AGRICULTURE SECTOR MODERNIZATION PROJECT

Analytical and Policy Advisory Support, Research Report – No 05

Policy Research in the Area of Agricultural Production Relations

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04th February 2021

AGRICULTURE SECTOR MODERNIZATION PROJECT

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Table of Contents

List of Tables

List of Figures

Executive Summary

The Agriculture Sector Modernization Project (ASMP), funded by the World Bank's International Development Association (IDA), aims at increasing the agricultural productivity, improving market access and enhancing the value addition of smallholder farmers and agribusiness in the project area of Sri Lanka, making them more competitive, responsive to market demands, resilient and sustainable. Carrying out an in-depth policy analysis on agricultural production relations has been recognized by the ASMP as one of the key elements that need to be examined comprehensively to understand the context under which the agriculture modernization process proceeds.

The objectives of the policy research are directed towards in identifying knowledge gaps, policy and regulatory barriers, constraints and inconsistencies in the area of Agricultural Production Relations and to recommend adjustments, improvements, reforms and/or formulation of new policies for seed and planting materials, fertilizer (cash and material subsidy programs), other agricultural inputs (agro-chemicals), irrigation water allocation and management, mechanization, agriculture extension provisions in vegetables, fruits, other field crops, spice crops and livestock sub-sectors. This is to enhance productivity of those agriculture products and to make agriculture sector more competitive, responsive to the market demand, sustainable and resilient.

Multiple information collection procedures were employed to gather relevant information from selected key stakeholders through desk reviews, key informant consultations, opinion surveys, semi-structured interviews, focus group discussions, workshops, field surveys, crop budgeting and joint observation visits. The data/information gathered were coded and recorded in appropriate forms to facilitate qualitative and quantitative analysis on policy as such can be used effectively for the purpose of comparisons, predictions and interpretation in terms of, for example, the respective sectors, components in the supply chain.

This final report carries the identified knowledge gaps, barriers, constraints and inconsistencies in relevant policies and regulations that affect agricultural production relations of the smallholder farmers and agribusiness. In addition, the efficiency of resource allocation and use, the land use patterns and the effects of existing policies and policy changes on production of vegetables, fruits, OFCs including chillies, B-onion, potatoes, maize and soya bean, dairy and poultry are also reported. Suitable strategies that can be used to improve efficiency of resource use are identified under this policy research with estimation of the maximum level of expected production of above-mentioned agriculture products taking into account of possible seasonal effects.

Based on the aforesaid outcomes, suggestions and recommendations are made accordingly on required reforms, improvements, and adjustments for existing policies and regulations and formulation of new policies related to agricultural production relations while retaining conducive policies to increase factor productivity of above indicated agriculture products.

As a result, the authors believe, this will create a conducive environment to attract investments of both private and public sectors and make smallholder farmers and agribusinesses more competitive and sustainable.

Chapter 1

Introduction

1. Introduction

1.1. Preamble

Domestic demand for food in Sri Lanka is always on the rise mainly due to increasing human population with increased life expectancy, per capita GDP and its growth rate, per capita consumption of foods and reduction of poverty levels. Furthermore, necessity of export promotion and import substitution in local food production has been emphasized with the challenging fiscal landscape of the country experiencing heavy fiscal deficit and public debt.

Smallholder dominated agriculture sector in Sri Lanka is characterized by a non-plantation crop sector and a plantation crop sector. About 1.65 million smallholder farmers operate in less than 2 hectares per farm (on an average), but contribute to almost 80 percent of the total annual food production. Agriculture policies have encouraged import substitution of basic agriculture commodities in order to make the country self-sufficient in those items. Hence, the agriculture production structure has remained concentrated in the low value food crops but has neglected the domestic fruits and vegetable sectors despite growing domestic demand and potential for export growth.

Despite policy initiatives and considerable investments on external inputs and services of agriculture production during the last few decades, the performance of agriculture sector appears to be “below the expectations”. It is plagued with low productivity and unbalanced utilization of resources. The present external input supply and service-providing systems are often described as “ineffective” owing to their weak relationships with end users, mainly the smallholder farmers and agribusinesses. Private sector participation in the supply chain of agriculture sector remains inadequate, especially in the non-plantation crop sector.

The returns to self-employed farm labor and wages of employed farm workers, however, have been increased with the increase in domestic food price and the increase of the international price of export commodities. There is a risk that these income gains may not be sustainable if agriculture productivity does not improve and the sector does not start to modernize through diversification, commercialization and value addition. Lucrative domestic and international markets are available and emerging for quality agriculture products, which can be produced sustainably by the Sri Lankan Smallholder Agriculture Sector.

Sector modernization, value chain development, agriculture diversification, strengthening agricultural production relations in supply chain, undertaking agriculture as a business joining with the private sector are essential for smallholders to cater to the markets on a competitive manner. In light of these, strengthening of agricultural production relations is of paramount importance for quality agricultural production, agriculture diversification especially of marginal paddy lands for commercially important crops, sector modernization, value chain and supply chain development and making reasonable profits by involved stakeholders through productivity enhancements and commercialization.

The ASMP, aims at increasing the agricultural productivity, improving market access and enhancing the value addition of smallholder farmers and agribusiness in the project area. Analysis of Agricultural Policy Environment for Agricultural Production Relations has been considered as one of the key elements that need to be examined comprehensively to understand the context under which the agriculture modernization process proceeds.

Accordingly, the ASMP of the Ministry of Agriculture (MOA) has decided to contract a suitable organization to carry out the policy study.

Following a competitive bidding process, MG Consultant (Pvt.) Ltd has been contracted to undertake the assignment. This document is the Final Report for the policy study on Agricultural Production Relations and responds specifically to the given Terms of Reference (TOR) and Procurement Plan Reference No. LK-MOA-PMU-31823-CS-QCBS.

It builds on Technical Proposal by:

- Considering the perspective of the ASMP expressed through interaction with senior management and review of project documents.
- Operationalization of scope, focus, main issues, methodologies and tasks specified in the TOR
- Elaborating the methodology for sampling and information collection
- Identifying the documents and other sources of information for use in the study
- Developing a detail timeline for desk reviews, field surveys, consultant deployment etc

1.2. Objectives of the Study

The objectives of this policy analysis are set out in the Technical Proposal submitted according to the TOR provided by the PMU of the ASMP.

These objectives encapsulate TWO strands, in particular:

- How relevant are the existing overarching agricultural policies and regulations to improve agricultural production relations of smallholder farmers and agri-businesses? and

- What are the policy and regulatory reforms, improvements, adjustments and formulation of new policies needed for new ways of promoting modern agriculture, in particular, those to improve agricultural production relations?

1.2.1. General Objective

To carry out in depth policy research in the area of Agricultural Production Relations, in order to identify knowledge gaps, policy and regulatory inconsistencies, barriers and constraints and to recommend reforms, improvements, adjustments and new policies needed to improve agricultural production relations to make smallholder farmers and agribusinesses more competitive, responsive to the market demand, sustainable and resilient.

1.2.2. Specific Objectives

This study is carried out with several specific objectives, including:

1. Estimation of efficiency of resource allocation.
2. Evaluation of effects of policies and policy changes on production of Vegetables, Fruits, Chillies, B-onion, Potatoes, Maize, Soya bean, Cinnamon, Sugarcane, Dairy and Poultry.
3. Estimation of maximum level of expected productions of selected vegetables, Chillies, B-onion, Potatoes, Maize and Soya bean taking into account on possible seasonal effects.
4. Assessment of household level profitability by preparing crop budgets on Selected vegetables, Fruits, Chillies, B-onion, Potatoes, Maize and Soya bean.
5. Detection of land use pattern in the project area.
6. Identification of suitable strategies that can be used to improve efficiency of resource use.
7. Reviewing and understanding the extent of effectiveness of existing agricultural production relations including private sector participation in agriculture sector supply chain.
8. Identify major policy /regulatory changes that affected agricultural production relations and suggestions/ recommendations for policy /regulatory improvements, adjustments, reforms or new policies to strengthen agricultural production relations with details of the responsible authorities to undertake changes.
9. Recommend appropriate policy instruments that the government could use to implement the proposed policy changes to improve agriculture sector competitiveness and sustainability.
10. Identify the implementing authorities (relevant Ministries, Departments or other organizations) and the procedure to be followed, in order to make policy changes /policy formulation a reality
11. Present the result /progress of the research at policy conference that is to be organized by the ASMP

1.3. Tasks of the Assignment (as per the TOR)

The tasks of the assignment as per the agreed Terms of Reference are as follows;

1) Undertake a meta-analysis and provide an account on the efficiency of resource allocation in different agricultural sub-sectors and the strategies that can be adopted to improve efficiency of resource use.

2) Evaluate the effects of seed policy, other agricultural input policy (agro-chemicals), Fertilizer policy (with special emphasis on the cash subsidy program), mechanization policy and Irrigation water allocation policy on technical and resource allocation efficiencies of different agricultural sub-sectors and to identify new strategies that can be adopted to improve efficiency of resource use.

3) Estimate the profitability of farm households with the crop budgets of major agriculture commodities namely Maize, Chili, Potato, Soya bean, B –Onion in Sri Lanka vis-a vis the regional countries (India, Pakistan, Bangladesh. Thailand &Vietnam)

4) Analyze the land utilization pattern of the above crops in Sri Lanka in the recent past and estimate the maximum level of expected production with the seasonal effects.

5) Identify major policy /regulatory changes that affected Agricultural Production Relationships and suggestions /recommendations for policy/regulatory changes to improve Production Relationships with the details of the responsible authorities to undertake changes.

6) Recommend appropriate policy instruments that the Government could be used to implement the proposed policy changes to improve agriculture sector competitiveness & sustainability, identify the implementing authorities (Relevant Ministries, Departments or other Organization) and the procedure to be followed, in order to make policy changes /policy formulation a reality.

7) Present the preliminary results of the research at the policy conference, is to be organized by the ASMP.

1.4. Key Outputs

Some of the key outputs that this research study is supposed to come up with are stated below:

1. A report on efficiency of resource allocation and use in selected Vegetables, and field crops

2. Report on review and analysis of policies of Seed and Planting Materials, Fertilizer (cash and material subsidy programs), Other Agricultural Inputs (Agro-chemicals), Irrigation Water Allocation, Mechanization and Agriculture Extension Provision in Rice, Fruits, Vegetables and Livestock Sub-Sectors.

3. Estimates of Farm Household profitability related to Chillies, B-onion, Potatoes, Maize, Soya bean, sub sectors in Sri Lanka.

4. Report on assessment of the land utilization pattern of Chillies, B-onion, Potatoes, Maize, Soya bean, sub sectors in the recent past and estimation of the maximum level of expected productions considering the seasonal effects.

5. Final report with recommendations on required policy and regulatory changes, policy instruments and implementation procedures.

Chapter 2

Conceptual Framework and Research Methodology

1. Conceptual Framework and Research Methodology

1.1. Research Approach

The research approach included the following:

- Review of policies and regulatory frameworks adopted from 1970 onwards on the agricultural production relations in connection with production of vegetables, fruits, other field crops, spice crops and livestock production including poultry sub-sectors in Sri Lanka.

- Evaluation and estimation of the effects of those policies and regulations on agriculture production relations, conducting gap analysis, analysis of policy vs. regulatory inconsistencies, and analysis of efficiency of allocation and use of physical, financial and human resources in those agricultural sub-sectors

- Identification of land use pattern and estimation of farm household level profitability of major agricultural commodities (B-onion, chilli, maize, soya bean, potato, cinnamon, sugar cane, dairy and poultry), including expected levels of maximum production considering seasonal effects in the project area.

It targeted basically to investigate the ways and means of increasing productivity and efficiency in physical, financial and human resource allocation and use for agricultural production and processing of the physical products aiming at 'Food Security', on one hand, and product diversification and market orientation to augment 'Food Quality' through an improved policy environment for agricultural production relations, on the other. The possibility of using several policy instruments starting from "more facilitative" instruments such as supply of quality guaranteed inputs, information, extension, capacity development through better financing (i.e. credits and subsidies), provision of other services and moving towards "regulatory" instruments such as mandating the standards and certifications etc. was focused.

The following approaches were used to collect necessary information/data to facilitate a complete analysis on policy:

- Obtain specific directions from the 'Project Coordination Committee' of the MOA and the Project Director, Policy Specialist and other relevant officials of the PMU of the ASMP in MOA.
- Review of historical and current agricultural policies with the mission to comprehend why these policies/regulatory functions in the areas of agricultural production relations failed to achieve the desired goals.
- Identify the major policy/regulatory changes that affected agricultural production relations.
- Review effectiveness of present agricultural production relations in supply chain of the agriculture sector in Sri Lanka.
- Provide an account of the policy and regulatory barriers, constraints and inconsistencies faced by various actors along the supply chains with special reference to those that inhibit the effectiveness of agricultural production relations.
- Conduct field surveys to collect some of necessary primary data for this research study.
- Prepare crop and livestock budgets of selected agriculture products indicated above in this document
- Detect land use pattern of the Project area

- Identify procedures available and the revisions required to encourage private sector investments in supply chains of the agriculture sector.
- Propose amendments and/or making suggestions/recommendations for policy/regulatory improvements, adjustments, reforms and/or formulation of new policies to the regulatory framework in Sri Lanka with details of responsible authorities to undertake necessary modifications.
- Recommend appropriate policy instruments that the government could use to implement the proposed policy changes to improve agriculture sector competitiveness, responsiveness to market demands and sustainability.
- Identify the implementing authorities (relevant Ministries, Departments or other organizations) and the procedure to be followed in order to make policy changes/policy formulation a reality.
- Present the results / progress of the research at the policy conference that is to be organized by the ASMP.

1.2. Research Methods and Design

2.2.1. Sources of Data and Data Collection Plan

Multiple information collection procedures were adopted to gather relevant information from MOA, PCC and PMU of the ASMP of MOA, MONP and EA, MOF, MOIT, CARP, CBSL, DOA, DAPH,.DEA., Agriculture Research Institutions, Academic Staff of Faculties of Agriculture, EDB, ICTA, Chamber of Commerce and other relevant national level public sector institutions, NLDB, PMOAs, PPMUs, PPCCs, PDOAs, PDAPHs and regional Chamber of Commerce in relevant Provincial Councils, leading private sector institutions actively involved in agriculture supply chain, other stakeholders of the agriculture chain including logistics and input suppliers, service providers, importers, smallholder farmers and their farmer groups and farmer organizations in the project area.

Desk reviews, Key Informant Consultations, Opinion surveys and semi-structured interviews, Focus Group Discussions (FGDs), workshops and field surveys, etc., were used for the purpose of gathering the data and first-hand information required for this policy analysis. The key areas covering the process of collection of data/information were characterized by:

- Review of national policies pertaining to agricultural production relations available in relevant ministries, treasury, research organizations, departments and other institutions to obtain insights into the present policy framework, policy inconsistencies and policy conflicts.

- Meet with the stakeholders, including growers and private sector organizations, agriculture researchers and key extension officials both at national and provincial level to facilitate the receipt of data on discrepancies and constraints faced by them that contribute to weaknesses in present agricultural production relations.

- Review imported agricultural inputs during the last five years and identify their behavioural trends.

- Review the present agricultural production relation networks and available facilities within the public and private sector organizations and the demand for such faculties from the intended target groups for wide scale usage as such would reveal the knowledge gap existing with both parties, i.e. input suppliers, service providers and end-users, and

relevance of these agricultural production relations to address the current weaknesses of the same.

- Meet with key officials involved in policy formulation and implementation on Agricultural Production Relations, i.e. Ministry of Agriculture, Department of Agriculture, Department of Animal Production and Health, National Livestock Development Board, Department of Export Agriculture, Agricultural Research Institutions, National Universities, Agriculture regulatory institutions (e.g. Quarantine Divisions, Registrar of Pesticide of the DOA, Veterinary Drug Control Authority and Registrar of Animal Feeds in DAPH) and other relevant institutions.

2.2.2. Data Collection and Data Collection Methods

2.2.2.1. Desk Reviews

A comprehensive desk review program was conducted to study the available policy documents and regulatory measures related with agricultural production relations in agriculture sector. Existing policy documents, regulatory functions related Acts and Ordinances, draft National Agricultural Policy, Annual Research Reports, research and extension annual proceedings, sectoral papers, progress reports and publications in related agriculture research institutions and authorities, customs, quarantine stations, other regulatory bodies and any other documents that influence (stimulate or constrain) private sector participation in supply chain activities of the agriculture sector particularly for commercial oriented agriculture and agribusinesses were the reading materials of this exercise. The available policy frameworks adopted in regional countries such as India, Pakistan, Bangladesh, Thailand & Vietnam were also reviewed as a comparison. Supporting information were browsed from web site and internet for this endeavor. See Annexure 1 for all the policies and policy-related documents reviewed for the purpose of meta-analysis.

Special attention was given to documents on the following subjects under the desk review:

- ASMP Project Appraisal Documents of the World Bank (Ref No: PAD 1790), TOR & RFP documents of the ASMP issued for this assignment.
- Existing policies and regulatory functions related to agricultural production relations.
- Evaluation reports of major agricultural development projects implemented in Sri Lanka with components in agricultural production relations.
- Evolutionary process of agriculture development in Sri Lanka changing emphasise from production increase, to productivity enhancement then for mechanization, value addition and market-oriented production systems.

2.2.2.2. Consultations and Opinion Surveys

Specific directions for this policy research were obtained by consulting the Project Director, Deputy Project Director, Policy Specialist and other relevant specialists in the PMU of the ASMP in MOA. Opinion survey was carried out in consulting with Secretaries, Head of the Institutions and other senior

officers of relevant public sector institutions. Minutes of each consulting meeting were recorded for research and recording purposes.

2.2.2.3 Consultative Workshop

Lengthy discussions are of paramount importance to collect adequate information from above indicated public and private sector institutions. Upon our invitation through the Ministry, most of the Heads of Institutions or their representatives participated at a consultative workshop, which was held on 29th March 2019 at Hector Kobbekaduwa Agrarian Research and Training Institute, to involve with this exercise more deeply (Figure 2.1). Institution-specific semi-structured questionnaires were used to collect information from these officers. Completed questionnaires were used for research and recording purposes. The list of participants at the workshop is given in the Annexure 2.

Figure 2.1. Consultative workshop held on 29th March 2019 at HARTI, Colombo

2.2.2.4 Focus Group Discussions

Large number of stakeholders playing different but unique role are actively involved in agriculture supply chain and value chain in the project area. A group of participants from key supply chain and value chain points such as production, processing, trading and agricultural marketing, input and logistic supply, service providing etc. was selected to ensure reasonable stakeholder coverage for data collection judiciously. Brainstorming sessions in the form of group discussions were held with all these selected stakeholder groups separately (Figure 2.2) by using problem census, problem analysis and problem-solving tools introduced by the World Bank for the Second Agriculture Extension Project in Sri Lanka.

Figure 2.2. Focus group discussions

2.2.2.5 Field Survey

Grass root level researching and field verifications are extremely essential to recommend meaningful policy interventions and regulatory measures for improving agricultural production relations effectively on a sustainable manner. Therefore, a smallholder farmer survey was conducted on 650 farms allocating a minimum of 50 farms for each district in the project area. The Study Population was defined as the farmers involved with cultivation of at least one of the six crop types of interest in this study, including Maize, Soya bean, Potato, B-Onion, Chilli, Cinnamon, Sugarcane, Dairy and Poultry within the 11 districts of interest from 5 provinces in Sri Lanka (i.e. Jaffna, Mullaitivu, Kilinochchi and Vavunia in the Northern province; Anuradhapura and Polonnaruwa in the North-Central province; Monaragala and Badulla in the Uva province; Batticaloa and Ampara in the Eastern province, and Matale in the Central province). Subsequently, two additional Districts, Gampaha and Kurunegala, were also included to the study as requested by the Project office thus making the total number of Districts 13 from 7 Provinces (Figure 2.3.). Given the fact that most of these crops and livestock, except for Potato, are cultivated in almost of all these districts at various scales (i.e. large to small-scale), the Primary Sampling Unit was considered as the '*Grama Niladhari Division*' (GND), while the Secondary Sampling Unit was a 'Farm Field'.

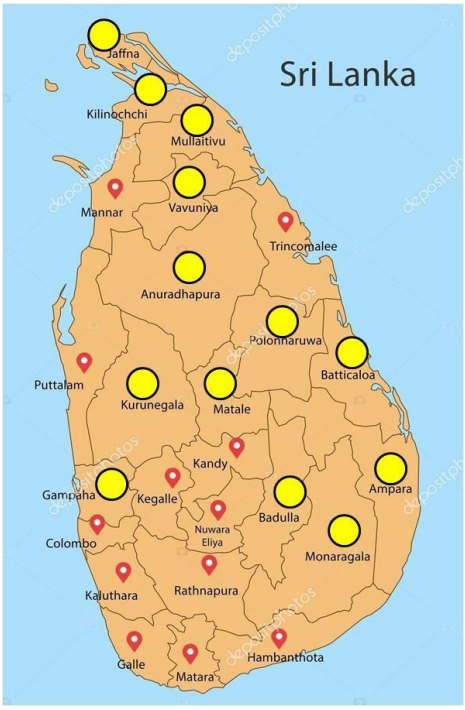


Figure 2.3. The Districts covered in the smallholder farmer survey

This survey was conducted by well-trained enumerators using pre-tested, structured questionnaire. Wherever possible, the research team also took part in the survey to get the first-hand information (Figure 2.4). Purposive sampling technique was used to select farmers for this survey. Duly completed survey questionnaires were used for research and record keeping purposes.

Figure 2.4. Smallholder farmer survey

2.2.2.6 Land Use Pattern

An assessment of land utilization pattern of Maize, Soya bean, Potato, B-onion, fruits, vegetables cinnamon, sugarcane cultivations and dairy & poultry units in the project area in recent past and estimation of the maximum level of expected productions with the seasonal effects was done. Mapping of the land utilization of Maize, Soya bean, Potato, B-onion, Chill, fruits, vegetables cinnamon, sugarcane cultivations and dairy and poultry units with time series and trend analysis on these commodities was carried out.

2.2.2.7 Estimation of Crop and Livestock Budgets

Quantitative analysis of data to estimate the profitability of farm households with crop and livestock budgets of Maize, Soya bean, Potato, B-onion, Chill, fruits, vegetables, cinnamon and sugarcane cultivations and budgets of dairy & poultry units in Sri Lanka vis-a-vis the regional countries (India, Pakistan, Bangladesh, Thailand &Vietnam) was carried out. Assessment of present budgets of agricultural products listed above and detection of their production potential by paying due attention to seasonal effects are of paramount to estimate efficiency of resource allocation and to identify suitable strategies that can be used to improve efficiency of resource use. Therefore, crop budgeting exercise was carried out in parallel with the information collection from field surveys.

2.2.2.8. Joint Observation Visits

All experts involve with this policy research made joint observation field and site visits to verify information receiving from various sources explained above, and also to get first-hand information from various key players involved in supply chain activities and verify practicality of final recommendations of this study. A joint report was prepared by participating experts at the end of each such visit for research and recording purposes.

2.2.2.9. Farmer Survey: Sources of Data and Data Collection Methods

The noticeable drop in the agriculture sector productivity could be recovered if technological techniques could be employed in the fields. Farmers have diversified perceptions on adapting new technologies to

pursue their livelihood. In-order to acquire the necessary information to study the field verifications that need to be established, by implementing meaningful policy interventions and regulatory measures, the research focused on a sample of 650 farmers from eight provinces in Sri Lanka including 13 districts (Northern Province- Jaffna, Vavuniya, Kilinochchi, Mullaitivu; North-Central- Anuradhapura, Polonnaruwa; Central- Matale; Eastern- Ampara, Batticaloa; North-Western- Kurunegala; Western- Gampaha; Sabaragamuwa- Kegalle and Uva Provinces- Badulla, Monaragala).

Face to face interviews were conducted followed by field inspections and semi structured questionnaires were used at the interviews to explore the farmer perceptions and attitudes on quality attributes, barriers and key instruments of technology adoption. Given the 'multi strata' nature of the sample it was suggested to use the 'Stratified Random Sampling' to extract a sample yet as resources were limited and aiming to facilitate the identification and selection of 'information-rich cases' 'Purposive Sampling' ; a non-probability sampling technique, was employed instead of the original suggestion. Purposive Sampling technique is 'statistically valid', because there is no need to "generalize" the findings, as this a sector-specific study. Prior to addressing the sample as a whole, pilot visits were made to assure the stability of the source of information and to secure the accuracy and reliability of the outcome of the study (Figure 2.5).

Figure 2.5. Data Sources and Data Collection though a Farmer Survey

2.3. Data Analysis

To obtain the required information a semi structured questionnaire was prepared. The questionnaire consisted of fields related to the general information of the farmers such as the demographic factors namely, age, educational level, farm size, gender, and years of experience of the farmers, etc.

However, most importantly it contained a total of 102 statements aiming to assess the farmer perceptions on technology adoption based on the following aspects,

- Quality attributes,
  - Crop Produce- 14 statements
  - Livestock Produce – 12 statements
- Barriers/Constraints/Problems on Production and Quality Management- 41 statements
- Key Policy Instruments – 25 statements

Each of the above aspects were subjected to Factor Analysis based on the scores obtained by each statement. Then they were classified into several categories as supported by literature.

- Quality Attributes
- Barriers/Constraints/Problems on Production and Quality Management
  a. Technical feasibility (TF)
  b. Economic feasibility (EF)
  c. Social, cultural and ethical acceptability (SE)
  d. Infrastructure compatibility (IC)
  e. Human Resources (HR)
  f. Institutional and Government Acceptance (IG)
  g. Environmentally sound (ES)

- Key Policy Instruments
  a. Product Related Policies
  b. External Services Related Policies
  c. Price Policies
  d. Agrochemical Related Policies

For each statement under each category and sub category, the farmers were supposed to give a value against a 10-point Likert Scale (Figure 2.6) where 0 indicates the idea conveyed through the statement is 'unimportant' and 10 indicates it is 'extremely important' as per the perspective of the farmer. The value 5 expressed neither important nor unimportant attitude towards the idea implied by the statement. All 102 statements were to be evaluated in the given scheme in order to identify the farmer perception on technology adoption.

0	1	2	3	4	5	6	7	8	9	10
EXTREAMLY POOR	VERY POOR	SOMEWHAT POOR	LITTLE POOR	SLIGHTLY POOR	SAME AS EFT	SLIGHTLY GOOD	LITTLE GOOD	SOMEWHAT GOOD	VERY GOOD	EXTREAMLY GOOD
81 – 100%	61 – 80%	41 – 60%	21-40%	0 – 20%		0 – 20%	21 – 40%	41 – 60%	61 – 80%	81 – 100%

Figure 2.6. Ten-Point Likert Scale

The Mean Score (Mean Score = Total for each statement as marked by all the farmers / 650) for each statement was calculated, then for each sub category an aggregated mean score was obtained. As implied by the 'relative rank' method after deriving the mean scores and aggregate mean scores given by the respondents as per the value of each statement after the process, they were ranked and ordered based on the importance as the most and least prioritized adopting strategies for strengthening agricultural production relations.

Chapter 3

Outcome of the Farmer Survey

3. Outcome of the Farmer Survey

3.1. Descriptive Statistics of the Sample

Farmer perceptions were analyzed for the further continuation of the project and the study was carried out in several agricultural districts of Sri Lanka. The sample of the study consists of both male and female farmers who engage in a variety of segments in farming.

Given below are the districts from where the farmers were selected for the study. Since both male and female farmers are engaged in the farming activities the actual numbers and proportions are verified as the table and the figure depict. Further the crops they grow and involvement in livestock farming are also analyzed in detail based on the district they come from. In addition, various demographic aspects as well as economic and socio-cultural parameters were subjected to research in order to present a well-versed descriptive analysis of the sample. Therefore, a careful observation of the entailing tables and graphs will demonstrate the accurate picture of the sample picked to pursue the project.

Table 3.1. Gender of the Farmers in Each District

District	Male	Female
Kurunegala	53	7
Mullaitivu	19	1
Kilinochchi	31	4
Polonnaruwa	48	12
Badulla	45	15
Baticaloa	40	10
Anuradhapura	26	44
Matale	19	71
Gampaha	31	4
Jaffna	38	2
Vavuniya	21	9
Ampara	38	12
Moneragala	40	-
Kegalle	7	3
Total	**456**	**194**

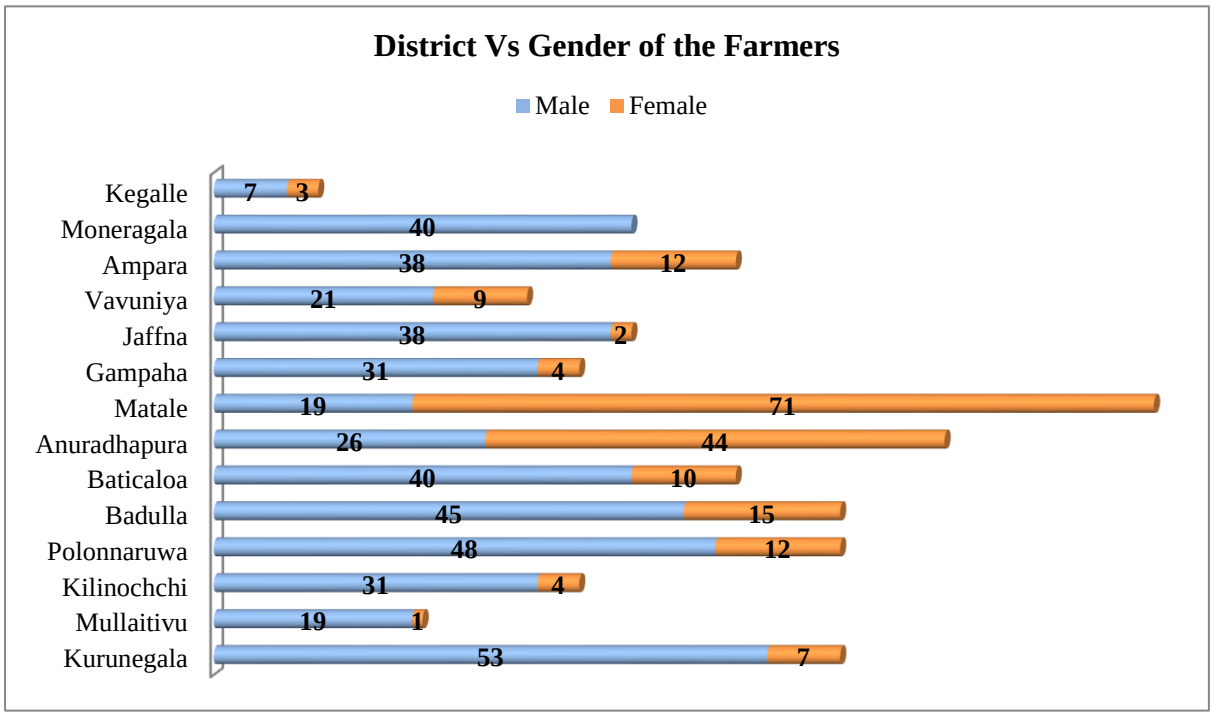


Figure 3.1. Gender of the Farmers in Each District

As indicated in Table 3.1 and Figure 3.1, the total sample consists of 650 farmers in which the larger portion is males whereas in some specific areas such as Monaragala, Jaffna, and Mullaitivu the number of females involved in farming is either negligible or zero. However highest number of farmers come from Matale and the number specifically stands out due to the large proportion of women involvement in comparison to the other districts. Matale the female farmers make a total of 71. The second largest group of farmers are from Anuradhapura where the number of female farmers is 44 and it is second in amount to Matale.

A deeper focus into the demographics of the farmers, district wise explains the education levels, age-groups, household sizes, farming experience, etc. of the farmers who have been used as the sample of the study. These attributes were identified to have a clear image of the sample so that it becomes easier to check the tendency of adoption to new technologies as proposed by the project.

Drawing the attention to the household sizes of the farmers of the sample, the Table 3.2 given below gives a detailed description about each district. The family sizes were categorized into basic four groups based on the possible number of members that could be in an average family. The details were obtained from each one of the farmers in the sample. In addition to the table, to give a more vivid and elaborative picture of the family sizes the graph is presented. The graphics aim at explaining the nature of the families in each district and gives the total of families under each category.

Table 3.2: Household Sizes

District	2-3 members	4-5 members	6-7 members	Above 7 members
Kurunegala (Ku)	12	40	6	2
Mullaitivu (Mu)	7	9	3	1
Kilinochchi (Ki)	6	27	-	2
Polonnaruwa (Po)	20	32	7	1
Badulla (Ba)	26	30	3	1
Baticaloa (Bt)	25	23	2	-
Anuradhapura (An)	29	37	2	2
Matale (Ma)	36	46	7	1
Gampaha (Ga)	11	21	3	-
Jaffna (Ja)	15	21	3	1
Vavuniya (Va)	13	14	1	2
Ampara (Am)	7	31	8	4
Moneragala (Mo)	17	15	7	1
Kegalle (Ke)	5	5	-	-
Total	***229***	***351***	***52***	***18***

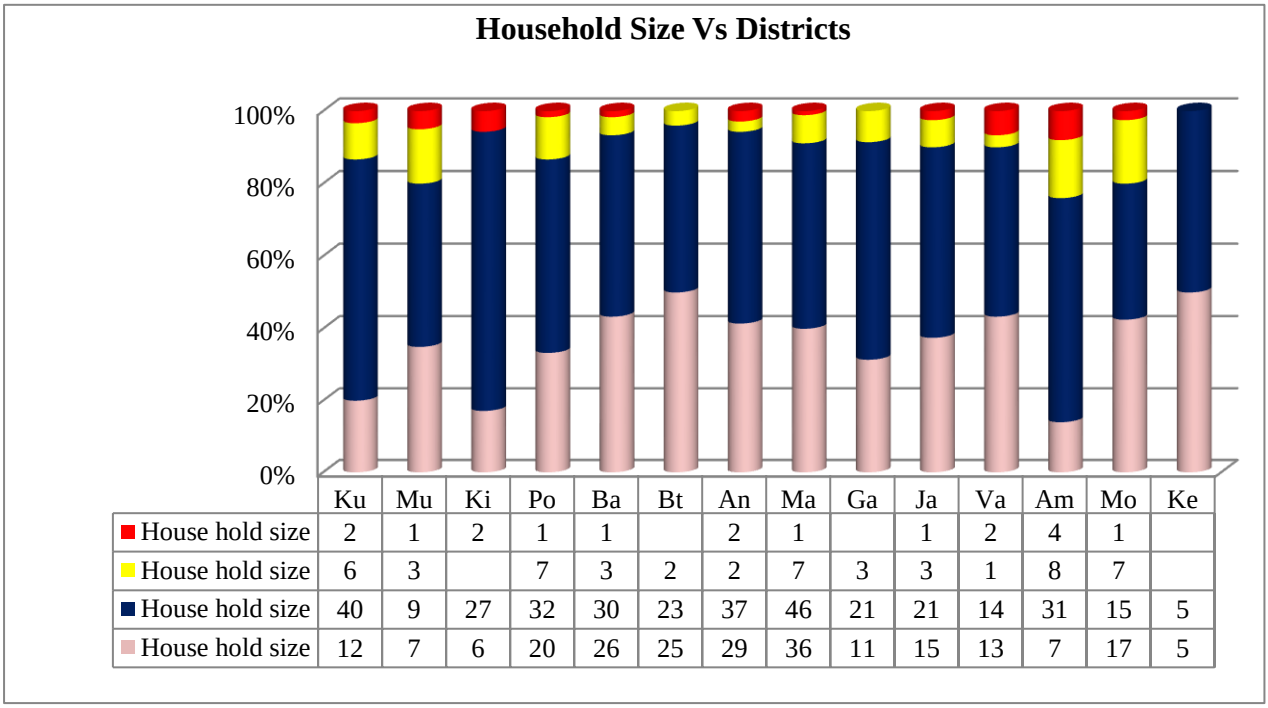


Figure 3.2: Household Sizes

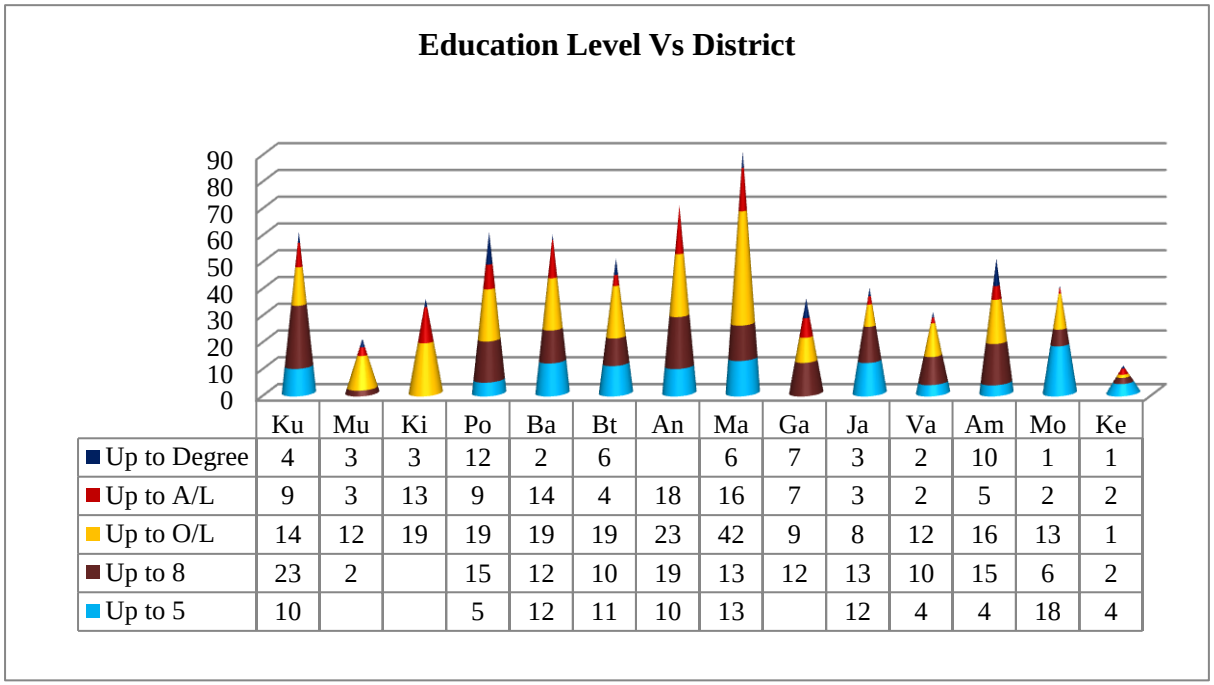
Based on the sample selected, the household sizes vary in between a very limited range. Most families in the sample have 4 to 5 members and such families make a number between 40 to 46. Secondly 26 to 36 number of families have 2 to 3 members in a household. A moderate number of families comprise

of 6 to 7 members and the least number of members are from families which have above 7 members. In some districts these kinds of families were not even found in the sample (Table 3.2 and Figure 3.2).

The next parameter of interest is the level of education of the farmers which could possibly have a direct impact on adoption of new technologies (Table 3.3 and Figure 3.3.

Table 3.3: Education Level of the Farmers

District	Up to 5	Up to 8	Up to O/L	Up to A/L	Up to Degree
Kurunegala (Ku)	10	23	14	9	4
Mullaitivu (Mu)	-	2	12	3	3
Kilinochchi (Ki)	-	-	19	13	3
Polonnaruwa (Po)	5	15	19	9	12
Badulla (Ba)	12	12	19	14	2
Baticaloa (Bt)	11	10	19	4	6
Anuradhapura (An)	10	19	23	18	-
Matale (Ma)	13	13	42	16	6
Gampaha (Ga)	-	12	9	7	7
Jaffna (Ja)	12	13	8	3	3
Vavuniya (Va)	4	10	12	2	2
Ampara (Am)	4	15	16	5	10
Moneragala (Mo)	18	6	13	2	1
Kegalle (Ke)	4	2	1	2	1
Total	**103**	**152**	**226**	**107**	**60**



	Ku	Mu	Ki	Po	Ba	Bt	An	Ma	Ga	Ja	Va	Am	Mo	Ke
Up to Degree	4	3	3	12	2	6		6	7	3	2	10	1	1
Up to A/L	9	3	13	9	14	4	18	16	7	3	2	5	2	2
Up to O/L	14	12	19	19	19	19	23	42	9	8	12	16	13	1
Up to 8	23	2		15	12	10	19	13	12	13	10	15	6	2
Up to 5	10			5	12	11	10	13		12	4	4	18	4

Figure 3.3: Education Level of Farmers

From a total of 650 farmers altogether from 14 districts, 226 have completed GCE Ordinary Level Examination. The second highest number is 152 farmers and they have reached to an education level of "Up to grade 8". Going beyond the traditional level of education of a common farmer some have actually completed the GCE Advanced Level Examination and among these 650 farmers 60 of them have acquired a degree as the highest level of education.
Many of these degree holders are from Ampara and Polonnaruwa. Knowing the education level of the farmers is a vital factor to be learnt, prior to exposing them to new technologies for the purpose of agriculture sector modernization.

Next important factor is the farming experience of the farmers in the sample. Table 3.4, given below indicates the number of farmers in each district and their years of experience in the field of agriculture.

Table 3.4: Farming Experience

District	Below 5 years	5 to 10 years	11 to 15 years	15 to 20 years	Above 20 years
Kurunegala	3	2	7	13	35
Mullaitivu	3	2	1	1	13
Kilinochchi	4	15	5	8	4
Polonnaruwa	3	13	4	7	33
Badulla	5	6	9	10	30
Baticaloa	3	6	12	9	20
Anuradhapura	4	17	7	11	31
Matale	3	9	4	22	52
Gampaha	1	3	4	3	24
Jaffna	3	2	1	9	25
Vavuniya	2	6	3	2	17
Ampara	3	3	2	4	38
Monaragala	-	2	2	6	30
Kegalle	4	2	1	2	1
Total	**41**	**88**	**62**	**107**	**353**

As shown in Figure 3.4, in the sample as a whole, majority of the farmers have been engaged in farming for more than 20 years. Farmers with less than 5 years are very low in number. Without a drastic difference between the districts, in almost all the areas, the proportions of farmer experience are quite the same. Basically, in each district from the total number of farmers the largest portion of the farmers have experience over 20 years in the field.

Not only the farming experience but the farm size is also a significant area to focus the attention on in order to specify the applicability of new technologies. As expressed in terms of acres, in the Table 3.5, the ownership of farms differs from farmer to farmer as well as from district to district.

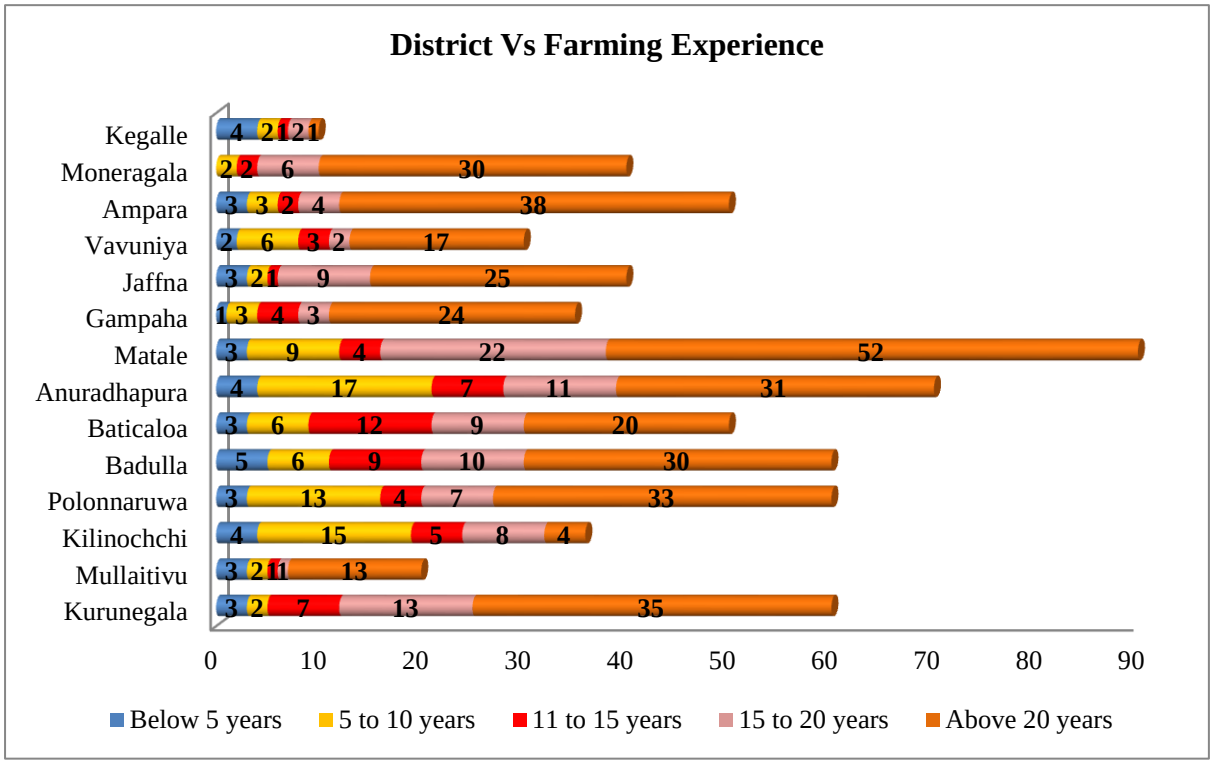


Figure 3.4: Farming Experience

Table 3.5: Land Ownership

Districts	Up to 0.5 acres	>0.5-1.0 acres	>1.0-3.0 acres	>3.0-5.0 acres	>5.0-10.0 acres	More than 10 acres
Kurunegala	5	22	26	2	4	1
Mullaitivu	0	0	6	6	7	1
Kilinochchi	4	23	2	4	2	0
Polonnaruwa	0	13	31	11	4	1
Badulla	4	21	25	9	0	1
Baticaloa	0	1	18	13	12	6
Anuradhapura	0	17	22	20	7	4
Matale	13	29	34	10	0	4
Gampaha	0	2	8	16	2	7
Jaffna	12	14	10	1	3	0
Vavuniya	1	2	12	6	6	3
Ampara	0	4	26	12	5	3
Moneragala	4	0	10	18	5	3
Kegalle	0	2	6	0	2	0
Total	***43***	***150***	***236***	***128***	***59***	***34***

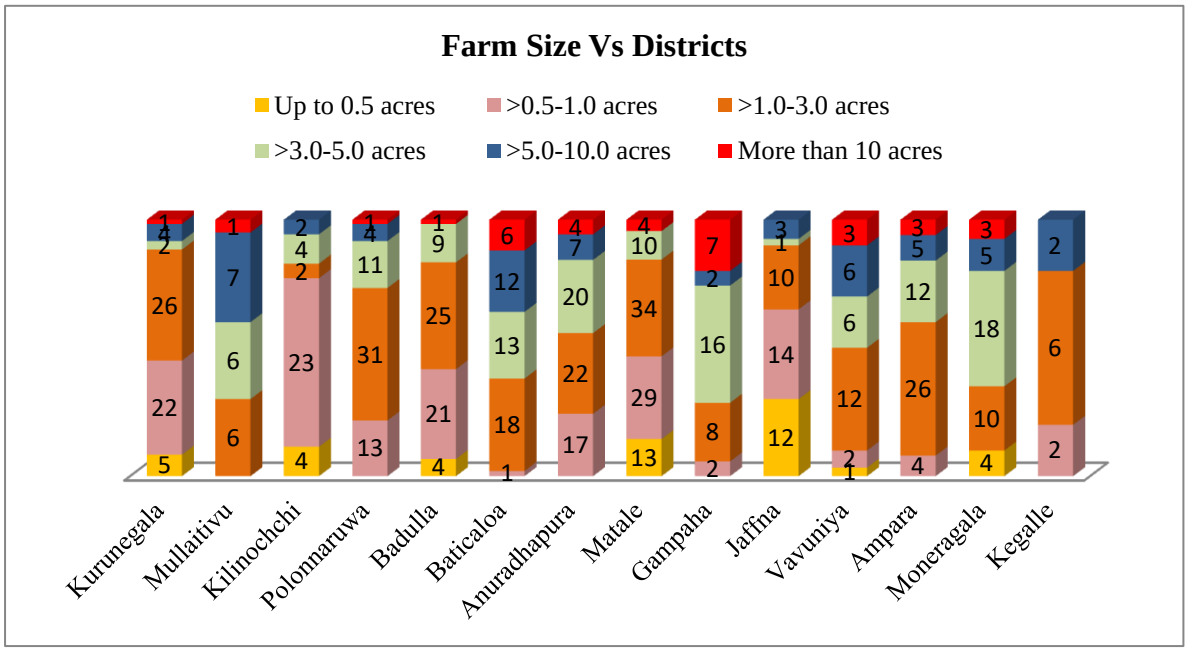


Figure 3.5: Farm Ownership

Analyzing the sample on the land ownership details brings in to attention that it is quite rare to find farmers who own land more than 10 acres but the highest number of farmers own farms between 1 to 3 acres in area. Based on the districts some districts do not give the same pattern, actually in Gampaha and Monaragala, there is a slight deviation from the prevailing order. There most farmers have farms sized between 3 to 5 acres. However, the sample analysis requires the most important factor, nature of farmer engagement in the field. There are farmers who grow a single crop, or many crops or even engaged in livestock farming. So explained below is the background of the farmers and their engagement in farming.

When considering the sample as a whole, for all the districts, a summarized Table 3.6, is given describing the number of farmers and how they are involved in farming.

Table 3.6: Types of Produce

Types of Products	No of Farmers
Paddy only	135
Paddy + one crop[1]	68
Paddy + More than one crop[2]	119
Other crops only[3]	221
Livestock only	15
Paddy + Livestock	52
Other crops + Livestock	29
Paddy + Other crops + Livestock	8
Total	**647**

[1] *This group consisted of 26 crops*

[2] *This group consisted of 52 crops*

[3] *This group consisted of 34 crops*

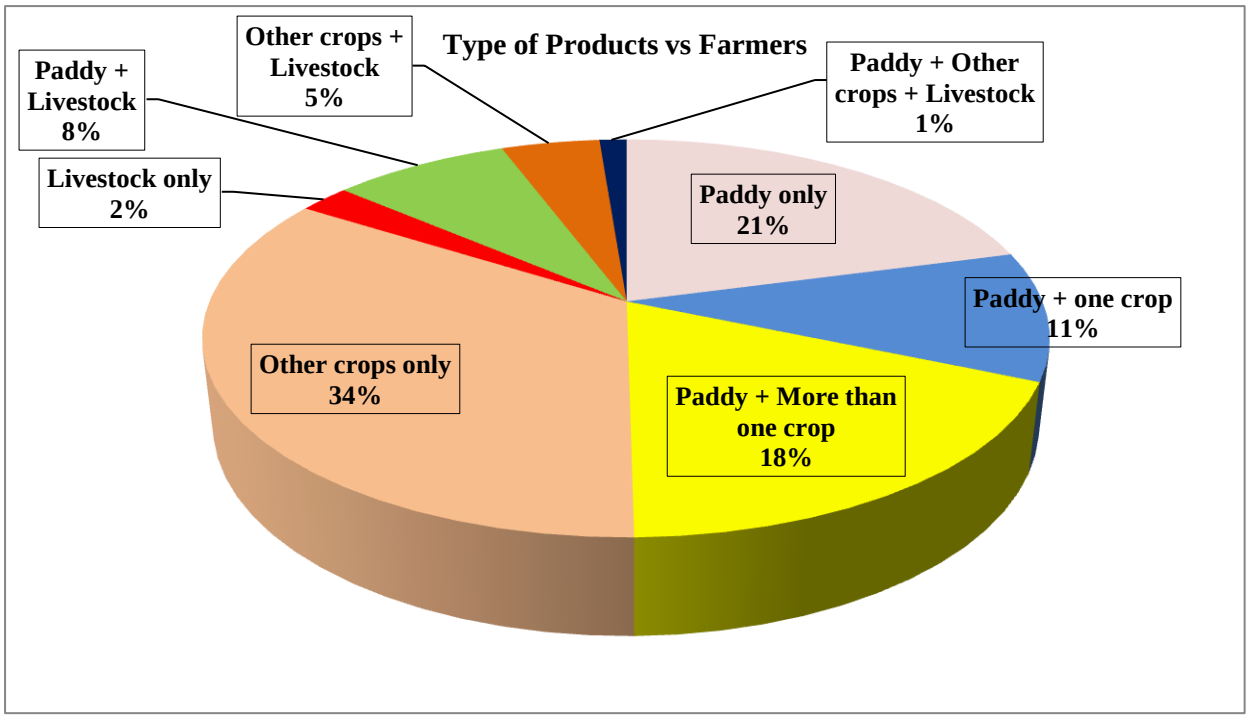


Figure 3.6: Types of Produce

Taking as a percentage from the whole sample, majority of the farmers grow other crops but not paddy, but 21% of the farmers are sole paddy farmers. Paddy and more than one crop are grown by 18% of the farmers whereas livestock farming is very low. Total livestock farming or livestock with any other product does not seem as a popular option among the farmers.

However the overall explanation which can be derived from the graph is that there is very less involvement of farmers in farming segments if they have too much variety and complicated combinations. E.g. – "Paddy, other crop growing and livestock farming" has the least number of farmers involved.

Therefore, the overall image of the sample consists of a set of 650 farmers with a majority of males. Their education levels vary from "passed grade five" up to being a "degree holder" and out of the 650 most of the farmers have farming experience for more than 20 years. A large portion of the sample own a farm somewhere in between 1 to 5 acres. Most importantly these farmers are more focused on growing crops than raring animals.

3.2. Farmer Perceptions on Quality Attributes

Fourteen statements were listed under the quality attributes related to the project. The farmers were questioned on the expected qualities of the product to be introduced and the Mean Attribute Scores (MAS) were calculated for further analysis. The Quality Attributes were identified for Crop Products and Livestock Farming separately on the basis of agricultural production relations in order to increase productivity. Table 3.7 shows the 14 statements regarding the "Crop Produce Quality Attributes" and the mean values of the points are used to rank and order the "Quality Attributes" based on the

importance given by the farmers. Based on the farmer preference the remarks were added to the sets of statements.

Table 3.7: Quality Attributes of Crop Produce

Statement No	Quality Attribute	MAS	Statement No	Ranked Mean Score	Remarks
CQA1	Product's Maturity	8.70	CQA1	8.70	Highest Preference of Crop Produce Quality Attributes
CQA2	Product's Impurities	7.24	CQA3	8.39	
CQA3	Product's Freshness	8.39	CQA13	8.16	
CQA4	Product's branded/graded	5.68	CQA9	7.99	
CQA5	Product's packaging	5.21	CQA12	7.40	
CQA6	Product's Labelling	2.91	CQA2	7.24	
CQA7	Product's Storability	5.92	CQA14	6.90	
CQA8	Product's Handling	6.38	CQA10	6.56	
CQA9	Product's Quality Standards	7.99	CQA8	6.38	
CQA10	Product's pesticides/Organic	6.56	CQA7	5.92	
CQA11	Product's Smell	5.02	CQA4	5.68	
CQA12	Product's Colour	7.40	CQA5	5.21	Lowest Preference of Crop Produce Quality Attributes
CQA13	Product's Size	8.16	CQA11	5.02	
CQA14	Product's Shape	6.90	CQA6	2.91	

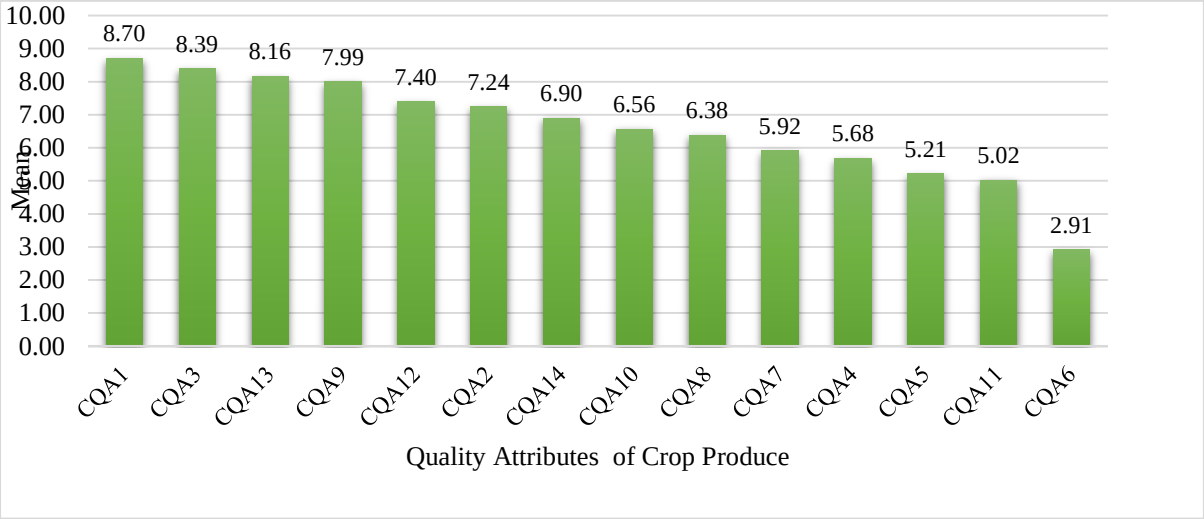


Figure 3.7: Quality Attributes of Crop Produce vs. Mean Score

As per the analyzed data, if Crop Produce Quality Attributes are arranged in the descending order based on the MAS given by the sample, the farmers were more concerned about the “Level of maturity, Impurities, and Freshness”, whereas the least concerns were regarding the “Colour, shape and size of the Product” (Fig 3.7). Then the Quality Attributes were studied for the Livestock Farming Sector. Same procedure as mentioned above was followed to prioritize the Quality Attributes in Livestock

Farming. Given below is the Table 21, explaining the result obtained from the Mean Attribute Scores given by the farmers of the sample. The statements are ranked according to the preference of the farmers.

Table 3.8: Quality Attributes of Livestock Produce

Statement No	Quality Attribute	MAS	Statement No	Ranked Mean Score	Remarks
LQA 1	SNF Content(milk)	7.46	LQA 11	8.99	Highest Preference Livestock Produce Quality Attributes
LQA2	Product's Smell	6.79	LQA 1	7.46	
LQA 3	Product's Colour	6.69	LQA 12	7.11	
LQA 4	Product's Impurities	6.70	LQA2	6.79	
LQA 5	Product's Size	6.54	LQA 4	6.70	
LQA 6	Product's Shape	3.95	LQA 3	6.69	
LQA 7	Product's branded/graded	6.60	LQA 7	6.60	
LQA 8	Product's packaging	4.87	LQA 5	6.54	
LQA 9	Product's Labelling	3.80	LQA 10	6.30	
LQA 10	Product's Storability	6.30	LQA 8	4.87	Lowest Preference Livestock Produce Quality Attributes
LQA 11	Handling the Product hygiene	8.99	LQA 6	3.95	
LQA 12	Content of Pesticides	7.11	LQA 9	3.80	

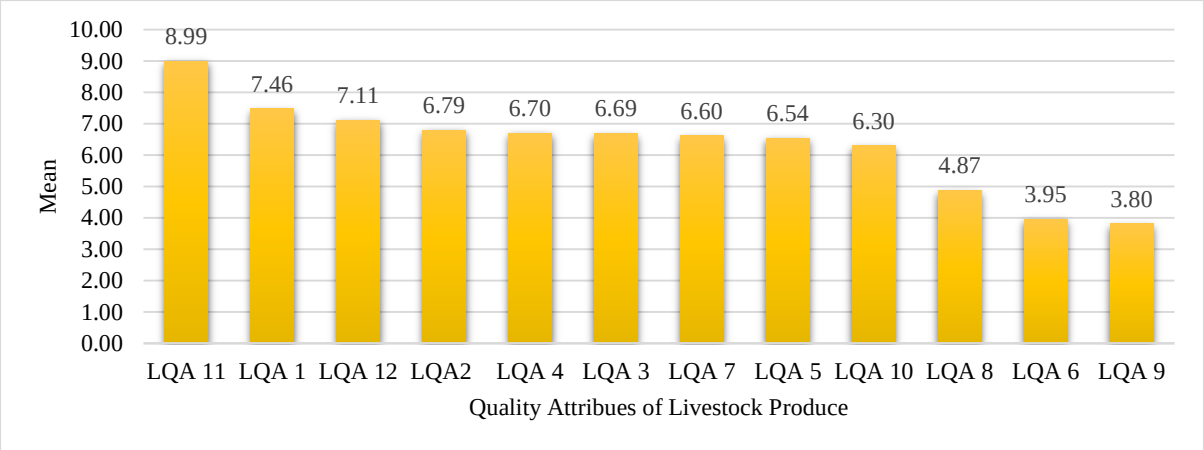


Figure 3.8: Quality Attributes of Livestock Produce vs. Mean Score

If the Livestock Produce Attributes are arranged in the descending order based on the MAS given by the farmers. SNF content in the product (milk), Smell and Colour of the product were the farmers' highest prioritized quality attributes, whereas they were least concerned about the Storability, Hygiene and the Content of pesticides of the final product (Fig 3.8).

Table 3.9: Classification and Notation of the Statements

	Category	Statements	Notation
1	Technical Feasibility	Availability of qualified technical personnel	TF1
2		Availability of technical guidelines	TF2
3		Availability of latest technologies/ machinery	TF3
4	Economic Feasibility	Need of large amount of capital to initiate production	EF1
5		Sufficient opportunities to sell the products in the market place	EF2
6		Additional costs associated with management of quality control processes	EF3
7		Availability of pricing mechanisms	EF4
8		Efficient distribution channels	EF5
9		High cost of transportation and distribution	EF6
10		High consumer concerns and awareness on the product	EF7
11		Need of high amount of capital to operate the production process	EF8
12		High cost of energy sources including cost of electricity	EF9
13		Difficulties to enter into the marketing channel due to monopoly	EF10
14	Socio-, Cultural. Ethical Acceptability	Pressure and objections from the neighbourhood	SE1
15		Compliance to high standards on health and safety	SE2
16		Effects of North Easter conflicts	SE3
17		Illegal activities such as ransom and tips	SE4
18	Infrastructure Compatibility	Small area of land to produce	IC1
19		Availability of raw materials/external inputs required	IC2
20		Proper storage facilities	IC3
21		Availability of raw materials/external inputs required	IC4
22		Long time period associated with production process	IC5
23	Gender Neutrality (Human Resource)	High use of labour	HR1
24		Expert advice on production	HR2
25		Lack of knowledge on production and processing	HR3

	Category	Statements	Notation
26	Environmentally Sound	Strict environmental compliance	ES1
27		Adverse climatic effects and natural disasters	ES2
28		Level of efficiency of water management mechanism	ES3
29		Disruption from wild animals	ES4
30		Disruption from diseases and pathogens	ES5
31		Difficulties in management of the waste generated	ES6
32	Institutional and Government Acceptance	Government policies, regulations and standards	IG1
33		Availability of certification bodies	IG2
34		Government support in terms of subsidies and incentives	IG3
35		Requirements of labeling	IG4
36		Long time period taken to obtain certification	IG5
37		Conflictive policies	IG6
38		No institutional support to overcome risks	IG7
39		Conflicts of existing policies at the provincial level	IG8
40		High cost of fines and penalties	IG9
41		High direct taxes on the production/ processing activities	IG10

Focusing on the statements on barriers/constraints/problems on production and quality management, when considering mean scores for constraint statements, 'Adverse climatic effects and natural disasters' (ES2) have scored the highest mean and the lowest was 'Illegal activities such as ransom and tips'(SE4). These statements belonged to 'Environmentally sound' category and the category of 'Social, Cultural and Ethical Acceptability' respectively (Table 3.9). According to the aggregated mean of factors, 'Technical feasibility' obtained the highest value which scored 6.86. 'Social, Cultural and Ethical Acceptability' obtained 3.76 which obtained the lowest value (Figure 3.9).

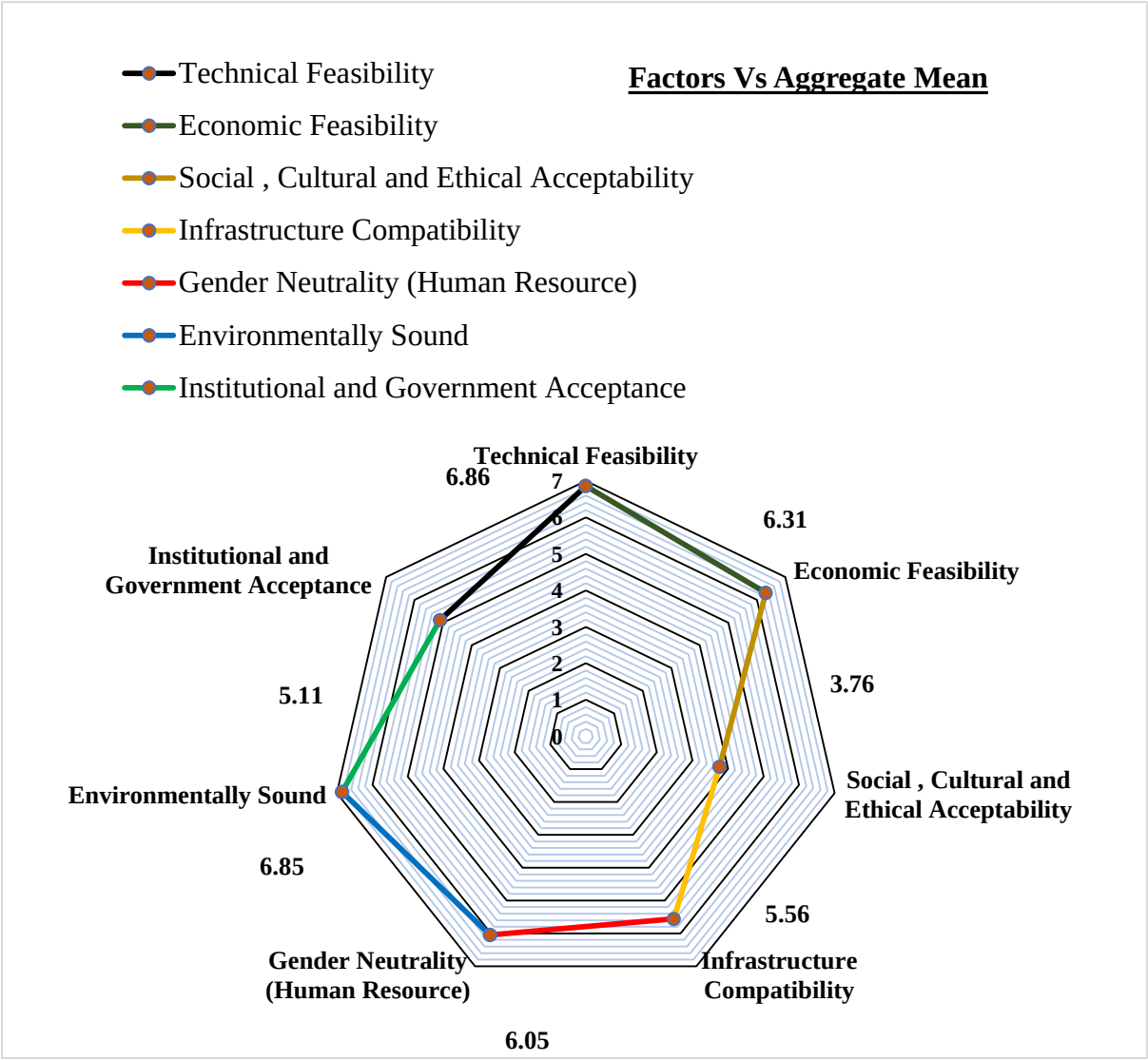
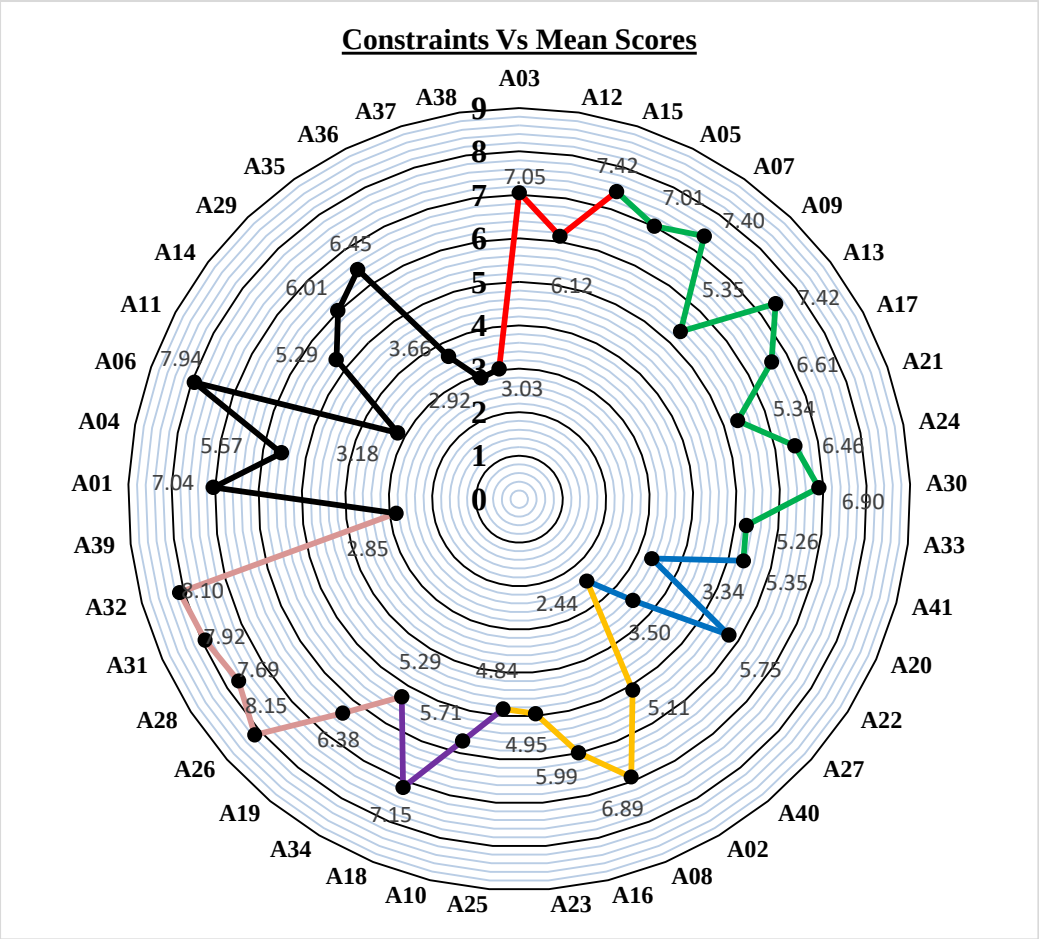


Figure 3.9: Aggregated Mean Scores of Barriers/Constraints/Problems on Production and Quality Management



Technical Feasibility	
Economic Feasibility	
Social , Cultural and Ethical Acceptability	
Infrastructure Compatibility	
Gender Neutrality (Human Resource)	
Environmentally Sound	
Institutional and Government Acceptance	

Figure 3.10: Mean Scores of Each Statement

Considering the given tables and graphs the final outcome can be concluded as that “Technical Feasibility” and “Environmental Concerns” are the major constraint causing factors in the venture and the farmers have a very less problematic mindset about the “Social, Cultural and Ethical Acceptability” of the agricultural production relations to be strengthened. From the seven major categories farmers have put more weight to the barriers such as “availability of latest technologies”, “government support in terms of subsidies and incentives”, “availability of raw materials/external inputs required”, “availability of pricing mechanisms”, “expert advice on production”, “compliance to high standards on health and safety” and “adverse climatic effects and natural disasters” (Figure 3.10).

In the light of the given factors it brings into attention the specific areas the farmers have focused on if they are supposed to strengthen their agricultural production relations.
In addition to these findings farmers' intentions about the key instruments to be implemented are also considered as a vital part of the study.

3.3. Farmer Perceptions on Key Policy Instruments

Given that "Key Policy Instruments" are extremely important, when introducing such modifications to the agriculture sector, it is also important to know which areas the farmers consider as better above others. The statements which were classified under 4 major categories which were employed to study the importance farmers place on each of these ideas. Based on the scores given to the statements by the farmers the mean scores were obtained for the key instruments with relation to strengthening agricultural production relations in the crop produce or livestock produce (Table 3.10).

Table 3.10: Classification and Mean Scores of Key Policy Instruments

Key Policy Instruments	Mean Score
Product related Policies	
Product Insurance	8.5
Information on Weather / Climate Conditions	8.4
Information on Product Variety Development	7.7
Seeds / Breeds Availability	6.9
Impose Import Restrictions	6.5
Storage Facilities	6.2
Release Export Barriers	6.0
Waste Disposal Mechanism	3.3
External services related policies	
Irrigation Water	8.9
Farm Machinery	7.8
Extension Services	7.4
Capacity Building /Training	7.4
Government Regulations	6.6
Establish Supply Mgt. System /Boards	6.0
Processing Facilities	5.6
Release Land - Use Restrictions	5.6
Farm Energy / Fuel	4.8
Support Migrated Labour	3.5
Price policies	
Information on Market / Price Conditions	8.6
Output Price Guarantee	8.5
Agricultural Credit	7.8
Fines / Penalties on Misconduct	2.9
Agrochemical related policies	
Fertilizer Subsidy	8.5
Agro-Chemicals	7.5
Organic Fertilizer	7.1

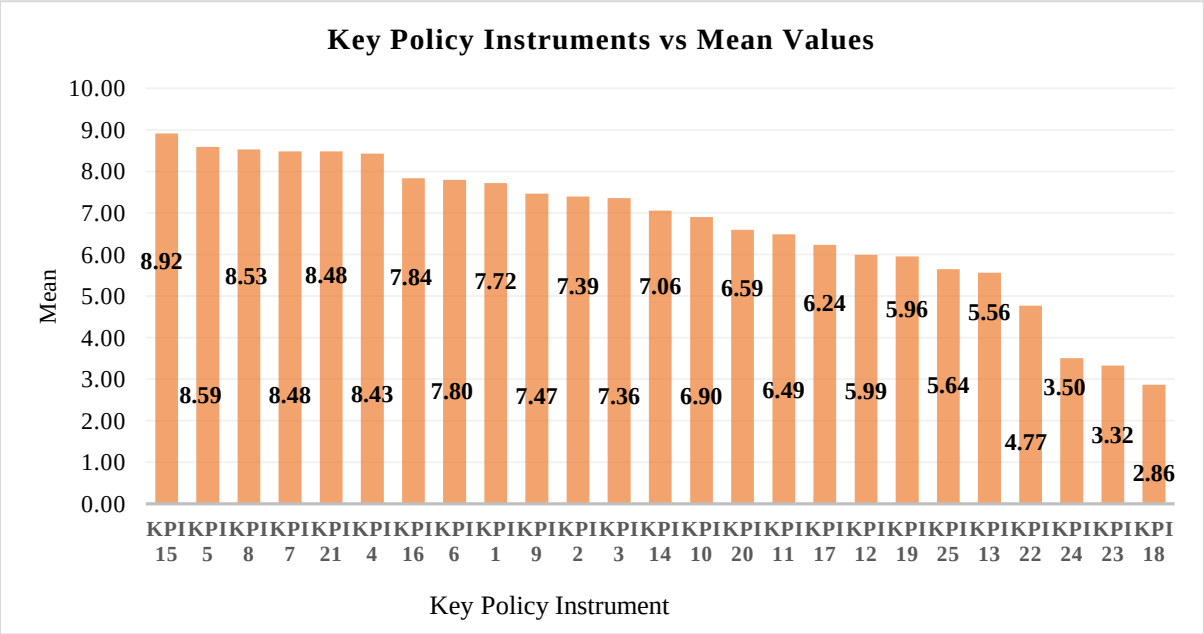


Figure 3.11: Mean Scores of Key Policy Instruments. *Note: KPI- Key Policy Instrument*

"Irrigation Water, Information on Market/ Price Conditions, Output Price Guarantee, Fertilizer Subsidy and Product Insurance" were the main aspects that the farmers have prioritized from the key instruments. Farmers have considered the "Release Land - Use Restrictions, Farm Energy / Fuel, Support Migrated Labour and Waste Disposal Mechanism and Fines / Penalties on Misconduct" as the less important points.

As presented in Figure 3.11, in the descending order, based on the scores given by the farmers on each "Key Policy Instrument", it can be said that the farmers have different levels of concerns on different factors. The mean values of the scores given by the farmers help in identifying the relevant areas of interest.

Given that "Key Policy Instruments" are extremely important when introducing such modifications to the agriculture sector it is also important to know which areas the farmers actually consider as better above others. Information on "Product Variety Development", "Extension Services", "Capacity Building/Training", "Information on Weather / Climate Conditions" and "Information on Market / Price Conditions" are the main aspects the farmers have prioritized from the key policy instruments and they have considered the "Product Insurance", "Farm Energy / Fuel", "Waste Disposal Mechanism", "Support Migrated Labour" and "Processing Facilities" as the less important points if agricultural production relations are to be strengthened.

Chapter 4

Systematic Review and Meta-Analysis of Policy Documents Related to Agricultural Production Relations

4. Systematic Review and Meta-Analysis of Policy Documents related to Agricultural Production Relations

Making agricultural policies related to agricultural production relations has been largely influenced by numerous government organizations and institutes with an interest in the outcome. It is therefore important to analyze agricultural policies related to agricultural production relations while remaining aware of the other intensions being expressed and how these may resonate with policy makers. Other important element in the policy implementation is inconsistencies of policies from time to time which could yield intermediate effects that may take place in achieving the objectives. Given this context, the analytical framework applied for the content analysis provides a common structure for summarizing effects both positive and negative and limitations of the policies at achieving its objectives.

The policy documents in Sri Lanka (local) and from various countries were selected, which include existing policy articles, regulatory functions related acts and ordinances, annual research reports, research and extension annual proceedings, progress reports and publications in related agriculture research institutions and authorities, customs, quarantine stations and several other documents that influence private sector technology generation and distribution particularly for commercial agriculture.

The documents related to different policy aspects and sceneries such as policy reports published in Sri Lanka formulated by various institutions to cover different sectors of the economy, for example, crop and livestock were considered. Those policies published “Locally” (National) and “Regionally” (International) were collected and they were documented systematically. This helped to separate which into various groups representing different ‘Products’ and ‘Formats’ (e.g. Acts / Frameworks / Strategic reports) etc. to facilitate a valid and reliable qualitative and quantitative analysis on policy. The Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) concept is applied in the document to illustrate the methodology (Figure 4.1)

The analytical framework provides a complete overview of policy implications. However, due to strategic and practical reasons, only certain analytical dimensions were considered both for national and international agricultural policies related to agricultural production relations. In the meta-analysis, initially, two broad dimensions were considered: ***Keyword Analysis*** and ***Content Analysis***.

4.1. Initial Categorization of Policy Documents

Each policy document in hand, which holds a direct link with the agricultural policy environment in which the current study is focusing on, was subjected to a methodical and in-depth scrutiny to obtain an idea on the extent to which they are expressed/written to reflect the meaning of certain keywords of interest, for the purpose of initial grouping of documents. The policy documents were rearranged into 10 major categories (Table 4.1).

Table 4.1: Major Policy Categories Used

Major Policy categories	
1. Credit and Finance policy	6. Livestock and Fisheries policy
2. Environment policy	7. Marketing policy
3. Food policy	8. Price policy
4. Institutional policy	9. Research and Educational policy
5. Land policy	10. Trade policy

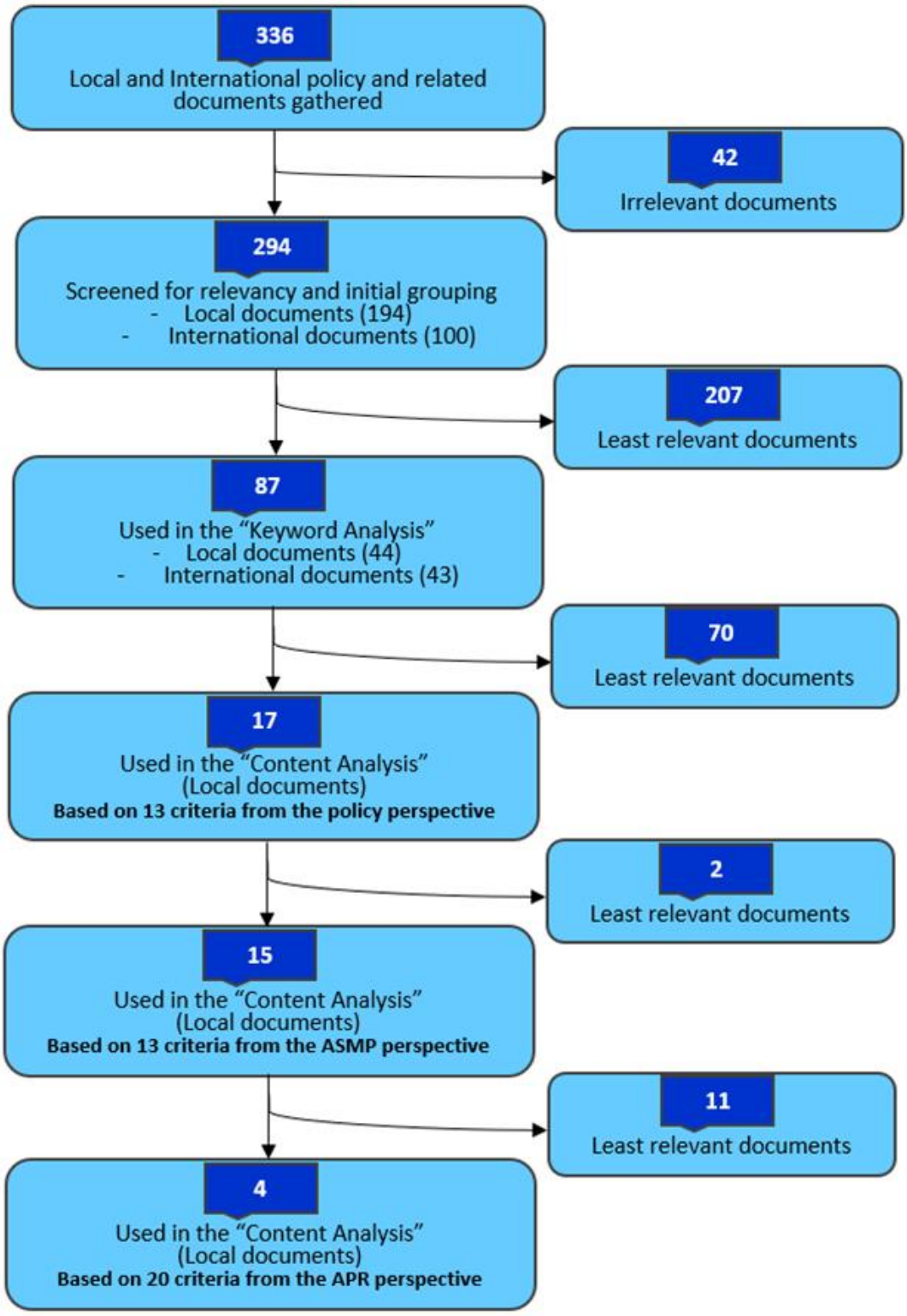


Figure 4.1: PRISMA (Preferred Reporting Items for Systematic reviews and Meta-analyses) flow diagram of included policy and policy-related documents in the Meta-analysis of Agricultural Production Relations

4.2. Keyword Analysis of Policy Documents

A formative literature review was employed and 36 key terms which are bound with policy related documents were selected (Table 4.2). Frequency of appearance of key terms (36) given in Table 4 were counted from each local policy document followed by a regional analysis. Altogether 15 countries were selected (8 developed countries and 7 developing countries) for the regional analysis.

Developed countries Selected:

Australia, Canada, China, France, Germany, Japan, United Kingdom, and United States.

Developing countries Selected:

Bangladesh, India, Pakistan, Indonesia, Malaysia, Philippine and Thailand.

Table 4.2: Keywords Selected for Analysis

Keywords Selected for Analysis			
Capacity	Effective	Marketing	Quality
Communication	Efficiency	Modernization	Research
Conservation	Employment	Network	Safety
Control	Extension	Operation	Sustain
Credit	Improvement	Partnership	Utilization
Development	Innovation	Processing	Value Addition
Diversification	Insurance	Production	Value Chain
e-agriculture	Intensification	Productivity	Technology
e-commerce	Investment	Protection	Adoption

Agriculture-related policy documents were collected from each country based on the above 10 policy classification and same procedure was carried out. Previously selected key terms were ranked to descending order according to the frequency of local policies. Then the regional policy key terms were ranked with the same local policy key term for the easy comparison. Of the 294 documents scrutinized initially, the most relevant Forty-four (44) Sri Lankan policy documents and 43 regional policy documents were subjected to the keyword analysis.

Figure 4.2 shows the frequency of appearance of keywords in local policy documents against production relations. Terms ‘Development’, ‘Production’ and ‘Quality’ were found to be the most frequently appeared key terms whereas terms ‘Intensification’, ‘e-commerce’ and ‘Modernization’ can be identified as the least frequently appeared key terms in local policy documents.

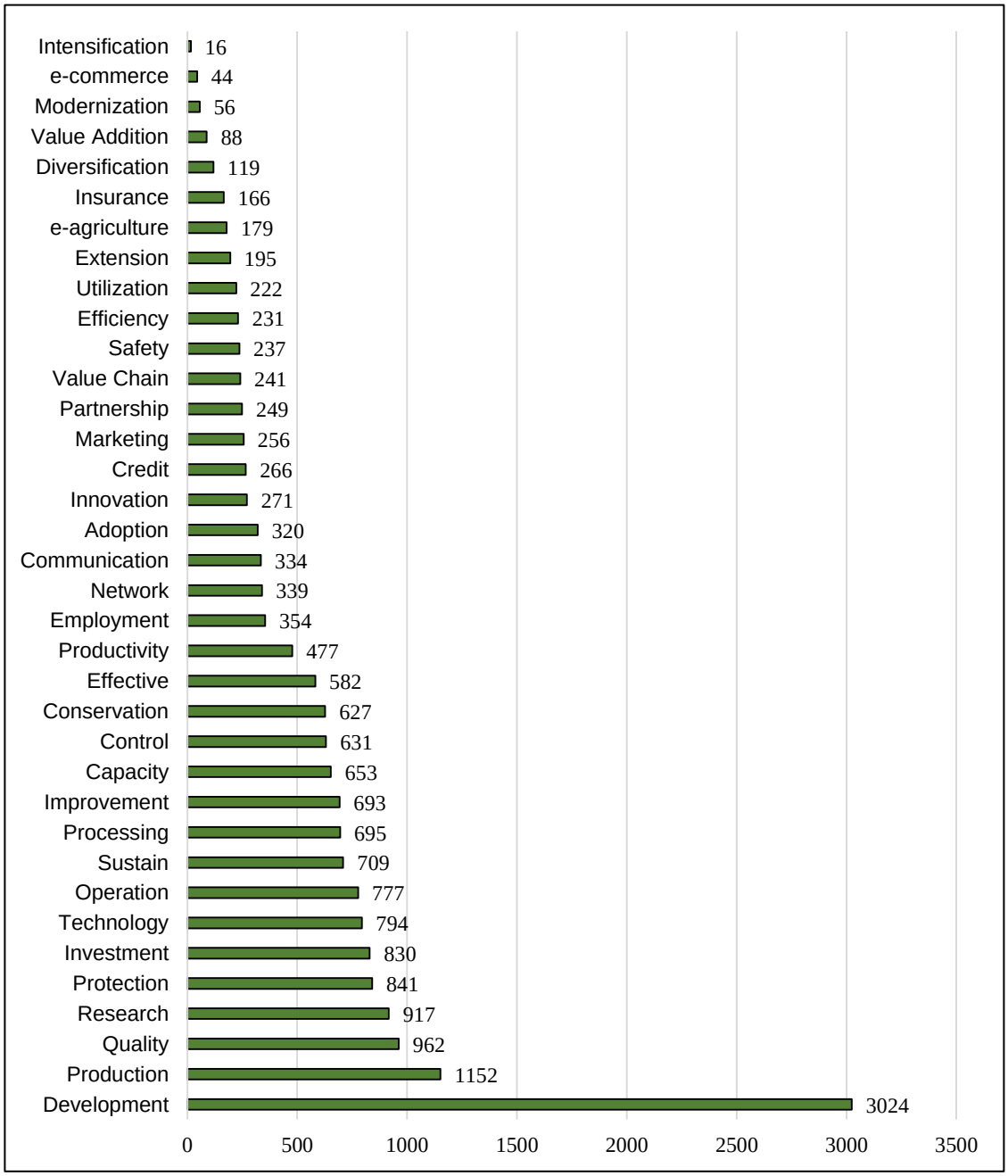


Figure 4.2: Frequency Chart for appearance of keywords in Sri Lankan Policy document against Production Relations

Figure 4.3 shows the frequencies achieved by different key words in regional policy documents against production relations. Terms 'Development', 'Research' and 'Production' were found to be the most frequently appeared key terms whereas the terms, 'e-commerce', 'Modernization' and 'Intensification' can be identified as the least frequently appeared key terms in regional policy documents. Surprisingly, the term 'e-agriculture' has been appeared in none of the policy documents referred.

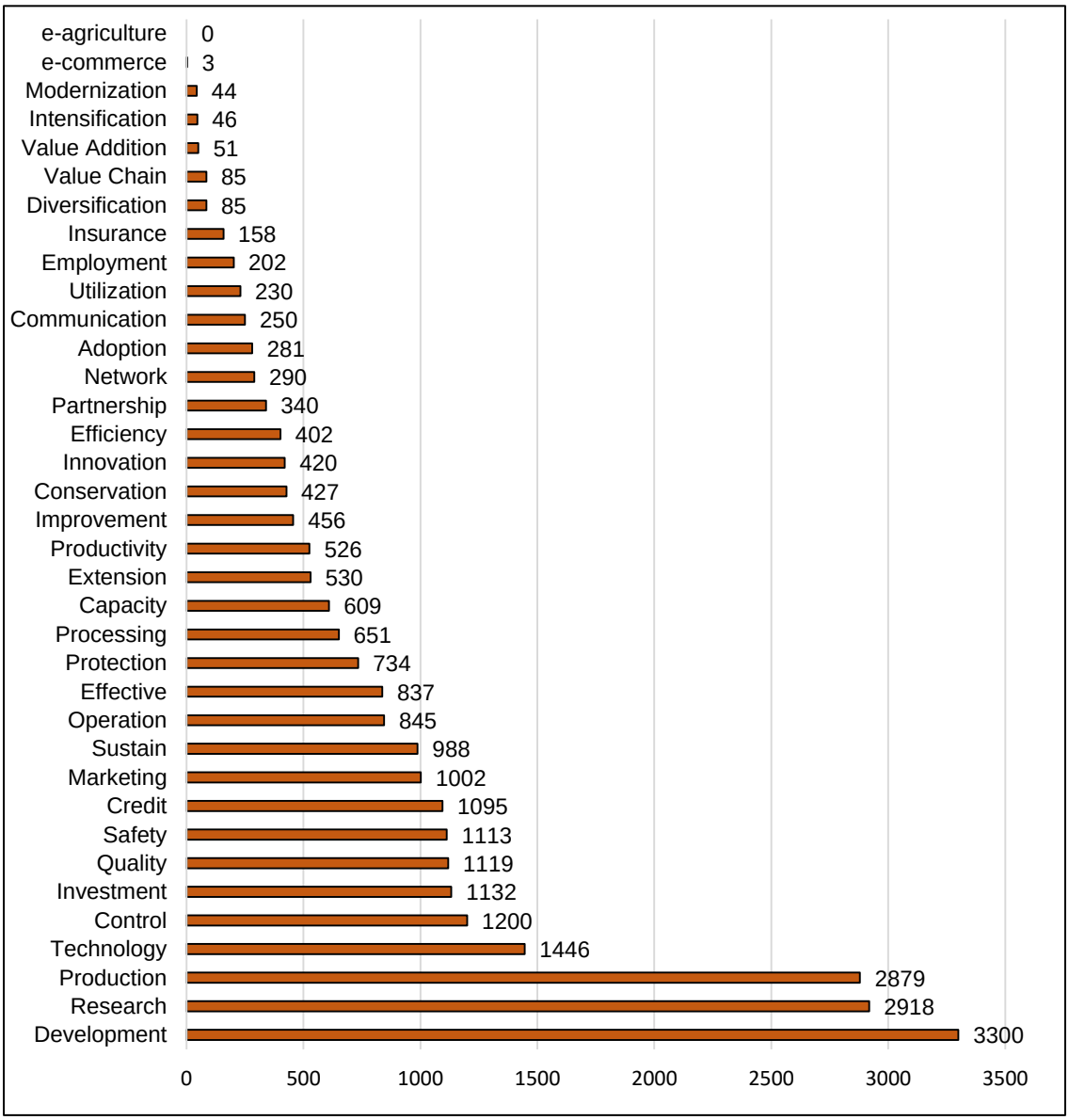


Figure 4.3: Frequency Chart for appearance of keywords in regional Policy document against Production Relations

The rank order comparison of keywords appeared in the policy documents in the local and regional documents as a whole, is depicted in the Figure 4.4. When both local and regional policies are compared, term 'Safety' ranked at eighth in regional policies while it ranked at twenty sixth in local policies. Results claimed that, policy documents in regional level have incorporated food and agriculture related safety matters for their policies more, since they occurred in high frequencies compared to local policies.

Apart from that, the term 'marketing' showed a considerable difference in frequencies between local and regional policy documents. It was appeared in high frequency in regional policies. It is clear that, respective policy forming bodies at regional level have taken responsibilities to regulate their marketing channels efficiently. Moreover, the term 'Credit' has not been occurred frequently in local policy

documents though credit facility is a major component in Sri Lankan agriculture. It gives an impression that government credit principles have not been well-defined through policies. It appears that 'Control' and 'Extension' also received a least priority in local policy documents compared to the regional ones.

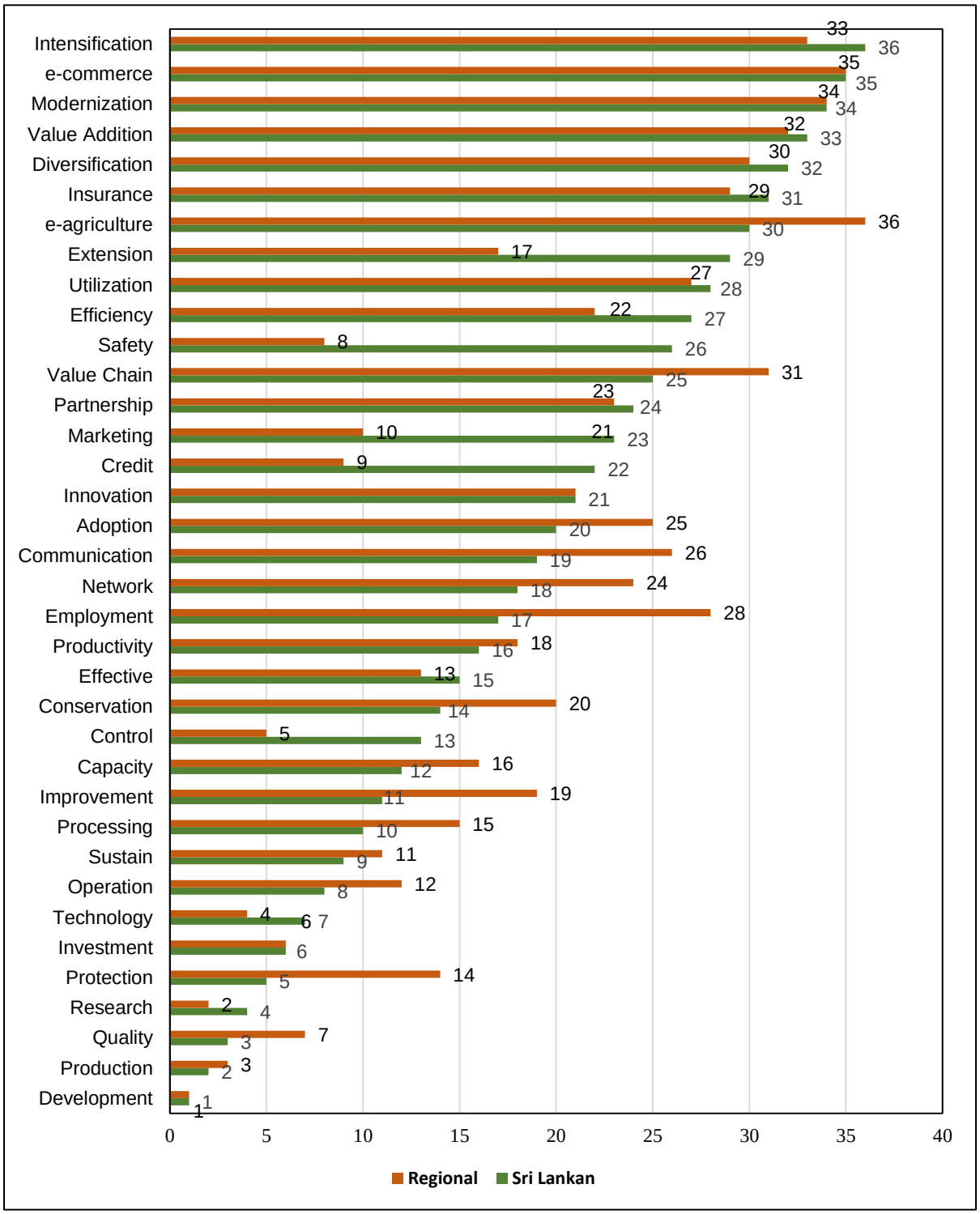


Figure 4.4: Rank Comparison of keywords in Local and Regional Policies against Production Relations

The following matrix (Table 4.3) shows the main three key terms that have been highly appeared in different policy documents separately in both local and regional policy documents against production relations, under each 10 themes stated earlier. In local policy analysis, term 'development' has been appeared in the highest frequency in almost all the policy documents except in livestock and research policy documents.

Term 'Production' and 'Research' were identified as the highest appeared key terms in livestock and research policy documents respectively. 'Development' was identified as the second highest appeared key term in livestock policies while third highest key word in research policies.

In regional policy documents, similarly 'Development' was identified as the highly appeared key term in environment, land and livestock policy documents while it was appeared in second highest frequency in institutional, marketing, price, research and trade policies. 'Production' was identified as the highly appeared term in price and trade policy while it was appeared in second highest frequency in food, land and livestock policies.

Table 4.3: Main Three Key Terms of Local and Regional Policies against Production Relations under 10 different policy themes. *Note: Different colours represent different keywords*.

Policy Type	1st Key Term		2nd Key Term		3rd Key Term	
	Local	Regional	Local	Regional	Local	Regional
Credit	Development	Credit	Network	Investment	Insurance	Development
Environment	Development	Development	Protection	Research	Sustain	Production
Food	Development	Safety	Capacity	Production	Quality	Development
Institutional	Development	Technology	Production	Development	Processing	Research
Land	Development	Development	Conservation	Production	Productivity	Sustain
Livestock	Production	Development	Development	Production	Control	Control
Marketing	Development	Marketing	Communication	Development	Quality	Production
Price	-	Production	-	Development	-	Control
Research	Research	Research	Technology	Development	Development	Technology
Trade	Development	Production	Investment	Development	Quality	Quality

As results suggested, 'Intensification', 'e commerce' and 'Modernization' showed the lowest frequency among local policy documents while 'Development', 'Production' and 'Quality' showed the highest frequency in local policy documents. If a policy document shows the highest occurrence of a key term, it claimed that the particular document has been intensified with the corresponding area.

For an example, local policy documents have contained, term 'Development' in a higher frequency. It revealed that, nowadays policy formational institutions focus on incorporating development related policies in to policy regulatory frameworks. On the other hand, term 'Production and 'Quality' highly appeared in local policy documents. It advocated that, responsible authorities have identified the necessity of the revising of traditional policies in order to increase the national production and improve its quality. In regional policy documents, 'Development', 'Research' and 'Production' were appeared in high occurrences. It proves that those countries have paid attention on novel technologies and innovations through research than in Sri Lanka when they come up with policy formations. Further, when focusing on term, 'Research', both local and regional policy documents have enclosed this area and it gives a sense that investigations came through scientific studies are incorporated with policy documents.

According to the rank comparison chart, the lowest rank in local policy documents has been obtained by Intensification', 'e commerce' and 'Modernization'. In regional policy documents, the lowest frequency showed for 'e agriculture', 'e commerce' and 'Modernization'. Local policy forming agents have not paid much interest on novel technologies of the corresponding area discussed through the policy documents. Surprisingly regional policy documents have not contained innovative technology related terms. Even though these countries are engaged in e agriculture, e commerce and modern agriculture with relative to Sri Lanka, it reveals that these practices have not been executed through policies.

The vast difference in frequency of key terms among local policy documents showed for 'Development' and 'Intensification'. Term 'Development' has been ranked first and term 'Intensification' has been ranked thirty sixth. In the local scenario, policy making bodies have paid their attention more on development because novel policies may have evolved on national development since it is the paramount importance of the country. Since the term 'Intensification' was the least appeared term, it suggested that, often policies are emerged for executing new ideas and intensifying existing policies are very seldom. Similarly, in regional policy documents, the term 'Development' was ranked first. It is obvious that developed nations achieved their national development through converting their policies in to a reality. Though e agriculture is a common practice in most of the regional countries, the term 'e agriculture' has been appeared rarely. Because they often use modern agricultural techniques for their cultivations. Even though these practices are not executed specially as policies, these techniques are serving as catalyst for institution and individuals in global environment.

As results suggested, same ranking was observed for 'E commerce', Modernization', 'Innovation', 'Investment' and 'Development' in both local and regional policy documents. It shows a same pattern of evolving these policies in both local and regional policy documents.

When comparing these frequencies further, it revealed that, there may be a mechanism of addressing, omissions occurred in the country level. Because, terms that give a sense of necessity of having corrective actions have not been appeared in very frequently in local policy documents. For an example Sri Lanka is a developing nation and necessarily should focus on intensification, diversification and value addition etc. Since they have been appeared in lower frequencies than regional policies, they have lower

ranks than in regional countries and it reveals the necessity of scrutinizing these areas through policy documents.

When paying an attention on summative frequencies of local policy documents, term 'Production' and 'Quality' has been appeared in high frequencies in Sri Lanka. It conceals that related policy areas are addressed in higher frequencies since they come to the discussion simultaneously. Similarly, 'Research' and Development' are discussed as duos. Therefore, term 'Research' and 'Development' ranked first because they have appeared in high frequencies.

4.3. Content Analysis of Policy Documents

Of all the policy-related documents considered for the keyword analysis, 44 Sri Lankan policy documents were further considered for the content analysis. Before the content analysis is performed, the research team had a brief look at the evolution of agriculture policies in Sri Lanka, with the intention of selecting the most updated policy-related documents.

4.3.1. Evolution of Agriculture Policies in Sri Lanka

Since 1948, the focus has been on the production increase through expansion of area under cultivation and agriculture related infrastructure development, particularly the irrigation systems. The scope for further expansion of area under cultivation was limited, thus the government initiatives for productivity improvement through introduction of high yielding crop varieties, provision of irrigation water, fertilizer use, pest control, which was accompanied by agriculture extension service were adopted. In this effort, relevant agricultural policies were introduced according to the needs of the country (Table 4.4).

Table 4.4: Evolution of policies related to agriculture production relations in Sri Lanka.

Approximate years	Key sector features	Major policy initiatives
1948-1960	- Expansion of production areas - Irrigation infrastructure development - Food production extension	- Land settlement policy (colonization) - Land use policy - Agrarian reforms
1960-1977	- Self sufficiency - Productivity enhancement - Import substitution - Agricultural extension and research - Provision of inputs, including seeds and fertilizers - Promotion of alternative food	- Private sector participation in agriculture enterprises - Opening up major irrigation schemes (e.g. Mahaweli) - Fertilizer subsidy. - New agricultural progress monitoring institutes - Land reform policy - Agricultural credit
1977-1990	- Export orientation - Diversification - Productivity improvement - Systematic agricultural extension - Agriculture research - Local seed production with small	- Open economic and trade policy reforms - Quality assurance - Provision of subsidies for agriculture enterprises - Trade liberalization

	farmers (e.g. potato, B-onion)	- Promotion of private sector participation in the livestock and poultry sector - Regularized importation of seed potato
1990- 2005	- Productivity improvement - Technology transfer - Export orientation of agricultural fresh and processed produce - Mechanization - Efficient use of input	- Policy support for marketing, research, credit and value chain development - Application of ICT for agriculture information and marketing - Policy support for tax incentives for agricultural machinery and technology - Subsidies for agriculture inputs (e.g. fertilizer) - De-centralization of agriculture extension
2005- to date	- Export orientation - Value chain development - Access to modern technological innovations - Relaxation of seed imports - Diversification	- Policy support for mechanization - Policy support for private sector agriculture commercial enterprises - Provision of subsidies and incentives for livestock and poultry

Source: Own tabulation based on literature review

National Agricultural Policy Related Documents identified under key term analysis were used for content analysis exercise. All 44 articles identified under key term analysis as appropriate national documents for agricultural production relations were further scrutinized based on the relevance of contents of those documents with agricultural production relations. As a result, 17 Agriculture policy related documents, which were brought forward after 2005, were finally selected for detailed content analysis (Table 4.5).

Table 4.5: Policy /Policy Related Documents selected for content analysis related to Agricultural Production Relations

Sector	No	Policy /Policy Related Document	Year
Agriculture			
	1	Sri Lanka National Agricultural Policy – Ministry of Agriculture and Agrarian Services	2007
	2	Ministry of Agriculture - Cooperate Plan 2011-2015	2011
	3	Development of a National Agricultural Policy for Sri Lanka (Not Cabinet approved)	2018
	4	National Agricultural Research policy and Strategy (CARP) 2018 – 2027	2018
	5	Overarching agricultural policy (Draft)	2019
	6	Sri Lanka E-agriculture Strategy	2016
Livestock			
	7	National Livestock Development Policy & Strategies	2006
	8	Livestock Master Plan 2011 - 2016	2010
	9	National Livestock Breeding Policy	2010

Spices			
	10	National export strategy of Sri Lanka 2018-2022 spices and concentrates strategy - Ministry of Development Strategies and International Trade	2017
Sugar Industry			
	11	Sri Lanka development policy for Sugar Industry	Not Indicated
Cross Cutting			
	12	National Biotechnology and Policy – National Science Foundation	2009
	13	National Policy for Primary Industries of Sri Lanka	2018
	14	National Science & Technology Policy – National Science and Technology Commission (NASTEC)	2008
	15	The National Climate Change Policy of Sri Lanka	2012
	16	National Policy and Strategy on Cleaner Production for Agriculture Sector	2012
	17	National Land Use Policy of Sri Lanka	2007

All the above policy related documents were examined in three key perspectives to find out the relationship among three perspectives which collectively influence the implementation of policies and ability to produce intended outcomes.

The three (03) perspectives considered for analytical purpose:

(1). Policy Perspective
(2). Agriculture Sector Modernization Project (ASMP) Perspective
(3). Agricultural Production Relations (APR) Perspective

4.3.2. Content Analysis from the Policy Perspective

It is necessary to review policies in terms of key areas involved in effective policy interventions. Hence, following four-step policy analysis methodology of FAO was adopted to fulfil this necessity.

(a) Policy and policy objectives
(b) Policy Instrument/s
(c) Policy Implementation
(d) Monitoring and Evaluation

Although it is desirable to have all the four elements in a policy, to proceed from policy formulation to impact evaluation, it is rarely able to find all the four elements included in most of the policies under review. This analysis provides insight into the extent of each sector having the all elements of policy implementation cycle. Of the 17 documents under review, only 8 satisfied the aforesaid four components. The aim of this effort is to find the gaps in policies where possible and suggest improvements. Sector-wise findings of this analysis is shown in Table 4.6.

Table 4.6: Sector wise Availability of Policy Related Arrangements

	No.	Policy and Policy Objectives	Policy Instruments	Policy Implementation Plan	Monitoring & Evaluation System
Agriculture	1	Sri Lanka National Agricultural Policy – Ministry of Agriculture and Agrarian Services - 2007	●	●	●
	2	Ministry of Agriculture - Cooperate Plan 2011-2015	●	●	●
	3	Development of a National Agricultural Policy for Sri Lanka - 2018 (Draft)	●	●	●
	4	National Agricultural Research policy and Strategy (SLCARP) 2018 – 2027	●	●	●
	5	Overarching agricultural policy (Draft)	●	●	●
	6	Sri Lanka E-agriculture Strategy	●	●	●
Livestock	7	National Livestock Development Policy & Strategies	●	●	●
	8	Livestock Master Plan 2011 – 2016	●	●	●
	9	National Livestock Breeding Policy	●	●	●
Spices	10	National export strategy of Sri Lanka 2018-2022 spices and condiments strategy - Ministry of Development Strategies and International Trade	●	●	●
Sugar Industry	11	Sri Lanka development policy for Sugar Industry	●	●	●
Cross-cutting	12	National Biotechnology and Policy – National Science Foundation	●	●	●
	13	National Policy for Primary Industries of Sri Lanka	●	●	●
	14	National Science & Technology Policy – National Science and Technology Commission (NASTEC)	●	●	●
	15	The National Climate Change Policy of Sri Lanka	●	●	●
	16	National Policy and Strategy on Cleaner Production for Agriculture Sector	●	●	●
	17	National Land Use Policy of Sri Lanka	●	●	●

● **Available** ● **Not Available**

4.3.3. Content Analysis from the ASMP Perspective

For further analysis, thirteen (13) key elements were identified under ASMP as important attributes which would facilitate accomplishment of project objectives (Table 4.7). The 13 criteria were selected based on the widely-accepted criteria used in policy analysis particularly, as stated in the *Recommendations of FAO on Voluntary Guide for National Seed Policy Formulation* (2015). The purpose of this analysis is to ascertain whether these policies are in line with these thirteen (13) ASMP attributes.

Table 4.7: Criteria used in content analysis of policies and policy-related documents from ASMP perspective

No.	Criterion (FAO standards)
1	Productivity Improvement
2	Diversification
3	Modernization
4	Post-Harvest Operation, Value Addition and Value Chain Development.
5	Employment Generation in Modern Agriculture
6	Market Orientation including Exports
7	Research and Development
8	Education and Transfer of Technology
9	Private & Public Sector partnerships/Investments for Production, R&D & TOT
10	Use of ICT in Agric. Modernization
11	Competitiveness
12	Sustainability
13	Resiliency & NRM

From the 17 policy documents used in the analysis in the policy perspective, 15 most relevant policy documents were analyzed based on the 13 criteria selected and scores were allocated for each policy under pre-determined, in-built policy instruments in each policy (Table 4.8). The 'Total potential score' was considered as the maximum that a policy can achieve within the framework of the policy. Each policy was then investigated for the level of achievement of the 'Total potential score'.

Table 4.8: Content Analysis of selected policy documents from ASMP Perspective

Sector	Policy / Strategy No	ASMP														Total Potential Score [2]	Percentage Scored [3]
		Productivity Improvement	Diversification	Modernization	Post-Harvest Operation, Value Addition and Value Chain Devt.	Employment Generation in Modern Agriculture	Market Orientation including Exports	Research and Development	Education and Transfer of Technology	Private & Public Sector partnerships/Investments for Production, R&D & TOT	Use of ICT in Agric. Modernisation	Competitiveness	Sustainability	Resiliency & NRM	Total Score [1]		
Agriculture	1	10	4	4	2	4	1	6	13	4	4	2	3	3	60	182	33
	2	3	1	1	2		2	1	1	1					12	91	13
	3				1	1	1					2	1	2	8	65	12
	4	10	6	14	7		5	12	9	3		2	6	4	78	286	27
	5	2	1	5	3	2	2	2	4	2	2	3	2	1	31	182	17
Livestock	6	4		1	1	1	1	3	3	1		3	3		21	143	15
	7	1		1	1	1	1		1	2		1	1		10	65	15
	8							7							7	91	8
Spices	9	2	2		3		1	1	1	1	3	3			17	91	19
Cross Cutting	10			1	1		1	2	7	1	8		1	2	24	117	21
	11		1		1			2	2	1			1		8	78	10
	12	1			3				2	1		1	1		9	52	17
	13			1				4	3			1	1	1	11	65	17
	14	3	2	1	1			3	10	2	5		1	3	31	169	18
	15	3	1	2	2		4	1	5		2		7	6	33	130	25

[1] *Sum of presence of each criterion under each of the policy instrument considered*

[2] *Number of policy instruments multiplied by the number of criteria considered for this analysis (i.e. 13)*

[3] *Percentage of 'Total Score' compared to 'Total potential score'*

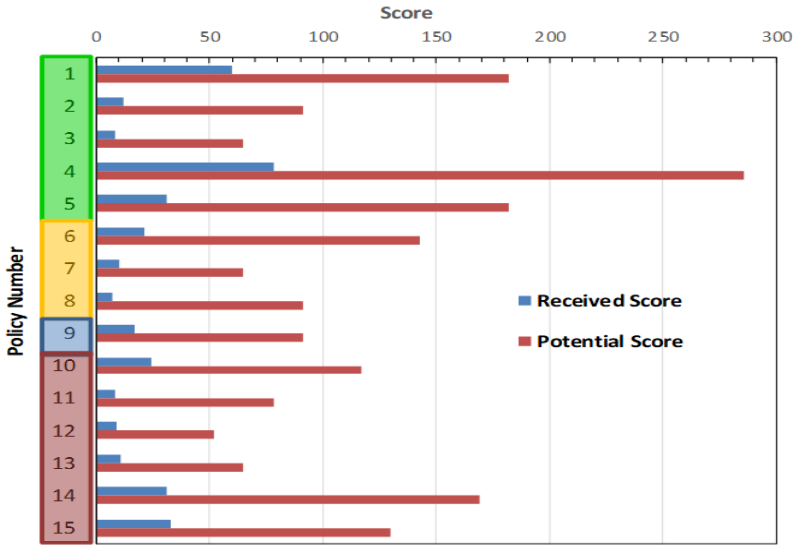


Figure 4.5: Scores received compared to the maximum potential score for each policy based on the appearance of 13 criteria in the policy instruments of each policy

The content analysis revealed that the mean 'Percentage score' of all 15 policies that were under scrutiny was 18% with a range of 8-33%, which is well below the basic expectation of a policy, as per our perceived analysis (Figure 4.5). The policies or policy-related documents that scored at least more than 25% were the Sri Lanka National Agriculture Policy (2007), National Agricultural Research Policy and Strategy 2018-2027 and National Policy and Strategy on Cleaner Production for Agriculture Sector (2012). National Livestock Breeding Policy (2010) received the least score in our analysis (8%).

When the criteria that the policies or policy-related documents try to address predominantly are considered, it was evident that majority of the documents have addressed 'Education and Transfer of Technology', 'Research and Development' and 'Productivity Improvement' sufficiently (44, 32 and 28% respectively) while giving the least priority to the criteria such as 'Employment Generation in Modern Agriculture', 'Diversification' and 'Competitiveness' (6, 13 and 13% respectively). Apart from these observations, it was striking to note that, majority of the policies and policy-related documents considered under the themes of 'Agriculture' and 'Livestock' have missed the inclusion of 'Use of ICT in Agriculture Modernization'.

4.3.4. Content Analysis from APR Perspective

Of all 15 policies and policy-related documents considered for the content analysis from the ASMP perceptive above, all the agriculture-related policies, except the National Agricultural Research Policy and Strategy 2018-2027 were selected for the content analysis from the Agricultural Production Relations perspective. These four policy documents were subjected to the content analysis based on 20 criteria identified from the literature survey (Table 4.9) that the research team has considered as important in a thorough content analysis. In this analysis, major input sub-sectors were taken in to consideration separately, namely, seeds and planting materials, fertilizer, pesticides, mechanization and irrigation water. The reason for the exclusion of the National Agricultural Research Policy and Strategy 2018-2027 from this analysis is merely due to the non-availability of information about the aforesaid input sub-sectors in the document separately.

Of all the 20 criteria evaluated, only 9 criteria have been addressed sufficiently (i.e. scored more than 50%) by the policy documents, namely; Adequacy of reflecting the government's vision (70%), Bio-safety (60%), Efficient use of resources (60%), Quality assurance(55%), Technology-Research-Development & innovation (55%), Agricultural extension (55%), Input security (50%), Regulatory instruments (50%) and Public Private Partnerships (50%). The least addressed criteria in the scrutinized policy documents include, Community participation opportunities (20%), Economic instruments (20%), Adequacy of reflecting needs & interests of stakeholders (15%), Misuse of economic instruments (15%), Institutional arrangements & mechanisms (5%) and Clarity of roles of relevant stakeholders (0%).

When the input sub-sectors are analyzed within the framework of policy documents, it was apparent that the seeds & planting materials and fertilizers are addressed sufficiently having percentage scores of more than 50% while mechanization and irrigation water being the least addressed input sub-sectors, having score percentages of 21% in each.

Table 4.9: Content validity grid used in the analysis of policy documents for each input sub-sector

No.	Criterion	Seed & Planting Materials	Fertilizer	Pesticides	Mechani - zation	Irrigation water	Total[1]	%
1	Local Production	4*	2	1	1	0	**8**	**40**
2	Import control	3	3	1	2	0	**9**	**45**
3	Quality assurance	4	4	2	1	0	**11**	**55**
4	Market	3	1	0	1	0	**5**	**25**
5	Input based enterprise development	2	1	2	3	0	**8**	**40**
6	Technology, Research, Development & innovation	3	2	2	3	1	**11**	**55**
7	Agricultural extension	2	4	3	1	1	**11**	**55**
8	Community participation opportunities	0	0	1	0	3	**4**	**20**
9	Capacity building	2	1	1	0	1	**5**	**25**
10	Institutional arrangements and mechanisms	0	0	1	0	0	**1**	**5**
11	Input security	4	3	2	0	1	**10**	**50**
12	Bio-safety	3	3	4	0	2	**12**	**60**
13	Regulatory instruments	3	4	2	0	1	**10**	**50**
14	Economic instruments	0	2	1	0	1	**4**	**20**
15	Adequacy of reflecting the government's vision	3	3	3	3	2	**14**	**70**
16	Adequacy of reflecting needs & interests of stakeholders	1	1	1	0	0	**3**	**15**
17	Clarity of roles of relevant stakeholders	0	0	0	0	0	**0**	**0**
18	Efficient use of resources	1	3	3	1	4	**12**	**60**
19	Misuse of economic instruments	0	2	1	0	0	**3**	**15**
20	Public Private Partnerships	2	3	4	1	0	**10**	**50**
	Total[2]	**40**	**42**	**35**	**17**	**17**		
	Percentage	**50**	**53**	**44**	**21**	**21**		

**Number of policy documents that carry the given criterion.*

[1]Total score for the given criterion (Higher the score, higher the number of policies that carry the given criterion)

[2]Total score for the given input sub-sector (Higher the score, higher the number of policies that carry as many criteria as possible for the given input sub-sector)

For each policy document, the coverage of the selected criteria under each input sub-sector was investigated and expressed as a percentage (Figure 4.6). It was observed that almost all the four scrutinized policy documents have covered at least 40% of the criteria considered in the analysis for the seeds and planting materials, fertilizer and pesticides input sub-sectors. Among the five input sub-sectors considered, mechanization and irrigation water seemed to be the areas which received the least attention in all the policies analyzed (on average, not reaching the 20% margin even).

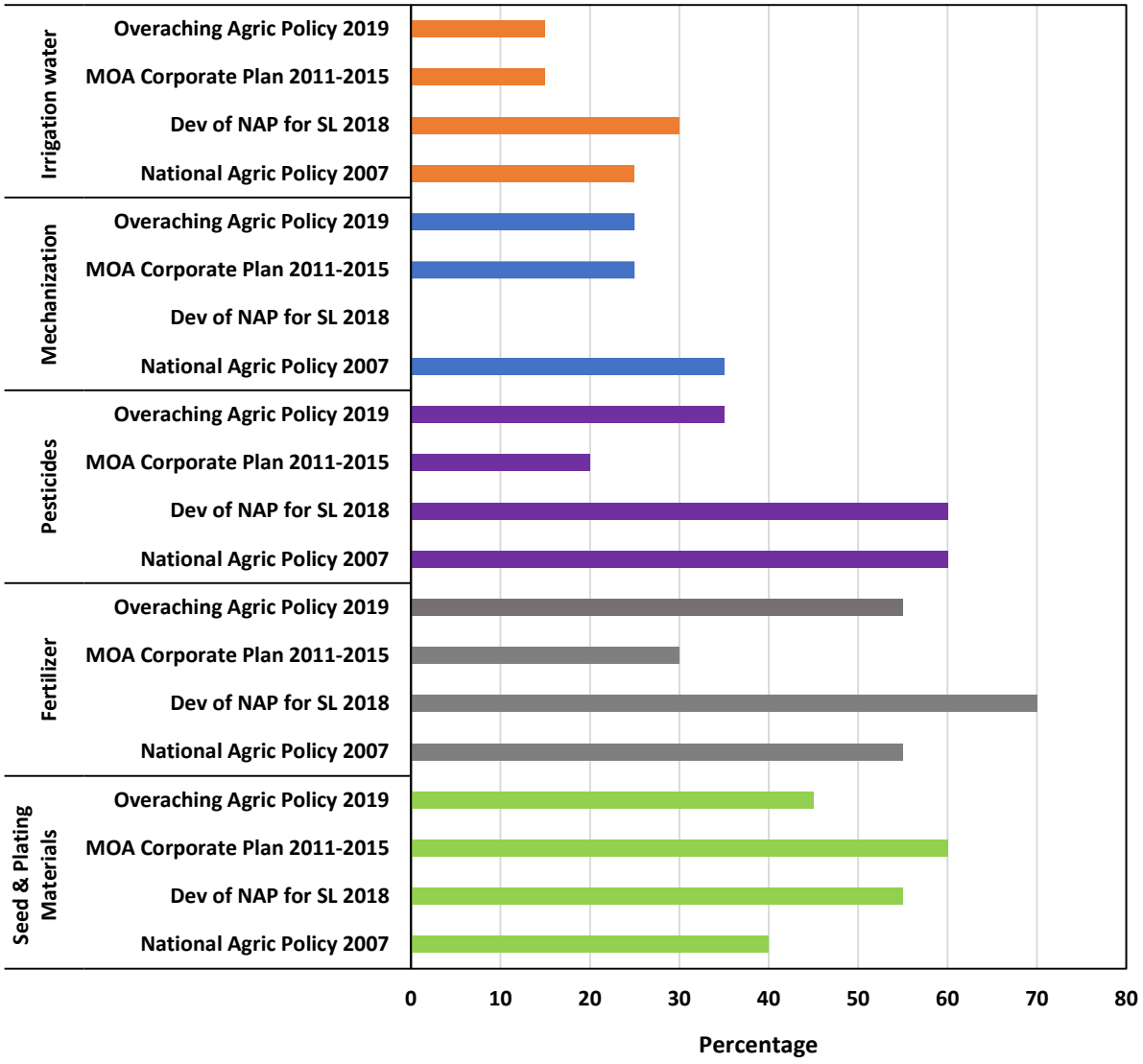


Figure 4.6: Content Analysis from APR Perspective for each input sub-sector

4.4. Salient Features of Policies in the Agriculture Sector

Salient features of Policies in the Agriculture sector are summarized in Table 4.10, below:

Table 4.10: Matrix on Agriculture Sector Related Policies

Agriculture Sector Policy	Major Goals and Policy Thrusts	Implementing Ministry
1. Sri Lanka National Agricultural Policy of MOA and Agrarian Services (2007)	• Promote sustainable agriculture development and increase productivity • Promoting integrated agriculture Introduction of modern technologies to rural agriculture • Ensure production and supply high quality seed and planting material • Promote production and utilization of organic and bio fertilizer and encourage integrated plant nutrition system • Promote bio pesticides and integrated pest management while regulating chemical pesticides • Promote mechanization through private sector involvement • Increase water use efficiency and promote improved water management systems • Adhere to land use policy and maximize land use) • Use bio technology and GIS, post-harvest technology, Nano technology for efficient agriculture production • Reorganize and strengthen agriculture system to disseminate innovations and information to the farming community through modern information and communication technology • Involve community-based organizations and farmers for technology transfer and establish research and extension linkages • Capacity building of agricultural scientists • Involve private sector in agriculture research and development and entrepreneurship •	Ministry of Agriculture and Agrarian development
2. Cooperate Plan (2011-2015).	• Current agricultural policy reforms and legal framework for agriculture development • Ensure food security • Value added products for exports • Post-harvest loses prevention • Transforming subsistence agriculture to commercial agriculture • Conservation of natural resources for sustainable land use • Facilitate access for farmers to quality inputs, services and factor production attributes • National, regional and global partnership for agriculture development • Capacity building for M&E to achieve high standards of service delivery	Ministry of Agriculture

3. Overarching Agricultural Policy (2019)	• Energizing market linkages • Revitalizing rural economy • Reaching to Global Value Chain • Ensuring food and nutrition security and food safety • Promote appropriate agricultural innovation and technology transmission through investments in research, education, training and partnerships for sustainable agricultural production • Promoting useful elements of biodiversity-friendly traditional practices integrated with modern technology • Subsidies for value chain actors to enhance agriculture production, including provision of seeds, fertilizers and machinery at affordable prices. • Opportunities for faster mechanization of agriculture operations through appropriate incentives. • Modified incentive framework for agriculture to make adoption of 'modern' technologies affordable and profitable • Provision of incentives for initiating product diversification. • Price and market interventions for enhancing the value chain development. • Restructure the NARS for greater effectiveness • Put in place an 'Agricultural Knowledge and Information System' for effective transfer of innovative practices. • Develop a comprehensive human resource and capacity building program covering all national and provincial agricultural institutions	Ministry of Agriculture
4. The Development of Agricultural Policy for Sri Lanka -2018	• Increased Sustainable Agricultural Production and Productivity • Research, Development and Innovation • Environment: Vulnerability and Resilience • Market Development • Private Sector Involvement • Extension and Empowerment of Farmers • Information Systems and Communication	Ministry of Agriculture

4.5. Global Comparison of Policies

This section aims to provide a brief analysis of agricultural production policies in the Asian region, then, propose appropriate policy recommendations emerging from these countries that could be applied to Sri Lankan context. Although many countries in the Asian region, envisage to achieve food security and production increase by having various policies and strategies in different agricultural commodities, the efficiency and effectiveness of the policies largely dependent on the adequacy of investments and role played by implementing agencies.

4.5.1. Agricultural policies in Vietnam

The master plan to develop agricultural production by 2020 and the vision in 2030 in the Vietnam government has promoted a comprehensive development effort toward food security, meeting domestic and export demand through application of science and technology, quality product assurance and improving the efficiency of agricultural inputs for competitiveness and profitability in agriculture enterprises.

In this effort, as a policy government has issued development strategies and development plans for each specific sub sectors such as rice in Mekong River Delta and Red River Delta, coffee in Dak Lak. This was followed by Agricultural restructuring plan in 2013 for value addition and maintain competitive capacity through productivity which lead to increase export and higher GDP growth of 3.5% to 4% within the period of 2016-2020.

Diversification of ineffective rice-growing areas to vegetable growing areas (112,000 ha) in Tien Giang province with government financial assistance for seed which brought higher economic efficiency as compared to rice cultivation. Under this policy, government continued to support diversification and ensure famers to produce crops all-year around and attain high productivity. More recently, promotion of Good Agricultural Practices (vietGAP) in wider areas gained momentum and enrich both in local markets and export markets.

The policies to provide incentives to private sector to get involved in irrigation water supply, build and maintain irrigation canal and access roads has considerably increase production. Introduction of policies to ensure quality of production input including seed, fertilizer and animals.

With regard to post harvest loses reduction, government has initiated policies to provide preferential credit facilities to buy machineries and equipment and for storage facilities to reduce post-harvest losses.

Policy lessons learnt and good practices

Initiation of area specific sub sectors (agricultural Zones) with the objective of promoting high value crops all-year around associated government support need to be emphasized in the production related policies.

The land use planning for diversification in the wet zone has a tremendous potential if enabling policies are existing. The availability of ineffective paddy lands in the wet zone has not been utilized to reap the potential that prevailed in these lands.

The policies to encourage prevention of post-harvest loses through application of technology and related machines and equipment and proper storage facilities seems to be relevant to Sri Lanka since there is significant gaps in value chain development in this regard.

4.5.2. Agricultural Production Policies in Bangladesh

According to the National agriculture policy in Bangladesh, Agriculture sector contributes more than 30% to the country's GDP, and more than 22% of which is contributed by the crop sector alone. About 63 percent of the labour forces are employed in agriculture with about 57 percent being employed in the crop sector.

The overall objective of the National Agriculture Policy is to make the nation self-sufficient in food through

increasing production of all crops.

The specific objectives are included in the National Agriculture Policy are to:

1. Increase crop production by both cropping intensification and increase yield and make use of fallow land
2. Crop diversification
3. Establish and consolidate the distribution system for irrigation equipment, fertilizers, seeds and credit in the light of farmers' need
4. Ensure responsibility and accountability of the private sector through strengthening of the relevant legal framework and its enforcement.
5. SEED- National Seed policy with the objective of promoting seed industry in the private sector and provide quality seed to farmers including
6. the private sector for production, import and marketing of seeds side by side with the public sector
7. The act of favourable policy preparation, technical supports, training, etc. will be strengthened in order to encourage private sector participation in seed development and seed preservation
8. Improved technology-based seed production, seed multiplication and related farm activities have been declared as industrial enterprises in the present industrial policy.
9. Already introduced seed buffer stock system will continue to ensure the normal supply of seeds of major crops at the time of natural calamities or any other disaster.
10. The conditional opportunity that has already been given to the private sector to import hybrid rice seeds for increasing rice production will be further consolidated on the basis of performance analysis. But special care will be taken to ensure that the private sector produces hybrid seeds locally and that the hybrid seeds offer higher yield and more financial benefits to the farmers on a sustained basis.
11. At present, Seed Certification Agency (SCA) is the only legal authority to certify seeds. With a view to increasing supply of quality seeds, private sector agencies participating in the seed production programmes will be allowed to market their ‘truthfully labelled seeds’ side by side with the government agencies
12. FERTILIZER As a broad principle of fertiliser use, a sustained increase in the productive capacity of land and its preservation in the long run will get priority over the immediate yield improvement. Policies for regulate excessive use of fertilizer, balance fertilizer use, including bio-fertilizer and private sector fertilizer distribution and maintaining a buffer stock are some of the policy initiatives /steps already taken by the government.
13. Irrigation policies to promote use of electricity water pumping make a significant impact on reducing the cost of production of irrigated crops.
14. As a policy Integrated Pest Management was advocated to control pest and diseases to avoid harmful consequences of indiscriminate use of pesticides by farmers.
15. With regard to mechanization of agricultural production, considering the limitation of animal draft power use, government has initiated financial assistance for farmer to buy machineries and initiated private sector enterprises not only for import of machinery but also manufacturing locally
16. Bangladesh agricultural land policy regulates use of agricultural lands for non-agricultural purpose. It also encourages zoning of agricultural land for specific crops and livestock production base on the agro-ecological conditions.
17. Policy to build up a reliable agricultural data base for planning purpose and contingency plan for

any natural disaster.

Policy lessons learnt and good practices

The most salient feature of the NAP of Bangladesh its complete coverage of all aspects of production in one policy document. Furthermore, it also shows the relevance and interlink with each component of production relations.

Other notable feature of the agriculture policy document is development of strong private public partnerships for seed production and distribution, fertiliser production and distribution, machination and production of local machinery.

Land policy adopted in Bangladesh is much relevant to Sri Lankan setting to a large extent.

It appears, make use of reliable agricultural data base for policy planning is inadequate in Sri Lanka and most of the policies may not reflect the ground situation and not necessarily evidence –based. Although policies are available for natural disasters but there is not specific policies related to disaster occur in agriculture sector such as pest outbreak, climate change effects, crop and livestock damage due to adverse weather conditions and market fluctuations. To mitigate these effects needs national policies to address the agricultural disasters

4.5.3. Agricultural and food security policies in Pakistan

The proposed Agriculture and Food Security Policy formulated by a team of experts involving national experts from the Ministry of National Food Security and Research, the Pakistan Agriculture Research Council and the National Agriculture Research Centre and adopted a strong stakeholder participatory process.

The main focus of the policy is to achieve sustainable growth in the productivity of major crops as well as the promotion of high value agriculture including horticulture, fisheries and livestock. Hence, the policy aims to increase the economic access to food for the socially deprived communities of the marginal areas.

As stated in the policy document, the key constraints identified for production and productivity are lack of favourable innovative environment to increase productivity, poor extension , access to inputs, supply chain inefficiencies, inadequate investment in agriculture sector.

The agriculture and food security policy would aim to: create a modern, efficient and diversified agricultural sector that can ensure efficient and sustainable use of natural resources, adequate supply of basic food supplies for the country's population, and provide high quality products to its industries and for export.

The National agriculture and food security policy suggested several policy strategies including institutional reform for innovation and technology transfer, Reforming Fiscal and Trade Measures, Promoting Private Investments, Improving Service Delivery to Farmers:

Targeted Productivity Enhancement Programmes and coordination of research activities between national and provincial systems, and sharing of research outputs and best practices

The policy document contains implementation arrangement and specifies roles and responsibilities of related agencies.

Policy lessons learnt and good practices

The policy focus on agriculture production and food security is considered a major trust considering the food accessibility and potential for agriculture development.

The policy Suggested institutional reforms toward addressing current agricultural production appears to be relevant to Sri Lankan situation which promote synergy and more efficient production systems.

The policy on promoting target productivity enhancement programmes to support marginal farmers through other income generation activities would benefit considerable proportion of farmers within the poverty level. This strategy could be complemented by income generating and skills enhancements programmes for the small subsistence level such as food processing, rural poultry, bee keeping, certified nurseries, tissue culture, livestock, mushroom production and seed enterprises.

It is also seen the coordination role played by government agencies to promote private sector investment and government policy support for facilitation of agricultural enterprises are encouraging and could be adopted under Sri Lankan situation.

4.5.4. Agricultural and food security Policies in India

It was observed that a shift from the previous five year plan of agriculture (2007-2012 in India in the twelfth five-year plan for 2012-17 that would accelerate the annual growth of agricultural GDP to 4% and allow for a shift of employment out of agriculture, helped by a policy restructuring aimed at supporting the diversification of agriculture and a greater involvement of the private sector in marketing agricultural produce.

The five year plan (2012-2017) emphasizes on (1) competitive agriculture enterprises, (2) the technology transfer efficiency back by quality research and capacities (3) improved agricultural infrastructure and market access with efficient natural resource use (4) Good governance in the institutions that make it possible to better deliver services like credit and animal health and quality inputs like seeds, fertilizers, pesticides and farm machinery

The Key National Agriculture policy objectives:

1. Raise the productivity of input including seeds, fertilizer, pesticides and irrigation water
2. Protect vulnerable farmers
3. Modernization of agriculture
4. Increase yield of major commodities to reach the potential yields and profits
5. Control environment degradation
6. Strengthen research and farmer linkages

Policy lessons learnt and good practices

It is seen that the policy environment allows regional or state agricultural policy formulation and investment within the framework of the Central government. This is a positive structural change that could result more specific areas /commodity-oriented programs.

The involvement of Local institutions such as Panchayad in policy formulation, programme planning, implementation and monitoring is encouraging which is not at optimum level in Sri Lanka.
Policy environment for strengthening research and farmer linkages is an important aspect in innovations and technology transfer. This approach seems to be applicable in Sri Lankan setting

India has been adopting a five-year cycle policy planning for agriculture and food security that continued for 12 consecutive periods. Because of this continuum, the progress of agriculture sector could be seen in proper perspective and make relevant and evidence-based policies decisions.

Chapter 5

Systematic Review and Meta-Analysis of Efficiency of Resource Allocation in the form of Technical Efficiency (TE)

5. Systematic Review and Meta-Analysis of Efficiency of Resource Allocation in the form of Technical Efficiency (TE) in Selected Agricultural Sub-sectors

Technical efficiency (TE) can be defined as the ability of a decision-making unit (e.g. a farm) to produce maximum output given a set of inputs and technology. According to Farrell (1957), TE is one component of economic efficiency (EE) where the latter is defined as the product of TE and allocative efficiency (AE). In turn, AE refers to the ability to produce a given level of output using cost-minimizing input ratios. In the present study, the research team has taken only the TE into consideration as it directly relates the inputs to outputs in a more tangible sense.

Technical efficiency reflects the ability of firms to produce as much output as possible from a given level of inputs, or to use as little input as possible to obtain a given level of output. Accordingly, two measures of technical efficiency could be defined (Kopp, 1981). The first one is the output-oriented *Timmer-type* measure, which relates actual output to best practice output. It gives the maximum amount by which output can be increased for a given input vector. The second one is the input-oriented *Farrell-type* measure, reflecting the ratio of best practice input usage to actual input usage, output held constant. It gives the maximum amount by which an input vector can be decreased proportionally, while producing the same amount of output. Moreover, the input-oriented measure has an intuitive cost interpretation since one minus the degree of technical efficiency gives the percentage decrease in total cost associated with the complete removal of technical inefficiency (Kopp 1981).

For multiple input variables and output factors, the TE value can be estimated by the ratio of the weighted sum of outputs to the weighted sum of inputs. Mathematically, it can be expressed as follows (Cooper, Seiford, & Tone, 2006):

$$TE = \frac{u_1 y_{1j} + u_2 y_{2j} + \ldots + u_n y_{nj}}{v_1 x_{1j} + v_2 x_{2j} + \ldots + v_m x_{mj}} = \frac{\sum_{r=1}^{n} u_r y_{rj}}{\sum_{s=1}^{m} v_s x_{sj}}$$

Where, u_r indicates the output weight n, y_r indicates the output quantity n, v_s indicates the input weight n, x_s indicates the input quantity n, r indicates the number of outputs (r = 1, 2, …, n), s indicates the number of inputs (s = 1, 2, …, m) and j indicates the jth DMU (j = 1, 2, …, k). If any parameter is missing here, the TE value cannot be estimated for a given crop, even though approximation methods have been used elsewhere.

The research team has initially made attempts to calculate the TE of the crops selected for the study within the farm households in the selected Districts. However, due to the following reasons, it was not made possible;

1. Farmlands of the majority (85%) of the farmers surveyed were less than 5 acres (2 ha) based on the information provided by the farmers (Table 5.1). The research team felt some reliability-related contradictions in noting down the given information by the farmers.
2. It was apparent in the survey results that, the farmers tend to cultivate various crops and rear livestock in a random manner. Even after following the purposive sampling technique, the total sample (n=650) included various types of farmers (Figure 5.1), accounting for 51 types of crops and 6 types of livestock, thus making the sample size for each crop or livestock category much smaller thereby making the TE analysis incomplete.

3. The study covered 14 Districts in Sri Lanka. The research team did not want to pool the data of all Districts as it will bring an unnecessary heterogeneity in TE estimations. It was difficult to obtain a sufficient sample size for a given crop within a District, thus making the TE estimation difficult.
4. Some of the famers were not conversant in providing the actual data in relation to the outputs whereas, some of the farmers were reluctant to provide the same.

Table 5.1: Cultivated land extent by the surveyed farmers in each District sampled.

District	Up to 0.5 acres	>0.5-1.0 acres	>1.0-3.0 acres	>3.0-5.0 acres	>5.0-10.0 acres	More than 10 acres
Kurunegala	5	22	26	2	4	1
Mullaitivu	0	0	6	6	7	1
Kilinochchi	4	23	2	4	2	0
Polonnaruwa	0	13	31	11	4	1
Badulla	4	21	25	9	0	1
Baticaloa	0	1	18	13	12	6
Anuradhapura	0	17	22	20	7	4
Matale	13	29	34	10	0	4
Gampaha	0	2	8	16	2	7
Jaffna	12	14	10	1	3	0
Vavuniya	1	2	12	6	6	3
Ampara	0	4	26	12	5	3
Moneragala	4	0	10	18	5	3
Kegalle	0	2	6	0	2	0
Total farmers	***43***	***150***	***236***	***128***	***59***	***34***
% of farmers	***6.6***	***23.1***	***36.3***	***19.7***	***9.1***	***5.2***

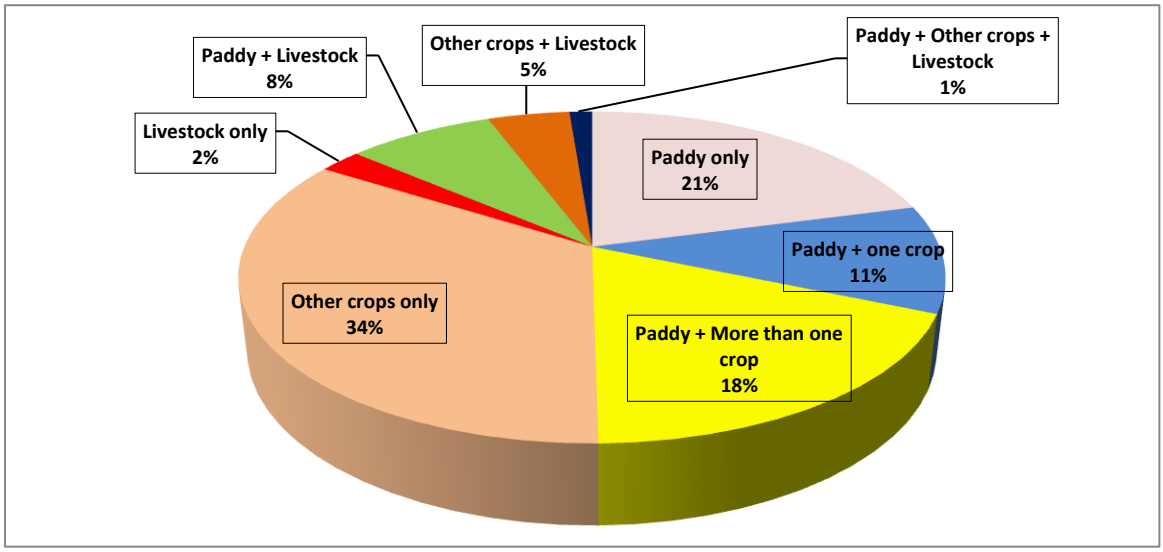


Figure 5.1: Types of farming activities by the surveyed farmers. *Note: 'Other crops' category comprises of 51 different types of crops including cereals, pulses, vegetables, OFCs and fruits*.

Therefore, considering all the aforesaid factors, the focus of the research team on the meta-analysis of Technical Efficiency was purely based on the empirical studies conducted by various scientists elsewhere.

Even though the documents carrying Technical Efficiency (TE) estimated through Deterministic production frontiers that include parametric and non-parametric frontiers, and through Stochastic production frontiers that include cross-sectional frontiers, panel data and dual frontiers were gathered at the pre-screening stage, the documents with Stochastic-production-frontier approach were selected to study the TE further. The Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) concept is applied in the document to illustrate the methodology (Figure 5.2).

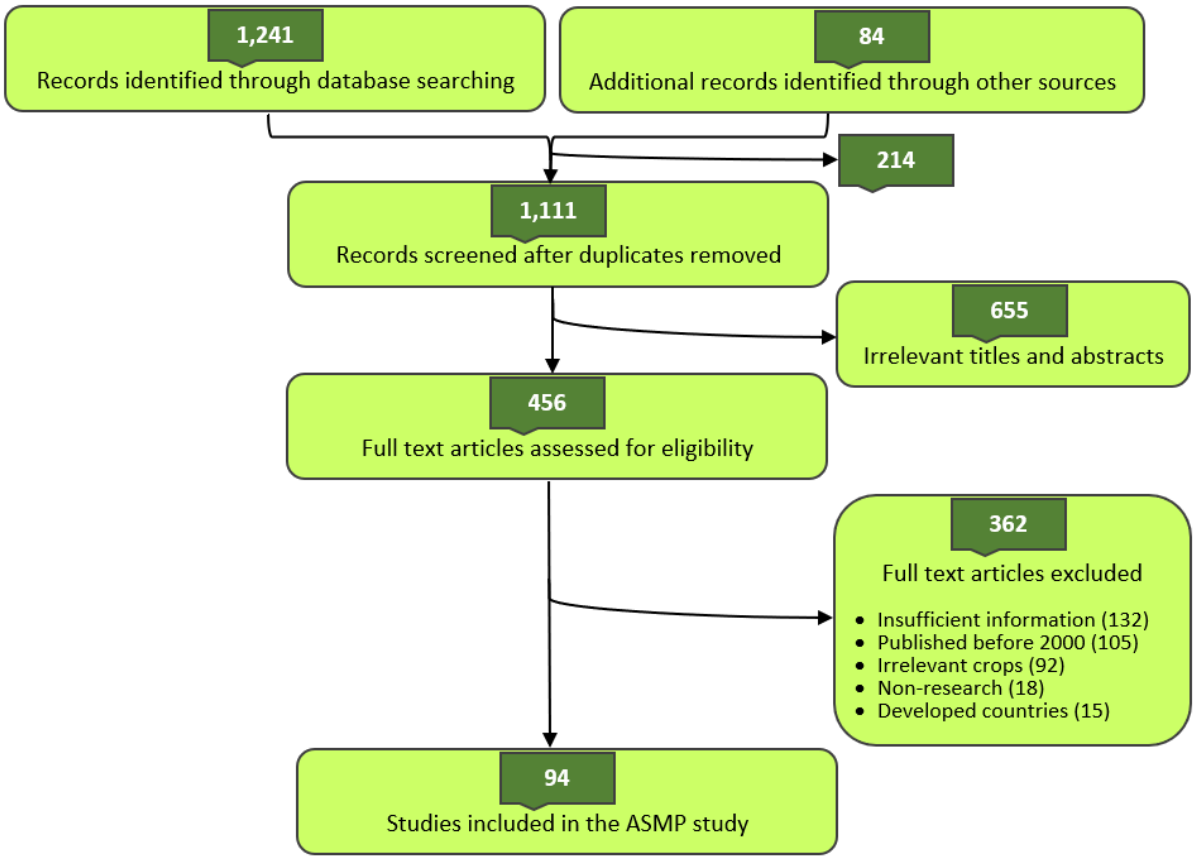


Figure 5.2: PRISMA (Preferred Reporting Items for Systematic reviews and Meta-analyses) flow diagram of included articles in the Technical Efficiency of resource allocation

One of the key observations of the research team in relation to TE is that, sufficient studies have been conducted to estimate the TE in paddy farming around the world. However, the attention paid on estimating TE of other crops is not satisfactory, perhaps due to the fragmented smallholder farm sizes and unavailability of reliable data, as the research team also experienced in its own farmer survey. With some effort, the research team tried to include TE studies conducted in Sri Lanka in relation to agriculture sector, however, again the hindrance was the lack of recent studies. Nevertheless, the current meta-analysis includes 11 Sri Lankan studies related to TE in agriculture sector.

The TE estimates for various crops and livestock are given in the Table 5.2. It is apparent that the TE of different crops in different regions in the world vary greatly. Even the TE of the same crop varies with the way that the resource allocation takes place even within a single country. The mean TE of each study is presented here, however, the TE data presented in the original articles show a considerable dispersion within a given study, in some cases dispersed in the range from 0.2 (min) to 0.9 (max). Of the 94 studies considered, only 47 studies have yielded a TE of above 0.8, where livestock sector stands out predominantly (poultry, dairy an aquaculture). Among the major crops belong to this category, cucumber and B-onion dominate.

Figure 5.3 shows the forest-plot carrying the mean technical efficiencies for the crops considered and for the livestock sub-sector, based on the means calculated for each crop/livestock sub-sector using the 94 articles presented here. Of the key crops considered in the Agriculture Sector Modernization Project, i.e. maize, potato, soybean, chilli and B-onion, the highest mean TE was recorded in B-onion (0.83±0.15) whereas the lowest was recorded in maize (0.703±0.09) and in soybean (0.705±0.13). The TE of chilli cultivation was 0.78 with the greatest variability (0.19 SEM) among those crops, that signifies the unpredictable nature of the chilli cultivation.

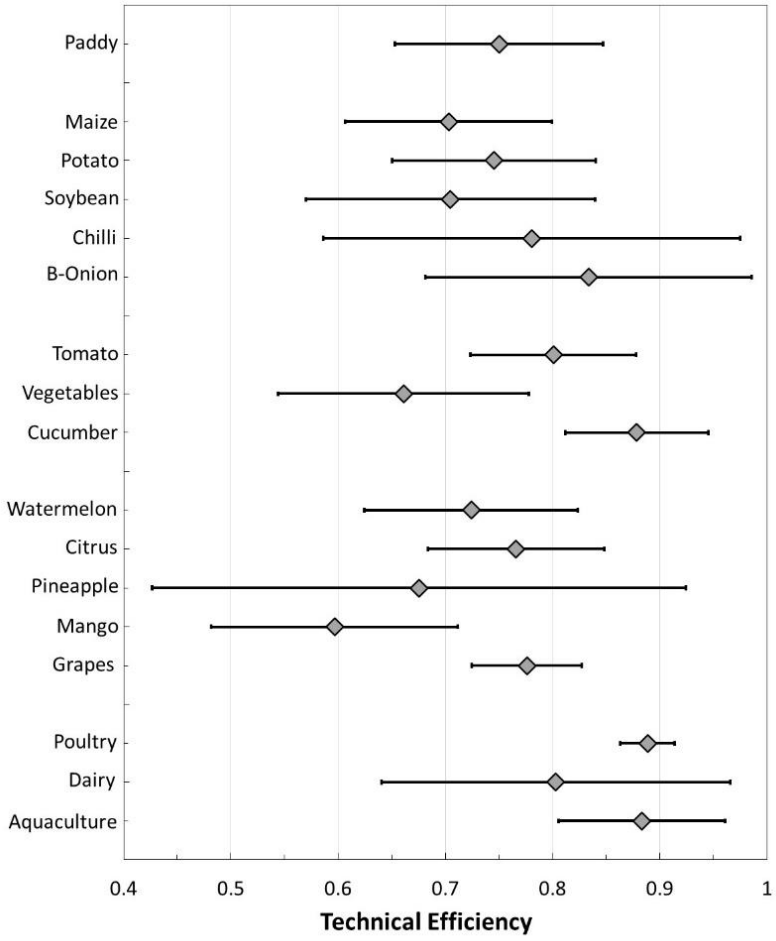


Figure 5.3: Forest-plot of mean Technical Efficiencies (TE) of different agricultural sub-sectors. Mean and the Standard error of the mean is given. n≥5 for each sub-sector except for Aquaculture (n=3)

Among all the crops considered in the present study, cucumber seems to be a highly technically efficient crop (Figure 5.3) with a mean TE of 0.88±0.07. However, within the sampling frame of the farmer survey that was carried out by the research team, only 17 farmers were there who cultivate cucumber. Tomato cultivation was also technically efficient (0.80±0.08) considerably. Of the total sample of 650 farmers in the survey conducted by the research team, 34 farmers cultivated tomato. Vegetables, in general, displayed approximately 34% of the technical inefficiencies.

Among the fruit crops studied in the meta-analysis, citrus and grapes resulted in an estimated mean TE of 0.78±0.05 and 0.77±0.08 respectively. Mango was found to be the least technically efficient with a mean TE of 0.596±0.11. Pineapple is the most unpredictable crop among the fruits studied resulting an average TE of 0.67 with a standard error of 0.25.

Dairy, poultry and aquaculture farming operations were found to be highly technically efficient having mean TE values of 0.80±0.16, 0.89±0.02 and 0.88±0.08 respectively. Among these three activities, the TE of poultry can be highly predictable, with a minimal dispersion of error, whereas the most unpredictable venture being the dairy farming.

As per the results based on this study, the broad differences in the technical efficiencies show that there is a need for awareness among farmers to operate the farming technique, appropriately. Technological awareness in operating farms is necessary to optimize a farmer's income (Zhang, Wang, & Duan, 2016). Definite governmental authorities and private sectors could help in minimizing of input costs to obtain output gains.

Many previous studies indicate that the farmer's education level and farming experience have significant positive effects on technical efficiency. Further, the wasteful uses of production costs by inefficient farmers have also been reported. In addition, age of the farmer, access to credit and extension facilities, scale of operation, fragmented structure of farmlands, off-farm income and membership in a cooperative society are amongst the other factors that affect the technical efficiency of a given farm.

In the present survey study, the research team wanted to find out how farmers perceive constraints that hinder their output leading to a low technical efficiency. Table 5.3 shows the highly rated constraints that the farmers face in terms of agricultural production relations. Based on the results of the survey, it was clearly evident that almost the same set of factors identified in the meta-analysis affect the study sample of farmers.

In recent years, evaluating farmer's efficiency in an agricultural community has become a vital issue. Numerous researchers have put forward various qualitative and quantitative ideas to optimize income generation in the smallholder sector. To reduce the poverty of farmers, the production efficiency needs to be optimized and the government-controlled policy interventions are necessary. In determining performance, TE is the means for developing new technologies and ideas which permit low input costs and low power-consuming inputs in farming.

From a policy standpoint, more accurate TE estimates are crucial in guiding policy decisions dealing with farm extension and training programs, among others. Finally, further meta-analysis research of TE seems warranted. In our opinion, additional work that incorporates a larger set of studies with broader geographical and or sectoral coverage would produce a better understanding of the association between measures of TE and the attributes of the studies reporting these measures. Moreover, the researchers should be encouraged to perform more and more studies related to technical efficiency of agriculture sub-sectors within Sri Lanka.

Table 5.3: Major constraints that affect the agricultural production relations in the famers surveyed (n=650)

Constraint	Mean Score*	SEM
Adverse climatic effects & natural disasters	8.15	2.88
Disruptions from diseases and pathogens	8.11	2.55
Lack of government support in terms of subsidies and other incentives	7.94	2.15
Disruptions from wild animals	7.92	2.77
Poor efficiency of water management mechanism	7.69	2.61
Non-availability of pricing mechanisms	7.42	3.08
Non-availability of latest technologies/Machinery	7.42	2.47
Insufficient opportunities to sell the products in the marketplace	7.40	2.66
Lack of expert advice on production	7.16	2.33
Insufficient availability of qualified technical personnel	7.05	2.48
Non-supportive government policies, regulations and standards	7.05	2.75
Need of large amount of capital to initiate production	7.01	2.78

*Pre-determined constraints were given to the farmers and they were asked to give a score for a particular constraint in a scale of 1-10. Higher the number, the greater the impact of the constraint as the farmers perceived. SEM: Standard Error of Mean. Of the 41 constraints tested, only the constraints having a mean score of >7 are presented here.

The findings of the meta-analysis of technical efficiency that will lead to several key policy implications, are summarized below;

a) In order to enhance productivity, there is a need to emphasize improvement of the socioeconomic characteristics of farmers. Since education levels significantly influence output, the focus should be on better training for the farmers and on encouraging the use of better farm inputs. This would discourage the farmers' mis-beliefs if any. Training of farmers can be intensified by increased extension services via demonstration farms within the vicinity of most farmers.

b) In recent years, a number of development agencies, including the world bank, have promoted farmer field schools (FFS) as a more effective approach to extend science-based knowledge and practices. The FFS training program utilizes participatory methods ''to help farmers develop their analytical skills, critical thinking, and creativity, and help them learn to make better decisions'' (Kenmore, 1997). Such an approach, in which the trainer is more of a facilitator than an instructor, reflects a paradigm shift in extension work (Roling and van de Fliert, 1994). As an extension approach, the FFS concept does not require that all farmers attend FFS training. Rather, only a selected number within a village or local farmer group are trained in these informal schools. However, in order to disseminate new knowledge more rapidly, selected farmers receive additional training to become farmer-trainers, and are expected to organize field school replications within the community, with some support from public sources. These farmer-to-farmer diffusion effects are expected to bring about cost-effective knowledge dissemination and financial sustainability, issues that have hampered many public extension systems in developed and developing countries (Quizon et al., 2001; Hanson and Just, 2001).

c) Given that the necessary complementary resources and economic environment are not yet in place for access to formal credit for smallholder rural population in Sri Lanka, and considering that the formation of sustainable rural financial institutions is such a difficult task in poor rural economies, the research team recommends a cautious and gradual strategy for expansion of the rural financial institutions in the farming communities. This strategy would require direct support by the government, through an adequate legal and regulatory framework, of institutional innovations and pilot programs in rural areas that may have the potential to reduce transaction costs in providing savings, credit, and insurance services to the rural clientele. In achieving the same objective, this can be done through farmers' cooperatives and other organizations at the local level.

Table 5.2. Systematic review and Meta-Analysis of Technical Efficiency (TE) of selected agricultural sub-sectors

a) **Paddy, OFCs and Vegetables**

Author	Country	Journal	Sample Size	Mean TE
Rice/Paddy				
Balcombe, et al (2008)	Bangladesh	*Applied Economics*	295	0.59
Chauhan et al. (2006)	India	*Energy Conversion and Management*	97	0.77
Dhungana, Nuthall, and Nartea (2004)	Nepal	*The Australian Journal of Agricultural and Resource Economics*	76	0.76
Diep (2013)	Vietnam	*Agricultural and Food Economics*	1,000	0.65
Hoang Linh (2012)	Vietnam	*International Journal of Development Issues*	595	0.70
Khan, Baten, Nawawi, and Murat (2016)	Malaysia	*American Institute of Physics*	70	0.61
Kwon and Lee (2004)	Korea	*The Australian Journal of Agricultural and Resource Economics*	5,130	0.72
Mohammadi et al. (2015)	Iran	*Journal of Cleaner Production*	82	0.8
Nabavi-Pelesaraei et al (2014)	Iran	*Engineering in Agriculture, Environment and Food*	120	0.79
Nabavi-Pelesaraei, Rafiee et al (2017)	Iran	*Journal of Cleaner Production*	240	0.95
Tipi, Yildiz, Nargeleçekenler, and Çetin (2009)	Turkey	*New Zealand Journal of Crop and Horticultural Science*	70	0.92
Bhavan and Maheswaranathan (2012)	Sri Lanka	*Sri Lanka Economic Research Conference*	100	0.73
Wijesinghe and Wijesinghe (2015)	Sri Lanka	*Research Reports - HARTI*	495	0.72
Gedara et al (2012)	Sri Lanka	*Journal of Agricultural Economics*	460	0.72
Aruna Shantha et al (2013)	Sri Lanka	*Australian Journal of Basic and Applied Sciences*	357	0.73
Maize				
Houshyar, et al (2012)	Iran	*Energy*	89	0.55
Banaeian and Zangeneh (2011)	Iran	*Energy*	10	0.81
Abdulai et al (2013)	Ghana	*African Journal of Agricultural Research*	360	0.74
Ayinde et al (2015)	Nigeria	*Journal of Development and Agricultural Economics*	100	0.69
Esham (2014)	Sri Lanka	*Mediterranean Journal of Social Sciences*	130	0.72
Potato				
Karimov (2013)	Uzbekistan	*Agriculture*	178	0.64
Mardani and Salarpour (2015)	Iran	*Information Processing in Agriculture*	23	0.9
Pahlavan, Rafiee, and Omid (2012)	Iran	*International Journal of Green Energy*	44	0.74
Prasanna and Lakmali (2016)	Sri Lanka	*Sri Lanka Journal of Economic Research*	100	0.73
Amarasinghe and Weerahewa (2001)	Sri Lanka	*Tropical Agricultural Research*	55	0.72
Soybean				
Mohammadi et al. (2013)	Iran	*Journal of Cleaner Production*	94	0.81
Mousavi-Avval, et al (2011b)	Iran	*Applied Energy*	94	0.85
Etwire, Martey and Dogbe (2013)	Ghana	*Sustainable Agriculture Research*	200	0.53
Mohammed et al (2016)	Ghana	*ADRRI Journal of Agriculture and Food Sciences*	168	0.61
Sharma et al (2016)	India	*Soybean Research*	200	0.72

Chilli				
Haq and Arshad (2010)	Bangladesh	*American Journal of Applied Sciences*	100	0.77
Hossain (2016)	Bangladesh	*Journal of Statistics Applications & Probability Letters*	50	0.88
Krasachat (2017)	Thailand	*91st Annual Conference of the Agricultural Economics Society*	107	0.45
Arya et al (2018)	Indonesia	*Proceedings of 2nd International Conference on Food and Agriculture*	125	0.86
Pakpahan and Nababan (2018)	Indonesia	*International Journal of Progressive Sciences and Technologies*	30	0.94
B-Onion				
Baree (2012)	Bangladesh	*Bangladesh Journal of Agricultural Research*	225	0.83
Khan (2015)	Pakistan	*Journal for the Advancement of Developing Economies*	93	0.94
Abdulkadir (2015)	Ethiopia	*International Journal of Agricultural Extension and Rural Development*	100	0.82
Mari and Lohano (2007)	Pakistan	*The Pakistan Development Review*	60	0.59
Nurhapsa et al (2017)	Indonesia	*Entomology and Applied Science Letters*	75	0.98
Tomato				
Murthy, et al (2009)	India	*Agricultural Economics Research Review*	90	0.78
Raheli, Rezaei, Jadidi, and Mobtaker (2017)	Iran	*Information Processing in Agriculture*	150	0.92
Pahlavan et al. (2011)	Iran	*Energy*	31	0.82
Donkoh et al (2013)	Ghana	*American Journal of Experimental Agriculture*	100	0.71
Murthy et al (2009)	India	*Agricultural Economics Research Review*	90	0.78
Vegetable crops				
Umanath and Rajasekar (2013)	India	*Indian Journal of Science and Technology*	270	0.57
Karunaratne (2014)	Sri Lanka	*Sri Lanka Journal of Economic Research*	450	0.52
Aruna Shantha (2018)	Sri Lanka	*Sri Lanka Journal of Economic Research*	243	0.75
Thayaparan et al (2019)	Sri Lanka	*Journal of Management and Tourism Research*	50	0.79
Rajendran et al (2015)	Tanzania	*Journal of Development and Agricultural Economics*	181	0.67
Cucumber				
Bolandnazar, Keyhani, and Omid (2014)	Iran	*Journal of Cleaner Production*	60	0.87
Khoshnevisan et al. (2013)	Iran	*Energy*	26	0.99
Heidari, Omid, and Mohammadi (2012)	Iran	*Expert Systems with Applications*	46	0.82
Omid, et al (2011)	Iran	*Energy Conversion and Management*	18	0.88
Pahlavan, Omid, and Akram (2012)	Iran	*Journal of Agricultural Science and Technology*	26	0.83

b) Fruits

Author	Country	Journal	Sample Size	Mean TE
Watermelon				
Banaeian and Namdari (2011)	Iran	*International Journal of Renewable Energy Research*	85	0.67
Khoshnevisan et al. (2015)	Iran	*Journal of Cleaner Production*	88	0.80
Sarkar et al (2017)	Bangladesh	*IOSR Journal of Economics and Finance*	180	0.86
Yekti et al (2015)	Indonesia	*International Journal of Computer Applications*	169	0.64
Otunaiya and Adedeji (2014)	Nigeria	*International Journal of Applied Agricultural and Apicultural Research*	80	0.65
Citrus				
Beltrán-Esteve and Reig-Martínez (2014)	Spain	*Agricultural Systems*	100	0.71
Clemente, Lírio, and Gomes (2015)	Brazil	*Bio-based and Applied Economics*	67	0.79
Nabavi-Pelesaraei et al. (2014)	Iran	*Journal of Cleaner Production*	60	0.90
Reig-Martínez and Picazo-Tadeo (2004)	Spain	*Agricultural Systems*	33	0.71
Pineapple				
Idris, Siwar, and Talib (2013)	Malaysia	*American Journal of Applied Sciences*	124	0.29
Amarasuriya et al (2010)	Sri Lanka	*Journal of Food and Agriculture*	80	0.85
Balogun et al (2018)	Nigeria	*International Journal of Fruit Science*	101	0.61
Lubis et al (2014)	Indonesia	*IOSR Journal of Agriculture and Veterinary Science*	142	0.70
Adegbite and Adeoye (2015)	Nigeria	*Agris on-line Papers in Economics and Informatics*	120	0.93
Mango				
Kiet et al (2019)	Vietnam	*International Journal of Multidisciplinary Research*	1613	0.53
Mar et al (2013)	Myanmar	*Journal of the International Society for Southeast Asian Agricultural Sciences*	151	0.71
Hong et al (2019)	Vietnam	*International Journal of Environmental & Agriculture Research*	741	0.43
Verma et al (2018)	India	*International Journal of Current Microbiology and Applied Sciences*	50	0.66
Grape				
Khoshroo et al. (2013)	Iran	*Energy*	41	0.72
Vázquez-Rowe, et al (2012)	Spain	*Journal of Cleaner Production*	40	0.86
Lwelamira et al (2017)	Tanzania	*Rural Planning Journal*	126	0.77
Lei et al (2016)	China	*International Conference on Education, Sports, Arts and Management Engineering*	1690	0.77

c) Livestock

Author	Country	Journal	Sample Size	Mean TE
Broiler and Poultry				
Amid, et al (2016)	Iran	*Information Processing in Agriculture*	70	0.88
Payandeh, et al (2017)	Iran	*Energy*	90	0.91
Begum, et al (2012)	Bangladesh	*Applied Economics*	75	0.86
Heidari, Omid, and Akram (2011)	Iran	*Brazilian Journal of Poultry Science*	44	0.92
Yusuf and Malomo (2007)	Nigeria	*International Journal of Poultry Science*	49	0.87
Dairy farm				
Candemir and Koyubenbe (2006)	Turkey	*Journal of Applied Animal Research*	80	0.95
Gelan and Muriithi (2012)	Africa	*Agrekon*	371	0.80
Günden, S¸ahin, Miran, and Yildirim (2010)	Turkey	*Journal of Applied Animal Research*	87	0.61
Hosseinzadeh-Bandbafha et al. (2017)	Iran	*Energy*	30	0.93
Hosseinzadeh-Bandbafha, et al. (2016)	Iran	*Journal of the Saudi Society of Agricultural Sciences*	110	0.90
Iribarren, et al (2011)	Spain	*Science of the Total Environment*	72	0.43
Kelly, et al (2012)	Ireland	*Irish Journal of Agricultural and Food Research*	190	0.83
Shortall and Barnes (2013)	Scotland	*Ecological Indicators*	200	0.82
Wettemann and Latacz-Lohmann (2017)	Germany	*Agricultural Systems*	216	0.83
Aquaculture				
Cinemre, et al. (2006)	Turkey	*Aquaculture*	73	0.82
Iliyasu and Mohamed (2016)	Malaysia	*Aquaculture Reports*	100	0.86
Zongli et al. (2017)	China	*Aquaculture Economics & Management*	48	0.97

Chapter 6

Analysis of Production Indicators of Selected Crops: Past, Present and Future

6. Analysis of Production Indicators of Selected Crops: Past, Present and Future

The annual production of maize shows an increasing trend over the last 10 years, though with some occasional ups and downs, yielding the maximum recorded in 2018 with a production of ~270,000 Mt (Figure 6.1 A). More than 80% of the production comes from the Maha season. The total annual requirement of maize in Sri Lanka is about 480,000 Mt (in 2018) which is almost double the current production within the country, thus showing a great potential to increase the production. The mean annual yield of maize has not reached the realizable potential yield, i.e. 5 Mt/ha yet, however, it appears that the mean annual yield is increasing over the last 10 years even though with a slow pace (Figure 6.1 B). The research potential yield is almost the double of the the current mean annual yield, showing some lapses in the cultivation practices. One way to achieve the production targets is to increase the cultivating extent. In maize, the cultivated extend has been stagnated over the last 5 years (Figure 6.1 C).

The total annual requirement of green chilli and dried chilli is about 30,000 Mt and 60,000 Mt respectively, creating about 270,000 Mt of green chilli demand annually. However, the current production is only about 79,000 Mt (2018) within the country, of which, about 65% comes from the Maha season (Figure 6.2 A). The mean annual yield in 2018 was 5.8 Mt/ha which is somewhat closer to the realizable potential yield, that is 8 Mt/ha (Figure 6.2 B). However, a serious attention should be paid to see why the mean annual yield at famer fields cannot come even closer to the research potential yield of 32 Mt/ha. Unless the country increases the cultivated extend of chilli, the annual demand will not be able to fulfilled as the current trend in extent of cultivation is almost stagnant around 14,000 ha over the last 10 years (Figure 6.2 C).

The annual production of potato has been showing an increasing trend over the last 10 years with a yield of *c.a.* 101,000 Mt in 2018 (Figure 6.3 A). Every year, both Yala and Maha seasons contribute to the total production approximately equally, except in 2011 and 2017. It is apparent that, to reach the total annual requirement of 200,000 Mt within the country, the production needs to be doubled. In achieving the production targets, the authorities need to look in to the possibilities of improving the mean annual yield which currently stagnates around 18 Mt/ha, which is the realizable potential yield (Figure 6.3 B). However, the research potential yield of 28 Mt/ha gives us a green light in improving the mean annual yield. The cultivated extent has been in a verge of increase from 2010 to 2016, however, has been declined in 2017 with a little increase again in 2018 (Figure 6.3 C), that shows the necessity of going for a drastic increase in cultivating extent in the future.

Of the total annual production of B-onion, about 95% is produced during the Yala season. Even though the country hit a record production of about 100,000 Mt in 2014, since then, a drastic decline in production has been observed (Figure 6.4 A). With the total annual requirement of 250,000 Mt, it seems impossible to reach this target with the current production trends. The mean annual yield of B-onion has reached the realizable potential yield of 20 Mt/ha in 2018 which is the only satisfactory indicator in terms of B-onion production in Sri Lanka (Figure 6.4 B) at present. However, achieving the potential yield at research level which is 37 Mt/ha seems to be a herculean task. The major reason for the decline in local production of B-onion since 2014 was because of the drastic decline in the cultivated extend (Figure 6.4 C), which also is an alarming indicator if the country expects to increase the domestic production.

The domestic production of soybean is not at all at a satisfactory level compared to the total annual requirement within the country, that is 280,000 Mt (Figure 6.5 A). Approximately 85% of the total domestic production comes from the Yala season, except in 2017 and 2018, where both Yala and Maha seasons contributed significantly to the total production. The country has gone beyond the realizable potential yield of 2.2 Mt/ha during 2008 and 2009, however, since then, the mean annual yield has been stagnating

around 1.5-1.7 Mt/ha, which needs to be addressed immediately (Figure 6.5 B). One of the biggest challenges in achieving the cultivation targets within the country is unpredictable and fluctuating cultivated extent of soybean with a drastic drop up to 1,500 ha in 2018 compared to 8,300 ha in 2017 (Figure 6.5 C).

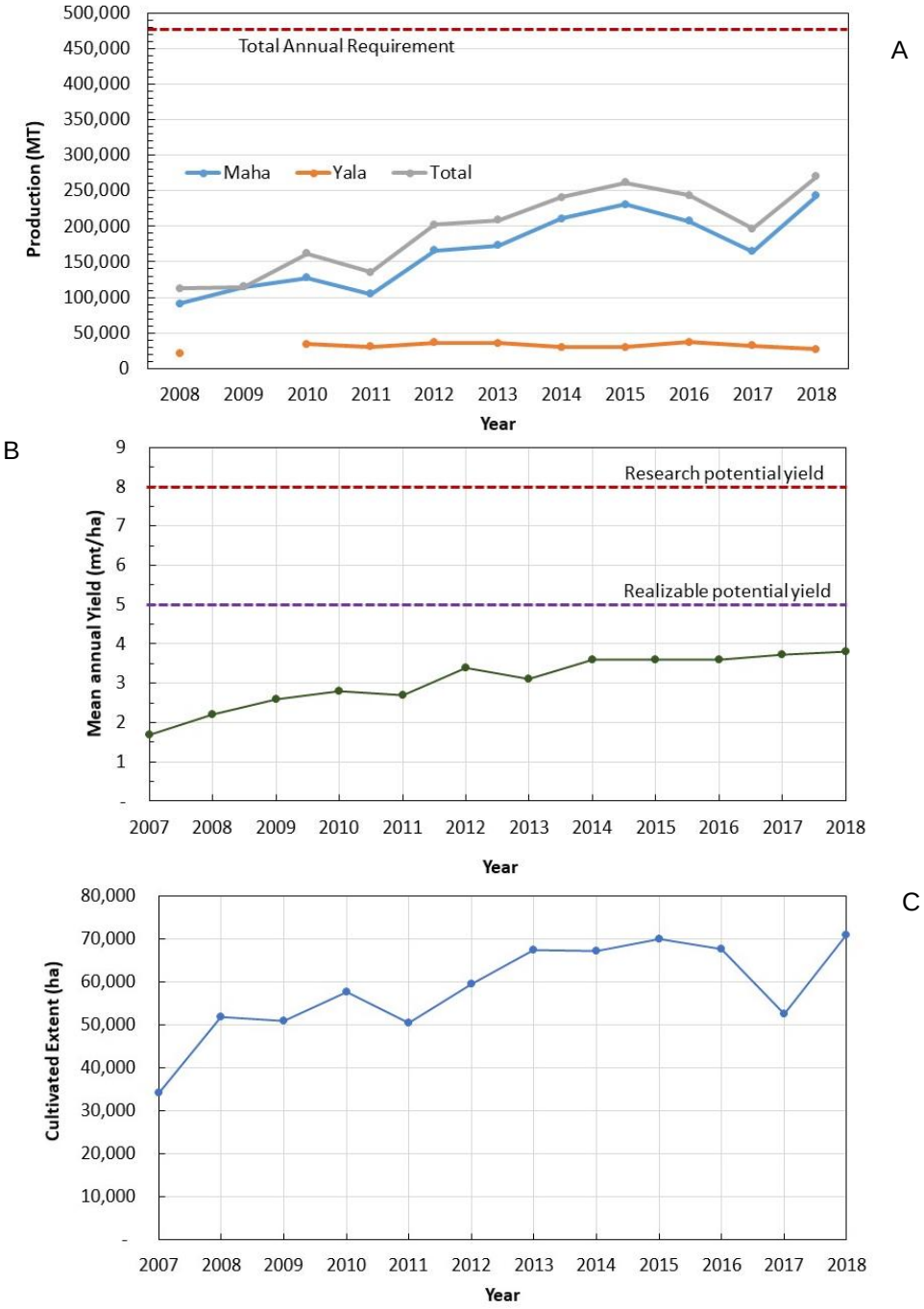


Figure 6.1: Production statistics of maize: A) Total annual production (Mt) including two main growing seasons with the total annual requirement (as of 2018) in the country, B) Mean annual yield (Mt/ha) compared to realizable yield and research potential yield, C) Cultivated extent (ha) over the years. *(Data source: Department of Agriculture)*

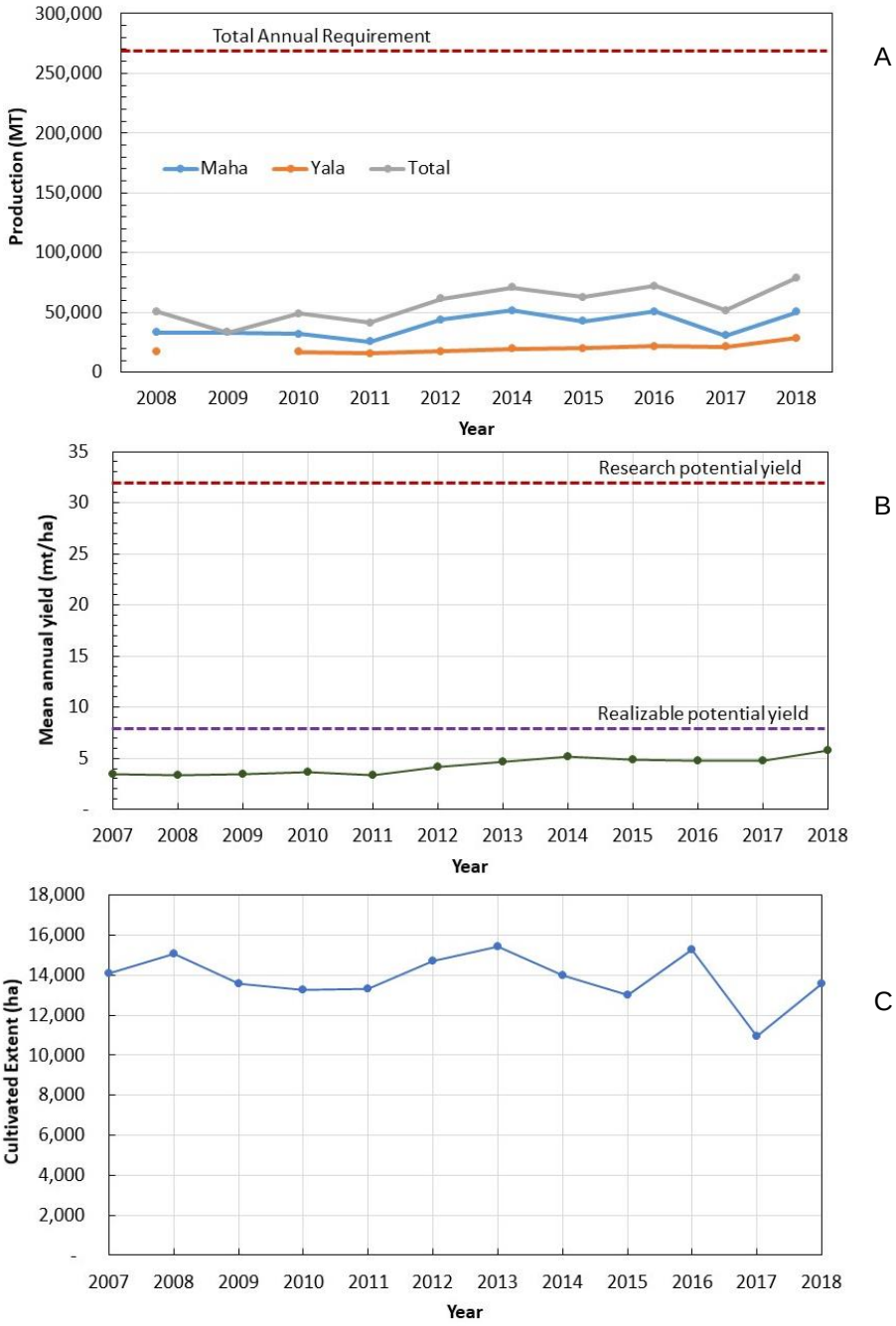


Figure 6.2: Production statistics of chilli: A) Total annual production (Mt) including two main growing seasons with the total annual requirement (as of 2018) in the country, B) Mean annual yield (Mt/ha) compared to realizable yield and research potential yield, C) Cultivated extent (ha) over the years. *(Data source: Department of Agriculture)*

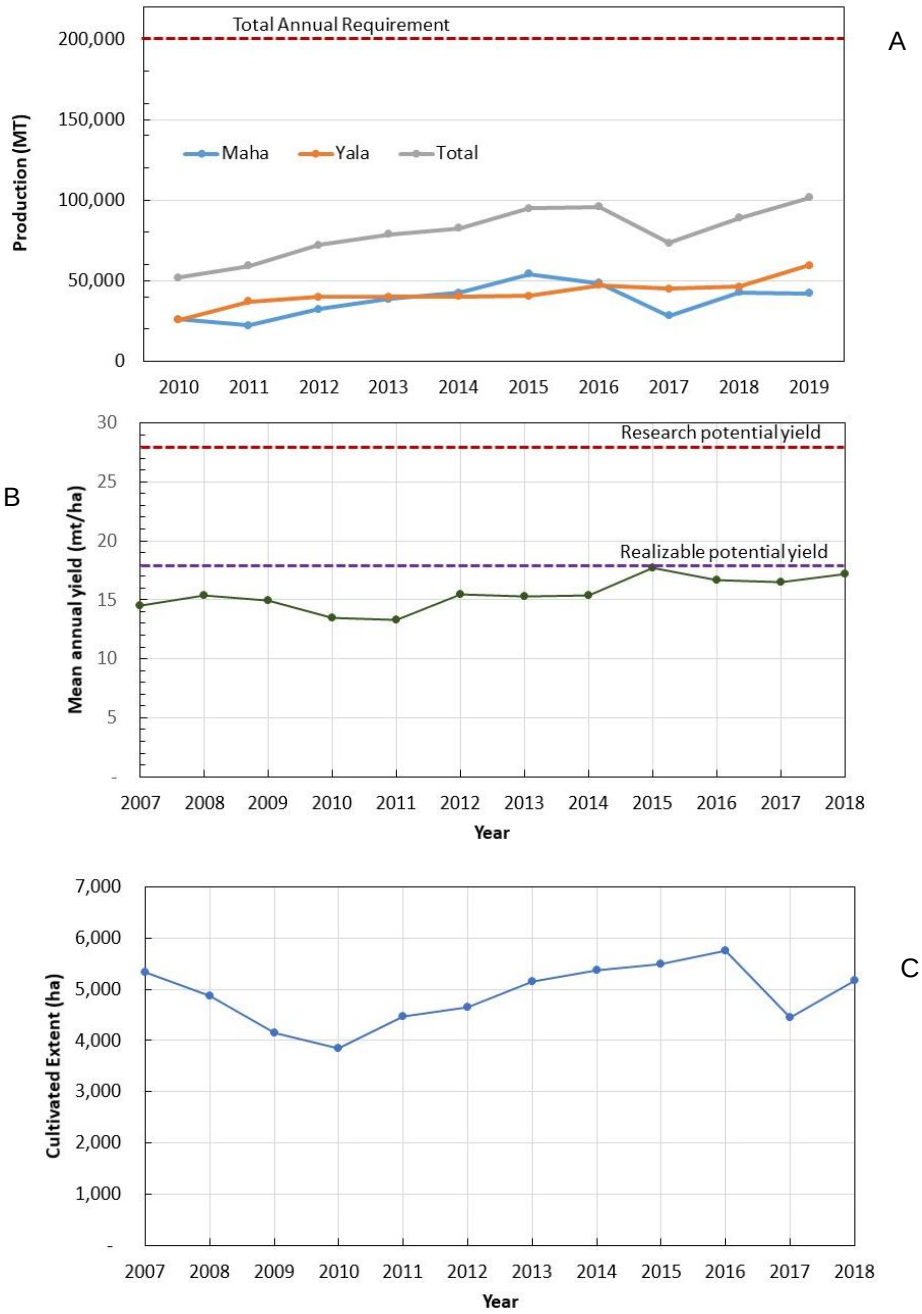


Figure 6.3: Production statistics of potato: A) Total annual production (Mt) including two main growing seasons with the total annual requirement (as of 2018) in the country, B) Mean annual yield (Mt/ha) compared to realizable yield and research potential yield, C) Cultivated extent (ha) over the years. *(Data source: Department of Agriculture)*

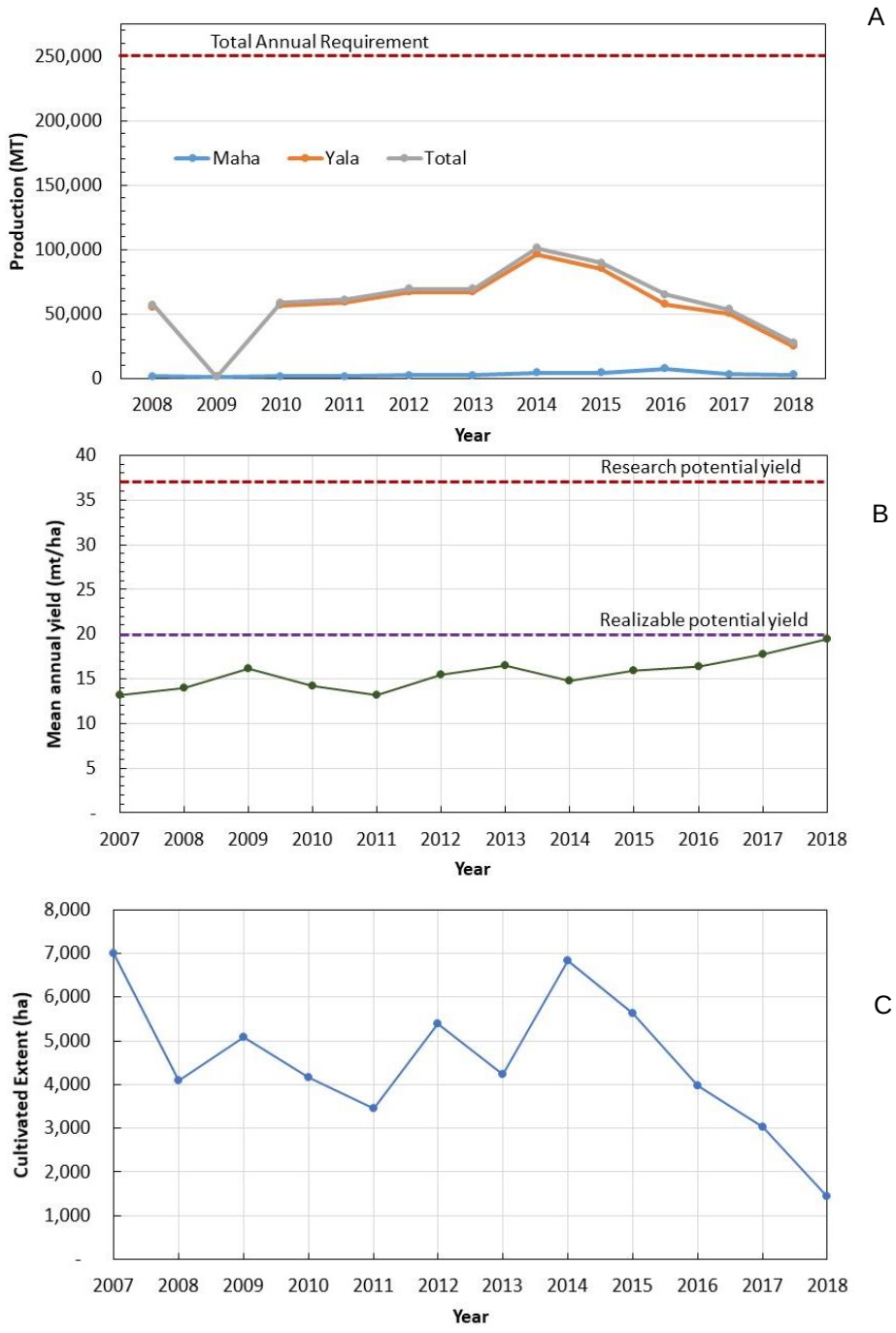


Figure 6.4: Production statistics of B-onion: A) Total annual production (Mt) including two main growing seasons with the total annual requirement (as of 2018) in the country, B) Mean annual yield (Mt/ha) compared to realizable yield and research potential yield, C) Cultivated extent (ha) over the years. *(Data source: Department of Agriculture)*

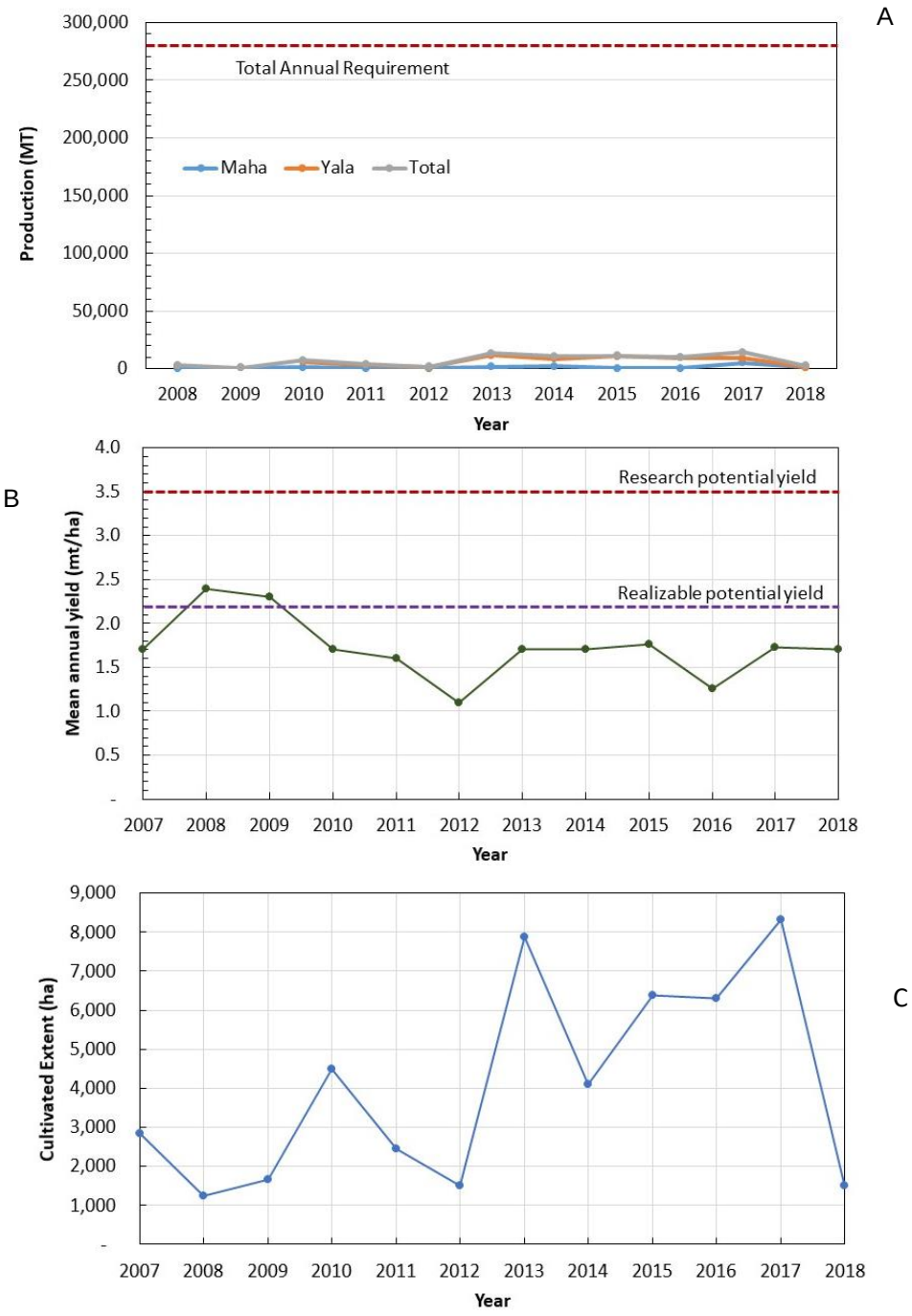


Figure 6.5: Production statistics of soybean: A) Total annual production (Mt) including two main growing seasons with the total annual requirement (as of 2018) in the country, B) Mean annual yield (Mt/ha) compared to realizable yield and research potential yield, C) Cultivated extent (ha) over the years. *(Data source: Department of Agriculture)*

Chapter 7

Assessment of Household Level Profitability: The Crop Enterprise Budgets

7. Assessment of Household Level Profitability: The Crop Enterprise Budgets

A crop enterprise budget is an estimate of the costs and returns to produce a crop (enterprise). In economic terms, enterprise budgets help to allocate land, labor, and capital, which are limited, to the most appropriate use. The most appropriate use is defined by the person in control of the resources and may be used to maximize profits, minimize soil loss or achieve any other goal. Enterprise budgets can be used to help make decisions such as pricing products, comparing production practices, or developing a product mix that matches business goals. Enterprise budgets can be compared to other producers' costs or industry averages to determine if the individual farm's costs are high or low in comparison. If costs are high, then the budget will point to specific areas that need to be analyzed further.

The research team has made all the attempts to prepare the Crop Budgets at the farmer level from the information gathered during the field surveys. However, the team noted that the information provided by the farmers were contrastingly different and thus are not reliable for this kind of a study of National importance. Therefore, the Crop budgets presented in this report are based on the information obtained from the Socio Economics and Planning Center of the Department of Agriculture for the Yala season, 2018. Further calculations were done and inferences are made based on these nationally accepted documents.

Tables 7.1 to 7.8 provide information pertinent to the operational costs of the key crops that are considered in the present study, i.e. maize, B-onion, chilli, soybean and potato. For the purpose of comparison, the cost of cultivation of pole bean and tomato are also presented. It was noted that the cost of cultivation for one acre of crop drastically vary among the crops and if ranked in the descending order; Potato (Badulla) – Rs. 340,801.00; Chlli (Anuradhapura) – 257,275.00; B-Onion (Matale) – Rs. 228,641.00; Maize (System H) – Rs 76,414.00; Maize (Badulla) – Rs. 73,678.00 and Soybean (System H) – Rs. 64,926.00. In addition, to cultivate one acre of Tomato (Badulla) and Pole bean (Badulla), it costed about Rs. 267,319.00 and Rs. 212,632.00 respectively. With this information, it is apparent that farmers have to make a 5-fold, 4-fold and 3.5-fold initial investment to cultivate potato, chillie and B-onion respectively, compared to cultivating maize or soybean, irrespective of the returns of the crops.

As the information revealed from the Tables 7.1 to 7.8, the imputed cost for labour, that is the unpaid family labour, accounted for approximately 65% to the total labour cost in maize and chilli whereas it was *c.a.* 45% in potato, B-onion and soybean. In other words, the cultivation of maize and chilli in the Districts taken into consideration, relied more on family labour, whereas cultivation of potato, B-onion and soybean relied more on hired labour. It is of paramount importance to investigate into the reasons for these observations as use of family labour has both positive and negative impacts on the productivity of a given agricultural venture.

One of the reasons for usage of family labour at this level could be the fact that family labour is much more productive than hired labour, and there is a limited substitution between family and hired labour, as reported by several researchers in countries such as India, Nepal, Pakistan and Bangladesh (see Chowdhuri, 2013). On the other hand, reliance on family labour might pose a threat to the sustainability of the said agricultural ventures as there is a trend in youth moving away from agriculture at present in Sri Lanka.

Table 7.1: Operational cost for cultivating Maize in Badulla District in Yala 2018

Operation	Percent Reported	Cost (Rs./ac)			
		Labour	Machinary	Material	Total
General land preparation	(29)	(4432)	-	-	-
1st plough with2wt	76	1232.00	4978.00	-	6210.00
(do Buffaloes)	(24)	-	(3455.00)	-	-
Digging holes & seeding	100	8378.00	-	6440.00	14818.00
Fertilizer application	100	4763.00	-	7978.00	12741.00
Weed control with weedicides	50	815.00	-	1983.00	2798.00
Weeding & earthing up	50	6253.00	-		6253.00
Pest & disease control	62	1305.00	-	1216.00	2521.00
Water management	100	6528.00	-	-	6528.00
Harvesting & drawing	100	11750.00	-	-	11750.00
Thershing & processing with engine powered thresher	76	2880.00	2070.00	-	4950.00
Additional drying	75	2640.00	-	-	2640.00
Transport produce to market	62	1131.00	1338.00	-	2469.00
Total including imputed cost		47675.00	8386.00	17617.00	73678.00
Total excluding imputed cost		15176.00	7017.00	17617.00	39810.00

(Data source: Department of Agriculture)

Table 7.2: Operational cost for cultivating Maize in Mahaweli System H in Yala 2018

Operation	Percent Reported	Cost (Rs./ac)			
		Labour	Machinary	Material	Total
General Land Preparation	41	2760.00	-	-	2760.00
1st & 2nd plough with 4wt	100	480.00	6950.00	-	7430.00
Preparation of beds & ridges	100	6000.00	-	-	6000.00
Seeding	100	6360.00	-	6666.00	13026.00
Fertilizer application	100	5160.00	-	7063.00	12223.00
Weeding & earthing up	100	11040.00	-	-	11040.00
Pest & disease control	91	2135.00	-	1434.00	3569.00
Water management	100	5400.00	-	-	5400.00
Harvesting & drawing	100	8652.00	-	-	8652.00
Threshing with 4w thresher	100	1652.00	3266.00	-	4918.00
Transport produce to market	53	720.00	676.00	-	1396.00
Total including imputed cost		50359.00	10892.00	15163.00	76414.00
Total excluding imputed cost		23980.00	10060.00	15163.00	49203.00

(Data source: Department of Agriculture)

Table 7.3: Operational cost for cultivating B-Onion in Matale District in Yala 2018

Operation	Percent Reported	Cost (Rs./ac)			
		Labour	Machinary	Material	Total
All nursery preperation	100	9120.00	-	3209.00	12329.00
1st & 2nd plough with 4wt	63	1080.00	10982.00	-	12062.00
1st & 2nd Plough with 2wt	(17)	-	-	-	-
1st 2nd & 3rd plough with 4wt	(20)	-	(12765.00)	-	-
Preparation of beds & ridges	100	22037.00	-	-	22037.00
Transplanting	100	24247.00	-	12235.00	36482.00
Fertilizer application	100	7800.00	-	17881.00	25681.00
Weed control with weedicides	90	1800.00	-	5209.00	7009.00
Weeding & earthing up	74	9536.00	-		9536.00
Pest & disease control	100	9121.00	-	13275.00	22396.00
Water management	100	22950.00	14506.00	-	37456.00
Harvesting & drawing	100	20311.00	-	-	20311.00
Processing manually	77	17422.00	-	-	17422.00
(do on contract)	(23)	(18245.00)	-	-	-
Transport produce to Stores	70	1950.00	3970.00	-	5920.00
Total including imputed cost		147374.00	29458.00	51809.00	228641.00
Total excluding imputed cost		88425.00	28796.00	48194.00	165415.00

(Data source: Department of Agriculture)

Table 7.4: Operational cost for cultivating Chillie in Anuradhapura District in Yala 2018

Operation	Percent Reported	Cost (Rs./ac)			
		Labour	Machinary	Material	Total
All nursery preperation	100	6720.00	-	1180.00	7900.00
General land preparation	40	7800.00	-	-	7800.00
(1st plough with 4wt)	(30)	(891.00)	(6447.00)	-	-
(1st plough manually)	(10)	(29120.00)	-	-	-
(1st plough with 2wt)	(7)	(650.00)	-	-	-
1st & 2nd Plough with 4wt	40	1820.00	10400.00	-	12220.00
(1st & 2nd plough with 2wt)	(13)	(650.00)	-	-	-
Preparation of beds & ridges	100	19018.00	-	-	19018.00
Transplanting	100	12067.00	-	2381.00	14448.00
Fertilizer application	100	17374.00	-	17207.00	34581.00
Weeding & earthing up	100	26706.00	-		26706.00
Pest & disease control	100	22050.00	-	18579.00	40629.00
Water management	100	35024.00	11703.00	-	46727.00
Harvesting & drawing	100	38826.00	-	-	38826.00
Transport produce to market	77	4022.00	4398.00	-	8420.00
Total including imputed cost		191427.00	26501.00	39347.00	257275.00
Total excluding imputed cost		70151.00	25253.00	38924.00	134328.00

(Data source: Department of Agriculture)

Table 7.5: Operational cost for cultivating Soybean in Mahaweli System H in Yala 2018

Operation	Percent Reported	Cost (Rs./ac)			
		Labour	Machinary	Material	Total
General land preparation	(33)	(1624)	-	-	
1st & 2nd plough with 4wt	100	840.00	7180.00	-	8020.00
Preparation of beds & ridges	100	7085.00	-	-	7085.00
Seeding	100	8123.00	-	3102.00	11225.00
Fertilizer application	93	1200.00	-	2760.00	3960.00
Weed control with weedicides	43	898.00	-	1781.00	2679.00
Weeding & earthing up	100	8546.00	-	-	8546.00
Pest & disease control	100	1282.00	-	2587.00	3869.00
Water management	100	3590.00	-	-	3590.00
Harvesting & drawing	100	9715.00	-	-	9715.00
Processing with 4w thresher	100	2205.00	3328.00	-	5533.00
Transport produce to stores	70	240.00	464.00	-	704.00
Total including imputed cost		43724.00	10972.00	10230.00	64926.00
Total excluding imputed cost		26232.00	10399.00	10166.00	46797.00

(Data source: Department of Agriculture)

Table 7.6: Operational cost for cultivating Potato in Badulla District in Yala 2018

Operation	Percent Reported	Cost (Rs./ac)			
		Labour	Machinary	Material	Total
General land preparation	67	11266.00	-	-	11266.00
1st plough with 2wt	100	1560.00	10787.00	-	12347.00
Preparation of beds & ridges	100	15850.00	-	2907.00*	18757.00
Digging holes & seeding	100	16683.00	-	131406.00	148089.00
Fertilizer application	100	5057.00	-	29927.00	34984.00
Weed control with weedicides	50	584.00	-	1490.00	2074.00
Weeding & earthing up	100	16524.00	-	-	16524.00
Pest & disease control	100	12300.00	-	17722.00	30022.00
Water management	100	17100.00	5304.00	-	22404.00
Harvesting & drawing	100	37950.00	-	-	37950.00
Transport produce to market	83	2942.00	3442.00	-	6384.00
Total including imputed cost		137816.00	19533.00	183452.00	340801.00
Total excluding imputed cost		75762.00	12685.00	127339.00	215786.00

(Data source: Department of Agriculture)

Table 7.7: Operational cost for cultivating Pole Bean in Badulla District in Yala 2018

Operation	Percent Reported	Cost (Rs./ac)			
		Labour	Machinary	Material	Total
General land preparation	77	8750.00	-	-	8750.00
1st plough with 2wt	70	1375.00	9269.00	-	10644.00
(do manually)	(30)	(11476.00)	-	-	-
Preparation of beds & ridges	100	12750.00	-	1950.00*	14700.00
Digging holes & seeding	100	16375.00	-	19474.00	35849.00
Fertilizer application	100	9750.00	-	19050.00	28800.00
Weeding & earthing up	100	14239.00	-	-	14239.00
Pest & disease control	100	13039.00	-	11852.00	24891.00
Fixing support	100	11116.00	-	24793.00	35909.00
Water management	100	10078.00	-	-	10078.00
Harvesting & drawing	100	23923.00	-	-	23923.00
Transport produce to market	83	1120.00	3729.00	-	4849.00
Total including imputed cost		122515.00	12998.00	77119.00	212632.00
Total excluding imputed cost		36518.00	9829.00	69086.00	115433.00

*Lime cost

(Data source: Department of Agriculture)

Table 7.8: Operational cost for cultivating Tomato in Badulla District in Yala 2018

Operation	Percent Reported	Cost (Rs./ac)			
		Labour	Machinary	Material	Total
All Nursery Preperation	93	4080.00	-	840.00	4920.00
General Land Preparation	93	9600.00	-	-	9600.00
1 st plough with 2wt	53	1907.00	9831.00	-	11738.00
(do manually)	(47)	(17391)	-	-	-
Preparation of beds & ridges	100	13701.00	-	2676.00*	16377.00
Digging holes & transplanting	100	16662.00	-	8556.00	25218.00
Fertilizer application	100	6807.00	-	25315.00	32122.00
Weeding & earthing up	100	17242.00	-	-	17242.00
Pest & disease control	100	23280.00	-	23076.00	46356.00
Fixing support & training	100	10900.00	-	17297.00	28197.00
Water management	100	22688.00	-	-	22688.00
Harvesting & drawing	100	37712.00	-	-	37712.00
Transport produce to market	70	9402.00	5747.00	-	15149.00
Total including imputed cost		173981.00	15578.00	77760.00	267319.00
Total excluding imputed cost		51840.00	12415.00	70188.00	134443.00

*Lime cost

(Data source: Department of Agriculture)

All the information given in the above tables are summarized in the Table 7.9 for easy comparison.

Table 7.9: Comparison of costs and returns of selected crops in Yala 2018

	B-Onion (Matale)	Green Chiili (A'pura)	Maize (Badulla)	Maize (Sys-H)	Soy Bean (Sys-H)	Potato (Badulla)	Pole Bean (Badulla)	Tomato (Badulla)
Cost of cultivation (Rs/ac) -total	228,641.00	257,275.00	73,678.00	76,414.00	64,926.00	340,801.00	212,632.00	267,319.00
Cost of cultivation (Rs/ac) -Cash cost	165,415.00	136,398.00	39,810.00	49,203.00	46,797.00	215,786.00	115,433.00	134,443.00
% cash cost from Total cost	72	53	54	64	72	63	54	50
Major cost components (Rs/ac) - Including cost of farmer owned inputs								
Labour	147,374.00	191,427.00	47,675.00	50,359.00	43,724.00	137,816.00	122,515.00	173,981.00
Power	29,458.00	26,501.00	8,386.00	10,892.00	10,972.00	19,533.00	12,998.00	15,578.00
Material	51,809.00	39,347.00	17,617.00	15,163.00	10,230.00	183,452.00	77,119.00	77,760.00
Major cost components (% from total)								
Labour	64	75	65	66	67	40	58	65
Power	13	10	11	14	17	6	6	6
Material	23	15	24	20	16	54	36	29
Labour units per acre (man days)	125	161	44	42	40	111	104	161
Family	50	102	30	22	16	50	73	113
Hired	75	59	14	20	24	61	31	48
Fertilizer cost (Rs/ac)	17,881.00	17,207.00	7,978.00	7,063.00	2,760.00	29,927.00	19,050	25,315
Fertilizer cost (% from toal input cost)	35	44	45	47	27	16	25	33
Yield (kg/ac)	6,370	4,105	1,890	2,040	912	5,744	3,025	8,442
Farm Gate Price (Rs/kg)	65	214	49.7	44.1	106.3	90	134	90.30
Returns (Rs/ac) - Gross	414,050	878,470	93,933	89,964	96,946	516,960	405,350	762,313
Returns (Rs/ac) - Net - Including farmer owned inputs	185,409	621,195	20,255	13,550	32,020	176,159	192,718	494,994
Returns (Rs/ac) - Net - Excluding farmer owned inputs	248,635.00	744,142.00	54,123.00	40,761.00	50,149.00	301,174.00	289,917.00	627,870.00
Unit cost (Rs/kg)	35.89	62.67	39.98	37.46	71.19	59.33	70.29	31.67
Break-even yield (kg/ac)	3,518.00	1,202	1,482.00	1,733.00	611.00	3,787.00	1,587.00	2,960.00

Figure 7.1 shows the contribution of major cost components in cultivation of crops, which were extracted from the above operational costs data of the Department of Agriculture. Among the five major crops considered in the ASMP study, except in potato, more than 65% of the total cost including the imputed cost, was on the labour. In potato, it was about 40%. Surprisingly, the material cost for potato accounted for more than 50% of the total cost, whereas in B-onion, chilli, maize and soybean, the material cost was in the range of 15-24%.

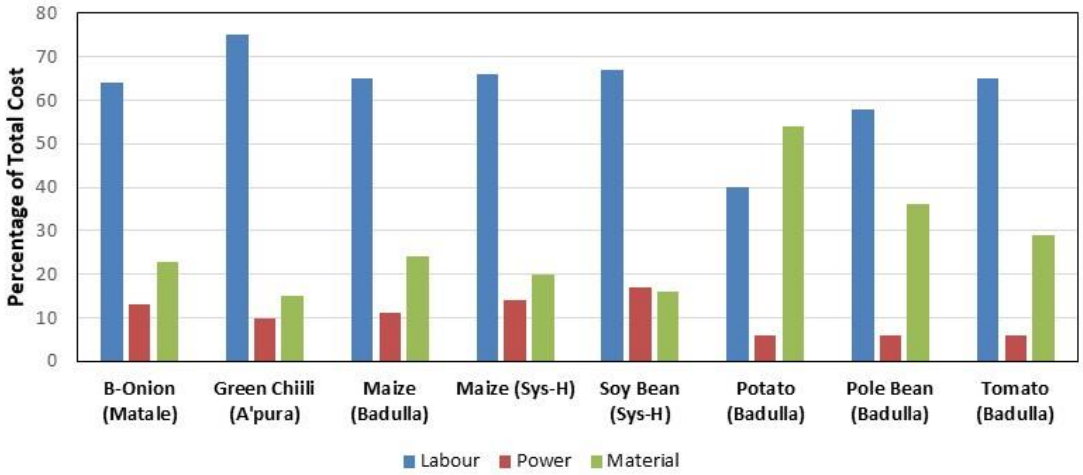


Figure 7.1: Comparison of major cost components in cultivated crops based on Yala 2018 data.

When the fertilizer cost for cultivating crops is considered (Figure 7.2), the highest cost (~Rs. 30,000.00 per acre) was incurred for the cultivation of potato, whereas soybean demanded the least cost for fertilizer (~Rs. 2,800.00). However, the percentage expenditure on fertilizer within the total input costs was more than 40% in chilli and maize. Even though potato needs a significant sum of money allocated for fertilizers, it was *c.a.* 16% of the total input costs in potato cultivation.

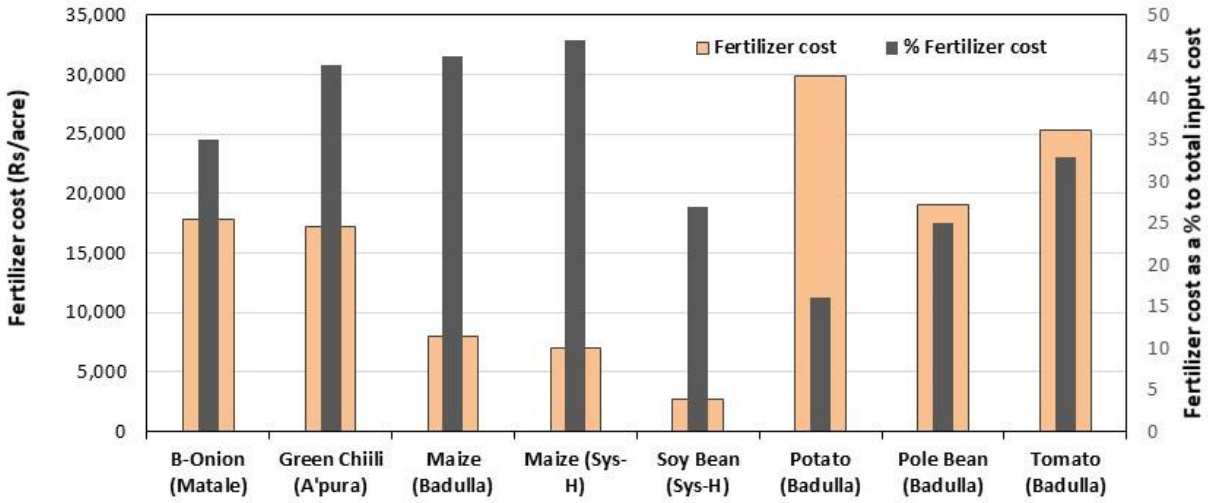


Figure 7.2: Comparison of cost of fertilizer in cultivating selected crops (based on Yala, 2018 data)

Based on the above information related to costs of operation, a cost-benefit analysis was performed and the results are presented in the Table 7.10. The highest benefit:cost ratio was observed with chilli cultivation in Anuradhapura. Maize cultivation in Mahaweli System-H was found to be marginally profitable, particularly when the total cost, including the imputed cost, is taken into consideration. Compared to the major crops of concern in the ASMP, except chilli, the cultivation of crops such as bean and tomato were found to be very much profitable.

Table 7.10: Benefit: cost ratios of selected crops in Yala 2018

	B-Onion (Matale)	Green Chiili (A'pura)	Maize (Badulla)	Maize (Sys-H)	Soy Bean (Sys-H)	Potato (Badulla)	Pole Bean (Badulla)	Tomato (Badulla)
Cost of cultivation (Rs/ac) -Total	228,641.00	257,275.00	73,678.00	76,414.00	64,926.00	340,801.00	212,632.00	267,319.00
Returns (Rs/ac) - Gross	414,050.00	878,470.00	93,933.00	89,964.00	96,946.00	516,960.00	405,350.00	762,313.00
Benefit:Cost ratio	1.81	3.41	1.27	1.18	1.49	1.52	1.91	2.85
Cost of cultivation (Rs/ac) - Cash cost	165,415.00	136,398.00	39,810.00	49,203.00	46,797.00	215,786.00	115,433.00	134,443.00
Returns (Rs/ac) - Gross	414,050.00	878,470.00	93,933.00	89,964.00	96,946.00	516,960.00	405,350.00	762,313.00
Benefit:Cost ratio	2.50	6.44	2.36	1.83	2.07	2.40	3.51	5.67

The benefit to cost ratio (BCR) values of the crops of concern in the present study are comparable to the BCR values for the same crops in the region (Table 7.11). However, these values are to get a general understanding only, as the Sri Lankan BCR values were obtained only from one particular area in Yala 2018 for a given crop, thus making it non-conclusive.

Table 7.11: Comparison of benefit: cost ratio (BCR) of the selected crops with regional values

Crop	Country	Authors	BCR	BCR (Sri Lanka)
Chilli	India	Senthilkumar et al (2018)	1.24	3.41
	India	Srikala et al (2016)	1.73	
	Pakistan	Khan et al (2017)	1.94	
	India	Kumar & Jain (2018)	3.87	
	Malaysia	Mohd et al (2016)	1.86	
Maize	Bangladesh	BBS-SID (2015)	1.75	1.23
	Bangladesh	Karim et al (2010)	1.89	
	India	Choudhri et al (2018)	1.88	
	India	Murthy et al (2015)	1.51	
	Pakistan	Koondhar et al (2015)	1.37	
Onion	Bangladesh	BBS-SID (2015)	1.93	1.81
	India	Barakade et al (2011)	1.48	
	India	Kantariya et al (2018)	1.74	
	India	Meena et al (2016)	1.62	
	India	Kumar & Jain (2018)	3.29	
Potato	Bangladesh	Mukul et al (2013)	1.27	1.52
	India	Raghuvanshi et al (2018)	1.89	
	India	Singh et al (2019)	3.42	
	Nepal	Bajrachaya & Sapkota (2017)	1.44	
	India	Peer et al (2013)	1.73	
Soybean	Bangladesh	Miah & Rashid (2015)	1.11	1.49
	Bangladesh	Salam & Kamruzzaman (2015)	1.43	
	India	Agarwal & Singh (2014)	1.76	
	India	Jaiswal & Hugar (2011)	1.29	
	Vietnam	Khai & Yabe (2014)	1.61	

Chapter 8

Land Use Pattern

8. Land Use Pattern

8.1. Mapping of the Land Utilization of Rice, Maize, Soya bean, Potato, B-onion and Chilli Cultivations Using GIS

Many crops have been grown all over the country covering almost all the agro-ecological zones, but certain crops are being prominent in some districts. Rice is grown in all over the country in imperfectly drained to poorly drained soils, while other field crops such as maize, soy bean, potato, B onion and chilli are grown in well drained upland and also in moderately drained paddy lands with improved drainage facilities or during water shortage Yala season.

Rice:

Rice is grown in all over the country covering about 0.7 million hectares, of which about 0.6 million ha are cultivated during Maha season while about 0.5 million ha are cultivated in Yala season. There are three rice growing ecosystems in the country, namely Major irrigation, Minor Irrigation and Rainfed rice. Almost all the paddy lands under major irrigation is cultivated during both Yala and Maha season and the extent is about 50% of the total land extent. Area under minor irrigation vary with the season where majority of the extent cultivate in Maha season, but the cultivation of rice is limited in Yala season and is manly depend on the rainfall of the season. Almost all the rainfed rice lands are cultivated only in Maha season, but very little in Yala season. The main rice growing districts are, Ampara, Hambantota, Polonnaruwa, Kurunegala and Anuradhapura districts and the Mahaweli areas. Of these areas all are under major Irrigation except Kurunegala district. Extent of paddy in Kurunegala is manly fall under minor irrigation.

Maize:

Maize is mainly grown in Anuradhapura, Badulla, Ampara and Monaragala districts (Figure 8.1 and Figure 8.2). The total annual cultivated extent is about 70,000 ha. Most of the maize is cultivated during Maha season under rainfed condition. However, a fair proportion of cultivation can be seen in moderately to imperfectly drained paddy land under supplementary irrigation during Yala season, especially in Anuradhapura district.

Soya bean:

Cultivation of soya been is only limited to Anuradhapura district, particularly in Galenbindunuwew area during Yala season. In addition, it is a minor crop in Mahaweli H area in Yala season.

Potato:

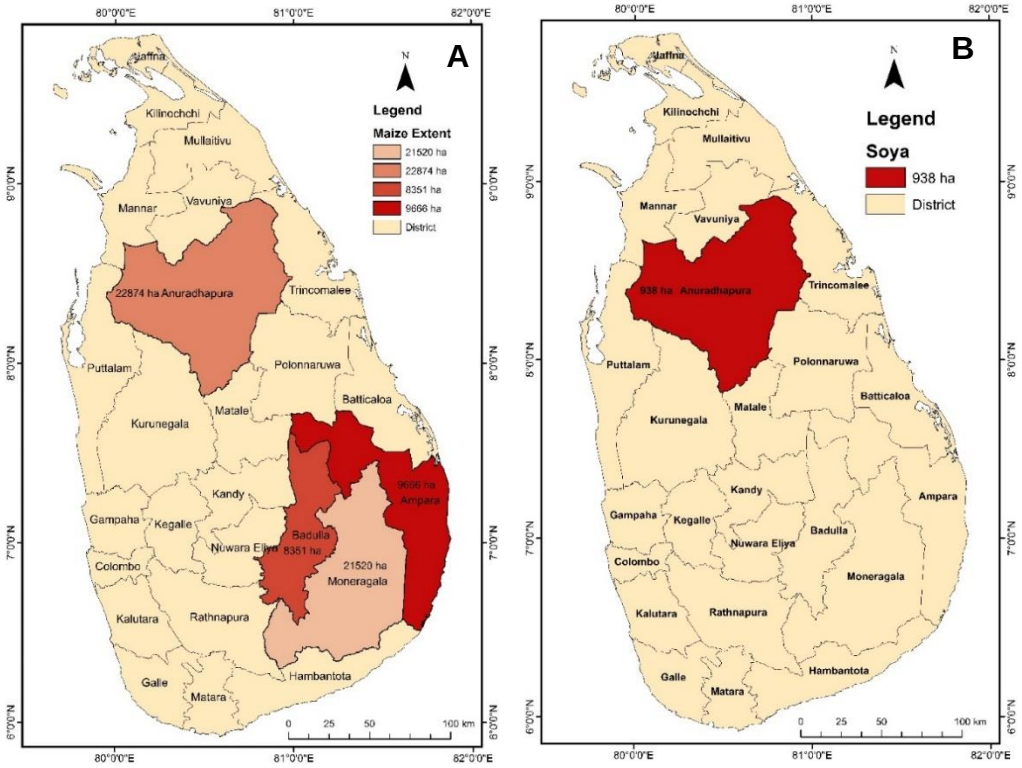
Major potato cultivating areas are Badulla and Nuwara Eliya districts and in these areas potato cultivation is basically done with different crop rotations. In Badulla district, potato, vegetable and rice rotation is prominent. The main cultivating area are Bandarawela, Welimada, Uva-Paranagama and Rahangala. In Nuwara Eliya district where potato cultivation is done throughout the year with a crop rotation of vegetable/ potato.

Onion:

Onion requirement of the country is supplied by both big onion and red onion. Big onion is mainly cultivated during Yala season with supplementary irrigation in Anuraghapura district particularly in Galenbindunawewa area, both in upland and moderately drain paddy lands, and in Mahaweli H area. The other main B onion growing areas are Dambulla and Galewela in Matale district. Big inion cultivation is limited to Yala season in both districts with supplementary irrigation. Red onion is cultivating mainly in Jaffna district and Kalpitiya area in Puttalama district in well drained lands; mainly in Regosols and Red Yellow Latasols.

Chilli:

In Sri Lanka, chilli cultivation done in all over the country throughout the year. It's a main crop in well drained upland crop during Maha season, but it's been cultivated in uplands with supplementary irrigation, especially under agro-well farming and moderately drained paddy lands.



Maize Soya bean

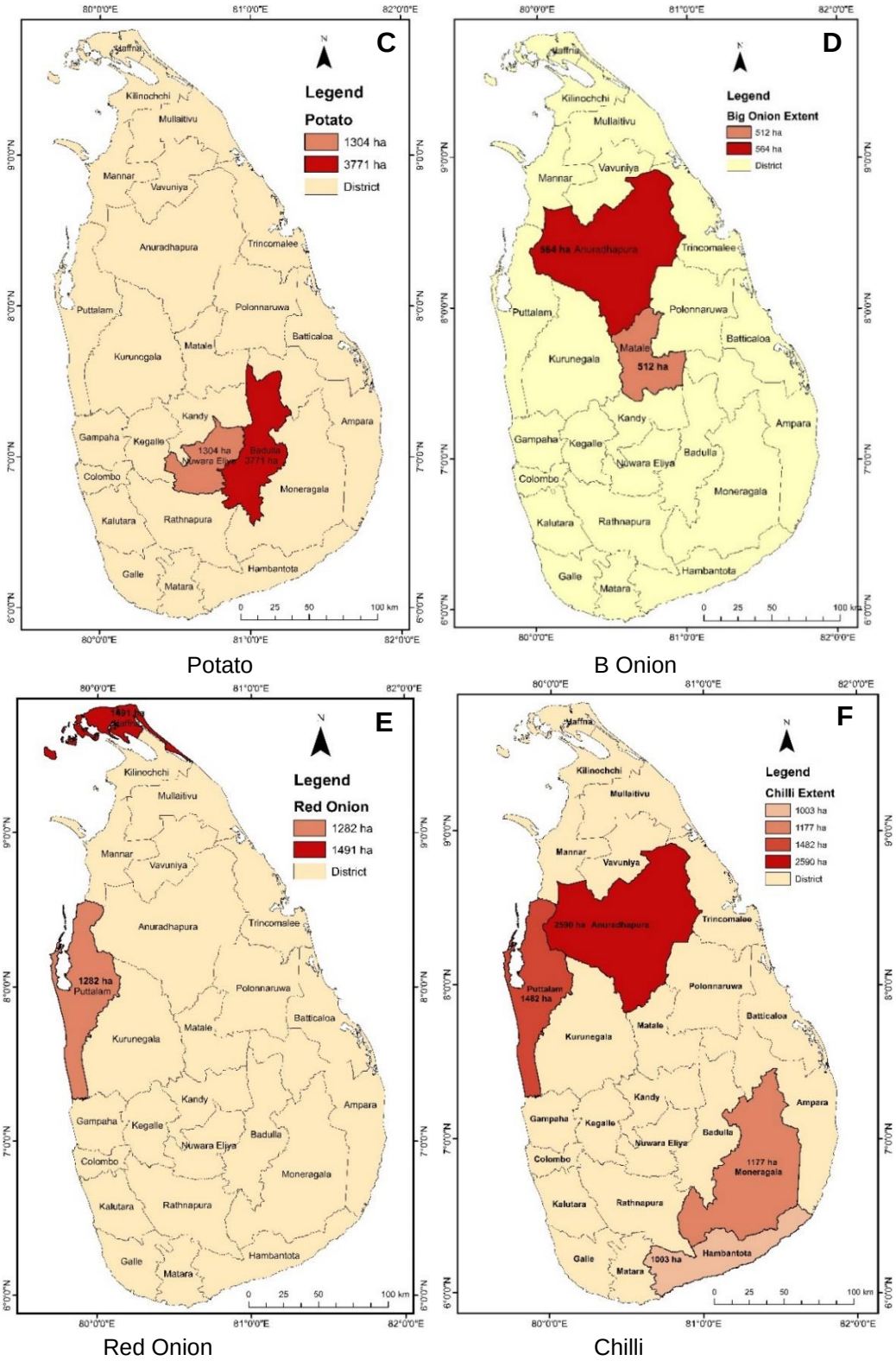


Figure 8.1: Land Use Patterns of A) Maize, B) Soya bean, C) Potato, D) B-Onion, D) Red Onion and E) Chillies in Main Growing Districts. *(Data source: Department of Agriculture)*

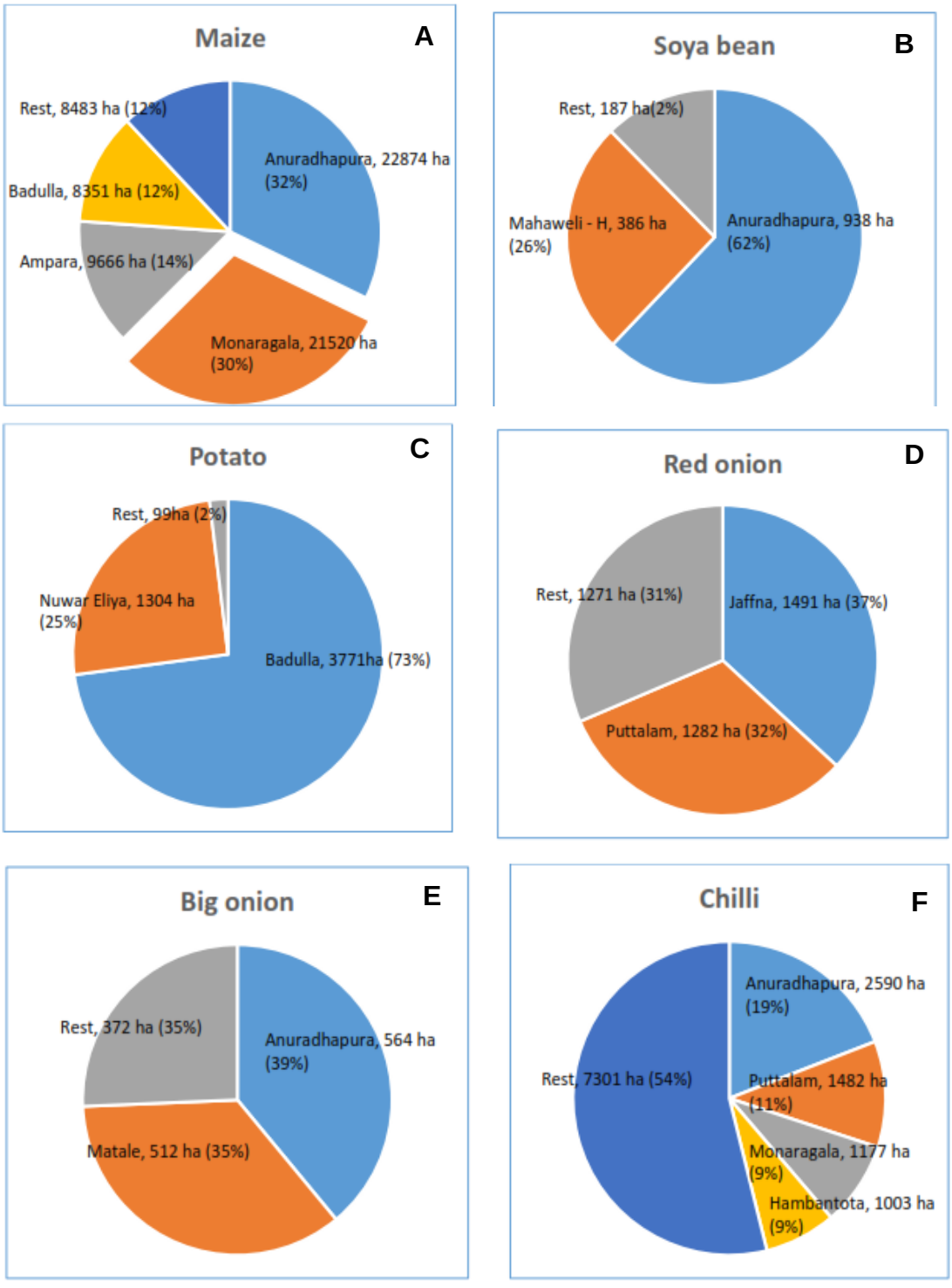


Figure 8.2: Main Cultivating Districts of A) Maize, B) Soy bean, C) Potatoes, D) Red onion, E) Big onion and E) Chillies in Sri Lanka. *(Data source: Department of Agriculture)*

8.2. Conducting of Time Series and Trend Analysis of Above Indicated Agriculture Commodities

Time series and trend analysis for rice, maize, soya bean, potato, big onion, red onion and chillies were performed in terms of extent of cultivation, production and the average yield per hectare and illustrated in Figure 8.3. When performing the analysis, recent past 10-year data from 2007 – 2018 were used.

Rice:

The average extent and paddy production of rice have varied considerably during study period. The variation was mainly due to the climatic condition (water availability) of that particular year. The highest annual extent recorded was about 1.2 million hectares and the highest production was 4.8 million tonnes, both were recorded in year 2015. The average yield throughout the study period is around 4,2 t /ha. But there is a yield potential of 10 t/ha of the cultivated varieties, means that further increase in total production could be made by increasing the average yield or in other terms the productivity in high potential areas leaving marginal paddy lands for cultivation of other suitable crops, particularly other field crops which could be cultivated, but are importing at present.

Maize:

Maize have performed very positively in terms of all the parameters considered. The extent has increased from 34000 ha in 2007 to 71000 ha in 2018. The production has also increased continuously, except 2016 and 2017 where the cultivation extent has decreased in those two years. The notable increment was increase in average yield over the years. Adoption of new varieties and technologies is the main reason for the increment. If the policies are conducive, there is a trend for further increase in production and extent.

The additional land could be found in marginal paddy lands in the dry zone in Yala season. However, supplementary irrigation facilities should be provided to increase the productivity and agro-well may be the suitable option.

Soya bean:

The cultivation extent of soya bean is very low and in confined to a small locality of Galenbindunuwewa in Anuradhapura district. The cultivating extent, production and the average yield are also very erratic. Poor policies in relation to soya been is the main reason for this trend. Sri Lanka had about 30,000 ha of soya bean cultivation in mid 80s and there is a potential to increase the production provided with having conducive policies and some other facilities such as quality seeds, storage and marketing.

Potato:

The extent of Potato in the country remain around 5000 ha with slight up and down. The lowest extent and production recorded in 2010 while highest extent recorded in 2016. The average productivity increased slightly from 2012 onwards, but the total productivity of the crop is low. Though several attempts have been made by the Department of Agriculture to expand the extent into unconventional areas such as Jaffna and Kalpitiya, but was not successful. However, it has to be calculated

the total economy of the crop including environmental cost. The trend data show that further increase of productivity is limiting and also increase in temperature in major producing area would further reduce the productivity.

Onion:

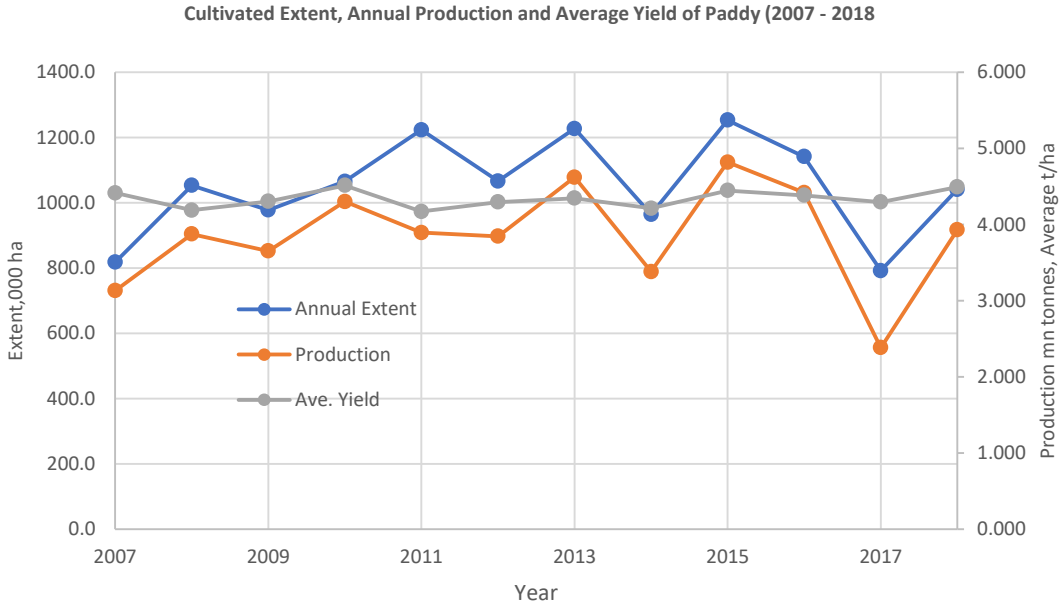
The Big onion extent varied considerably during the study period. The highest extent was recorded in 2007 and the lowest was recorded in 2018 where the extent was 1450 ha. The highest production was recorded in 2014 where more than 100000 mt was produced, contrast to the production in 2018 was 28000 mt. An erratic pattern of extent and the production is mainly due to the inconsistence policies towards this crop. In spite of all the difficulties, that average productivity has increased continuously from 2007 to 2018 mainly due to use of improved varieties and their seed and also related other production technologies.

The extent of red onion remains more or less constant as cultivating areas are limited to two districts. However, the production has increased over the period mainly due to increase in productivity. There is a potential of further increase in production of the crop by adopting improved seed and production technologies.

Chillies:

As most other crops, chillies shows similar pattern where the extent remains unchanged over the study period though several attempts were made to increase the extent. Two diseases namely leaf curl disease and the virus disease are the main limitations for expansion of the crop extent. However, increasing trend of total production and the productivity have been recorded over the study period particularly from 2011 – 2014 and 2017 afterword.

A



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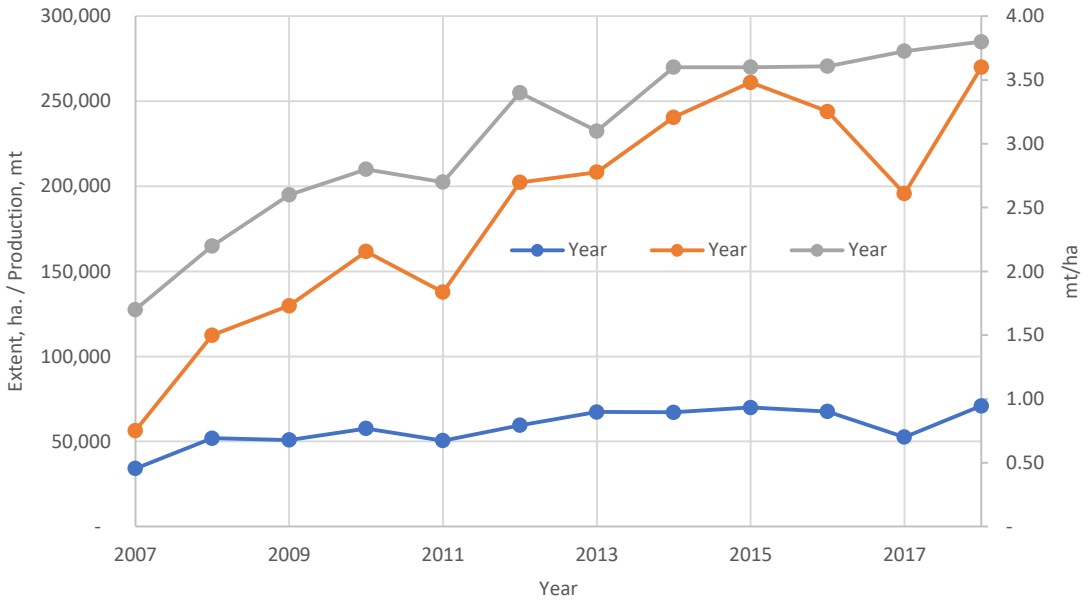
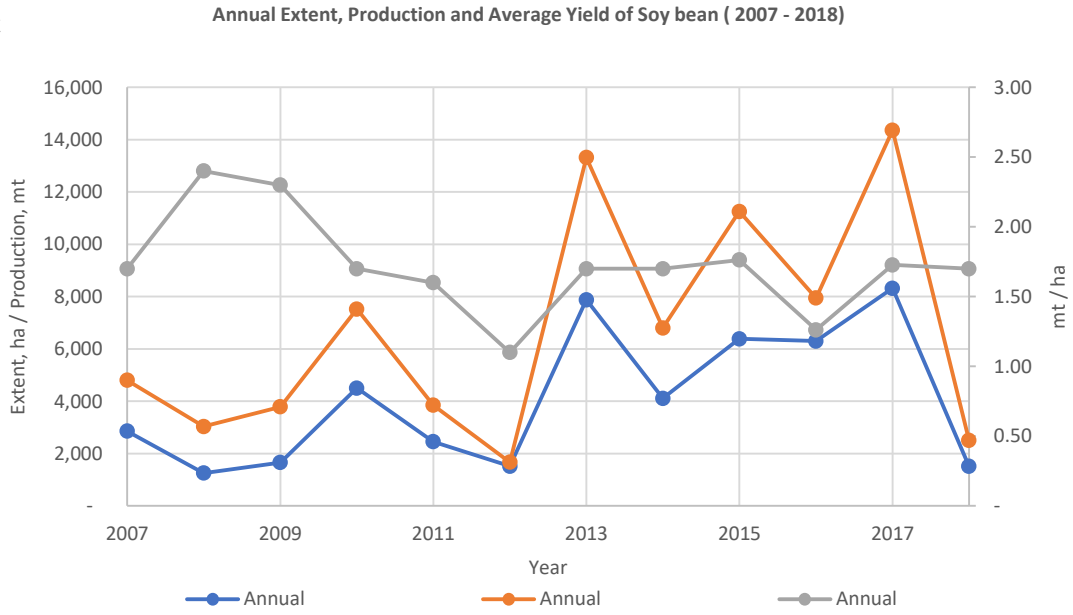

Annual Extent, Production and Average Yield of Maize (2007 - 2018)
300,000
250,000
200,000
150,000
100,000
50,000
-
Extent, ha. / Production, mt
4.00
3.50
3.00
2.50
2.00
1.50
1.00
0.50
-
mt/ha
Year
Year
Year
2007
2009
2011
2013
2015
2017
Year

C


Annual Extent, Production and Average Yield of Soy bean (2007 - 2018)
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
-
Extent, ha / Production, mt
3.00
2.50
2.00
1.50
1.00
0.50
-
mt / ha
2007
2009
2011
2013
2015
2017
Year
Annual
Annual
Annual

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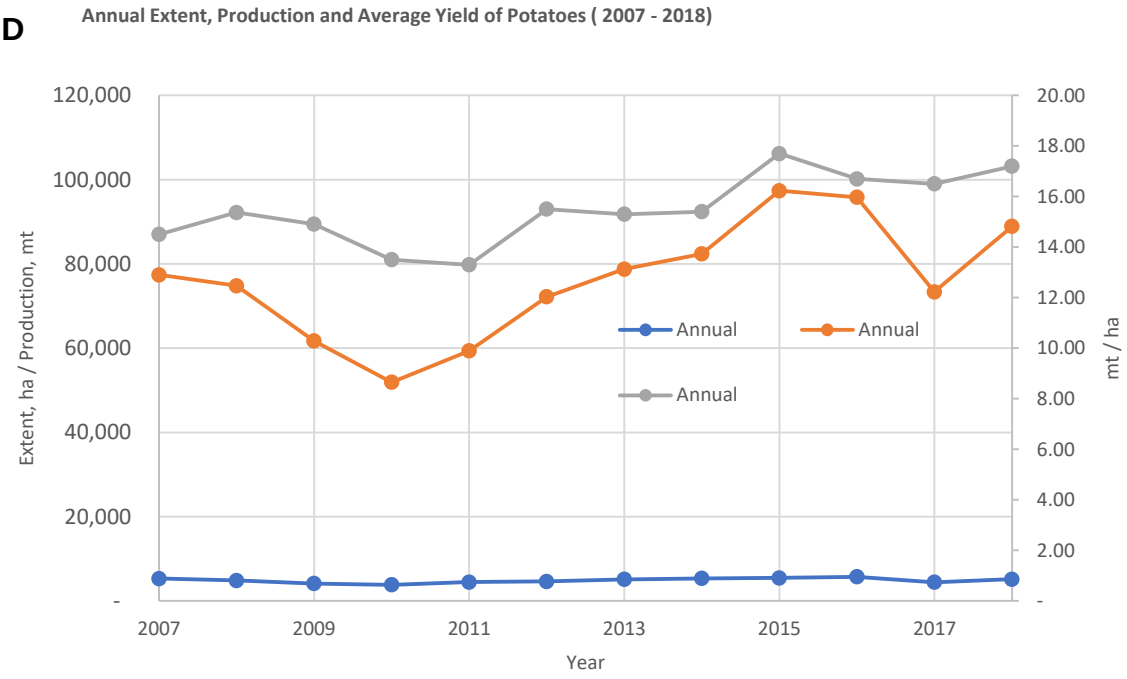
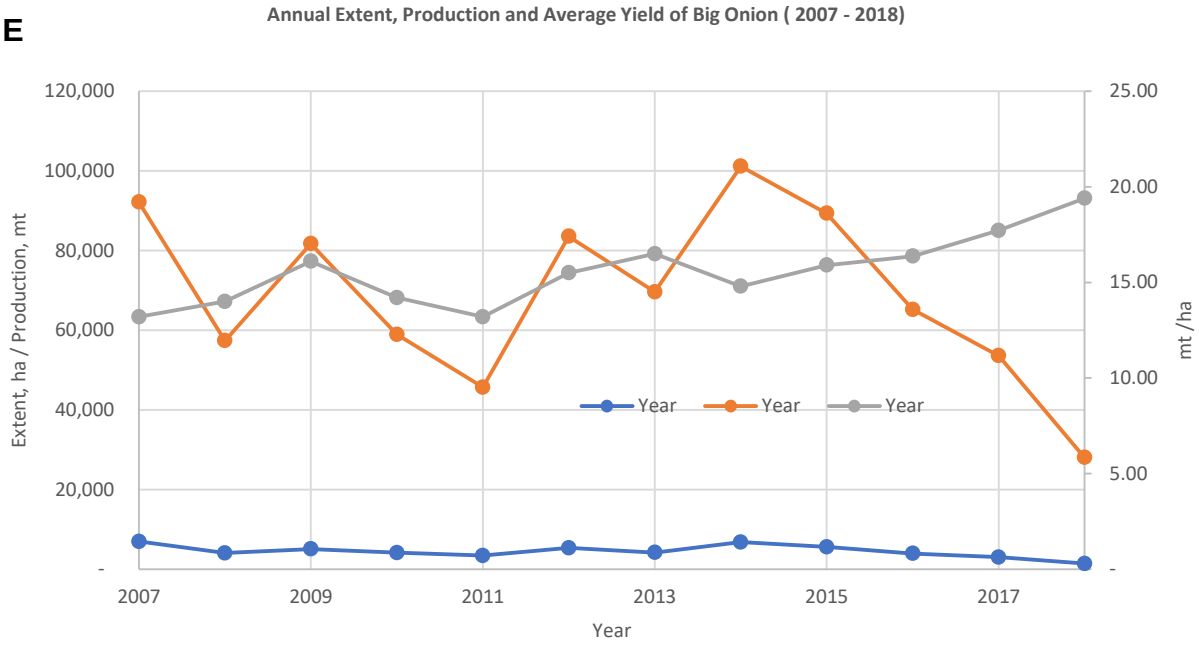
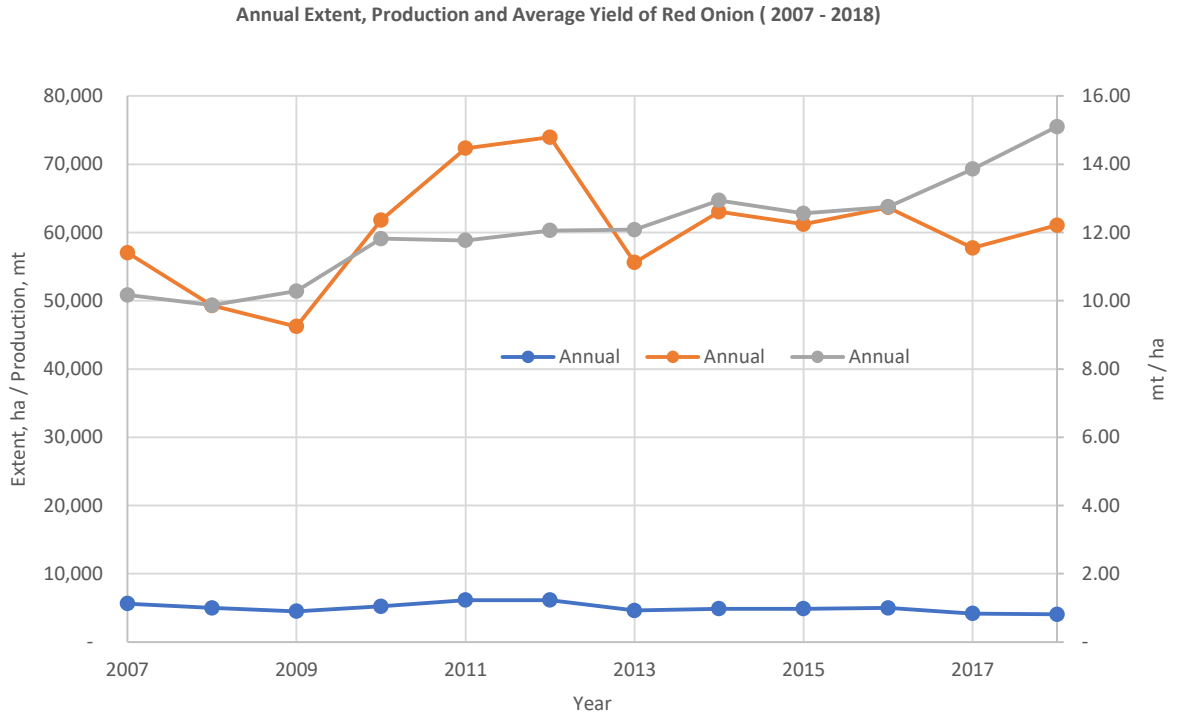

Annual Extent, Production and Average Yield of Potatoes (2007 - 2018)
120,000
100,000
80,000
60,000
40,000
20,000
-
20.00
18.00
16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
-
Extent, ha / Production, mt
mt / ha
Annual
Annual
Annual
2007
2009
2011
2013
2015
2017
Year

E


Annual Extent, Production and Average Yield of Big Onion (2007 - 2018)
120,000
100,000
80,000
60,000
40,000
20,000
-
25.00
20.00
15.00
10.00
5.00
-
Extent, ha / Production, mt
mt /ha
Year
Year
Year
2007
2009
2011
2013
2015
2017
Year

F



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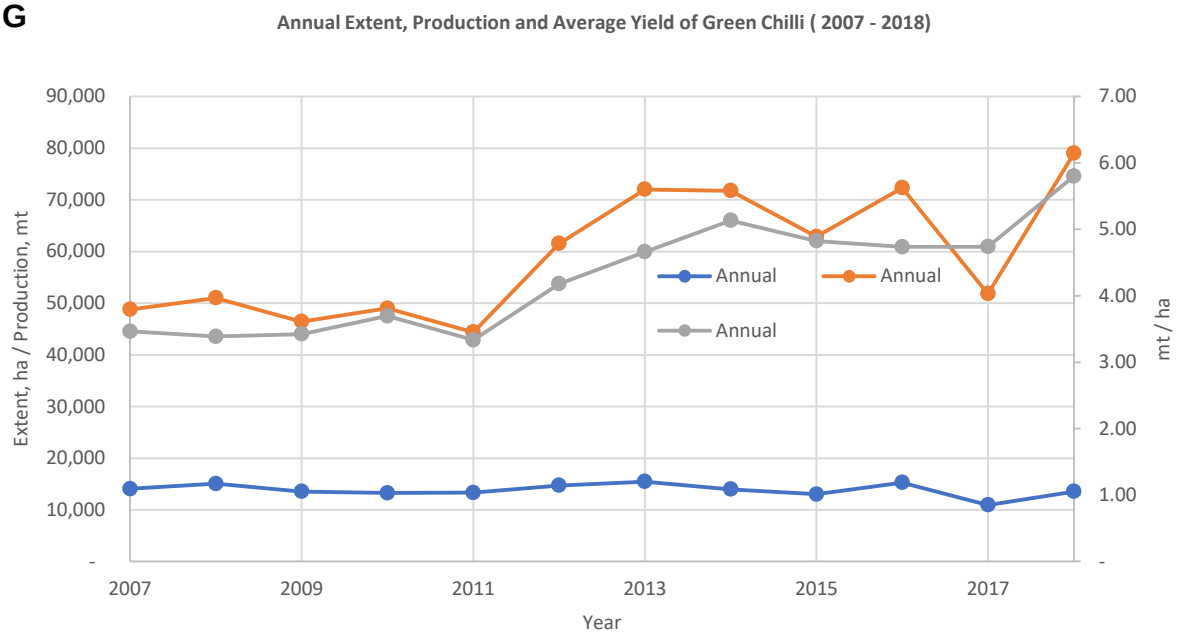

Figure 8.3: The Annual Extent, Annual Production and Average Yield of A) Paddy, B) Maize, C) Soybean, D) Potato, E) Big Onion, F) Red Onion and G) Chilli (2007 – 2018). (Data source: Department of Agriculture)

8.3. Major implications of the present land use pattern

The land utilization patterns for each crop considered from 2007 to 2018 are given in Figure 8.3. However, it can be noted that land is not the limiting factor for increasing production of most of the crops except for potato and chilli, but there are some other factors. Chilli is grown in varying scale from pot cultivation to large scale cultivation all over the country. But the main constrain is the 2 main diseases such as Leaf curl virus and narrow leaf disease affecting the crop all over the country. Potato cultivation cannot be increased due to limitation of the cropping pattern of the system and causing of severe erosion, particularly in Nuwara Eliya district. Main Potato land extent is from Welimada and Uva Paranagama in Badulla district where paddy lands are using for Potato in Yala season in a particular cropping pattern. However, if proper land use-based crop recommendation is used there is a huge potential for further increase in production of all the crops. Especially lot of paddy lands are inundated during Yala season in rainfed and minor irrigation systems. These lands could be used for the production of crops such as maize, soybean, onion and chilli.

Chapter 9

Policies Related to Agricultural Production Relations: Gaps Identified and Recommendations Suggested

9. Policies Related to Agricultural Production Relations: Gaps Identified and Recommendations Suggested

Production Relation: Land Use

Gaps/ Negative Effects/Main Issues/Absence/ inadequacy/Barriers/Constraints/Inconsistencies and for efficiency of resource allocation and use	Policy Recommendations	Policy Instruments/ Strategies	Responsible Authorities	Implementing Authorities
	Implementation			
• No clear policy on efficient use of inputs	• Introduce land use planning as a strategy for efficient use of inputs and improve productivity in major field crops.	Land use planning	Ministry of Agriculture and Land & Provincial Ministry of Agriculture and Land	DOA/NRMC
• Mega crop zoning is essential for market-oriented production and provision of other services. There are no guiding policies in this regard.	• Policy environment for facilitating crop zoning in districts considering the agro-ecological considerations and crop potential.	Mapping/ Crop zoning		DOA/NRMC
• Policies to enhance soil fertility through IPNM application	• Facilitate adoption of Integrated Plant Nutrient Management (IPNM) systems in intensive cultivation of crops both under open fields and protected agriculture.	Integrated Plant Nutrient Management (IPNM)		DOA and Provincial DOA
• Provision in paddy land act to facilitate innovative agricultural ventures is lacking.	• Policy alternative to use of paddy lands with irrigation facilities for raising other agricultural produce such as fruits, fodder for livestock, fisheries and high value export-oriented crop which is not allowed hitherto	Use of paddy lands with irrigation facilities for raising other high value agricultural produce		Dept of Agrarian

Production Relation: Seed Sector

Gaps/ Negative Effects/Main Issues/Absence/ inadequacy/Barriers/Constraints/Inconsistencies and for efficiency of resource allocation and use	Policy Recommendations	Policy Instruments / Strategies	Responsible Authorities	Implementing Authorities
	Formulation			
Inadequate consultation with stakeholders in policy formulation.	• Initiate a consultative process involving all stakeholders in all stages of policy formulation process including the formal and informal seed sectors and validation of the seed policy through a National Seed Forum would allow successful creation of an enabling seed policy environment which integrated to the National Agricultural policy.	Strengthening of National Seed Forum	Dept of Agriculture	Dept of Agriculture/ SCPPC/SPMDC
Policy updating is needed.	• Periodically review impact of National Seed Policy and make aligned with changing National Agriculture Policy.	Periodically review impact of National Seed Policy	Ministry of Agriculture	
	Implementation			
There is no policy for collaborative R &D	• Creating a policy environment to R&D partnership in seed sector in collaboration with government departments, private sector and Universities by sharing technologies,	Promotion of collaborative R&D partnership in seed sector	Ministry of Agriculture	Dept of Agriculture/ SCPPC/ SPMDC and

	infrastructure, human capital and cost.			ETC Dept of Agriculture/ SCPPC/ SPMDC and ETC
There is no enabling policy for partnership.	• Policy environment for building dynamic partnerships for high quality seed and planting materials production, storage and marketing with private sector and farmer organizations	Building necessary dynamic partnerships for the seed sector	DOA, CARP, Universities & Private Sector Agri Businesses	
Non - compliance of seed quality standards in the supply chain and inadequate enforcement of seed act	• Policies to regulate seed and planting materials quality, seed security and price and take legal action for non-compliance.	Establishment of necessary regulatory systems for the seed sector	DOA	
Inadequate investment and opportunities for updating knowledge and skills of key players.	• Capacity building of seed sector players in the supply chain through regular training and monitoring.	Training and monitoring for capacity building		DOA/SPMDC and ETC
Present policies regulate flow of advance seed and planting material in to the country preventing investments in profitable new ventures.	• Make access to imported high quality seed and planting materials for commercial enterprises for export-oriented production with adequate regulatory measures.	Make access to imported high quality seed and planting materials for commercial enterprises	Ministry of Agriculture	DOA/SCPPC

Inadequate integration of international R&D opportunities	• Policies to foster international regional collaboration for seed sector development with R&D institutions.	fostering international regional collaboration for seed sector development with R&D institutions.	DAO, CARP	DOA/SCPPC, Agriculture Faculties of Universities
There's no mechanism for monitoring quality standards at grass root level.	• Establish grassroots level quality assurance and monitoring system for seed, planting and breeding materials.	Establishing grassroots level quality assurance and monitoring system for seed, planting and breeding materials.	DOA	DOA/SCPPC
Too long procedure for importation of new improved germplasm.	• Revise and streamline seed and planting (seed, planting and breeding) materials importation procedures for specific purposes of national interests	Streamline seed, planting and breeding materials importation procedures for specific purposes of national interests	MOA, DOA, DAP&H	DOA/SCPPC/ RRDI/FCRDI/ HORDI/FCRDC /DAP&H

Production Relation: Fertilizer

Gaps/ Negative Effects/Main Issues/Absence/ inadequacy/Barriers/Constraints/Inconsistencies and for efficiency of resource allocation and use	Policy Recommendations	Policy Instruments / Strategies	Responsible Authorities	Implementing Authorities
	Formulation			
Present policies do not adequately support soil fertility, productivity, environmental protection and food safety. Update according to the present need.	Amend the Fertilizer Act, No. 68 of 1988 to suite the present-day context.	Formulate a national fertilizer policy	MOA	MOA/ National Fertilizer Secretariate
	Implementation			
Straight fertilizer policy no longer practical.	• Thoroughly review the straight fertilizer policy adopted by the DOA and MOA for food crops.	Amend the Regulation of Fertilizer Act, No. 68 of 1988,	MOA, DOA	
		Review the straight fertilizer policy	MOA, DOA	Research Division of DOA
Depleting soil health and fertility	• Introduce a system (combining soil, growing environment, crop and cropping system, target production etc.) based on soil fertility including soil	Change crop-based fertilizer recommendation into soil fertility-based system	DOA	DOA

	health management system instead of crop-based fertilizer recommendation.	including soil health management.		
Abuse of fertilizer subsidies.	• Target deserving farmers for fertilizer subsidy base on crops, production potential and productivity impact.	Target fertilizer subsidy base on crops, production potential and productivity.	MOA, DOA, DAD	DAD, DOA, NFS
Inadequate monitoring of subsidized fertilizer use.	• Field monitoring mechanism for fertilizer subsidy schemes should be in-place with institutional arrangement and required resource allocation.	Establish Field monitoring mechanism for fertilizer subsidy schemes with adequate resources	DAD, DOA	DOA and DAD
Systematic soil testing facilities are not available.	• Promote Fertilizer application based on soil testing and crop requirement. Provide infrastructure facilities for and training for field staff, Farmer organizations and fertilizer dealers.	Promote Fertilizer application based on soil testing and crop requirement	MOA, DOA	DOA
Absence of fertilizer use regulatory mechanisms.	• Policies to regulate inorganic fertilizer misuse and promote judicious fertilizer practices through balanced fertilizer use including organic and bio fertilizer.	Regulate inorganic fertilizer misuse and promote judicious fertilizer practices	MOA, DOA	NFS/DOA/ DAD
	• Incentives for organic fertilizer production and use for farmers to maintain the soil fertility and productivity of farm lands.	Incentives for organic fertilizer production and use for farmers	MOA, DOA	DOA, DAD/ Private Sector Agribusiness Enterprises

Lack of practical alternatives for fertilizer subsidies for targeted farmers.	• Considering the demerits of the present policy on fertilizer subsidy (cash subsidy), provide target fertilizer subsidies for priority crops and deserving target groups	Target fertilizer subsidies for priority crops and deserving target groups	MOA, DAD, DOA	MOA. DAD, DOA, PDOA
	• Introduce output-based price support system (gradual shift) – instead input based subsidy scheme.	Introduce output-based price support	MOA, DAD, DOA	DOA, DAD, MOA, PDAO

Production Relation: Pesticides

Gaps/ Negative Effects/Main Issues/Absence/ inadequacy/Barriers/Constraints/Inconsistencies and for efficiency of resource allocation and use	Policy Recommendations	Policy Instruments / Strategies	Responsible Authorities	Implementing Authorities
	Formulation			
Inadequacy of present policy implementation and provisions for non-compliance.	• Streamline the policies related to pesticide use and marketing through appropriate policy instruments and implementation plan & monitoring system.	Streamline the policies using appropriate policy instruments and implementation plan & monitoring system.	DOA	DOA
	• Review the Control of Pesticides Act, No. 33 of 1980 and subsequent amendments and Make necessary amendments to facilitate legal action against non-compliance in the supply chain and include regulations on marketing.	Facilitate legal action against non-compliance in the supply chain and include regulations on marketing	MOA, DOA	DOA
	Implementation			
Inadequate health and environment risk aversion	• Mandatory implementation of pesticide regulatory system based on FAO international code of conduct on distribution and use of pesticides to reduce health and environmental risk.	Implement FAO recommended pesticide regulatory system	MOA, DOA, Ministry of Trade, Ministry of Health	DOA, Regional Health Authorities and Consumer Affiars

Inadequacy of institutional capacities.	• Providing Infrastructure and necessary institutional capacity building for implementation and monitoring the pesticide act.	Provide infrastructure facilities and build capacity for implementation and monitoring the pesticide act	MOA, DOA	DOA
Less incentives for bio fertilizer production	• Encourage private sector collaborations for bio pesticide industry and local production of bio pesticides.	Encourage private sector collaborations for bio pesticide industry	MOA, Private Sector Bio Fertilizer Manufacturers	DOA, Private Sector Bio-fertilizer Manufacturers, Farmer Organizations

Production Relation: Mechanization

Gaps/ Negative Effects/Main Issues/Absence/ inadequacy/Barriers/Constraints/Inconsistencies and for efficiency of resource allocation and use	Policy Recommendations	Policy Instruments / Strategies	Responsible Authorities	Implementing Authorities
	Formulation			
Inadequate provision for PPPP for R&D	• Facilitate through a PPPP platform including government departments, private sector enterprises and universities to conduct R & D and develop technologies /innovations that suit to enhanced mechanization in small holder farming operations.	Establish a PPPP platform to undertake R& D for mechanization in smallholder farming operations	MOA, Universities, Private Sector Agribusinesses	DOA, Private Sector, Chambers of Commerce and Industry
Lack of provision for incentives for technology generation and commercialization.	• Provide policy environment for commercialization of technologies and innovations that developed by individuals and joint ventures, and provide incentives and investments for industry. Facilitate commercialization and popularization.	Promote joint ventures with incentives	MOA, CARP, DOA, Universities, Private Sector R&D groups	DOA, Private Sector R&D groups

	Implementation			
Lack of incentives	• Provide incentives for small farmers to adopt mechanization of some aspect to relive labour shortage and drudgery involved in farm operation.	Provide incentives for smallholders to adopt appropriate mechanization	MOA, DOA	
Lack of training opportunities.	• Create opportunities for training of extension agents and farmers on use and O&M of machines and equipment.	Make use existing District Training Centers for training of extension agents and farmers on use and O&M of machines and equipment.	MOA, DOA, DAP&H	DOA/ETC DAP&H
Private sector dominance and inadequate state regulations.	• Establishing strategic locations, Farmer organizations, cooperative managed machine lending centers to facilitate access to machines and equipment.	Establish farmer organizations, cooperative managed machine lending centers	MOA, DAD	DAD

Production Relation: Irrigation Water Allocation

Gaps/ Negative Effects/Main Issues/Absence/ inadequacy/Barriers/Constraints/Inconsistencies and for efficiency of resource allocation and use	Policy Recommendations	Policy Instruments / Strategies	Responsible Authorities	Implementing Authorities
	Formulation			
Inadequate policy environment for diverse use of irrigation water.	• Review the Agrarian Development Act, No. 46 of 2000 and make necessary amendments to facilitate wider usage of paddy lands for increased agricultural production.	Amend the Agrarian Development Act, No. 46 of 2000 to use marginal paddy lands for increased agricultural production.	MOA, DAD	DAD
	• Facilitate alternative use of paddy lands with irrigation facilities for raising other agricultural produce such as fodder production for livestock, fisheries, production of high value crops under control agriculture for efficient and profitable irrigation water use.	Facilitate alternative use of paddy lands with irrigation facilities for production of high value agriculture commodities	DOA, DAD	DOA, DAD
	Implementation			
Lack of policy for economic use of irrigation water	• Ensure a higher water productivity to increase cropping intensity and to facilitate crop diversification and realize profit maximization.	Ensure a higher water productivity	MOA, DAD, DOA	DAD, DOA

Inadequate policy environment for interactive participation of stakeholders.	• Location specific, dynamic scheduling of cropping activities in participation with farmers and technical agencies to harness the rainfall and cropping patterns for increased water use efficiency and climate mitigation.	Introduce location specific, dynamic scheduling of cropping activities for increased water use efficiency and climate mitigation	MOA, DOA, DAD, Dept. of Irrigation	DOA, DAD, Dept. of Irrigation, Met. Department
Inadequate enforcement of policies regarding water saving and watershed management.	• Ensure water use efficiency in all irrigated agriculture areas with regulatory and monitoring measures and take legal action against non-compliances.	Strengthening regulatory and monitoring measures to ensure water use efficiency in irrigated agriculture	DAD, Dept of Irrigation, DOA	DAD, Dept. of irrigation, DOA
	• Encourage water saving methods of cultivation where possible through promotion of mulching and water conservation methods.	Promoting mulching and other water conservation methods	DOA	DOA
	• Policies to prevent encroachment of water sheds and drainage systems with area demarcation.	Demarcate areas to prevent encroachment of water sheds and drainage systems	DAD, Dept. of Irrigation	DOA, Dept. of Irrigation, Local authorities, Farmer organizations

Production Relation: Agricultural Extension Provision

Gaps/ Negative Effects/Main Issues/Absence/ inadequacy/Barriers/Constraints/Inconsistencies and for efficiency of resource allocation and use	Policy Recommendations	Policy Instruments / Strategies	Responsible Authorities	Implementing Authorities
	Formulation			
Divisional level extension system inadequate to cover farming population.	• Establish a grass root level agriculture extension system with competent agriculture extension agents mobilized and monitored at divisional areas, or specific production zones.	Mobilized and monitored competent extension agents at divisional areas, or specific production zones.	MOA	DOA
Inadequate policy environment for coordinated extension system.	• Ensure and facilitate coordination among extension system of different agencies including livestock, export agriculture.	Ensure and facilitate coordination among extension system of different agencies	MOA	DOA, DAP&H
Moving from production orient to market-oriented quality production.	• Expand the present production-oriented extension system to accommodate post-harvest, value addition and marketing components	Accommodate post-harvest, value addition and marketing components in extension system	MOA, DOA, EDB	DOA, Post Harvest Institute

	Implementation			
Lack of policy environment for collaborative agriculture extension.	• Develop partnership for agriculture extension with public sector agencies including livestock and export crop sector, private sector, universities and farmer organization and involve them adequately in program planning, implementation and monitoring.	Develop partnership for agriculture extension with public sector agencies	MOA, DOA, Universities, Private Sector	DOA, Universities, Private Sector
Lack of incentives for extension agents.	• Introduce performance /production-based reward system for extension agents.	Introduce performance /production-based reward system for extension agents.	MOA, DOA	DOA
Inadequate trained extension agents to deal with a complex farming system.	• Capacity building of extension agents through regular training on technical aspect of production and marketing, as well as on social mobilization.	Capacity building of extension agents through regular training including social mobilization	MOA, DOA	DOA, Training Institutes On Social Mobilizations, University out-reach Programs

	• Promote cross cutting areas of agriculture production, environment protection, natural resource management and effect of climatic change through extension system.	Promote cross cutting areas of agriculture production, environment protection, natural resource management and effect of climatic change through extension system.	MOA, Ministry of Environment, Department of Disaster Management	DOA, Regional Environmental Authorities, Regional Disaster Management Authorities

Production Relation: e-Agriculture

Gaps/ Negative Effects/Main Issues/Absence/ inadequacy/Barriers/Constraints/Inconsistencies and for efficiency of resource allocation and use	Policy Recommendations	Policy Instruments / Strategies	Responsible Authorities	Implementing Authorities
	Implementation			
Lack of policies to implement E-agriculture strategies.	• Create Policy environment for implementation of E-agriculture strategy in considering significant and different roles played by multiple sectors including individuals, public and private sector, international development agencies and donors to improve access to right information at the correct time and make decisions by service providers and users.	Create Policy environment for implementation of E-agriculture strategy	MOA, DOA, HARTI, private sector service providers, TRC, EDB	DOA, Private sector, regional agriculture trading
Absence of policy for investment in E-agriculture.	• Provide investment in infrastructure, Communication technologies and human resource development in the relevant stakeholders for application of ICT.	Provide investment in infrastructure, Communication technologies and human resource development for application of ICT	MOA	DOA, HARTI, Regional Economic Centers, Private Sector

Need policy initiative to E-agriculture.	• Application of accessible, affordable and secure ICT platform in R&D, Agriculture extension, supply chain and value chain management and production planning and monitoring, risk management, climate prediction, food security and early warning systems initially at national and provincial level.	Establishment of accessible, affordable and secure ICT platform for critical areas of the agriculture sector	MOA, DOA	DOA, Private Sector Service Providers, Met. Dept.
	• Reform existing policy framework, regulations and guidelines for application of e-agriculture through relevant stakeholder participation.	Reform existing policy framework, regulations and guidelines for application of e-agriculture through relevant stakeholder participation	MOA, DOA, TRC	MOA, DOA, DAD, PDOA

Annexures

Annexure 1

Titles of the National Policy Documents Reviewed

	Category		Policy
1	**Land**	1	AP 1 Agrarian Development (P 115)
2		2	A-1 Agrarian Development ACT, No. 46 OF 2011 (P 25)
3		3	A-2 Agricultural Lands (P 23)
4		4	A-11.1 Mahaweli Authority (Amendment) (P 6)
5		5	A-11.2 Mahaweli Authority of Sri Lanka (P 18)
6		6	A-11.3 Mahaweli Development Board (Amendment) Law (P 5)
7		7	A-11.4 Mahaweli Development Board (Repeal) (P 7)
8		8	A-11.5 Mahaweli Development Board (P 13)
9		9	A-16.1 PADDY LANDS – Enactment (P 16)
10		10	A-16.2 Paddy Lands (P 38)
11		11	A-16.3 Paddy Lands (Special Provisions) (P 7)
12		12	P 5 Combating Land Degradation in Sri Lanka (P 166)
13		13	P 53 SL National Wetland Policy and Strategy (P 27)
14		14	P 52 SL National Land Use Policy (P 19)
15		15	LS-12 Pasture Lands (Reservation and Development) (P 8)
16	**Input**	1	P 9 SL National Policy for Rural Water Supply and Sanitation Sector (P 13)
17		2	P 23 SL Draft National Policy on Protection and Conservation of Water (P 10)
18		3	P 34 SL National Drinking Water Policy (P 11)
19		4	P 35 SL National Watershed Management Policy (P 25)
20		5	P 36 SL Policy Protection Water Resources Catchments (P 13)
21		6	P 59 SL National Rainwater Policy and Strategies (P 7)
22		7	P 76 SL National Water Resources Policy and Institutional Arrangements,
23		8	AP 11.1 International Irrigation Management Institute (Amendment) (P 9)
24		9	AP 11.2 International Irrigation Management Institute (P 21)
25		10	AP 12.1 IRRIGATION – Enactment 2 (P 76)
26		11	AP 12.2 IRRIGATION – Enactment (P 74)
27		12	AP 12.3 Irrigation (Amendment) 2 (P11)
28		13	AP 12.4 Irrigation (Amendment) 3 (P 5)
29		14	AP 12.5 Irrigation (Amendment) 4 (P 12)
30		15	AP 12.6 Irrigation (Amendment) (P 17)
31		16	AP 9.1 FERTILIZERS – Enactment
32		17	AP 9.2 FERTILIZERS – Enactment 2 (P 10)
33		18	AP 9.3 Fertilizers (P 10)
34		19	AP 18 Regulation of Fertilizer (P 17)
35		20	AP 8.1 Control of Pesticides (Amendment) (P 19)
36		21	AP 8.2 Control of Pesticides – Enactment (P 20)
37		22	AP 8.3 Control of Pesticides (P 10)
38		23	AP 8.4 Pesticides ACT, No, 31 OF 2011
39		24	AP 20 Seed (P 19)

	Category		Policy
40	**Livestock and Fisheries**	1	LS-1 Animal Diseases (P 30)
41		2	LS-2 Animal Feed (P 20)
42		3	LS-3.1 Animals (Amendment) (P 7)
43		4	LS-3.2 Animals (Amendment)2 (P 13)
44		5	LS-3.3 Animals (P 10)
45		6	LS-3.4 Animals (P 22)
46		7	LS-3.5 Animals ACT, No. 10 OF 2009 Amended (P 8)
47		8	LS-4 BUFFALOES PROTECTION – Enactment (P 6)
48		9	LS-5.1 BUTCHERS – Enactment (P 19)
49		10	LS-5.2 BUTCHERS – Enactment 2 (P 17)
50		11	LS-5.3 Butchers (Amendment) (P 5)
51		12	LS-5.4 Butchers ACT, No. 13 of 2008 Amendment (P 6)
52		13	LS-6 CATTLE TRESPASS – Enactment (P 23)
53		14	LS-7 CRUELTY TO ANIMALS – Enactment 2 (P 10)
54		15	LS-8 DISEASES OF ANIMALS – Enactment 2 (P 20)
55		16	LS-10.1 MILK BOARD – Enactment (P 15)
56		17	LS-10.2 MILK BOARD – Enactment 2 (P 15)
57		18	LS-11 National Zoological Gardens (P 12)
58		19	LS-13 Prevention of Cruelty to Animals ACT, No. 52 OF 2009 (P 11)
59		20	LS-14 REGISTRATION OF DOGS – Enactment (P 10)
60		21	LS-15.1 Veterinary Surgeons and Practitioners (Amendment) (P 14)
61		22	LS-15.2 Veterinary Surgeons and Practitioners (Amendment) Law
62		23	LS-15.3 Veterinary Surgeons and Practitioners (P 12)
63		24	LS-15.4 VETERINARY SURGEONS AND PRACTITIONERS –Enactment (P 22)
64		25	P 54 SL National Livestock Development Policy and Strategies (P 22)
65		26	P 71 SL National Livestock Breeding Policy 2010
66		27	P 6 SL National Fisheries and Aquatic Resources Policy (P 6)
67		28	P 7 SL National Fisheries Policy (P 10)
68		29	P 19 SL Draft National Fisheries and Aquaculture Policy (P 9)
69		30	P 56 SL National Mid Term Policy Framework for Fisheries Sector Development (P 28)
70		31	P 71 SL National Livestock Breeding Policy 2010 1 (p 58)

	Category		Policy
71	**Environment Protection and Sustainable Development**	1	AP 15.1 PLANT PROTECTION – Enactment 2 (P 9)
72		2	AP 15.2 Plant Protection (Amendment) (P 6)
73		3	AP 15.3 Plant Protection (P 18)
74		4	A-9 Environment Levy ACT, No. 26 of 2008 (P 9)
75		5	A-13.1 National Environmental (Amendment) (P 34)
76		6	A-13.2 National Environmental (Amendment) 2 (P 7)
77		7	A-13.3 National Environmental (P 14)
78		8	P 13 SL National forestry Sector Master Plan (P 29)
79		9	AP 5 Botanic Gardens (Amendment) Law (P 4)
80		10	LS-9.1 Fauna & Flora ACT, No. 22 OF 2009 Amendment (P 95)
81		11	LS-9.2 FAUNA AND FLORA PROTECTION – Enactment 2 (P 46)
82		12	LS-9.3 Fauna and Flora Protection (Amendment) (P 12)
83		13	LS-9.4 Fauna and Flora Protection (Amendment) 2 (p 57)
84		14	LS-9.5 FAUNA AND FLORA PROTECTION –Enactment (P 59)
85		15	P 28 SL Bio Safety Framework (P 68)
86		16	P-1 Action Plan for Air Quality Management
87		17	P-2 Climate Change Adaptation Strategies for Sri Lanka
88		18	P-3 Climate Change Impacts in Sri Lanka
89		19	P-4 Climate Change Policy
90		20	AP 16 Quarantine & Prevention of Diseases (P 13)
91		21	A-17.1 SOIL CONSERVATION – Enactment (P 10)
92		22	A-17.2 SOIL CONSERVATION – Enactment 2 (PLY)
93		23	A-17.3 Soil Conservation (Amendment) (P 15)
94		24	P 15 SL National Wildlife Conservation Policy (P 2)
95		25	P 11 SL National Policy on Sand as a Resource for the Construction Industry (P 12)
96		26	P 26 SL Draft Policy on Consumption Production (P 22)
97		27	P 65 SL Sustainable Development Goals Indicators (P 138)
98		28	P 68 Strategic Plan for Sustainable Sri Lanka (P 362)
99		29	P 16 SL Cleaner Production Policy for Agriculture Sector (P 4)
100		30	P 17 SL Cleaner Production Policy for Agriculture Sector English (P 8)
101		31	P 18 SL Cleaner Production Policy for Agriculture Sector Sinhala (P 16)
102		32	P 33 SL National Cleaner Production for Health Sector (P 6)
103		33	P 73 SL National Policy and Strategy on Cleaner Production Fisheries Sector 2008
104		34	P 74 Sl National Policy and Strategy on Cleaner Production for Agriculture Sector 2012
105		35	P 61 SL National Strategy for Solid Waste Management (P 13)
106		36	P 79 Vision 2025
107		37	A-26 Divineguma ACT, No. 01 OF 2013 (P 36)
108		38	P 70 SL National Housing Policy 1
109		39	P 8 SL National Policy for Decent Work (p 80)

	Category		Policy
110	**Industrial and Enterprise Development**	1	P 12 SL National Policy on Siting of High Polluting Industries (P 7)
111		2	P 29 SL Development of National Policy for Primary Industries (P 19)
112		3	P 30 SL Development Policy for Sugar industry (P 10)
113		4	P 66 SL Tourism Development Strategy (P 40)
114		5	AP 19 Tea Subsidy (P 8)
115		6	A-21 Sri Lanka Fruit Board Law (P 11)
116		7	P 14 SL National Plantation Industries Policy Framework (P 70)
117		8	P 21 SL Draft National Agricultural Policy (P 40)
118		9	P 25 SL Draft National Transport Policy (P 37)
119		10	P 27 SL National Agricultural Policy (P 10)
120		11	P 63 SL Northern Province Agric Policy (P 13)
121		12	P 77 SL Northern Province Med Term Sect Plan 2019-21
122		13	A-12.1 National Enterprise Development Authority (P 23)
123		14	A-12.2 National Enterprise Development Authority ACT, No. 18 OF 2014 (P 6)
124		15	P 24 SL Draft National Small and Medium Enterprise Policy (P 6)
125	**Research and Educational Development**	1	A-18 Sri Lanka Council for Agricultural Research Policy (P 23)
126		2	A-24 Sugarcane Research Institute (P 16))
127		3	A 28 Research Council Act 11 of 2016 (P 4)
128		4	P 32 SL National Agricultural Research Policy & Strategy (P 25)
129		5	A-14 National Institute of Technical Education of Sri Lanka (P 24)
130		6	P 37 SL National Education Policy Proposals (P 28)
131	**Import, Export and Trade**	1	P 62 SL New Trade Policy (P 29)
132		2	P 67 SL Trade Policy Issues (P 20)
133		3	AP 14 Imports and Exports (P 9)
134		4	A-20 Sri Lanka Export Development (P 13)
135		5	P 40 National Export Strategy - Boat Building (P 67)
136		6	P 41 National Export Strategy - Electronic and Electrical Component (P 53)
137		7	P 42 National Export Strategy - Information Technology (P 57)
138		8	P 43 National Export Strategy - Processed Food and Beverages 1 (P 52)
139		9	P 44 National Export Strategy - Quality Infrastructure Strategy (P 70)
140		10	P 45 National Export Strategy - Trade Information & promotion (P 43)
141		11	P 46 National Export Strategy - Wellness Tourism (P 62)
142		12	P 47 National Export Strategy (P 103)
143		13	P 48 National Export Strategy for Processed food and beverages 2 (P 53)
144		14	P 49 National Export Strategy- Logistic Strategy (P 68)
145		15	P 50 SL National Export Strategy - Spices and concentrates (P 24)
146		16	P 51 SL National Export Strategy - Spices and concentrates (P 59)
147		17	P 78 Spices and concentrates strategy FINAL Edited
148		18	AP 17 Regulated Equipment for Agricultural Projects (Special Provisions) (P 7)

	Category		Policy
149	**Investment, Planning and Evaluation**	1	A-3 BOI Act No 03 OF 2012 (P 7)
150		2	A-4 BOI ACT, No. 36 OF 2009 Amendment (P 7)
151		3	AP 4 Board of Investment of Sri Lanka (Amendment) (P 5)
152		4	P 58 SL National Physical Planning Policy and Plan (P 104)
153		5	A-15 National Planning Council (P 6)
154		6	P 72 SL National Physical Planning Policy and Plan Sri Lanka 2030
155		7	P 39 SL National Evaluation Policy (P 4)
156	**Energy, Science and Technology**	1	AP 10 Information and Communication Technology (P 13)
157		2	AP 13 Natural Resources, Energy and Science Authority of Sri Lanka Act (P 24)
158		3	P 60 SL National Science and Technology Policy (P 56)
159		4	AP 22 ITC ACT, No. 33 of 2008 (P 4)
160		5	P 64 SL Policies and Procedures for ICT Usage in Government (P 35)
161		6	P 31 SL e-Agri strategy (P 62)
162		7	P 69 SL National Biotechnology Policy 2009
163		8	P 38 SL National Energy Policy and Strategies of Sri Lanka (P 13)
164	**Finance**	1	AP 2 Agricultural and Agrarian Insurance (P 21)
165		2	AP 3.1 Agricultural Insurance (P 24)
166		3	AP 3.2 Agricultural Insurance Law (P 12)
167		4	AP 23 Mico Finance Act 06 of 2016 (P 4)
168	**Price**	1	AP 21 Rice Subsidy Tax (Repeal) (P 5)
169	**Food**	1	A-10.1 FOOD – Enactment (P 32)
170		2	A-10.2 Food (Amendment) (P 16)
171		3	A-10.3 Food Act (P 15)
172		4	A-10.4 Food ACT, No. 29 OF 2011 (P 8)
173		5	P 57 SL National Nutrition Policy of Sri Lanka (P 25)
174	**Disaster Management**	1	A-19 Sri Lanka Disaster Management (P 24)
175		2	P 10 SL National Policy on Disaster Management (P 11)
176	**Marketing**	1	P 55 SL National Media Policy (P 5)
177	**Health**	1	P 20 SL Draft National Health Promotion Policy (P 15)
178			P 22 SL Draft National Policy on Health Information (P 10)

	Category		Policy
179	**Institutional**	1	A-22 Sri Lanka Standards Institution (P 40)
180		2	AP 7 Companies ACT, No. 13 OF 2014 Amendment (P 8)
181		3	A-5 Bureau of Ceylon Standards (P 17)
182		4	A-7 Companies ACT, No. 07 OF 2007 (P 453)
183		5	A-8 Department of Agriculture - Enactment (P 5)
184		6	A-23.1 State Agricultural Corporations (P 11)
185		7	A-23.2 State Agricultural Corporations 2 (P 5)
186		8	A-25.1 Vocational Training Authority of Sri Lanka (P 24)
187		9	A-25.2 VTC ACT, No. 31 of 2008 (P 4)
188		10	A-27 Acts 1956-2006 (Official) (P 12)
189	**Intellectual Property**	1	A-6.1 Code of Intellectual Property (Amendment) 5 (P 6)
190		2	A-6.2 Code of Intellectual Property (Amendment) (P 5)
191		3	A-6.3 Code of Intellectual Property (Amendment) 2 (P 5)
192		4	A-6.4 Code of Intellectual Property (Amendment) 3 (P 8)
193		5	A-6.5 Code of Intellectual Property (P 49)
194		6	AP-6 Code of Intellectual Property (Amendment) (p 7)

Annexure 2

Titles of the Global Policy Documents Reviewed

	Country	Policy
1	**Australia**	Food and Nutrition Policy
2		Biotechnology and Agriculture
3		Land Use and Management
4		National Strategy on Climate, Health and Well-being
5		Digital Agriculture Strategy
6		Farm Credit Policy in the Early Stages of Agricultural Development
7		Rural Research and Development Policy
8		Australian Agricultural Trade
9		Export Finance
10		Agriculture Water Pricing
11	**Pakistan**	Rural Finance policy
12		National Food Security Policy (Draft)
13		Agricultural Research and Development
14		National Climate Change Policy
15		Land Development and Utilization Act
16		Environment protection Act
17		Agriculture Trade and Price Policy
18		Agricultural Marketing Infrastructure and Post-Harvest Management
19		Strategic Trade Policy Framework
20		Repayment of Loans
21	**India**	Food Security and Food Policy in India
22		National Policy for Farmers
23		Agriculture Export Policy
24		Climate Change Policy for India
25		Draft National Land Reforms Policy
26		Indian Biotech Agriculture Industry: Vision 2025
27		Agricultural Produce and Livestock Marketing
28		Financing Purchase of Land for Agricultural Purposes
29		Agricultural Credit for 2020
30		Agricultural Research and Development Policy
31	**Japan**	Climate Change Adaptation Plan
32		Specifications and Standards for Food
33		Research and Development and Extension Services
34		Japanese Agricultural Trade Policy and Sustainable Development
35		Agricultural Land Reform
36		Japan's Strategy for its Agriculture in the Globalized World
37		Japan's Rice policy
38		Directed Credit Programs for Agriculture and Industry
39		Japan Biotechnology
40		Japan Agricultural Finance

41	**United States**	Agricultural credit policy
42		Dairy Price Policy
43		USDA Climate Change Science Plan
44		Food Safety Policy and Regulation
45		Agricultural Biotechnology: Background and Recent Issues
46		Agricultural Marketing Act
47		Agricultural Research and Development
48		Land Use Policy
49		Trade and Investment
50		Agricultural Financing
51	**Canada**	Action Plan for Food Security
52		Climate Change Action Plan
53		Biotechnology and Cleaner Production
54		Preserving Agricultural Land
55		Agricultural Products Marketing Act
56		Farm Creda Canada Act
57		Canadian Agricultural Loans Act
58		The Output-Based Pricing System
59		Research and Scientific Integrity Policy
60		Agriculture and Trade Policy
61	**United Kingdom**	Food Security
62		The Climate Change Act
63		Code of Good Agricultural Practice for Reducing Ammonia Emissions
64		The Agricultural Marketing Act
65		A Future Sustainable Farming and Land Management Policy
66		Strategy for Agricultural Technologies
67		Agriculture and Trade
68		British Agricultural Policy
69		Rural Finance
70		Availability of Capital and Credit
71	**China**	Policies and Actions Addressing Climate Change
72		Food Safety Law
73		Land Policy and Urbanization
74		Marketing Infrastructure and Agricultural marketing Reforms
75		China's Agricultural Development and Policy
76		Agricultural Biotechnology to 2030
77		Agriculture Law
78		Agriculture and Trade Policy
79		Financial Fund Supporting Agriculture in China
80		Agricultural credit in China

81	**France**	Climate Plan
82		Paris Strategy for Sustainable Food
83		The Ministry in Action
84		Preservation of the Agricultural Lands
85		Agricultural Specific Trade
86		France Research and Development
87		Agricultural Biotechnology
88		France Agriculture Pricing
89		Agricultural Finance
90		Agricultural Credit
91	**Germany**	Combating Climate Change
92		Food Security
93		Rural Finance Policy
94		Agricultural Research for Development
95		Common Fisheries Policy
96		Sustainable Access to Land
97		Agriculture and Economic Development
98		Policy in Biotechnology
99		German Economic Policy
100		Farm Credit System

Annexure 3

The List of Attendees at the Key Stakeholder Meeting Held on 29th March 2019 at HARTI, Colombo

WORKSHOP ON AGRICULTURE SECTOR MODENIZATION PROJECT

Date : 29. 03. 2019

Venue : Hector Kobbekaduwa Agrarian Research and Training Institute

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Submitted by

WORKSHOP ON AGRICULTURE SECTOR MODENIZATION PROJECT

Date : 29. 03. 2019

Venue : Hector Kobbekaduwa Agrarian Research and Training Institute

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Annexure 4

Key Informants Interviews

The following key officials were interviewed by the research team and the outcome of the meetings were taken in to account in preparing the final report, in identifying the gaps in policies and in suggesting recommendations, in particular.

1. Dr. M.W.M. Weerakoon
   Director General
   Department of Agriculture

2. Dr. A.P. Heenkenda
   Director General
   Department of Export Agriculture

3. Prof. Gamini Pushpakumara
   Dean
   Faculty of Agriculture
   University of Peradeniya

4. Dr. K.D. Ariyapala
   Director General
   Department of Animal Production and Health

5. Mr. P.R.P.Y. Pallemulla
   Provincial Director of Agriculture
   Central Province
   Ministry of Agriculture

6. Mr. Gamini Rajakaruna
   Former Director General
   Mahaweli Authority of Sri Lanka

Annexure 5

The summary statistics used to calculate the Mean Attribute Scores (MAS)

Summary statistics of Crop Produce Quality Attributes

		CQA1	CQA2	CQA3	CQA4	CQA5	CQA6	CQA7	CQA8	CQA9	CQA10	CQA11	CQA12	CQA13	CQA14
N	Valid	619	623	619	619	618	617	618	614	617	619	623	621	624	617
	Missing	31	27	31	31	32	33	32	36	33	31	27	29	26	33
Mean		8.70	7.24	8.39	5.68	5.21	2.91	5.92	6.38	7.99	6.56	5.02	7.40	8.16	6.90
Median		9.00	9.00	9.00	7.00	6.00	1.00	7.00	7.00	8.00	7.00	5.00	8.00	9.00	8.00
Std. Deviation		2.043	3.268	2.089	3.051	3.130	3.273	2.899	2.349	1.982	3.216	3.192	2.789	2.485	3.220
Variance		4.174	10.679	4.364	9.306	9.796	10.715	8.401	5.518	3.930	10.344	10.191	7.776	6.177	10.370

Summary statistics of Livestock Produce Quality Attributes

		LQA1	LQA2	LQA3	LQA4	LQA5	LQA6	LQA7	LQA8	LQA9	LQA10	LQA11	LQA12
N	Valid	127	143	143	141	142	140	139	143	142	143	141	141
	Missing	16	0	0	2	1	3	4	0	1	0	2	2
Mean		7.46	6.79	6.69	6.70	6.54	3.95	6.60	4.87	3.80	6.30	8.99	7.11
Median		9.00	9.00	9.00	8.00	8.00	4.50	7.00	5.00	4.00	8.00	10.00	9.00
Std. Deviation		3.681	3.562	3.651	3.357	3.560	3.769	3.009	3.200	3.644	3.371	2.209	3.799
Variance		13.552	12.688	13.330	11.271	12.676	14.206	9.052	10.243	13.280	11.367	4.879	14.430

Annexure 6

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