Systems of Food Hygiene Inspection Organizations and Food Hygiene Standards

(1) Food Hygiene Tests

The Food Control Administration Unit of the Health Service Department of the Ministry of Health (FCAU) conducts inspection of imported and exported food and monitoring and inspection of domestic processed food. In accordance with the Food Act (revised) No. 29 (2011), the Food Control Bureau regulates and provides guidance on food processing, food import, food distribution, and sales.

As for imported foods, food and medicine inspectors of FCAU assigned to harbors and airports conduct random visual inspections of imported products, collect samples for quality inspections, send samples to testing organizations, and evaluates the result of the qualitative tests. Import of fresh vegetables and fruits requires a permit issued by the DoA. Test items for vegetables and fruits are heavy metals and residual pesticide content.

Food exporters are required to obtain the following certificates:

- Certificate of origin (Department of Commerce, Chamber of Commerce)
- Quality certificate (SLSI, private inspection facility)
- Health certification (Ministry of Health, FCAU), plant quarantine certification (Plant Protection Service of

DoA)

- Fumigation certificate (Plant Protection Service of DoA)

(2) Differences of Food Sanitation Standards between Sri Lanka and Main Exporting Countries

Of the agricultural products exported from Sri Lanka, there has been a ban in Japan in the past, including chili powder (2006), aflatoxin positive (12 ppb, 10 ppb), and tea bags (2018, Food Sanitation Act). Herbicides 3 to 17 times higher than the standard value of 0.01 ppm was detected. There is no record of commercial export of vegetables and fruits from Sri Lanka to Japan.

Values of the maximum residual limit (MRL) of Sri Lanka, EU, and CODEX were compared for the main export items of vegetables and fruits in the country. Sri Lankan standards are based on the maximum content of CODEX and covers 30 available pesticides. EU standards are stricter than that of Sri Lanka for some pesticides. Sri Lankan standards are stricter than that of EU for other pesticides. EU import standards are strict as they include standards for transportation, packaging, etc., in addition to the standards for pesticide residues.

In order to expand exports of Sri Lankan vegetables and fruits, it is necessary to improve domestic administration of pesticides, quality control of products, packaging, and transportation. In the future, it is necessary to take measures to expand export gradually by identifying countries for exports.

6.5 Relationship between Pests and Pesticide Used in Major Fruit and Horticultural Crops

Pest damage to fruit and horticultural crops has been observed throughout the country. It has been reported depending on the growth stage of crops. In the country, a wide variety of crops are cultivated in various regions, regardless of climate and altitude. Pesticide spraying and promotion of integrated pest management are conducted to prevent pest damages, although it is to a limited extent.

A fact-finding survey of health damage due to the application of pesticides has not yet been conducted; therefore, the statistical fact could not be clarified. In general, countermeasures against viruses and bacterial pest, e.g., using pesticides, are not conducted in Sri Lanka. Measures against pest damage to crops are sometimes conducted by combining pest control measures. For example, they are to introduce resistant varieties, biological control by introducing enemies to the pest, physical measures by net houses, plastic green houses, use of organic fertilizer, and improved cultivation methods, such as soil improvement and plant protection agents. However, they are not popular among the farmers yet because they are costly.

6.6. Status of Pesticide Residue Tests and GAP Certification Activities for Vegetables and Fruits

(1) SL-GAP Implementation Structure

SLSI, in consultation with relevant organizations, announced the GAP standard for vegetables and fruits in 2016 (SLS 1523). The contents of the standards include soil and water tests, recording of agricultural practices, reduction of pesticide use, pesticide residue tests, etc. These are the standards commonly used.

The Agri Enterprise Development Information Service in the Agricultural Extension Training Center is responsible for GAP technical extension and training, and SCPPC conducts GAP certification. They are the implementation organizations of GAP.

(2) GAP Certification Status

The total number of farmers that have been GAP-certified by SCPPC was 53 (391 ha) for fruits and 35 (13.8 ha) for vegetables since the start of certification in 2016, for a combined total of 88 (404 ha). This number is 0.8% and 0.01% of the total certification extent of fruits and vegetables in Sri Lanka, respectively. Certification includes soil and water tests (currently conducted free of charge), cultivation records, fertilizers and pesticide input records (implementation date and quantity), residual agricultural chemical tests (currently conducted free of charge), etc.

Therefore, it is limited to farmers and production companies with high level of knowledge and techniques of cultivation.

The Extension and Training Center of DoA is responsible for the technology dissemination necessary for GAP certification to farmers. Agricultural Instructor (AI) based on DoA's regional research centers is cooperating with AI of the agriculture department of the provinces for the promotion of GAP. Training and technical transfers to AI is essential because they are in charge of a large number of farmers in a wide area.

(3) Problems in Dissemination of GAP

The content of extension of GAP includes a wide range of contents, such as water supply, soil tests, guidance to farmers, and monitoring, which are advanced contents for farmers in general. Although there are many requirements needed for extension officers to guide farmers in varieties of in-depth contents to obtain GAP certificates, there is currently no system in place to implement this extension in a large extent.

It is indispensable to carry out GAP guidance training to AIs in each province as such trainings can be conducted to a certain extent. However, in order to spread GAP over a wide area, it is necessary to prepare an implementation plan and budget measures. The test equipment for residual pesticides operated by PRO is not enough. However, there are external testing agencies. There are many issues for PRO to conduct advanced analysis economically, such as training of test staff and securing an operating budget for equipment. There are also issues in the distribution of GAP certified crops. Agricultural Enterprise Development and Information Services mentioned that there was a problem wherein initially, GAP-certified crops had no price difference from crops that were not certified in the local market, and there were few benefits of being GAP-certified.

On the other hand, major supermarket companies purchase GAP-certified crops at least 10% higher than non-certified crops and are currently promoting purchasing from GAP farmers. The Agricultural Enterprise Development Information Service holds regular meetings in order to cooperate with such companies to promote GAP. In the future, it is necessary to forecast the expansion of consumption demand for GAP-certified crops, to select and expand items accordingly, and to adjust the harvest time in each production area. This effort should be done in collaboration with the government and with private supermarket companies.

SL-GAP has just begun, and its production volume is small. However, it is expected that demand will increase to accommodate the expansion of GAP-certified crop production in the future. For this purpose, it is necessary to monitor the production, demand, and price of GAP products and to maintain its price advantage.

6.7 Current Status and Responses to the Requests Related to Food Safety (Safe and Appropriate Use of Fertilizers and Agricultural Chemicals)

(1) Requests related to food safety

The request of assistance from the DoA to JICA consists of the following items, along with the purpose and project implementation costs for each item:

1. Market research on pesticide and chemical fertilizer products
2. Efficient testing protocol for pesticide and chemical fertilizers
3. Facility and capacity development for testing
4. Promotion of soil survey and appropriate input of chemical fertilizer
5. Study on pest diseases and development of integrated pest control
6. Fruit fly eradication campaign
7. Establishment of plant clinic and its operation system
8. Strengthening the capacity of agricultural extension staff

The Survey Team interviewed relevant departments regarding the contents of each item, requested the relevant departments to summarize the implementation detail, and held a meeting on 8 April 2019 with the relevant departments. After that, they collected information on fertilizer subsidy system and budget, fertilizers, agricultural chemical testing activities, agricultural extension activities, pest diseases and control, soil survey activities, etc. and prepared the report (draft) on Sri Lankan's current status on resources and efforts, specific activities, and implementation methods to solve the problems. During both meetings, the Study Team obtained approval for future activities.

(2) Overall evaluation of the requests for assistance

Most of the requests are for the continuation of current activities with the purpose to compensate the lack of budget and staff of the Sri Lankan government. There are also requests that require a large amount of investment and maintenance costs (new establishment of port/regional agricultural chemical testing laboratories, introduction of expensive test equipment, etc.). There is a concern about the sustainable operation of the facilities after the investment. Based on the current status and issues on the items in the request, the following issues are tentatively considered important with regard to the agricultural development and food safety promotion in Sri Lanka.

Table S-7 Priority of the Requested Items in view of their Importance and Urgency

Request	Priority (Tentative)
1. Market research on pesticides and chemical fertilizer products	Low
2. Efficient testing protocol for pesticides and chemical fertilizers	Chemical fertilizer: low Agricultural chemicals: low to medium
3. Facility and capacity development for testing	
4. Promotion of soil survey and appropriate input of chemical fertilizer	Middle-upper
5. Promotion of appropriate inputs for pest diseases and development of integrated pest control	Low
6. Fruit fly eradication campaign	
7. Establishment of plant clinic and its operation system	
8. Strengthening the capacity of agricultural extension staff	High

Source: Survey Team

Assistance to HORDI is requested with regard to the excessive usage of chemical fertilizer by confirming the appropriate fertilization amount through soil testing and reflecting this in the distribution of subsidy fertilizers to optimize the fertilization amount, by reducing the use of fertilizer, and reducing the subsidy budget support. This is highly specific and is suitable for technical cooperation projects. Local government units in Japan are implementing extension on fertilizer application and pest control according to the crop cultivation history and soil characteristics. However, this is not yet implemented in Sri Lanka.

It is recommended to implement a model project aiming at the establishment of a new extension system for the Extension and Training Center of DoA and for the extension unit of the provincial agriculture departments, e.g., on the theme to share roles between the line ministry and local governments related to extension, improvement of extension efficiency, and collaboration with private organizations and companies. By implementing model projects for the northern province where the development of the extension system of the Ministry of Agriculture is delayed, it is expected to strengthen and promote the northern province's extension system, the province's self-help on extension activities, and the provincial government's budgeting and cooperation with private companies.

As for food safety, popularization of SL-GAP (mainly vegetables) will be implemented as part of the abovementioned extension model project. The market advantage of GAP products is limited to some supermarkets. Its market is limited. For farmers who cannot immediately implement the SL-GAP requirements, it is recommended for them to learn basic GAP with limited implementation requirements as an introductory measure to reduce the health damage of producers and consumers, to improve crop production profits, and to create awareness for safe

crops.

According to the requests of the Ministry of Agriculture, 1) introduction of test equipment related to residual agricultural chemicals in fertilizers, pesticides, vegetables, and fruits; 2) training of test staff; 3) strengthening of extension system; and 4) awareness creation activities related to safe fruits and vegetables can be evaluated as follows:

- Purchasing test equipment would entail a large expense. Fertilizer testing requires construction of a building for testing.
- As for the operation of the testing equipment, both the PRO and the NFS need to ensure that there is staff-in-charge and training for operation of the equipment. Staff training takes time because there is no experienced person in each organization.
- Currently, fertilizers and pesticides are tested for a fee, but water, soil, and residual pesticides are tested free of charge for GAP certification of fruits and vegetables. A separate budget is indispensable for the operation and maintenance of equipment.
- The certified area for GAP is less than 1% of the total area for both fruits and vegetables. Although there are issues with the testing system, there is a limitation on the extension system. The number of extension officers of DoA is small, and in order to promote GAP, it is essential to establish a cooperative system with provincial AIs. Furthermore, only a few farmers can meet the requirements for GAP certification, and majority of them need to develop their eligibility for certification; therefore, it is essential to conduct intensive extension activities.

Prior to the introduction of fertilizer and pesticide testing equipment, it is necessary to promote the proper use of pesticide and dissemination of integrated pest control, proper fertilization application according to soil conditions, farming record practices, etc. by strengthening agricultural extension. Prior to the introduction of GAP, it is necessary to develop and implement a system to disseminate basic farming techniques with lower cost burden for farmers and to increase farmers' ability to implement GAP, such as “Basic GAP”, which is being implemented in Vietnam.

There are also options of outsourcing for the inspection system. It is necessary to solve the problems of securing and training personnel and operation and maintenance expenses first for the introduction of new equipment.

Chapter 7 Applicability of Market-Oriented Agriculture

7.1 Present Situation of Smallholder Farmers and Characteristics of Areas in Sri Lanka

Smallholder farmers in Sri Lanka can be divided into two categories: i) those who are self-sufficient with less than 0.1 ha of land, and ii) those with 0.1 ha to 0.8 ha of land. The five districts in the Northern Province of Sri Lanka consist of 34 divisions, with 921 Girma Nildharis (GN[2]). There are 196,308 farmers in the Northern Province[3], and except for those in a region of the Kilinochchi District, these are all smallholder farmers. The Kilinochchi District is the second poorest district in the nation, next to the Monaragala District in Uwa Province.

The agricultural policy of the Agriculture Department of the Northern Province aims to strengthen the relationships between farmers and the private sector, wholesale and retail markets, and transportation companies and exporters. It is expected that the growth of the market will increase farmers’ incomes.

7.2 Cultivation and Consumption of Major Crops in the Northern Province

In the Northern Province, rice, red onions, ground nuts, and black beans are the major crops produced. As for

[2] GN is the smallest government administration unit.
[3] As at August 2019.

vegetables and fruits, mangos, bananas, grapes, papaya, and passion fruit are cultivated. As indicated in Figure 7.1, vegetable production fluctuates yearly, whereas fruit production has increased since 2015.

Source: Department of Agriculture, Northern Province

Figure S-1 Cultivation Area and Production Volume of Vegetables and Fruits

As indicated in Table S-8, similar types of vegetables and fruits are cultivated in the five districts of the Northern Province. There is a relatively high production of red onions in Jaffna and groundnuts in Mullaitivu.

Table S-8 Outline of Horticultural Activities in Five Districts

District	Jaffna	Kilinochchi	Mullaitivu	Vaunia	Mannar
Major horticulture crops	Beet, long bean, eggplant, leafy vegetables, okra, mango, papaya, grape	Tomato, cabbage, carrot, okra, mango, banana, lime, jackfruit	Eggplant, tomato, chili, long bean, bitter gourd, pumpkin, ground nuts, papaya, mango, lime, lemon, passionfruit	Chili, tomato, bitter gourd, papaya, banana, mango, lime, passionfruit	Mango, banana, papaya, guava, wood apple
Cultivated land (ha)	Vegetables + fruits: 7,423	Vegetables: 902 Fruits: 1,045	Vegetables: 600 Fruits: 1,328	Vegetables: 1,292 Fruits: 98	Vegetables: 660 Fruits: 821
Production (Mt)	Vegetables: 45,695 Fruits: 31,827	Vegetables: 34,610 Fruits: 11,194	Vegetables: 42,119 Fruits: 9,625	Vegetables: 30,450 Fruits: 16,708	Vegetables: 14,124 Fruits: 1,881
No. of farmers' groups	Farmers' cooperative: 1 (Banana)	Youth club: 5 Women's club: 3 (Vegetables)	Farmers' society: 1 (Seed production) Farmers' company: 1	Farmers' society: 19	Women's group: 1 (Mango production)
Major markets	Local, Dambulla, Keels collection center	Local, Dambulla, Cargills processing plant	Local, Dambulla, Farmers' company's packing center	Local, Dambulla	Local, Dambulla, Vaunia
Issues	Water shortage due to dry area, soil degradation due to long term use of chemical pesticides, vermin, and farmers' adherence to traditional farming techniques	Water shortage, long dry season, lack of quality seed, underdeveloped irrigation systems, inexpensive imported crops, pests and diseases, difficulties in off-season cultivation, and excessive pesticide use	Limited acceptance for farmers at Cargills processing plant, high transportation costs to Dambulla market, low usage of quality seed, and low skill levels for off-season cultivation	No nearby market, high poverty rate due to ongoing effects of civil war	Lack of quality seed, lack of irrigation and access roads are underdeveloped

Note: Cultivated land area, production, number of farmers, and organizations are data from 2016, 2017, and 2018. Therefore, they are all for reference.
Sources: Agriculture District Office in Northern Province, farmers, farmers' societies/organizations/cooperatives, interviews with the private sector, and answers to a questionnaire.

7.3 Issues on Extension

An extension system has been implemented by the Sri Lankan government and is administered by the Directorate of Agriculture (DOA), the Directorate of Agriculture Development (DAD), and the Mahaweli Development Authority (MASL) under the Ministry of Agriculture and the Provincial Office, as shown in Figure 7.8. On average in the five districts, one extension staff member manages 1,600 farmers in the Northern Province. However, the contents of this extension system are outdated, and it has been noted that suitable techniques are not transferred based on the characteristics of the land and the crop. Furthermore, extension staff in private companies in Sri Lanka, such as Cargills and CIC Holdings, transfer skills and knowledge only to farmers registered within their company.

Table S-9 Outline of Agricultural Extension System

	Ministry of Agriculture		Provincial Government	Mahaweli Development Authority (MASL)
	Directorate of Agriculture (DOA)	Directorate of Agriculture Development (DAD)	Provincial Department of Agriculture (PDOA)	
Extension Staff	Agriculture Instructor (AI), Technical Assistant (TA)	Agriculture Research and Production Assistant (ARPA)	Agriculture Instructor (AI), Technical Assistant (TA)	Agriculture Officer (AO), Field Assistant (FA)
Educational Background	Diploma in Agriculture	No need for an agricultural certificate	Diploma in Agriculture	Bachelor of Agriculture
Roles	Technical transfer in areas with more than 1000 ha of irrigated land	Management of subsidized agricultural inputs, Agricultural information collection	Technical transfer of minor agricultural land in the Northern Province	Technical transfer alongside the Mahaweli River
Number	Nationwide post: 1,144 Allocation: 819	Nationwide post: 15,000 Allocation: 12,000	Allocation nationwide: 1,608 Post in Northern Province: 143 Allocation: 108	Nationwide post: 80 Allocation: 80

Sources: DOA, DAD, Northern Province, MASL

Chapter 8 Supply Chain

8.1 Overview of Agricultural Products Distribution

(1) General System

The following are the three types of distribution systems for vegetables and fruits based on their characteristics:

- Traditional distribution system through the Dedicated Economic Center (DEC) and local market, etc.
- Modern distribution system through supermarkets and agribusiness companies
- Distribution system through farmer groups and agricultural cooperatives

(2) Distribution System for Vegetables and Fruits

As for the vegetable distribution systems, the route through Dambulla DEC is still mainstream, specifically in the traditional distribution system. Since the handling amount is not recorded, it is not possible to grasp the exact amount. However, through interviews with DEC, it was found that the distribution system based on Dambulla DEC is still working well.

On the other hand, because fruits are cultivated on average throughout Sri Lanka and are generally consumed less than vegetables, distribution channels could not be confirmed based on Dambulla DEC as mainstream, like vegetables. In traditional distribution systems, fruit farmers are likely to ship their products to local markets through their own channels. (Farmers who grow high-value-added fruit trees are shipping to modern distribution systems, such as supermarket distribution systems.)

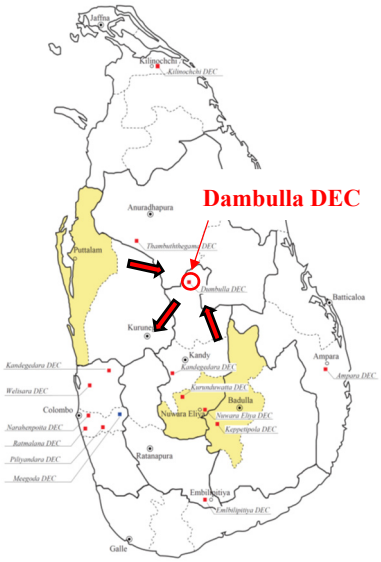

Figure S-2 Distribution Route for Highland Vegetables (Carrots)

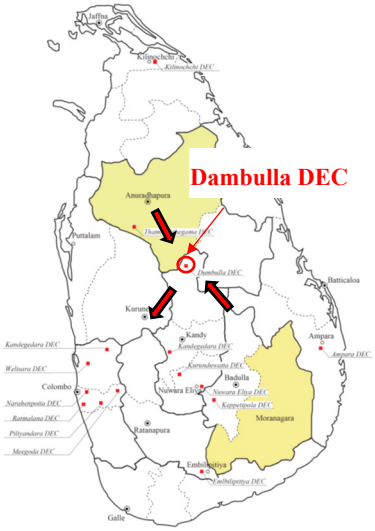

Figure S-3 Distribution Route for Lowland Vegetables (Maize)

8.2 Efforts by Private Companies

The following approaches are being taken by private companies to address issues in the conventional distribution system:

Table S-10 Problem Awareness and Efforts by Private Companies

No.	Problem Awareness of Responsible Persons	Efforts	Remarks
1	The loss in the distribution process is large in the conventional distribution system.	【Improvement of Extraction rate】 ・Require middlemen to use plastic cases to transport agricultural products ・Carries crops using plastic cases and cushioning materials to retail stores ・Transportation using refrigerated vehicles	Cargills, Keels
2	It is necessary to provide safe and reliable crops. (Sales of high value-added products)	【GAP Market Expansion】 ・Purchase GAP certified crops from farmers at relatively high prices ・Commendation system for excellent farmers	Cargills, Keels
3	Farmers must make a cultivation plan in anticipation of market price fluctuations and must create a system that makes it difficult for price fluctuations due to excessive supply.	【Crop Diversification】 ・Introduction of new seeds and guidance on new cultivation methods	Cargills

source: JICA survey team

Chapter 9 Educational Institutions (Agriculture Faculties of the Universities) and Research and Development Institutions

The Survey Team studied the current status of agriculture faculties of major universities in Sri Lanka and in agriculture-related research and development institutions that play an important role in solving development issues of the agriculture sector of the country.

The study was conducted for the agriculture faculties of six universities (Faculty of Agriculture, University of Peradeniya; Faculty of Agriculture, University of Jaffna; Faculty of Agriculture, Rajarata University of Sri Lanka; Faculty of Agriculture and Plantation Management, Wayamba University of Sri Lanka; Faculty of Agriculture Sciences, Sabaragamuwa University of Sri Lanka; Faculty of Animal Science and Export Agriculture, Uva Wellassa

University), four research and development institutes (Field Crops Research and Development Institute (FCRDI), Horticultural Crop Research and Development Centre (HORDI), Fruit Research and Development Institute (FRDI), and Natural Resources Management Center (NRMC)), and an international research institute (International Water Management Institute (IWMI)).

Human Resources in the Agriculture Faculties of the Universities

The University of Peradeniya has, by far, the largest number of academic staff (113). The faculties that have a greater number of students are the Peradeniya (940), Wayamba (838), and Uva Wellassa (813) Universities. The University of Peradeniya has the largest number of PhD holders (78) and professors (33). There are fewer PhD holders in Jaffna (9) and Uva Wellassa (15) Universities. There are a fewer number of professors in Rajarata (1), Uva Wellassa (3), and Jaffna (3) Universities. The academic staff of the universities are promoted based on the degree status, number of papers published, years of employment, and other achievements. The academic staff can take paid leaves to earn a degree, in which case they are required to work at a university in Sri Lanka for a minimum of seven years after returning home.

Status of Cooperation with National and Foreign Organizations

As for cooperation among the faculties of agriculture, special lectures, review of research papers, acceptance of research projects of students, and other endeavors at other universities are being carried out. Resources of Peradeniya University are used extensively by other universities. Faculties cooperate with government agencies in participation in emergency task force committees, provision of advice and research findings, contracting specific researches, participation in the Annual Agricultural Symposium held by the Agriculture Department, and so on. The faculties cooperate with private companies in holding industrial forums, carrying out joint research and development, providing consultancy services, and sending students to industry training in companies. For corroboration with overseas institutions, study abroad with scholarship, joint research, participation in research symposiums, and invitations are carried out. The achievements of Peradeniya University are outstanding in this regard. Academic staff members who studied in Japan under the scholarship offered by the Japanese Ministry of Education, Culture, Sports, Science and Technology are often conducting joint programs with Japanese universities by using their personal connections. The University of Peradeniya conducts exchange programs with Japanese universities.

Human Resource of the Research and Development (R&D) Institutions

HORDI has the largest number of staff, followed by FRDI and FCRDI. HDRDI has the largest number of PhD holders among all institutions. Graduate staff at research and development institutions are encouraged to have a master's/doctoral degree and a proven track record of published research papers. Due to the ongoing lawsuit regarding recruitment conditions, these research and development institutes under the DoA had not employed graduates for the past six years. The absence of next-generation executive candidates has become a major problem for these institutes (as of March 2019).

Status of International Collaboration of the R&D Institutions

R&D institutions mainly focus on breeding, water and land use, dissemination activities, and support for farming improvements, in collaboration with international institutions. FCRDI, HORDI, and FRDI are continuously conducting projects with South Korea. IWMI is conducting a project funded by the Ministry of Agriculture, Forestry and Fishery of Japan by accepting long-term researchers from the Ministry. An example of a collaboration with Japanese organizations other than JICA is the project on oranges undertaken by the Ehime Mikan Research Institute and FRDI.

Recent Research Topics of the Universities and R&D Institutions

Many of these universities and institutions are working on R&D projects on climate change and response, food security, food safety, and GAP (Good Agricultural Practice). Researches on climate change emphasize development of drought-resilience varieties, cultivation methods, and efficient water usage. The next most common research theme is soil and water management and marketing.

Cooperation and Support Expected by the Universities and the R&D Institutions

The Survey Team had hearings from the universities and R&D institutions about the examples of support and collaborations expected from Japan. There is a high expectation for technical cooperation and joint research projects with Japan in areas where domestic technology and facilities are inadequate, in spite of the urgency of researches. There was a high expectation for conducting researches, which include advanced chemical analysis, for which analytical equipment is not available. There is also a need for technical support and cooperation for the new initiatives conducted by universities, such as curriculum revision, establishment of new departments, laboratory expansion, expansion activities to local communities, improvement of educational methods, etc. There was a desire for young academic staff from all universities to study in Japan to obtain doctoral degrees. The academic staff members who had obtained doctorate degrees also emphasized the necessity of short-term overseas visits and participation in training for technical cooperation, joint research, and acquisition of latest knowledge and technology.

Opinions of the Japanese Universities That May Render Support and Collaboration

The Department of International Agricultural Development, Tokyo University of Agriculture, recognized that the agriculture faculties of the universities in Sri Lanka lacked research capabilities for incorporating the latest research methods, such as molecular biology. They plan to continue to engage in human resource development, especially young academic staff, and R&D activities, mainly with the University of Jaffna, where they currently assist the capacity development component of the Japanese Grant Aid Project to the university. They are also considering to provide cooperation to the university through the JICA volunteer dispatch system of their university and through an international student exchange system.

JISNAS advised the Survey Team that, when forming a support/cooperation project with Sri Lankan universities by appointing academic staff as counterpart members, it is necessary to consider the structure of the university and to ensure that there are incentives for academic staff to participate in the project. They also advised that it is important to formulate projects by strengthening research capabilities as part of human resource development for the purpose of solving problems of the country rather than merely for research purposes.

Recommended Programs for Cooperation

The following projects and activities are worth considering as future support and cooperation:

- Technical cooperation project to improve research capacity (with the Agriculture Faculty of University of Jaffna)
  - Research capacity enhancement that contribute to branding and stable supply of horticultural crops, mainly focused on mango
  - Research capacity enhancement on varietal improvement, production, and processing techniques for drought-tolerant crops, mainly focused on peanuts
- Accepting faculty members and researchers to study and to have short-term visits in Japan
- Support for new initiatives through exchange, dispatch, and training of academic staff and students
- Formulation of a network among the universities and the R&D institutions in Sri Lanka
- Private sector partnership projects

- Development of land use and yield forecast information using satellite data
- Identification of actual capacity of irrigation tanks using floating scanner

Chapter 10 Proposed Future Program

10.1 Major Challenges of the Agricultural Sector in Sri Lankan

The agricultural sector in Sri Lanka has socio-economic challenges. The average annual growth rate from 2008 to 2017 is 0.6% per year, the agricultural labor force population has decreased (from 32.6% in 2008 down to 26.1% in 2017), and GDP contribution of the agricultural sector has also decreased (from 12.6% to 7.6% during the same period). There is a tendency of labor shortage and labor wage increase, and the ratio of labor wage to agricultural production cost exceeds 50% (Source: DoA Production Cost Survey). On the other hand, most oil, fertilizer, and production materials depend on imports, and the total production cost is high. Therefore, even if the products meet export quality standards, they are not competitive in the international market.

Although the government's fertilizer subsidy system has the effect of reducing the production costs borne by producers, it is limited because it mainly targets rice for self-consumption.

Structural changes are indispensable for Sri Lankan agriculture for maintaining employment opportunities in rural areas and developing the agricultural sector. Sri Lanka, once a major tea exporter, now has lost its glory. It is necessary to strengthen competitiveness in the international market. Although there is a direction to expand production scale (mass production) and to reduce production costs, it may be difficult to secure such lands because the country has many small-scale farmers. It is necessary to promote the production and export of competitive agricultural products with higher quality to neighboring countries, such as India. Steady efforts, such as breeding of new varieties, introduction of new crops, and introduction of modern technology, are necessary to fulfil this need.

Requests for assistance related to food safety can be considered to be indispensable for the abovementioned modernization of agriculture and expansion of production of highly competitive safe crops. Instead of implementing all projects, it can be recommended to implement only the highly urgent projects systematically.

10.2 Advantage and Priority Area of Japan's Agricultural Cooperation

(1) Food Safety

The Survey Team evaluated the current situation, issues, necessary measures, and priority for the proposal of assistance consisting of eight items for food safety, which includes the promotion of use of safe and appropriate fertilizers and agricultural chemicals. Based on the evaluation, the following are areas of priority, to which Japan has competitive advantages in cooperation:

- Implementation of soil survey and soil analysis, creation and dissemination of fertilizer standards for each crop/district, and regular soil diagnosis. Specifically, promotion of simple soil kits for farmers, creation of a database of soil test results, and introduction of monitoring and evaluation systems for fertilization and harvesting.
- Introduction of an efficient operation system for an integrated laboratory equipped with the testing machine currently established in HORDI.
- Introduction and expansion of an extension system for group formation of farmers, promotion of autonomous and market-oriented activities, dissemination of safe crop cultivation techniques, and promotion of collaboration with private companies.

In carrying out the cooperation, the Ministry of Agriculture needs to secure necessary budget for counterpart expenses and to assign staff of the central government (DoA, etc.) and provincial government (Agriculture Department, etc.) who will receive technology transfer (full-time for the project) and part-time staff who will

participate in meetings.

(2) Agriculture Mechanization

Land preparation and harvesting have been mechanized, but ban making and sowing (rice planting), which are processes that can be mechanized, still depend heavily on human power. The introduction of rice planting machines has been promoted by the government, such as the introduction of demo machines, but there are several issues, such as the improvement of rice planting machines (to narrow the gaps) and the dissemination of seedling cultivation techniques.

Agricultural mechanization in the tea sector is a serious issue, and there is an urgent need for mechanization of tea plucking operations that account for 64.27% of tea leaf production costs. In the plantation sector, mechanization of tea plucking is important in order to address the shortage of tea plucking workers and price competitiveness in the international market. The introduction of the riding-type tea plucking machine requires certain investments, such as the reform of tea gardens and the expansion of furrows.

1) Agricultural mechanization

Agricultural mechanization is necessary to reduce labor costs and production costs. In areas where mechanization is needed but is yet to be done, such as ban making, rice planting, and power-driven tea leaf plucking, once applicability and cost efficiency is verified, the public sector may consider providing necessary assistance, such as yen loan project to large scale farm reform, etc. The public sector may be able to introduce a demonstration farm, which the Ministry of Agriculture, Forestry and Fisheries, Japan introduced in Gujarat, India for the verification and promotion of Japanese machineries. In addition, the yen loan project for tea garden reform can be considered.

2) Inspection standards and procedure for agricultural machine performance

It is necessary to prepare inspection standards and procedures for agricultural machinery. Previously, a senior volunteer was dispatched by JICA to FMRC, and he developed inspection standards and procedures for the combine harvester and rice planting machines based on Japan Industrial Standards (JIS). It is expected from the dispatchment of the expert to develop those standards and procedures, as well as to participate in JICA trainings (at the Institute of Agricultural Machinery, National Agriculture and Food Research Organization).

(3) Climate Chang Risk Management

1) Agriculture Insurance

Training by Japanese experts on agriculture insurance and risk management is expected.

2) Training for farmers

Insurance access improvement, provision of knowledge on insurance, and awareness activity can be included in a livelihood improvement project or in a financial inclusion project, if any.

(4) Market-Oriented Agriculture

The main issues regarding the cultivation and sale of horticultural crops by small farmers are: (a) low selling price; (b) no market/inaccessible market; (c) unavailable market information; (d) difficulty in getting water, (e) inability to invest in irrigation materials or green houses, (f) inability to produce the amount expected by buyers, (g) unstable number of extension staff and problems of instruction content, and (h) vulnerable farmer organizations.

In order to solve these problems, it is proposed to implement technical cooperation projects using the SHEP approach targeting the northern provinces, improvement of the Farmer Business School (FBS) carried out by the DoA through the fusion of FBS and SHEP approaches, and market-oriented training curriculum incorporating SHEP

by HARTI.

10.3 Possibility of Collaboration with Japanese Educational and Research Institutions

The following proposals are worth considering as future support, cooperation, and projects for assistance.

- The following technical cooperation projects for improving research capabilities are to be conducted with the Faculty of Agriculture of the University of Jaffna as a counterpart agency:
  - Improve research capabilities that contribute to branding and stable supply of horticultural crops, mainly mango
  - Improve research capacity to develop variety, production, and processing techniques of drought-tolerant crops, mainly peanuts
- Accepting overseas studies and short-term visits by faculty members and researchers
- Support for new initiatives through exchange, dispatch, and training of academic staff and students
- Networking of Sri Lanka universities and research and development institutions
- The following are private partnership projects:
  - Development of land use information and yield data using satellite data
  - Identification of the actual capacity of irrigation tanks using a floating scanner