Analytical and Policy Advisory Support, Research Report – No 04

Policy Research in the Area of Agricultural Technology Adoption

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AGRICULTURE SECTOR MODERNIZATION PROJECT

No 123/2, Pannipitiya Rd, Battaramulla, Sri Lanka

Agriculture Sector Modernization Project

FINAL REPORT

Policy Research in the Area of Technology Adoption

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I. Acronyms & Abbreviations

ADB	Asian Development Bank
AI	Artificial Intelligence
ASMP.	Agriculture Sector Modernisation Project
CARP	Sri Lanka Council for Agriculture Research Policy
CBSL	Central Bank of Sri Lanka
CS	Chief Secretary of Province
EDB	Export Development Board
DOA	Department of Agriculture
GDP	Gross Domestic Product
ICT	Information and Communication Technology
ICTA	Information and Communication Technology Agency
IDA	International Development Association
Ltd.	Limited
MOA	Ministry of Agriculture
MOF	Ministry of
MOIT	Ministry of International Trade
MONP & EA	Ministry of National Planning and Economic Affairs
PDOA	Provincial Department of Agriculture
PCC	Project Coordinating Committee
PMOA	Provincial Ministry of Agriculture
PMU	Project Monitoring Unit
PPCC	Provincial Project Coordinating Committee
PPMU	Provincial Project Monitoring Unit
Pvt.	Private
R&D	Research and Development
RFP	Request for Proposal
TOR	Terms of Reference
T&V	Training and Visit

II. Executive Summary

The Agriculture Sector Modernization Project (ASMP) funded by the International Development Association (IDA) of the World Bank and executed by the Ministry of Agriculture aims at increasing the agricultural productivity, improving market access and at enhancing the value addition of smallholder farmers and agribusiness in the project area.

Analysis of agricultural policy environment for technology adoption has been considered as one of the key elements that needs 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, MG Consultants (Pvt.) Ltd. was contracted to undertake the assignment. This document is the Final Report for the 'Policy Study on Agricultural Technology Adoption' and responds specifically to the given Terms of Reference (TOR) and Procurement Plan Reference No. LK-MOA-PMU-31831-CS-QCBS.

The objectives of the policy analysis are set out in the Technical Report submitted according to the TOR provided by the PMU of ASMP. The specific objectives set out in the report are, in turn, directed towards on investigation into the constraints of current policy environment, possible policy reforms, and make desired recommendations to support the agriculture modernization process through technology adoption. It detailed out the multiple information collection procedures proposed to gather relevant information from selected key stakeholders, which include desk reviews, key informant consultations, semi-structured interviews, focus group discussions, workshops, field surveys and joint observation visits. The data/information gathered to be 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 value chain (e.g. production, harvesting, storing, processing, and marketing).

The final report would, in turn, identify the impact, relevance, efficiency and effectiveness of agricultural policies on technology adoption towards agriculture modernization; the policy constraints which affect the technology generation and adoption in the smallholder farmers and commercial agriculture sector and make recommendation for reform and new policy initiatives; review the regional policy environment and regulations which supported technology generation and adoption for agriculture modernization and assess the potential for integration into in Sri Lankan setting, and develop a policy framework for creating conducive environment for adoption of technologies and to attract investments and sustainable growth of agriculture sector including smallholder farmers and private sector.

1. Introduction

Domestic demands for food in Sri Lanka are always on the rise mainly due to increasing human population with increase 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 sector and a plantation sector. About 1.65 million smallholder farmers operate, on an average, less than 2 hectares, but contribute 80 percent of the total annual food production. Agriculture policies have encouraged import substitution of basic agriculture commodities in order to make country self-sufficient from those items. Hence, agriculture production structure has remained concentrated in the low value food crops and neglected the domestic fruits and vegetable sectors despite growing domestic demand and potential for export growth.

Despite policy initiatives, investments and technology adoption in the agriculture sector during the last few decades, the performance of agriculture sector appears to be “below the expectation”. It is lagging with low productivity, less investments, low technology adoption, and inadequate penetration into the international markets. Public investments on research and development (R&D) and extension services account for less than three percent of total agriculture expenditure, and in fact, much of this limited budget is spent on rice research. In consequent to this, public sector under investment, generation and dissemination of new technologies that are critical for productivity enhancement, and profitability improvement in whole agricultural value chain have fallen behind. Present research and extension systems is often described as “ineffective” because of their supply-driven nature and insufficient demand orientation. Private sector participation in R&D and extension services remains low, especially in non-plantation crop sector.

However, returns to self-employed farm labour and wages of employed farm workers 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, undertaking agriculture as a business, and joining with the private sector are extremely essential for smallholders to cater to these markets on a competitive manner. In the light of these, adequate adoption of appropriate technologies is of paramount importance for quality agriculture production, agriculture diversification, sector modernisation, value chain development and making reasonable profits by involved stakeholders through productivity enhancements and capacity building.

Through the Agriculture Sector Modernization Project (ASMP), the IDA aims at increasing the agricultural productivity, improving market access and enhancing the value addition of small farmers and agribusiness in the project area. Analysis of Agricultural Policy Environment for Technology Adoption 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, MG consultant (Pvt.) Ltd. was contracted to undertake the assignment. This document is the FINAL REPORT[1] for the policy study on Agricultural Technology Adoption and responds specifically to the given Terms of Reference (TOR) and Procurement Plan Reference No. LK-MOA-PMU-31831-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, consultant deployment and indicative timing for later tasks

[1] *Three Progress Reports were submitted to ASMP Office, including the Inception, 02nd and 03rd Progress Review Reports.*

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 ASMP.

These objectives encapsulate three strands, in particular:

- How relevant are the existing overarching agricultural policies and regulations to enhance adoption of agricultural technologies by farmers and private sector agri-businesses?

- Learning from the regional experiences of countries where modernization of sector has triggered economic growth with equity, and

- What is the policy and regulatory reforms needed for new ways of promoting modern agriculture, in particular, the adoption of agricultural technologies?

2.1 General Objective

To carry out in depth policy research in the area of Technology Adoption, in order to identify knowledge gaps, policy and regulatory inconsistencies in the area of Technology Adoption and to recommend adjustments, reforms or new policies needed for better Institutions to facilitate technology development, innovations and technology transfer, to make agriculture sector more competitive, responsive to the market demand, sustainable and resilient.

2.2 Specific Objectives

This study would deal with 08 specific objectives to find answers to research problems pertaining to technology adoption in very distinct and important areas, including:

1. Review and understand the extent of effectiveness of existing agricultural technology transfer system including procedures involved in private sector participation in agriculture technology development and release.

2. Identify policy revisions required to encourage private investment in new technology development and institutional constraints that inhibit the effectiveness of agricultural extension provision

3. Regional country comparison of technology development and transfer procedures in agriculture sector aiming at improving performance in agriculture sector in Sri Lanka using the best practices and understanding the process adopted elsewhere

4. Identify the policy and regulatory barriers faced by various actors along the value chain with respect to innovations and new technology development, intellectual property rights, technology transfer and technology adoption scale up and propose revisions to

the regulatory framework in Sri Lanka with details of responsible authorities to undertake changes

5. Identify major policy /regulatory changes that affected technology adoption and suggestions/ recommendations for policy /regulatory changes to improve technology adoption with details of the responsible authorities to undertake changes

6. Recommend appropriate policy instrument that the government could be used to implement the proposed policy changes to improve agriculture sector competitiveness and sustainability

7. 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

8. Present the result /progress of the research at policy conference that is to be organized by the ASMP by end of 2019.

3 Tasks of the Assignment

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

1. Identification of the impact, relevance, efficiency and effectiveness of agricultural policies on technology adoption towards agriculture modernization.

2. Policy / regulatory constraints which affect the technology generation and adoption in the agriculture sector and recommendation for reforms and new policy initiatives to influence increase productivity, diversification, and promote agribusinesses.

3. Review of the regional policy environment and regulations which supported technology generation and adoption for agriculture modernization and assess the potential for integration into the Sri Lankan setting.

4. Technology adoption policy framework for creating conducive policy environment for crop diversification and high value crop production, adoption of technologies and attract investments and employment generation in modern agriculture sector.

5. Required policy changes for involving agriculture private sector, public-private partnership for technology development and transfer, communication network, post-harvest operations, value addition and marketing.

6. Identification of relevant Ministries, Departments and authorities responsible to undertake proposed changes.

7. Final report with recommendations and implementation procedures.

This report in particular fulfils the final, i.e. no. 05, of the above.

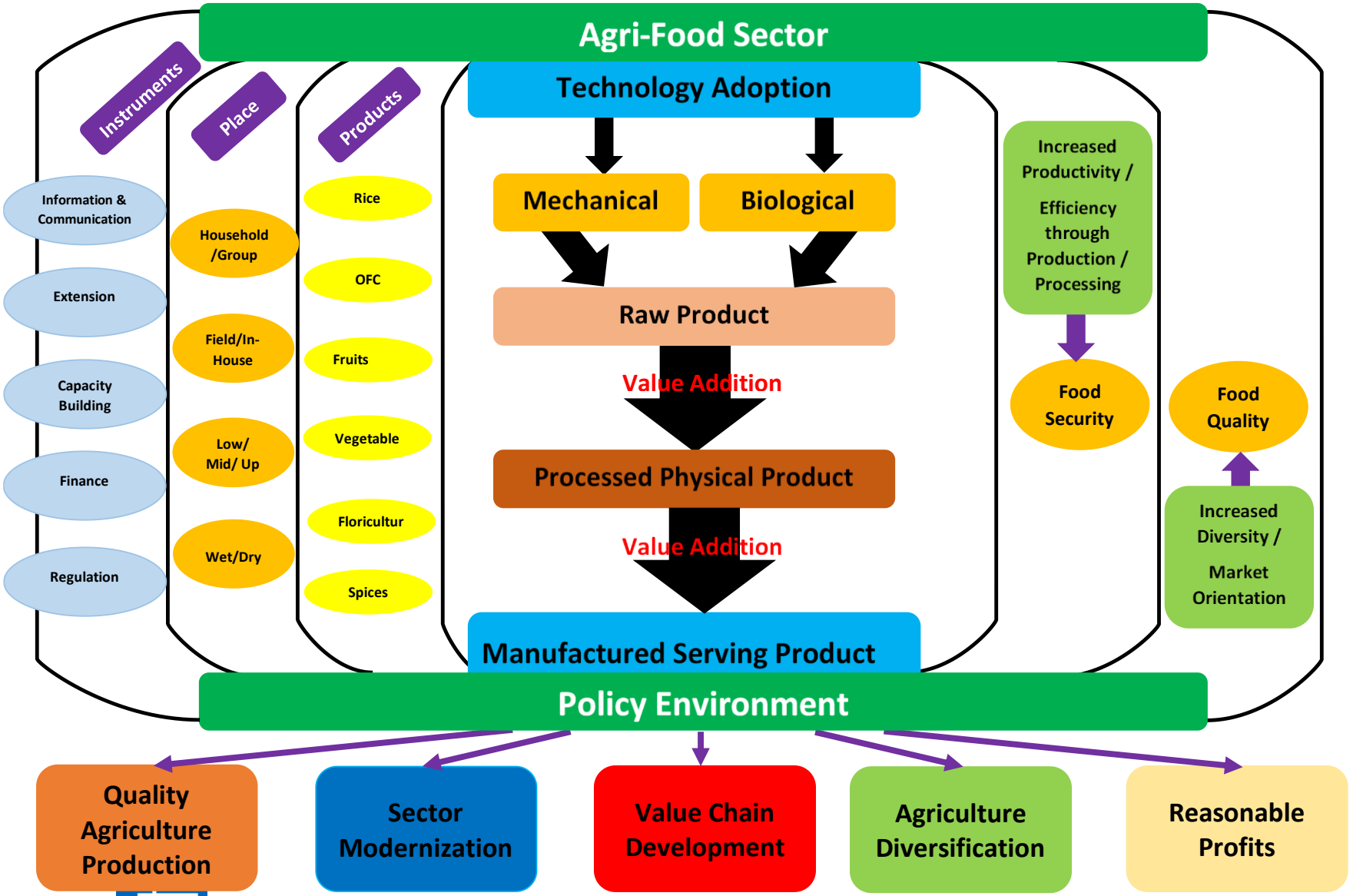
4 Conceptual Framework and Research Methodology

Those agricultural policies adopted from 1970s onwards having direct and indirect influence on technology adoption in rice and Other Field Crops (OFCs); fruits and vegetables (i.e. Horticulture) and floriculture and spice crops was of prime concern in assessing the policy environment affecting their production, processing and trade/marketing.

As can be seen from the figure below, special attention was given to characterize the existing coverage as well as gaps in relation to policy environment triggering the adoption of agricultural technologies characterize by both “mechanical” and “biological” technologies. The policy environment of which the technical and biophysical as well as institutional and market forces are governed to generate and work on appropriate agricultural technologies.

These technologies are technically feasible, environmentally sustainable, economically feasible, socially acceptable and culturally compatible, and gender neutral etc. for the farming community and those agribusinesses were examined. It would basically investigate the means and ways of increasing productivity and efficiency in agricultural production and processing of the physical products aiming ‘Food Security’, from one hand, and product diversification and market orientation to augment ‘Food Quality’ through an improved policy environment for technology adoption, on the other.

The possibility of using several policy instruments starting from “more facilitative” instruments such as provision of information, extension and capacity development through better financing (i.e. credits and subsidies) and moving towards “regulatory” instruments such as mandating the standards and certifications etc. will be focused.


Agri-Food Sector
Instruments
Place
Products
Technology Adoption
Information & Communication
Extension
Capacity Building
Finance
Regulation
Household /Group
Field/In-House
Low/ Mid/ Up
Wet/Dry
Rice
OFC
Fruits
Vegetable
Floricultur
Spices
Mechanical
Biological
Raw Product
Value Addition
Processed Physical Product
Value Addition
Manufactured Serving Product
Increased Productivity / Efficiency through Production / Processing
Food Security
Food Quality
Increased Diversity / Market Orientation
Policy Environment
Quality Agriculture Production
Sector Modernization
Value Chain Development
Agriculture Diversification
Reasonable Profits

The following approaches were used in particular 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 technology generation and adoption failed to achieve the desired goals.
- ✓ Identify the major policy/regulatory changes that affected technology adoption.
- ✓ Review the effectiveness of present agriculture technology transfer system in Sri Lanka.
- ✓ Identify those institutional constraints that inhibit the effectiveness of agricultural extension provision.
- ✓ Undertake a country comparison of technology adoption in the agriculture sector within the scope of South Asia, prominent nations in Asia (e.g. China, Thailand, Vietnam), and in the developed countries such as Australia, Canada, the United States, and those in the European Union.
- ✓ Provide an account of the policy and regulatory barriers faced by various actors along the value chains with special reference to intellectual property rights in research and development, technology transfer, technology adoption, scale-up and spill-ins.
- ✓ Identify procedures available for the private sector to develop and release new agricultural technology, and the revisions required to encourage private investment in new technology development.
- ✓ Propose amendments and/or making suggestions/recommendations for policy/regulatory changes to the regulatory framework in Sri Lanka with the details of responsible authorities to undertake necessary modifications.
- ✓ Recommend appropriate policy instruments that the government could be used to implement the proposed policy changes to improve agriculture sector competitiveness and 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.
- ✓ Present the results / progress of the research at the policy conference that is to be organized by the ASMP.

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, Agriculture Research Institutions, Academic Staff of Faculties of Agriculture, EDB, ICTA, Chamber of Commerce and other relevant national level public sector institutions, PMOAs, PPMUs, PPCCs, PDOAs and regional Chamber of Commerce in relevant Provincial Councils, leading private sector institutions actively involved in agriculture value chain, other stakeholders of the agriculture value chain, including logistics and input suppliers, service providers, exporters, smallholder farmers and their farmer groups and farmer organisations in the project area.

Desk reviews, Key Informant Consultations and semi-structured interviews, Focus Group Discussions (FDGs), 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 technology generation and adoption available in relevant ministries, treasury, research organizations and departments 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 slow growth of the sector.

- Review export data of agricultural products during the last five years and identify the potential for export, commodities and their behavioural trends.

- Meet with modern trade and find the potential for up-market agricultural produce and policy constraints for investments, production and marketing.

- Review the technology development process and available technologies within the agricultural research and development institutes, extension divisions and private sector organizations and the demand for such technologies from the intended target groups for wide scale adoption as such would reveal the knowledge gap existing with both parties, i.e. technology development agencies and end-users, and relevance of technology generation to address the current slow growth of the sector.

- Use secondary data sources, including the reports published and web sites for regional country comparison on technology generation and transfer of technology to end-users and identify the best options that could be applied to Sri Lankan situation.

- Meet with key officials involved in policy formulation and implementation on technology adoption, i.e. Ministry of Agriculture, Department of Agriculture, Department of Export Agriculture, Agricultural Research Institutions, National Universities, Agriculture regulatory institutions (e.g. Quarantine Division, Registrar of Pesticide of the DOA) and other relevant institutions.

4.1 Desk Reviews

A comprehensive desk review program was conducted to study the available policy documents and regulatory measures related with technology 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 (stimulate or constrain) influence private sector technology generation and distribution particularly for commercial agriculture and their intellectual property rights etc. were become the reading materials of this exercise. Supporting information was also be browsed from web site and internet for this endeavour.

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 technology generation and adoption particularly for commercial agriculture.
- Evaluation reports of major agricultural research and extension projects implemented in Sri Lanka, including T & V and Second Agricultural Extension project of the World Bank.
- Evolutionary process of agricultural research and extension system in Sri Lanka changing emphasise from production increase, to productivity enhancement then for mechanization, value addition and market-oriented production systems.
- Available secondary data for regional country comparison for technology generation and transfer of technology to end uses

4.2 Consultations

Specific directions for this policy research have been 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.

4.3 Semi-structured Interviews

Lengthy discussions are of paramount importance to collect adequate information from above indicated public and private sector institutions. Heads of most these institutions are constrained by their heavy work schedules to allocate adequate time for such activity.

However, most of them may participate for a consultation and nominate one or few of his/her key officers to involve with this exercise more deeply. Institution specific semi-structured questionnaires was used to collect information from these officers. Completed questionnaires were used for research and recording purposes.

4.4 Focus Group Discussions

Large number of stakeholders playing different but unique role are actively involved in agriculture value chain in the project area. Selection of group of participants from key value chain points such as production, processing, trading and agricultural marketing, input and logistic supply, service providing etc. using stratified sampling technique can be considered a practical solution 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 by using problem census, problem analysis and problem-solving tools introduced by the World Bank for the Second Agriculture Extension Project in Sri Lanka. Around 25 such discussions allocating five for each province under this research study were planned. Proceedings of these discussions were used for research and recording purposes.

4.5 Workshop

There are many leading private sector institutions actively involved with various points of agriculture value chain from production, processing, marketing, trading, exporting, supply of logistics and inputs and providing services. Some of these institutions are actively involved with technology transfer and development in the agriculture sector while some operate very successful high-tech based contract growing programs with smallholder farmers in companies are also constrained by tight target-oriented work schedules. However, it is possible to get their services thorough well conversed nominees from their organisations for a day program. Private sector is the right choice for changing present ineffective supply driven agricultural extension system in to demand driven sustainable business model creating win-win situations for all parties involve. An interactive workshop was, therefore, organized for leading private sector institutions to make their contributions for this research study. Proceedings of this workshop were used for research and recording purposes.

4.6 Field Survey

Grassroots level researching and field verifications are extremely essential to recommend meaningful policy interventions and regulatory measures for an effective and sustainable R&D and extension programs. Therefore, a smallholder farmer survey was conducted on 600 farms allocating 50 farms for each district in the project area. This survey was conducted by well-trained enumerators using pre-tested, structured questionnaire. Random sampling method was used to select farmers for this survey. Duly completed survey questionnaires was used for research and record keeping purposes.

4.7 Joint Observation Visits

All experts involve with this policy research would make 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 marketing centres such as Colombo Manning Market, Dedicated Economic Centres in Dambulla and Meegoda to meet traders, collectors and transporters of agricultural produce and verify practicality of final recommendations of this study. Two such visits for each district were made by the experts during the period allocated for this assignment. A joint report prepared by participating experts at the end of each such visit for research and recording purposes.

5 Review of Literature

5.1 Analysis of Policy Relevance

A systematic and comprehensive process of review of documents related to the key objectives of this project was carried out. Nearly 200 different documents related to different policy aspects and sceneries such as policy reports published in Sri Lanka by various institutions to cover different sectors of the economy, for example, crop and livestock. In addition to that a large number of hard copies from known parties attached to the state/non-state agencies/institutions, 'web browsing' has been in place overtime to search for related documents.

Those policies published from "Local" (National) and "Regional" (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. Each policy document in hand, which hold a direct link with the agricultural policy environment the current study is focusing on, 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.

As of 31 August 2019, the 'National' lot of policy documents contain 194 articles. These articles were then classified into 17 Categories to reflect different "Policy Themes" *(Titles of the documents are annexed).*

To make a systematic comparison on the level of documentation of "Technology Adoption" in the agricultural policies in other countries, it was decided to gather those documents to represent key 'Policy Themes' (i.e. 10) and limit the analysis to 10 major countries (i.e. International), which play predominant role in agriculture, in general, and involved with adoption of various technologies, i.e. both mechanical and biological, in the fields of agriculture and agribusiness in particular.

The Countries Selected: Australia, Canada, China, France, Germany, India, Japan, Pakistan, United Kingdom, and United States

The Themes of Policies Considered: Biotechnology and Cleaner production, Climate change, Credit, Finance, Food, Land, Marketing, Price, Research & Development Trade.

Having gathered above mentioned documents, which could have a link with policy environment on technology adoption, it was scrutinized all these documents for the presence of keywords of "*Technology*" and "*Adoption*" more specifically. In this way, each and every article from the "Local" (194) and "Regional" (100) were subject to this scutinisation.

This exercise helped the research team to find those articles contain these 2 keywords. In the context of 'National', it was found 44 articles (out of 194 searched for) satisfy this criterion. Moving ahead, we then classified these 44 articles under 12 Themes as shown in Table 1.

Table 1: Classification of Local Agricultural Policies Related to Technology Adoption:

Category	Policy	Pages
1. Land	Combating Land Degradation in Sri Lanka	(p 166)
	SL National Wetland Policy and Strategy	(p 27)
2. Livestock and Fisheries	SL National Livestock Development Policy and Strategies	(P 22)
	SL National Mid Term Policy Framework for Fisheries Sector Development	(p 28)
3. Environment Protection and Sustainable Development	National Environmental	(P 14)
	Climate Change Impacts in Sri Lanka	(p 178)
	SL National Policy for Decent Work	(p 80)
	SL National Policy on Sand as a Resource for the Construction Industry	(p 12)
	SL National forestry Sector Master Plan	(p 29)
	SL Cleaner Production Policy for Agriculture Sector English	(p 8)
	SL Cleaner Production Policy for Agriculture Sector Sinhala	(p 16)
	SL Draft Policy on Consumption Production	(p 22)
	SL Bio Safety Framework	(p 68)
	SL Sustainable Development Goals Indicators	(p 138)
	Strategic Plan for Sustainable Sri Lanka	(p 362)
	SL National Housing Policy 1	(p 52)
	SL National Policy and Strategy on Cleaner Production Fisheries Sector 2008 1	(p 7)
	Sl National Policy and Strategy on Cleaner Production for Agriculture Sector 2012 1	(p 8)
4. Industrial and Enterprise Development	SL National Plantation Industries Policy Framework	(p 70)
	SL Draft National Agricultural Policy	(p 40)
	SL Draft National Transport Policy	(p 37)
	SL National Agricultural Policy	(p 10)
	SL Development of National Policy for Primary Industries	(p 19)
	SL Development Policy for Sugar industry	(p 10)
	SL Northern Province Agric Policy	(p 13)
	SL Northern Province Med Term Sect Plan 2019-21 1	(p 14)
5. Research and Educational	SL National Agricultural Research Policy & Strategy	(p 25)
	SL National Education Policy Proposals	(p 28)
6. Trade, Import and Export	National Export Strategy - Boat Building	(p 67)
	National Export Strategy - Electronic and Electrical Component	(p 53)
	National Export Strategy - Information Technology	(p 57)
	SL National Export Strategy - Spices and concentrates	(P 24)
	SL National Export Strategy - Spices and concentrates	(P 59)
	SL New Trade Policy	(p 29)
	Spices and concentrates strategy FINAL Edited 1	(p 50)

Category	Policy	Pages
7. Investment, Planning and Evaluation	SL National Physical Planning Policy and Plan	(p 104)
	SL National Physical Planning Policy and Plan Sri Lanka 2030 1	(p 104)
8. Energy, Science and Technology	SL National Energy Policy and Strategies of Sri Lanka	(p 13)
	SL National Science and Technology Policy	(p 56)
	SL Policies and Procedures for ICT Usage in Government	(p 35)
9. Disaster Management	SL National Policy on Disaster Management	(p 11)
10. Marketing	SL National Media Policy	(p 5)
11. Health	SL Draft National Policy on Health Information	(p 10)
12. Institutional	SL Draft National Transport Policy	(p 37)

In the context of 'Regional' analysis, similar procedure was followed with the 100 policy documents selected, and at the end of this process, we found 43 documents contains the keywords of both 'Technology' and 'Adoption' (Table 2).

Table 2: Classification of Regional Agricultural Policies Related to Technology Adoption

	Country	Policy	No. of Pages
1	Australia	Biotechnology and Agriculture	(p 13)
2		National Strategy on Climate, Health and Well-being	(p 56)
3		Digital Agriculture Strategy	(p 12)
4		Rural Research and Development Policy	(p 60)
5	Pakistan	Rural Finance policy	(p 58)
6		National Food Security Policy	(p 28)
7		Agricultural Research and Development	(p 64)
8		National Climate Change Policy	(p 47)
9		Environment protection Act	(p 25)
10		Agriculture Trade and Price Policy	(p 42)
11		Agricultural Marketing Infrastructure and Post-Harvest	(p 88)
12	India	National Policy for Farmers	(p 28)
13		Agriculture Export Policy	(p 31)
14		Draft National Land Reforms Policy	(p 36)
15		Agricultural Produce and Livestock Marketing	(p 123)
16		Agricultural Credit for 2020	(p 15)
17		Agricultural Research and Development Policy	(p 174)
18	Japan	Research and Development and Extension Services	(p 31)
19		Japan's Strategy for its Agriculture in the Globalized World	(p 29)
20		Directed Credit Programs for Agriculture and Industry	(p 40)
21		Japan Biotechnology	(p 24)
22	United States	Food Safety Policy and Regulation	(p 56)
23		Agricultural Biotechnology: Background and Recent Issues	(p 25)

	Country	Policy	No. of Pages
24		Agricultural Marketing Act	(p 65)
25		Agricultural Research and Development	(p 8)
26	Canada	Action Plan for Food Security	(p 60)
27		Climate Change Action Plan	(p 86)
28		Biotechnology and Cleaner Production	(p 96)
29	United Kingdom	The Climate Change Act	(p 23)
30		Strategy for Agricultural Technologies	(p 52)
31		Rural Finance	(p 48)
32	China	Food Safety Law	(p 27)
33		Marketing Infrastructure and Agricultural Marketing Reforms	(p 45)
34		Agricultural Biotechnology to 2030	(p 22)
35		Agriculture Law	(p 21)
36	France	Climate Plan	(p 24)
37		Agricultural Specific Trade	(p 63)
38		Agricultural Biotechnology	(p 22)
39		Agricultural Finance	(p 86)
40	Germany	Rural Finance Policy	(p 26)
41		Common Fisheries Policy	(p 24)
42		Policy in Biotechnology	(p 13)
43		German Economic Policy	(p 40)

Once the documents directly related to policy environment on technology adoption were classified, those were further scrutinized to see extent to which they are related / expressing / focus on the 'Keywords' selected through Stakeholder Meeting held at the HARTI. Table 3 below records those keywords selected for analysis:

Table 3: Keywords Used in Policy Relevance 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	
e-commerce	Investment	Protection	

At the end of this exploration for all keywords (k=34) in each document [i.e. n = 44 (National); 43 (Regional), the frequency in which each keyword was included in the document was recorded in a matrix of (k x n).

Table 4 reports the frequency of each key word appeared in National (Sri Lankan) [n=44] and Regional [n=43] policy documents.

Table 4: Frequency of Keywords Appeared in Technology Adoption Related Policy Documents:

Key Words	Sri Lankan Analysis		Regional Analysis	
	Frequency	Rank	Frequency	Rank
Development	2113	**1**	1940	**2**
Production	829	**2**	1557	**3**
Research	652	**3**	2096	**1**
Quality	646	**4**	683	7
Sustain	508	**5**	541	8
Investment	486	6	728	6
Improvement	457	7	261	18
Processing	447	8	451	12
Protection	401	9	363	16
Capacity	395	10	393	15
Conservation	386	11	143	23
Effective	352	12	493	11
Productivity	346	13	310	17
Operation	277	14	428	14
Network	243	15	174	22
Employment	242	16	109	25
Control	230	17	533	9
Innovation	206	18	231	20
Communication	190	19	125	24
Value Chain	182	20	75	27
e-agriculture	179	21	0	34
Efficiency	174	22	230	21
Marketing	166	23	762	5
Partnership	159	24	245	19
Extension	158	25	439	13
Safety	153	26	964	4
Utilization	114	27	102	26
Credit	102	28	500	10
Diversification	93	29	47	30
Value Addition	72	30	49	29
Insurance	55	31	73	28
Modernization	52	32	37	31
e-Commerce	16	33	3	33
Intensification	10	34	25	32

Figure 1 and 2 illustrate, respectively, the frequency of each key word appeared in 'Local' (n=44) and 'Regional' (n=43) policy documents against technology adoption. Figure 3 indicates the keywords ranked according to the frequency to make a comparison between the local and regional policies against technology adoption.

In Figure 1, term 'Development', 'Production' and 'Research' can be accounted as most frequently appeared key terms while term 'development' shows a significantly highest frequency in local policy documents. Term, 'Intensification', 'e-commerce' and 'Modernization' can be identified as least frequently appeared key terms in local policy documents and it is same as in production relations of local policies.

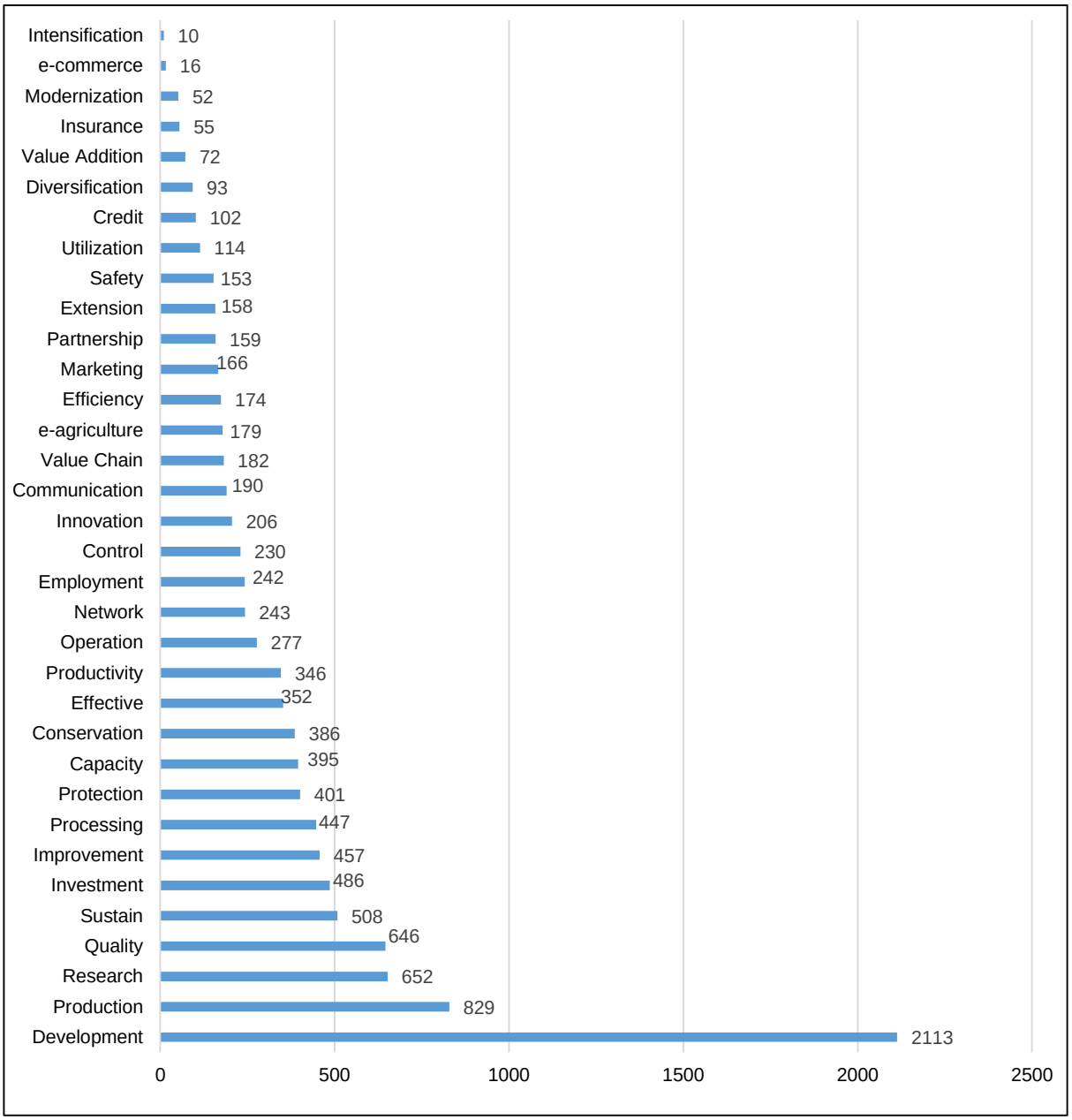


Figure 1: Frequency of Keywords Appeared in Local Policy Documents against Technology Adoption

In figure 2 term, 'Research', 'Development' and 'Production' can be accounted as most frequently appeared key term in regional policy documents. Term, 'e-commerce', 'Intensification' and 'Modernization' can be identified as least frequently appeared key terms in regional policy documents. Surprisingly term 'e agriculture' have been appeared in none of the policy documents referred as in regional policy analysis against production relations. Term 'Improvement' and 'Adoption' has been appeared in same frequencies.

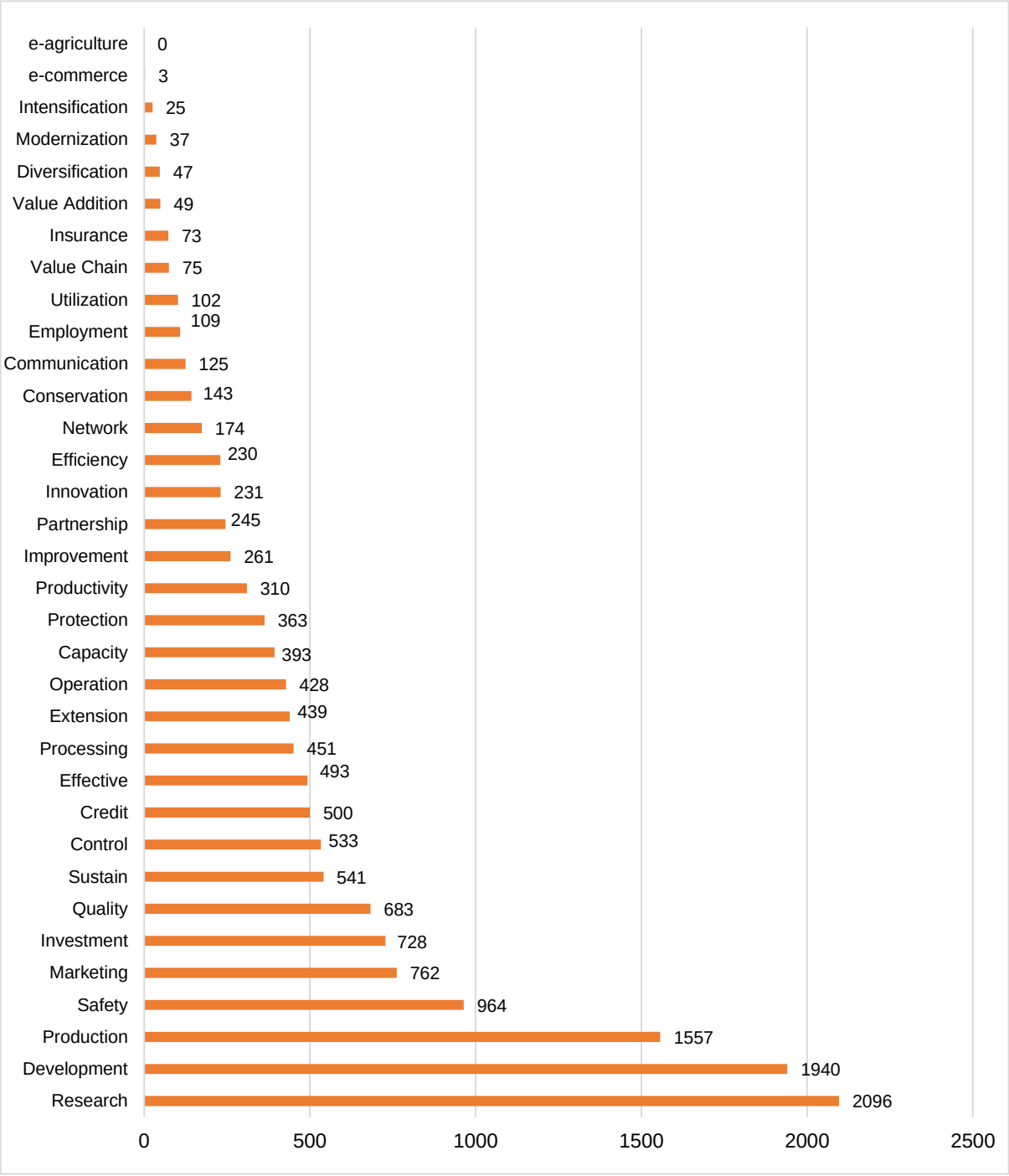


Figure 2: Frequency of Keywords Appeared in Regional Policy Documents against Technology Adoption

The main three keywords selected under each policy category according to the obtained frequencies of local and regional policy documents have been indicated in Table 10. The term 'Development' was the frequently used keyword by seven out of ten policy categories in local policies. 'Research' was the mostly used keyword under Research policy category. 'Sustain' and 'Production' were the mostly used keywords under Environment policy while 'Production' and 'Quality' used under Trade policy. Marketing policy was related with the keywords of 'Communication' and 'Quality'.

In local policy documents relates with technology adoption were not found under the Food and Price policy category.

In regional policy documents, similarly 'Development' was identified as the highly appeared key term in environment, land, livestock and trade policy documents while it was appeared in second highest frequency in institutional, marketing, price and research policies. 'Credit', 'Safety', 'Marketing' and 'production' were identified as the highly appeared terms in credit, food, marketing and price policies respectively while 'Research' was appeared in both institutional and research policies (Table 5).

The keywords were ranked according to the frequency to make a comparison between the local and regional policies in terms technology adoption (Figure 3).

Table 5: Main Three Key Terms of Local and Regional Policies against Technology Adoption:

Policy Type	1st Key Term		2nd Key Term		3rd Key Term	
	Local	Regional	Local	Regional	Local	Regional
Credit	Development	Credit	Network	Investment	Quality	Production
Environment	Development	Development	Sustain	Research	Production	Efficiency
Food	-	Safety	-	Production	-	Development
Institutional	Development	Research	Production	Development	Investment	Production
Land	Development	Development	Conservation	Effective	Research	Protection
Livestock	Development	Development	Production	Production	Improvement	Research
Marketing	Development	Marketing	Communication	Development	Quality	Production
Price	-	Production	-	Development	-	Protection
Research	Research	Research	Development	Development	E Agriculture	Extension
Trade	Development	Development	Production	Quality	Quality	Investment

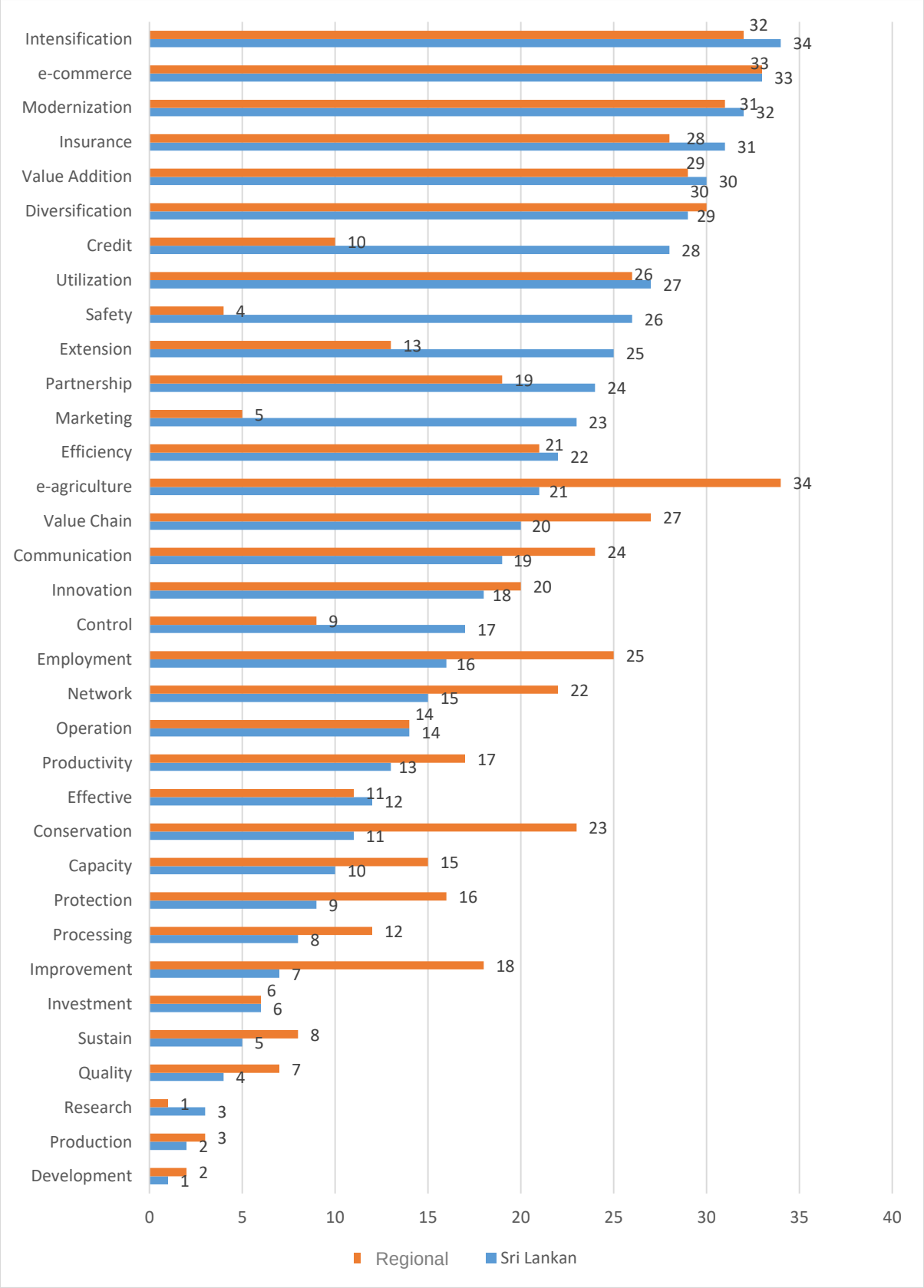


Figure 3: Rank Chart for Sri Lankan and Regional Policies Against Technology Adoption

As results suggested, 'Intensification', 'e commerce' and 'Modernization' showed the lowest frequency among local policy documents while 'Development', 'Production' and 'Research' showed the highest frequency in local policy documents. In regional policy documents, 'Research', 'Development' 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 since it is the fourth highest appeared word in local scenario 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 'Intensification'. Again, it proved that the 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.

There was no difference between ranks of the keywords, 'Investment' and 'Operation' in both local and regional policy documents. The words 'Improvement' and 'Conservation' were used more frequently in local policies than regional and the difference was significantly high. 'Safety', 'Marketing' and 'Credit' were the mostly used keywords in regional policy documents than local policy document and the difference was significantly high.

The least difference was obtained by the words 'Development', 'Production', Innovation', 'Efficiency' and these words were included frequently in local policy documents than international. The words 'Effective', 'Research' were also obtained a less difference and they were included frequently in regional policy documents.

Policy discussions have become increasingly important to address issues related to technology adoption, particularly not only in the agriculture sector, but also in other several dimensions. In environmental policies, specific criteria as; development, sustainability, production efficiency and research etc. have been highly focused. Many environmental problems and policy responses are evaluated over long time horizons, since the cumulative impact of adverse technological changes and adoption on the severity of environmental problems is likely to be large. Policy interventions themselves create solutions for those constraints and incentives that influence the favourable technological changes. These induced effects of environmental policy on technology may have forced on better policy decisions.

As results suggested, none of the food and price policy documents focused on technology adoption or in other words none of the food policy or price policy have been executed on technology adoption in national level. However, there are several food and price policies which have addressed the technology adoption in regional level.

Implementation of the food safety policy play a vital role in ensuring that meets globally accepted food safety standards, guidelines and signals to improve the quality and safety of the food supply systems in regional level. The Policy provides the foundation for a comprehensive and integrated approach to food safety and food security programmes that would result in the protection of the health. Therefore it is high time to focus on the execution of food policies on technology adoption too.

This report highlights the role of policy forming bodies and respective organizational processes on technology adoption in smallholder livestock production systems. Innovative systems have been used in both local and regional scenarios, and above key term occurrences were examined to assess the dynamic aspects of livestock innovation systems. The results showed that different policies have been evolved on development of the livestock sector and increase its production in both local and regional level. Though research policies on livestock sector have been executed specially in regional level, policies on the improvement of livestock production have been emerged in national level due to the problems of feeding, breeding and animal healthcare at the production level.

Further, according to the results, the word 'Development' was obtained as the keyword which has the highest frequency among the seven out of ten selected policy themes. The word 'Research' was obtained under the Research and Educational policy category.

The words which were obtained highest frequency under policy categories are more relevance with their focus 'Policy Themes'. 'Quality' and 'Production' are the other keywords appeared more frequently in all Sri Lankan policy documents.

When comparing the keywords with the developed and developing countries, policy documents in Sri Lanka were obtained similarities. Hence, the policy environment in Sri Lanka is relevance with their focus areas and there are better policy initiatives to develop the technology adoption. The problem should be with the implementation of these policies. So the necessary steps should be taken to implement these existing policies to improve the productivity of Sri Lankan agriculture sector by adopting appropriate technologies through the government and other relevant parties.

5.2 Content Analysis of Technology Adoption Policy Documents

Making agricultural policies related to technology transfer has been largely influenced by numerous government organizations and institutes with an interest in the outcome. It is therefore important to analyse agricultural policies related to technology adoption 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 summarising effects both positive and negative and limitations of the pollicises at achieving its objectives.

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 technology adoption. Initially, two broad dimensions are considered: Thematic Analysis and Content Analysis.

National Agricultural Policy Related Documents identified under thematic analysis were used for content analysis exercise. All 44 articles identified under thematic analysis as appropriate national documents for technology adoption were further scrutinized based on the relevance of contents of those documents with agricultural technology adoption. As a result, Agriculture policy related documents shown in Table 6 were finally selected for detailed content analysis.

Table 6: Policy Related Documents - Technology Adoption:

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
Livestock	6	National Livestock Development Policy & Strategies	2996
	7	Livestock Master Plan 2011 - 2016	2010
	8	National Livestock Breeding Policy	2010
Spices	9	National export strategy of Sri Lanka 2018-2022 spices and concentrates strategy - Ministry of Development Strategies and International Trade	2017
Sugar Industry	10	Sri Lanka development policy for Sugar Industry	Not Given
Cross Cutting	11	Sri Lanka E-agriculture Strategy	2016
	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

Electronic version of all documents in Table 6 are attached as Annex i to xvi. Brief notes were prepared for each document separately (Electronic versions of Annex xvii to xxxii). A Summary of Content Analysis of Agricultural Policy and Technology Adoption Related Documents was prepared based on findings included in Annexes xvii to xxxii (Electronic version of Annexe xxxiii). Two Excel master sheets were compiled for data analysis purpose using data available in the Summary of Content Analysis (Electronic versions xxxiv & xxxv). Further data analysis was done using these Excel master sheets and findings were included in this document. All the above policy related documents were examined in key perspectives to find out the relationship among three perspectives which collectively influence the implementation of policies and ability to produce intended outcomes.

Those three (03) perspectives given below were considered for analytical purpose:

(1). Policy Perspective
(2). Technology Adoption Perspective
(3). Agriculture Sector Modernisation Project (ASMP) Perspective

6 Policy Perspective

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

(1) Policy and policy objectives
(2) Policy Instrument/s
(3) Policy Implementation
(4) Monitoring and Evaluation

Although it is desirable to have 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. The aim is to find the gaps in policies where possible and suggest improvement. Sector wise findings of this analysis is shown in Table 7.

Table 7: Sector wise Availability of Policy Related Arrangements:

Sector	P/S No	Policy and Policy Objectives	Policy Instrument/s	Policy Implementation Plan	Monitoring & Evaluation System
Agriculture					
	1	Sri Lanka National Agricultural Policy – Ministry of Agriculture and Agrarian Services – 2007	A	NA	NA
	2	Ministry of Agriculture - Cooperate Plan 2011-2015	A	A	A
	3	Development of a National Agricultural Policy for Sri Lanka - 2018 (Draft)	A	A	A
	4	National Agricultural Research policy and Strategy (SLCARP) 2018 – 2027	A	NA	NA
	5	Overarching agricultural policy (Draft)	A	A	A

Livestock					
	6	National Livestock Development Policy & Strategies	A	A	A
	7	Livestock Master Plan 2011 - 2016	A	A	A
	8	National Livestock Breeding Policy	A	NA	NA
Spices					
	9	National export strategy of Sri Lanka 2018-2022 spices and concentrates strategy - Ministry of Development Strategies and International Trade	A	A	A
Sugar Industry					
	10	Sri Lanka development policy for Sugar Industry	A	NA	NA
Cross Cutting					
	11	Sri Lanka E-agriculture Strategy	A	A	A
	12	National Biotechnology and Policy – National Science Foundation	A	NA	NA
	13	National Policy for Primary Industries of Sri Lanka	A	NA	A
	14	National Science & Technology Policy – National Science and Technology Commission (NASTEC)	A	A	NA
	15	The National Climate Change Policy of Sri Lanka	A	NA	NA
	16	National Policy and Strategy on Cleaner Production for Agriculture Sector	A	A	A

P/S NO - Policy / Strategy No A - Available NA - Not Available

7 Technology Adoption Perspective

A three-step-process of technology awareness, try out, and adoption is evident in technology adoption at smallholder farmer level in many situations. Therefore, examining of how technology generate, innovate, transfer and finally adopt by smallholder farmers and rural agribusiness in the project area on long term basis is extremely useful for strengthening technology adoption.

Hence, successful adoption of technology, it is crucial to complete the following steps in its adoption process:

(1) Technology Development/Innovation
(2) Transfer of Technology
(3) Adoption

Sector-wise policy related documents were analysed under above three steps and findings are given under section below Table 8 and 9. Details are given in Annexes xvii to xxxv.

Table 8: Overall Policy Comparison - TA Perspective:

Sector	Policy / Strategy No	Technology Adoption			
		T-Generation	T-Transfer	T-Adoption	
Agriculture	1	5	10	8	23
	2	2	2	7	11
	3	4	7	4	15
	4	11	15	17	43
	5	2	3	11	16
Livestock	6	5	4	8	17
	7		3	5	11
	8	7			7
Spices	9	2	4	5	11
Sugar	10		2	5	7
Cross Cutting	11	3	9	1	13
	12		4	2	6
	13		2	4	6
	14	2	4	2	8
	15		12	8	20
	16	1	5	8	14
Total Response		**43**	**86**	**95**	**214**
% Response		**20.1**	**40.2**	**44.4**	

Table 9: Sector Comparison - TA Perspective:

Sector	Policy / Strategy No	Technology Adoption			
		T-Generation	T-Transfer	T-Adoption	
Agriculture	1	5	10	8	23
	2	2	2	7	11
	3	4	7	4	15
	4	11	15	17	43
	5	2	3	11	16
Total Response		**24**	**37**	**47**	**108**
% Response		**22.2**	**34.259**	**44**	
Livestock	6	5	4	8	17
	7	3	3	5	11
	8	7			7
Total Response		**15**	**7**	**13**	**35**
% Response		**42.9**	**20.0**	**37.1**	
Spices	9				
Total Response		**2**	**4**	**5**	**11**
% Response		**18.2**	**36.4**	**45.5**	
Sugar	10				
Total Response			**2**	**5**	**7**
% Response			**28.6**	**71.4**	
Agriculture	11				
Total Response		**3**	**9**	**1**	**13**
% Response		**23.1**	**69.2**	**7.7**	
Cross Cutting	12		4	2	6
	13		2	4	6
	14	2	4	2	8
	15		12	8	20
	16	1	5	8	14
Total Response		**3**	**27**	**24**	**54**
% Response		**5.6**	**50.0**	**44.4**	

8 ASMP Perspective

Thirteen (13) key elements were identified under ASMP as important attributes which would facilitate accomplishment of project objectives. The purpose of this analysis is to ascertain whether these policies are in line with these thirteen (13) ASMP attributes. The findings are summarized in Table 11 and 12 below and under different sectors. Details are given in Annexes xvii to xxxv.

Sector Wise Policy Comparison

For this comparison, sixteen agriculture technology adoption related policies within five sectors are analysed. The technology adoption elements indicated in the policies was analysed in terms of Technology generation led by research and development, Technology transfer provision through agriculture extension and technology adoption by end users. As shown in Table 8 and 9 and the annexes XXXIII and xxxiv, there are significant differences in priorities provided for three areas in each policy within the sector.

Agriculture Sector

Five major policies were analysed for this sector. It appears that none of these policies have specific technology adoption processes that complement and reinforce each other which link to a unified national agricultural extension system, but different Ministries, departments and agencies adopted their own outreach programs for extension. The Table 3 and 4 shows the variability of major policy trust areas of five National Agriculture Development Policies formulated and implemented under the Ministry of Agriculture Development.

The Sri Lanka National Agricultural Policy of MOA and Agrarian Services (2007), more than 43% devoted to technology transfer while only 18 % provided for the same aspect through MOA Cooperate Plan (2011-2015). The draft Overarching Agricultural Policy (2019) provides more than 68% for technology adoption aspect and 18% for technology transfer.

Sri Lanka National Agricultural Research Policy & Strategy (2018-2027) by SLCARP provided highest priority of 25.6 % for technology generation while Overarching Agricultural Policy given only 12.5% for this aspect.

The overall sector wise comparison of agriculture Policies, as shown in Table 8, technology adoption aspect received highest priority (44.4 %) followed by technology transfer (40.2%). The priority given for technology generation aspect 20.1%.

Salient features of Policies in the Agriculture are summarized in Table.10 below:

Table 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 (2006)	• 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

Agriculture Sector Policy	Major Goals and Policy Thrusts	Implementing Ministry
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. Sri Lanka National Agricultural Research Policy & Strategy (2018-2027) by CARP	Sugar • Develop and introduce crop improvement, • Promote value addition and sugarcane industry by-products and marketing, • Strengthen R D and technology transfer through public private partnerships Export Agricultural Crops • crop improvement, mechanization and value addition for global competitiveness OFC • productivity improvement, input efficiency, • enhance land and water efficiency • Vegetable sector • crop improvement, value addition and increase consumption of vegetables Fruit crops • increase availability of fruits • value chain development Livestock and poultry • increase production General • plant genetic resource conservation regulating international planting material movement and assuring quality seed and planting material • promotion of organic farming, farm mechanization and • public and private partnership for R&D	Ministry of Agriculture / CARP
5. 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

Livestock Sector

Three major policies related to livestock sector were analysed. The National Livestock Development Policy & Strategies developed in 2006 maintained a balance of priorities for the three aspect of technology adoption. As shown in the table, the priority given for technology adoption was relatively higher than the other aspects (47.1%).

Similar trend was observed in the Livestock Master Plan (2011) but, priority given for technology generations seems to be lacking. The National Livestock Breeding Policy has concentrated in the technology generation aspect only.

The overall sector wise comparison of livestock policies shows the priority given for technology generation aspects was relatively higher than the agriculture sector policies (42.9%).

Spice Sector

There was only one policy document available for analysis in the spice sector - National Export Strategy of Sri Lanka 2018- 2022 which was developed by the Export Development Board (EDB). Much of the priority provided for technology adoption (45.5%) while only 18.2% given for Technology generation.

Sugar Sector

The Sri Lanka Development Policy for Sugar Industry 2016 was used for analysis. The priority given for sugar Industry for technology adoption (71.4%) is relatively higher than the technology transfer (28.5%). This indicates that the focus given for sugar industry is for expansion of extent rather than productivity improvement through intensification. There were no evident strategies for technology generation aspect in this policy.

Cross Cutting Policies

There are several cross-cutting policies that influence the technology adoption areas. Although these policies related not only for agriculture sector technology adoption areas, but also covers wider aspects of many sectors. For the analysis purpose, policies which are directly influence the agriculture technology adoption were taken into consideration.

E-Agriculture

Among the cross-cutting policies, E-Agriculture Policy elaborated wider space of technology transfer aspects through strategic communication and information systems involving different media channels and target groups. Since this is an emerging development area, for application in agriculture modernization in the region, the opportunities and potential for agriculture development appears to be substantial. The priority given for technology Transfer aspects is more than 69% as expected. However, there is only 7.7% priority for monitoring technology adoption aspect. The details of the policy instruments are given in the annexure xxvii. The nine policy instruments were elaborated in the policy.

Policy on Bio-Technology

Role and application of bio- technology in agriculture modernization process has widely recognised worldwide. Moreover, genetic engineering, mainly in crop and livestock sector, is the area in which biotechnology is most directly affecting agriculture in developing countries and in which the most vital public concerns and policy issues have arisen. Agriculture biotechnology applications are helpful in productivity improvement and sustained food production.

National Biotechnology Policy (2009) document reviewed for analysis stressed that biotechnology applications are complementary not an alternative for many areas of conventional agricultural research. As shown in the annex xxxiv, 2/3 rd of focus was on technology transfer and the balance 1/3rd is on technology adoption leaving the technology generation aspect at a very low profile.

National Policy on Primary Industries

Analysis of The National Policy on Primary Industries (2018) revealed that 66.7% priority was given to technology adoption aspect which benefits end users. The policy also emphasised on productivity improvement, adopting Good Agricultural Practices (GAP) and establishes linkages with agriculture producers and processors in the private sector. These strategies cement the coordination with agricultural produces and entrepreneurs. It appears there was no significant facilitation for technology generation in this policy pertaining to agriculture technology adoption.

National Science and Technology Commission

This policy focused on promotion of science and technology among industries including agriculture. The role of improving resource base and build capacities of scientists to respond to development needs of the country. The policy instruments much geared for technology transfer emphasis (50%) while maintaining a balance between technology generation and technology adoption.

National Climatic Change Policy

Review of National Climate Change Policy revealed with 13 technology adoption related policy instruments that nearly 60% of the policy strategies included priority for technology transfer aspects while less emphasis on technology generation. The strategic approach for climate change policy formulated with vulnerability assessment, followed by adoptions, mitigation, sustainability and co-ordination, knowledge transfer and institutional arrangements. However, these elements interact with each other and warrant involvements at different levels in terms of technology generation, transfer and adoption.

National Policy and Strategy on Cleaner Production for Agriculture Sector

National policy and strategy on cleaner production for agriculture sector (NPSCPA) has been formulated with an objective of achieving sustainable agriculture for national prosperity ensuring food security of the nation through ecologically sound, economically viable and socially acceptable agricultural systems.

This policy supports the environment and natural resource management in a sustainable manner. Therefore, the emphasis has been on technology adoption aspect. The priority given for these areas is more than 57%. However, the priority for technology generation is 7.1%.

9 Overall Policy Comparison - General View

As shown in Table 11 and 12 below, sixteen (16) policy and policy related documents reviewed on technology adoption are generally in line with national agriculture development goals of productivity improvement, food security, high farm income, input efficiency, sustainable resource utilization, technology transfer and research and development. However, policies revived are far from adequacy in addressing the current scenario of development in the agriculture modernization process, hence, the review implies the need for alternative policy strategies.

Some of them include: facilitation of robust research and development emphasis for innovative technology adoption, private sector involvement for R&D, preparing farmers for competitive high value market chain in the changing global agriculture scenario, better coordination among government agencies for evidence –based policy formulation, and inadequate implementation strategies and monitoring. It is also observed that one of the key problems associated with agricultural policy formulation, is because of different Ministries, government institutions and cooperation related agriculture, have different mandates that are not clearly defined or demarcated therefore, often, overlapping policy objectives.

Table 11: Overall Policy Comparison - ASMP Perspectives:

Sector	Policy / Strategy No		ASMP													
			Productivity Improvement	Diversification	Modernization	Post-Harvest Operation, Value Addition and Value Chain Debt.	Employment Generation in	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	
			1	2	3	4	5	6	7	8	9	10	11	12	13	
Agriculture	1	23	10	4	4	2	4	1	6	13	4	4	2	3	3	60
	2	11	3	1	1	2		2	1	1	1					13
	3	15				0	1	3					3	2	2	29
	4	43	10	6	14	7		5	12	9	3		2	6	4	78
	5	16	2	1	5	3	2	2	2	4	2	2	3	2	1	31
Livestock	6	17	4		1	1	1	1	3	3	1		3	3		21
	7	11	3		1	1	2	3		1	3		2	1		22
	8	7							7							7
Spices	9	11	2	2		3		1	1	1	1	3	3			17
Sugar	10	7	3	2			1	1		2	2		2			13
Cross Cutting	11	13			1	1		1	2	7	1	8		1	2	24
	12	6		1		1			2	3	1			2		10
	13	6	1			3				2	1		1	1		9
	14	8			1				4	3			1	1	1	11
	15	20	3	2	1	1			3	10	2	5		1	3	31
	16	14	3	1	2	2		4	1	5		2		7	6	33
Total		**214**	**44**	**20**	**31**	**27**	**11**	**24**	**44**	**64**	**22**	**24**	**22**	**30**	**22**	**409**
%			**10.8**	**4.9**	**7.6**	**6.6**	**2.7**	**5.9**	**10.8**	**15.6**	**5.4**	**5.9**	**5.4**	**7.3**	**5.4**	

Table 12: Sector Policy Comparison - ASMP Perspective:

Sector	Policy / Strategy No	ASMP													
		Productivity Improvement	Diversification	Modernization	Post-Harvest Operation, Value Addition and Value	Employment Generation in Modern Agriculture	Market Orientation including Exports	Research and Development	Education and Transfer of Technology	Private & Public Sector partnerships/Investments for	Use of ICT in Agric. Modernisation	Competitiveness	Sustainability	Resiliency & NRM	
Agriculture	1	10	4	4	2	4	1	6	13	4	4	2	3	3	60
	2	3	1	1	2	0	2	1	1	1	0	0	1	0	13
	3	2	3	3	0	1	3	1	5	2	2	3	2	2	29
	4	10	6	14	7	0	5	12	9	3	0	2	6	4	78
	5	2	1	5	3	2	2	2	4	2	2	3	2	1	31
Total Response		**27**	**15**	**27**	**14**	**7**	**13**	**22**	**32**	**12**	**8**	**10**	**14**	**10**	**211**
% Response		**13**	**7.1**	**12.8**	**6.6**	**3.3**	**6.2**	**10.4**	**15.2**	**5.7**	**3.8**	**4.7**	**6.6**	**4.7**	
Livestock	6	4		1	1	1	1	3	3	1		3	3		21
	7	3		1	1	2	3		1	3		2	1		22
	8							7							7
Total Response		**7**		**2**	**2**	**3**	**4**	**10**	**4**	**4**		**5**	**4**		**50**
% Response		**14.0**		**4.0**	**4.0**	**6.0**	**8.0**	**20.0**	**8.0**	**8.0**		**10.0**	**8.0**		
Spices	9														
Total Response		**2**	**2**		**3**		**1**	**1**	**1**	**1**	**3**	**3**			**17**
% Response		**12**	**12**		**17.6**		**5.9**	**5.9**	**5.9**	**5.9**	**17.6**	**17.6**			

Sector	Policy / Strategy No	ASMP													
		Productivity Improvement	Diversification	Modernization	Post-Harvest Operation, Value Addition and Value	Employment Generation in Modern Agriculture	Market Orientation including Exports	Research and Development	Education and Transfer of Technology	Private & Public Sector partnerships/Investments for	Use of ICT in Agric. Modernisation	Competitiveness	Sustainability	Resiliency & NRM	
Sugar	10														
Total Response		**3**	**2**			**1**	**1**		**2**	**2**		**2**			**13**
% Response		**23**	**15**			**7.7**	**7.7**		**15.4**	**15.4**		**15.4**			
Agriculture	11														
Total Response				**1**	**1**		**1**	**2**	**7**	**1**	**8**		**1**	**2**	**24**
% Response				**4.2**	**4.2**		**4.2**	**8.3**	**29.2**	**4.2**	**33.3**		**4.2**	**8.3**	
Cross Cutting	12		1		1			2	3	1			2		10
	13	1			3				2	1		1	1		9
	14			1				4	3			1	1	1	11
	15	3	2	1	1			3	10	2	5		1	3	31
	16	3	1	2	2	0	4	1	5	0	2	0	7	6	33
Total Response		**7**	**4**	**4**	**7**	**0**	**4**	**10**	**23**	**4**	**7**	**2**	**12**	**10**	**94**
% Response		**7.4**	**4.3**	**4.3**	**7.4**			**10.6**	**24.5**	**4.3**	**7.4**	**2.1**	**12.8**	**10.6**	

10 Global Agriculture Policy Review

The global agricultural policy review is an important part of the policy analysis by collecting, organizing and synthesising available information to assess and have a clear understanding of the regional agricultural policy context that helps to identify gaps, good practices and lessons learned and integration into the Sri Lankan context in respect of technology adoption.

Asian region countries namely: Philippines, Myanmar, Indonesia, Bangladesh, India, Thailand are selected for this exercise because of their relevance and applicability to Sri Lankan context. Since there are large numbers of policies available for agriculture sector, a few selected policies are taken into consideration, particularly related to technology adoption.

10.1 Philippines

In view of making efforts to modernize and strengthen its agriculture sector, with both the state and private companies promoting the adoption of advanced technology and smart farming methods to increase harvests and minimize losses considering the inevitable climate change challenge facing the county. The two main aspects of agricultural policy focus are: Production relation policies and the technology adoption policies.

Technology Transfer Policies

Technology adoption policy strategies are translated policy instruments formulation in different programs implemented by different agencies. These strategies were in cooperated in different programs and under different funding arrangements which includes public sector, UN agencies, international collaborations and private sector.

This is a unique policy arrangement involving various stakeholders under different funding sources which enhance integrated, systems-based approaches, strategies and institutional arrangements that span across different sectors, ministries, private sector and intergovernmental organizations.

Apart from these, the partnership collaborations initiated enhance knowledge sharing between stakeholders, including scientists, farmers, private sector, civil society and governments. With initiatives such as participatory research and development agendas, building capacity for innovations and more efficient technological transfer systems have created an enabling environment for achieving the policy objectives.

The Philippines has recognized that science, technology and innovation are essential for national development and progress. Accordingly, agriculture technology transfer Policy of the county emphasis on:

1) Give priority to research and development, invention, innovation, and their utilization; and to science and technology education, training and services (Sec 10);

2) Support indigenous, appropriate and self-reliant scientific and technological capabilities and their application to the country's productive systems and national life (Sec. 10);

3) Regulate the transfer and promote the adaptation of technology from all sources for the national benefit (Sec. 12);

4) Encourage the widest participation of private groups, local governments, and community-based organizations in the generation and utilization of science and technology (Sec. 12.); and

5) Protect and secure the exclusive rights of scientists, inventors, artists and other gifted citizens to their intellectual property and creations, particularly when beneficial to the people, for such period as may be provided by law. (Sec. 13).

Good Practices and Lessons

Often a large number of agricultural technologies are developed in many sectors but sharing existing technologies off the shelf and into the hands of farmers, commercial entrepreneurs and private sector is greatly inadequate. Therefore, establishment of a Technology Information Access Facility, Technology Licensing Offices (TLOs) and/or Technology Business Development Offices.

Facilitate policy environment to encourage public and private sector collaborations, CBOs, Small Farmers and commercial farmers in technology generation, innovations and technology transfer.

Creating platforms/learning hubs and bringing together farmer groups/associations at the grassroots level to facilitate dialogue and knowledge sharing perhaps through ICT, and to building capacity of research institutions and extension divisions to innovate and adopt good practices.

There is no formal provision of formal financial reward environment for researchers/R&D institutions and extension officers when commercialization of technology. These incentives may enhance the research and extension output considerably.

These s good practice need to be included in the Sri Lanka policy environment where, often, single line Ministry/ Agency is responsible for implementation of policies perhaps beyond their capacity and mandate.

10.2 Myanmar

It was recognised that Agricultural research, extension and education system play vital roles in the agricultural sector development and on the way forward to intensive diversification from production to consumption of agricultural commodities.

Aligned with country's agricultural policy, research programs of Department of Agriculture Research and Extension has been giving attention on increasing crop production through improved seeds, and a few programs on crop management, crop protection techniques, and cropping systems tailored to suit the country's various agro- ecological zones.

Current extension approaches that are practiced in the whole country are to establish integrated high technology demonstration villages by practicing Good Agricultural Practices (GAP).

Although Department of Agriculture Research (DAR) and Department of Agriculture (extension arm) (DOA) are the main actors for research and extension respectively, collaboration among them is still insufficient.

Under these programs crop demonstrations for GAP/SRI organising seed growers' associations and co-operatives and crop diversification for various crops are included.
In addition, extension service includes dissemination of information about rules, laws and regulation and updated technology through Social and Mass Media such as DOA homepage and Facebook, Radio, TV channel (Farmer Channel), newspaper, posters, pamphlets, bulletins, agricultural shows.

Besides central or regional governments, extension services can be run by NGOs, by cooperatives, by universities or research institutes and by the commercial sector.

Livestock sector is operated by the Department of Livestock with research and extension divisions.

It is stated that there is no linkage among crops sector and livestock sector in extension and research services.

Good Practices and Lessons

As a policy, establishment of integrated high technology demonstration villages by practicing Good Agricultural Practices (GAP) is encouraged with the intension of increase production and crop diversification for better income.

Apart from the general agriculture extension, dissemination of information about rules, laws and regulation related to agriculture environment would be useful as problem related to agriculture environment pollution, natural resource conservation and climate change effects are emerging in an alarming way.

Having a policy instrument for extension services through NGOs, cooperatives, universities or research institutes and commercial sector would be useful under present weak extension system in Sri Lanka. However, the capacities and competencies of these institutions have to be evaluated.

10.3 Indonesia

In general, government research institutions in Indonesia implement technology transfer of research results through two channels, namely the public domain and commercialization pathways.

Public domain - the technology transfer is conducted in stages, from research institutions to government agencies that are in charge to disseminate the technology and then to the end users.

Commercialization models - developed in the government research institutions through the development of technology incubators, which opens business opportunities for small, micro and medium enterprises in distributing technology to the users. The second approach is to work directly with the private sector such as research collaborations, where the final results of the study developed jointly, and intellectual property rights belong to those who contribute the most in funding, or governed by a separate agreement.

Good Practices and Lessons

Research collaboration of government with private sector often did not produce the desired output. Therefore, the research result may not use and resources may go waste. It is therefore, suggested to joint investment for research and development effort to avoid such undesirable outcomes and ensure commercialization of technology.

10.4 India

Agricultural policy of India is generally designed by the Government to raise agricultural production and productivity and also to upgrade the level of income and standard of living of farmers in view of these, six agricultural development policies objectives are articulated.

1) Raising the productivity of inputs–optimizing efficiency of input for productivity improvement.
2) Protecting the interest of underprivileged agriculturalists through land reforms and credit support for poor.
3) Modernizing agricultural Sector- Introducing of modern technology in agricultural operation and application in order to improve the agricultural input products.
4) Enhancing crop yield of major commodities.
5) Checking environmental degradation- natural base of Indian agriculture.
6) Agricultural research and training- strengthening g agricultural Research and extension facilities and research and farmer linkages.

The major strategies and the government initiatives in agricultural development

1) Increase Sugar production for export.
2) Establishment of MEGA Parks for developing agro-processing clusters.
3) The Government of India Agricultural Export Policy geared to increase the India's agricultural export to US$ 60 billion by 2022.

4) Adopt the compensation scheme and partner with different organizations and agencies to ensure fair prices of farmer's market in the country.
5) The Government of India also provided funds for computerization to ensure benefits through digital technology.
6) A new AGRI-UDAAN programme was introduced to enable the start-ups to connect with potential investors from different countries.
7) The Government of India also launched another scheme aimed at the development of irrigation sources (India Brand Equity Foundation, 2019).
8) The Government of India allotted US$ 936.38 billion investments for mega food parks in the country for Agro-Marine Processing and Development of Agro-Processing Clusters (India Brand Equity Foundation, 2019).

Good Practices and Lessons

After the green revolution of India with an objective of food security for all, agricultural policies shifted to focus on modernization of agriculture sector by application of modern technological innovations. It is also emphasised the need for strengthening agriculture research, training and farmer research linkages.

Other salient feature of the Indian agriculture policies is moving to application of digital technologies enable to efficient information exchange among agriculture producers and trade.

These policy initiatives are vital in the moving agriculture for modernization process under Sri Lankan context.

10.5 Vietnam

Policies on Promoting Good Agricultural Practices (GAP) in order to Increase Quality and Food Safety in Vietnam were introduced to promote quality product for a competitive export market. In order to meet the above requirements and in accordance with the development trend, Ministry of Agriculture Research and Development (MARD) has issued the Vietnamese Good Agricultural Practices (Viet GAP) for safe fresh fruits and vegetables, safe fresh tea and safe pig raising, safe poultry, safe bees, safe dairy cows in Vietnam in 2008. The policy aims to create favourable conditions for Vietnamese fresh vegetables and fruits to participate in the Southeast Asian market and the world, towards a sustainable agriculture.

To support the application of Good Agricultural Practices (GAP) in agriculture, forestry and fisheries, in Vietnam, the key areas supported by the government policies are:

1) Identifying concentrated production areas that are eligible for food safety
2) Building and renovating infrastructure of concentrated production areas
3) Training
4) Partly supporting the certification cost

Good Practices and Lessons

Vietnam has adopted a policy for quality improvement of agricultural produce through GAP to be a strong market leader and be competitive in the global market. Identification of specific

concentrated areas for different crops and livestock with associated funding and infrastructure development created a desirable environment for production of quality agricultural produce.

After more than 10 years of implementation, Viet GAP has shown that this is the right direction for sustainable agricultural production, beneficial to society and producers, for export processing enterprises and ultimately the most important is being beneficial to consumers which are in line with expectations of agriculture modernization project in Sri Lanka.

This strategy could be adopted under Sri Lankan context to develop regional production areas with a potential for competitive market entry.

10.6 Thailand

Thailand Agricultural Policies and Development Strategies- The 20 – year agricultural development plan (2017-2036)

The specific goals are as follows:

1) Farmers specialize in their professions, so-called “Smart Farmer;”
2) Farmer institutions have efficiency in management, so-called “Smart Agricultural Group;”
3) Quality of agricultural products meet the customers need, in other words, being “Smart Agricultural Products;”
4) Agricultural area and sector have potential, known as “Smart Area / Agriculture.”

This long-term plan flags out strategies in five aspects with number of guidelines which can be highlighted as follows:

1) Strategy 1: Strengthening the Farmers and Farmer Institutions
2) Strategy 2: Increasing the Productivity and Quality Standards of Agricultural Commodities Enhancing the Management Efficiency of Agricultural Commodities along their Supply Chains
3) Strategy 3: Increasing Competitiveness in the Agricultural Sector through Technology and Innovations
4) Strategy 4: Balanced and Sustainable Management of Agricultural Resources and the Environment
5) Strategy 5: Development of Public Administration System

Apart from Smart agriculture initiative, Thailand has adopted a unique feature in policy development to address issue-based problems

(1). National Organics Agriculture Development Plan (2017-2021)

This development plan envisions Thailand to be the leader in the region in terms of production, consumption, trade and services in organic agriculture at the international level.

(2). MOAC’s Digital Agriculture Strategy (2017-2021)

This strategic plan comprises of three missions, which are to develop agricultural information system for proactive management, to apply appropriate digital technology with context to agriculture sector, and to support sustainable agriculture.

(3). MOAC Food Security Strategy Framework (2017-2021)

(4). Climate Change in Agriculture Strategy (2017-2021)

This 5-year plan comprises of four missions who are to build awareness and disseminate data, information, and knowledge to stakeholders at all levels, to develop database, knowhow, and technology to support adaptation capacity to climate change, to participate into GHG mitigation regarding the conformity of agriculture sector, and to encourage integration of adaptation measures.

(1). Mega farming policy – consolidated lad utilization policy to maximise production units.

The fields of each small farmer in the neighbourhood are consolidated to make a large farm (mega-farm) under the supervision of a (large) farm manager while the ownership of land remains unchanged.

(2). Zoning by AGRI-pap policy

The agricultural land areas in the country are delineated on the map into four categories namely: highly suitable, moderately suitable, least suitable and unsuitable for each major crop and is called AGRI-Map.

(3). Agriculture Learning Canters (ALCs) policy

For each commodity, the best practice farm in each district was selected as a learning canter for the farmers in the area considering digital literacy is not equal among farmers

Good Practices and Lessons

Thailand agricultural policies have changed considerably over the time to address the current need of the sector. The two policies promoting Smart Agriculture and the issue –based policies are greatly shape the agricultural sector in Thailand. These strategies cover wide range of issues related to agriculture some of the policies suggested in the policy documents are relevant to Sri Lankan context.

10.7 Bangladesh

There is a plethora of policy/ strategy documents relevant to broad agriculture and rural development in Bangladesh. These can be classified in three sub-categories- crops, non-crops and cross cutting policies (Table 8).

Table 13: Matrix on Agriculture Sector Related Policies:

Sub-Sector Policies	Major Goals and Policy Thrusts	Implementing Ministry
Crop sub-sector		
1. National Agriculture Policy (NAP), 1999	• Food security, profitable and sustainable production, land productivity and income gains, IPM, smooth input supplies, fair output prices, improving credit, marketing and agro-based industries, protecting small farmers interest	Ministry of Agriculture
2. New Agricultural Extension Policy (NAEP), 1996	• Provision of efficient decentralized & demand led extension services to all types of farmers, training extension workers, strengthening research-extension linkage, and helping environmental protection	Ministry of Agriculture
3. DAE-Strategic Plan, 1999-2002	• Adoption of Revised Extension Approach, assessment of farmers' information needs, supervision, use of low or no cost extension methods, promotion of food and non-food crops, and mainstream gender and social development issues into extension service delivery.	Ministry of Agriculture
4. Seed policy, 1993	• Breeding of crop varieties suitable for high-input and high output agriculture, multiplication of quality seeds, balanced development of public and private sector seed enterprises, simplification of seed important for research & commercial purposes, provision of training and technical supports in seed production, processing & storage monitor, control and regulate quality and quantity of seeds.	Ministry of Agriculture

Sub-Sector Policies	Major Goals and Policy Thrusts	Implementing Ministry
B. Non-crop sub-sector		
5. Livestock Policy and Action Plan, 2005	• Improvement of small-scale poultry and dairy farming replicating CLDDP, reform of DLS, enforcement of low and regulations towards animal feeds, vaccines and privatization of veterinary services adoption of breeding policy, and establishment of livestock insurance development fund and livestock credit Food.	Ministry of Fisheries and Livestock
C. Cross-Cutting Policies		
6. National Land use policy	• Minimizing loss of cropland, stopping indiscriminate use of land, preparing guidelines for land use for different regions, rationalizing land acquisition, and synchronization of land use with natural Environment.	Ministry of Land
7. Environment Policy 1992 and Implementation Program	• Protection of environment, identification and control of pollution, sustainable use of natural resources and participation in all international initiatives to protect environment	Ministry of Forests and Environment
8. National Food Policy, 2004	• Ensuring dependable food security system, adequate and stable supply of safe and nutritious food at affordable prices, increasing access and food purchasing power of people	Ministry of Food

Good Practices and Lessons

Agricultural policies are geared toward food security, improved land productivity and income gain for small farmers. The policy support provided for livestock and diversification of crops also helped them to gain more income for farmers on a regular basis.

The three main policy documents are:

1) Agricultural Production Policy
2) Agricultural Extension Policy
3) Agriculture Research Policy

These policies need a coordination mechanism for achieving desired outputs

The strong land utilization policy which set out the guideline for land use is very much relevant to Sri Lankan context.

One of the policy implications for implementation is role of Ministries are much more than their capacities and mandates which need to be avoided.

11 Research Methods and Design

11.1 Sources of Primary 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 14 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.

11.2 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 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%

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 concepts of technology adoption.

12 Results and Major Findings

12.1 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 demonstrate the accurate picture of the sample picked to pursue the project.

Table 14: 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
Monaragala	40	-
Kegalle	7	3
Total	**456**	**194**

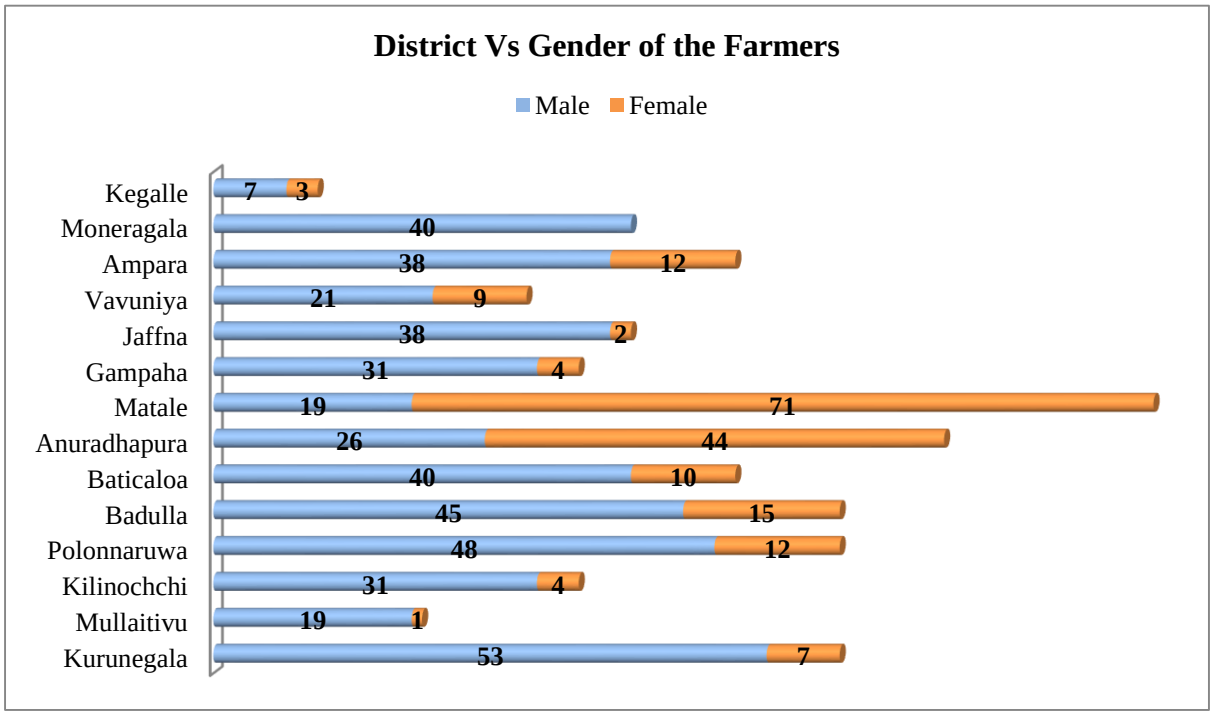


Figure 4: Gender of the Farmers in Each District

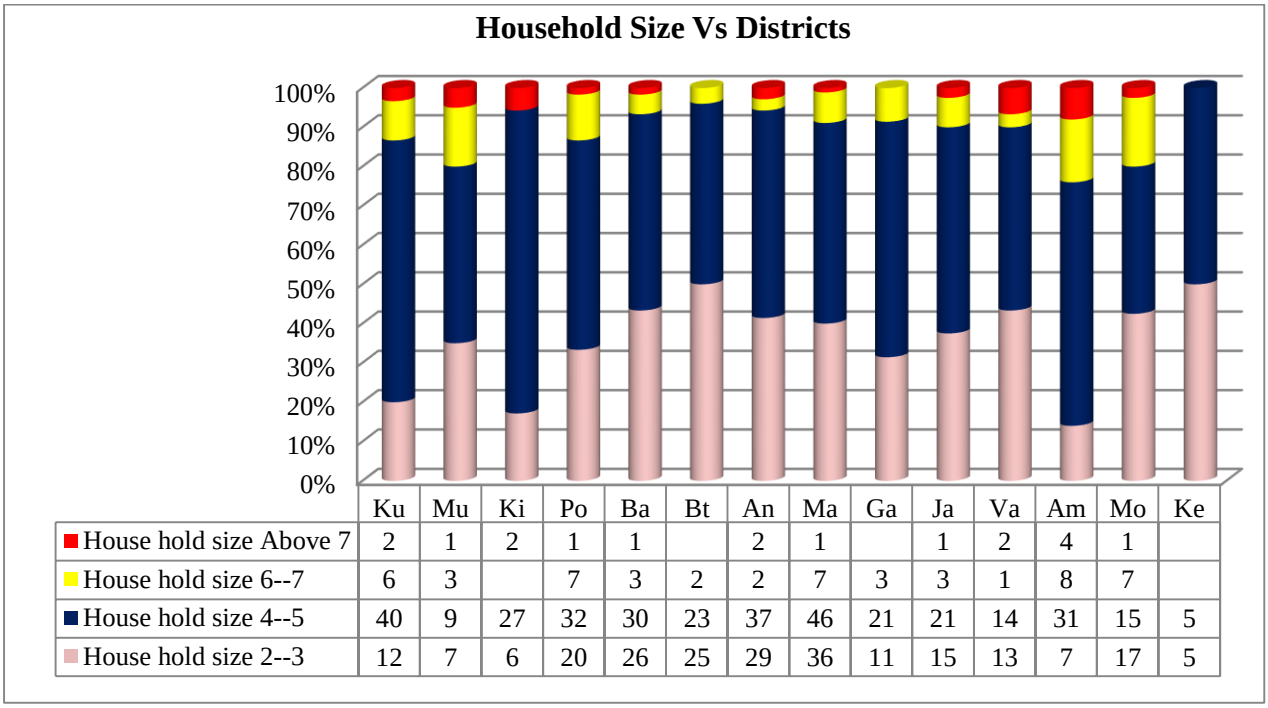
As indicated in Table 14 and Figure 4, the total sample consists of 650 farmers in which the larger portion is males whereas in some specific areas such as Monaragala, Jaffna, and Mullaitivu the number of females involved in farming is either negligible or zero. However highest number of farmers come 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 makes 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 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 15: Household Size

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
Monaragala (Mo)	17	15	7	1
Kegalle (Ke)	5	5	-	-



	Ku	Mu	Ki	Po	Ba	Bt	An	Ma	Ga	Ja	Va	Am	Mo	Ke
House hold size Above 7	2	1	2	1	1		2	1		1	2	4	1	
House hold size 6--7	6	3		7	3	2	2	7	3	3	1	8	7	
House hold size 4--5	40	9	27	32	30	23	37	46	21	21	14	31	15	5
House hold size 2--3	12	7	6	20	26	25	29	36	11	15	13	7	17	5

Figure 5: Household Size

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 4 to 5 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.

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 16: 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**

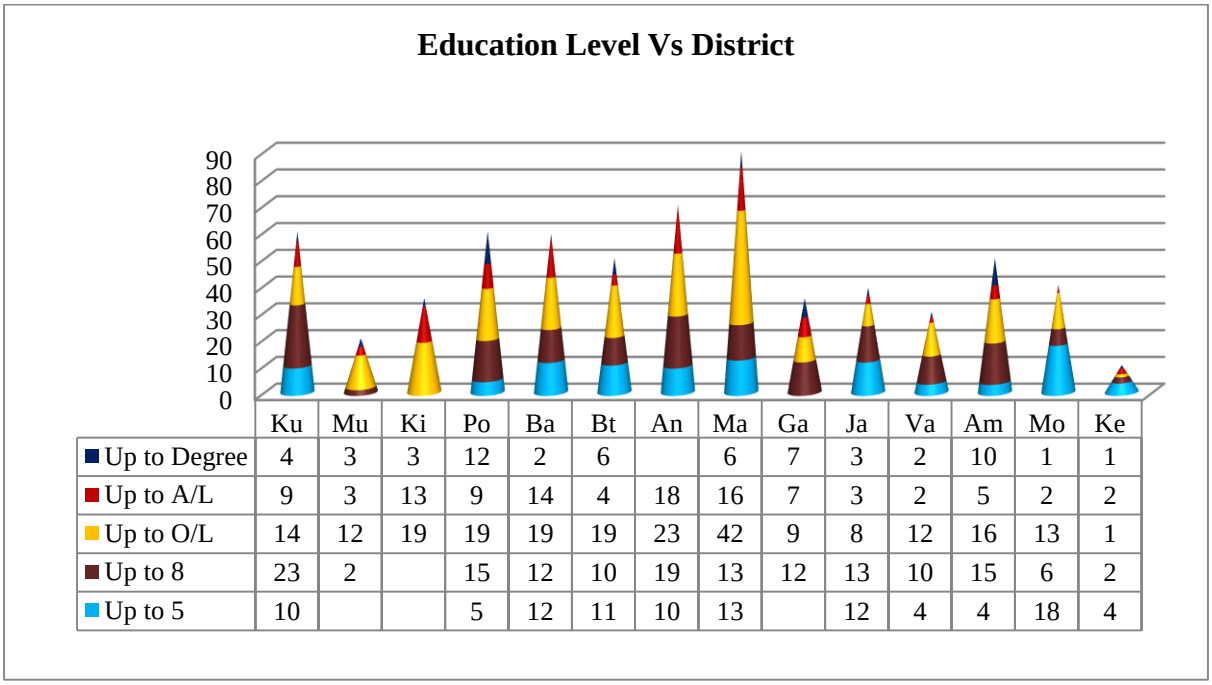


Figure 6: Education Level of Farmers

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 17 indicates the number of farmers in each district and their years of experience in the field of agriculture.

Table 17: 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
Moneragala	-	2	2	6	30
Kegalle	4	2	1	2	1
Total	**41**	**88**	**62**	**107**	**353**

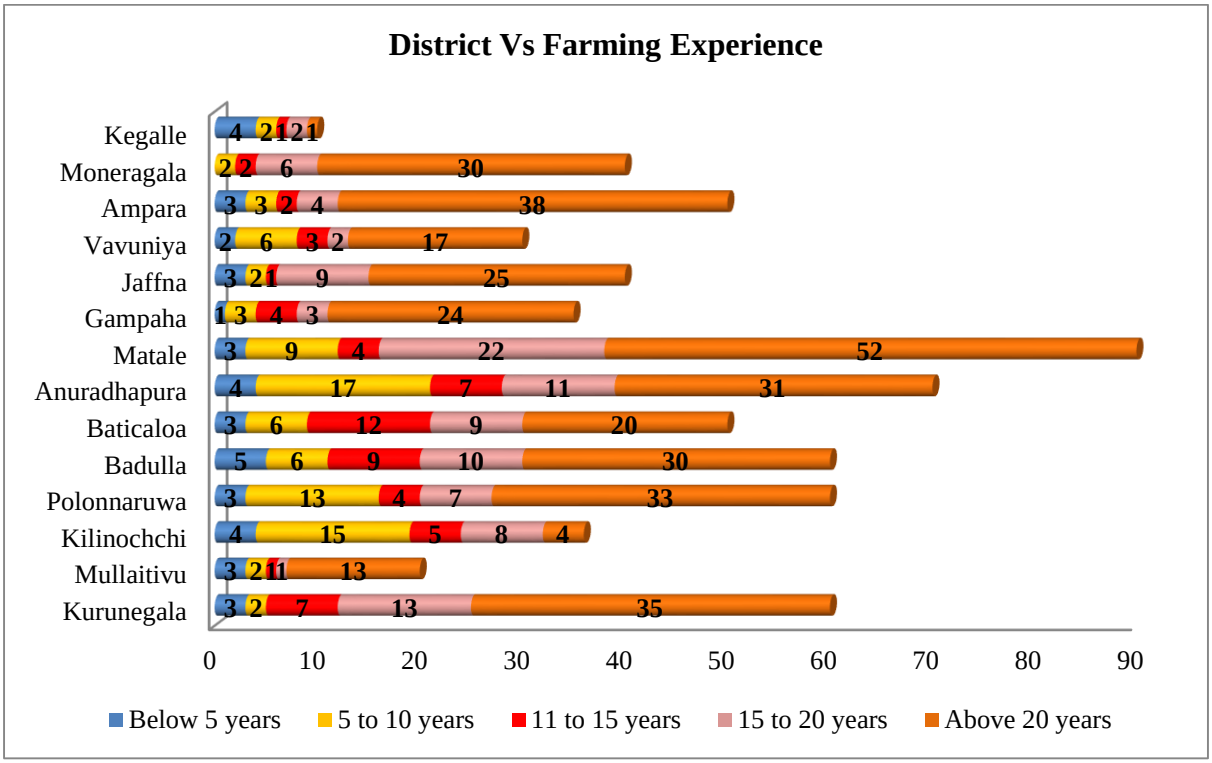


Figure 7: Farming Experience

As shown in Figure 7, 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, which is a supposed to be helpful in analyzing the farmer perception on technology adoption for the improvement of the efficiency and enhancing the production.

Not only the farming experience but also 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 following table, the ownership of farms differs from farmer to farmer as well as from district to district.

Table 18: 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

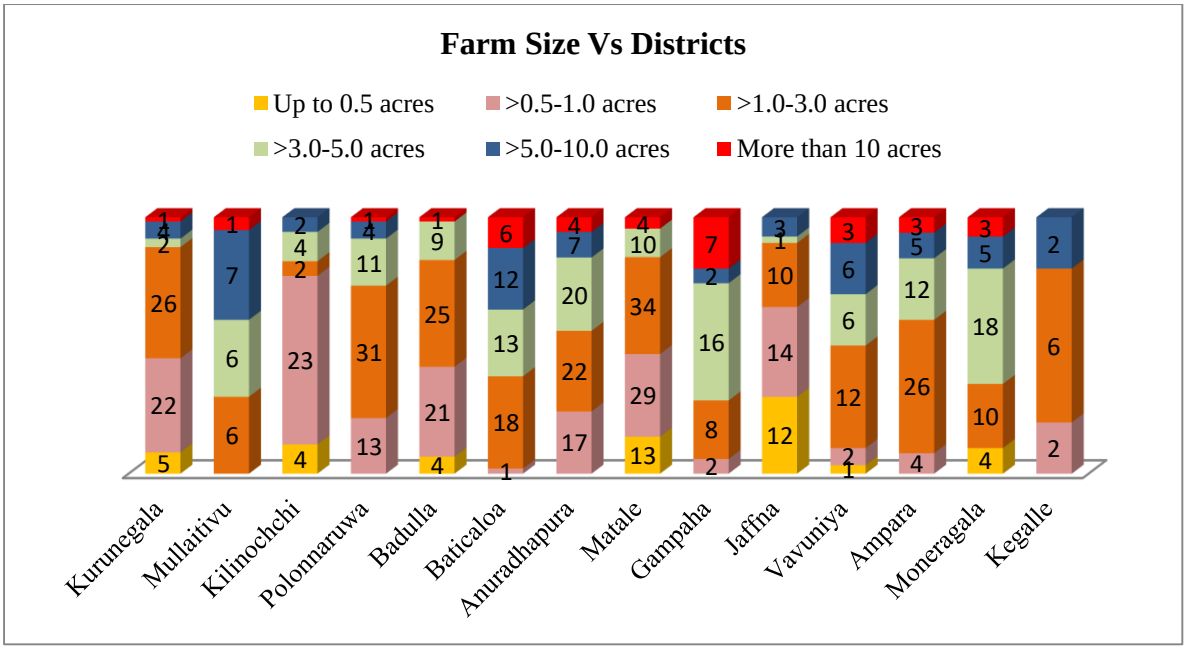


Figure 8: Farm Ownership

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 is given describing the number of farmers and how they are involved in farming.

Table 19: Types of Products

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

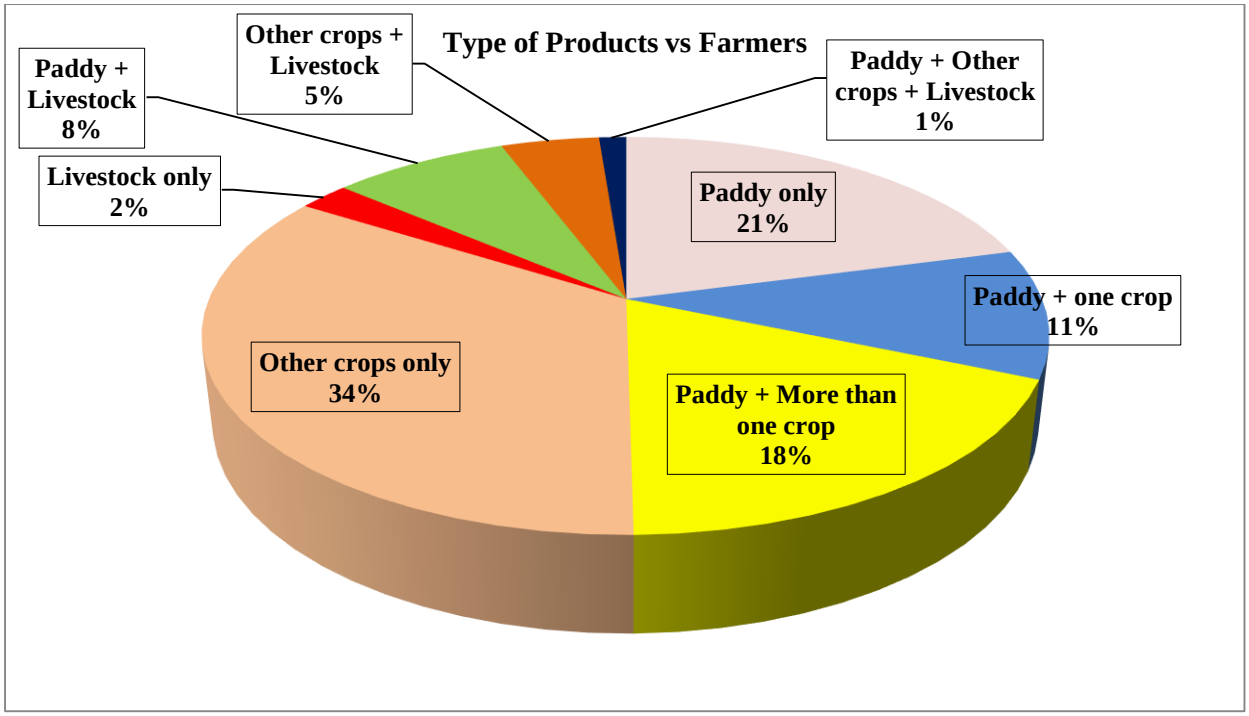


Figure 9: Types of Products

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.

So, 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.

12.2 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 technology adoption in order to increase productivity. Given below are the 14 statements regarding the "Crop Produce Quality Attributes" and the mean values of the points each statement has obtained from 650 farmers. The table demonstrates the numerical values that 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 20: 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	

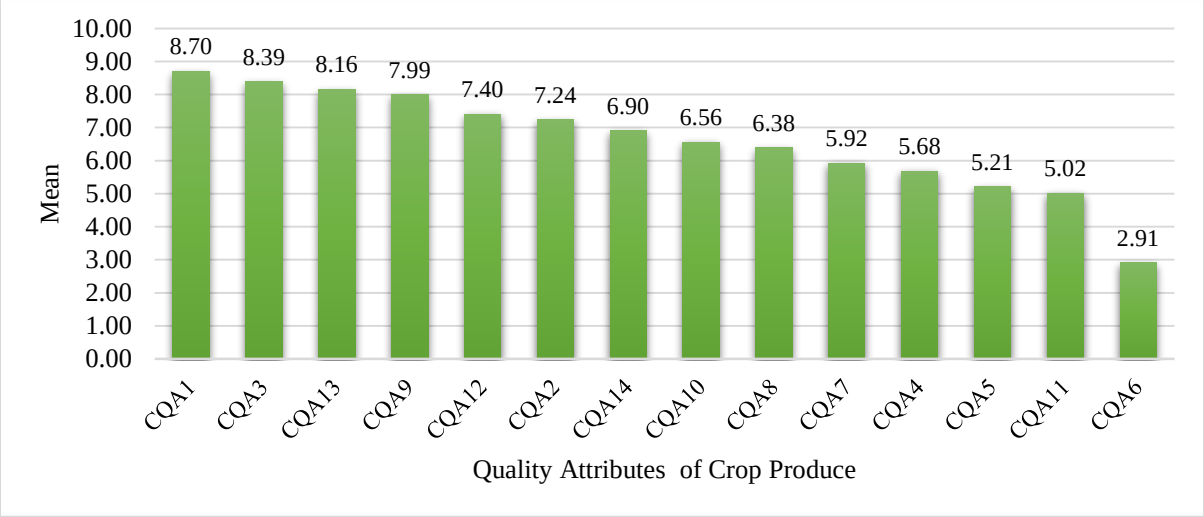


Figure 10: Quality Attributes of Crop Produce vs. Mean Score

As per the analysed 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" (Figure 3.3).

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 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 21: 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 Color	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	

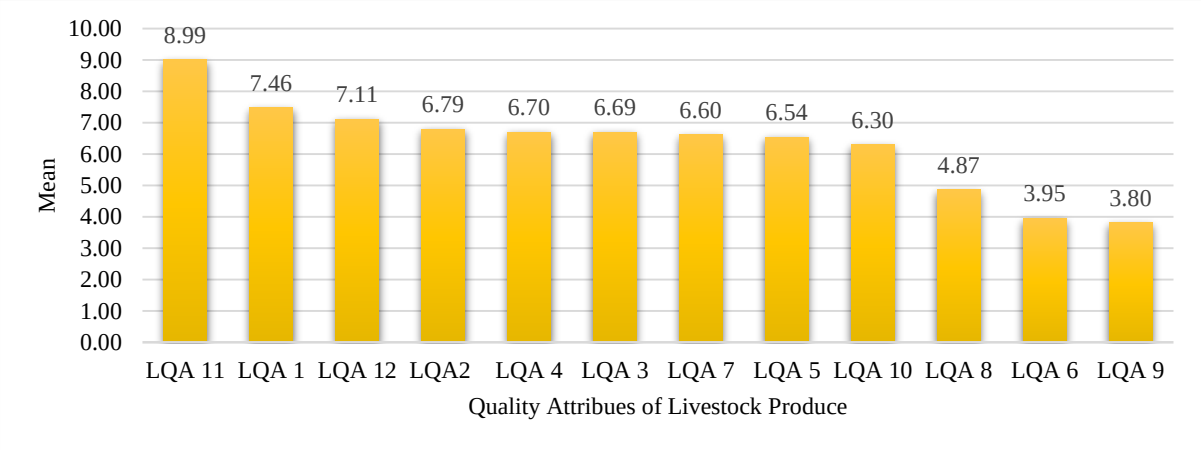


Figure 11: Quality Attributes of Livestock Produce vs. Mean Score

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.

12.3 Barriers / Constraints / Problems on Production & Quality Management

When introducing new technologies to the framers who have been practicing the traditional methods for years it is inevitable encountering constraints and problems regarding many facts including the production and the quality management processes.

Table 22: 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 neighborhood	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

	Category	Statements	Notation
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
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 22).

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.

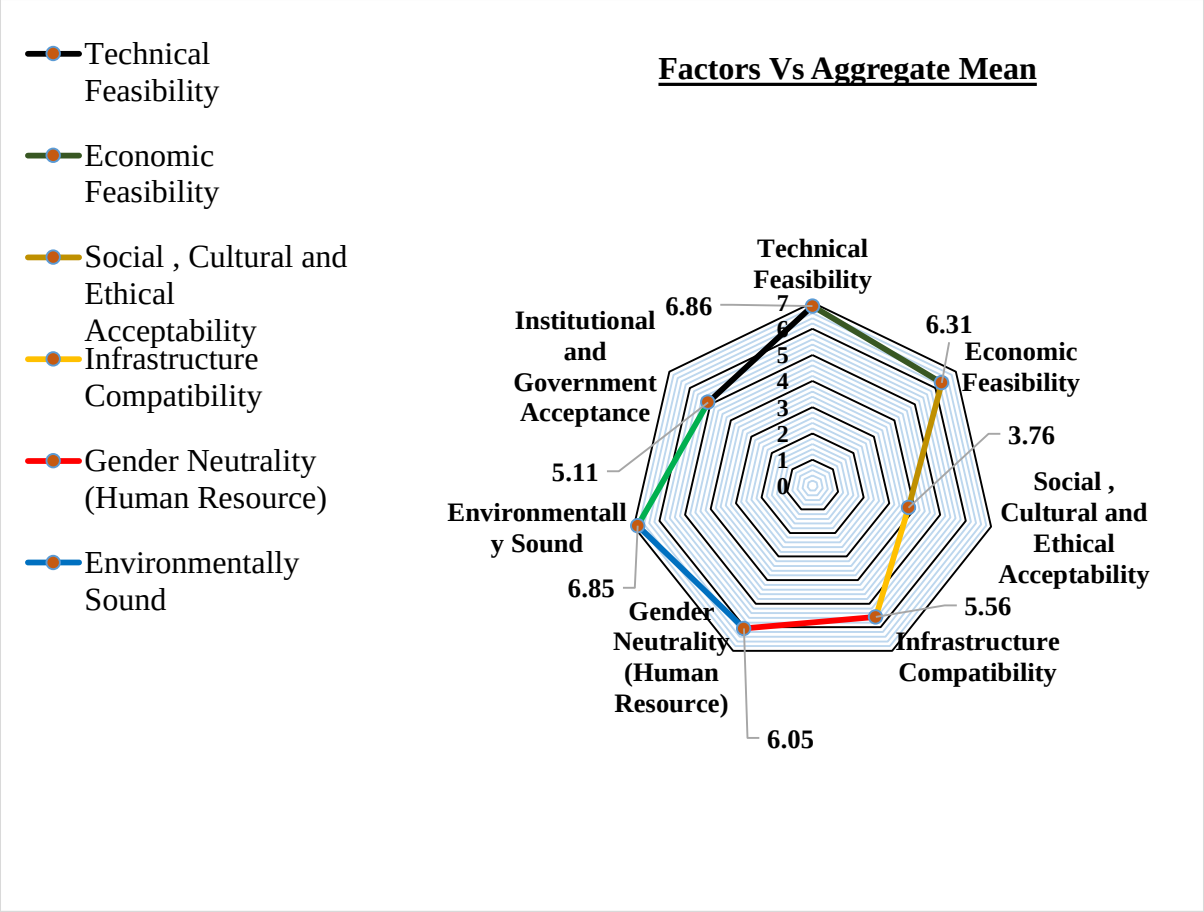
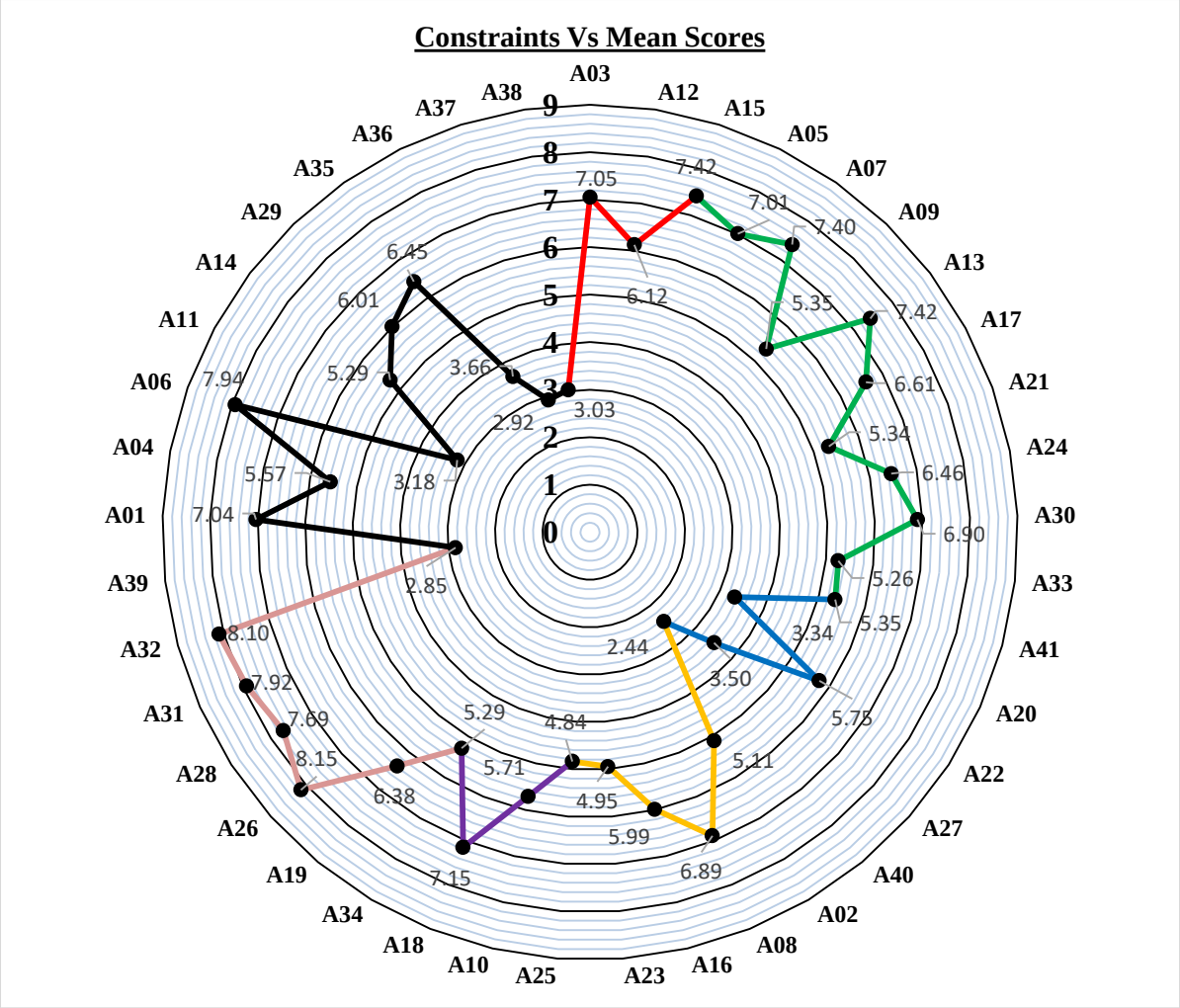


Figure 12: Aggregated Mean Scores of Barriers/Constraints/Problems on Production and Quality Management



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

Figure 13: 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 novel technologies to be launched.

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".

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

12.4 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 adopting novel technologies in the crop produce or livestock produce.

Table 23: 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

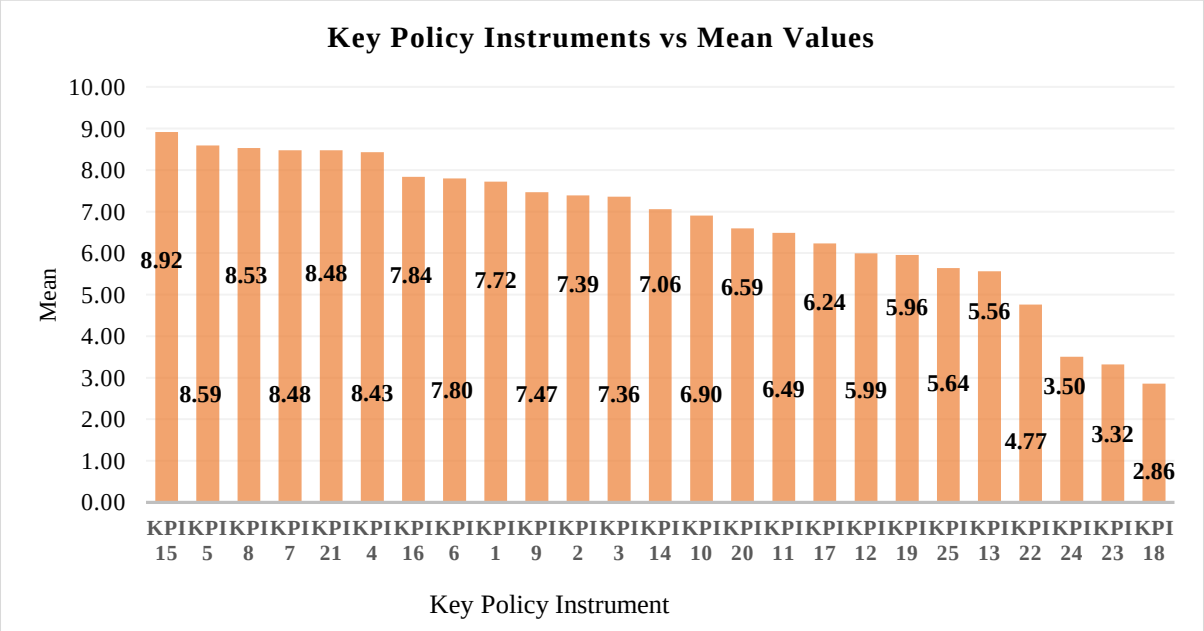


Figure 14: Mean Scores of Key Policy Instruments

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. These key policies were in need of higher concern in case of implementing new technologies to the farmers. 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 indicated in the above graph 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 a new technology is to be introduced to the field of agriculture.

"Level of maturity, Impurities, and Freshness" where the major concerns of farmers in Crop Produce Quality Attributes. "SNF content in the product (milk), Smell and Colour of the product" were the farmers' highest priorities in Livestock Produce Quality Attributes. "Product Variety Development, Extension Services, Capacity Building (Training), Information on Weather / Climate Conditions and Information on Market / Price Conditions", are the main aspects which the farmers have prioritized if they are to be exposed to new technologies regarding agriculture.

According to farmer perceptions the major constraints which affected them were ‘adverse climatic effects and natural disasters’, ‘disruption from diseases and pathogens’ and ‘disruption from wild animals. ‘Illegal activities such as ransom and tips’, ‘difficulties in management of the waste generated’,’ high cost of fines and penalties’ are the conditions the farmers were least concerned on. Depending on the aggregate mean score, out of seven categories ‘Technical feasibility’ and ‘Economical feasibility’ are the highest influencing categories of constraints on farmers. ’Social, cultural, ethical acceptability’ were the least concerned areas of farmers when it comes to the concerns of barriers against technology adoption.

Therefore, the responsible parties should pay higher attention on the priorities of farmers when developing the technologies. At the same time proper systems should be established to control the damage which could happen from adverse climatic conditions. Though the farmers have no high concern even Garbage disposal, management processes and health and sanitary conditions should be monitored in an orderly manner prior to introducing these novel technologies to the farmers. Basically, the farmers should be equipped with the knowledge and instruments required to implement the novel technologies. The confidence should be established in them about the positive aspects of the modern ways of farming techniques. So, the frequency of training and awareness programmes would be intensifying. The support of the authorities should be within the range of the farmer requirements for the betterment of the farmers’ as well the projects’ output. Therefore, a close look at the farmer needs and interests would assist in understanding the mind-set of the end users. With that background laid, the technologies can be successfully implemented among the farmers.

13 Policy Compatibility and Synergies

The 16 agriculture policies related to technology adoption are generally compatible in terms of agricultural productions objectives. Almost all these policy documents have been prepared before the initiation of agriculture productivity improvement, but the major content of these policies are largely compatible with agriculture modernization context. These policies, in general terms, possess synergies within the broad objective of achieving food self-sufficiency and food security. However, most of these policies are “inadequate” to address efficient use of inputs and natural resources with special emphasis to develop a market-oriented production system.

The other major concerns of all these policies are need for strengthening research-extension and farmer linkages for application of modern technologies for productivity improvement and obtaining higher income from farming. It was also observed the weak linkages and coordination among ministries, agencies and private sector in the process of technology adoption.

It is useful to provide some reflections on the formulation process and implementation of these policies by various agencies.

First, it appears that the conceptual level of policy formulation generally led toward agriculture production but, less on value chain development. This uni-focal perception of agriculture policies often effected the related other sectors such as technology generation, market orientation and profitability.

The second issue is the concern of ministerial domain of administration and mandates of agencies within the agricultural sector. Sometimes conflicting interest between ministries such as Ministry of Agriculture and Ministry of Livestock create problems in promoting livestock industry in paddy lands. Therefore, the coordination between ministries, and agencies regarding the mandates and establishment of accountability in adhering to the policies seems to be an issue in formulating and implementing any agricultural policy.

Thirdly, policy making, planning and decision-making functions are vested at the ministry level but the regional or local level officers are responsible for implementing the plans. Therefore, inadequate participatory regional policy making for agricultural development underscore the efficiency of the policy at regional level.

Forth, the evidence-based policy making is vital for developing relevant policies. The use of database and facts considered for policy formulation often limited to government agencies. However, the policy makers more often do not consider huge potential of involving private sector, NGOs and farmer organizations which could enrich policies that could be applied to all stakeholders.

The policies reviewed in this exercise dwell on technology adoption process and concerns, there are generic areas for concern as follows;

- ***Dominance of rice production*** - The agricultural policy documents mainly focus on production increase specially, rice production giving lesser emphasis to other agricultural enterprises. Therefore, the policy prescriptions for input - supply extension services, research and marketing of produce are directed to rice.

- ***Diversification of commercialization*** – Although, policy documents state diversification and commercialization of agriculture as a common objective. But very little emphasis is given in terms of location specific agricultural enterprises, research and extension, supply chain management, processing storage and marketing of produce.

- ***Inadequate crop and livestock integration*** – the policies regarding these aspects are limited and implemented by individual ministries without proper coordination and sharing responsibilities.

- ***Involvement of private sector*** – the policies that have been revealed for this exercise largely focus on roll of public sector agencies. Although the policies state that private sector is important for a vibrant agricultural sector, often the present policy directions are limited and less supported as to how the vibrant private sector, farmer organization and NGOs get involve and play more active role, particularly in technology transfer.

- ***Contract farming and value chain*** – The policies reviewed indicated that, agriculture pursued as individualistic production system. The individual farm base is becoming economically and technically unsound and no longer profitable. The policies do not support the emerging new forms of farming such as contract growing for private sector for high value products.

- ***Subsidies for agriculture inputs*** – The subsidy schemes for spices production and fertilizer for rice cultivation gave rise to several positive and negative effects. It is seen that, fertilizer subsidy is formulated with good intension however, without any rigorous analysis of its possible effect on other crop productions and sustainability of profitable production systems.

14 Recommendations

It appears that, many agriculture policies reviewed related to technology adoption have little relevance to face new challenges of agriculture modernization process. Therefore, it is necessary to update and review key policies and put them into proper perspective. At the same time more pro-active policies are needed to ensure inclusive growth of small farmers and enterprises.

The policy recommendation proposes for technology adoption;

Technology Development/ Innovation

Formulation

- Coordination between and among government ministries and research institutions, private sector and farm organizations for policy formulation, planning and implementation and monitoring.

- Facilitate institutional reforms to strengthen research and development efforts at national level, involving universities, research institutes and private sector to promote close collaborative research.

Implementation

- Strengthen research-extension and farmer linkage platform for effective participation of all concern in technology generation, transfer and adoption process.

- Policies to provide incentives for technology generation and commercialization for both researches and institutions.

Transfer of Technology

Formulation

- Establish a grass root level general agriculture extensions system with trained agriculture extension agents to serve small farmer operations mobilized and monitored at divisional level.

- Create multidisciplinary technical teams at provincial level to serve specific production zones and cropping system.

Implementation

- Policy environment for promoting e-agriculture strategies proposed by MOA for technology generation, improve research capabilities and access to reliable information using ICTs.

- Application of various communication channels and media for timely dissemination of agriculture information and improve accessibility to public domain.

- Policies for application and maintain high quality standards, certification of products, processes and management systems in the value chain.

Technology Adaption

Formulation

- Policy for promotion of new alternative agri-business ventures in high potential areas with technical and financial assistance.

Implementation

- Policies to ensure agriculture research extension programs in line with National Agricultural Policy priorities.

- Special extension systems for promoting high value crops development in specific areas involving private sector, farm organization and value chain actors for promoting export-oriented production systems.

Policy Recommendation Matrix for Technology Adaption

Table 24: Policy Recommendation Matrix for Technology Adaption

Technology Adoption	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
(1) Technology Development / Innovation				
Formulation	Lack of coordinated policy plan led to policy conflicts and inconsistencies	Coordination between and among government ministries and research institutions, private sector and farm organizations for policy formulation, planning and implementation and monitoring	Identification of Stakeholders and consultation, Develop Coordination Mechanism	MOA, Ministry of Trade, Chamber of Commerce, CARP, DOA, Department of Agrarian Development
	Lack of policy environment for collaborative R&D initiatives between relevant institutions thus lack of opportunities for sharing technology and resources	Facilitate Institutional reforms to strengthen research and development efforts at national level, involving universities, research institutes and private sector to promote close collaborative research	Assess the capacities of R&D Institutions and Identify Gaps, Provide Institutional reforms to facilitate collaborations	DOA, Universities, CARP, Private Sector Agri Ventures

Implementation	Need policy instruments to get involved all partners in the process.	Strengthen research-extension and farmer linkage platform for effective participation of all concern in technology generation, transfer and adoption process.	Identify Strength and Weaknesses of present systems, Facilitate Participatory Planning involved in all concerns, Joint Monitoring	DOA, Research and Extension Divisions, DAP&H
	Inadequate of policies for rewarding researches and extension for their extra -ordinary achievements.	Policies to provide incentives for technology generation and commercialization for both researches and institutions.	Identify technological advancement areas and technologies which need incentives. Develop Incentive Schemes for technology generation and commercialization which is self-sustained	MOA
(2) Transfer of Technology				
Formulation	Present Divisional Level extension is unable to make a reasonable coverage of extension. Policy to create grass root level extension system to cater small farmers which was abolished long time ago	Establish a grass root level general agriculture extensions system with trained agriculture extension agents to serve small farmer operations mobilized and monitored at divisional level	Recruit agriculture extension agents with knowledge of agriculture. Train and develop skills of extension agents and Initiate grass root level extension system monitored by Divisional level	MOA, DOA
	Current technology transfer system does not equipped to serve this sector.	Create multidisciplinary technical teams at provincial level to serve specific production zones and cropping system	Formation of multidisciplinary technical teams at Provincial Level	DOA, PDOA, DAP&H

Implementation	Lack of Policies to intergrate E-agriculture in agriculture sector.	Policy environment for promoting E-agriculture strategies proposed by MOA for technology generation, improve research capabilities and access to reliable information using ICTs.	Identify Trained Staff for managing E- agriculture platform at DOA. Prepare Action Plan by DOA, Stakeholder Consultation for implementation , Establish Protocol.	MOA, DOA, Hector Kobbekaduwa Agrarian Research and Training Institute,Private ICT companies.
	Timely dissemination of relevant information to technology transfer process is vital for effective extension service. Current systems do not fulfil this requirement.	Application of various communication channels and media for timely dissemination of agriculture information and improve accessibility to public domain.	Preperation of information packages, Identify medium for disseminate, Establish trained staff for interactive communication through various medium	DOA, DAP&H
	The current policies do not adequately address quality standards and guidelines for certification of products, processes and unaware end users	Policies for application and maintain high quality standards, certification of products, processes and management systems in the value chain	Establish quality standards for products and process, Make aware quality standards and product procedures for target groups	DOA, Seed Certification, Organic Certification, Modern Trade

(3) Technology Adaption				
Formulation	Current policies do not adequately support agribusiness ventures such as protected agriculture, rapid multiplication and product processing	Policy for Promotion of new alternative agri-business ventures in high potential areas with technical and financial assistance	Identification of alternative agri business ventures, provide technical and financial assistance for agribusiness ventures in high potential areas	DOA, PDOA, Private Sector Agri Businesses
Implementation	It appears inconsistency of extension policy with national agriculture policy priorities.	Policies to ensure agriculture research extension programs in line with National Agricultural Policy priorities	Identify national agriculture priorities and align research & extension program accordingly	DOA
	Current general extension systems may not adequately cater this sector as it demands specific technologies approaches and collaborations	Special extension systems for promoting high value crops development in specific areas involving private sector, farm organization and value chain actors for promoting export-oriented production systems.	Identification and mapping of specific areas for high value crops, Identification of specific cropping systems, promote private sector for invstments through incentives, Connect farmer organizations with private sector. Establish Special extension systems for identified areas	DOA, Farmer Organizations, Chamber of Commerce, EDB

Annex 1 - Desk Review Global

Philippines

1. Introduction

The country's main agricultural crops are rice, corn, coconut, sugarcane, bananas, pineapple, coffee, mangoes, tobacco, and abaca. Secondary crops include peanut, cassava, camote (a type of rootcrop), garlic, onion, cabbage, eggplant, calamansi (a variety of lemon), rubber, and cotton.

The Philippines has been identified as one of the country's most at risk from climate change, with the Global Climate Risk Index 2018, released by Bonn-based NGO German watch, ranking the country as the 5th most affected by changing weather patterns over the past 20 years.

The Philippines is making efforts to modernize and strengthen its agriculture sector, with both the state and private companies promoting the adoption of advanced technology and smart farming methods to increase harvests and minimize losses.

2. Climate Smart Agriculture Policies

Climate smart agriculture related policies of the Philippines aim to – (1) reduce the risks posed by climate change to project activities, stakeholders and results, (2) to ensure that project or program activities maximize their contribution to adaptive capacity of target populations and do not inadvertently increase vulnerability to climate change, and (3) to build resilience while achieving development goals.

For the desk review purpose, two dimensions were used to analyse the policies and instruments.

2.1 Production Relations Policies

2.1.1 Climate Resilience Rice

This is the use of drought, submergence, and saline tolerant rice varieties. Farmers participated in the selection of these rice varieties, paving the way for a need-based selection of rice varieties and promoting faster adoption of these varieties in the farming community.

2.1.2 Review and Adjustment of Cropping Calendar

Farmers Scientist network have developed early-maturing rice varieties which led network of people's organizations, non-government organizations and scientists to help reduce crop failure risks.

2.1.3 Sloping Agricultural Land Technology (SALT)

This promotes contour farming and other soil conservation measures in sloping lands.

2.1.4 Farm Diversification in The Rainfed And Upland Ecosystems

Farmers are intercropping corn with cassava, because the 2nd cropping of corn is no longer successful.

2.1.5 Rice Intensification in the Farm

This refers to an integrated farming system for rice and vegetable components, as well as fish and livestock.

2.1.6 Farmers Using Biotechnology

Promotion of Genetically Modified (GM) corn to increase farmers' income.
Promotion of organic agriculture, Enhanced Farmers Field School (EFFS), feed formulation in Livestock industry

2.2 Technology Transfer Policy Instruments

Following climate smart strategies are included in the policy instruments formulation. These strategies were in cooperated in different programs and under different funding arrangements which includes public sector, UN agencies, international collaborations and private sector.

2.2.1 School on the Air (SOA)

Use of distance learning as a good tool to disseminate good practices on climate change was adopted.

2.2.2 Radio Broadcasting Campaign on Climate Smart Agriculture (CSA)

Selected regions wherein localized interviews on the experiences of farmers, experts and LGUs are aired in radio stations. It discusses integrated farming and other strategies in the adaptation and mitigation of climate change.

2.2.3 Small-Scale Native Pig Production

In the Philippines, small-scale native pig production was introduced as a low-cost investment that women can manage which was supported by the CGIAR Research Program on Climate Change, Agriculture and Food Security in Southeast Asia (CCAFS SEA).

2.2.4 Revolutionary Guide Map

A revolutionary guide map (www.farmersguidemap.gov.ph) plots which crops are best grown for each area in the Philippines and where there are shallow water tables. It also indicates fertilizers needed to make up for the nutrients lacking in the area's soil and the poverty incidence of the community selected.

2.2.5 Solar-Powered Irrigation System

The use of solar-powered irrigation system costs less from the traditional irrigation systems. The NIA (National Irrigation Administration) computes that for every hectare of irrigated farm, the government must spend Php 450,000. With the solar-powered irrigation system, it can only spend Php150,000 per hectare and can be constructed in just a matter of 60 days. With the first solar-powered irrigation already set in place, the DA is eyeing to set up 170 units nationwide.

2.2.6 Drones

In terms of smaller scale technology, the DA also began the use of drones, which were intended to be used in vegetable farms to spray fertilizers and pesticides on a strawberry farm in Benguet.

2.2.7 Smart Farm

A smart farm which is part of the SPICE project is designed to develop and promote urban farming and high-tech plant conservation.

This was implemented by Department of Science and Technology's nursery of indigenous and endemic plants in Quezon City, and operated in coordination with the University of Philippines Diliman and the University of Philippines Los Baños, the facility serves as a greenhouse for new technology and modern farming methods. Techniques such as vertical farming, micro propagation, cryopreservation and hydroponics to be practiced, with the aim of developing technology to boost crop production and reduce the need for manual labor.

2.2.7 APPS

The Philippine Rice Research Institute (PhilRice), more known for its invention and promotion of hybrid rice seeds, has been tinkering with the computer to develop mobile and desktop applications. Under this initiative following APPS were developed.

Rice Crop Manager (RCM) - Utilize by the extension workers to reach farmers nation wise with relevant crop production recommendations.
Leaf Color Chart (LCC) – Use for fertilizer recommendation
AgriDOC App - The AgriDOC App is a farm management tool which can keep records on expenses and activities and linked to the value chain.

2.2.8 METOS Instruments

These instruments enable farmers to monitor weather patterns and model forecasts for their fields such as temperature, humidity, rainfall, leaf wetness, and insect pressure. Collected data are sent to the farmer's mobile phone.

3. Recommendations

The following are suggested and important commitments and actions that can be undertaken among the ASEAN member countries to tackle the challenges of food and water security, nutrition, poverty, climate change, sustainable development, environmental sustainability, and CSA.

3.1 Policy reforms

- Enhance integrated, systems-based approaches, strategies and institutional arrangements that span across different sectors, ministries and intergovernmental organizations;
- Address the sustainable management of oceans for food security and livelihoods, including addressing illegal, unreported and unregulated fishing;

- Promote international cooperation and avoid unilateral measures, such as export bans;
- Encourage private sector investment by reducing or insuring gain-risk (for example, through funding transitional programs that enable eventual private sector investment.
- Support low income food importing countries, with particular attention for vulnerable families and children.

3.2 Research and Development

- Address the scientific, technical and socio-economic aspects of adaptation and mitigation in agriculture and their synergies, within international food security and climate change processes, for example through further work under the UNFCCC SBSTA.
- Investing in the research and development of non-proprietary plant varieties and breed that require nutritional, productivity, and diseases and climate resistant traits needed by different producers.
- Partnerships between the private sector and farmers/farmer groups and cooperative to promote the production of high quality products. Partnership enhances knowledge sharing between stakeholders, including scientists, farmers, private sector, civil society and governments, with participatory agenda setting, for example, through initiatives such as the Global Research Alliance.

3.3 Extension and education

- Strengthen the knowledge base on sustainable practices, as well as on financial and policy options that would enable countries and communities to meet their food, water and nutritional security and development goals;
- Improve farmers‟ access to and awareness of knowledge services, finance, agricultural inputs, rights (for example, land tenure rights) as well as increase the availability of these resources.
- Implement and scale-up innovative successful programs and best practices that combine sustainable agriculture and land use, forestry and sustainable fisheries and aquaculture, through local, regional, sub regional, and national programs and institutions, as a matter of priority;
- Sharing existing technologies off the shelf and into the hands of (small holder) farmers, thereby improving their access to information, technical knowledge, for example ICT options;
- Creating platforms/learning hubs (such as CSA knowledge platforms) and bringing together farmer groups/associations at the grassroots level to facilitate dialogue and knowledge sharing, and to building capacity to innovate and adopt CSA practices.

Philippines Technology Transfer Policy

As a matter of policy, the 1987 Philippine Constitution, Article XIV, Sections 10 to 14, recognizes that science, technology and innovation are essential for national development and progress. Accordingly, the state has been tasked to:

1. Give priority to research and development, invention, innovation, and their utilization; and to science and technology education, training and services (Sec 10);
2. Support indigenous, appropriate and self-reliant scientific and technological capabilities and their application to the country's productive systems and national life (Sec. 10);
3. Regulate the transfer and promote the adaptation of technology from all sources for the national benefit (Sec. 12);
4. Encourage the widest participation of private groups, local governments, and community-based organizations in the generation and utilization of science and technology (Sec. 12.); and
5. Protect and secure the exclusive rights of scientists, inventors, artists and other gifted citizens to their intellectual property and creations, particularly when beneficial to the people, for such period as may be provided by law. (Sec. 13).

Technology transfer problems

1. Weak Public-Private Collaboration

Unlike in most developed economies where there is strong public-private collaboration from the planning stage to R&D and technology transfer phase, technology generation activities in the country, particularly those that are publicly funded, are often regarded as not receptive to agriculture sector needs.

2. Weak Technology Transfer System/Policy Setback

Harmony and convergence of technology transfer policies and activities is lacking among stakeholders such as research and development institutions, government agencies, private entrepreneurs, and venture capitalists.

3. Technology Ownership and Information Sharing Issues

The absence of an institutional mechanism for technology transfer, such as a technology transfer office, contributes to the instability of technology property rights especially if these came from publicly funded research. Because of weak IPR culture, there are scientists who do not want to negotiate or part with the technology believing that it would be disadvantageous to them.

4. Weak Intellectual Property Culture Worldwide

It is increasingly recognized that market-oriented mechanism such intellectual property (IP) is important in encouraging innovation, diffusing scientific and technical knowledge, and in enhancing market entry and company creation.

5. Lack of Resources for Technology Transfer

Considering the comparatively limited budget for S&T in general appropriations, public support for S&T continues to be inadequate. In a 2005 data at the DOST, the expenditure on R&D amounted only to 0.12% of the Gross Domestic product (GDP), too low as compared to the 1% GDP prescribed by the United Nations.

6. Policy Setbacks

In many countries, governments have recognized that placing the outputs of publicly funded research in the public domain is not sufficient to generate social and economic benefits from R&D. Global ranking for competitiveness is lagging behind neighbouring countries in the region in terms of technology transfer. Such setbacks may have been avoided had there been a favourable structure for technology commercialization backed by a legislative policy to set the system in motion. The challenge, therefore, was to provide a conducive policy environment that would give due flexibility and benefit for our RDIs to maximize the use of the IPs they generate and move fruits of research and creative efforts from laboratories to the marketplace.

Salient Provisions for to Address above Constraints in the Policy Documents

Ownership of Technologies/Ips

As a default provision, the law10 significantly provides for the retention of ownership of IPRs derived from research funded in whole or in part by the Government Funding Agency (GFA) to the RDI or contractor that actually implemented the research.

Revenue Sharing

When it comes to sharing of revenues, the default rule is that all revenues from the commercialization of IPs and IPRs from R&D funded by GFA(s) shall accrue to the RDI11, while sharing between the RDIs and their researchers shall be governed by an agreement, but shall not diminish the 40 % share in royalties of scientists, engineers, and researchers under Section 7 (b) of RA 8439.

Use of Income

On the use of income, public RDIs undertaking technology transfer shall be vested with the authority to use its share of the revenues derived from commercialization of IP generated from R&D funded by GFAs12. All income generated from commercialization of IPs and/or IPRs from R&D funded by public funds shall be constituted as a revolving fund for specific uses, including for use of defraying the cost in technology transfer and IP protection.

Capacitating Technology Generators

The law likewise provides for enabling institutional mechanisms to hasten commercialization such as the establishment of Technology Licensing Offices and Technology Business Development Offices. RDIs are also mandated to craft their own IP policy frameworks with reference to the law.

Commercialization by Researchers and Spin-Offs

In meritorious cases and to help ensure successful commercialization, the law15 indicates that an RDI shall allow its researcher-employee to commercialize or pursue commercialization of the IP and/or IPRs generated from R&D funded by GFA by creating, owning, controlling, or managing a company or spin-off firm undertaking commercialization, or accepting

employment in a spin-off firm undertaking such commercialization. The spin-off or start-up company provides the mechanism to manage and commercialize the IPR into profitable venture. The employee-researcher can own, manage, control, or work as consultant or employee in the spin-off company undertaking the commercialization without formally leaving the RDI.

Institutional Mechanisms

To ensure commercialization, the law provides for mechanisms that would enhance the environment for diffusing technologies or IPRs. The Act16 mandates the Establishment of a Technology Information Access Facility, Technology Licensing Offices (TLOs) and/or Technology Business Development Offices and development of Internal IP Policies.

Impacts on Stakeholders

For researchers, it can create a financially rewarding environment for them by virtue of a mandated 40 % minimum share in royalties. It is also seen that R&D workers would stick to their careers locally, and reversing the trend of brain drain among R&D workers or shifting to non-science jobs. More researchers would also venture to S&T/research, which in effect could generate more technological innovations and breakthroughs.

Conclusion and Policy Implications

Extension plays crucial role in bolstering growth in the AANR sectors. It is an important node that links research outputs to its ultimate beneficiaries. Research community has already been sensitized of the role of extension in helping the farmers to participate in technology development and transfer.

In the Philippines, the importance of research-extension linkage is recognized by the government through different laws and administrative orders. Among the various laws enacted and administrative orders crafted, the AFMA is the principal policy that stipulates provisions on how extension shall be undertaken in the country. Specifically, AFMA defines extension as initiatives undertaken by the government and non-government organizations to improve the welfare of the various stakeholders in the AANR sectors through provision of trainings and information and sharing of knowledge and skills.

While policies are in place, several issues impede the effective and efficient delivery of extension services in the country. Among others, the problems include limited funding support, poor synergy of programs and initiatives of agencies and institutions on AANR development, inadequate human resources development programs and limited use of mass and social media as means of providing extension services.

Given such, a review of the extension policies, through consultative meeting with all key stakeholders may be necessary.

If policy environment does not provide adequate incentive mechanisms to future extension workers, collapse of the extension system may be inevitable. Opportunities to look at

extension system on digital perspective may also be explored to maximize availability and access of technologies and provide for quicker and more responsive services.

Also, it must be high time to consider the role of the private sectors and engaging into co-payment systems in the provision of extension services. This provides farmers and key AANR stakeholders to articulate priorities while enabling a more effective and efficient use of scarce government resources.

Lastly, the need for a comprehensive and exclusive law on agricultural extension services in the country may be regarded.

Recent development on the policy environment for extension services in the AANR sectors in the country includes the crafting of house and senate bills. During the 16th Philippine Congress, the following bills were initiated. These policies can be reviewed and refiled to the 17th Congress to strengthen the agricultural extension in the country.

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Myanmar

Agricultural Research and Extension Policy

Traditional rice cantered agricultural has undergone a significant structural transformation to promote crop diversification. It was recognised that Agricultural research, extension and education system play vital roles in the agricultural sector development and on the way forward to intensive diversification from production to consumption of agricultural commodities.

Aligned with country's agricultural policy, research programs of Department of Agriculture Research and Extension has been giving attention on increasing crop production through improved seeds, and a few program on crop management, crop protection techniques, and cropping systems tailored to suit the country's various agro- ecological zones.

Aligned with country's agricultural policy, research programs of DAR has been giving attention on increasing crop production through improved seeds, and a few program on crop management, crop protection techniques, and cropping systems tailored to suit the country's various agro- ecological zones.

Current extension approaches that are practiced in the whole country are to establish integrated high technology demonstration villages by practicing Good Agricultural Practices (GAP), and to conduct site specific soil nutrient management and seed production, conducting demonstration programs for GAP, SRI, organizing Seed Grower Associations/ Cooperatives, Commodity Development and Production System for Mango, sesame, green gram, mung bean, tomato, coffee, and dragon fruit.

In addition, extension service includes dissemination of information about rules, laws and regulation and updated technology through Social and Mass Media such as DOA homepage and Facebook, Radio, TV channel (Farmer Channel), newspaper, posters, pamphlets, bulletins, agricultural shows.

Livestock Sector Extension

There are many prioritized activities that are undertaken by LBVD in the field of – Improvement of Livestock and Livestock Products, improvement of disease control, improvement of Animal Health, improvement of breed animals, and improvement of livestock production system.

Apart from the training of extension personals, on the other side, training for active farmers are also conducted such as community animal health workers, on basic poultry production, basic swine production, ruminant nutrition, pasture development, poultry production and biosecurity, vaccination, making silage, basic livestock production course, basic duck production and integrated farming.

The extension education activities include public awareness program through various communication medias such as publishing newsletters, advertisements in radio, TV and newspapers, distribution of pamphlets, exhibition.

The livestock services and department are mainly run by vets, and focus on animal health issues: curative treatment of individual animals, preventive health, and health screening of animal products. Extension services are run by the departmental level to the township and village levels. Besides central or regional governments, extension services can be run by NGOs, by cooperatives, by universities or research institutes and by the commercial sector.

Linkage of Agricultural Research and Extension System

Although DAR and DOA are the main actors for research and extension respectively, collaboration among them is still insufficient. Most of the activities are joint meetings on quality seed production and distribution with a purpose to increase production and provision of good quality seeds and certified seed multiplication program, joint field surveys, field trips and field days especially at the experiment stations in cooperation with some international organizations, consultation meetings, to identify and/or to solve the problems faced in the implementation of various crop production programs. There is still a lack of collaboration and cooperation for the diversification issue. Moreover, there is no linkage among crops sector and livestock sector in extension and research services.

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Indonesia

Model of Technology Commercialization from Government Research Institutions to Private Sector in Indonesia

In general, government research institutions in Indonesia implement technology transfer of research results through two channels, namely the public domain and commercialization pathways. For technologies that are public domain, the technology transfer is conducted in stages, from research institutions to government agencies that are in charge to disseminate the technology and then to the end users. For example, agricultural technologies from research institutions communicate to the extension agency, and then delivered to farmer groups and farmers as end users.

Meanwhile, commercialization generally is cooperated with various parties, especially the private sectors. There are two commercialization models developed in the government research institutions in Indonesia, the first, is through the development of technology incubators, which opens business opportunities for small, micro and medium enterprises in distributing technology to the users. A unit set up by research institutions is responsible for development of the technology incubator in promoting the acquisition of intellectual property rights and technology commercialization. The second approach is to work directly with the private sector. This cooperation is implemented through various forms, such as research collaborations, where the final results of the study developed jointly, and intellectual property rights belong to those who contribute the most in funding, or governed by a separate agreement.

The dominant cooperation between private sector and government research institutions is in the form of a direct cooperation, in which private sector develops the results from research by government research institutions through cooperation agreement. Technology transfer can be performed through public domain or commercialization pathways.

Universities and R & D institutions have an obligation to transfer the technology of intellectual property and the results of R & D activities generated by research and development activities that are financed fully or partially by the Government and / or Regional Government as long as not in the contrary to public order and legislation.

Both of these regulations encourage government research institutes to collaborate with the private sectors in the technology transfer through commercialization scheme.

Challenges

The main challenge in this commercialization is how the government research institutions can produce an interesting result for the private sector, which plays role to in technology dissemination, as well as how to raise researcher's awareness for generating research results that meet the needs of the users. One of the complaints from the private sector is that the research results have not been fully required by the users, as well as the quality of the technology that does not meet its specification.

To respond to this problem, therefore an intensive communication between government research institutions with the private sector is absolutely necessary.

The government permits researchers to receive royalty as a result of cooperation. This is expected to attract the researchers to generate more technologies in accordance with market needs.

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India

Introduction

Agricultural policy of India is generally designed by the Government to raise agricultural production and productivity and also to upgrade the level of income and standard of living of farmers within a definite time frame [Anon, 2018]. Rapid sustainable growth in the agricultural sector remains dynamic for creating of jobs, enhancing incomes, and ensuring food security. The main policy measures in the agriculture sector were adopted in the mid-1960s [Chand, 2018]. India pursued a policy of food self-sufficiency in staple foods such as rice and wheat. The policies were initially focused on the expansion of cultivated area, introduction of land reforms, community development, minimum support prices, public storage, procurement and distribution of food grains, trade protection measures and restructuring of rural credit institutions [Arora, 2013; Chand, 2018].

National Agricultural Policy with Important Objectives

1. Raising the Productivity of Inputs
   One of the significant objectives of India's agricultural policy is to improve the productivity of inputs purchased, that is, HYV seeds, fertilizers, pesticides, irrigation projects etc.
2. Protecting the Interest Of Underprivileged Agriculturalists
   Protecting the interest of poor and marginal farmers by abolishing arbitrators through land reforms and expanding institutional credit support to poor farmers.
3. Modernizing Agricultural Sector
   Introducing of modern technology in agricultural operation and application in order to improve the agricultural input products [Pingali et al., 2017; Anon, 2018; Chand, 2018].
4. Enhancing Yield of Major Commodities
   Since major crops yield and livestock is much lower than that of other parts of the world, the future increase in food production is necessary in order to meet the country's population demand from increasing the yield [Dantwala, 2018].
5. Checking Environmental Degradation
   Agricultural policy of India has set another objective to check environmental degradation of natural base of Indian agriculture.
6. Agricultural Research and Training

   Promoting agricultural research and training facilities in order to saturate the outcome of such research among the farmers by establishing a close linkage between research institutions and farmers [Pingali et al., 2017].

Measures taken to accomplish the suggested objectives (Policy Instruments)

It appears the suggested policy instruments are in adequate to address the policy objectives.

1) To utilize the barren wasteland for agricultural purposes and afforestation [Grossman and Carlson, 2018];
2) To control indiscriminate division of agricultural lands for non-agricultural uses.

3) Enhance cropping through multi-cropping and inter-cropping;
4) To emphasize rational use of ground and surface water so that over-exploitation of ground water resources can be checked [Dantwala, 2018; Grossman and Carlson, 2018]; and
5) Supporting farmers and landless laborers by providing adequate financial incentives and entitlement of trees and pastures.

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Policy on the Advancement of Agricultural Growth and Production in India

The main aim and focus of the agricultural development policy is to generate income and larger on-farm and off-farm opportunities within the country as well as bringing development in the rural areas (Emerick., 2018). In this context, the agricultural policy envisage to improve the productivity of inputs, increase the value added per hectare to the small and marginal holdings, prevention of environmental degradation and educating farmers with the basic knowledge on agriculture produce.

The Major Strategies and Investments and the Government Initiatives in Agricultural Development

1. It is projected that by 2019, India to start exporting sugar to its neighboring country such as China.
2. The first mega food park in the states of Rajasthan was inaugurated in March, 2018.
3. In India, the agri-food start-ups received a funding of US$ 1.66 billion between 2013-17. (India Brand Equity Foundation, 2019).
4. The Government of India in December 2018 approved the Agricultural Export Policy with the aim to increase the India's agricultural export to US$ 60 billion by 2022 (Agri Tech India, 2019).
5. In September 2018, the Government of India asserted US$ 2.25 billion procurement policy named "Pradhan Mantri Annadata Aay Sanraksn Han Abhiyan" (PM-AASHA), in which states can adopt the compensation scheme and partner with different organizations and agencies to ensure fair prices of farmer's market in the country (India Brand Equity Foundation, 2019).
6. In September 2018, the Cabinet Committee on Economic Affairs (CCEA) approved US$ 820.41 million assistance packages for enlarging the sugar industry in India (Agri Tech India, 2019).
7. The Government of India also provided US$ 306.29 million for computerization to ensure benefits through digital technology (India Brand Equity Foundation, 2019).

8. A new AGRI-UDAAN programme was introduced to enable the start-ups to connect with potential investors from different countries.
9. The Government of India also launched another scheme called as the “Pradhan Mantri Krishi Sinchai Yojana” (PMKSY) with an investment of US$ 7.7 billion aimed at the development of irrigation sources (India Brand Equity Foundation, 2019).
10. The Government of India allotted US$ 936.38 billion investments for mega food parks in the country for Agro-Marine Processing and Development of Agro-Processing Clusters (India Brand Equity Foundation, 2019).

Expected Policy Impacts

1. As per the status and current scenario of the country, India is expected to achieve the ambitious goal of doubling the income from US$ 1,505.27 in 2015-16 to US$ 3,420.21 by 2022-23 by 2022 (Agri Tech India, 2019).
2. It is expected that the agricultural sector will have a recovering momentum in the next few years with an increase in investments and facilities in agricultural infrastructure.
3. Using of genetically modified crops will also help recover the yield and increase the market value of the farmers.
4. With advancement in the field of agriculture, India is predictable to be self-reliant in pulses and grains through scientific efforts in producing different mixtures of early mature pulses in minimum fair prices.
5. In addition, food handling industry will also offer several benefits by adopting the International food safety and quality assurance mechanisms such as Total Quality Management.

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Vietnam

Introduction

After participating in the WTO, agricultural products in Vietnam must meet the increasingly stricter commodity standards of importing countries. At the same time, safe food production and trading are an imperative requirement and also a concern of consumers and the whole community. For producers, this is both a social responsibility and a good trading of their products, increases their competitiveness in the market. This simultaneously ensures good production environment and maintains a sustainable agricultural production. In order to meet the above requirements and in accordance with the development trend, MARD has issued the Vietnamese Good Agricultural Practices (VietGAP) for safe fresh fruits and vegetables, safe fresh tea and safe pig raising, safe poultry, safe bees, safe dairy cows in Vietnam in 2008.

Viet GAP is a voluntary standard to guide producers to improve quality and ensure food safety (FS) on the basis of controlling hazards, and is compiled based on the criteria of AseanGAP, GlobalGAP, Freshcare aims to create favorable conditions for Vietnamese fresh vegetables and fruits to participate in the Southeast Asian market and the world, towards a sustainable agriculture.

Policy Supports

To support the application of Good Agricultural Practices (GAP) in agriculture, forestry and fisheries, in Vietnam, the key areas supported by the government policies are: identifying concentrated production areas that are eligible for food safety; building and renovating infrastructure of concentrated production areas; training; partly supporting the certification cost.

Viet GAP Standards

The Government of Vietnam has recognized organic vegetables as SV and puts organic production into the Vietnamese standard system. Organic products are like VietGAP and RAT because it is a voluntary standard, it means that if producers choose whether or not to do it, the State would not force it. The legal document for organic production is Industry Standard No. 10-TCN602-2006 dated December 30th, 2006 issued by MARD, later is TCVN 11041-1: 2017; TCVN 11041-2: 2017 for organic farming issued under Decision No. 3883/QD-BKHCN dated December 29th, 2017.

Solutions to promote the application of good agricultural practices (gap) and monitoring strategies

After more than 10 years of implementation, VietGAP has shown that this is the right direction for sustainable agricultural production, beneficial to society and producers, for export processing enterprises and ultimately the most important isits being beneficial to consumers. VietGAP is necessary because each country needs its own standard as a legal basis for quality management, food safety and sustainable production. Let VietGAP be widely applied, we propose the following solutions:

1. For the domestic market, GAP is a voluntary standard for producers, but needs to become a demand of safe products consumers, thus creating GAP market mechanism, independent of state support.

2. Communication and training on GAP for farmer households, cooperatives, enterprises and consumers are very important. The Ministry of Agriculture and Rural Development cooperates with the Vietnam Consumer Protection Association and mass organizations to strengthen communication and raise awareness of society on food safety in general and VietGAP in particular, especially in the framework of New Rural Program.

3. There is a need to promote the building and the development of the linkage model according to the GAP value chain with the participation of enterprises and cooperatives/cooperatives/Professional associations representing small farmers to ensure safe food chains.

4. Strengthen the inspection and supervision of certification bodies as well as the entire VietGAP certification process implemented by the certification bodies and fine fraud organizations and individuals, especially for organizations and individuals joining in exporting value chains because when a shipment is assessed as a failure by the importing country, the rate of enterprises inspected will increase to 50%, even 100% (instead of just 5% normally). This not only damages the actors in the value chain but also affects the reputation of Vietnamese agricultural products.

5. The Ministry of Agriculture and Rural Development and the ministries regularly publicize and disclose information on food safety and Viet GAP for consumers to participate in the monitoring system.

6. The State should strengthen the inspection and supervision closely from production, distribution on the market so that all organizations and individuals involving in the production of vegetables and other agricultural products must ensure State safety regulations, regardless of whether these entities are small farmers or business establishments.

7. At the same time, it is necessary to strengthen the accumulation and exchange of plots, formulate policies to develop agricultural land markets for land accumulation and support the development of cooperatives/farmer groups/professional associations. Thus, the legal documents relating to production standards and norms as well as quality control and supervision can be implemented in a large-scale reality.

8. Negotiating with importing countries and international organizations for mutual or partial recognition, as a basis for revising and supplementing the contents of VietGAP standard to be recognized in the international market.

9. It is necessary to supplement the criteria applied according to the quality standards of consumers such as GAP in criterion 17th on Environment and food safety in New Rural criteria. The new rural commune in the future must be a place where farmers have the skills and good awareness of safe food production according to GAP.

References

Policies on Promoting Good Agricultural Practices (GAP) in order to Increase Quality and Food Safety in Vietnam - 2019-08-15

Food and Fertilizer Technology Center for the Asian and Pacific Region (FFTC Agricultural Policy Articles), Dao The Anh1, Hoang Xuan Truong2, Pham Cong Nghiep, Vietnam Academy of Agricultural Sciences (VAAS), Center for Agrarian System Research & Development (CASRAD).

Thailand

Thailand Agricultural Policies and Development Strategies

The 20 – Year Agricultural Development Plan (2017-2036)

The development plan envisions securing farmers livelihood, to prosper agricultural sector and to sustain agricultural resources, which aims to make Thai farmers escape from the middle- income trap by having the average national income per head of more than US$13,000 (390,000 baht) in the year 2036.

The specific goals are as follows: (1) Farmers specialize in their professions, so-called “Smart Farmer;” (2) Farmer institutions have efficiency in management, so-called “Smart Agricultural Group;” (3) Quality of agricultural products meet the customers need, in other words, being “Smart Agricultural Products;” and (4) Agricultural area and sector have potential, known as “Smart Area / Agriculture.” This long-term plan flags out strategies in five aspects with number of guidelines which can be highlighted as follows:

(1) Strategy 1: Strengthening the Farmers and Farmer Institutions
(2) Strategy 2: Increasing the Productivity and Quality Standards of Agricultural Commodities Enhancing the Management Efficiency of Agricultural Commodities along their Supply Chains
(3) Strategy 3: Increasing Competitiveness in the Agricultural Sector through Technology and Innovations
(4) Strategy 4: Balanced and Sustainable Management of Agricultural Resources and the Environment
(5) Strategy 5: Development of Public Administration System

Issue-Based Policy and Strategies

National Organics Agriculture Development Plan (2017-2021)

This development plan envisions Thailand to be the leader in the region in terms of production, consumption, trade and services in organic agriculture at the international level.

MOAC’s Digital Agriculture Strategy (2017-2021)

This strategic plan comprises of three missions, which are to develop agricultural information system for proactive management, to apply appropriate digital technology with context to agriculture sector, and to support sustainable agriculture.

MOAC Food Security Strategy Framework (2017-2021)

The plan determines into 4 strategies as follows:

1. Producing food to sustainable serve domestic consumption by increasing food production capability, investing in compulsory infrastructure, supporting private investment in agricultural sector, and so on
2. Supporting people, at all levels, access to food in any times by increasing food production in community level, enlarging services activities in agricultural sector, facilitating logistics management
3. Encouraging high-quality production, reduce losses, and suitable usage by enforcing food safety regulation along the supply chain, educating food literacy to people, reducing food losses and wastes
4. Maintaining food stability by maintaining agriculture area, balancing food crops and energy crops production and
5. Supporting food and nutrition security by basing on R&D to increase safety and nutritious agriculture products.

Climate Change in Agriculture Strategy (2017-2021)

This sectorial strategic plan envisions a self-resilient Thai agriculture that partly mitigates carbons to meet sustainable development. This 5-year plan comprises of four missions who are to build awareness and disseminate data, information, and knowledge to stakeholders at all levels, to develop database, knowhow, and technology to support adaptation capacity to climate change, to participate into GHG mitigation regarding the conformity of agriculture sector, and to encourage integration of adaptation measures.

Mega Farming Policy

The fields of each small farmer in the neighbourhood are consolidated to make a large farm (mega-farm) under the supervision of a (large) farm manager while the ownership of land remains unchanged.

Zoning by AGRI-Pap Policy

The agricultural land areas in the country are delineated on the map into four categories namely: highly suitable, moderately suitable, least suitable and unsuitable for each major cropand is called AGRI-Map.

Agriculture Learning Centers (ALCs) Policy

For each commodity, the best practice farm in each district will be selected as a learning center for the farmers in the area. This policy breaks out into 882 centers in every single district throughout the country. The basis thinking is that since digital literacy is not equal among

farmers; therefore, this conventional mechanism can play well with this circumstance and even more tangible, network building, and interaction of man-to-man than the visual searching plug-and-play via internet.

Reference

Thailand Agricultural Policies and Development Strategies - 2019-06-18
Food and Fertilizer Technology Center for the Asian and Pacific Region (FFTC Agricultural Policy Articles), Apichart Pongsrihadulchai, Ph.D. Secretary General, Agricultural Economic Society of Thailand. e-mail: apichart_p@yahoo.com

Annex 2: Work Plan with Deliverables

No	Deliverable	Months													
		1	2	3	4	5	6	7	8	9	10	11	12	13	Total
D1	**Understanding the objectives and develop methodologies for information collection and compilation of Inception Report**														
	1) Preparation of the inception report & work plan of the assignment	x													0.5
	2) Delivery of documents	x													-
D2	**Review of policy document and Analysis of existing policies in terms of relevance, effectiveness for technology development and transfer**														
	1) Collection of relevant documents	x													1
	2) Preparation of interview schedule and data collection questionnaire	x													1
	3) Preparation of data collection plan	x													1
	4) Reviewing of historical data	x	x	x											3
	5) Reviewing of published report	x	x	x											3
	6) Conducting of key informant surveys & focus group discussions and compilation of summaries.	X	x	x											3
D3	**Assessment of policy effects on agriculture R&D and technology transfer**														
	1) Collection of relevant documents			x											1
	2) Conduction of policy review on public and private sector agriculture R&D and investment			x	x	x									3
	3) Policy regulation on private – public partnership for R&D and policy constrains					x									1
	4) Meeting agriculture value change key players and review the policy constrain and gaps					x									1
D4	**Country Comparison of policies related to technology generation and transfer models**														
	1) Use secondary data source of including web sites, project evaluation reports and documents in regional countries including India, Thailand, Bangladesh and Philippines			x	x										2
	2) Interviews / FGD with researchers and extensions in agricultural research institutions and extension divisions			x											1
	Understanding the policy influence on technology adoption by different target groups														
	3) Identify the policy gaps for agriculture research and technology adoption			x	x	x	x								4
	3) Identify the policy gaps for agriculture research and technology adoption			x	x	x	x								4
	4) Interview, FGD with Farmer groups women's groups and private sector commercial farmers				x			x	x						2
	5) Compilation of initial draft of the final report								x	x					2

Annex 3: 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)
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)
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)
110	**Industrial and**	1	P 12 SL National Policy on Siting of High Polluting Industries (P 7)
111	**Enterprise**	2	P 29 SL Development of National Policy for Primary Industries (P 19)
112	**Development**	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**	1	A-18 Sri Lanka Council for Agricultural Research Policy (P 23)
126	**Educational**	2	A-24 Sugarcane Research Institute (P 16))
127	**Development**	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,**	1	P 62 SL New Trade Policy (P 29)
132	**Export and**	2	P 67 SL Trade Policy Issues (P 20)
133		3	AP 14 Imports and Exports (P 9)
134	**Trade**	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)

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)

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)

Annex 4: 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