Sri Lanka E-agriculture Strategy

June 2016

"Excellence in adopting e-solutions to transform agriculture for national prosperity"

Table of Contents

ACKNOWLEDGMENT 4

EXECUTIVE SUMMARY 5

1.0 BACKGROUND 8

1.1 WHAT IS E-AGRICULTURE? 8
1.2 THE CASE FOR E-AGRICULTURE 9

2.0 COUNTRY OVERVIEW AND AGRICULTURE 13

2.1 COUNTRY PROFILE 13
2.2 GEOGRAPHY 13
2.3 AGRO-ECOLOGICAL ZONES 14
2.4 ADMINISTRATIVE DIVISIONS 15
2.5 GOVERNMENT 16
2.6 PRESENT AGRICULTURE STATUS 16
2.7 POLICY ENVIRONMENT 19

3.0 DEVELOPING THE E-AGRICULTURE VISION 22

3.1 E-AGRICULTURE STEERING COMMITTEE AND TASK FORCE 23

4.0 AGRICULTURE SECTOR DEVELOPMENT GOALS AND CHALLENGES 25

4.1 AGRICULTURE SECTOR PRIORITIES 25
4.2 AGRICULTURE SECTOR ISSUES: CHALLENGES AND OPPORTUNITIES 25

5.0 STATUS OF ICT INFRASTRUCTURE, SERVICES AND ADOPTION 29

5.1 ICT WORKFORCE 29
5.2 PUBLIC ICT NETWORKS AND DEVICES 29
5.3 ICT PROJECTS AND INITIATIVES IN SRI LANKA 31

6.0 STATUS OF E-AGRICULTURE SERVICES IN SRI LANKA 36

7.0 SRI LANKA E-AGRICULTURE VISION 42

7.1 E-AGRICULTURE EXPECTED OUTCOMES 42
7.2 FEASIBILITY OF E-AGRICULTURE VISION AND OUTCOMES 43
7.3 STRATEGIC RECOMMENDATIONS 43

8.0 NATIONAL E-AGRICULTURE ACTION PLAN 47

8.1 E-AGRICULTURE ACTION PLAN 47
8.2 AGRICULTURE CHALLENGES AND ICT SOLUTIONS 47
8.3 E-AGRICULTURE ACTION PLAN 52

TABLE 8: E-AGRICULTURE ACTION PLAN FOR SRI LANKA (2016-2020) 54

8.4 PHASES OF E-AGRICULTURE ACTION PLAN 58

9.0 MONITORING AND EVALUATION FOR E-AGRICULTURE SERVICES 61

9.1 MONITORING OF OUTCOME AND SOLUTIONS 61

Acknowledgment

The Ministry of Agriculture through the Department of Agriculture led the development of this strategy together with Telecom Regulatory Authority of Sri Lanka (TRCSL) and other ministries and departments such as Department of Agrarian Development, Department of Export Agriculture, Department of Animal Production and Health, Sri Lanka Council for Agriculture Research Policy, Tea Research Institute, Provincial Departments of Agriculture (Uva, Eastern, Northern, Western, North western), Hector Kobbekaduwa Agrarian Research and Training Institute, Faculty of Agriculture in the University of Peradeniya, Department of Irrigation, Mahaweli Development Authority, Coconut Cultivation Board, Export Development Board, Bank of Ceylon, RDB Bank, Institute of Post-Harvest Technology and private sector (CIC, Baures, IPMC). Furthermore, the valuable support and inputs from the Information and Communication Technology Agency of Sri Lanka (ICTA) was indispensable in formulating this strategy.

The development of the Sri Lanka E-agriculture Strategy was supported by the Food and Agriculture Organization (FAO) and the International Telecommunication Union (ITU) together with the CAB International (CABI).

The FAO-ITU E-agriculture Strategy Guide (http://www.fao.org/3/a-i5564e.pdf) was used as a framework for developing this strategy.

Executive Summary

The **Sri Lanka E-agriculture Strategy** lays down a roadmap by which ICT developments can significantly contribute towards achievement of the country's agricultural vision and development objectives.

It integrates standalone ICT experiments under a collaborative and inclusive framework while prioritizing solutions that can be scaled up and supported through the required ecosystem. This document provides an analysis and evaluation of current and prospective roles of Information Communication Technology (ICT) in agriculture in Sri Lanka, lays down a vision for e-agriculture in the country and recommends specific actions plans. The strategy document has been prepared based on the framework proposed by the Food and Agriculture Organization (FAO) and the International Telecommunication Union (ITU)[1].

The strategy has been prepared through extensive research and stakeholder consultation from multiple sectors and has taken into consideration the fact that ICT would influence peoples life from many different aspects, not only agriculture, and will act as an efficiency multiplier that enables people and processes to achieve higher level of efficiency, efficacy and enhance the overall quality of life. It leverages on the existing ICT developments that impact agriculture in Sri Lanka and aims to mainstream it.

Innovations in ICT is happening at a very fast pace and this document has captured the effects of future disruptive technologies and recommends roadmap for adoption and evolution of current ICT initiatives, to be relevant and useful in future. The cross-sectoral nature of agriculture as well as ICTs requires formal mechanisms for collaboration amongst critical stakeholders. A leadership committee, steering committee and task force structure has been proposed to guide the implementation (Section 3.1).

The strategy is guided by the Agriculture Policy Framework and National Agriculture Policy framework and National Food Production Programme (2016-18) documents published by the Ministry of Agriculture (MoA), Sri Lanka, which identifies the following priority objectives for the agriculture sector:

- Achieve self-sufficiency in food crops, which may grow locally and save foreign exchange on imports of those food items;
- Increase availability of safe food by promoting eco-friendly practices and minimizing agro chemicals and pesticides in food crop production;
- Ensure food security through appropriate management of buffer stocks;
- Introducing and implementing agro-ecological region based food crop cultivation programs;
- Increase the productivity of crop production through appropriate technologies;

[1] FAO-ITU E-agriculture Strategy Guide http://www.fao.org/3/a-i5564e.pdf

- Establish proper coordination among all agricultural stakeholders in the local food production process and connect all schools, civil organizations and general public to the program;
- Provide quality inputs for production and establish proper marketing mechanism for their products;
- Ensure building a healthy nation.

The key findings from the stakeholder consultation and need assessment identified 97 challenges [Section 4] in the following areas:

- Policies, guidelines and regulatory frameworks
- Availability of resources
- Value chain, farm inputs and logistics
- Natural resource management and climate change
- Marketing and financing
- Data availability, accessibility and reliability
- Knowledge, information and awareness
- Services

The strategy aims to address these challenges and in doing so envision achieving "***Excellence in adopting e-solutions to transform agriculture for national prosperity".*** It specifies a set of e-agriculture outcomes (Section 7.1) and makes the following strategic recommendations.

Recommendation 1: *Increase the availability and accuracy of agricultural information by creating, updating, analyzing and linking critical databases.*

Recommendation 2: *Develop accessible, affordable and secure ICT platforms, networks and devices with enhanced sensing, hosting, analytical, identification, tracking and communicating features.*

Recommendation 3*: Improve the awareness, education and skills of farmers, extension staff, livestock herders and other sector end-users by creating and disseminating credible agricultural knowledge remotely.*

Recommendation 4: *Reduce the demand-supply gap, and enhance outreach and profitability of Sri Lankan products and services through vibrant e-agriculture market places and efficient logistics.*

Recommendation 5: *Improve the research capability, quality, credibility and reach of extension advisory using ICTs.*

Recommendation 6*: Promote innovation in e-agriculture services.*

Recommendation 7*: Reduce the individual risks of agriculture sector stakeholders*

Recommendation 8*: Improve the financing, investing and banking outreach to agriculture sector leveraging on electronic and mobile technologies.*

Recommendation 9*: Improve the existing framework of policies, legislations, regulations and guidelines critical for e-agriculture and ensure its effectiveness implementation.*

To realize these outcomes, and implement the strategic recommendations, a set of ICT solutions were identified (Section 8.2) and an action plan for 2016-2020 was developed (Table 8.2). The action plan is envisioned to be implemented in three phases.

A detailed monitoring and evaluation (M&E) plan would need to be developed after adoption of the strategy for the expected outcomes (Section 7.1) and the action plan (Section 8.1) for each phase.

This is a living document and would be updated periodically based on ongoing developments.

The report and the recommendations are now ready for evaluation, critical assessment and piloting by wider groups of stakeholders and the learning from these would continue to enrich this live document till near future as the country would progress towards achieving its agricultural and developmental goals.

1.0 Background

The Sri Lanka E-agriculture Strategy is aimed at harnessing the ICT potential of Sri Lanka in achieving its agricultural goals. This strategy was developed following the framework proposed by the FAO-ITU E-agriculture Strategy Guide[2] (Figure 1)

Figure 1: Adapted from the FAO-ITU E-agriculture Strategy Guide

An e-agriculture task force was set up in Sri Lanka comprising of members from various departments of the Ministry of Agriculture (MOA) and the Telecommunications Regulatory Commission of Sri Lanka (TRCSL). Other critical stakeholders from Department of Agriculture (DOA), TRCSL, Information and Communication Technology Agency (ICTA), Fixed and Mobile Telecom Operators in Sri Lanka were also consulted during the process. Technical assistance was provided by the FAO office in Sri Lanka together with the FAO and ITU Regional offices for Asia and the Pacific in the development of this strategy.

1.1 What is e-agriculture?

E-agriculture is evolving in scope as new Information and Communication Technologies (ICTs) applications continue to be harnessed in the agriculture[3] sector. It is seen as an emerging field focusing on the enhancement of agriculture and rural development through improved information and communication processes. In this context, ICT is used as an umbrella term encompassing all information and communication technologies including devices, networks, services and applications; these range from innovative Internet-era technologies and sensors to other technologies that have existed for much longer such as telephones, mobiles, television, radio and satellites.

[2] FAO-ITU E-agriculture Strategy Guide http://www.fao.org/3/a-i5564e.pdf
[3] Agriculture in this document includes forestry, fisheries and livestock

More specifically, it involves the conceptualization, design, development, evaluation and application of innovative ways to use ICTs in the rural domain, with a primary focus on agriculture and allied fields. Provision of standards, norms, methodologies, tools as well as development of individual and institutional capacities, and policy support are all key components of e- agriculture.

1.2 The case for e-agriculture

Access to the right information at the right time through the right medium is crucial for people involved in the agricultural sector. This includes farmers, fishers, foresters, policy makers, industries and other actors in the agricultural value chain. Increasingly, the challenges faced by small holder farmers as a result of climate change, irregular rainfall patterns, attack of pest and the onset of diseases, drought, desertification are detrimental to the agriculture sector's goals.

However, opportunities exist through innovative ICT solutions to address a number of these challenges. In recent past, the role that ICTs play in promoting innovation in the agricultural sector has been phenomenal and potentially transformative. Smallholder farmers, particularly women and youth involved in the sector, have a huge advantage when the right ICTs are induced into the agricultural value chain. The access to the right information at the right time gives them the capacity to make informed decisions that would improve their livelihoods, make agri-business more attractive and play a major role in ensuring food security.

The rapid growth of mobile voice and internet globally provides new avenues to share and access information. In Sri Lanka, there are 23.7 million mobile subscriptions (113.4%); total tele-density (mobile and fixed) is 126%; 11.8% internet access in terms of households; and 19.1% broadband in terms of population (Department of Census and Statistics) with the fixed broadband connectivity being 3% while the mobile broadband connectivity comprised a significant 16%.[4]

Digitization has provided the capability for convergence of these traditional network technologies and the emerging ones (e.g. Machine to Machine (M2M), Internet of Things (IoTs]) using information technology platforms (e.g. mobile apps, data analytics). These networks when combined with data availability, required applications and the right enabling environment, can unleash the tremendous innovation potential of the Sri Lankan agriculture sector (Figure 2).

[4]Source: TRCSL

Source: FAO, ITU

Figure 2*:* Use of ICTs in enhancing agricultural development

The cross-sectoral nature of ICTs propels growth in other sectors that can be further leveraged by the Agriculture sector. For example use of data gathering and data analytics by weather department can make micro insurance for the agriculture sector more efficient. The deployment of mobile banking and mobile money by the Telecom and Banking sector can significantly address financial and transactional challenges for the rural communities. The two combined can create a base for providing social safety net for people involved in agriculture sector activities. E-government services too can provide a bouquet of services as well as guidelines critical for e-agriculture growth in the country.

While in many farming communities people still rely on feature phones, which offer mainly voice and text services, smartphone access are becoming affordable and their use is on the rise. Social media platforms such as WeChat, WhatsApp etc., are becoming services of common use. The rapid growth of broadband, especially mobile broadband provides a great opportunity for the agricultural sector. Also, access to Internet at the telecentres with guided assistance can significantly improve livelihoods and reduce drudgery. With added banking services, the potential is manifold.

In terms of service capabilities offered by ICTs (Figure 3(a) and 3(b)), new technologies pave the way to advance the services from 'push' (e.g. radio, television, SMS) and 'interactive' services (e.g. Government to Customer(G2C) services, interactive website) further on to transactional (e.g. mobile payments, banking services, payment platforms) and finally connected services. (e.g. a network of sensors and databases integrated over secure

platforms monitoring and offering services on various devices and providing timely, accurate and real-time information). Transactional capabilities are the key to linking revenue to services being offered over ICT platforms.

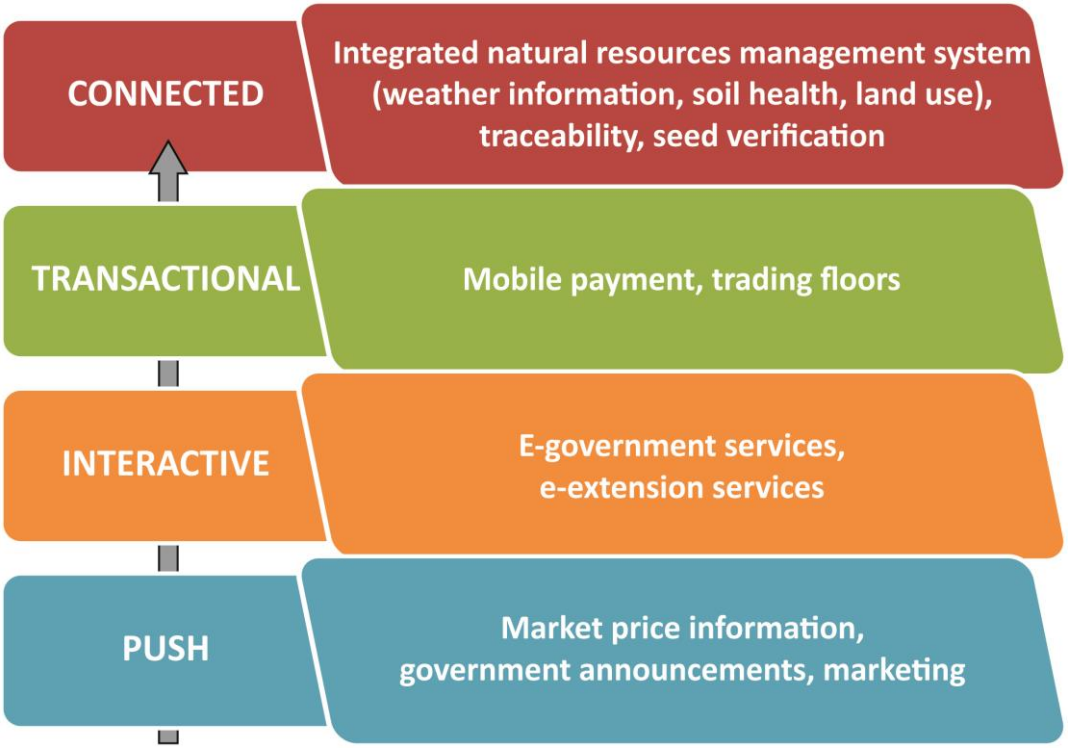
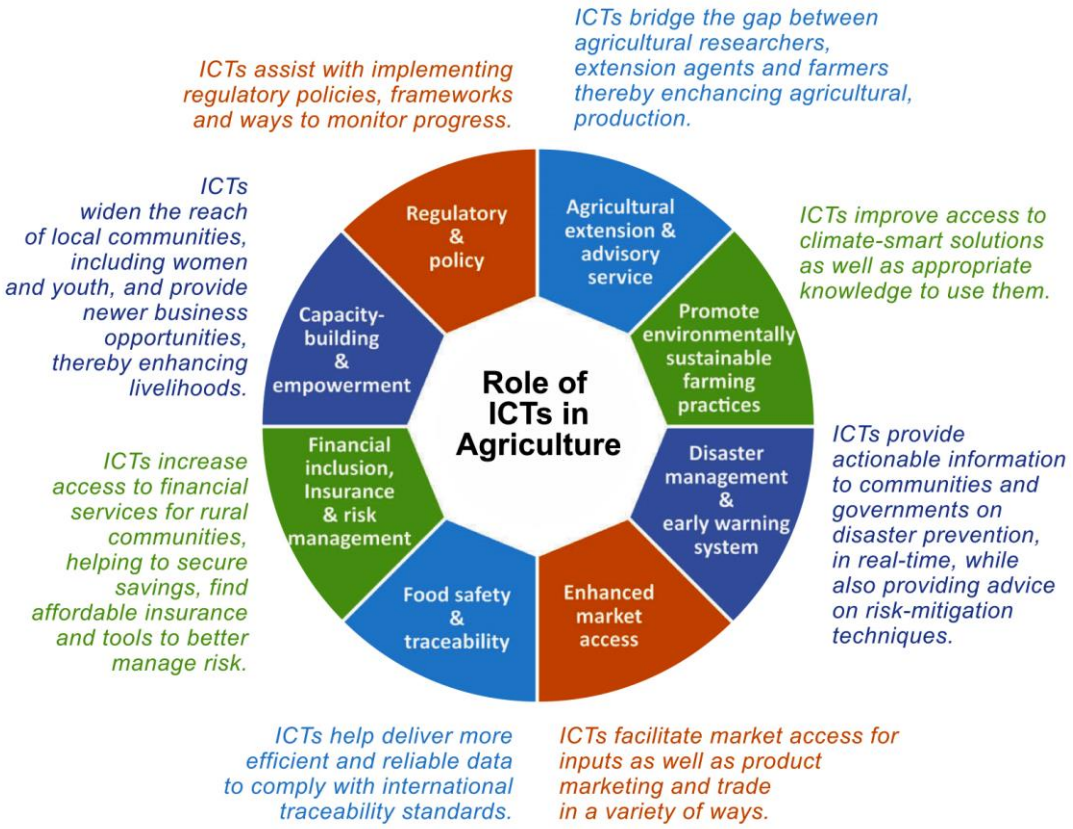


Figure 3(a)*:* Information exchange over emerging technologies – *the rise from rom push towards connected services*



Source: FAO, ITU

Figure 3(b): Role of ICTs in agriculture

More specifically, e- agriculture has the potential to meet the agricultural goals of Sri Lanka by contributing in the following areas:

1. Improving agricultural research and national agricultural information systems.
2. Facilitating International trade and domestic market access and trade.
3. Improving agricultural extension and advisory services.
4. Promoting sustainable farming practices.
5. Improving postharvest handling and logistics.
6. Enhancing disaster management and early warning systems.
7. Facilitating financial inclusion, credit, insurance and risk management schemes.
8. Advising policies and monitoring effective implementation.
9. Improving data availability and analytics for food safety and traceability.
10. Enhancing linkage between government, researchers and producers which in turn facilitates effective policies.
11. Improving farmers' incomes and productivity on a sustainable basis.
12. Enhancing knowledge management and access to information.

2.0 Country Overview and Agriculture

2.1 Country profile

The Democratic Socialist Republic of Sri Lanka is an island nation covering approximately 66,000 square km land area in the Indian Ocean, bordered by India to the Northwest and the Maldives to the Southwest. Its documented history spans 3,000 years, with evidence of pre-historic human settlements dating back to at least 125,000 years. Its geographic location and deep harbors made it of great strategic importance from the time of the ancient Silk Road through to World War II. The majority of its 21 million people live in the rural areas with urban residents accounting for just 15% of total population.

Economic growth in Sri Lanka has been among the fastest in South Asia in recent years. Growth averaged 6.3 percent between 2002 and 2013, with Gross Domestic Product (GDP) per capita rising from US$ 859 in 2000 to US$ 3,256 in 2013. Preliminary indications are that GDP further increased by 7.8% in 2014.[i]

For most of the past decade, growth has been pro-poor, with consumption per capita of the bottom 40% growing at 3.3% a year, compared to 2.8% for the total population. Other human development indicators are also impressive by regional and lower middle income standards. Sri Lanka has surpassed most of the Millennium Development Goal (MDG) targets set for 2015, outperforming nearby country comparators on most MDGs[ii].

2.2 Geography

Sri Lanka lies on the Indian Plate, a major tectonic plate that was formerly part of the Indo-Australian Plate. It is in the Indian Ocean Southwest of the Bay of Bengal, between latitudes 5° and 10°N, and longitudes 79° and 82°E. The country is separated from the Indian subcontinent by the Gulf of Mannar and Palk Strait[iii]

The island consists mostly of flat to rolling coastal plains, the South-central part of Sri Lanka is a rough plateau cut by a range of mountains whose highest peak is Pidurutalagala, 2,524 m (8,281 ft.). Narrow coastal plains skirt the mountainous section on the East, South, and West, but in the North the extensive coastal plain fans out, reaching from the eastern to the western shores of the island. Five-sixths of the land is less than 300 m (1,000 ft.) in elevation. Numerous rivers and streams flow seaward in all directions from the central mountain area; the longest river, flowing northeastward, is the Mahaweli Ganga (332 km/206 mi).

2.3 Agro-ecological Zones

The mountains and the Southwestern part of the country, known as the "wet zone," receive ample rainfall (an annual average of 2500 millimeters). Most of the Southeastern, Eastern, and Northern parts of the country comprise the "dry zone", which receives between 1200 and 1900 mm of rain annually. Much of the rain in these areas occurs from October to January.During the rest of the year there is very little precipitation. The arid Northwest and Southeast coasts receive the least amount of rain—600 to 1200 mm per year—concentrated within the short period of the winter monsoon. Another intermediate zone demarcates the area, which receives a mean annual rainfall between 1,750 to 2,500 mm with a short and less prominent dry season.

Monsoon pattern

Mid May – October: South West Monsoon
October – November: Inter-monsoonal months
December – March: North East Monsoon
March – Mid May: Inter-monsoonal months

As temperature is an important climactic factor affecting plant growth, a sub-division based on the altitude takes into account the temperature limitations in different regions. In this delineation, the low-country is demarcated as the land below 300 m in elevation and the mid-country with elevation between 300 m – 900 m while the up-country is the land above 900 m elevation. Both wet and intermediate zones are spread across all three categories of elevation while the dry zone is confined to the low-country alone. There are seven agro-climatic zones covering the entire island as follows -

1. Wet-zone Upcountry (WU)
2. Wet-zone Mid Country (WM)
3. Wet-Zone Low Country (WL)
4. Intermediate-zone Upcountry (IU)
5. Intermediate-zone Mid Country (IM)
6. Intermediate-zone Low Country (IL)
7. Dry Zone (Low Country) (DL)

Table 1: Rainfall distribution in Sri Lanka

Elevation in meters (MSL)	Annual rainfall - mm		
	Less than 1200= Dry	1200 – 2000=Intermediate	Above 2000=Wet
Less than 300 = Low country	DL	IL	WL
300 – 1000 = Mid country	-	IM	WI(M)
Above 1000 = Up country	_	IU	WU

These major zones are further sub divided in terms of 75% probability of rain fall, topography, soil type and vegetation and a total of 42 agro-climatic zones are identified for agricultural purposes.

More information on the agro ecological zones of Sri Lanka can be found at the DoA site at http://www.doa.gov.lk/index.php/ta/component/content/article/206.

2.4 Administrative divisions

Administratively, Sri Lanka has 9 provinces, 25 districts, 331 divisions and 14022 villages.

Provinces: 9
Districts: 25
Divisions: 331
Grama (villages): 14,022

Figure 4: Provincial Map of Sri Lanka
Source:
http://www.nationsonline.org/oneworld/map/sri_lanka_map.htm

Figure 4: Administrative structure in Sri Lanka

With a view to ensure an administrative system at grass root level is at par with public policies, Grama Niladhari (GN) division is under Home Affairs division of the Ministry of Public Administration and the Home Affairs implements all administrative functions of Grama Niladaries (Village level officers for government administration) performing their duties in each of the 14,022 GN Divisions in Sri Lanka. They operate under 331 Divisional Secretaries, which in-turn is administered by 25 District Secretaries within 9 Provinces in the Island.

2.5 Government

Central Government

The legislative powers in Sri Lanka are exercised by the Parliament, elected through universal franchise on proportional representation basis. The President, who is also elected by the people, exercises executive power including defense. Sri Lanka enjoys a multi-party system, and the people vote to elect a new government every five years.

Local Government system

The members of the local government system are selected through voting by registered voters living in the area. The local government division is as follows:

- Pradheshiya sabha (PS)
- Urban councils (UC)
- Municipal councils (MC)
- Provincial councils (PC)

Table 2: Distribution of local govrnment bodies

Province (PC)	MC	UC	PS	Total
Central	4	6	33	43
Eastern	3	5	37	45
North-Central	1	0	25	26
North-Western	1	3	29	33
Northern	1	5	28	34
Sabaragamuwa	1	3	25	29
Southern	3	4	42	49
Uva	2	1	25	28
Western	7	14	27	48
Country	***23***	***41***	***271***	***335***

2.6 Present agriculture status

Sri Lankan agriculture sector comprises several categories; the food crops (rice, fruits, vegetables, field crops and spices), the plantation crops (tea, rubber, coconut, sugar, and oil palm), the floriculture and ornamental crops, livestock, fisheries and forestry.

Although Sri Lanka is an agricultural country, food crop production in the country has been facing several challenges. At present 55% of the total land area of the country is being utilized for agriculture; 35% for paddy, 28% for plantation crops and 37% for other crops.

More than 70% of the population is living in rural areas whose main livelihood being agriculture (Agstat, 2015).

The food crop sector in agriculture contributes significantly to the Gross Domestic Products (7.9 % in 2015) as well as the labor force employed in agriculture (28.5%) (Table 3). Plantation crops, forest, fishery and livestock sector contribute to over 10% of the country's Gross National Production (Agstat, 2015).

Table 3: Gross Domestic Product by sector

Economic Activity	Rate of Change (%)		Contribution to Change (%)		As a Percentage of GDP (%)	
	2014 (c)	2015	2014 (c)	2015	2014 (c)	2015
Agriculture, Forestry and Fishing	**4.9**	**5.5**	**7.8**	**9.0**	**7.8**	**7.9**
Growing of Cereals (Except Rice)	4.3	1.0	0.2	0.0	0.2	0.2
Growing of Rice	- 7.0	23.3	- 1.2	3.6	0.7	0.9
Growing of Vegetables	2.1	24.9	0.3	3.5	0.7	0.8
Growing of Sugar Cane, Tobacco and Other Non-perennial Crops	- 6.3	- 14.5	0.0	- 0.1	0.0	0.0
Growing of Fruits	9.4	16.5	0.9	1.7	0.5	0.6
Growing of Oleaginous Fruits (Coconut, King Coconut, Oil Palm)	20.1	5.1	2.8	0.8	0.8	0.8
Growing of Tea (Green Leaves)	- 1.1	- 2.6	- 0.2	- 0.5	0.9	0.8
Growing of Other Beverage Crops (Coffee, Cocoa etc.)	16.4	- 18.1	0.1	- 0.1	0.0	0.0
Growing of Spices, Aromatic, Drug and Pharmaceutical Crops	13.1	1.3	1.7	0.2	0.7	0.7
Growing of Rubber	- 24.5	- 10.1	- 2.4	- 0.7	0.3	0.3
Growing of Other Perennial Crops	7.3	2.8	0.3	0.1	0.2	0.2
Animal Production	31.0	8.0	3.0	1.0	0.6	0.6
Plant Propagation and Support Activities to Agriculture	6.4	0.1	0.2	0.0	0.1	0.1
Forestry and Logging	10.2	1.9	1.2	0.2	0.6	0.6
Fishing	3.7	- 2.7	1.1	- 0.8	1.5	1.4
Industries	**3.5**	**3.0**	**19.6**	**16.5**	**26.7**	**26.2**
Mining and Quarrying	2.2	- 0.9	1.2	- 0.5	2.5	2.3
Manufacturing	2.3	4.7	7.6	15.5	15.7	15.7
Electricity, Gas, Steam and Air Conditioning Supply	3.3	7.8	0.7	1.6	1.0	1.0
Water Collection, Treatment and Supply	4.8	4.3	0.1	0.1	0.1	0.1
Sewerage, Waste, Treatment and Disposal Activities	11.9	24.8	0.5	1.1	0.2	0.3
Construction	6.6	- 0.9	9.6	- 1.3	7.2	6.8
Services	**5.2**	**5.3**	**59.9**	**62.6**	**56.3**	**56.6**
Wholesale and Retail Trade, Transportation and Storage, and Accommodation and Food Service Activities	4.0	4.6	19.3	22.5	23.3	23.2
Information and Communication	11.6	12.5	1.2	1.4	0.5	0.6
Financial, Insurance and Real Estate Activities Including Ownership of Dwellings	8.1	12.3	18.6	29.6	11.5	12.3
Professional Services and Other Personal Service Activities	4.3	1.3	11.0	3.3	12.2	11.8
Public Administration, Defence, Education, Human Health and Social Work Activities	5.5	3.2	9.8	5.8	8.8	8.7
Equals Gross Value Added (GVA) at Basic Price	**4.7**	**4.6**	**87.3**	**88.1**	**90.8**	**90.7**
Taxes less Subsidies on Products	6.9	6.2	12.7	11.9	9.2	9.3
Equals Gross Domestic Product (GDP) at Market Price	**4.9**	**4.8**	**100.0**	**100.0**	**100.0**	**100.0**
Net Primary Income from Rest of the World	-2.9	-3.7				
Gross National Income at Market Price	**4.9**	**4.8**				

(a) The data is based on the base year 2010 GDP estimates of the Department of Census and Statistics.
(b) Provisional
(c) Revised

Source : Department of Census and Statistics

The agriculture, forestry and fishing activities grew by 5.5% in value added terms during 2015 compared to 4.9% growth in 2014. The growth in agriculture activities was largely attributable to the significant expansion in the growing of rice, as a result of the bumper harvest recorded during the year and the substantial contribution from the growing of vegetables. Moreover, growing of fruits, animal production and growing of coconut (coconut, king coconut, oil palm) also significantly contributed to this growth. Further,

forestry and logging, growing of spices, aromatic, drug and pharmaceutical crops, other perennial crops and other cereals, and plant propagation and support activities to agriculture contributed positively to the overall growth in agriculture. However, the contraction in fishing, growing of rubber, tea, sugar cane, tobacco and other non-perennial crops and other beverage crops (coffee, cocoa etc.) dampened the growth in Agriculture in 2015 (Central Bank report 2015).

In 2015, total annual paddy production was 4,819,000 MT[5] and net harvested extent estimated as 1,088,000 ha. Although the country is self -sufficient in paddy, almost 286,000 MT of rice was imported in the year 2015. Cost of cultivation of paddy including imputed cost was estimated as Rs[6]. 30.48 per kg of paddy (Agstat 2015). Extent and production of other field crops in 2014 was 181,947 ha and 585,216 MT respectively. Total root and tuber crop production in 2014 was estimated as 436,817 MT. In 2014, Rs. 206,477,000.00 was spent by the government to import other field crops. Due to several factors, we have failed in fulfilling the total food demand of the country through local production. Accordingly, the government incurs a large amount of foreign exchange of over Rs. 100 million annually for the importation of food items including supplementary food crops. In 2014 total vegetable production and extent was estimated as 614,655 MT and 59,230 ha respectively.

Total tea production in 2015 declined by 2.7% i.e., from 338 million kgs in 2014 to 329 million kg in 2015. This is due to supply side factors as well as in response to demand conditions. From the supply perspective, unfavorable weather conditions during the greater part of the year, and the "go slow" labor action in the plantation sector in July demanding a wage hike affected tea production. Rubber production declined by 10.1% i.e., from from 98,573 MT in 2014 to 88,570 MT in 2015. In particular, smallholders slowed their tapping operations in response to lower rubber prices. Coconut production grew by 6.5% to 3,056 million nuts compared to 2,870 million nuts in the previous year. The improvement in production was attributed to favorable rainfall in coconut growing areas and conducive air temperature during 2014 and early 2015(Central bank report 2015).

The production of pepper, clove, cinnamon, cardamom and arecanut recorded a growth during the year, while the production of coffee, cocoa and nutmeg declined. Pepper production at 31,013 MT recorded a remarkable growth of 66.2% driven by favorable weather conditions in the flowering and fruiting period and the expansion of the extent harvested.

Fish production during 2015 declined by 2.8% to 520,190 MT compared to the expansion of 4.3% recorded in 2014. This was mainly due to a significant decline in inland fish production by 11.2 per cent to 67,300 MT.

[5] MT Metric Tonne

[6] Sri Lankan Rupee (1$ = 140 SRL rupee, as of June 2016)

Milk production increased by 12.1% to 374 million liters in 2015 compared to the growth of 1.4% recorded in the previous year, owing to favorable producer prices for milk and growing demand for raw milk from large milk collectors with the increased capacity of milk factories. Cattle milk production increased by 11.9% to 305 million liters whilst buffalo milk production increased by 13.2% to 69 million liters. The poultry sector showed a mixed performance in 2015. Chicken production increased by 9.4% to 164,450 MT in 2015. The number of broiler parents production increased by 8.3% in 2015, while imports of broiler parents and layer parents declined by 21.9% and 28.0%, respectively.

According to the Forest department, the forest cover of Sri Lanka in 2015 remained at 1,951,472 hectares, unchanged from the previous year. Due to the fact that even though 422.6 hectares were deforested for timber extraction, 450 hectares were reforested.

2.7 Policy Environment

2.7.1 Three-year Medium-term National Food Production Programme) NFPP 2016 –2018

The Food Production National Program[7] (2016-2018) was implemented with the objective of ensuring food security, producing supplementary food crops locally thereby minimizing food imports and increasing farmer incomes. The program has highlighted the following activities:

1. Enhancement of food crop production and productivity: Increase the production of rice, seed paddy, maize, ground nut, green gram, soybean, big onion, red onion, chili, potato, gingerly, black gram, cowpea, finger millet, turmeric, ginger, vegetable, fruits as well as promote home gardening.
2. Livestock development: Increase animal protein consumption, increase local production of veterinary vaccines, promote Liquid milk production and consumption, promote milk collection, promote curd production, and also increase mutton production.
3. Increase the production of fisheries and aquaculture products: Promotion of inland fisheries, lagoon prawn production, and also costal and deep sea-fish production.
4. Promotion of plantation crop production: To increase coconut production.

To achieve the target for the above programs, 14 key strategic development areas have been identified:

1. Input management
2. Empowerment of farmers
3. Facilitating marketing
4. Management of natural resources and adaptation to climatic changes
5. Public-Private partnership

[7]Source: http://www.agrimin.gov.lk/web/index.php/en/agricsers/semin

6. Youth and women participation
7. Knowledge management and using ICTs for agriculture
8. Using traditional knowledge and skills
9. Research and technology development
10. Consumer protection and satisfaction
11. Food Safety
12. Legal and regulatory framework
13. Development of infrastructure and irrigation facilities
14. Institutional coordination

2.7.2 Issues, challenges and priorities

The country faces several challenges in the area of agriculture. Some of the issues and challenges identified include:

1. Continuous rise in demand for food due to increase in population.
2. Need to spend a large amount of foreign exchange on import of food items that could be produced locally.
3. Farmers increasingly becoming economically weak.
4. Environmental issues arising from irrational use of agrochemicals.
5. Competition for land with other sectors involved with economic development for land.
6. Inadequate utilization of appropriate technologies for crop production for local food production.
7. Younger generation moving away from agriculture.
8. Issues of food safety and food security.
9. Non-adherence to international standards of production for the promotion of exports.
10. Inadequacy in enhancement of productivity to compensate effects of competition.
11. Harmful effects of climactic vagaries.
12. Low quality food products.

The program implementation is expected to be carried out as a team effort of the following **Key Actors** sharing responsibilities;

1. Presidential Secretariat
2. Ministry of National Policies and Economic Affairs
3. Ministry of Finances
4. Ministry of Agriculture
5. Ministry of Rural Economic Affairs
6. Ministry of Fisheries and Aquatic Resources
7. Ministry of Plantation Industries
8. Ministry of Irrigation

9. The Department of Agriculture
10. The Department of Agrarian Services
11. The Department of Irrigation
12. The Department of Export Agriculture
13. The Department of Animal Production and Health
14. Mahaweli Development Authority of Sri Lanka
15. All Provincial Councils
16. All Provincial Departments of Agriculture, Veterinary Resources and Fisheries
17. All District Secretaries and Divisional Secretaries

3.0 Developing the E-agriculture vision

The agriculture sector forms the centre stage in the Sri Lanka's development agenda with about 70% of population engaged in agriculture. It is an essential pillar for rural development. The country also has a vibrant ICT sector with some e-agriculture solutions in place or in pipeline, and is very keen on harnessing its potential. The wide adoption and awareness of ICTs in Sri Lanka not only in agriculture but also in other critical areas such as telecom, banking, e-governance etc. provides transformative potential for agriculture stakeholders to leverage upon. It is also characterized by significant roles played by individuals, public enterprises, private sector, and international development and donor agencies. A vision for ICT deployment in this sector, therefore, needs to build upon the development across multiple sectors while recognizing the varying expectations and roles of different types of stakeholders.

The FAO-ITU framework for development of e-agriculture vision (Figure 5) entails

- Establishment of an e-agriculture Steering Committee and Task Force;
- Understanding the national agriculture goals, priorities and challenges;
- Development of an initial e-agriculture vision;
- Detailing the e-agriculture outcomes to meet the vision;
- Analysing the ICT solutions that can realize the outcomes; and
- Refining and finalizing the e-agriculture vision and outcomes.

Source: FAO, ITU

Figure 5: E-agriculture vision development

3.1 E-agriculture Steering Committee and Task Force

A national approach to e-agriculture developed in an inclusive manner, involving representatives of all critical stakeholders, will ensure that adequate national awareness is raised and that the key stakeholder groups are engaged. In addition, this will also ensure that ICT challenges such as access and use (including costs, applications and quality) posing as hindrances, notably in rural areas and across sectors, are identified and tackled at a higher level in a systematic manner. This would also apply to other sectors critical to agriculture. Such strategic alignment will result in better sustainability of solutions, cost-effectiveness and their wider adoption.

A national approach will also help improve the coordinated planning and funding of e-agriculture solutions/service development, avoid duplication and the waste of resources. ICT for agriculture projects are sometimes duplicated in different ministries, agencies as well as service providers targeting the same stakeholders. Systematic effort in planning and setting up a national e-agriculture approach allows for a streamlining of government efforts, ensuring the judicious use of scarce resources while providing a clear direction to the private sector, donors and other stakeholders.

Furthermore, the process of developing a national e-agriculture approach may reveal the need for related institutional changes or adjustments and instituting an ICT interoperability framework leading to an enabling regulatory environment for the deployment, adoption or integration of innovative technologies. The elaboration of such an approach offers the opportunity not only to raise awareness but also to clarify the main components and potential benefits of e-agriculture for the vast majority of stakeholders and their role in realizing that potential.

3.1.1 Proposed E-agriculture Steering Committee and Task Force

The E-agriculture governance framework in Sri Lanka is proposed to comprise of a Leadership Committee, a Steering Committee and a Task Force. Working groups can be formed based on the decision of the steering committee as and when required.

The compositions of the committees are suggested as under:

I. **Leadership Committee** (as members in the supreme body governing e-agriculture activities)

- Minister of Agriculture - Chairman
- Minister / Deputy Minister / Secretary to the Ministry of Plantation Industries
- Minister / Deputy Minister / Secretary to the Ministry of Telecommunication and Digital Infrastructure
- Minister of Technology, Technical Education and Employment,

- Deputy Minister/Secretary to the Ministry of Mahaweli Development and Environment
- Minister of Irrigation and Water resource Management
- Minister/Dep. Minister/Secretary to the Ministry of Rural Economic Affairs Minister/Dep. Minister/Secretary to the Ministry of Lands
- Minister/Dep. Minister/Secretary to the Ministry of Fisheries and Aquatic Resources development
- Chairman / Director General of Telecommunication Regulatory Commission of Sri Lanka (TRCSL)
- CEO – Information and Communication Technology Agency in Sri Lanka (ICTA)

II. Steering Committee

- Secretary, MOA (Chairman)
- Director General of Agriculture or representative from the Department of Agriculture
- Representatives from other relevant Ministries/Institutes**:**
    - Director General of Export Agriculture,
    - Director General of Animal Production and Health,
    - Director General of Irrigation
    - Commissioner General of Agrarian Development
    - Director General of Rural Economic Affairs
    - Land Commissioner General Director General of Department of Meteorology, and Ministry of Telecommunication and Digital Infrastructure
    - Telecommunication Regulatory Commission of Sri Lanka (TRCSL)
    - Information and Communication Technology Agency in Sri Lanka (ICTA)
    - Banking
    - Insurance

- **Subject Matter Experts and Advisory Group**
    - Chief of Projects-ICTA, Dean/ Faculty of Agriculture (Peradeniya), Director-LIRNEasia, representatives from private sector, agri business and telecom operators.

III. E-agriculture Task Force

The E-agriculture Task Force should be led by a senior level officer from the ministry of agriculture or the department of agriculture and should comprise officers at director or senior management executive level from various departments of agriculture, telecom and ICTs. Working groups can be formed by the task force on specific issues involving stakeholders from other sectors as and when required.

4.0 Agriculture sector development goals and challenges

4.1 Agriculture sector priorities

The agriculture policy framework published by the Ministry of Agriculture (MoA), Sri Lanka identifies the following priority objectives for the agricultural sector:

- Achieve self-sufficiency in food crops, which may grow locally and save foreign exchange on imports of those food items;
- Increase availability of safe food by promoting eco-friendly practices and minimizing agro chemicals and pesticides in food crop production;
- Ensure food security through appropriate management of buffer stocks;
- Introducing and implementing agro-ecological region based food crop cultivation programs;
- Increase the productivity of crop production through appropriate technologies;
- Establish proper coordination among all agricultural stakeholders in the local food production process and connect all schools, civil organizations and general public to the program;
- Provide quality inputs for production and establish proper marketing mechanism for their products;
- Ensure building a healthy nation.

4.2 Agriculture sector issues: challenges and opportunities

The work on e-agriculture strategy started in 2014, where initial issues and challenges were identified. In December 2015, Sri Lanka's Department of Agriculture and Telecommunications Regulatory Commission of Sri Lanka hosted a four-day expert workshop in collaboration with the ITU, FAO & CABI to validate the work done in the development of the National E-agriculture Strategy. Key stakeholders from the policy makers, public and private sectors attended the workshop. The stakeholders identified issues and challenges pertaining to the agriculture sector in Sri Lanka in the following categories –

- Policies, guidelines and regulatory frameworks
- Resource constraints
- Value chain, farm inputs and logistics
- Natural resource management and climate change
- Marketing and financing
- Data availability, accessibility and reliability
- Knowledge, information and awareness
- Lack of services

As a result of the brainstorming, 97 challenges (Table 4) were identified under these 8 categories.

Table 4: Sri Lanka agricultural sector challenges

A.	**Policies, guidelines and regulatory frameworks**
1	Lack of a consistent and long term national agricultural policy
2	Lack of a comprehensive national agricultural production plan (presently available)
3	No adequate/suitable subsidy schemes
4	Lack of clear ICT policy for agriculture information dissemination
5	No proper value chain certification scheme (e.g. quality seeds, planting material)
6	Lack of schemes for seed industry development
7	Inadequate framework for land use and development
8	No certified price (minimum guarantee price) for agricultural products
9	Inadequate enforcement measures on biodiversity
10	Inadequate enforcement of Soil Conservation Act
11	Inadequate enforcement of Pesticide Act
12	Inadequate enforcement of Land Rights
13	Inadequate enforcement of other legal frameworks
14	Inadequate enforcement for quality control of agriculture products
15	Inadequate enforcement measures on plant protection
16	Inadequate framework for IPR on plant variety
17	Inadequate legal framework for seed transfer, quality etc.
B.	**Resource constraints**
18	Lack of coordination and integration among the related organizations
19	Inadequate finance, human resources & infrastructure
20	Slow process of research and development
21	Inadequacy of subject matter specialists and research staff
22	Insufficient opportunities for capacity building of public servants
23	Inadequacy of extension and surveillance staff
24	Unavailability of resources to implement, maintain and update databases
C.	**Value chain, farm inputs and logistics**
25	High involvement of middlemen
26	No value addition on farm and off farm
27	Post-harvest losses
28	Insufficient supply of agricultural inputs
29	Lack of improved varieties
30	Poor genetic diversity of crop varieties (Germ plasm)
31	Poor product quality at harvesting
32	Lack of suitable machineries / mechanizations
33	High cost for labor
34	Lack of safe / quality agro-chemicals

35	Lack of facilities post-harvest (pack houses, packing material, certified farm fields, cold storage etc.)
36	Inadequate infrastructure (transport, road)
37	Lack of telecom network infrastructure
38	Seasonality of production
39	Overproduction and off seasonal production
D.	**Natural Resource Management and Climate Change**
40	Unavailability of agricultural land
41	Soil degradation / poor soil conservation
42	Water pollution
43	Climate change impact
44	Natural disasters
45	Lack of irrigation water
46	Environmental hazards
47	Threat of wild animals
48	Poor management of agricultural and animal waste
49	Extreme weather events and biotic and abiotic stresses (Climate change unpreparedness)
50	Poor water management/ Silt depositions/ water conservation
51	Low productivity of land
E.	**Marketing and financing**
52	Inadequate marketing, unavailability of facilities
53	Pricing discovery / behavior
54	Lack of proper market access (strategies, channels etc.) for farmers
55	Improving insurance schemes
56	Market demand, supply and consumer requirements
57	Credit and loan availability
58	Lack of information on buyers and producers
59	Lack of international branding (e.g. Ceylon) for local products
60	Lack of Geographic Indicators (GI) branding for products from Sri Lanka
F.	**Data availability, accessibility and reliability**
61	Inadequate real-time data on pesticides, Maximum Residue Limit (MRL)
62	Inadequate real-time data of food production in the country
63	Inadequate real-time data on food demand
64	Inadequate real-time data on land availability and land use
65	Inadequate real-time data on agro-meteorology
66	Lack of agriculture information sharing amongst stakeholders
67	Unreliability of data
68	Lack of inventory on biodiversity information

69	Inadequate data storage, forecasting and analytical framework
70	Inadequate availability of data for insurance schemes
71	Inadequate data for land use
72	Inadequate data for seed and plant demand
G.	**Knowledge, information and awareness**
73	Lack of real-time information on pest population and disease
74	Inadequate information dissemination on pests and disease
75	Diagnosis of pests and diseases, and early response
76	Public awareness program
77	Poor mechanisms for technology dissemination
78	Farmer attitudes (awareness on new schemes, technology adoption etc.)
79	Lack of knowledge on international market standards
80	Lack of public awareness on quality standard
81	Poor access to Good Agricultural Practices (GAP) and organic certification standards
82	Lack of awareness on safe crop husbandry (Green houses, poly tunnels)
83	Overuse of inorganic fertilizer and abuse of chemicals
84	Non-compliance to Government / institutional recommendations
85	Food habits of the general public
86	Lack of collective approach in farmer community
87	Lack of knowledge on climactic change
88	Youth moving away from agriculture
89	Lack of information and awareness on financial and insurance schemes
90	Inadequate linkages between researchers, extension system and farmers
91	Improve education on agriculture at school and university level
H.	**Lack of services**
92	Need efficient emergency advisory services
93	Poor weather forecasting system
94	No proper risk management system
95	Need efficient quarantine and taxonomic facility
96	No traceability mechanism for pesticide misuse
97	Poor status of IT applications for agriculture

Source: Sri Lanka E-agriculture expert workshop, December 2015

5.0 Status of ICT infrastructure, services and adoption

5.1 ICT workforce

Positive domestic developments in post-conflict era and gradual recovery of the global economic situation have created conducive environment for growth of the ICT workforce. As a result, the overall workforce has grown from 50,159 in 2010 to 75,107 in 2013 a rise of 50% at compound annual growth rate (CAGR) of 14.4%. The projected figure of 82,854 for 2014 suggests that this momentum is likely to continue in the future also. Respective contributions by four subsectors to the total workforce in 2013 are 40.8% from ICT companies, 47.1% from non-ICT private sector users, 7.8% from government organizations and 4.2% from BPO companies.

The profile of ICT workforce has undergone some changes since the last workforce survey. The programming/software engineering category still has the highest share among job categories but it has reduced to 21% in 2013 from 26% in 2009. However, its share remains as high as 36.7% in ICT companies followed by software quality assurance (16%), jointly occupying more than half of the workforce in ICT companies.

5.2 Public ICT networks and devices

Sri Lanka currently has five mobile network operators and around 27 million mobile connections. The unique mobile subscriber rate in Sri Lanka is roughly 51% of the population. Of those, 77% have a 2G connection, 22.5% have a 3G connection, and less than 1% have 4G connections. In addition, 23% have mobile broadband access. (Source: GSMA Intelligence, Q3 2014).

There is still headroom for subscriber penetration in the country. On the face of it, the bulk of this growth would come from closing the urban-rural divide.The current mobile ownership is around 53% in urban cities as compared to 42% in rural areas. Given that the majority (85%) of the population resides outside of cities, even if rural ownership plateaued at 50%, this still implies an incremental rise of 1.2 million people based on current levels. While coverage not-spots and digital literacy are barriers to this, affordability, especially in rural areas, also presents a considerable challenge. Rural households have fewer income earners (1.7 versus 1.9 in cities) and their household incomes are 25% lower than those in urban areas[iv]

The telecom sector is regulated by the Telecommunications Regulatory Commission of Sri Lanka (TRCSL), which reports to the President. Some of the key responsibilities of TRCSL includes licensing, telecom network development, universal access, interoperability, ensuring quality of service, spectrum management, and consumer protection amongst others. In 2003, the ICT Agency of Sri Lanka (ICTA) was created as the ICT policy implementing body in Sri Lanka in relation to e-governance and e-services. The Ministry of Telecommunication and Digital Infrastructure was established in 2015.

Telecommunications services in Sri Lanka, as of June 2016, are very competitive, with eight operators in the country making retail offerings. Sri Lanka Telecom (SLT) is the partially privatized incumbent, and the only firm with a copper access network to reach homes and businesses. Of the five mobile operators, four (Dialog Axiata, Etisalat, Airtel and Hutch) are private companies that are part of large international or regional telecom operators, and one (Mobitel) is a fully owned subsidiary of the incumbent SLT. Two other operators (Dialog Broadband Networks and Lanka Bell) primarily provide CDMA based (fixed-wireless) telecommunications services.

Table 5: Statistical Overview of the Telecommunication Sector

Statistical Overview of the Telecommunication Sector (End of September 2015)	
Number of System Licenses	38
Total number of Fixed phones	2,644,366
Teledensity (Fixed Phones per 100 inhabitants)	12.6
Number of Cellular Mobile Subscribers (90 days)	23,771,580
Mobile Subscription per 100 people	113.4
Internet & Email Subscribers – Fixed	631,523
Fixed Narrowband subscribers	16,417
Fixed Broadband subscribers	615,106
Internet & Email Broadband Subscribers (Mobile)	3,373,388
Number of Public Pay Phone Booths	5,955

Source: TRCSL

Table 6: Telecommunications license categories in Sri Lanka (2015 September)

Category of Service	No of Licenses
Fixed Access Telephone service	3
Cellular Mobile phones	5
Data Communications (Facility based)	4
Data Communications (Non-facility based) & ISP's	09
Trunk Mobile Radio	1
External Gateway Operators	07
Direct-to-Home Satellite Broadcasting Service	03
Cable TV Distribution Network	03
Satellite Services	01
Leased Circuit Providers	01
Licensed Payphone Service Providers	01
Sub Total	**38**

The technologies currently deployed in the country include:
Fixed: Dialup, ADSL/ADSL+/VDSL/SHDSL, Fiber-FTTH
Fixed Wireless: CDMA, 4G LTE, Wi-Max, Wi-Fi
Mobile: GSM, GPRS, EDGE, UMTS, HSPA, HSPA+, DC-HSPA+, 4G LTE, Wi-Fi
Data: P-P, P-MP, Wi-Fi, Leased Lines
Source: TRCSL

High-speed Broadband Backbone Networks

Broadband was introduced by Sri Lanka Telecom (SLT) in 2003. In 2007, the second operator, Dialog Broadband Networks, joined the market. The new entrant chose wireless technology based on Worldwide Interoperability for Microwave Access (WiMAX) (IEEE 802.16d) to provide broadband services to subscribers, initially in urban areas. In late 2007, mobile operators also joined the market to provide wireless broadband using 3G technology (HSPA). Mobile broadband services based on 3G HSPA have captured a significant share of the market within a short period of time.[v]

Major telecom operators own fiber optics and microwave linked backbone networks covering the whole island. Some operators also lease their infrastructure facilities to other operators and customers. There is a need to replace microwave links with fiber optics as much as possible to increase the capacity and protect the environment.

Only two operators in Sri Lanka have optic fiber based nationwide backbone. Sri Lanka Telecom (SLT) has the widest fiber coverage with more than 22,000 kilometers of fiber covering large areas of the country and another development planned. SLT is also transitioned to a Next Generation Network (NGN) with around 20% of its customers served by this technology. SLT has also launched i-Sri Lanka project placing fiber closer to the customer to reduce the length of copper loops.

The Government has launched a National Broadband Network program. The program would provide fiber rollout into every Divisional Secretariat (DS) Area level in Sri Lanka. At present, there are 331 Divisional Secretariats in Sri Lanka.

5.3 ICT projects and initiatives in Sri Lanka

In 2005, the Government of Sri Lanka (GOSL) launched the e-Sri Lanka Development Project with the objective of using ICT to foster social integration, peace, economic growth and poverty reduction. It is one of the world's pioneering ICT development initiatives.

Among many outstanding achievements under this project, some key ones are -

- Under the e-Government infrastructure in the areas of connectivity, accessibility and content, the Lanka Government Network (LGN) connects more than 500 central and provincial government organizations and their services into a single network platform.

  The infrastructure and services of the LGN are supported by several related modules that include the Lanka Gate Infrastructure comprising of the government web portal (www.gov.lk), Internet and mobile payment gateway (LankaGov Payment Service), SMS Gateway (GovSMS), and the government Internet Data Centre. At present LGN hosts several e-Government services, which include the e-population registry.

- ICTA has created a cloud infrastructure named as the "Lanka Government Cloud (LGC)" to provide information service to many government organizations. At present nearly 500 virtual server spaces are provided for more than 50 different projects under LGC.

- In April 2013 total cumulative usage of government websites was over 10 million while the usage of GIC information services had reached the 3,000,000 mark. In addition to these, the GIC call center has serviced nearly 5,000,000 requests from the general public and approximately 5500 to 6000 callers were serviced in a day. The number of user registrations at Lanka Gate country portal was more than 20,000 by April 2013. On the mobile domain there were over 105,000 SMS based transactions and over 33,000 downloads on the Android apps

- Since 2005 the process of setting up "Nenasala" telecenters throughout the island had begun and by 2014 there were 1005 telecenters have been established. Of these centers nearly about 55% are actively operational.

- An increasing number of Sri Lankans have started to use their mobile phones to access the Internet. Since 2009, mobile internet users have almost doubled each year.

With the smartphone adoption continuing to rise, driven by falling device prices, increasing broadband mobile coverage and operator marketing, there will be more and more last mile users added to the mobile network. Operator investment is targeted on networks to preempt the rise in traffic associated with more users and higher intensity of usage.

With an aim of fully leveraging the potential of digital disruption, since 2016 January, Government of Sri Lanka is commencing implementation of a comprehensive three year National Digital Strategy. The strategy will focus on rapid digital infrastructure development program across the country and empowerment of citizens for creating a knowledge society. The planned ICT transformation will also focus on sustainability and inclusive growth across all segment of the economy. As the main apex government institution, Information and Communication Technology Agency (ICTA) is chiefly responsible for implementing policies and projects to achieve the vision of National Digital Strategy.

Through successfully implementing the Government Connectivity (G-Connect) strategy, it is expected that by end of 2018, all the government buildings including Divisional Secretary offices, Provincial councils, Pradeshiya Sabhas, Sub Post offices and Police Stations are all connected to the high speed internet and using 90% of their transactions on line, which inturn will lead to large cost saving. In addition, the strategy will also facilitate connecting 70% of individuals across the country to the Internet through the mobile network to be created. Through improving internal efficiency of the government as well as providing effective public services on line, it is expected that there will be great efficiency enhancement across the government.

5.3.1 Alignment with e-Government Initiative

Alignment of e-agriculture strategy with the e-government strategy is important for scalability, interoperability and sustainability of services. It is important to take into consideration the existing e-government activities in the country. ICTA conducted the 'e-Government Survey' toward the beginning of 2014 to evaluate e-government outcomes in connection with the intervention of eSri Lanka initiative which had been phased out at the end of 2014.

The principal development outcomes of the eSri Lanka project were anticipated to be:

- More effective, citizen-centered, and business-friendly government;
- Empowerment of the rural poor, disabled, women, and youth through increased and affordable access to information and communication tools;
- Develop leadership and skills in ICT; and
- Employment creation through the ICT industry, ICT-enabled services, and enhanced competitiveness of user industries and services.

The Re-engineering Government Program is a major component of the eSri Lanka Development Project that aimed to improve internal efficiency, transparency, effectiveness, and quality of services. It also aimed to expand the already identified fundamental governance and public management reforms by re-engineering public sector work processes for strategic use of ICT. Re-engineering Government Program was an integrated effort of the six main components of the eSri Lanka Government Program, which operate interdependently. The efforts integrate the activities in building information infrastructure and an enabling environment, developing ICT human resources, modernizing government and delivering citizen services, leveraging ICT for economic and social development and promoting Sri Lanka as an ICT destination.

This evaluation of the e-Government Program under e-Sri Lanka Development initiative has revealed some of the following major outputs toward its overall objectives:

- ICTA took the leadership in formulating the "e-Government Policy" that was adapted by the Cabinet of Ministers in December 2009. This policy was instrumental in preparing regulatory frameworks that enabled the use of electronic transactions and payments within the state sector, established Lanka interoperability framework for standardization and secure data sharing, and the local language standards that enable trilingual content in government data and services.

- Under the e-Government infrastructure in the areas of connectivity, accessibility and content, the Lanka Government Network (LGN) connects more than 500 central and provincial government organizations and their services into a single networked platform. The infrastructure and services of the LGN are supported by several related modules that include the Lanka Gate Infrastructure comprising of the government web portal (www.gov.lk), Internet and mobile payment gateway (LankaGov Payment

Service), SMS Gateway (GovSMS), and the government Internet Data Centre. At present, LGN hosts several e-Government services which include the e-population registry.

- ICTA has created a cloud infrastructure named as the "Lanka Government Cloud (LGC)" to provide information service to many government organizations. At present nearly 500 virtual server spaces are provided for more than 50 different projects under LGC.

- One of the major achievements is the Lanka Gate initiative towards making eGovernment more accessible to the citizens through the official government web portal hosted at http://www.gov.lk. It is a trilingual website that provides a convenient single point access to all government services and information. As at present there are over 225 transactional, information and interactive services including payment services (offered through Lanka Government Payment Platform) that are accessible through the government web portal. In addition, over 622 e-Services are provided by a number of government organizations ranging from ministries, departments, to statutory boards via e-services and m-services offered by various government institutions that are supported by ICTA. These services are indexed and listed in the government web portal (www.gov.lk) providing an easy access point to all available services. A major achievement was the e-Revenue License service, which is the first transactional e-service, and has created the path to accept electronic payments for government services. It was initially implemented in the Western Province and is now replicated in six provinces. In addition to the above, capacity building opportunities were provided for over 16,000 government officers by ICTA enabling them to successfully implement the newly developed IT systems. In addition, digitizing 20 million births, marriage and death certificates are some of the achievements under this component.

- As in any ICT development initiative, Sri Lanka is advancing towards ICT enabled services, is not without vulnerabilities towards risks, threats and attacks in the cyber space. ICTA have taken initiatives to setup a separate entity dedicated for ensuring cyber security under its umbrella. Referred to as the Sri Lanka Computer Emergency Readiness Team (SLCERT) this organization provides a range of services to both government institutions as well as the general public. Achievements of SLCERT over the past few years have earned them the reputation and designation as the "National CERT" of the country.

- In order to receive the true benefits of e-Government, the public must be empowered with necessary access facilities to e-Services and required ICT skills to utilize such services. Under the e-Sri Lanka project this aspect was covered through the establishment of "Nenasala" telecentres throughout the island. The initial plan was to establish 200 centers but by 2013 this target was surpassed by more than

350% reaching a target of 741 centers. Of these centers about 75% remained actively operational and 66% financially self-sustaining.

- Another component of the e-Sri Lanka program, the eSociety Development Initiative combined a competitive transparent grant-making program with local content development. It provided multi-channel assistance ranging from community assistance to community-based organizations to partnership assistance to organizations with higher capacity in the execution of innovative and replicable projects.

- The eParticipation platform to discuss eGovernment policies for effective and efficient implementation of the e-Sri Lanka Program. This forum consists of stakeholders representing both public and private sector and IT experts.

- ICTA Monitoring and Evaluation (M&E) program to measure the progress of achieving results of the e-Government Program of which the main objective was to gather data required to assess the improvements of internal efficiency of the government and effectiveness of providing public services to the citizens and business in terms of time spent and cost incurred by citizen to obtain public services and the level of satisfaction. The primary tool used for collection of data in this evaluation is a field survey conducted in selected government organizations. In addition, the following analysis was carried out using secondary data mainly with the aim of generating background and supplementary information on the eGovernment:
    1. Analysis of Network Readiness Index (NRI);
    2. UN e-Govenment Survey data to understand the overall e-government development status and identify best practices;
    3. Content analysis of the government web sites to understand the situation of providing information to citizen through web sites. The sample used for the web content analysis included 39 government organizations.

  The findings of both the surveys are found here https://www.icta.lk/monitoring-and-evaluation-reports/

6.0 Status of e-agriculture services in Sri Lanka

Department of Agriculture (DOA) under the Ministry of Agriculture plays the major role in technology generation and transfer in the food crop sector in Sri Lanka. DOA has already initiated several e-agriculture programs.

- **The official website of the Department of Agriculture (www.doa.gov.lk)**: This was initiated in 2005 in English but later it was revamped and developed in all local languages viz. Sinhala and Tamil. It targeted the farming community in particular and, in general, all stakeholders in the agricultural sector as well as the general public. The website was once awarded as the best departmental and government website in Sri Lanka. It provides agricultural technical information and also access to agriculture publications, videos and radio programs. The website has been developed further and is ready to be revamped again.

- ***Wikigoviya* web site (www.goviya.lk)**: This web site was developed on web2 concept to facilitate all stakeholders in agriculture to have progressive dialogues on agriculture issues (*Agriforum*) and establish public knowledge repository in this area (*Agripedia*).It also facilitates distance learning in agriculture and ICTs (*e-learning*). IMMCDs produced by DOA on various crops and subjects have been uploaded for e-learning. *Wikigoviya*web site won several awards including the prestigious World Summit Award in 2011 for its e-creativity. This site has also been redesigned and revamped recently.

- ***Krushilanka* agriculture portal (www.krushilanka.gov.lk):** It acts as the gateway for all agriculture related institutes and their services for the agricultural sector. The home page has provided access to number of ministries, departments, statutory boards and authorities, banks, international organizations and private sectors which work for agricultural development in Sri Lanka. Though the portal is on line, most of the linked sites have yet to develop content in local languages.

- **AgMIS (Agriculture Management Information System):** This was developed and implemented as a pilot project in 2006 to strengthen the value chain activities especially catering to policy makers to get decisions on crop production. Though the software solution is good enough to monitor the status of cultivations and productions, the pilot project was not successful in establishing proper data management mechanism due to lack of field staff. Need for monitoring the progress of National Food Production Program through real time information system has already been identified as a priority.

- **Rice Knowledge Bank website:** The country information system for rice cultivation with the cooperation of International Rice Research Institute (IRRI) was developed in 2007 especially to cater to the field staff in agriculture. This platform was created by IRRI to share the rice related knowledge between scientists and other stakeholders in the world. One important feature of the site is *Rice Doctor*, which provides tools to diagnose field problems and remedies.

- **Call Center (1920) for Agriculture Advisory Service:** *'GoviSahanaSarana'* agriculture advisory service was established in 2004 with **1920** short code, which was linked with all land and mobile telephone service providers in Sri Lanka. Farmers can directly contact agriculture technical officers (Agriculture Instructors) in the service through this short code. All conversations are recorded and all information gathered into 1920 call centre database. Though this service is popular among the farming community, capacity to cater to all queries is challenged due to the limited number of phone connectivity. The system is proposed to be upgraded with latest technologies.

- **e-SMS Service:** e-SMS service has been introduced recently to integrate with the ***1920*** agriculture advisory service. Farmers can send messages to *krushifm* team to discuss their maters in radio programs and send messages to Call Centre team requesting advice for their issues. They can also register for different crops, which enable them to get timely relevant messages via SMSs.

- **Krushi FM web radio (www.krushifm.lk):** The web radio has been operated since December 2013 by Farm Broadcasting Service under the DOA. Main objective of this initiative was to pioneer a separate radio channel for agriculture sector in Sri Lanka. The web-based program has been enabled for android phones through the app called *Krushfm*. Variety of programs are produced and broadcasted with the cooperation of other institutions like Department of Animal Production and Health, Department of Export Agriculture Crops, Department of Irrigation, Department of Agrarian Services, Department of Botanic Gardens, Mahaweli Development Authority, etc.

- **Rice-Pest Spread Analysis System (www.ricepestpps.com**): This system has been developed and commissioned in 2015. The Plant Protection Service of the DOA maintains database for major pest incidents of the country. The extension officers at the field level enter data such as pest incident intensities, type of pest, damage level, affected crop varieties etc. This data can be analyzed and viewed as projected graphs and on map-based view together with predictions for various user groups.

- **Agriculture videos on the Internet:** (https://vimeo.com/user3815270) (www.youtube.com/channel/UCBegMRLuc6kMVphVETVB0Ow) *GoviBimataArunalu* (awareness program on timely relevant technologies), *MihikathaDinuwo* (success stories of farmers) and *KethaBathaKamatha* (documentary on traditional agriculture knowledge) video programmes have been produced by DOA weekly and telecasted via National Television Service channel. Uploading agriculture videos to *Vimeo* site was initiated in 2012. This *Vimeo* provides public access to all videos produced by Audio Visual Centre of DOA. Uploading DOA videos to *youtube* channel started recently. These channels are also used for webcasting an important event of DOA such as the Annual Symposium of the DOA.

- **Use of Social Media**: The Department of Agriculture also makes use of social media such as Facebook, twitter and Google+. This helps creating awareness of new technological developments, important news etc. among the public.
  - https://www.facebook.com/SLKDOA
  - https://twitter.com/AgriTwitt
  - https://plus.google.com/u/o/116214131126823897581/posts

- ***Govi Mithuru* project:** *Govi Mithuru* project is a mobile agriculture initiative which is being jointly implemented by Dialog Telecom, CABI International and Department of Agriculture. The purpose of the project is to strengthen technology transfer in agriculture to farming community using mobile technology. Relevant agriculture messages are passed to farmers, who are registered over the dialog mobile network in a timely manner. Experts in the DOA prepare technical messages with the assistance of CABI; voice messages are then produced and distributed through the mobile system by Dialog telecom. This has been started for paddy farmers. For 11 other crops, content development with the respective crop research institutes and extension divisions are in progress. Along with agriculture message, the project also promotes "nutrition sensitive agriculture" concept and technology to the farmers, especially to women farmers through messages and interactive voice response system (IVRS) on topics such as balanced nutrition, deficiency syndrome and management, women and child health, basic hygiene etc.

- **Market price Information Systems:** Daily market price information is provided over the mobile phones by two mobile networks. '6666' short code is operated by Mobitel network and '977' is operated by Dialog network. Dialog *Tradenet* provides agri-produce price information from three dedicated economic centres in Sri Lanka through the 977 short code.

  Hector Kobbakaduwa Agrarian Research and Training Centre under the Ministry of Agriculture updates their crop market price information system daily through their field staff and provides IVR service to public through Mobitel mobile network.

- **Information System for Bio-diversity of Food and Nutrition System (BFN - under development):** BFN Project has been implemented last year with an aim to develop a web application system to offer information on healthy food items and preparations together with the respective nutrition values. The system has been targeted to record important information including nutrition availability of various edible plant types. The system is aimed at contributing towards popularizing traditional food items, which would help prevent health hazards.

- **Human Resource Management Information System for DOA (under development):** Main objective of this initiative is to keep up-to-date record of human capital of the department and facilitates efficient use of human resources. Administrative function of the DOA will be made simple and efficient with the use of the proposed database.

- **Seed and Planting Material Management Information System (under development):** DOA and the Ministry require real-time seed and planting material information to monitor their production, certification, distribution, sales and available stocks. The software has been developed since August 2014. It has to be integrated with the activities of Seed Certification Service, National Plant Quarantine Service, Seed certification and Plant Protection Centre, and Seed and Planting Material Development Center.

- **Progress Monitoring System for National Food Production Program (under development):** A software solution to monitor the progress of the National Food Production Program (NFPP) is an urgent need. The President of Sri Lanka has launched the program and the core objective is to address national food security issues by enhancing food crop production in the country. Targets are to be achieved within three-year period (2016-2018) and therefore, developing and implementing a database at the earliest to monitor progress is very important. The proposed database will help policy makers to take critical decisions for planning cultivation programs and also exports and imports of food crops.

- **QR Code System for GAP certification program (under development):** Department of Agriculture has implemented a GAP certification program (good agriculture practices) on fruits and vegetables especially to meet international standards for export market. Extension and Training Centre (ETC) of DOA has recruited counselors for agri-business (CAB) officers at field level to monitor the crop production at farm level and its transportation to the National Quarantine Service Center to certify for exports. Certified farmers and institution can obtain QR codes from ETC, which will be linked to a secured database. QR code of the product will help the consumer to get all relevant information about the product, producer and certification.

- **Cyber Agriculture Extension Pilot Project (not functioning):** This was implemented in 2005 as a pilot project. The main objective was to upgrade the field level agriculture extension office (Agriculture Instructor's Office at Agrarian Service Centers) as a rural knowledge center by providing access to Internet and connectivity to all agriculture research and training centers. Through establishing the network, it was expected that Agriculture Instructor could be able to update the agriculture database (AgMIS). The database was developed under the project to gather and analyze data on farmers, crops and yields, which may help appropriate planning, promote marketing and correct decision making. Further, it was expected that use of computer and Internet facilities, which was provided by the project will assist in farmer training and e-learning, especially using IMMCDs produced by DOA on various crops and subjects. The pilot project functioned for a few years only. This was due to lack of coordination among different stakeholders, no specific fund allocations to maintain the system, lack of staff for updating data, Internet access problems, and failure in continuous monitoring and training support.

Some of the potential applications of ICTs that have been considered to improve existing agriculture system information collection, efficiencies and services in Sri Lanka include:

1. **Mobile based integrated agriculture advisory service:** An integrated ICT approach is required to streamline and strengthen agriculture extension and advisory services including 1920 call center, SMS service (push and pull), field problems diagnostic tools, field visits of extension staff, experts' consultancies and progress monitoring.
2. **Food crop forecasting and marketing information service:** Real time information system for cultivation extent and yield forecasting is an urgent need to monitor the progress of National Food Crop Production Program. This information is also important to strengthen the value chain in agriculture to avoid over production or scarcity of food crop production in the country.
3. **Pesticide registration and pesticide information e-service**: Registration, marketing and use of pesticides are governed by the Pesticide Registration Act and implemented by the Office of Registrar of Pesticides of the DOA. Pesticide testing and registration process can be monitored through an information system, which may increase awareness to pesticide companies, administrators and policy makers. Pesticide recommendations with relevant information can be transferred through an e-service.
4. **Plant protection e-service:** Pest and disease diagnostic tools can be introduced as mobile and web based applications. This may reduce the over use of pesticides and promote Integrated Pest Management Methodologies.
5. **Research information management system**: Sri Lanka Council for Agriculture Research Policy compiles information collected from research institutions, but there is a need to establish full-fledged information system that enables research information to be shared among scientist and provides an access to online repository.
6. **Soil test results e-service**: DOA research stations provide soil-testing facilities to farmers. All results are given manually and processes can't be monitored. Web based and mobile-based information system can provide e-service for soil testing results as well as enable tracking progress.
7. **E-agriculture library service:** IMMCDs, video on demand, bibliography service will be effective through an IT solution. E-learning mechanism could also be introduced through this system.
8. **Natural resources management information services:** Natural resource management centre of the DOA implements Soil Conservation Act and Regulations. Access to e-applications and e-reports related to the regulations should be available online. Access to soil and weather information for different agro climatic zones can also be made possible through IT solution.
9. **Plant genetic resources information service:** DOA has one of most important plant genetic resource centre in South Asia and information related to conservation could be made available online.
10. **Agriculture diploma students' information system:** DOA has conducted agriculture diploma course at five agriculture schools under the NVQ level six. Students' evaluation has been done manually, which can be made available online to students. At the same

time, e-learning mechanism could be introduced to strengthen the agriculture education in the country**.**

11. **Plant quarantine e-service:** National Plant Quarantine Service (NPQS) of DOA is authorized to implement plant quarantine regulations under the Plant Protection Act. The plant quarantine offices have been located at the major seaport and airports. Imports and exports at those locations are under control of the Custom Authority which plans to introduce a single window platform. NPQS involves in issuing phytosanitary certificates to exporters as well as for searching pest and disease risk in importing agriculture living material. There is a need for an information system to monitor all plant quarantine activities at the seaport and airport.
12. **Weather forecasting and advisory service:** As climate change has adversely affected agriculture sector, daily weather forecasting and advisory service (especially location specific services) will be very useful to farmers. Such a system could be implemented as a joint program of the Natural Resource Management Centre of the DOA and the Meteorological Department.
13. **Land use and soil conservation mapping and e-information system:** Land development and soil conservation has been identified as crucial factors of agriculture in the country and such information system may help all stakeholders in agriculture in improving the land information and use.
14. **Geo-spatial information service**: Establishment of geo-spatial information service will help the Department of Agriculture, the Ministry of Agriculture and other stakeholders, to take correct decisions based on real time information. It would also empower the current crop insurance scheme.
15. **Farm Machinery e-information service:** Farm mechanization is a high priority in accordance with the present National Food Production Program. Proper ICT solution may increase the production, distribution and use of farm machineries.

E-agriculture solutions were discussed as part of the strategy development exercise and the team arrived at forty-nine (49) possible solutions that are detailed in Chapter 9.0.

7.0 Sri Lanka E-agriculture Vision

ICTs form an important pillar to address agricultural challenges and facilitate meeting national agricultural goals. As a first step, developing an e-agriculture vision would provide a strategic direction to the desired outcomes. E-solutions can then be adopted to achieve these outcomes.

Recognizing the transformative potential of ICTs in the agriculture sector, the e-agriculture vision for Sri Lanka is aimed at

> ***"Excellence in adopting e-solutions to transform agriculture for national prosperity"***

Although the adoption of e-solutions is an ongoing activity, the current ***action plans*** are set for a timeline of **2020**.

The vision embodies the strategy to accelerate the growth of the agriculture sector, increase production and reduce imports, reduce the demand and supply gap of food produce and consumption, improve the quality and safety of food and improve livelihoods more effectively. The expected outcomes are detailed in the subsequent section.

7.1 E-agriculture expected outcomes

Effective deployment of ICTs in agriculture by **2020** would make a transformative impact on the sector in Sri Lanka. It is expected to deliver the following e-agriculture outcomes through a number of ICT solutions (or eSolutions):

1. Increase the availability and accuracy of agricultural information by creating, updating, analyzing and linking critical databases;
2. Accessible, affordable and secure ICT platforms, networks and devices with enhanced sensing, hosting, analytical, identification, tracking and communicating features;
3. Improve the awareness, education and skills of farmers, extension workers, livestock herders and other sector end-users by creating and disseminating credible agricultural knowledge remotely;
4. Reduce the demand -supply gap, and enhance outreach and profitability of Sri Lankan products and services through vibrant e-agriculture market places and efficient logistics;
5. Improve the research capability, quality, credibility and reach of extension advisory using ICTs;

6. Increase the traceability, certification, verification and monitoring capability to improve food safety and quality, wildlife tracking and bio-safety, and reducing food waste;
7. Promote innovation in e-agriculture services;
8. Reduce the individual risks of agriculture sector stakeholders;
9. Improve the financing, investing and banking outreach to agriculture sector leveraging on electronic and mobile technologies;
10. Improve the existing framework of policies, legislations, regulations and guidelines critical for e-agriculture and ensure its effective implementation.

7.2 Feasibility of E-agriculture Vision and Outcomes

It is important that the vision and outcomes are actionable and can be realized through feasible solutions. These outcomes should realize the expected transformation that ICTs could bring about in the sector. The expected changes that ICT solutions (Table 7) should make to realize these outcomes and the vision and the feasibility of each solution were discussed. A monitoring and evaluation framework for these outcomes would help report on the progress.

7.3 Strategic Recommendations

In order to meet the expected outcomes of e-agriculture and realize the vision, the following strategic recommendations are important.

Recommendation 1: Increase the availability and accuracy of agricultural information by creating, updating, analyzing and linking critical databases:

- Develop technical guidelines and requisite institutional framework for interoperability, privacy and security of connected databases and network infrastructure;
- Creating and updating of various government and private databases is critical for e-agriculture services. It is also important to have the linkage and integration of databases, wherever feasible;
- Develop guidelines for sharing of data amongst governments, private sector and academia; and
- Align the e-agriculture services with the e-Government services as far as possible including utilization of the existing service platform for government linked e-agriculture services.

Recommendation 2: **Accessible, affordable and secure ICT platforms, networks and devices with enhanced sensing, hosting, analytical, identification, tracking and communicating features**:

- Ensure universal access to affordable broadband and low cost smartphones. Although, a number of services can also be launched over feature phones, the full potential of ICTs requires capability to share multimedia;
- A secure digital application platform for e-agriculture should be established (or used if existing) for delivery of services and sharing of information with government and non-government entities;
- Integration of databases with application platform and transactional capability is very important to unleash the growth of government and third party services;
- Make accurate information available in real time or near real time for the sector leveraging on smart sensing technologies and integration of required databases;
- Enhance the sensing capabilities of agriculture and associated services using modern technologies (e.g. satellite, drones, Internet of Things (IOTs)) and systematically integrate into database;
- Effective monitoring of agriculture sector using ICTs;
- Strengthening tracking and traceability framework nationwide;
- Need to harness the big data generated in the agriculture sector by deploying effective analytics systems and capabilities; and
- Strengthen the existing call centres capabilities in scope and quality

Recommendation 3: **Improve the awareness, education and skills of farmers, extension workers, livestock herders and other sector end-users by creating and disseminating credible agricultural knowledge remotely**:

- Bridging the skills and knowledge gap in the sector using e-learning and networking tools;
- Improving the confidence in use of extension and advisory services through enhanced online knowledge resources; and
- Facilitate education and better health in agriculture sector through ICT interventions;

Recommendation 4: **Reduce the demand-supply gap, and enhance outreach and profitability of Sri Lankan products and services through vibrant e-agriculture market places and efficient logistics**:

- Create tools for analyzing and linking nationwide demand and supply of agricultural produce;
- Develop an e-agriculture market place for sharing information on supply and demand, promoting e-agriculture product and advising on international trading norms and practices; and
- Promote e-services that can enhance the efficiency of logistics linked with transportation, storage, farm machinery etc. as well as workforce;

Recommendation 5: Improve the research capability, quality, credibility and reach of extension advisory using ICTs:

- Promote research and innovation through availability of information and enhance engagement leveraging on modern communication tools;
- Improve linkage between agriculture extensions and researchers and increase responsibility of agricultural advice; and
- Increase the efficiency of production, climate smart agriculture and diversity of crops

Recommendation 6: Promote innovation in e-agriculture services:

Given the emphasis of e-agriculture in Sri Lanka, a dedicated centre for such services could be considered. This centre can be hosted by the Department of agriculture and focus on

- Development of applications to deliver priority e-agriculture services;
- Development of the ecosystem for innovative e- agriculture services;
- Strengthen the call centre services and extend its scope to all e-agriculture services;
- Enhance the efficiency and sustainability of existing e-agriculture services;
- Develop a framework for service delivery by private sector using digital platform;
- Provide hosting for private sector application and services and serve as a one stop shop for e-agriculture services. The detailed scope, however, would need to be developed;
- The consumer protection framework and language remains a bottleneck for developing trust around use of ICTs in agriculture. It is recommended to build a consumer protection system in consultation with public and private sector entities involved in e-agriculture services; and
- Encourage universities and academia to strengthen research and capability to develop applications and services. Facilitate availability of timely data and platform for development and delivery of these services.

Recommendation 7: Reduce the individual risks of agriculture sector stakeholders

- Bridging the information gap and improving the efficiency of risk management tools and procedures using ICTs;
- Introduce new risk management services, while improving the efficiency of existing services, such as micro-insurance, government subsidy, others;
- Creating effective early warning systems and agricultural disaster alerts using mobile platforms

Recommendation 8: Improve the financing, investing and banking outreach to agriculture sector leveraging on electronic and mobile technologies:

- Ease availability of credit and loan through electronic and mobile credit verification systems; and

- Strengthen mobile payment and banking systems and enhance its uptake by agriculture sector stakeholders;

Recommendation 9 :Improve the existing framework of policies, legislations, regulations and guidelines critical for e-agriculture and ensure its effective implementation:

- Develop and strengthen the current policy, legislative and regulatory frameworks by identifying gaps, addressing them and creating guidelines;
- Proactively coordinate with policy makers and regulators of various sectors to create the appropriate enabling environment and ensure strategic alignment with other sectoral developments;
- Proactively coordinate with key stakeholders from Agriculture, Banking, Telecom, IT, Governance, Agromet, Insurance and donor agencies to enhance synergy; and
- Increase the transparency and awareness on policies and regulations;

8.0 National e-agriculture action plan

8.1 E-agriculture Action Plan

The E-agriculture action plan would enable the government to:

- Identify all components of e-agriculture expected outcomes, how they should be governed, funded, implemented and coordinated to ensure that results are achieved at a national, state and local level;
- Identify key stakeholders and engage with them effectively in designing, implementing and sustaining the activities; and
- Prioritize the activities in implementation phases to achieve tangible outcomes.

The FAO-ITU framework for development of action plan was adopted. The plan identified forty-nine outputs (e-agriculture solutions) in the context of Sri Lanka.

Source: FAO, ITU

Figure 6*: FAO-ITU framework for development of E-agriculture action plan*

8.2 Agriculture challenges and ICT solutions

The challenges of the agriculture sector (Section 4.2) were discussed by the expert group and possible solutions were identified. ICT does not have similar impact on all agriculture challenges and to gauge the impact of ICT solution on each challenge a detailed analysis was carried out taking into account solutions that must, should, could or would be developed. When reclassified on the basis of solutions, 48 independent ICT solutions were identified and briefly described (Table 7). Each of these could address one or more challenges and would have an impact on one or more than one e-agriculture outcome.

Table 7: List of identified solutions and their brief description

	Name of solution	Brief description
1	Integrated natural resource management information system	Information system that includes GIS data (incl. high resolution satellite image) and other information on land use / land cover / land degradation, Soil map/ land fertility, forest resource use, Geo portal and geo morphology, Irrigation and water management, Bio-diversity, invasive alien species, Disaster management, weather forecasting, fire history and forest preservation.
2	Social network amongst agriculture users	To create a network of agriculture sector stakeholders including (producers, marketers, extension workers, policy makers etc.) to distribute information (informal) and enhanced engagement.
3	Credible GAP content aggregation and packaging	Creation of agriculture content, which is packaged for various dissemination medium (video, audio, website, text) or could be repurposed for capacity building.
4	E-agriculture advisory services (with possible consumer protection)	Advisory services offered by extension workers, consultants, researchers in country or abroad through electronic media (phone, Internet, email, video chat), face to face meetings or paper reports. Recognizing that the lack of credibility may deter agriculturists to deploy good agricultural practices, credible advisory services with consumer protection can be created. These can be paid or reused and would complement availability of content in open mode. The dissemination can be through computers, telecom, Internet or broadcasting network.
5	Capacity development and education using ICT	Use of videos, audios, texts, brochures on good agricultural practices and their dissemination through web based, mobile based, print or broadcasting networks. Using multimedia tools to build skills and offer distance education. It also includes vocational and skill based courses.
6	Smart water management	Deployment of sensors, GIS maps to manage information around water and manage their smart utilization. Knowledge sharing, access to weather data online, geo-referenced (map) water source identification (ground water, river, etc.) and sub-surface moisture sensors.

7	E-market place for agriculture	Creation of e/m-market place, market information and scalable payment systems for national and international trade, promotion and awareness raising on use of e/m-services.
8	Logistics (storage and transport) information linking agriculture service providers and markets	Creation of database of storage and transportation service providers with information management, tracking and payment capability.
9	Certified higher yielding seeds/ planting/ breeding materials verification and traceability	Database with web interface (barcoded) to verify the authenticity of seeds.
10	Online Agriculture workforce information and services	Creation of an online workforce (skilled and non-skilled) requirement and availability information system.
11	Agromet data and services	Online availability of weather and other climate data, forecasting, and knowledge base.
12	Agriculture Early warning system	Early warning systems for agriculture stakeholders against disasters and hazards alert and response system, integration with disaster management.
13	Information on climate smart technologies and Climate resilient crops & breeds	Information, access to training on climate smart agricultural practices, and new technologies
14	GIS wildlife movement (e-wildlife surveillance), Area mapping of wildlife crop damage/prone, Online system for wildlife conflict management, wild life cyber tracking and alert	Traps, trackers, sensors with capability to inform on wildlife movement.
15	Online compensation for affected crop and livestock	Database of livestock with capability of remote verification and online compensation
16	Electronic Pest surveillance system	Pest online database with historic vector linked with crop lifecycle, climate data, video based verification, remote compensation and GIS maps. Pests and pest management online database, advisories and knowledge sharing
17	Online food quality and safety verification and bio-safety monitoring	Online monitoring of food quality and bio-safety

18	Online information on offseason crop production technology package	Information, access to training on offseason crop production.
19	Accessible information resources on government policies and guidelines	Information and access to government policies and guidelines.
20	Farm mechanization information and service	Creation of online machine and equipment information system linked with market machine availability and rentals.
21	Information on enabling environment and agri-business opportunities	Information on investment opportunities for entrepreneurs and international investors, buyers and suppliers.
22	Electronic banking and payment	Creation of banking facilities for all using electronic / mobile banking.
23	Credit rating and loan availability	Create a credit management system that makes credits available using simplified procedure and online verification. A credit rating mechanism can also be developed.
24	Linking research institutes with industry, extensions, producers and other stakeholders	linking research institutes with extensions, producers and agriculturists for anytime anywhere learning, certification or business etc.
25	Setting up / strengthening of IVR systems	A system to provide voice based services
26	Policy guidelines and support to agri insurance providing companies	Guidelines to enable micro-insurance, field database, disaster and compensation.
27	Monitoring of groups / cooperatives through online systems	Creation of database, linking of database, registration and monitoring processes.
28	E-agriculture extension monitoring	Creation of monitoring feedback and extension service request and complaint redressal.
29	Traceability and DNA coding of prioritized species	DNA bar coding of wildlife & plants and tracking at checkpoints.
30	Information on fertilizer history by land area	An application to provide history of fertilizer use in the land area.
31	Universal mobile broadband connectivity, deployment of low cost mobile phones, tablets	3G, 4G connectivity with tablets and broadband services.
32	Interoperable and secure e/m-agriculture applications platform with content	An integrated application platform interoperable with e-government services for E-agriculture service delivery.
33	Integrate e-agriculture services with G2C	Service integration of e-government and e-agriculture services including security, interoperability.

34	Remote video based surveillance	A solution to carry out remote video based information capture and remote surveillance.
35	ICT policy on data sharing, data classification, data formats, secure e-documents	Policy and guidelines on data formats, data classification, implementation.
36	E/M App for certification standard, compliance and traceability	Electronic /Mobile Applications for certification standard, compliance and traceability.
37	Monitoring of compliance to government policies, guidelines	Systems for monitoring of compliance to government policies, guidelines.
38	Database of approved chemicals, fertilizers	Database of approved chemicals, fertilizers.
39	Traceability of agro-chemical movement through value chain	Traceability of agro-chemical movement through value chain.
40	Climate change modeling	Estimating the impact of climactic parameters (change) on crop, fisheries and livestock productivity.
41	Commodity outlook modeling	Forecasting future demand and supply of specific commodity.
42	Data capture and analytical tool	Data capture and analytical tool to syndicate demand from farmers
43	Nutrition sensitive agriculture content	Information on linkage between food nutrition and health and promoting indigenous nutrition diets
44	Plant genetic resource database	Information on plant genetic resources at the Plant genetic resource centre
45	Global plan of action for plant genetic resources-information sharing mechanism	Information on conservation, utilization and capacity building on PGR in the country
46	Central database of research programmes and new technologies	Repository of research findings/abstracts and information on on-going research programs to find and analyses the present and past research titles/findings toward designing appropriate research for the benefit of farmers and the country.
47	Central database of agriculture statistics	Reliable data collection and updating mechanism with compliance to national data from census and statistic department.
48	Database for seed and planting material	Planning seed and planting material production public and private both to meet the farmers/country need, monitoring the progress of the production programs, forecasting the seed and planting material production, making awareness and access to the information on available seed and planting materiel stocks.

8.3 E-agriculture Action Plan

An E-agriculture action plan was developed for the period 2016-2020 through discussion with experts. The action plan for 2016-2020 (Table 8) is dynamic in nature and would need to be revisited at least annually based on the progress made, ICT developments and change in any top level priorities or goals.

The solutions were then prioritized taking into consideration the following factors (Figure 7):

1. Impact on meeting agriculture goals
2. Existing status of the solution
3. Dependency of other solutions on this solution
4. Feasibility of the solution

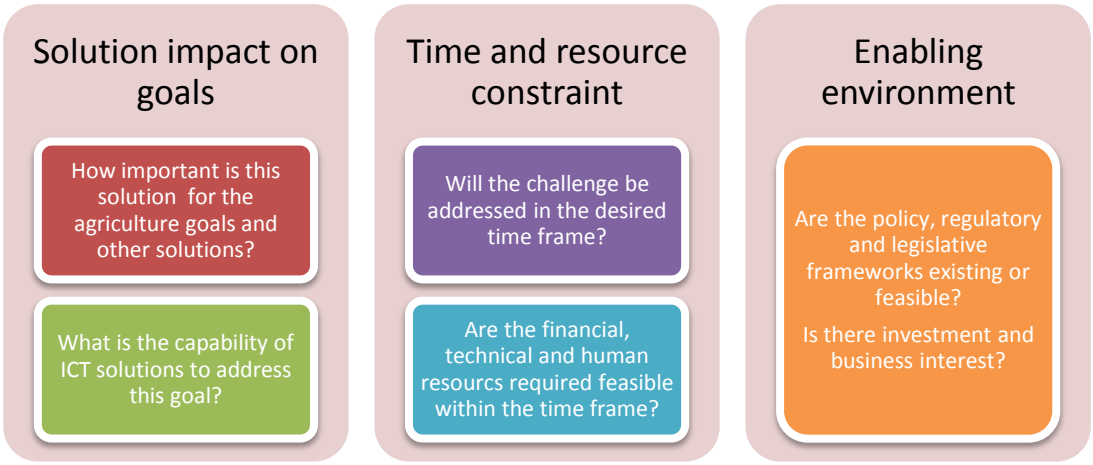


Figure 7: Criteria for prioritization of solutions

A rating of High (H), Medium (M) and Low (L) was provided by the expert group during the strategy development workshop based on the four criteria above. Applying these criteria, the expert group considered that 24 solutions MUST be implemented, 16 SHOULD be implemented, 5 WOULD be implemented and 3 COULD be implemented (Figure 8).

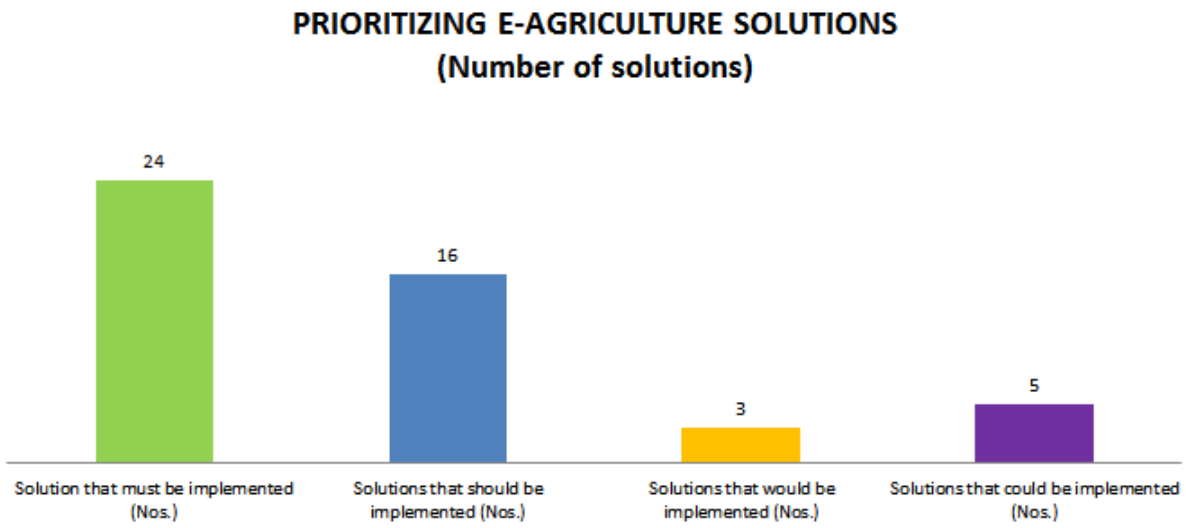


Figure 8: Prioritizing e-agriculture solutions in Sri Lanka

Table 8: E-AGRICULTURE ACTION PLAN FOR SRI LANKA (2016-2020)

	Name of e-agriculture solution	Impact	Exists	Dependency	Feasibility	MUST SHOULD WOULD COULD	2016	2017	2018	2019	2020
		High (H), Medium (M), Low (L)									
1	Integrated natural resource management information system	H	L	H	L	MUST					
2	Social network amongst agriculture users	M	H	H	H	MUST					
3	E-Agriculture advisory services (with possible consumer protection)	H	M	H	M	MUST					
4	Capacity development and education using ICT	H	L	H	M	MUST					
5	E-market place for agriculture	H	L	H	H	MUST					
6	Agromet data and services	H	M	H	M	MUST					
7	Accessible information resources on government policies and guidelines	H	H	H	H	MUST					
8	Electronic banking and payment	H	M	H	H	MUST					
9	Credit rating and loan availability	M	M	H	H	MUST					
10	Setting up / strengthening of IVR systems	H	H	M	H	MUST					
11	E-Agriculture extension monitoring	H	L	H	M	MUST					
12	Universal mobile broadband connectivity, deployment of low cost mobile phones, tablets	H	M	H	M	MUST					

13	Integrate e-Agriculture services with G2C	H	M	H	H	MUST					
14	ICT policy on data sharing, data classification, data formats, secure e-documents	H	L	H	H	MUST					
15	Database of approved chemicals, fertilizers	H	H	M	H	MUST					
16	Data capture and analytical tool	H	L	H	L	MUST					
17	Plant genetic resource database	M	H	M	H	MUST					
18	Global plan of action for plant genetic resources-information sharing mechanism	M	H	M	H	MUST					
19	Central database of research programme and new technologies	H	L	M	H	MUST					
20	Database for seed and planting material	H	M	H	H	MUST					
21	Interoperable and secure e/m-agriculture applications platform with content	H	L	H	M	MUST					
22	E/M App for certification standard, compliance and traceability	H	L	M	M	MUST					
23	Commodity outlook modeling	H	L	H	H	MUST					
24	Central database of agriculture statistics	H	M	H	H	MUST					
25	Credible GAP content aggregation and packaging	H	L	L	M	SHOULD					
26	Logistics (storage and transport) information linking agriculture service providers and markets	H	L	M	M	SHOULD					

27	Information on climate smart technologies and Climate resilient crops & breeds	M	L	H	M	SHOULD					
28	Farm mechanization information and service	H	L	L	M	SHOULD					
29	Information on enabling environment and agri-business opportunities	H	L	H	M	SHOULD					
30	Policy guidelines and support to agri insurance providing companies	H	L	L	H	SHOULD					
31	Nutrition sensitive agriculture content	H	L	M	M	SHOULD					
32	Agriculture Early warning system	H	L	H	M	SHOULD					
33	Online compensation for crop and livestock affected	H	L	L	M	SHOULD					
34	Electronic Pest surveillance system	H	L	M	M	SHOULD					
35	Online food quality and safety verification and bio-safety monitoring	H	L	M	M	SHOULD					
36	Linking research institutes with industry, extensions, producers and other stakeholders	H	M	H	M	SHOULD					
37	Remote video based surveillance	M	L	M	L	SHOULD					
38	Monitoring of compliance to government policies, guidelines	H	L	H	M	SHOULD					
39	Traceability of agro-chemical movement through value chain	H	L	M	L	SHOULD					
40	Climate change modeling	H	L	M	M	SHOULD					
41	Online information on offseason crop production technology package	M	M	L	H	WOULD					
42	Smart water management	H	L	M	L	WOULD					

43	Certified higher yielding seeds / planting/ breeding materials verification and traceability	M	L	M	M	WOULD					
44	GIS wildlife movement (e-wildlife surveillance), Area mapping of wildlife crop damage/prone, Online system for wildlife conflict management, wild life cyber tracking and alert	H	L	L	M	WOULD					
45	Information on fertilizer history by land area	M	L	M	M	WOULD					
46	Online Agriculture workforce information and services	M	L	L	L	COULD					
47	Monitoring of groups / cooperatives through online systems	M	L	L	M	COULD					
48	Traceability and DNA bar coding of prioritized species	L	L	M	M	COULD					

8.4 Phases of E-agriculture Action Plan

The action plan is divided into three phases as implementing 48 solutions simultaneously is challenging both in terms of resources and management. The phases are classified in biennium (2 year periods).
Phase 1: 2016-2017
Phase 2: 2018-2019
Phase 3: 2020 onwards

8.4.1 First phase (2016-2017)

The first phase focuses on strengthening existing services, the launch of high impact feasible services, preparing and linking databases, improving financing and risk mitigation solution, creating an enabling environment and the necessary guidelines for other solutions (Table 9).

Table 9: Solutions that will be started in 2016-2017 and completed by 2017

No.	Solution	Priority	Start	End
1	Social network amongst agriculture users	MUST	2016	2016
2	E-Agriculture advisory services (with possible consumer protection)	MUST	2016	2017
3	E-market place for agriculture	MUST	2016	2017
4	Agromet data and services	MUST	2016	2016
5	Accessible information resources on government policies and guidelines	MUST	2016	2016
6	Electronic banking and payment	MUST	2016	2017
7	Credit rating and loan availability	MUST	2016	2017
8	Setting up / strengthening of IVR systems	MUST	2016	2016
9	ICT policy on data sharing, data classification, data formats, secure e-documents	MUST	2016	2016
10	Database of approved chemicals, fertilizers	MUST	2016	2016
11	Plant genetic resource database	MUST	2016	2016
12	Global plan of action for plant genetic resources-information sharing mechanism	MUST	2016	2016
13	Central database of research programme and new technologies	MUST	2016	2017
14	Database for seed and planting material	MUST	2016	2016
15	Logistics (storage and transport) information linking agriculture service providers and markets	SHOULD	2016	2017
16	Information on climate smart technologies and Climate resilient crops & breeds	SHOULD	2016	2017
17	Farm mechanization information and service	SHOULD	2016	2017
18	Policy guidelines and support to agri insurance providing companies	SHOULD	2016	2017
19	Electronic Pest surveillance system	SHOULD	2017	2017
20	Climate change modeling	SHOULD	2017	2017
21	Online information on offseason crop production technology	WOULD	2016	2017

This phase also starts laying the foundation for solutions that would be ongoing in nature or are required for solution in phase two and three (Table 8). These include integrating natural resource management information, greater data capture and analysis systems, ensuring ubiquitous broadband ICT connectivity, development of application platforms, preparing content, developing agriculture early warning systems, and strengthening the monitoring and compliance mechanism etc. (Table 10)

Table 10: Activities that will be started in 2016 or 2017 and completed after 2017

	Solutions	Priority	Start	End
1	Integrated natural resource management information system	MUST	2016	2018
2	Capacity development and education using ICT	MUST	2016	Ongoing
3	E-Agriculture extension monitoring	MUST	2016	2018
4	Universal mobile broadband connectivity, deployment of low cost mobile phones, tablets	MUST	2016	2018
5	Integrate e-Agriculture services with G2C	MUST	2016	Ongoing
6	Data capture and analytical tool	MUST	2016	Ongoing
7	Interoperable and secure e/m-agriculture applications platform with content	MUST	2017	2019
8	E/M App for certification standard, compliance and traceability	MUST	2017	2018
9	Central database of agriculture statistics	MUST	2017	Ongoing
10	Credible GAP content aggregation and packaging	SHOULD	2016	Ongoing
11	Information on enabling environment and agri-business opportunities	SHOULD	2016	Ongoing
12	Nutrition sensitive agriculture content	SHOULD	2016	2018
13	Agriculture Early warning system	SHOULD	2017	2018
14	Online compensation for crop and livestock affected	SHOULD	2017	2019
15	Linking research institutes with industry, extensions, producers and other stakeholders	SHOULD	2017	2018
16	Monitoring of compliance to government policies, guidelines	SHOULD	2017	2019
17	Traceability of agro-chemical movement through value chain	SHOULD	2017	2018
18	Online Agriculture workforce information and services	COULD	2017	2018

8.4.2 Second phase (2018-2019)

By the start of second phase, there would be visible changes in the use of ICTs in agriculture in terms of linked databases, greater content available online, near universal connectivity, better interoperability of data and services, development of mobile platform and deployment of mobile applications, significant ease of operations in financing and risk management, enhanced information availability and clarity on policy implementations and guidelines.

The second phase is characterized by take up of mobile application services, rise in connectivity, greater integration of databases, launch of innovative services, improved traceability and certification services, improved capability to develop advanced e-agriculture services, greater awareness and knowledge base, and greater confidence in use of ICT for risk management and financing (Table 11).

Table 11: Activities that will be started in 2018 or 2019 and completed by 2019

		Priority	Start	End
1	Commodity outlook modeling	MUST	2018	2018
2	Certified higher yielding seeds / planting/ breeding materials verification and traceability	WOULD	2018	2019
3	GIS wildlife movement (e-wildlife surveillance), Area mapping of wildlife crop damage/prone, Online system for wildlife conflict management, wild life cyber tracking and alert	WOULD	2018	2019
4	Information on fertilizer history by land area	WOULD	2018	2018
5	Traceability and DNA bar coding of prioritized species	COULD	2018	2019

8.4.3 Third phase (2020 +)

By the start of third phase, the e-agriculture environment in Sri Lanka would be fully matured with most of the priority solutions in place. This phase entails continued efforts in capacity development and education, data analysis, traceability, smart water management, effective monitoring and enhanced video based services (Table 12).

Table 12**:** Activities that will continue after 2019

		Priority	Start	End
1	Capacity development and education using ICT	MUST	2016	Ongoing
2	Integrate e-Agriculture services with G2C	MUST	2016	Ongoing
3	Data capture and analytical tool	MUST	2016	Ongoing
4	Central database of agriculture statistics	MUST	2017	Ongoing
5	Credible GAP content aggregation and packaging	SHOULD	2016	Ongoing
6	Information on enabling environment and agri-business opportunities	SHOULD	2016	Ongoing
7	Online food quality and safety verification and bio-safety monitoring	SHOULD	2018	Ongoing
8	Remote video based surveillance	SHOULD	2018	Ongoing
9	Smart water management	WOULD	2019	Ongoing
10	Monitoring of groups / cooperatives through online systems	COULD	2020	Ongoing

9.0 Monitoring and Evaluation for E-agriculture Services

The e-agriculture monitoring framework includes monitoring of outcomes and solutions (outputs).

9.1 Monitoring of Outcome and Solutions

A detailed monitoring and evaluation (M&E) plan would need to be developed after adoption of the strategy for the expected outcomes (Section 7) and the action plan (Section 8) for each phase.

[i] Central Bank of Sri Lanka, 2015
[ii] The World Bank, June 2015
[iii] https://en.wikipedia.org/wiki/Sri_Lanka
[iv] Household income and expenditure survey – 2012/13, Department of Census and Statistics
[v] ITU Broadband Series, Sri Lanka 2012

References

1. Country overview Sri Lanka, 2013 GSMA Intelligence
2. ITU statistical market overview: Sri Lanka, GSR 12 (web report)
3. Broadband Strategies Toolkit, InfoDev 2011
4. Sri Lanka 2013 Review and Opportunities in 2014, Nielsen, 2013
5. Grameen Foundation's Community Knowledge Workers http://ckw.grameenfoundation.org/
6. http://news.xinhuanet.com/english/2015-08/02/c_134472388.htm,. accessed 5 August, 2015
7. FAO. 2011. Global food losses and food waste: extent, causes and prevention.
8. Esoko https://esoko.com/
9. e-Choupal https://www.echoupal.com/
10. http://www.e-agriculture.org/
11. Braun, P. & Islam, M.F. 2012. ICT-enabled knowledge brokering for farmers in coastal areas of Bangladesh Centre for Development Informatics (CDI), University of Manchester, UK
12. GSMA's Agricultural value-added services (Agri VAS): market opportunity and emerging business models report, https://gsmaintelligence.com/research/2015/02/market-size-and-opportunity-for-agricultural-value-added-services/478/
13. Success stories on information and communication technologies for Agriculture and rural development, http://www.fao.org/3/a-i4622e.pdf
14. Agriculture and Climate Risk Enterprise Ltd. (ACRE) http://www.syngentafoundation.org/index.cfm?pageID=562
15. Farmforce, http://www.farmforce.com/
16. Central Bank of Sri Lanka, 2015
17. The World Bank, June 2015
18. https://en.wikipedia.org/wiki/Sri_Lanka
19. Chapter on Agriculture in the Central Bank Report 2014
20. Household income and expenditure survey – 2012/13, Department of Census and Statistics
21. ITU Broadband Series, Sri Lanka 2012
22. Broadband Strategies Toolkit, InfoDev 2011
23. Country overview Sri Lanka, 2013 GSMA Intelligence