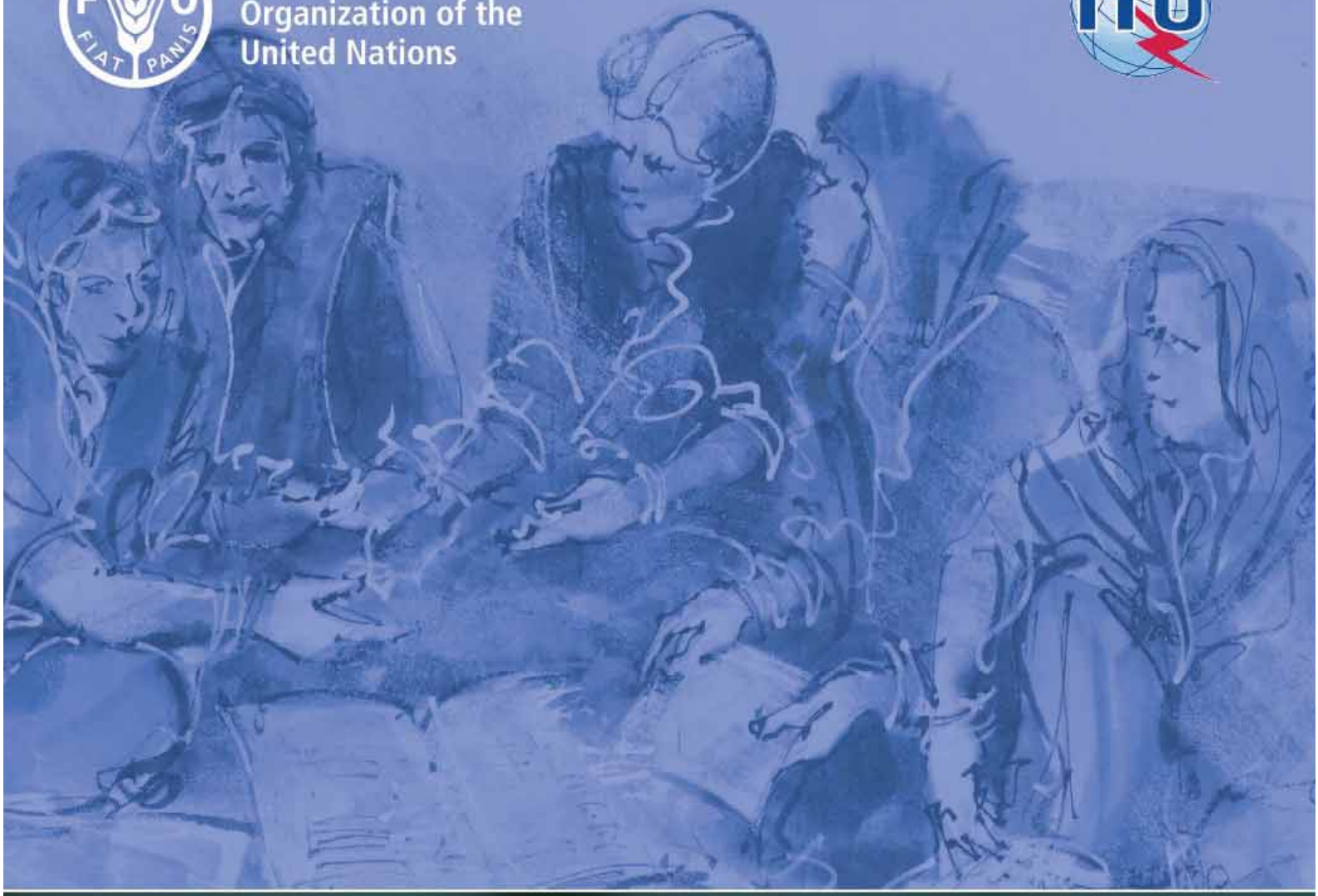
Food and Agriculture Organization of the United Nations



E-AGRICULTURE STRATEGY GUIDE

PILOTED IN ASIA-PACIFIC COUNTRIES

E-AGRICULTURE STRATEGY GUIDE

Piloted in Asia-Pacific countries

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FOREWORD

Agriculture is increasingly becoming more knowledge-intensive. Having access to timely, accurate information that is tailored to specific locations and conditions is critical in helping farmers make the most of their resources in often changing circumstances.

Over the past 15 years the information and communication technology (ICT) revolution has driven global development in an unprecedented way. Today ICTs are a transformative force for good in socio-economic development. We at FAO and ITU strongly believe that, with their enormous growth and reach, ICTs can empower people through improving their access to the latest and most useful agricultural techniques.

E-agriculture, or ICTs in agriculture, is about designing, developing and applying innovative ways to use ICTs in the rural domain, with a primary focus on agriculture. E-agriculture offers a wide range of solutions to some agricultural challenges.

Setting in place a national e-agriculture strategy is an essential first step for any country planning on using ICTs for agriculture. While the need for e-agriculture strategies is acknowledged by many stakeholders, most countries have yet to adopt a strategic approach in making the best use of ICT developments in agriculture. E-agriculture strategies will help to rationalize both financial and human resources, and address holistically the ICT opportunities and challenges of the agricultural sector while generating new revenues and improving the lives of people in rural communities. It will also help ensure that the goals of national agricultural plans are achieved.

This publication provides a framework for countries in developing their national e-agriculture strategies. These strategies would include an e-agriculture vision, an action plan, and a framework by which results can be monitored and evaluated. Like all strategies and plans, the outcomes of these processes are not static and changes in a country's strategic context will require a dynamic approach to updating the strategy so that it remains relevant.

Adopting a national approach to e-agriculture will result in improved livelihoods and incomes for people living in rural communities.

E-agriculture holds great potential in promoting sustainable agriculture while protecting the environment and finding an effective way to feed the world's population.

Kundhavi Kadiresan

Assistant Director General and
Regional Representative,
FAO Regional Office for Asia and the Pacific

Ioane Koroivuki

Regional Director
ITU Regional Office for Asia and the Pacific

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The E-agriculture Strategy Guide was developed under the FAO's TCP/RAS/3505 component 1: Development of E-agriculture Strategy Guide for Asia and the Pacific and the ITU's operational plan relating to ICT applications.

ACRONYMS AND ABBREVIATIONS

CARICOM	Caribbean Community
CSO	Civil Society Organizations
CTA	Technical Centre for Agricultural and Rural Cooperation
FAO	Food and Agriculture Organization of the United Nations
GFAR	Global Forum on Agricultural Research
GIS	Geographic Information System(s)
ICT	Information and communication technology
ICT4D	Information and communication technologies for development
IFFCO	Indian Farmer's Fertilizer Cooperative Limited
INGO	International Non-governmental Organization
ITU	International Telecommunication Union
IVR	Interactive Voice Response
KCC	Kisan Call Centre
M2M	Machine-to-Machine
M&E	Monitoring and Evaluation
MDG	Millennium Development Goals
MNO	Mobile Network Operators
MoA	Ministry of Agriculture
NGO	Non-governmental Organization
PC	Personal Computer
PDA	Personal Digital Assistant
RML	Reuters Market Light
SDG	Sustainable Development Goals
SMS	Short message service
TSP	Telecom Service Providers
TV	Television
UNFCCC	United Nations Framework Convention on Climate Change
VAS	Value-added service(s)
WSIS	World Summit on the Information Society

EXPLANATORY NOTES

Agriculture in this document is used in a broader sense and covers crop cultivation, animal husbandry, dairying, fisheries, forestry and other associated activities.

This guide consists of three parts to developing a national e-agriculture strategy – the vision development process (Part 1), action plan (Part 2) and a monitoring and evaluation (Part 3) component. However, countries may like to implement them in full or adopt only part of them based on their own unique circumstances and existing components of the strategy.

The figures, tables and annexes are numbered as Part.Chapter.Sequence to facilitate ease of reference. For example, Figure 1.2.1 would mean that it is part of Part 1, Chapter 2 and is the first figure in that chapter.

The E-agriculture Strategy Guide web space at http://www.fao.org/asiapacific/resources/e-agriculture will be constantly updated with improved tools and techniques to assist countries in developing their e-agriculture strategy.

INTRODUCTION

INTRODUCTION

Agriculture and information and communication technology (ICT)

Agriculture is a sector that holds great promise for pro-poor economic growth. Economic growth is a key success factor for reducing undernourishment, but it has to be inclusive and provide opportunities for improving the livelihoods of the poor. Enhancing the productivity and incomes of smallholder family farmers is the key to progress.[1] In fact, agriculture is around four times more effective at raising incomes among the poor than other sectors.[2] It has been amply demonstrated that enhancing the ability of farming communities to connect with knowledge banks, networks and institutions via information and communication technologies (ICTs) has improved their productivity, profitability, food security and employment opportunities substantially.[3] Agriculture also has significant linkage in its operations with other related sectors such as rural development, natural resource management, banking, insurance, media, governance, transportation and logistics management. Individuals, public enterprises and the private sector all have important roles to play in the agriculture sector. Agriculture in this document is used in a broader sense and covers crop cultivation, animal husbandry, dairying, fisheries, forestry and other associated activities.

The agriculture sector faces many challenges posed by climate change, loss of biodiversity, drought, desertification, increase in food prices and inefficient supply chains. The sector is increasingly becoming knowledge-intensive, and the availability of the right information, at the right time, in the right format, and through the right medium, influences and affects the livelihoods of many stakeholders involved in agriculture and related fields. The availability, accessibility and applicability of agricultural research outputs are keys to addressing a range of issues related to food security.

What is e-agriculture?

E-agriculture is seen as an emerging field focusing on the enhancement of agricultural and rural development through improved information and communication processes. In this context, ICT is used as an umbrella term encompassing all information and communication technologies including devices, networks, mobiles, services and applications; these range from innovative Internet-era technologies and sensors to other pre-existing aids such as fixed telephones, televisions, radios and satellites. E-agriculture continues to evolve in scope as new ICT applications continue to be harnessed in the agriculture sector.

More specifically, e-agriculture involves the conceptualization, design, development, evaluation and application of innovative ways to use ICTs in the rural domain, with a primary focus on agriculture. Provisions of standards, norms, methodologies, and tools as well as development of individual and institutional capacities, and policy support are all key components of e-agriculture.[4]

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[1] http://www.fao.org/hunger/key-messages/en/

[2] World Bank. 2008.

[3] World Bank 2011, Miller et al. 2013.

[4] http://www.fao.org/fileadmin/user_upload/kce/Doc_for_Technical_Consult/E-AGRICULTURE_-_English.pdf

The case for e-agriculture

Agriculture is increasingly knowledge-intensive and today's farmers live in a challenging milieu. There is a continuing need to provide the right information to the people who need to make the decisions that make the difference to their livelihoods and thereby ensure the food security of the ever growing population. Providing such knowledge can be challenging, however, because the highly localized nature of agriculture means that information must be tailored specifically to distinct conditions.[5]

ICTs have been a significant contributor to growth and socio-economic development in business sectors, countries and regions where they are well adopted and integrated. The large adoption and integration of ICTs have improved service delivery, created new jobs (while making some older ones less relevant), generated new revenue streams and saved money.

The rapid growth of mobile phone ownership globally provides new avenues to share and access information. About half of the world's population owns a mobile phone and this figure is much higher when children are not counted.[6] While in many farming communities many people with phones still rely on basic or feature phones, which offer mainly voice and text services, smartphone access is on the rise. The rapid growth of broadband (especially mobile broadband) and its increasing affordability provides a great opportunity for e-agriculture.

Many ICT interventions have been developed and tested around the world, with varied degrees of success, to help agriculturists improve their livelihoods through increased agricultural productivity and incomes, and reduction in risks. Some useful resources for learning about e-agriculture in practice are the World Bank's *e-sourcebook, ICT in agriculture – connecting smallholder farmers to knowledge, networks and institutions*[7] (2011), FAO's *ICT uses for inclusive value chains*[8] (2013), FAO's *Information and communication technologies for sustainable agriculture*[9] and *Success stories on information and communication technologies for agriculture and rural development*.[10] All the above publications as well as annex B documents several applications of technology and innovations that serve as useful reference material in the process of developing an e-agriculture vision. They also have a collection of initiatives, technologies and processes that hold great promise for agricultural and rural development. The policy briefs on the e-agriculture.org[11] platform are also valuable source of information.

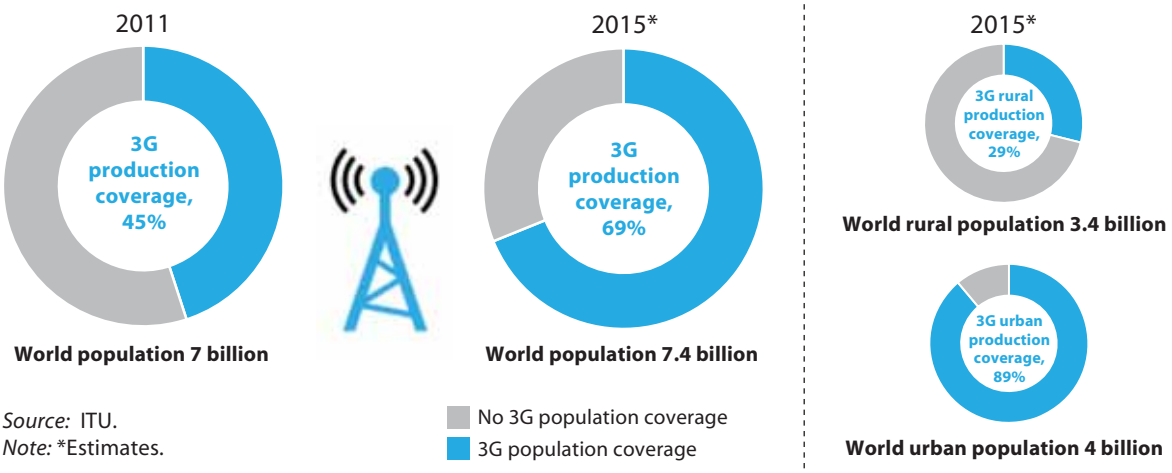
E-agriculture has been one of the main action lines of The World Summit on the Information Society (WSIS) implementation process. During the WSIS+10 high-level events in 2014, the meeting identified six major action points for e-agriculture beyond 2015 in its Outcome Document (Box A.1).

[5] Adapted from World Bank 2011. *ICT in agriculture: Connecting smallholders to knowledge, networks, and institutions.*
[6] GSMA Intelligence, as of November 2014.
[7] http://www.ictinagriculture.org/
[8] http://www.fao.org/docrep/017/aq078e/aq078e.pdf
[9] http://www.fao.org/docrep/019/i3557e/i3557e.pdf
[10] http://www.fao.org/3/a-i4622e.pdf
[11] http://www.e-agriculture.org/policy-briefs

Box A.1. WSIS+10 – action lines for e-agriculture[12]

- As part of national ICT strategies, foster the development and implementation of national e-agriculture strategies focusing on providing reliable and affordable connectivity and integrating ICTs in rural development to support food security and hunger eradication.
- Foster collaboration and knowledge sharing in agriculture via electronic communities of practice, including the e-agriculture Community, in order to showcase and promote models, methodologies, good practices and the adoption of Open Access and interoperability standards, for effective and equitable use of ICTs for sustainable agriculture and rural development.
- Promote the creation and adaptation of content including in local languages and contexts from reliable and trusted sources, including, ensuring equitable and timely access to agricultural knowledge by resource-poor men and women farmers, foresters and fisher folk in rural areas.
- Foster digital literacy of institutions and communities in rural and remote areas taking into consideration local needs and constraints by providing appropriate learning opportunities for all which will enhance individual and collective decision-making skills.
- Promote the use of ICTs to reinforce the resilience capacity of states, communities and individuals to mitigate and adapt to natural and man-made disasters, food chain challenges, socio-economic and other crises, conflicts and transboundary threats, diseases, and environmental damages.
- Promote Public-Private Partnerships in cooperation with relevant CSOs/NGOs, cooperatives, farmer organizations, academia, research institutions in the agricultural sector (which also includes forestry and fishery) for inclusive, efficient, affordable and sustainable ICT services and initiatives in agriculture and rural development which will promote the wide scale use of ICT and foster sustainable agri-business models.

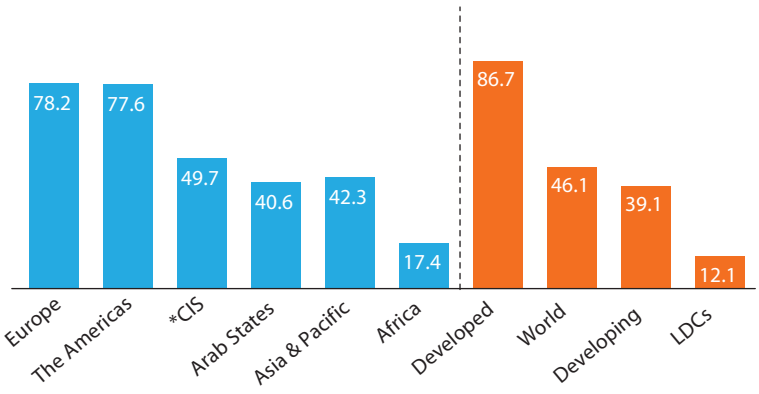
Figure A.1. 3G mobile-broadband coverage is extending rapidly into the rural area[13]



Source: ITU.
Note: *Estimates.

[12] http://www.itu.int/net/wsis/implementation/2014/forum/inc/doc/outcome/362828V2E.pdf
[13] https://www.itu.int/en/ITU-D/Statistics/Documents/facts/ICTFactsFigures2015.pdf

Figure A.2. Mobile broadband subscriptions



- Mobile-broadband penetration levels are highest in Europe and the Americas, at around 78 active subscriptions per 100 inhabitants
- Africa is the only region where mobile broadband penetration remains below 20 percent

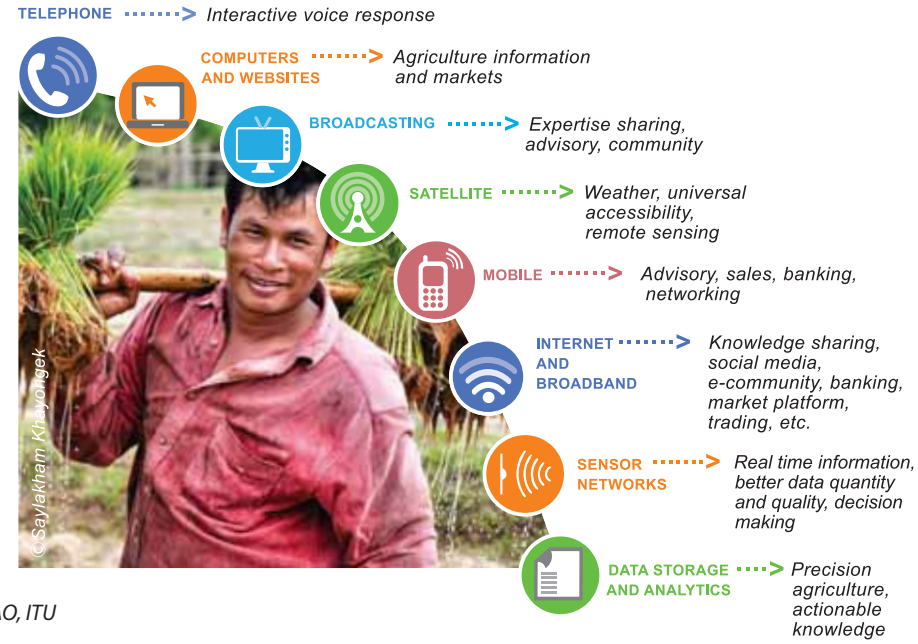
Source: *ITU statistics*[14]

The emphasis on ICT growth and its deployment continues as is reflected in the global telecommunication/ICT targets for 2020 (see Annex A.1 for details)[15] agreed by the International Telecommunication Union (ITU) members.

Potential benefits of e-agriculture across value chains

The rapid growth of ICT provides new avenues to share and access information. Digitization has provided the capability for convergence of these traditional network technologies and the emerging ones (e.g. Machine to Machine [M2M], Internet of Things [IoTs]), Cloud computing, Big Data and data analytics, etc.). These networks, when combined with data availability, required applications and the right enabling environment, can unleash the tremendous innovation potential of the agriculture sector responsibly (see figure A.3).

Figure A.3. ICTs in agriculture



Source: *FAO, ITU*

[14] https://www.itu.int/en/ITU-D/Statistics/Documents/facts/ICTFactsFigures2015.pdf
[15] http://www.itu.int/en/plenipotentiary/2014/Documents/final-acts/pp14-final-acts-en.pdf

Some of the characteristics of e-agriculture are provided in Table A.1, followed by more specific examples in the text that follows.

Table A.1. Some characteristics of e-agriculture benefits across value chains

Characteristics	Details	Examples
Transformation of processes	E-agriculture transforms the way actors in agricultural value chains collect, analyse, store and share agricultural information for their daily decision making purposes.	The Grameen Foundation's Community Knowledge Worker[16] programme in Uganda uses a mobile-based app integrated with a Web-based dashboard that enables the use of data for improved decision-making.
Investments	E-agriculture development stimulates investment in ICT infrastructure and human capital.	Taobao.com, China's largest online shopping platform has launched an agricultural channel.[17]
Efficient markets	E-agriculture leads to greater efficiencies in rural markets: lower transaction costs, less information asymmetries, improved market coordination and transparent rural markets. E-agriculture reduces wastage in various stages from the field-to-fork value chain. Around one-third of the food in the supply chain is either lost or wasted at the farm, during storage and distribution, or in households.[18] By facilitating real-time information exchange, e-agriculture can improve supply chain efficiency which can significantly reduce such food waste.	Esoko[19] offers a range of mobile-based monitoring tools, marketing solutions and advisory services aimed at making agriculture profitable for smallholders.
Improved vertical and horizontal linkages	E-agriculture results in the development of trust-based relationships between value chain actors. In conventional agri-value chains, intermediaries add to reduced transparency and thus increasing price manipulation resulting in mistrust. E-agriculture can help in reducing the layers of intermediaries and can make transactions unbiased and transparent, thus improving the trust factor.	e-Choupal links directly with rural farmers via the Internet for procurement of agricultural and aquaculture products. It also tackles the challenges posed by fragmented farms, weak infrastructure and the involvement of intermediaries.[20]

[16] Grameen Foundation's Community Knowledge Workers http://ckw.grameenfoundation.org/
[17] http://news.xinhuanet.com/english/2015-08/02/c_134472388.htm, accessed 5 August, 2015
[18] FAO. 2011. *Global food losses and food waste: extent, causes and prevention.*
[19] https://esoko.com/
[20] https://www.echoupal.com/

Table A.1. (continued)

Characteristics	Details	Examples
Facilitation of information-sharing networks	E-agriculture facilitates the development of networks for agricultural information-sharing and knowledge societies.	The online community e-agriculture.org[21] enables practitioners from around the world to share information with each other.
Value-added services	E-agriculture leads to the development of value-added services for rural farmers and other actors of the agricultural value chains.	The potential number of Agri VAS users has been forecasted to reach 80 million by 2020. Approximately 50 million of the users will be in South Asia and the remaining 30 million in Africa.[22]
Reducing individual and institutional risk	E-agriculture can be leveraged to reduce uncertainty and enhance preparedness and response to climate change, disasters and other agricultural risks.	Agriculture and Climate Risk Enterprise Ltd. (ACRE)[23] offers index-based crop insurance to farmers in East Africa, using ICT-enabled solutions.
Increased food and nutrition security and safety	E-agriculture can improve food management through efficient information flow, data gathering and analysis, traceability, transactions and supply chain management.	Farmforce[24] is a supply chain management tool that can be used to improve traceability, farmer management, and compliance.

E-agriculture creates opportunities for ICT-driven solutions to numerous agricultural problems.

Annex B has a list of example ICT innovations in agriculture and rural development

Many literatures exist on the ways in which ICTs assist in the agricultural value chain. The FAO publication *ICT uses for inclusive agricultural value chains*[25] classified it into three main areas – ICTs for production systems management, ICTs for market access, and ICTs for financial inclusion. The *ICT in Agriculture Sourcebook*[26] classified it into enhancing productivity on the farm, accessing markets and value chains and improving public service provision.

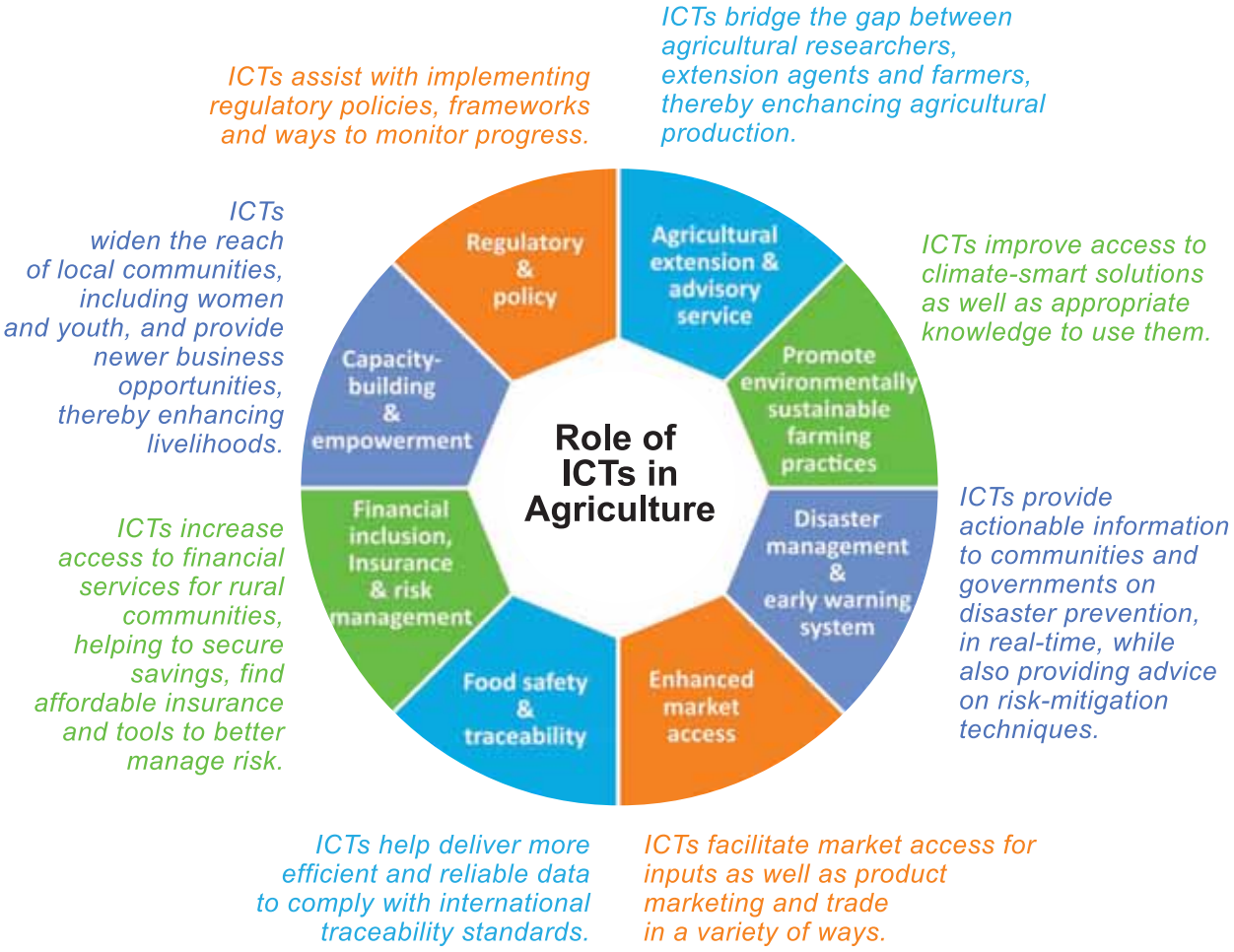
More specifically, e-agriculture has the potential to meet the agricultural goals of the country more effectively in the following areas:

- Agricultural extension and advisory services
- Promoting environmentally sustainable farming practices
- Disaster management and early warning system

[21] http://www.e-agriculture.org/
[22] https://gsmaintelligence.com/research/2015/02/market-size-and-opportunity-for-agricultural-value-added-services/478/
[23] http://www.syngentafoundation.org/index.cfm?pageID=562
[24] http://www.farmforce.com/
[25] http://www.fao.org/docrep/017/aq078e/aq078e.pdf
[26] http://www.ictinagriculture.org/

- Enhancing market access
- Food safety and traceability
- Financial inclusion, insurance and risk management
- Capacity building and empowerment
- Regulatory and policy

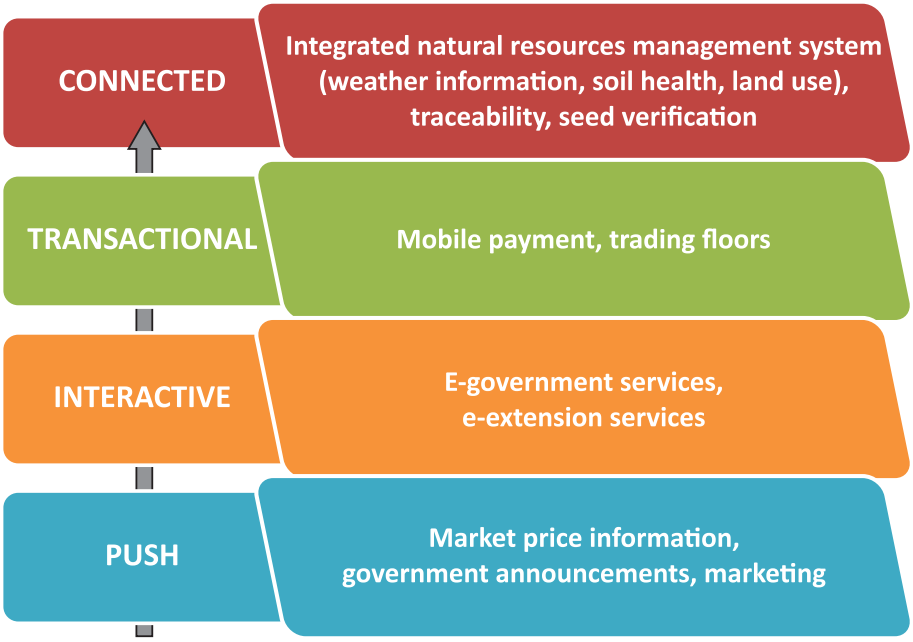
Figure A.4. The role of ICTs in agriculture



Source: FAO, ITU

The cross-sectoral nature of ICT propels growth in other sectors that can be further leveraged by agriculture communities. For example, use of data gathering and data analytics by weather departments can make micro-insurance more efficient. The deployment of mobile banking or mobile money by the telecom and banking sector can significantly ease financing, transactional, social safety and investment challenges.

Figure A.5. Types of information exchange and examples



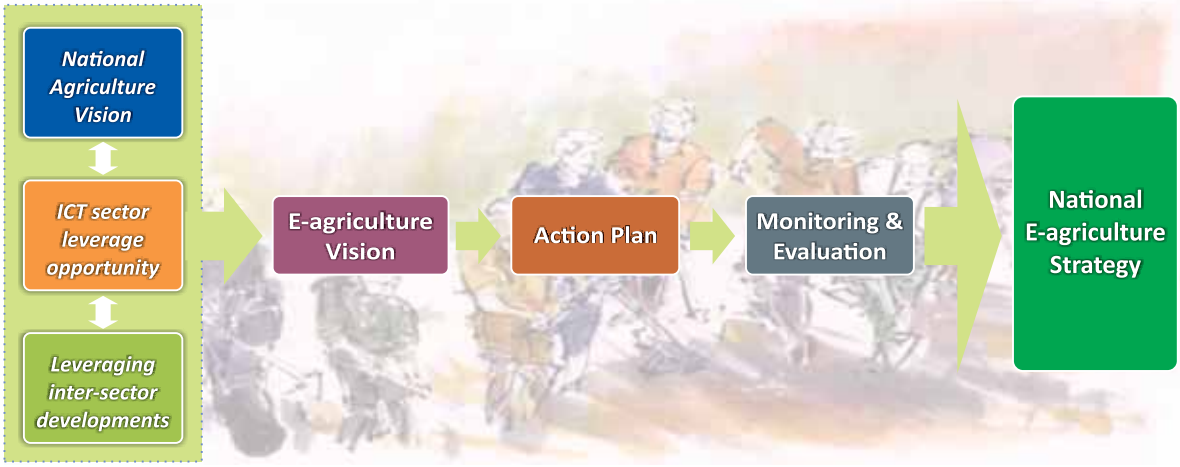
The need for a national e-agriculture strategy

The national e-agriculture strategy document provides an essential framework for developing or revitalizing a country's e-agriculture strategy in alignment with agricultural goals and priorities. It can be used equally by countries just setting out and those which have already invested significantly in e-agriculture. This latter group includes countries now seeking to build on promising results from pilot initiatives, to establish foundations for scaling up e-agriculture projects, or to update current strategies to reflect changing economic circumstances. Whatever the starting point, e-agriculture efforts can be strengthened, accelerated or aligned through a national strategic planning process.

An e-agriculture strategy and its alignment with other government plans will prevent e-agriculture projects and services from being implemented in isolation thereby increasing the sustainability and scalability of such initiatives.

The strategy guide is intended for use by agriculture sector managers/leaders in ministries, departments and agencies who will manage the development of an e-agriculture strategy in close consultation with other existing and potential stakeholders in the agriculture sector. These entities often may not fall under a single sector. It is therefore important to ensure that relevant stakeholders such as those who deal with ICTs, food processing, rural development, irrigation and water management, land allocation and classification, meteorological services, disaster management, transportation, e-governance, finance and commerce are involved and consulted as required in developing the country's e-agriculture vision. The successful application of the guide requires a team experienced in strategic planning, sectoral knowledge, analysis and communication.

Figure A.6. Methodology for developing a national e-agriculture strategy



The need for a national approach

A national approach to e-agriculture that has been developed in an inclusive manner, involving representatives of all agriculture and other stakeholders, will ensure that adequate capacity development needs are identified, awareness is raised and effective engagement of key stakeholders is achieved. In addition, this will also ensure that ICT access challenges (including their coverage, costs and quality) posing hindrances to the adoption of use of these tools, notably in rural areas, are identified and tackled at higher levels in a systematic manner. Specific policy measures and incentives can then be taken, so that agricultural stakeholders are able to benefit from the potential of e-agriculture at an affordable price.

A national approach will also help to improve the coordinated planning and funding of e-agricultural development, avoid duplication and the wastage of resources. ICTs for agricultural projects are sometimes duplicated in different ministries as well as by NGOs and service providers targeting the same stakeholders. It is also possible that ICT infrastructure developed for other sectors (e.g. e-governance) can also be leveraged for agricultural systems. Systematic effort in planning and setting up a national e-agriculture approach would result in streamlining of public and private sector efforts, ensuring the judicious use of scarce resources and providing a clear direction to the private sector, donors and other stakeholders.

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

Determining the appropriate e-agriculture approach

Given the complexity of the agriculture sector, some stakeholders may argue that the best approach to adopt is one focused on adopting an ICT strategy for a specific value chain segment/key agricultural activity. However, in order to maximize the potential from e-agriculture at a systemic level, a holistic e-agriculture approach is needed to clearly formulate a national vision and overall strategic objectives, to identify the e-agricultural priorities of the nation, to define the areas of intervention, as well as to define stakeholder responsibilities and necessary resources. This helps in providing a sense of common purpose and a framework for synergy amongst stakeholders at a national level.

Structure of this guide

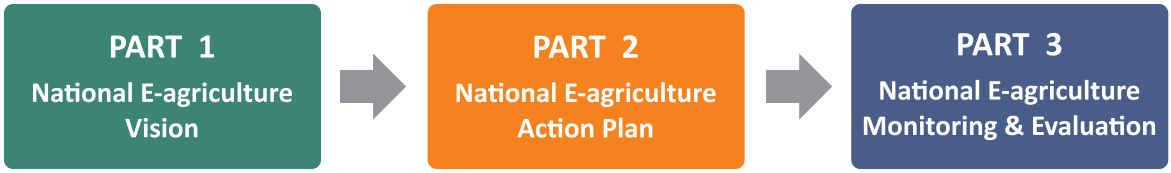
© Ashish Narayan

This guide supports the development or enhancement of a country's existing national e-agriculture strategy and is expected to facilitate achieving the country's agricultural goals and priorities in a timely, effective and efficient manner. The strategy has three parts:

Part 1: Establishing a national e-agriculture vision

Part 2: Developing a national e-agriculture action plan

Part 3: Monitoring and evaluating the implementation of the strategy



The ***first part*** of the guide consists of 10 chapters and focuses on developing the national e-agriculture vision.

- Chapter 1 gives an overview of e-agriculture, the elements of a national e-agriculture vision and the method of developing it;
- Chapters 2-3 describe how to manage the vision process and work with stakeholders;
- Chapters 4-9 provide a detailed guide to gathering and analysing information, preparing draft vision and strategic recommendations; and
- Chapter 10 provides guidelines on constructing and refining the e-agriculture vision and strategic recommendations.

Part 2 of the guide contains 4 chapters and deals with developing an e-agriculture action plan based on the e-agriculture vision developed in part 1.

- Chapter 1 deals with the need for developing a national e-agriculture action plan;
- Chapter 2 gives the steps involved in develop e-agriculture outputs and activities;
- Chapter 3 deals with developing an integrated action plan; and
- Chapter 4 assists with defining the implementation phases.

Part 3 of this guide provides guidance on establishing a national monitoring and evaluation framework.

- The introduction summarizes the outputs of Part 2 and how these relate to monitoring and evaluation;
- Chapters 1-2 cover the elements of a monitoring and evaluation framework, and the method by which the framework is developed; and
- Chapters 3-5 provide detailed guidance on defining a national monitoring and evaluation framework.

Annexes at the end of many of the chapters provide useful tools and templates for completing the activities suggested within each chapter.*

* Annexes are numbered as *Part.Chapter.Sequence*, example Annex *1.2.4 refers to the 4th annex in Part 1-Chapter 2*

ANNEX B.1. Connect 2020 Goals and Targets (source: ITU)[27]

Goal 1: Growth – enable and foster access to and increased use of telecommunications/ICTs

- **Target 1.1:** Worldwide, 55 percent of households should have access to the Internet by 2020
- **Target 1.2:** Worldwide, 60 percent of individuals should be using the Internet by 2020
- **Target 1.3:** Worldwide, telecommunication/ICTs should be 40 percent more affordable by 2020[28]

Goal 2: Inclusiveness – bridge the digital divide and provide broadband for everyone

- **Target 2.1.A:** In the developing world, 50 percent of households should have access to the Internet by 2020
- **Target 2.1.B:** In least developed countries (LDCs), 15 percent of households should have access to the Internet by 2020
- **Target 2.2.A:** In the developing world, 50 percent of individuals should be using the Internet by 2020
- **Target 2.2.B:** In LDCs, 20 percent of individuals should be using the Internet by 2020
- **Target 2.3.A:** The affordability gap between developed and developing countries should be reduced by 40 percent by 2020[29]
- **Target 2.3.B:** Broadband services should cost no more than 5 percent of average monthly income in developing countries by 2020
- **Target 2.4:** Worldwide, 90 percent of the rural population should be covered by broadband services by 2020[30]
- **Target 2.5.A:** Gender equality among Internet users should be reached by 2020
- **Target 2.5.B:** Enabling environments ensuring accessible telecommunications/ICTs for persons with disabilities should be established in all countries by 2020

Goal 3: Sustainability – manage challenges resulting from telecommunication/ICT development

- **Target 3.1:** Cybersecurity readiness should be improved by 40 percent by 2020
- **Target 3.2:** Volume of redundant e-waste to be reduced by 50 percent by 2020[31]
- **Target 3.3:** Greenhouse gas emissions generated by the telecommunication/ICT sector to be decreased per device by 30 percent by 2020[32]

Goal 4: Innovation and partnership – lead, improve and adapt to the changing telecommunication/ICT environment

- **Target 4.1:** A telecommunication/ICT environment conducive to innovation[33]
- **Target 4.2:** Effective partnerships of stakeholders in the telecommunication/ICT environment[34]

[27] http://www.itu.int/pub/S-CONF-ACTF-2014
[28] Cost of ICT services to be 60 percent of the 2012 value.
[29] Cost of ICT services comparing to the 2012 value.
[30] Due to data limitations, currently mobile-broadband signal coverage is considered in determining this target.
[31] Particularly for the targets framework, this target needs to be discussed at the ITU-T Study Group 5.
[32] Particularly for the targets framework, this target needs to be discussed at the relevant ITU Study Group.
[33] Target 4.1 is a qualitative target.
[34] Target 4.2 is a qualitative target.

National E-agriculture Vision

PART 1
ESTABLISHING A NATIONAL E-AGRICULTURE VISION

PART 1
National E-agriculture Vision

PART 2
National E-agriculture Action Plan

PART 3
National E-agriculture Monitoring & Evaluation

PART 1

ESTABLISHING A NATIONAL E-AGRICULTURE VISION

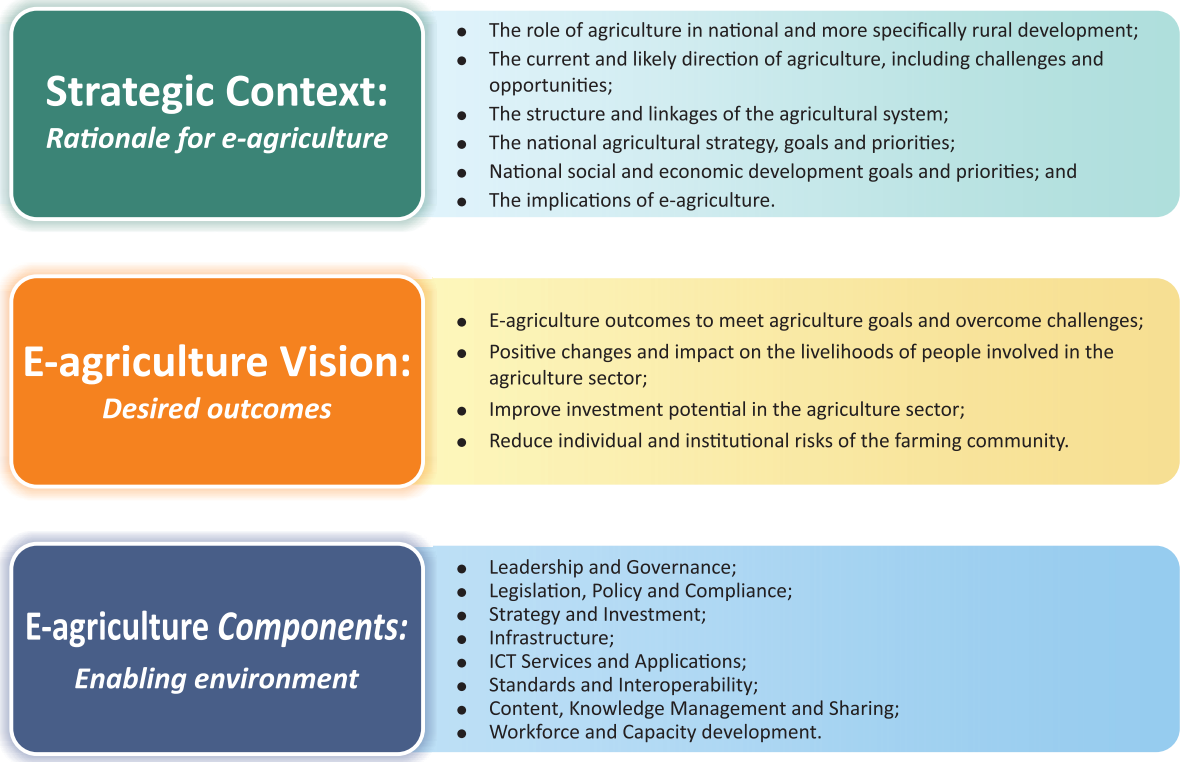
As ICTs and agriculture are cross-sectoral in character, an e-agriculture vision needs to harness the ICT potential for agriculture across multiple sectors while recognizing the varying expectations and roles of different types of stakeholders.

Establishing the national e-agriculture vision is the first step towards developing the national e-agriculture strategy. It takes into account the country's agricultural vision and priorities, the ICT sector leverage potential and other inter-sectoral developments (e.g. banking, e-governance) that have significant impact on agriculture (refer figure A.6).

This part deals with establishing a national e-agriculture vision.

CHAPTER 1 Framework for a national e-agriculture vision

Figure 1.1.1. A framework for a national e-agriculture vision



1.1 Strategic context (rationale)

A national e-agriculture vision emerges from the broader context of a country's agricultural, national and rural development goals, providing the rationale for why e-agriculture is needed. The importance of e-agriculture in the national context will depend on:

- The role of agriculture in national and more specifically rural development;
- The current and likely direction of agriculture, including challenges and opportunities;
- The structure and linkages of the agricultural system;
- The national agricultural strategy, goals and priorities;
- National social and economic development goals and priorities; and
- The implications of e-agriculture.

In particular an e-agriculture strategy is developed in the following context:

- To improve the agricultural system and improve value chain efficiencies;
- To leverage the growth of ICTs in agriculture and other linked sectors;
- To accelerate meeting agricultural and sustainable development goals and overcome challenges in a resource-efficient and timely manner; and
- To create new employment opportunities in rural areas through innovative entrepreneurship development using innovative ICT-based service businesses.

1.2 E-agriculture vision

The strategic vision describes a national agricultural system that has been enabled by e-agriculture. It shows how e-agriculture will be used to respond to the priorities and challenges of the agricultural system. It answers the question of what the future state of agriculture envisioned by the country will be and how e-agriculture will help in getting there.

At the national level, a strong vision statement is necessary that serves as a high-level message that agriculture and technology sector leaders can adopt and communicate to their respective stakeholders. It should be meaningful and understandable to important stakeholder groups, particularly in terms of what the vision will mean for them.

In summary, an e-agriculture vision is designed to meet the following outcomes:

- Attainment of agricultural goals and overcoming existing challenges;
- Positive changes and impact on the lives and work of stakeholders involved in the agriculture sector;
- Improved investment potential in the agriculture sector; and
- Reduced individual and institutional risks for farming communities.

1.3 Required components

The required e-agriculture components are the building blocks that need to be put in place to achieve the vision. Comparing the required components with the current e-agriculture environment shows what is already in place, and what is still needed. This will enable the formulation of strategic recommendations to be used as the starting point of a national e-agriculture action plan, which is the focus of Part 2.

The required components that need to be considered include:

- Leadership and governance;
- Strategy and investment;
- Services and applications;
- Infrastructure;
- Standards and interoperability;
- Content, knowledge management and sharing;
- Legislation, policy and compliance; and
- Workforce and capacity development.

Figure 1.1.2. Identifying required e-agriculture components

More information on how to identify the required e-agriculture components can be found in Part 1-Chapter 7.

1.4 Suggested structure and method

A successful outcome requires effective leadership, a well-managed process and stakeholder engagement (more information in Part 1-Chapter 3). A country's vision should be developed through an iterative approach, which ensures it is grounded in the current context, yet is not overly constrained.

A suggested structure for a national e-agriculture vision, which can be customized to individual country needs and context, is provided in Annex 1.1.1.

It is suggested to first develop an initial 'unconstrained' vision, based on a review of national and rural development goals, agricultural system goals, priorities and challenges, relevant international trends and good practices, the ICT sector leverage potential and other inter-sectoral developments that have significant impact on agriculture. Next, the vision can be refined based on an analysis of the current e-agriculture enabling environment, feasibility of implementation, opportunities and gaps.

The following chapters of this part of the guide provide a methodology for effectively completing this process:

- Manage the vision development process (Chapter 2);
- Stakeholder engagement process for e-agriculture (Chapter 3);
- Strategic context for e-agriculture (Chapter 4);
- Learning from e-agriculture trends and practices (Chapter 5);
- Draft an initial vision (Chapter 6);
- Identify the required e-agriculture components (Chapter 7);
- Gather information on the current e-agriculture environment (Chapter 8);
- Assess opportunities, gaps, risks and barriers (Chapter 9); and
- Refine the vision and develop strategic recommendations (Chapter 10).

ANNEX 1.1.1. Suggested structure for a national e-agriculture vision document

Title
Foreword
Purpose
Audience
How to read this document
Executive summary

1. Strategic context for e-agriculture

1.1 Agricultural system status
1.2 Agricultural and development goals and challenges
1.3 Status of ICT networks and services
1.4 E-agriculture status, challenges and opportunities
1.5 Potential applications of ICTs to improve agricultural system efficiencies and services

2. Vision for e-agriculture

2.1 National e-agriculture vision
2.2 E-agriculture expected outcomes
2.3 Changes and impact on stakeholders (individuals and institutions)

3. E-agriculture Components

3.1 Leadership and governance
3.2 Legislation, policy and compliance
3.3 Strategies and innovation
3.4 Infrastructure
3.5 Standards and interoperability
3.6 ICT services and applications
3.7 Content, knowledge management and sharing
3.8 Workforce and capacity development

4. Strategic recommendations

[Note: Strategic recommendations generally comprise only those recommendations that cannot be reversed without significant loss of resources]

CHAPTER 2 Manage the vision development process

This chapter focuses on the processes involved for effectively managing the development of a national e-agriculture vision.

Effective leadership and governance improve transparency and credibility, facilitate guidance, provide ownership and ensure that mechanisms for approving, endorsing and owning the national e-agriculture vision are in place. Effective management ensures that the process is undertaken in a structured and timely manner with the inclusion of appropriate stakeholders.

The process requires establishing or ensuring:

- High-level agriculture sector leadership and support;
- High-level support from the ICT sector;
- Appropriate governance structure and mechanisms;
- A multidisciplinary project team with the requisite skills and expertise; and
- An agreed timeline and resources for completing the work.

Outputs

The output would be a governance structure with well-defined processes and protocols that supports the development of a national e-agriculture vision.

2.1 Agriculture leadership and support

Significant reform or transformation initiatives require sustained leadership and commitment from senior government officials, and agriculture and ICT sector leaders.

The strategy development and implementation process will benefit from a credible and respected leader, or leadership team, which actively and visibly champions the effort. This sends a clear message that the national e-agriculture vision is being driven by the agriculture sector with support from other sectors that manage critical inputs to agriculture. The leadership team will also be responsible for securing any funding and resources required to develop the e-agriculture vision, and assisting in resolving major issues and challenges that may arise during its implementation.

Given the central role of ICT in e-agriculture, the ministry and regulators dealing with ICT should also be co-drivers of the vision. Depending on the national conditions, inputs may also be needed from financial (banking, insurance, risk management), disaster management, governance, meteorological, media and educational sectors as appropriate. In some countries, agriculture may already be explicitly mentioned in their national policies for ICT. Examples of this include Bangladesh's National ICT Policy[35], Malawi's National ICT for Development Policy[36] and Zambia's National Information and Communication Technology Policy[37]. Côte d'Ivoire is an example of one country that has already begun the process of developing a specific e-agriculture strategy that builds off of its national ICT policy. In this context CTA provides interesting analysis about Côte d'Ivoire's agricultural strategies.[38]

2.2 Governance structure and mechanisms

The governance structure and roles should be set up early in the vision development process to gain credibility, coordinate efforts and establish the necessary expert and reference groups. A governance mechanism is a committee, council, task force or special group that has the mandate or responsibility to perform one or more of the following functions:

1. Oversight and steering.
2. Subject-matter (expert) input across domains such as:
   - National agricultural system and services delivery, including the agricultural workforce and budget;
   - National agricultural strategy and policy;
   - Current ICTs and e-agriculture environment; and
   - Other aspects including national infrastructure, telecommunications, workforce development, education, finance, governance, irrigation and water management, disaster management, meteorology, etc.; and
3. Stakeholder engagement and consultation.

[35] http://www.bcs.org.bd/img/upload/page/11.pdf
[36] http://unpan1.un.org/intradoc/groups/public/documents/unpan/unpan033688.pdf
[37] http://unpan1.un.org/intradoc/groups/public/documents/unpan/unpan032690.pdf
[38] http://ictupdate.cta.int/Feature-Articles/e-agriculture-strategies-the-case-of-Ivory-Coast/%2873%29/1377173497

The structure, reporting or accountability mechanisms can be flexible depending on the organizational or ministerial structure, and the desired management of the process. Figure 1.2.1 provides an example of a governance structure, and a description of roles is given in Table 1.2.1. The joint efforts of both agriculture and ICT sectors are required for successful launching of an e-agriculture vision. However, it is recommended that the key leadership and ownership should rest with the agriculture sector.

Figure 1.2.1. Sample e-agriculture governance structure

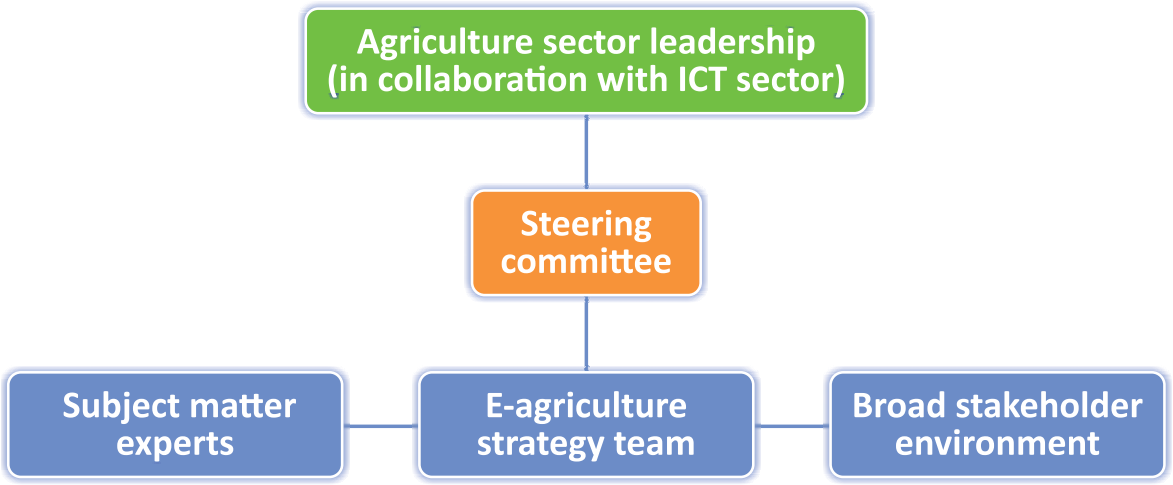


Table 1.2.1. Examples of governance functions, responsibilities and composition

Group	Responsibilities	Composition
Agriculture sector leadership in collaboration with the ICT sector	• Gives overall direction, oversight and mandate; • Secures spending authority and resources; • Acts as the vocal and visible champion; • Assists with resolution of major issues, problems, conflicts and other challenges; and • Approves, endorses and owns the national e-agriculture vision.	Senior-level agricultural and ICT sector decision-makers, such as the Minister or a senior bureaucrat in the Ministry of Agriculture and Ministry of ICT and/or regulatory authority.
Steering Committee	• Acts individually and collectively as a vocal and visible champion through its representative organizations; • Provides direction and guidance to other groups; • Plans and manages the vision development process; • Makes decisions at key stages of the process; • Organizes information gathering, analysis and drafting of the national e-agriculture vision;	Those individuals who should be involved in making decisions in relation to development of the national e-agriculture vision, the acceptance of the vision, and the progression of its recommendations, including representatives from ministries and sector regulators (agriculture, ICT, finance, commerce, governance,

Table 1.2.1. (continued)

Group	Responsibilities	Composition
	• Assists in addressing risks, resolving issues and conflicts; • Oversees overall progress, and approves changes to scope or approach; and • Provides support in policy and advocacy.	meteorology, etc.). Representatives of industry could be considered.
Subject-matter experts and advisory groups	• Provide guidance on the development of outcomes and recommendations, and support the development of the national e-agriculture vision; • Assist in identification of existing or planned e-agriculture components, and their re-use or sharing; • Provide recommendations on specific reforms; • Provide insights into the implications of strategic directions and recommendations for the stakeholder groups; • Review and provide feedback on findings, conclusions and draft deliverables; • Help in service design and define user experience according to the target group; and • Define information management standards (such as entity definition, metadata standards etc.).	Includes input from academics, thought leaders and representatives from the agriculture sector, ICT sector, other concerned sectors and farmers' organizations. Not involved directly in decision-making but able to exert a high degree of influence due to their acknowledged expertise in the field and/or their role as formal or informal advisors to key decision-makers.
Broad stakeholder environment	• Responsible for soliciting broad stakeholder input to the development of the national e-agriculture vision; • Piloting of proof of concept; and • Provide feedback on deliverables that have been shared or published.	Involves input from individuals and organizations that are impacted by, or have a particular interest in e-agriculture and the outcomes of the process.

2.3 E-agriculture strategic team composition

The complexity of the nation's agricultural system and the associated stakeholder environment will determine the number of individuals required in each group. Ideally, this should range from between five and ten people. This is particularly the case for the e-agriculture vision team as the effort associated with coordinating, management and consultation is directly related to the complexity and size of the stakeholder environment.

This guide takes a project-based approach to the development of a national e-agriculture vision, which is a complex undertaking requiring knowledge and expertise across several disciplines, sectors and ministries. At a minimum, the core strategy team should have domain

expertise, and can draw from other government agencies and the private sector as required. Senior agriculture and ICT sector, ministerial or government representatives should also be a part of the team.

Individuals involved in the development of an e-agriculture vision should include or have access to the following skills, knowledge and expertise:

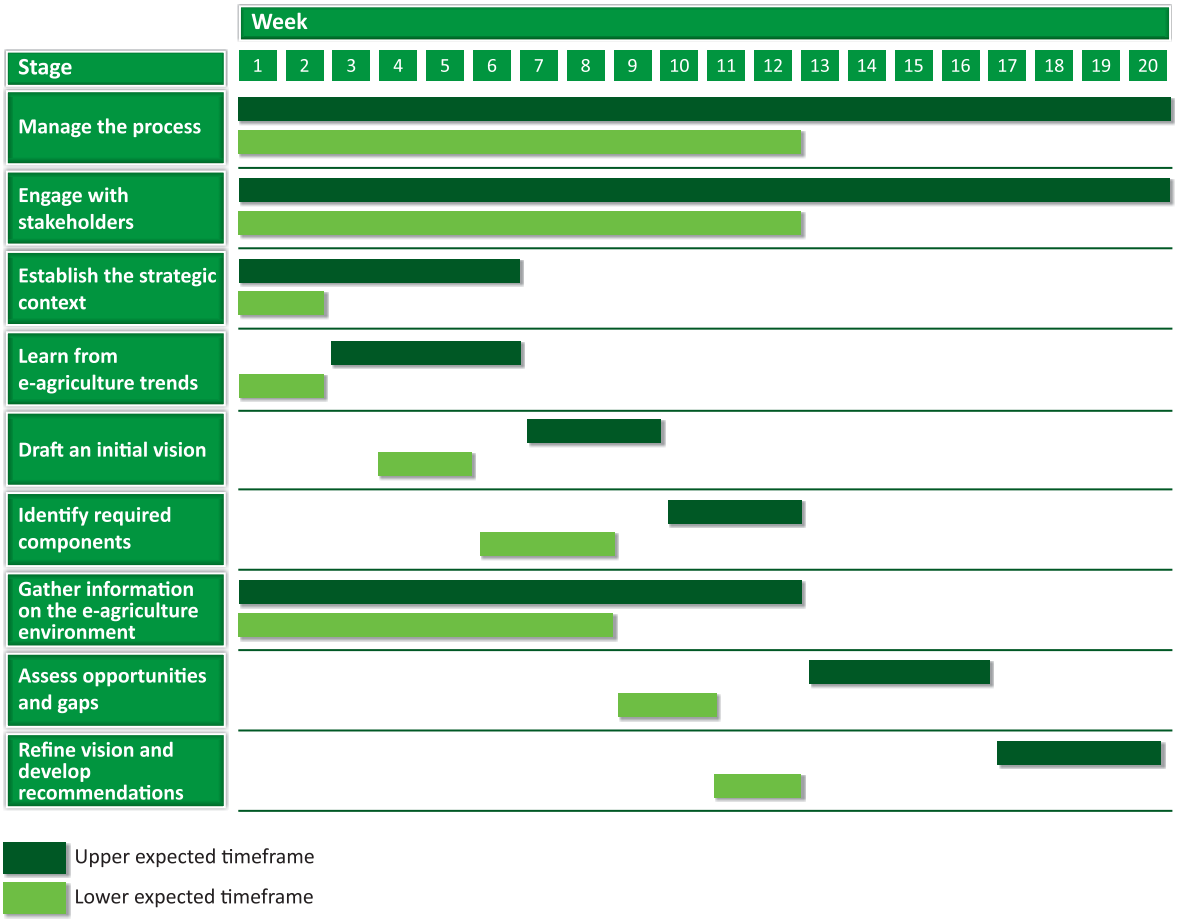
- Deep understanding of national agriculture sector needs and challenges;
- Ability to research, analyse and extract lessons from international programmes and projects;
- Strategic analysis, planning skills and experience at the national level;
- Broad experience in working with stakeholders and communicating with broader constituencies;
- Knowledge of the ICT industry, e-agriculture, its components and its application in the sector;
- Broad knowledge of financing (banking, insurance, risk management, investment), disaster management, local-level administration processes, irrigation and water management, meteorological and weather information applications in agriculture;
- Awareness of gender aspects and the changing role of women and youth in ensuring food security and using ICTs;
- In-depth knowledge of existing and emerging ICTs, standards and services; and
- Knowledge and experience of other e-strategies being adopted in the country (e.g., e-governance, e-education, e-health, etc.)

2.4 Timeline and milestones

The time frame for developing a national e-agriculture vision can vary significantly, based on factors such as the size, structure and diversity of the agricultural system, the level of engagement and support sought for the scope of the strategy and the resources available for the process. Developing a realistic plan and monitoring and updating it regularly are important for successful management and implementation. Taking time to develop this plan enables the team to understand the expectations of the steering committee and decision-makers, and to keep them informed as the process progresses. It also helps to forge a common view across the team, facilitates coherence between different strands of the process and helps to anticipate long lead-time activities.

Planning for internal (team) coordination and communication, project documentation and management should be conducted at an early stage. The duration and the timelines required for developing the e-agriculture vision are given in Figure 1.2.2.

Figure 1.2.2. Sample timelines for developing a national e-agriculture vision



CHAPTER 3 Stakeholder engagement approach

Engaging with and properly understanding the perspective of different stakeholders involved in the e-agriculture ecosystem is essential for building an e-agriculture vision. Stakeholders cover a broad range of actors, including government agencies (departments and regulators), the private sector, media, farmers, development agencies, business associations, research institutes, academia, experts, NGOs and other entities. Receiving the inputs, engagement and endorsement of this diverse range of stakeholders is crucial to setting a national e-agriculture vision. Success of this process greatly depends on the right administration of stakeholder mapping and engagement. The priorities and interests of strategic stakeholders should be considered in order to align the e-agriculture vision with stakeholder interests and expectations, as well as with broader national development goals.

This chapter focuses on gaining the active involvement and support of stakeholders, which will be required to develop and implement the country's e-agriculture vision.

Given the wide range of stakeholders and their diverse needs, managing the engagement process can be quite complex and sensitive. It requires:

- Identifying all of the potential stakeholders, including organizations, groups and individuals, that might have a role to play in the formulation and implementation of the national e-agriculture vision;
- Understanding the potential role and interests of different government agencies and other relevant stakeholders in the development of the national e-agriculture vision, along with their incentives for participating;

- Developing a pragmatic approach to managing and engaging with different segments, taking into account their role, influence, knowledge and expertise;
- Developing a clear communication process to make sure that all stakeholders are sufficiently and consistently engaged and informed, including defining the points at which consultation will occur and identifying the expected inputs/outputs from each of those consultation points; and
- Developing clear value propositions for the individual stakeholders and also how these converge into a common value proposition (e.g. mobile network operators may be interested in mass out-scale which gives them more subscribers and/or increased revenue while researchers may be interested in small researchable niches; both of which converge when there are many such niches and combine into a larger addressable market segment).

Outputs

The output of this exercise is a clear and cohesive stakeholder engagement approach, which will contribute to an e-agriculture vision that is relevant to, and broadly supported by, all stakeholders.

3.1 Identifying stakeholders

The objective of this step is to identify the relevant stakeholders from the agriculture and other relevant sectors that would have a role to play in developing the national e-agriculture vision. This process will identify all of the relevant stakeholders at all levels of society.

Within the agriculture sector, consider including representatives from the following stakeholder groups:

- Government ministries, such as agriculture, food, fisheries, livestock, irrigation, etc.;
- Private sector agribusiness including agro-entrepreneurs;
- Academia (agricultural universities);
- Agricultural research organizations (both local and international);
- Development agencies and NGOs/INGOs working directly on agricultural projects;
- Specialized financial institutes for agriculture;
- Media (working in the field of agriculture);
- Mobile network operators (MNOs)/telecommunication service providers (TSPs) with e-agriculture services;
- Business associations and professional bodies;
- Certification authorities;
- E-agriculture service providers;
- Farmers' associations and cooperatives;
- Women and young farmers to ensure representation of women and youth; and
- Agro-entrepreneurs, agribusinesses, and other rural marketers.

Other stakeholders outside of the agriculture sector may also play an important role in framing the national e-agriculture vision. Some stakeholders may directly affect the ability to effectively implement the national e-agriculture vision (such as the ICT ministry, telecommunication regulator, IT solution companies, and telecom service providers [TSPs]), while others may have a more indirect role. Potential stakeholders from non-agriculture sectors include:

- Government ministries and regulators, such as ICT/telecommunications, finance, commerce, e-governance agencies, rural development and other sector regulators (e.g. banking, insurance, disaster management, etc.);
- Mobile network operators/TSPs;
- Non-agricultural research organizations;
- Industry associations (e.g. ICT, banking, etc.);
- Financial institutions (banks, insurance companies, micro-finance institutions [MFIs]);
- National statistics bureaus;
- NGOs/INGOs working outside agriculture in sectors that impact agriculture;
- Arbitration authorities; and
- Media.

When identifying potential stakeholders, it is also important to think about individuals who are not organized, but whose interests should be considered, and how to engage with them. Examples include village knowledge workers (VKW) or knowledge intermediaries, as well as farmers who are not part of established associations or cooperatives.

The stakeholder mapping matrix in Annex 1.3.1 is useful to provide details about the name of each potential stakeholder group, its category and its likely relevance to the national e-agriculture vision. The remaining columns in the matrix will be completed as part of the next step. It is important to treat this list as a living document.

3.2 Understand the potential role and interests of stakeholders

The strategy development process can vary considerably depending on the country context and the role of the government and other key stakeholders. Having already identified potential stakeholders, this step will assist to determine what role each stakeholder will play in contributing to the strategy development process. Carefully considering the role of different stakeholders is crucial to gaining broad input to and acceptance of the national e-agriculture vision. It is important that the role of each stakeholder group is linked with the capability to contribute and engage, as well as being consistent with their interests.

Table 1.3.1 outlines how the role of stakeholders may vary depending on the extent of government involvement and the general regulatory environment of the country as it pertains to e-agriculture.

Table 1.3.1. Implications on vision development based on the level of government involvement

Market	Description	Implications for vision development
Government-driven	Government drives the development and adoption of e-agriculture from a central mandate. E-agriculture is generally implemented through large-scale national or state programmes and projects.	• Government is responsible for developing the national e-agriculture vision; and • Government consults with relevant stakeholders to ensure that the national e-agriculture vision is representative of broader stakeholder needs.
Market-driven	Government provides no central authority or governance over the development of the national e-agriculture environment. There is heavy reliance on external parties to cooperate and collaborate with each other to develop the national e-agriculture environment.	• Government is responsible for developing the national e-agriculture vision; • Government facilitates the process by which stakeholders are brought together to develop the national e-agriculture vision; and • Government does not provide significant input or content, but may play a facilitating and advisory role to assist in the development of the national e-agriculture vision, which different stakeholders will endorse.
Hybrid	Government provides central coordination of e-agriculture in areas of national significance. There is greater flexibility and reduced central control and regulation in areas where the agriculture sector and market are best positioned to play a role in developing the e-agriculture environment.	• Government is responsible for developing the national e-agriculture vision; • Government works with stakeholders to develop the strategic context, vision and supporting recommendations. Stakeholders may provide subject-matter expertise on the current and future e-agriculture environment; and • Content of the plan is driven by both the government and relevant stakeholders.

Stakeholders may also be characterized by the role, contribution, level of influence and interest that each is likely to have in the development of the national e-agriculture vision. Understanding these aspects will enable strategic engagement of key groups at the right points in the process. Figure 1.3.1 and Table 1.3.2 illustrate the different types of stakeholders and their potential role in the e-agriculture vision development process.

Figure 1.3.1. Four common stakeholder roles involved in developing a national e-agriculture vision

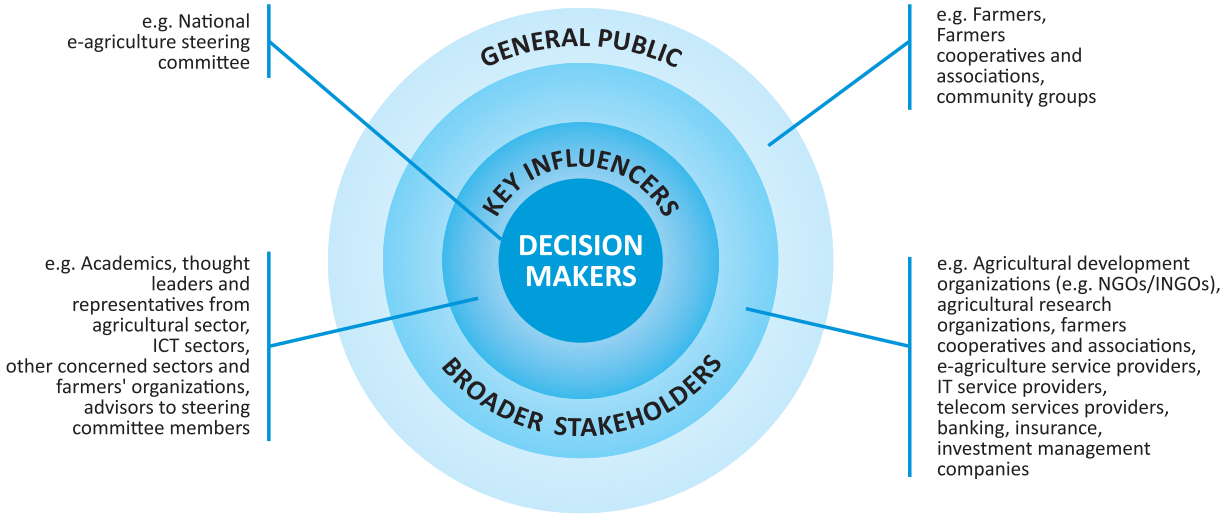


Table 1.3.2. Stakeholder roles in a national e-agriculture vision

Role	Description	Examples
Decision-makers	They set the overall vision and strategic direction, guiding the vision and planning process. They are responsible for approving, endorsing and owning the national e-agriculture vision and carrying out strategic recommendations.	Senior-level agriculture and ICT sector decision-makers (e.g. minister, vice-minister, secretary or a senior bureaucrat in the ministry of agriculture and ministry of ICT); National e-agriculture steering committee; Other government committees or councils to which the steering committee reports (e.g. the steering committee may be a subset of a broader agricultural and/or ICT council); Representatives from ministries and sector regulators (finance, governance, meteorology, etc.); and Representatives of industry and agriculture could be considered.
Key influencers	They are not involved directly in decision-making but are highly influential in decisions relating to the national e-agriculture vision. This is due to their acknowledged eminence, enhanced stake and expertise in the field as well as their roles as formal or informal advisers to key decision-makers.	Academics, thought leaders and representatives from the agriculture sector, ICT sector, other concerned sectors and farmers' organizations. Not involved directly in decision-making but able to exert a high degree of influence due to their acknowledged expertise in the field and/or their role as formal or informal advisors to key decision-makers; and

Table 1.3.2. (continued)

Role	Description	Examples
		Sometimes structured in the form of an expert advisory group, which is a small group of industry, sector or issue experts who are asked to provide technical input and advice on a specific issue or a cluster of issues.
Broader stakeholders	They are a source of subject-matter expertise and have a strong interest in the national e-agriculture vision because of the impact it will have on them and/or their organizations.	Agricultural development organizations (e.g. NGOs/INGOs); Agricultural research organizations; Farmers' cooperatives and associations; E-agriculture service providers; TSPs; Banking, insurance, investment management companies; Input suppliers; Agro commodity traders; and Rural marketers.
General public	There may be sections of the general public who are aware of developments in e-agriculture and are interested in the potential impacts on them. There may also be a requirement to ask the general public to provide input or endorsement of components of the national e-agriculture vision.	Farmers; Farmers' cooperatives and associations; and Community groups.

The tables present only potential scenarios. It is important to clarify the likely contributions, value propositions, interests, incentives and expectations of the relevant stakeholders. It is recommended to spend a substantial amount of time in this process as it will require speaking with different stakeholder groups to hear their perspectives and how they envision their potential role. Answer the following questions for each potential stakeholder group:

- What incentives do they have for participating? How to best obtain their buy-in?
- What are the existing stakeholder processes and how are they affected by e-agriculture?
- What potential role do they envision for themselves as part of the strategy development process?
- What expertise and/or resources may be available for the present strategy development process, as well as for implementation of the action plan?
- How important and influential is each group?
- How supportive is each group of the process? Who will serve as their primary point of contact during the strategy development process and action plan implementation?

The responses to each of these questions will enable the completion of the rest of the stakeholder mapping matrix. Understanding the different stakeholders makes it possible to determine the level, focus, frequency and medium of engagement to use. Their interests, level of influence and potential contribution should be well understood before determining what each of their roles will be.

Understanding stakeholder interests and capabilities is useful not only for the strategy development process, but will also be required for Part 2, implementation planning.

The strategy team will need to decide how to prioritize its efforts and how to engage most effectively, particularly with those stakeholders most capable of influencing the strategy and its implementation. Achieving buy-in for the national e-agriculture vision is as critical as serving the intended beneficiaries of this strategy.

3.3 Determine the approach to stakeholder engagement

Each stakeholder group requires a distinct approach to engagement and consultation, taking into account its role (Table 1.3.3). Once this has been determined, it can also be used to plan where stakeholders will be consulted, communicated with and informed during development of the vision.

Stakeholder engagement should be linked to a communications plan that sets out what and how the project team will communicate about the project, including with the media. Mass media outlets may be the only means by which the general public is informed and influenced about it, so these outlets are particularly important if a high public profile is sought. National media or specialized agricultural or rural media may express interest at any stage. Social media, such as Facebook, YouTube, Twitter and other mobile-based messaging apps are increasingly becoming viable options for reaching large audiences, although they are limited to only those people with Internet access. A number of video-based technologies and services can be enabled with the proliferation of broadband (especially mobile broadband).

Communications with other key groups should be designed according to their level of interest, expertise and support. Channels of communication and the way content is framed should reflect the goals of working with the particular stakeholder group and will link to a later step of this process, when the benefits to stakeholders are outlined. It is important to carry out your stakeholder engagement in a transparent and inclusive manner in order to gather sufficient input, build consensus and ensure the quality of the overall strategy.

Table 1.3.3. Sample stakeholder engagement approach

Role	Approach to engagement
Decision-makers	Frequent and formal contact to seek input and guidance, present material for final review and seek acceptance and endorsement of recommendations. A positive confirmation may be sought.
Key influencers	Frequent and more informal contact to seek input and guidance and assistance in forming key directions and recommendations.
Broader stakeholders	Initial consultation through industry associations and trade bodies (e.g. chambers of commerce), telecommunication associations followed up with structured outward communications at appropriate intervals to advice on the process and outcomes.
General public	May be managed through mass media or online/mobile-based questionnaires and surveying techniques. These enable publication of material such as a summary of the e-agriculture vision, and seek input from the general public through a questionnaire, poll or survey. Generally, face-to-face consultations with the general public are not required during the development of the national e-agriculture vision and action plan, although public consultation forums can be used if needed.

3.4 Develop a stakeholder consultation plan

The project team should develop a stakeholder consultation plan that describes in detail how, when and for what purpose stakeholders will be engaged. This is important to ensure that all stakeholders have an understanding of what will be expected from them along with relevant timelines. A high-level example is provided in Table 1.3.4.

The final plan should take into account the availability of stakeholders, and in particular seek to reduce the number of consultations, interviews and discussions that need to be held with the same stakeholder. This may be accomplished over a number of interactions (Table 1.3.5), and completed in a time-bound manner (three to five months). The stakeholder consultation plan worksheet provided in Annex 1.3.2 can be used to keep track of the approach.

Table 1.3.4. Types of consultation with stakeholders during each stage

Stage	Decision-makers	Key influencers	Engaged stakeholders	Broader stakeholders and the general public	Indirect beneficiaries
Establish the strategic context for a national e-agriculture vision	Consulted to gather input required to develop the strategic context for national e-agriculture; and Review and endorse strategic agricultural system goals and challenges.	Consulted to gather input required to develop the strategic context for national e-agriculture.	Consulted to gather input to understand the challenges facing farmers and other stakeholders within agricultural value chains.	May be consulted to gather general public views on agricultural system challenges that e-agriculture could be used to resolve.	Obtain the business vision of the particular industry segment and how the e-agriculture vision synchronizes with it.
Identify relevant e-agriculture trends and best practices	Consulted to identify international jurisdictions and projects that should be considered or explored as part of research activities.	Consulted to identify international jurisdictions and projects that should be considered or explored as part of research activities.	May be consulted as part of identifying compelling uses of e-agriculture in similar nations and geographical regions.	May be consulted to learn about what types of e-agriculture services and products they are already using.	Analysis of the existing processes of the respective industries (e.g. how commodity traders procure agro commodities).
Construct an initial vision for national e-agriculture	Review and endorse the time frame for the national e-agriculture vision; Consulted to provide input into the initial national e-agriculture vision; and Review and endorse the initial national e-agriculture vision.	Consulted to provide input into the initial national e-agriculture vision; and Consulted to provide input into and shape scenarios that put the e-agriculture vision into practice.	May be consulted as part of refining scenarios that put the e-agriculture vision into practice; May be provided with an overview of the initial e-agriculture vision to which they can provide feedback and comments.	May be provided with a high-level overview of the initial e-agriculture vision for reaction.	Active consultation with industry associations and trade bodies.

Table 1.3.4. (continued)

Stage	Decision-makers	Key influencers	Engaged stakeholders	Broader stakeholders and the general public	Indirect beneficiaries
Identify the required e-agriculture components	Consulted to provide input into required e-agriculture components; and Review and endorse required e-agriculture components.	Consulted to provide input into and review required e-agriculture components.	Consulted to provide input into and review required e-agriculture components.	N/A	Review and endorse relevant e-agriculture components.
Gather information about the current e-agriculture environment	Consulted as part of identifying existing or planned e-agriculture components within the nation's current e-agriculture environment.	Consulted as part of identifying existing or planned e-agriculture components within the nation's current e-agriculture environment	Consulted to identify existing or planned e-agriculture components	Consulted to learn about what types of e-agriculture they are already using	Consulted to gather information about the existing process and process gaps (identified and hidden)
Assess the current state of e-agriculture for opportunities, gaps and barriers	Consulted as part of assessment of existing or planned e-agriculture components within the nation's current e-agriculture environment; and Review and endorse assessment outcomes (i.e. re-use and sharing opportunities, gaps, risks and barriers).	Consulted as part of assessment of existing or planned e-agriculture components within the nation's current e-agriculture environment; and Provide input on potential areas of mutual benefit for telecommunications, IT companies, and agricultural stakeholders.	Consulted as part of the assessment of existing or planned e-agriculture components; and Help to identify key bottlenecks and opportunities.	Consulted to learn what potential gaps and barriers exist to their usage of e-agriculture, as well as what demand for services exists.	Cost benefits analysis of the impact on the existing processes as a result of the e-agriculture strategy.

Table 1.3.4. (continued)

Stage	Decision-makers	Key influencers	Engaged stakeholders	Broader stakeholders and the general public	Indirect beneficiaries
Refine the vision and develop strategic recommendations	Provide input and guidance to the prioritization of e-agriculture components that will be delivered over the vision's time frame; Provide input and guidance to the development of strategic recommendations; and Review and endorse the refined national e-agriculture vision and strategic recommendations.	May be consulted to provide additional input and guidance to the prioritization of e-agriculture components; Provide input and guidance to the development of strategic recommendations; and The endorsed national e-agriculture vision and strategic recommendations presented to key influencers not involved in its refinement.	Broader stakeholders should receive a summary of the refined national e-agriculture vision as part of the broader socialization process.	May be provided with an overview of the endorsed e-agriculture vision as part of broader public awareness and education.	Obtain buy-in and investment commitments that will support implementation of the e-agriculture policy.

Table 1.3.5. Sample approach to stakeholder consultations

Interaction	Focus of engagement and consultation	Proposed mechanism
One	Preliminary consultations would explore questions such as: – What are the priority challenges within the agriculture sector that e-agriculture may be able to resolve? – Why should we consider investing in e-agriculture? – What is our vision for e-agriculture over the next 5 to 10 years? – What should be the priorities for a national e-agriculture vision? – What are the risks and barriers to delivering an e-agriculture vision in our country? – What existing, current or planned initiatives are we aware of that could be a foundation for a national e-agriculture vision or could be scaled nationally towards the vision? – Which other countries could we learn from and why? – What will be significantly delayed, consume resources inefficiently or not be achieved in the absence of a national e-agriculture vision?	• Individual or small group interviews
Two	A broader set of consultations should be undertaken to: – Validate and refine initial drafts of the strategic context for e-agriculture and the initial national e-agriculture vision; – Identify additional agriculture sector challenges and benefits of relevance to e-agriculture; and – Explore e-agriculture components that would be required to deliver the initial national e-agriculture vision.	• Group forums and workshops wherever practical to facilitate participation by a larger group of stakeholders; and • Individual or small group interviews as required where group forums are inappropriate or impractical.
Three	A set of targeted and focused consultations would be undertaken to: – Gather information regarding the nation's current e-agriculture environment; – Identify opportunities to re-use or share existing or planned e-agriculture components; – Explore and assess model options for e-agriculture leadership and governance; and – Discuss findings and recommendations with individual decision-makers and stakeholders where required.	• Scheduled on an as-needed basis; • Individual interviews and small group forums as appropriate; video conferences and teleconferences, as required

ANNEX 1.3.1. Stakeholder mapping matrix

Name of stakeholder	Category	Relevance to e-agriculture vision	Importance/ influence	Potential role	Expertise & resources available	Primary contact person & contact details	Other notes
Example: Department of Agricultural Extension	Government	Responsible for overseeing extension services to farmers	High/low	Can provide perspective on opportunities, gaps and barriers for e-agriculture within the extension system	Have access to extensive network of extension agents	Dr A.N. Other 012-5678901	Have an incentive to participate, as they are already testing e-agriculture services

ANNEX 1.3.2. Stakeholder consultation plan worksheet

Stakeholder group	When to consult	Method of consultation	Notes
Example: Farmers' associations	*Interactions two and three*	*Small group forums; phone calls*	*Aim to target at least five farmer associations during the consultation period*

CHAPTER 4 Strategic context for e-agriculture

Eliminating hunger, food insecurity and malnutrition; making agriculture, forestry and fisheries more productive and sustainable; reducing rural poverty; enabling inclusive and efficient agricultural and food systems and increasing the resilience of livelihoods to threats and crises are some of the major development goals of the twenty-first century for the agriculture sector. A thorough understanding of the interests, needs and expectations of all the stakeholders is critical to setting the strategic context for e-agriculture.

This chapter focuses on establishing the strategic context for a national e-agriculture vision that is tailored to the need of the country. Developing a national e-agriculture vision begins by establishing the strategic context, which describes the priority agricultural system goals and challenges that e-agriculture will help to address. The strategic context is developed by intensively researching the agriculture sector holistically, including a thorough understanding of agricultural value chains, a country's national agricultural strategy, priorities and goals (if available) and its socio-economic development goals.

The activities involved in developing the strategic context are outlined in Figure 1.4.1.

Figure 1.4.1. Developing the strategic context for the national e-agriculture vision

Outputs

- A list of the strategic goals and challenges, along with an understanding of the relative strategic priorities for the sector; and
- A summary paper of the potential role for e-agriculture in addressing these goals and challenges.

4.1 Research agriculture sector growth and demographics

This step focuses on forming a broad understanding of the agriculture sector domestically and internationally, and how it is expected to change over the next five to ten years. The questions in Table 1.4.1 can serve as a guide for completing this task.

This step should lead to understanding of:

- The current state of the agriculture sector, population demographics and anticipated changes;
- The implications of these changes on the agriculture sector; and
- Specific challenges for segments of the population (age groups, socio-economic groups, etc.).

The recommended approach is to conduct an internal research and analysis, supported by stakeholder interviews.

Table 1.4.1. Agriculture and demographics

Dimension	Current state	Implications of future changes
Size and demographics	• What are the primary geographic, social, economic and other demographic segments (e.g. population engaged in agriculture, living below the poverty line, age groups, farm holdings, on- and off-farm income, gender, literacy and other relevant indicators)? • What is the demographic profile of business along the agricultural value chain (e.g. percentage of medium and large agribusinesses vs. micro and small enterprises)? • What is the current level of literacy, access and usage of ICTs by farmers based on gender, socio-economic and other factors? • What are the environmental factors that affect agricultural production cost (e.g. cost of fertilizer, subsidies etc.) and agricultural marketing (e.g. open market, controlled market, oligopolistic market)? • How are these various segments expected to change?	• What demographic changes are forecast to occur? Some examples include: – Changes in employment opportunities outside of agriculture; – Changes in migration patterns; and – Changes in the demographic composition of your country. • What challenges will these changes create for the agricultural system? • Which of the environmental factors will be affected and how?
Current agricultural outcomes	• What are current agricultural outcomes? Some examples include: • Average productivity of crops/animals; • Efficiency of resources – water, nutrients, etc.; • Losses caused by wildlife, pests and diseases; • Postharvest losses, extent of value addition; • Level of food security; • Cost of production, profitability; • Level of food, nutrition and social security (farming as a profitable and sustainable vocation); and • Quality of individual and institutional risk management.	• What changes in cropping/farming patterns, food preferences, use of inputs and resources are expected to occur? • What changes in employment opportunities, value addition, agribusiness and services and support for market access and financial transactions are likely to occur? • What agricultural and non-agricultural factors are expected to be responsible for these changes? • What challenges will these changes create for the agricultural system and specific population segments?

Internal research and analysis: The project team should use data and information resources available with the national agricultural ministry, departments, industry and agencies. Other sources include international agencies, such as FAO, which collect and publish data and country reports online (e.g. http://data.fao.org/statistics and http://www.fao.org/statistics/en/).

Stakeholder interviews: Interviews should be conducted with related ministries, departments, industry and agencies responsible for monitoring and reporting on agriculture, where internal research has been unable to locate the required information. Additional interviews with farmers' organizations, agribusinesses, agro-entrepreneurs and different players in the agricultural value system may also be useful to gain insights into the agricultural and non-agricultural drivers of agricultural outcomes. In addition, interviews with ICT sector stakeholders that are providing or likely to provide e-agriculture services and applications should also be conducted.

4.2 Describe the agricultural extension and advisory systems

Agricultural extension systems were originally created by governments to disseminate knowledge on agricultural management practices amongst farming communities. The nature of these services has changed dramatically over the last 20 to 30 years. There has been a huge decline in investments by governments in a number of countries, thus seriously affecting the availability and quality of services. In many developing countries, the ratio of government extension agent to farmers, which was a healthy 1:300 on average has widened to 1:1,500-3,000 today. This is well below the 1:400 ratio recommended by FAO (CTA 2012).

Globally, there is now a growing realization that the simple delivery or dissemination of information is no longer sufficient. Instead, service providers today are looking to create new platforms for the co-construction of knowledge specific to the farming context, with an emphasis on the use of local knowledge and on farmer-to-farmer learning (Sulaiman et al. 2012). While there has been an overarching decline in extension services over the last 20 to 30 years, the landscape has simultaneously become more varied, with NGOs, producer groups, farmers' cooperatives and associations, consultants and the private sector all starting to play a stronger role. Alongside these shifts, ICT-based services are also playing an increasingly important role and will likely be the key knowledge management, knowledge sharing and advisory mechanisms moving forward. Even in the current context, use of ICTs is critical in managing and sharing information.

One of the interesting new roles to have emerged is that of the '*infomediary*': an agent able to use ICT-based services to access and share information on behalf of intended beneficiaries. The Grameen Foundation's Community Knowledge Workers in Uganda, for example, operate as generalist extension workers who rather than disseminating information are able to co-construct knowledge by combining local knowledge with more general insight from global knowledge bases.

In the future we will likely see a shift beyond services offered through *infomediaries* and public communication channels (web sites, television, radio, etc.) to the rise of individualized services (through mobile platforms, e-mail, apps), which will usher in an era of personalized services for agriculture.

This step focuses on understanding the national agricultural extension system, including challenges of access, cost and quality of services and their overall management. Understanding each of these factors is important to determining what role ICTs might have to support the extension system in the country.

Table 1.4.2. Examples of agricultural extension system dimensions to be explored

Dimension	Sample questions
Services	• What types of ICT services and applications are already available to support agricultural extension? • What types of agricultural extension and related information services[1] are needed and are available to farming, livestock and fishing communities? • What services and support are available to other actors in the value chain? • What types of databases, diagnostic tools and decision support systems are available to the extension agents, farmers and other stakeholders? • What services and support are available to various players in the agricultural value chain to promote entrepreneurship and to facilitate agribusiness development? • What services/support cannot be delivered and what challenges or barriers exist? • What types of licences/permits are required to offer e-agriculture infrastructure and services? • What type of information management and advisory services can be developed commercially? • How and to what extent do these services affect the cost of production and profitability of farming?
Structure and roles	• Which entities plan, manage and develop content and tools to support agricultural extension services? • Which entities plan, manage and deliver the agricultural extension services mentioned above at a national, state, regional and local level? • What are the responsibilities of these entities and what are their relationships with each other? • What gaps or challenges exist within the current agricultural extension system structure? • Who controls the quality of services and performs customer protection functions? • What are the quality criteria for information (content) standards?
Workforce	• What are the size, education, digital literacy level and distribution of the agricultural workforce at national, state, regional and local levels? • What is their level of expertise and knowledge in the use of ICTs? • What workforce imbalances presently exist or are expected in the future? • What impact will these imbalances have on the agricultural extension system, services and agricultural outcomes? • What is the propensity/adversity of the existing workforces towards ICT (in many cases, people associate ICT with reduction of human roles, resulting in loss of employment opportunities)?

Table 1.4.2. (continued)

Dimension	Sample questions
Funding	• What is the current expenditure of the national agricultural extension system? • What is the current expenditure on applications of ICT in agriculture related to extension or farmer information systems? • What changes in spending and funding models are likely to occur? • What kind of investments from the private sector is available? Where do these investments go?
Governance, policy and regulation	• What governance and policy mechanisms exist at national, state, regional and local levels? • What are the relationships and interactions among these mechanisms? • How are regulation and performance monitoring of the agricultural extension system undertaken?
Effectiveness and efficiency	• What challenges affect the quality and efficiency of agricultural extension services? • What challenges affect the effort, time and cost associated with delivering agricultural extension services? • How can the time frame of delivering these services be reduced using ICTs? • How can these services be made more cost efficient?
Accessibility	• What challenges affect the ability of certain segments of the farming community to access agricultural extension services? • What are the literacy and technology barriers that affect uptake of ICTs?
Content	• What are the current sources of agricultural extension content? • What is the nature of available content? (globally generalized, nationally generalized, locally specific) • What language(s) are content available in? (consider all of the languages that exist in the country) • What gaps/limitations exist in terms of available content and requirements from the extension system? What challenges exist to overcoming those gaps? • Are these contents available online in the appropriate format? Are these in a shareable format?

Notes:
[1] Examples of agricultural extension services include agro-advisories, alerts, weather information and market prices.
[2] Examples may include public agricultural departments, agencies, organizations and providers, private organizations, networks and providers, and NGOs.

This step should produce a summary of:

- The national agricultural extension system;
- Existing ICT services and applications targeting agricultural extension;
- Agricultural extension system challenges; and
- Potential opportunities and challenges to the development of a national e-agriculture environment as it relates to extension.

The preferred approach is through internal research and analysis, supported by stakeholder interviews.

Internal research and analysis: The project team should use data and information resources available with the national agricultural ministry, departments, industry and agencies, particularly any with a focus on agricultural extension or related information services.

Stakeholder interviews: Interviews should be conducted with related ministries, departments and agencies responsible for agricultural extension and information, where internal research has been unable to locate the required information. Additional interviews with NGOs, farmers' organizations, agribusinesses, agro-entrepreneurs and different players in the agricultural value system may also be useful to gain insights into agricultural extension and related information systems.

4.3 Describe the existing services, information flow and transaction streams in agricultural value chains

Agricultural value chains are complex systems with a diversity of actors, including input suppliers, logistics providers, agents, traders, processors, exporters, financial institutions and others. One of the key concerns in e-agriculture is the access to the right information at the right time through the right medium, wherein ICTs play a critical role.

Improving information flow and transaction streams across the value chain can significantly improve delivery of services. Annex B has a list of ICT innovations in the agricultural value chain.

This step focuses on understanding the existing services, information flows and transaction streams in agricultural value chains, including challenges of access, cost and quality of services and their overall management.

This step should produce a summary of:

- Existing services being delivered for agriculture and the potential services in demand over the short (one to two years) and medium (three to five years) terms;
- Existing information flows and transaction streams in agricultural value chains; and
- Potential challenges that e-agriculture can address in improving information flow.

Internal research and analysis: The project team should use data and information resources available with the national agricultural, telecommunications and finance ministries, departments, regulators, e-agriculture service providers and agencies.

Stakeholder interviews: Interviews should be conducted with related ministries, departments and agencies responsible for agriculture, telecommunications, banking, insurance and information, where internal research has been unable to locate the required information. Additional interviews with NGOs, farmers' organizations, agribusinesses, agro-entrepreneurs, TSPs, mobile financial service providers, rural banks, rural development agencies, e-government service providers and different players in the agricultural value system may also be useful to gain insights into information flows and transaction streams within agricultural value chains.

4.4 Review agricultural strategy, goals and priorities

This step focuses on identifying the agricultural strategies, goals and priorities that may exist and distilling them into a common group on which a national e-agriculture vision can be developed. A national vision cannot be developed until this alignment exists. The Food and Agriculture Policy Decision Analysis (FAPDA)[39] is a sample resource that has links to many country policies spread across various themes.

The output of this step should be a set of strategic themes, goals and priorities that are supported by the relevant agriculture sector leaders and decision-makers.

Countries may not have a well-articulated agricultural strategy, set of goals or priorities. Often multiple versions of these co-exist at national, state and regional levels, in addition to those being promoted by bilateral and multilateral donor organizations. This step will require consultation with agriculture-sector stakeholders to identify and refine them to an agreed set that can be used for the basis of developing a national e-agriculture vision.

Internal research and analysis: This step should focus on reviewing information on a country's agricultural strategy, goals and priorities. Information may be in the form of an agricultural strategy, reform agenda or a set of future agricultural policies or principles. Sources will depend on the structure and governance of the agricultural system, but will probably be found in national, state, regional and local agricultural departments and agencies.

Stakeholder interviews: Interviews with stakeholders should refine or confirm internal research. Stakeholders responsible for agricultural strategy, planning and policy at a national, state, regional and local level should be selected, including:

- Agricultural strategists and planners from both the public and private sectors;
- Agricultural policy-makers; and
- Bilateral and multilateral donors.

Workshops may need to be conducted where discussion is required to explore and resolve divergent strategies, goals and priorities.

[39] http://www.fao.org/economic/fapda/fapda-home/en/

Table 1.4.3. Examples of an agricultural strategy, goals and priorities

Challenges	What are the current challenges to the agricultural system and broader agriculture sector? Areas to consider: • Challenge of feeding an ever-growing population; • Food and nutritional security; • Sustainability of the production system; • Shrinking resource base – both in quality and quantity; • Increasing cost of production; • Threats of climate change and negative market forces; • Equity and accessibility of information services; • Agricultural workforce supply and distribution; • Agricultural system structure and organization; • Risk management for individuals and institutions in agricultural value chains; • Effectiveness and efficiency of agricultural services delivery; • Access to financing and insurance; • Fulfilling international obligations/agreements (example: those pertaining to the World Trade Organization); • Digital literacy and capability of farmers to harness ICTs; • Funding and financial transactions; • Livestock losses because of wildlife predation; and • Unavailability of quality statistics on agriculture in a timely manner.
Priorities	What are the government's stated priorities for addressing these challenges?
Strategy	What is the national agriculture strategy? Also see other national-level planning or strategies referring to agriculture. • How recently has the strategy been developed and what is its time frame? • Does the national agricultural strategy already reference ICTs? If so, how? • Does the national ICT strategy already reference agriculture? If so, how? • What other relevant information related to e-agriculture exists in 5/10 year plans, economics plans, budget statements, etc.?
Goals and targets	What goals and targets have been identified as part of the national agricultural strategy? What international obligations, partnerships or programmes are in place?[1]
Time frames	What are the time frames for delivering the agricultural strategy, goals and priorities?
Initiatives	What major agricultural system improvement, transformation or reforms are underway or planned?
Funding	What are the implications for future funding of the nation's agricultural system?

Notes:
[1] Such as the Sustainable Development Goals (SDGs), International Treaty on Plant Genetic Resources for Food and Agriculture, United Nations Framework Convention on Climate Change (UNFCCC).

4.5 Identify socio-economic development goals relevant to e-agriculture

This step focuses on determining the important social or economic development goals or commitments in agriculture that should be considered as part of developing a national e-agriculture vision. While e-agriculture strategies are primarily developed to improve agricultural systems, deliver effective services, and provide monitoring and traceability, they can also be an important mechanism for facilitating cooperation at the regional level and driving investment in other associated sectors (e.g. ICTs for development infrastructure, research and development). For example, a national e-agriculture strategy could establish incentives and facilitate the development of technologies for export, promote a new market, improve financial inclusion, strengthen social protection, decentralize trade or serve as a driver for innovation in the nation's agricultural ICT sector.

This step should identify agriculture and non-agriculture sector drivers that are relevant to e-agriculture and should be considered in the development of a national e-agriculture vision.

It is recommended to have internal analysis followed by validation with high-level sector stakeholders.

Internal analysis: Analyse the key agricultural goals that can be achieved using ICTs. This should be followed by the other sectoral goals that such an initiative would provide. Regional documentation, reports, announcements or cooperation agreements should be obtained from development partners in other ministries, agencies or institutions. These agreements may take the form of policies or major commitments such as the Sustainable Development Goals (SDGs), WSIS, the International Treaty on Plant Genetic Resources for Food and Agriculture and the UNFCCC.

Refinement and validation with stakeholders: Interviews with stakeholders in agriculture, ICT, science, technology, development and related ministries and industries can help validate the findings, shed light on the priorities and time frame, and clarify how these may inform the development of the national e-agriculture vision.

4.6 Identify work already done on strategies for e-agriculture

This step reviews work done to date and the status of strategies related to e-agriculture. These could be in the area of e-agriculture directly (such as vision statements, goals, policy documents, government mandates or pledges) or indirectly through agricultural strategies, master plans, national plans and other planning documents that may reference ICTs in agriculture.

The output of this step should be a summary of any existing strategies related to e-agriculture and their potential relevance or impact on your national e-agriculture vision.

It is recommended to have internal analysis followed by validation with high-level sector stakeholders.

Internal analysis: Review of agriculture and ICT ministry documentation, including a review of resolutions, mandates, policy statements or commitments. It is also worth exploring whether any bilateral or multilateral donors include e-agriculture in any of their strategy documents for the country. Previous reports or other documentation can yield valuable insights and lessons for the current effort. As value-added services are considered to be an important growth engine for the telecommunications sector, it is also important to review mobile network operators and other telecommunications providers' strategies for agricultural services, where available.

4.7 Identify goals and challenges where e-agriculture will have the most impact

The agriculture sector's goals and priorities often have unique challenges. E-agriculture has the potential to contribute enormously to the following efforts:

- Increase the availability, accuracy and speed of information relating to agriculture sector to the stakeholders
- Improve the awareness and skills of farmers, fishermen, livestock herders and other sector end users leveraging on ICTs
- Enhance the research capability, quality of extension advisory and adoption of credible best practices
- Improve the profitability of agricultural products and services through efficient logistics, universal and connected ICT infrastructure, better market access
- Promote innovation in e-agriculture services
- Reduce the individual risks of agriculture sector stakeholders
- Improve the policy and regulatory capability and awareness in the sector

E-agriculture can improve the efficiency of the agricultural value chain by facilitating better access to markets and benefiting farmers by offering transparent, efficient and dispute-free financial services amongst many other advantages. The choice of selecting a goal depends on the priorities of each country. It is advisable to select a goal which has an immediate socio-economic impact and which can be achieved at lower cost and within a relatively short time frame.

This step focuses on combining the knowledge gained through the previous steps to identify the strategic goals and challenges that can best be supported by e-agriculture. While a country may have identified many goals and the challenges, only some will be directly supported by a national e-agriculture environment. This step aims to identify those where e-agriculture can have the biggest impact, to be used as the basis for defining the national e-agriculture vision.

The goals selected may be common across different agricultural value chains, sectors and strategies, or may have occurred in only one of these areas. The questions in Table 4.5 can be used to help in identifing and selecting goals and challenges to focus on the national e-agriculture vision.

Table 1.4.4. Strategic goals and challenges: common areas

Area	Sample questions
Agriculture	• What are the strategic goals for meeting agricultural goals and improving agricultural outcomes? • What challenges will be created by current and expected changes in the agriculture sector? • What are the challenges in content and knowledge management and agricultural extension service delivery?
Equity and accessibility	• What are the challenges impacting the delivery of equitable and accessible agricultural services?
Agricultural workforce supply and distribution	• What are the challenges facing the supply of the nation's agricultural workforce and its ability to support effective and efficient agricultural delivery services at all levels? • What are the challenges related to the distribution of nation's agricultural workforce and its ability to support effective and efficient agricultural services' delivery in regional, rural and remote parts of the country?
Agricultural system structure and organization	• What are the challenges caused by the existing structural, funding, governance and leadership arrangements of the nation's agricultural system?
Effectiveness and efficiency of agricultural service delivery	• What are the challenges that affect the quality and safety of agricultural services delivered to the farming, fishing and livestock community? • What are the challenges affecting the effort, time and cost associated with delivering agricultural services? • What are the challenges in marketing and trading agricultural goods and services? • What are the challenges in promoting export of agricultural goods?
Funding/ investment	• What are the funding challenges for agriculture, trends in public and private spending, projected funding and its impact on future agricultural services? • What opportunities exist to attract investments from outside the agriculture sector?

These are just examples, and the specific goals and challenges may differ significantly between countries. However, the process for reaching them is the same.

This step should produce a clear description of the main strategic goals and challenges around which the national e-agriculture vision will be developed. It is important to limit the number of strategic goals and challenges as large numbers increase the complexity of developing a well-structured, understandable vision and action plan. A large number of goals and challenges should be grouped into a set of *strategic themes*. The vision can then be drafted to respond to these themes. It is also important to avoid overlap and duplication among goals and challenges. If, for example, one challenge is actually a result of another, the focus should be on the main challenge.

Internal analysis followed by validation and refinement with agriculture sector stakeholders is recommended.

Internal analysis: The information collected so far should be consolidated to form a manageable number of strategic goals and challenges around which a national e-agriculture vision can be constructed.

The strategy guide comes with a toolkit that can be used for internal analysis and development of the strategy.

The toolkit, worksheets and other annexes can be downloaded from http://www.fao.org/asiapacific/resources/e-agriculture

Refinement and validation with stakeholders: The strategic goals and challenges should be reviewed in consultation with key stakeholders and refined based on their feedback. This essential step should focus on developing a consensus on the set of themes, goals or challenges around which the national e-agriculture vision will be constructed.

4.8 Describe how e-agriculture will support selected goals

This step explores the relationship between e-agriculture services, flows of agricultural information and the goals and challenges identified in the previous step. The focus is on determining how e-agriculture would change the current experience. It may also identify how the development of a national e-agriculture environment could support non-agriculture sector goals and challenges and vice versa.

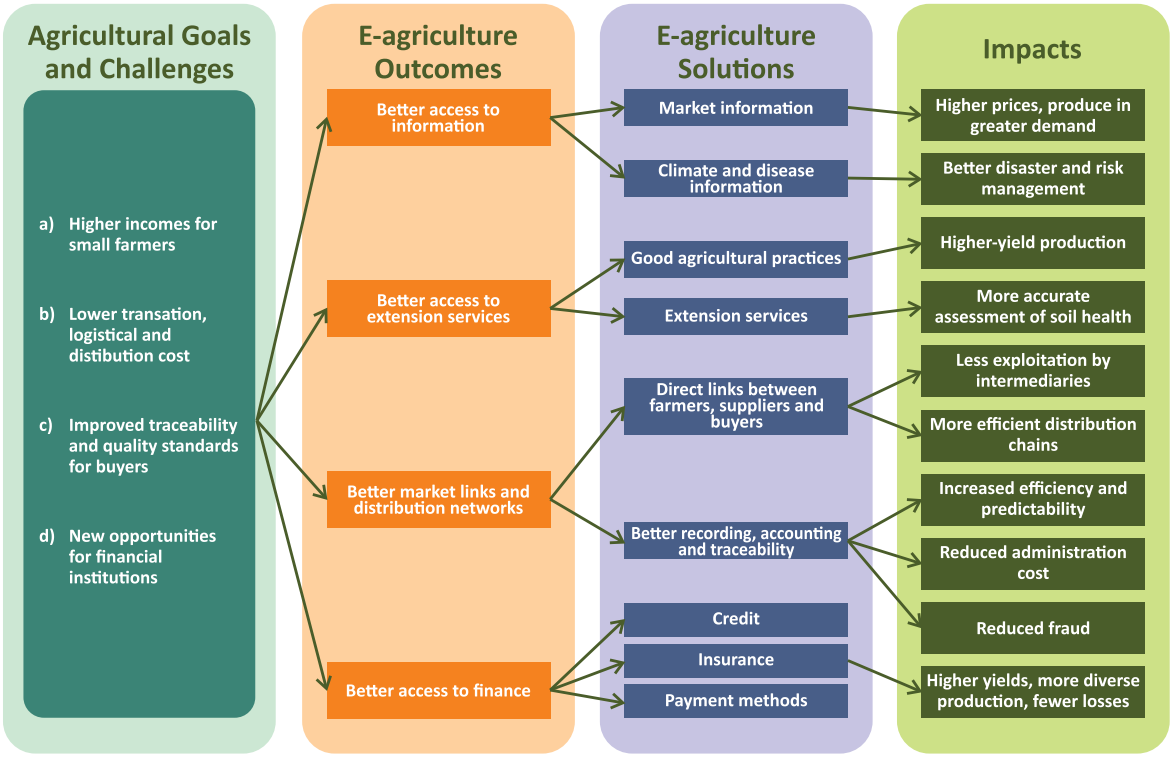
'Agricultural information flows' refers to the exchange of information within the agriculture sector, and the provision of agricultural services through electronic channels. Exploring a strategic goal or challenge from this perspective helps determine how these flows may need to be improved to enable a goal to be met or a challenge to be overcome. This is a critical step towards understanding what a national e-agriculture vision has to do to enable or support the broader agricultural system. Similarly, other services such as ICT-enabled financial transactions, data analysis and advisory services can bring much-needed efficiency and transparency into agricultural value chains.

One technique for mapping out how goals and challenges link to information flows is to use a logical framework. The example in Figure 1.4.2 shows how agricultural development goals and challenges can be linked to information flows to achieve specific impacts.

The questions below may assist in understanding the implications of strategic goals and challenges for e-agriculture:

- What are the main service deliveries, information and financial transaction flow challenges that currently exist? Who are the key stakeholders and influencers?
- How do these challenges act as a barrier to achieving a strategic goal or overcoming a strategic challenge?
- How will the flow of information and financial transactions in the agriculture sector need to change?

Figure 1.4.2. Agricultural development goals and challenges linked to information flows to achieve specific impacts



Source: World Bank [adapted] (2011).

- What information, knowledge and tools would need to be made available to individuals, businesses, agriculture service providers, managers and policy-makers?
- How does a particular ICT intervention improve the efficiency and productivity of a particular element of the value chain?

This step should describe the implications for e-agriculture arising from the themes identified in the previous step. These should be described in terms of agricultural information flows or the potential impact on other sectors.

Internal analysis: Internal analysis and stakeholder consultation should be used to determine and describe how e-agriculture will support agricultural and development goals, with particular attention on:

- The strategic goals and challenges for the agricultural system and socio-economic development;
- The implications of these goals and challenges;
- A description of how sharing and access to information and other e-agriculture services can address agricultural goals; and
- A description of how a national e-agriculture environment may allow non-agricultural goals and challenges to be addressed.

CHAPTER 5 Learning from e-agriculture trends and practices

This chapter is intended to guide stakeholders involved in the development of the national e-agriculture vision to understand and research the e-agriculture experiences of other countries, including lessons learned and trends. It includes experiences, outcomes, lessons and recommendations in applying ICT in agriculture and also in developing e-agriculture visions and strategies.

Outputs

By the end of this chapter, you will have developed an understanding of:

- How e-agriculture is being used in similar countries and settings;
- The types of goals or challenges that e-agriculture can address; and
- Evidence of the specific benefits that e-agriculture has delivered in similar settings.

5.1 Research national e-agriculture visions and strategies

This step identifies knowledge and lessons from other national e-agriculture visions and strategies that may be used as input to the development of a national e-agriculture vision.

Examples of the type of information that this step should seek to identify include:

- Goals and challenges that countries are trying to address through e-agriculture;
- Strategic recommendations on how e-agriculture should be used;

- Non-agriculture sector goals and challenges where e-agriculture has been applied;
- Changes to information flows and payment streams in agricultural value chains;
- The current environment (and constraints) in which e-agriculture is implemented;
- Lessons learned from successes and failures.

This step should focus on countries that may be similar in terms of:

- Advancement and similarity of agricultural value chains;
- Goals and challenges faced within agriculture; and
- The e-agriculture and national development context.

This step should produce a broad understanding of the national e-agriculture visions and strategies of similar countries. The e-agriculture vision and strategy mapping worksheet in Annex 1.5.1 at the end of this chapter can be used to keep track of the national e-agriculture visions and strategies identified.

Internal research and analysis, complemented by exploratory interviews with representatives from other countries is recommended.

Internal research and analysis: This step requires selecting appropriate countries and deciding the questions to be asked. A small set of countries should be decided upon at an early stage in order to focus research efforts and ensure this step is appropriately time-limited. This can be a challenging undertaking due to a lack of familiarity with other countries, a lack of comparability in many instances and the time required to undertake this work.

Information should be sought from the relevant agricultural departments and agencies. Some countries may have a dedicated e-agriculture department; although it is more likely that e-agriculture will be managed within the ministry of agriculture or ministry of ICT. The existence of these entities should be confirmed early in the process.

Reports from international agencies, such as FAO, ITU, World Bank and CTA, may be of use when information is not directly available from countries. Relevant reports should be reviewed as input to this step.

Many ICT interventions have been developed and tested around the world, with varied degrees of success, to help farmers improve their productivity and incomes. Some useful resources for learning about e-agriculture in practice are the World Bank's *ICT in agriculture – connecting smallholder farmers to knowledge, networks and institutions*, FAO's *ICT uses for inclusive value chains*, FAO's *Information and communication technologies for sustainable agriculture* and *Success stories on information and communication technologies for agriculture and rural development*. All the above publications document several applications of technology and innovations that serve as useful reference material in the process of developing an e-agriculture vision. Annex B has a list of ICT innovations in agriculture and rural development. Annex 1.5.1 provides a selection of experiences with development of e-agriculture from several countries, along with a synthesis of key lessons and recommendations.

Exploratory interviews: Relying on research alone for a full understanding of another country' s e-agriculture vision and/or strategy, and the lessons associated with its implementation, can also be challenging. For countries of particular interest there may be value in organizing regional meetings, study tours or interviews with individuals who are responsible for e-agriculture. It is important to focus the enquiry on experiences and lessons learned. Most countries are open to sharing knowledge about their e-agriculture experience. The primary challenge is often locating the right individual(s) with whom to communicate, particularly in those countries without a nationally-coordinated approach to e-agriculture.

5.2 Research international e-agriculture trends, good practices and outcomes

This step develops a broader understanding of how e-agriculture can be applied to agricultural goals and challenges. Globally, there are numerous projects and research studies on the application of e-agriculture within particular value chains, for particular purposes and in a variety of different settings, each with different challenges. Understanding these and the benefits and outcomes they have delivered helps to inform a national e-agriculture vision.

Examples of the type of information that this step should seek to identify include:

- E-agriculture services and applications in use in other countries;
- Goals and challenges that e-agriculture services and applications address;
- Settings in which these services and applications are being used;
- Challenges and barriers experienced in delivering e-agriculture; and
- Measured benefits or outcomes, such as improved yields and incomes.

Although the benefits and outcomes of e-agriculture vary based on context and use, some general trends and best practices from experience globally include:

- Using ICT to achieve agricultural development goals requires substantial investments, resources and strategies;
- In developing an e-agriculture intervention, it is important to focus on the services to be developed, improving the experiences of the beneficiaries and addressing the problems in using modern technology;
- The newest, most elaborate or most innovative technology is not automatically the most appropriate one to deal with the agricultural challenge in question. It is always best to use appropriate technologies;
- In developing an e-agriculture initiative, it is important to attempt to address issues of affordability and access. Different and appropriate use models (individual use, shared use and public access) should also be explored and applied;
- To create an enabling environment for e-agriculture innovations in a country, there should be appropriate policies, strategies and regulations guiding the country's investment in and provision of ICT infrastructure, tools and services;
- There has been developments of e-services in other sectors critical for agriculture that can be leveraged;

- Device convergence, service convergence and network convergence are making ICT infrastructure increasingly cheaper in rural areas, and hence making e-agriculture services affordable to rural farmers and other actors in agricultural value chains; and
- Efforts should be made to reduce the cost of ICT tools/applications/services so as to make e-agriculture applications sustainable to attract private investments and affordable for the farmers.

This step should lead to an understanding of the common ways in which e-agriculture has been used in other countries to address specific goals and challenges, and the benefits and outcomes that it has delivered.

Research should focus on information on the use of e-agriculture to address agricultural goals and challenges. Most of this research can be conducted via the Internet. Common sources of information include government, development organization and industry reports on the use of e-agriculture.

Keep in mind that much of what has been reported on e-agriculture is based on independent reports by the service provider or project implementer. While rigorous, third-party impact evaluations do exist, most information on best practices and outcomes related to e-agriculture is anecdotal.

Key questions to ask when conducting this research include:

- What are the benefits of the e-agriculture service or application to farmers, fishers, herders, agribusinesses, government and society?
- What are the policies and institutional issues that have supported or hindered the development and implementation of the e-agriculture service/application?
- How does the e-agriculture service/application enhance the performance of agricultural productivity, agribusinesses and the global food system in general?
- What other impact has the e-agriculture service/application had to date?
- What business model does the e-agriculture service/application use? Who is paying for its services? Is it self-sustaining?

ANNEX 1.5.1. Experiences in the development of e-agriculture

Many countries have identified ICT initiatives as solutions to their numerous agricultural development challenges and some of those countries have begun the development and implementation of e-agriculture policies and strategies. Understanding the initiatives and the practical use of ICTs will help both current and future generations to devise new and better ways to transform agricultural development using modern technologies. Understanding the experiences of others, their shortcomings and their successes, should help to drive the development of a national e-agriculture vision that is grounded in reality.

Case study from Rwanda: Rwanda has achieved accelerated growth in economic development and the government's rebuilding agenda has been on course. Rwanda operates an agrarian economy and over 75 percent of its population makes a living through agriculture. The government's 'Vision 2020' aims at transforming the economy to middle-income knowledge-based status using ICT as an engine of growth. The government is promoting access to ICTs in the agriculture sector to achieve economic development and reduce poverty. It has invested in a number of ICT initiatives aimed at boosting the level of the ICT skills of its citizens and the development of applications in the agribusiness sector.

Rwanda's e-agriculture strategy is embedded in the national development strategy. Unlike many other countries, the government has played a lead role in the development of the ICT-led economy by promoting the deployment and utilization of ICTs within Rwandan society, especially in agriculture, which has yielded huge successes in a very short time. The government's investments in e-agriculture development and its commitment to the implementation of the strategies is the key success factor for the impacts recorded to date in the agriculture sector.

The government's investment in developing rural ICT infrastructure has stimulated private investments in e-agriculture in the country. The enabling environment created by the government has opened up the country to individuals and organizations who have invested in developing various tools and applications aimed at enhancing agricultural development in Rwanda.

The agricultural information and community centres set up by the government were used as conduits for reaching farmers in remote parts of the country by private sector investors and development partners, thus, the power of ICT is being leveraged to improve on service delivery in the agriculture sector.

Experience from Côte d'Ivoire: [40] In Côte d'Ivoire the motivation to put an e-agriculture strategy in place lies at the intersection of three processes: the consolidation of e-governance in the country, the implementation of its national ICT for development strategy and the ambition to modernize the country's agriculture sector and enhance its productivity. The overarching national vision was the preparation of Côte d'Ivoire to become an emerging country by 2020. From the agriculture sector perspective in particular, the goal was to use ICTs to increase the country's income from export of cocoa, coffee and other produce, and to decrease its dependence on food imports and strengthen food security.

[40] Adapted from *ICT Update* (CTA) Issue no. 73, August 2013.

From the onset, a collaboration framework was established between the ministers in charge of ICT and the one in charge of agriculture. They appointed an interdepartmental committee of experts whose role was to guide and oversee the development of the e-agriculture strategy. The committee adopted a comprehensive participatory approach by involving stakeholders from all relevant government departments (including notably the ministry in charge of commerce).

They notably involved the Association Nationale des Organisations Professionnelles Agricoles de Côte d'Ivoire (the professional body of agricultural professionals), agricultural educational and research institutes, ICT for development experts and relevant development partners. Regional and Pan African agricultural strategy documents were also consulted.

The developed strategy is articulated around the following interdependent axes:

- ICT infrastructure and equipment;
- An agricultural market information system;
- Applications and services for agriculture;
- A legal and institutional framework;
- An ICT capacity development programme;
- Agricultural information systems; and
- A national communication system for the Ministry of Agriculture.

Apart from bilateral meetings, national multi-stakeholder workshops were organized to build consensus, ensure that the strategy has integrated all key insights, prioritize projects designed to implement the strategy and also to inform international partners.

The major steps of the development of the strategy were completed in 2013 with the validation seminar which took place in June in Agboville, Côte d'Ivoire. Though some follow-up actions have been taken to launch the implementation of the strategy, the government is working on fundraising to implement key projects identified. The Ministry of Post, Information and Communication Technologies initiated and led important phases of the development of the strategy but the Ministry of Agriculture validated all key decisions and led other phases. The development of the strategy took more than one year.

Experiences from the Caribbean: The Caribbean is made up of different sovereign states, with the Caribbean Community (CARICOM) serving as the regional body that promotes the development of member states. Agriculture is a priority sector for Caribbean countries and CARICOM seeks to transform the agriculture sector into a competitive and sustainable system with ICTs playing a vital role. CARICOM has developed an agricultural policy called the 'CARICOM Agriculture Policy' and a regional ICT policy that talks about e-agriculture. Some of the member countries are already engaged in e-agriculture activities, although most of these are not very detailed.

E-agriculture is contained in the ICT policy and as such is being championed by individuals with primarily an ICT background.

The success of implementation to a very large extent is dependent on the involvement of agricultural experts at the beginning of the process.

Affordability and accessibility are crucial indicators in the uptake of ICT technologies, especially in the agriculture sector. When the costs of ICT solutions are high, farmers and other stakeholders in agricultural value chains are unable to procure these solutions. It is therefore important that developers of ICT tools and initiatives for agriculture are supported and encouraged to bring down their cost to make them accessible and affordable.

The Indian example: As a lower-middle-income country, India has challenges dealing with food insecurity, high production costs and inefficiencies in agricultural development in the face of a rapidly growing population. This has led to high rural-urban migration, creating societal imbalances with severe consequences on the country's development and growth. Appreciating the power of ICTs in national development, successive governments have made huge investments in creating IT infrastructure and promoting the application of ICTs in all fields, including agriculture. An investment of over US$18.8 billion is earmarked for the 'Digital India' programme to transform the country into a digitally-empowered knowledge economy. The government has set a target of providing broadband connectivity to 250,000 villages (India has about 641,000 villages, according to the 2011 Census). The Digital India programme that aims to offer a one-stop shop for government services would use the mobile phone as the backbone of its delivery mechanism. About a third of India's 252 million Internet users and a fourth of mobile internet users, live in rural areas. But Internet penetration in villages, at 8.6 percent compared to 37.4 percent in cities, has a long way to go, and this is the statistics Digital India hopes to change.[41]

Some of the successful projects launched by the Government of India include the Kisan Call Centre (KCC) scheme launched in 2004 and the Kisan Portal in 2013. In the KCC scheme farmers can access all relevant information related to agriculture in their own dialect by calling a toll-free number (1551). Replies to the farmers' queries are given in 22 local languages. More than 90 percent of the queries are answered instantly by the KCC agents who are graduates in agriculture and allied disciplines with excellent communication skills in respective local languages. Queries which are not answered by the agents are referred to the subject-matter experts. A total of 85,078 calls were registered during 2013 with an average of 12,154 calls per month and 405 calls per day.[42]

The Farmers' Portal launched in 2013 serves as a one-stop shop for farmers[43] and provides information on a range of topics including best practices, input suppliers' networks and agromet advisory. Location-specific information can be accessed by drilling down to the block level. To overcome language and literacy challenges, an SMS portal is used for dissemination of voice-based advisories. Over 7 million farmers are already benefiting from this service.[44]

[41] http://deity.gov.in/sites/upload_files/dit/files/Digital%20India%20Presentation%20on%20DeitY%20website.pdf
[42] http://agritech.tnau.ac.in/kisan/kisan_docs_reports.html
[43] http://farmer.gov.in/
[44] http://agricoop.nic.in/imagedefault/whatsnew/Press%20Note%20on%20SMS%20Portal%20for%20Farmers.pdf

Significant non-governmental efforts include:

Reuters Market Light (RML): Reuters Market Light[45] provides a range of ICT solutions across the entire agrivalue chain. With coverage of more than 450 crop varieties and 1,300 markets, RML has been accessed by over 1.4 million farmers in 50,000 villages across 18 states in India.

e-Choupal: Launched by the Indian Tobacco Company business conglomerate in 2000, *e-Choupal*[46] provides a virtual market place where farmers can transact directly with buyers and place orders for inputs. It is rural India's largest Internet-based intervention providing customized knowledge on market prices, best practices and risk management. There are around 6,500 *e-Choupals* in operation in 40,000 villages involving around 4 million farmers. It offers a better supply chain for ITC for farm inputs such as lower transaction costs and better value through traceability. The network has become a big rural sales and distribution channel for ITC. The company has started to sell its fast-moving consumer goods products in rural India through *e-Choupal*. Today, more than 160 companies ride on the *e-Choupal* network including Bayer, BASF, State Bank of India, Bharat Petroleum, Nokia, TVS Motors, Maruti Suzuki India, Tata Motors and Monster.com.

Digital Green: is a not-for-profit international development organization that uses an innovative digital platform for community engagement to improve lives of rural communities across South Asia and Sub-Saharan Africa. Digital Green brings together technology and social organization to share knowledge on improved agricultural practices, livelihoods, health, and nutrition, using locally produced videos and human mediated dissemination. In a controlled evaluation, the approach was found to be 10 times more cost-effective[47] and uptake of new practices seven times higher compared to traditional extension services.

Digital Green is currently implementing projects in collaboration with over 20 partner organizations across 9 states in India and parts of Ethiopia, Afghanistan, Ghana, Niger and Tanzania. Since 2008 and as of April 2015, they have reached over 660,646 individuals across 7,645 villages through 3,782 videos, which showcase and demonstrate best practices.

IKSL: IFFCO Kisan Sanchar Ltd[48] is a joint venture between the largest telecommunication network operator Airtel and the largest fertilizer manufacturer in India – Indian Farmer's Fertilizer Cooperative Limited (IFFCO). IFFCO has around 40,000 societies and is present in 98 percent of India's villages. Through the 'Green' SIM card supplied by IKSL, up to four free voice messages are delivered to the subscribers every day, covering contextual alerts and advisories on agriculture, health, employment, education, women's empowerment, financial inclusion, government schemes etc. Other features include a dedicated helpline for query resolution by experts, call back facility to listen to voice messages once again and space for focused communities/groups with common interest.

The Bangladesh example: Bangladesh is well positioned to effectively start using ICT for its agriculture sector. In particular the recent boom of the telecommunications sector and the Digital Bangladesh[49] initiative of the government have ignited the process. "e-agriculture"

[45] http://www.reutersmarketlight.com/
[46] http://www.itcportal.com/businesses/agri-business/e-choupal.aspx
[47] http://itidjournal.org/itid/article/view/322
[48] http://www.iksl.in/
[49] Digital Bangladesh is an initiative of the Government of Bangladesh as a part of its election mandate to bring public services to the doorsteps of citizens by using ICT tools.

((ই-কৃষি)) is an emerging field where Information and Communication technologies or ICTs (radio, TV, cell phone, PDAs, PCs) are playing a vital and catalytic role in addressing key hindrances to the growth of agriculture such as mismanagement of inputs, inaccessibility to rural finance, ineffective and inadequate extension service, lack of awareness about agro-processing, and insufficient preparedness for natural calamities, among others" (Strategic Priorities of Digital Bangladesh, Access to Information (A2I) Programme, Prime Minister's Office 2010). The vision of Digital Bangladesh has forecast an ICT-enabled connected society by 2021.

The National ICT Policy 2009 (Ministry of Post Telecom & ICT, Govt of Bangladesh) categorically identifies agriculture as a thriving sector to pursue ICT-enabled services for increasing productivity, facilitate market linkages, develop farmers' databases, establishing agriculture information centres, address climate change issues etc. The National ICT Policy 2015 also emphasizes on e-agriculture. The National Agriculture Extension Policy 2015 identified ICT as an enabler for the development of agricultural sector and specified scopes of integration of ICT at various levels. To foster e-agriculture at farmers doorstep, the NAEP focused on strengthening shared access points for farmers, mobile and web based rural advisory services (RAS), knowledge management, market information, farmer & input suppliers database, etc.

The private sector is a major driver of e-agriculture in Bangladesh. The lead actors in this field are telecommunication operators; business initiatives like Bangladesh Institute of ICT in Development (BIID), Miaki VAS, mPower, and Win Incorporate; development projects like USAID's Agricultural Extension Service Activities (AESA) project; and media houses like Channel i. The Department of Agricultural Extension (DAE) is collaborating with different organizations to facilitate ICT-enabled solutions at the field level. The Soil Resources Development Institute (SRDI), MoA provides soil analysis data linked to an online GPS database.

Mati-o-Manush is one of the flagship TV programmes broadcast by two TV channels. Call centres operated by mobile phone operators and AIS (MoA) are popular and have wider reach. Recently AIS started to produce material for regional and community radio stations in local dialects.

The low literacy rate, particularly among the rural population at 72 percent (CIA Web site), has emerged as a major limitation for connecting directly with farmers using text-based ICT solutions such as SMS or Web-based written information. Meanwhile mobile applications are becoming popular due to increasing penetration of smart phones and more youth communities are now being targeted by the e-agriculture service providers. The network of Union Digital Centres (UDC) and other rural ICT centres like Batighar, and Community Information Centres (CIC) are also contributing significantly to overcoming the accessibility issue to relevant services by farmers and agribusinesses.

Zero Cost EAS (extension and advisory service), a new service approach offered by BIID and the Bangladesh Seed Association (BSA) is a model where information is bundled with input packages which farmers are able to directly avail through their mobile phones. The Bangladesh Rice Knowledge Bank is an Internet-based agriculture knowledge repository initiated by the International Rice Research Institute (IRRI). An e-toolkit for the organizations and practitioners in the field of nutrition in Bangladesh has been developed by the Bangladesh Centre for Communication Program (BCCP).

The major service propositions offered by many of the service providers are still at a very basic level, mainly on extension-related information, and are call centre-based. A few services are now concentrating on developing high-end solutions for the agriculture sector by using drone-based GIS data and monitoring and evaluation applications as decision-making tools.

Thus remarkable headway has been made both in the public and private sectors at policy and implementation levels as well among the extension service providers; also in terms of developing public-private partnerships.

Key lessons and recommendations for developing an e-agriculture vision and/or strategy

Even though developing an e-agriculture strategy differs by country, there are some common experiences and recommendations that should be followed as a general rule:

1. There should a clear owner of the process who has the mandate to implement the strategy, and who is committed to the process. While the agriculture sector is best positioned to lead this, it is important to have high-level buy-in from the ICT sector.
2. The right stakeholders should be identified and involved at every stage of the process.
3. Efforts should be made to incorporate all relevant ongoing ICT in agricultural projects/programmes into the planning process.
4. Defining clear roles and responsibilities for all participants in the development process is critical.
5. Decision-makers should be involved at all levels of the process to ensure their total buy-in and their understanding of the process. Their total commitment throughout the process is also essential.
6. The vision/strategy should respond to broad national, regional and international policies, plans and strategies.
7. E-agriculture visions/strategies should be incorporated in future agriculture sector policies and plans so that in implementing the sector policy, issues of e-agriculture will be dealt with.
8. The right resources should be available for the development and implementation processes.
9. The process should be transparent and considerable awareness should be created before and during the development process.
10. Agricultural experts supported by relevant stakeholders from other key sectors (e.g. telecommunications, banking, insurance, disaster management, rural development, etc.) should be involved in the development of e-agriculture strategies. This will make them understand the benefits of e-agriculture, and also the underlying challenges.
11. There should be clear business benefit (economic or brand building) for the private sector stakeholders for long-term support and adoption.
12. Content and data related standards (metadata, quality assurance etc.) should be established at the early stage of e-agriculture implementation.

CHAPTER 6 Draft an initial vision

This chapter focuses on drafting an initial e-agriculture vision.

A national e-agriculture vision describes how e-agriculture will contribute to achieving a country's agricultural goals. It will reflect stakeholder input obtained so far, and be informed by research on global e-agriculture trends and practices.

The key activities include:

- Agree on the time horizon for the e-agriculture vision;
- Define desired e-agriculture outcomes based on e-agriculture goals and challenges;
- Describe the rationale for each outcome sought and link outcomes to the strategic context;
- Develop an initial vision statement;
- Describe what delivering the national e-agriculture vision will mean for stakeholders;
- Develop one or more scenarios that put the national e-agriculture vision into practice (optional); and
- Conduct a pre-mortem of the national e-agriculture vision (optional).

Outputs

In addition to drafting an initial vision, as a result of these activities, one should develop a summary document that includes the following:

- The agricultural system outcomes that e-agriculture should enable or support;
- The rationale between outcomes and the strategic context for e- agriculture;
- The benefits to stakeholders; and
- One or more scenarios that demonstrate the national e-agriculture vision in practice.

6.1 Setting the time horizon

This step determines the time horizon for the e-agriculture vision. This improves focus and ensures that the benefits and outcomes can be described in terms of a target delivery date (e.g. "By 2020 e-agriculture will enable the country to…").

The time horizon takes into account:

- The national agricultural strategy and its time frame for targets and goals;
- Lessons from other national e-agriculture strategies, and associated time frames; and
- Guidance provided by senior political and agriculture sector decision-makers.

This step defines the time frame for the national e-agriculture vision, agreed to by agriculture sector leadership.

6.2 Define the desired e-agriculture outcomes

This step defines the change, or outcomes, that a national e-agriculture environment should produce. It answers questions on what will be achieved or changed by using e-agriculture and how the agricultural system and services will change as a result. The outcomes should address the priority agriculture goals and overcome the challenges faced (see Part 1-Chapter 4-Section 4.7).

E-agriculture outcomes are achieved by establishing a national e-agriculture environment that:

- Meets agricultural goals and overcomes challenges;
- Generates positive changes and impacts on the lives and work of agriculture sector stakeholders;
- Leverages the existing ICT developments impacting agriculture in a strategic manner;
- Improves investment potential and harnesses the potential of ICTs effectively;
- Reduces individual and institutional risks;
- Clearly defines the content sources and standards;
- Promotes innovative services and enhances the efficiency of existing services;
- Improves the capacity and skills of the work force; and
- Prepares ground for private sector participation.

Agriculture is a very diverse sector involving food and fibre crops, vegetables, horticulture, fisheries, livestock and many allied enterprises. Priorities can be set to support a particular sector, or to meet broader national goals, such as meeting the domestic requirement of food for the growing population or meeting specific export targets. E-agriculture outcomes are derived from strategic themes (goals and challenges) and country context. Once agreed, the e-agriculture outcomes form the basis for determining the required components. Table 1.6.1 includes sample questions that may help you to better define your e-agriculture outcomes.

Table 1.6.1. Sample questions for defining e-agriculture outcomes

Dimension	Areas where changes may be needed
What changes to the agricultural system and services are required to meet the goals identified in the strategic context? Where are the changes needed?	– Agricultural services' delivery models; – Financial services' delivery models; – Coordination and sustainability of agricultural and financial services' delivery; – Traceability; – Agriculture extension system, knowledge management and transfer; – Access to agricultural services and infrastructure; – Supply and distribution of agricultural products and workforce; – Quality and accuracy of agricultural services' delivery; – Time and cost of agriculture and financial services delivery; – Policy, investment and research decision-making; – Digital literacy and human capacity development; and – Monitoring and information infrastructure and service delivery.
What changes to agricultural information flows would support these desired changes?	– Better information for timely decision-making (in some cases real time using big data); – Capture and sharing of agricultural information among agricultural services' providers; – Coordination and monitoring of different entities involved in agricultural services' delivery; – Access to agricultural services for individual farmers and fishers in remote areas and all players in the value chain; – Access to agricultural services' delivery tools that support agricultural service providers in delivering services to farming communities; – Access to trading, payment and payment platforms for serving stakeholders in agricultural value chains; and – Access to agricultural education and information for individuals, and through intermediaries.

This step should describe the e-agriculture outcomes, followed by:

- The required changes to agricultural information and transaction flows or the way in which agricultural services are delivered; and
- The agricultural system outcomes that will result from the e-agriculture outcomes.

This approach ensures each description can stand alone, but that its value to the agriculture system is clear (Box 1.6.1).

Internal working sessions should be used to formulate a concise description of how e-agriculture will be used to respond to agricultural system goals, encompassing insights from research into e-agriculture trends and best practices.

Box 1.6.1. Examples of e-agriculture outcomes

- Enable access to agricultural services for all farmers and fishers in remote or rural communities;
- Facilitate improved domestic and international trade via farm-to-fork traceability consistent with global standards;
- Facilitate continuous improvement of farming practices and yields through more effective utilization of agronomic best practices, agricultural information and decision support tools;
- Improve the quality, safety and efficiency of agricultural production by facilitating access to accurate content and decision support tools;
- Support more informed policy, investment and research decisions through access to timely, accurate and comprehensive information from the agriculture sector;
- Enable agricultural service providers to operate more efficiently as a connected system, overcoming fragmentation and duplication of service delivery;
- Improve logistics and supply chain management (e.g. storage, transportation, farm inputs);
- Enable multidisciplinary teams to communicate and exchange information and provide better coordinated services across value chains;
- Enable financial transaction services to facilitate trade;
- Facilitate free and open sharing of information and knowledge generated by public institutions;
- Introduce new and improve the efficiency of existing risk management services such as micro-insurance or government subsidies;
- Strengthen tracking and traceability framework nationwide to protect the bio-diversity;
- Increase the availability, accuracy and accessibility of actionable information for agriculture sector stakeholders;
- Improve linkage between extensions and researchers;
- Increase the efficiency of production and diversity of crops;
- Improve access to markets;
- Increase the transparency and awareness as well as bridge the gap in policies and regulations;
- Facilitate access to insurance and compensation mechanisms in case of disaster.

6.3 Link e-agriculture outcomes to the strategic context

This step describes the rationale between the strategic context and the e-agriculture outcomes defined in the previous step. A national e-agriculture vision should demonstrate how it addresses agricultural system goals and challenges, and how it responds to stakeholders' needs. Without a clear link to the strategic context, a national e-agriculture vision risks being misinterpreted or considered irrelevant. In some cases, e-agriculture outcomes will address multiple agricultural system goals, so outcomes should be described in a broad manner. Describing the rationale clearly makes the relationships explicit.

This step should produce a description of the rationale between e-agriculture outcomes and the agricultural system goals and challenges defined as part of the strategic context for e-agriculture (Table 1.6.2).

Table 1.6.2. Sample links between e-agriculture outcomes and agricultural system goals

Agricultural system goal	
Overcome agricultural extension agent shortages, which primarily affect agricultural service delivery to farming communities, particularly in remote areas.	
E-agriculture outcome	***Rationale***
Enables farmers to electronically access appropriate agricultural services directly without the need of an extension agent.	Enabling individuals to access services through electronic means will partly compensate for agricultural workforce shortages.
Agricultural system goal	
Double agricultural exports from our country by 2020.	
E-agriculture outcome	***Rationale***
Improved agricultural extension and information services to provide high quality information on good practices and diagnostics to farmers and fishers.	Access to information on improved practices and diagnostic tools will help farmers and fishers to improve yield volumes and quality which will increase the likelihood of export to international markets.
E-agriculture outcome	***Rationale***
Facilitate improved traceability and certification of agricultural produce.	Being able to certify compliance with internationally-recognized agricultural standards and more effectively trace movements of agricultural products will increase likelihood of export to international markets.

Additional information could be provided to strengthen the rationale for the associated e-agriculture outcome. Examples include outcomes of relevant e-agriculture projects and other studies, identified through research and stakeholder consultation.

Internal working sessions[50] are held to develop a sound rationale for each outcome sought. The knowledge to support this step should exist largely through activities already undertaken. Country experience recommends that consultation with broad stakeholders on the rationale should be considered after the national e-agriculture vision statement has been drafted, and impacts on stakeholders identified.

6.4 Develop an initial vision statement

This step develops an initial vision statement that can be endorsed by political and agriculture sector decision-makers used to support agricultural policy and easily communicated to stakeholders and constituencies. The statement should be meaningful and relevant, and should not be technology-oriented.

A vision statement is a high-level statement that communicates the value of e-agriculture in a simple and understandable manner. It describes how e-agriculture will lead to achieving the strategic benefits for stakeholders in the agriculture sector, and within what time frame.

[50] http://www.fao.org/asiapacific/resources/e-agriculture

This step should produce a vision statement that has been reviewed and refined with the relevant stakeholders.

Sample structure for an initial vision statement

By *[time frame]*

e-agriculture will deliver *[strategic benefits and outcomes for the agricultural system and population]*

through *[strategic changes to agricultural services and information flows]*.

This structure ensures that the vision statement for e-agriculture can exist in isolation and still communicate the value of investing in a national e-agriculture environment.

Sample country vision statement for e-agriculture

By 2020

e-agriculture will enable a more productive, more profitable, more equitable and sustainable agricultural system by transforming the way information is used to plan, manage and deliver agricultural services.

Visual models to communicate complex vision statements, such as the example provided in Figure 1.6.1.

Figure 1.6.1. Sample visual model for an e-agriculture vision statement

The model above communicates a vision for e-agriculture through three elements:

- The strategic agricultural system priorities and focus for e-agriculture;
- The expected benefits or outcomes to the agricultural system; and
- The e-agriculture outcomes that are sought.

This step requires internal working sessions with e-agriculture strategy team to draft a compelling vision statement for e-agriculture.

Once developed, the statement should be reviewed with a small group of stakeholders. The focus should be on refining the content of the statement, the e-agriculture outcomes that underpin it and the manner in which the vision has been articulated. Broader consultation on the vision statement should be deferred until the impact of the vision has been described for stakeholders.

Important questions to ask while formulating a vision include:

- What are the best opportunities and key challenges for e-agriculture?
- How can e-agriculture contribute to the national agricultural vision?
- What cannot be achieved if such a vision is not developed?

6.5 Describe what the e-agriculture vision will mean for stakeholders

This step describes how e-agriculture will impact each stakeholder group. This helps stakeholders to understand what e-agriculture means for them, and is critical to gaining their support for the vision. Table 1.6.3 provides some example questions that can be used to help complete this step.

Table 1.6.3. Sample questions for describing the vision for important stakeholders

Questions	Potential considerations
Which are the important stakeholder groups for which the vision should be described?	• Farmers and fishers; • Agricultural service providers and intermediaries; • Agricultural researchers, managers and administrators; • Input suppliers, agribusinesses, logistics providers, traders, bankers, financial service providers, insurance companies, agents, telecommunication & IT service providers and other actors in the value chain; and • Potential investors or strategic partners within and outside the agriculture sector.
What is each stakeholder group's current experience when interacting within the agricultural system?	This should be driven by agricultural system challenges that were identified through the strategic context, which may include areas such as: • Access to agricultural information; • Access to agricultural service delivery tools and platforms; • Access to financial services; • Linkages with others in agricultural value chains; • Improved delivery of services (e.g. soil test result through SMS); and • Their role in the agricultural system and potential for revenue expansion of other sectors (telecommunications, banking, insurance), enhancing the efficiency of public service delivery (disaster management, rural development).
How will e-agriculture improve their experience within the agriculture system?	This covers the same areas as above, except that the focus is on describing practically how the challenges will be overcome as a result of delivering the vision.

This step should describe the e-agriculture vision for important stakeholder groups, including:

- Challenges they currently experience in relation to agricultural services or the agricultural system; and
- Improvements they would experience if the vision were delivered (Table 1.6.4).

Table 1.6.4. Sample national e-agriculture vision for farmers

The 2020 e-agriculture vision for farmers		
By 2020, mainstreaming ICTs in agriculture would provide a significant enhancement in farming efficiency and visible improvement in farmer's livelihood. *[Explanation]* Delivering a national e-agriculture vision will enable farmers to enhance their farm productivity by making more informed decisions as a result of better access to accurate and complete information on best practices, pest and disease management and coping practices to manage abnormal weather conditions. Facilitating better market access will improve farmers' income by reducing transaction costs, increasing access to timely storage and transport facilities, and opportunities for export.		
Service	**Current situation**	**Situation by 2020 with delivery of the e-agriculture vision**
Accessibility to information and services	Not accessible by all, particularly in remote areas	Accessible by all
Timeliness of services	Timely services not guaranteed	Timely services available to the farming community
Production system services	Incomplete and generalized	Holistic and site-specific resulting in increased efficiency of inputs and saving of cost
Pest and disease outbreaks	Incomplete and untimely information and inefficient way of managing a crisis resulting in huge economic loss	Better management of pest and disease outbreaks with complete and timely information resulting in crop failure prevention
Weather information	Incomplete and generalized information resulting in poor benefits	Holistic and site-specific information resulting in better benefits
Market access	Largely limited to information on commodity prices	Holistic information on markets, prices, transport, storage. Trading with less or no involvement of intermediaries or agents
Payments and money transfers	Largely done manually with cash – slow, tedious, inefficient and involving considerable cost and risk.	Fast, transparent and reliable money transactions at affordable charges with reduced risk
Interaction with experts	Limited	Significantly improved level of direct interaction with experts

6.6 Develop one or more scenarios that put the national e-agriculture vision into practice (optional)

This step develops scenarios that communicate how a national e-agriculture vision will look in practice. Scenarios typically describe hypothetical, but common, real-world situations illustrating how challenges would be addressed by e-agriculture. Scenario development is an optional step that provides additional detail for stakeholders. Country experience suggests that scenarios are valuable for educating and building awareness of the intended role of e-agriculture.

Developing scenarios requires an understanding of:

- The stakeholder groups that should feature in the scenario;
- The current agricultural system challenges that the scenario should focus on demonstrating; and
- The future role of e-agriculture in overcoming these challenges.

This step should produce one or more scenarios that will assist important stakeholder groups to understand how delivering the national e-agriculture vision will improve their experience with the agricultural system. While doing so, please take into account the different end users including farmers, fishers, livestock herders, horticulturists, etc.

Developing scenarios is a creative exercise that involves constructing a story to demonstrate how e-agriculture will improve the agricultural system experience for different types of stakeholders. Examples of e-agriculture services and applications (such as those described throughout this guide) can be used to add further credibility and realism to the scenario. Once developed, scenarios should be reviewed and refined with the relevant stakeholder groups. This provides an opportunity to gather input and insights to ensure the scenario is accurate, builds awareness and support for the national e-agriculture vision.

6.7 Conduct a pre-mortem of the national e-agriculture vision (optional)

A pre-mortem is an exercise that aims to help you to try to understand all of the possible reasons why a national e-agriculture vision could possibly fail. The results of the pre-mortem are intended to be used to further refine and improve your vision (described in more detail in Chapter 10).

As a result of this step, a summary of all of the potential challenges for fulfilling the draft national e-agriculture vision will be developed, which will be used to guide your assessment of opportunities, gaps, risks and barriers (see Chapter 9) further refine your vision (see Chapter 10) and develop an e-agriculture action plan (see Part 2).

Conducting a pre-mortem involves bringing together project team members and other relevant stakeholders to discuss all of the plausible ways that the vision might fail to be effectively implemented. For additional guidance on how to conduct this activity refer to 'Performing a Project Premortem[51]' by Gary Klein in the September 2007 issue of the *Harvard Business Review* or 'The Premortem Technique' by Olivier Serrat published by Cornell University ILR School.[52]

[51] https://hbr.org/2007/09/performing-a-project-premortem

[52] http://digitalcommons.ilr.cornell.edu/cgi/viewcontent.cgi?article=1218&context=intl

Box 1.6.2. Sample scenario

How e-agriculture would change Ida's experience

Ida and her family live in a rural agricultural community in Indonesia's West Java. Her family subsists on 1.5 hectares of land, planting mostly cassava and vegetables.

Ida's experience with the current agricultural system

Ida's family consumes most of what they produce. Their yields are significantly lower than the global averages for what they grow, and they are highly susceptible to pests, disease and weather. What she is able to sell is sold entirely to intermediaries who come right to her house. She is unaware of the market price for her crops, and accepts whatever price she is offered.

Ida does not have access to a bank to save money, and has been the victim of theft in the past since the little money she can save is kept in her house. She would like to purchase better inputs and equipment, but does not have access to loans. She also does not have access to crop insurance, and has experienced significant losses in the past from disease and drought. Her children only go to school some of the time, as she does not always have money to pay their school fees. When someone in the family is sick, they generally cannot afford to seek medical attention or pay for medicine, so they just hope it is nothing major.

There is an extension agent who serves her community, but he also supports 50 other communities and therefore Ida rarely sees him. She follows mostly traditional planting practices, as almost all of her knowledge about agronomic practices has been passed down through her family.

How e-agriculture would change Ida's experience with the agricultural system

With growing mobile phone penetration in the country, and a cohesive national strategy for e-agriculture, Ida's experience is now much different. Through a mobile-based service, she can now receive localized weather updates and pest and disease outbreak alerts, which has enabled her to time her planting and apply inputs better. She can also receive updates on market prices and contact buyers directly when she has harvested so she is no longer entirely at the mercy of intermediaries.

She is now able to save money in a mobile wallet, which is more secure than cash. A new service has created a basic credit score for her based on her mobile usage, and linked her with a microfinance institute that issued her a small loan paid (and re-paid) directly from her phone. She has since received larger loans, which she has been able to invest in improved inputs and equipment. There is another service that offers indexed crop insurance that can be purchased and paid out directly from her phone. When disaster strikes in the form of floods or drought, the likely impact on Ida is detected by sensors that trigger pay outs.

The extension agent still only comes infrequently, although Ida is able to use a mobile service to access information about improved agronomic practices. The local radio station has also set up a show where farmers can call in for expert advice, which Ida listens to daily—and has even called into a few times. When the agent does come to her community, he now carries a portable, rechargeable projector that he uses to show educational videos to farmers in Ida's community to further improve their understanding of how to apply new practices.

As a result of all of these changes, Ida has improved her yields, made improvements to her farm and is earning more income than before. Life is still not perfect. The roads are still poor, which means that she has a difficult time bringing her crops directly to market where she can sell them for a higher price, and she does not have access to cold storage, so she must find a buyer soon after harvest.

Despite these obstacles, she is happier now than before because at least she has some financial security and can save some money to invest in her children's education and medical care for the family.

CHAPTER 7 *Identify the required e-agriculture components*

Successful delivery of an e-agriculture environment is dependent on components such as leadership and governance; strategy and investment; services and applications; infrastructure; standards and interoperability; content, knowledge management and sharing; legislation, policy and compliance; and workforce and capacity development. Any deficiency in any of the components will impact the delivery of the vision. This chapter focuses on identifying the e-agriculture components required to deliver the national e-agriculture vision, which is still at a draft stage.

Once the initial 'unconstrained' vision for the national e-agriculture environment has been drafted, it is possible to define the required e-agriculture components, or building blocks, of a national e-agriculture environment.

The next steps are to identify the required e-agriculture components across the following areas:

- Leadership and governance;
- Strategy and investment;
- Services and applications;
- Infrastructure;
- Standards and interoperability;
- Content, knowledge management and sharing;
- Legislation, policy and compliance; and
- Workforce and capacity development.

Figure 1.7.1. Identifying required e-agriculture components

Outputs

A description of:

- The set of e-agriculture components required to deliver the national e-agriculture vision; and
- The relationships and interdependencies between the components.

7.1 Leadership and governance

This step identifies the e-agriculture leadership and governance components required to direct and coordinate national, state, regional and local e-agriculture activities towards the delivery of a national e-agriculture environment (Table 1.7.1).

Table 1.7.1. Examples of e-agriculture leadership and governance components

Components	Description	Examples
Policy and regulatory oversight	Oversight of adherence to e-agriculture, agriculture and other policies that support the development of the national e-agriculture environment. It is also important to consider the policies and regulations of external sectors that are critical such as e-governance, telecommunications (including broadband), banking, IT etc.	• Policy identification and assessment; • Regulatory environment; and • Policy linkages.
Programme management	Oversight and coordination of specific e-agriculture initiatives across the national e-agriculture programme to ensure delivery of on-time and on-budget projects.	• Project coordination; • Progress tracking and reporting; • Risk management; and • Dependency management.
Stakeholder engagement	Consultation with stakeholders to gather input and ensure they are involved for the duration of the programme.	• Reference groups; • Engagement forums; • Public consultation; and • Communications strategy and plans.

Table 1.7.1. (continued)

Components	Description	Examples
Strategic architecture	Defines e-agriculture and enabling functions required to ensure that e-agriculture can operate successfully and deliver the expected benefits.	• Requirements' definition; • Component models; • Functional architecture; and • Reference architecture.
Management and operation	Management, operation and support of the national e-agriculture environment to ensure that it is reliable and available to support all stakeholders.	• Availability, incident, access and service-level management; and • Change management.
Monitoring and evaluation	Measurement of the outcomes that are being delivered, the identification and correction of planned outcomes, those that are not being achieved and demonstrating to stakeholders the outcomes that have been achieved.	• Outcome identification, monitoring and assessment.

These components may exist at different levels including at national, state, regional and local levels. Roles, relationships and responsibilities will need to be defined during implementation planning.

This step should produce a description of the leadership and governance required to deliver a national e-agriculture environment. This should include a description and chart, or visual model, of the recommended functions and mechanisms required at national, state, regional and local levels including:

- Leadership and governance bodies and mechanisms;
- Roles and responsibilities; and
- Relationships between these governance bodies and mechanisms.

This step should be approached as an internal activity that involves brainstorming and working sessions to identify the preferred leadership and governance model, including defining the relationship to existing bodies at national, state and local levels. It also requires alignment with the composition of the various stakeholder engagement groups described in Part 1-Chapter 2 (Manage the vision development process).

7.2 Strategy and investment

This step identifies the e-agriculture strategy and investment components required to develop, operate and sustain the national e-agriculture environment. These components support the development of the strategy and plans at various levels to guide the development of that environment. The e-agriculture investment components focus on providing the appropriate investment and funding for the execution of e-agriculture strategies and plans (Table 1.7.2).

Table 1.7.2. Examples of common e-agriculture strategy and investment components

Components	Description	Examples
Strategy and planning	Establishes the e-agriculture strategy and plan to guide the development of the national e-agriculture environment in response to agricultural system goals and challenges.	• National, state, regional and local e-agriculture strategy and planning bodies and mechanisms; and • Integration of these bodies among different levels.
Funding	Enables the development and operation of the national e-agriculture environment.	• National, state, regional and local e-agriculture, agriculture and ICT funding mechanisms and incentive schemes.
Investment management	Supports the allocation of e-agriculture investment funding to projects that assist the development of a national e-agriculture environment.	• E-agriculture investment and business case development; • Evaluation and prioritization of e-agriculture investment and business cases; and • Budgeting and tracking of investment funds.

Nations have been investing substantially in creating ICT infrastructure which means that some of the investments required for creating a holistic e-agriculture environment may already be in place.

This step should produce a description of the e-agriculture strategy and investment components required to support the development and operation of the national e-agriculture environment.

Internal activity that involves brainstorming and working sessions to identify the required e-agriculture strategy and investment components needed to develop, operate and support the national e-agriculture environment.

Where possible, these components should be linked back to the e-agriculture outcomes defined in Part 1-Chapter 6-Section 6.2, as a means of creating traceability to the strategic context for e-agriculture. Given the enabling nature of these components, they may also be linked to service and application, infrastructure or standards and interoperability components.

7.3 Services and applications

This step identifies the e-agriculture service and application components required to address the agricultural system goals and challenges. Services and applications are the means to address the needs of farmers, farmers' organizations, entrepreneurs, the private sector, development agencies and agribusinesses. This requires concerted efforts by the government, research institutions, experts, NGOs, agricultural service providers, managers, administrators and the media. These components enable stakeholders to access, use and share agricultural information and deliver services in new ways.

Understanding how information and transaction flows need to be improved, or how services need to be delivered via electronic channels, will assist in identifying the e-agriculture services and applications components that need to be present in the national e-agriculture environment (refer to Annex B). This understanding should have been developed during the stage of establishing the strategic context and the initial e-agriculture vision.

This step should produce a description of the e-agriculture service and application components required to deliver the e-agriculture outcomes described by the initial e-agriculture vision. It is also important to check the feasibility of each service against the key prerequisites. For example:

- What type of ICT network is required and is it available?
- What type of end-user terminal is required (feature phones, smartphones, laptops, servers etc.)? What is the current and expected penetration level of these terminals?
- What are the policy and regulatory pre-requisites? For example, licensing requirements, network roll out requirement, security and privacy requirements.
- What is the level of digital literacy required to access these services? How well does the digital literacy plan tally with the service roll out?

This step should be approached as an internal activity that involves brainstorming and working sessions to identify the required e-agriculture service and application components, and link these back to the e-agriculture outcomes defined within the initial vision for national e-agriculture. This helps stakeholders understand why the identified e-agriculture service and application components are required in the national e-agriculture environment. The tool[53], which complements this guide, provides a framework to analyse each service across different components to check the feasibility.

Table 1.7.3. Linking an e-agriculture service and application to an e-agriculture outcome

Agricultural system goal	
Overcome agricultural extension agent shortages, which primarily affect agricultural service delivery to farming communities, particularly in remote areas.	
E-agriculture outcome	***Rationale***
Enable farmers to electronically access appropriate agricultural services directly without the need for an extension agent.	Enabling individuals to access services through electronic means will partly compensate for agricultural workforce shortages.
Service and applications component	***Rationale***
Agricultural information service delivery channels (e.g. mobile, radio, video, Internet).	Making agronomic information accessible via a variety of ICT delivery channels increases the likelihood of farmers accessing that information.

[53] The toolkit is available at http://www.fao.org/asiapacific/resources/e-agriculture

The implementation plan described in Part 2 will determine the detailed requirements and design of these components.

Other components will probably be identified during this step. Often, these are enabling components, such as infrastructure, policy and standards. They should be noted as they are identified, and considered when analysing that specific component.

7.4 Infrastructure

This step identifies the e-agriculture infrastructure components required to support the sharing of structured and meaningful agricultural information across geographical and sectoral boundaries, and to support new and improved ways of delivering services and information. Significant progress at a national level is dependent on the establishment of e-agriculture infrastructure components to support agricultural information and transaction flows. Infrastructure components span both physical technology infrastructure as well as software platforms and services that support information exchange across the agriculture sector (see Table 1.7.4 for some examples).

Table 1.7.4. Examples of common e-agriculture infrastructure components

Components	Description	Examples
Communication infrastructure	Communication infrastructure coverage that enables people to access e-agriculture services using voice, SMS, MMS, social media, radio stations, sensor networks and television.	• Mobile, fixed and satellite networks; • Cloud networks and locally-hosted data storage; • Radio stations and towers; • Television towers; • Sensor networks; • Interactive voice response systems (IVRS); • Data analytics services.
High-speed data connectivity	The high-speed network connectivity infrastructure required to access advanced e-agriculture services and applications.	• Submarine communications' cables; • Broadband connections; • Internet.
Electrical infrastructure	By its very definition, e-agriculture requires access to electricity at some point in order to function.	• Power plants; • Power lines; and • Off-the-grid power (e.g. solar panels).
Computing infrastructure (hardware and software)	The physical computing infrastructure (e.g. PCs, laptops, mobile phones, smartphones, tablets, server infrastructure, sensors and associated networks, switches, etc.) and the software applications which enable the	• National, state, regional and local service and computing infrastructure; • Agricultural service provider computing infrastructure; • Financial service provider computing infrastructure (switches, ATMs, POS devices, etc.);

Table 1.7.4. (continued)

Components	Description	Examples
	collection, recording and exchange of electronic information across the agriculture sector, and support agricultural service delivery.	• Smartphone and desktop applications; and • Applications platforms e.g., Content Management Systems.
Agricultural content, datasets and related applications	Datasets that support agricultural service management and administration, which typically provide access to longitudinal and aggregated information for analysis, reporting, research and decision-making. Databases and content repositories that enable farmers and agricultural service providers to access trusted and verified agricultural information and knowledge.	• Weather, pest, disease, price, production and other national, regional, and local databases; • Open access to data and big data analysis; • GIS and satellite data; • Disaster-related data; and • Agricultural knowledge resources.

Despite the best efforts by governments to expand connectivity to all of their citizens, significant portions of the population in many countries, particularly in rural and remote regions, remain without access to mobile and broadband networks. There are also challenges of data collection through sensors and integration of this information into existing databases and application platforms. It is also likely that e-agriculture will be inhibited by irregular power supply, which is common in many developing countries. Off-the-grid energy solutions do exist, but are not yet widely available.

This step should produce a description of the e-agriculture infrastructure components required to deliver the e-agricultural outcomes described by the initial e-agriculture vision.

This step should be approached as an internal activity that involves brainstorming and working sessions to identify the required infrastructure for delivery of e-agriculture service and application components, and link these back to the e-agriculture outcomes defined within the initial vision for national e-agriculture. This helps stakeholders understand why the identified e-agriculture infrastructure is required in the national e-agriculture environment.

As mentioned above, these components are not required to be defined in detail at this stage. It may also unnecessarily constrain the way in which these components can be realized physically. The implementation plan will determine the detailed requirements and design of these components. Other e-agriculture components will likely be identified during this step, for example components such as policy, standards and information protection. They should be noted as they are identified, and considered when analysing that specific component.

Table 1.7.5. Linking an infrastructure component to an e-agriculture outcome

Agricultural system goal	
Overcome agricultural extension agent shortages, which primarily affect agricultural service delivery to farming communities, particularly in remote areas.	
E-agriculture outcome	***Rationale***
Enable farmers to electronically access appropriate agricultural services directly without the need for an extension agent.	Enabling individuals to access services through electronic means will partly compensate for agricultural workforce shortages.
Infrastructure components	***Rationale***
Communication infrastructure, affordable high-speed data connectivity, computing infrastructure, electrical infrastructure, applications (including platforms) and software.	The delivery of information on best practices via a variety of ICT delivery channels requires sufficient communication and high-speed data infrastructure for dissemination, computing infrastructure to run the services and electrical infrastructure to power them.

7.5 Standards and interoperability

The step identifies the e-agriculture standards and interoperability components required to enable the consistent and accurate collection and exchange of agricultural information across geographical and agriculture sector boundaries (Table 1.7.6). Without these components, agricultural information cannot be collected consistently, will be open to misinterpretation and will be difficult or impossible to share due to incompatibilities in data structures and terminologies.

Often, there are synergies between e-agricultural services and other services such as e-governance, e-health and e-education. Common infrastructure and applications can be used to deliver e-agricultural services in addition to other services. In order to do so, it is important that data and e-services' infrastructures are interoperable. For example, Bhutan has a well laid out process to ensure interoperability of e-services which is coordinated through the e-Governance framework.[54]

A useful resource for learning more about e-agriculture standards is FAO's AIMS. Relevant ITU standards are available at http://www.itu.int/en/ITU-T/publications/Pages/recs.aspx.

This step should produce a description of the e-agriculture standards and interoperability components required to support:

- The e-agriculture service and application components identified in Section 7.3;
- The e-agriculture infrastructure components identified in Section 7.4; and
- Broader changes to agricultural information flows required to deliver the e-agriculture outcomes described in the initial e-agriculture vision.

[54] http://www.dit.gov.bt/sites/default/files/page/2013/09/egif_summary_21460.pdf

Table 1.7.6. Examples of common e-agriculture standards and interoperability components

Components	Description	Examples
Data structure standards	These standards govern the way agricultural datasets are stored using consistent data structures and can be presented with consistency in software applications, to ensure information is neither misinterpreted nor overlooked.	• FAO's Agricultural Information Management Standards (AIMS)[55] supports standards, technology and good practices for open access and open data in the agricultural domain; • Geospatial and sensor data; • Metadata standards, such as Meaningful Bibliographic Metadata (M2B); • Data set compatibility for cross-platform sharing; and • Open data access.
Content quality standards	These standards govern the way that agricultural content is controlled for quality and accuracy.	• Although not a government standard, GSMA' mAgri's *Guidelines for creating agricultural VAS content*[56] are a relevant example; and • Direct2Farm content management guidelines.
Common terminologies	These enable information communicated electronically to make use of a common language across e-agriculture platforms for consistency. A localized thesaurus of agricultural terminologies is critical for localization and portability of content across a country/region.	• Agricultural terminology standards, such as AGROVOC.[57]
Secure messaging standards (where necessary)	These are for the secure transmission and delivery of messages and the appropriate authentication of the message receiver, to ensure that information is securely transmitted and delivered to the correct recipient.	• Security standards; • Network and Interoperability standards; and • Cloud security standards. For example, ITU-T X Series and Y Series recommendations.
Service interoperability	These define the requirements necessary to conduct services (such as transactions, information search) across platforms.	• Platform-level interconnectivity; and • Inter-Cloud interoperability. • Financial services interoperability. For example, ITU-T X Series and Y Series recommendations.

[55] http://aims.fao.org/

[56] http://www.gsma.com/mobilefordevelopment/wp-content/uploads/2014/08/Guidelines_for_Creating_Agri_VAS_Content_v2_final.pdf

[57] http://aims.fao.org/vest-registry/vocabularies/agrovoc-multilingual-agricultural-thesaurus

This step should be approached as an internal activity that involves brainstorming and working sessions to identify the required e-agriculture standards and interoperability components, as well as to refer to international and national standardization bodies. The link can also be made by describing how e-agriculture standards and interoperability components are required to support a service and application or infrastructure component, which in turn has been linked to an e-agriculture outcome (Table 1.7.7).

Table 1.7.7. Linking e-agriculture standards and interoperability to an e-agriculture outcome

Agricultural system goal	
Overcome agricultural extension agent shortages, which primarily affect agricultural service delivery to farming communities, particularly in remote areas.	
E-agriculture outcome	***Rationale***
Enable farmers to electronically access appropriate agricultural information and services directly without the need for an extension agent.	Enabling individuals to access services through electronic means will partly compensate for agricultural workforce shortages.
Standards and interoperability component	***Rationale***
All e-agriculture services providing agronomic information to farmers adhere to the AGROVOC standard.	Agronomic information services are being provided by several actors (including the government, the private sector and NGOs). Adoption of AGROVOC by all providers will ensure that farmers are not confused by differences in terminology.

Other e-agriculture components will probably be identified during this step, usually enabling components such as policy, standards and information protection. They should be noted as they are identified, and considered when analyzing that specific component.

7.6 Content, knowledge management and sharing

This step identifies the elements required to effectively leverage e-agriculture as a vehicle through which knowledge is shared and acted upon. Knowledge management and sharing are critical to the success of e-agriculture. They leverage ICT to convert information into knowledge, and create channels for transferring relevant knowledge in a timely manner to the appropriate target audience while enhancing the capability of advisory services.

This step should produce a description of the e-agriculture-related knowledge management, sharing, and advisory services' components required to deliver the e-agriculture outcomes described by the initial e-agriculture vision.

This step should be approached as a group activity that involves brainstorming and working sessions to identify the information within multiple departments and industry that is meaningful for the delivery of e-agriculture services. Content, knowledge management and sharing are often led by multiple, and sometimes uncoordinated parties in government

Table 1.7.8. Examples of common e-agriculture knowledge management, sharing and advisory services' components

Components	Description	Examples
Relevant content and information identification	The process of identifying relevant content, information and data sources and how to access it.	• Weather station information; • Production information and demand; • Historical data about land quality; • Landownership; and • Content relating to agricultural practices.
Knowledge resource creation	The process of creating knowledge resources from raw information and data sources.	• Weather alerts; • Good agricultural practices; and • Market price information.
Analytical and advisory services	This refers to enhanced services that provided highly personalized analytical and advisory services for users, as opposed to more general knowledge resources.	• Personalized alerts and suggested actions based on weather, timing, crop and land quality.
Knowledge delivery	The channels through which requested and appropriate information are delivered.	• M-learning platforms; • SMS, MMS, mobile applications (apps); • Voice messages, video messages; and • Disaster warning systems • Agriculture portals.

agencies, the NGO sector and the private sector. It is important to make sure that any stakeholder group that is already working in this space is engaged in this process.

7.7 Legislation, policy and compliance

This step identifies the e-agriculture legislation, policy and compliance components that are required to support the development and operation of the national e-agriculture environment (Table 1.7.9).

This step should produce a description of the e-agriculture-related legislation, policy and compliance components required to develop and operate the national e-agriculture environment.

This step should be approached as an internal activity that involves brainstorming and working sessions to identify the e-agriculture legislative, policy and compliance components required for delivering and operating the national e-agriculture environment; consultation with subject-matter experts may be required. Where possible these components should be linked back to e-agriculture outcomes, including through e-agriculture service and application, infrastructure or standards components.

Table 1.7.9. Examples of common e-agriculture legislation, policy and compliance components

Components	Description	Examples
Legislation	National legislation, policy and regulatory components that govern how information is stored, accessed and shared amongst stakeholders and across geographical and sectoral boundaries.	• Privacy, protection, storage, transportation and retention of personal information; • Access and consent to personal information use and disclosure, including secondary use; • Licensing regimes which may be needed to ensure that private operators of components of a national e-agriculture environment meet required standards; and • Intellectual Property Rights of various actors in the content development process and policies guiding it.
Policy	Broader public policy required to support the development of a national e-agriculture environment.	• Agriculture sector policy (e.g. reform, improved access to and use of agricultural information); • Non-agriculture sector policy (e.g. telecommunications, broadband, banking, insurance, digital authorization, utilization of existing e-government infrastructure); • Policies to stimulate and manage innovation, risk, evaluation of feasibility and utility of services; and • Policies on offshore hosting of data from agricultural service providers and sharing of data (open access).
E-agriculture specific policy	Policies specifically governing e-agriculture services and applications.	• Policies that outline best practices for e-agriculture; and • Policies related to the equitable distribution of e-agriculture services and applications.
Compliance	Components required to support the development of e-agriculture services that are compatible with the national e-agriculture environment.	• National e-agriculture standards and other interoperability requirements; • Open data/data access framework; and • Compliance mechanisms such as Certification/Accreditation of e-Agriculture services and applications.

7.8 Workforce and capacity development

This step identifies the e-agriculture workforce and capacity development components required to design, develop, operate and support the national e-agriculture environment (Table 1.7.10). These components encompass farmers, fishers and agribusinesses who may use e-agriculture for personal benefit, workers who will use e-agriculture as part of performing their jobs (such as agricultural extension providers) and those who will design, implement and support the broader national e-agriculture environment (such as Ministry of Agriculture employees).

Table 1.7.10. Examples of common e-agriculture workforce and capacity development components

Components	Description	Examples
Agricultural workforce (e.g. intermediaries and agents)	The components required to deliver an agricultural workforce that has the skills, experience and knowledge to apply e-agriculture in the management and delivery of agricultural services to farmers.	• E-agriculture skills and competencies that agricultural workers require; • Education and training (development, integration or changes to existing curricula) required to develop an e-agriculture-ready workforce; • E-agriculture accreditation requirements for agricultural workers; and • Priority segments of the nation's agricultural workforce.
ICT workforce	The same components as above but applied to designing, building, operating and supporting e-agriculture services.	• As above, but applicable to ICT workers, such as software engineers and applications' developers.
Farmers, fishers and agribusiness workers	The components required to enable farmers, fishers and agribusiness workers to effectively access and make use of e-agriculture tools and applications.	• Education and training (literacy and digital literacy); and • Digital literacy of the agriculture sector workforce and their families.

This step should produce a description of the e-agriculture workforce components required to develop, operate and support the national e-agriculture environment.

This step should be approached as an internal activity that involves brainstorming and working sessions. Where possible these components should be linked back to e-agriculture outcomes, including through e-agriculture service and application, infrastructure or standards' components.

CHAPTER 8

Gather information on the current e-agriculture environment

Understanding the current e-agriculture environment is important to frame the national e-agriculture vision. Now that all the required components for e-agriculture have been identified in Chapter 7, the next step is to gather information on the current e-agriculture environment in the country.

This part will focus on understanding the current national e-agriculture environment in terms of e-agriculture components that already exist, or will be delivered within the timeframe of the e-agriculture vision.

The next step is to investigate the current e-agriculture environment across the following areas:

- Leadership and governance;
- Strategy and investment;
- Services and applications;
- Infrastructure;
- Standards and interoperability;
- Content, knowledge management and sharing;
- Legislation, policy and compliance; and
- Workforce and capacity development.

Figure 1.8.1. Gathering information on the current e-agriculture environment across various components

Section 8.1 to 8.8 provides an approach to gather this information.

Approach

This step will require a combination of internal research and analysis, and consultation with agriculture sector stakeholders.

Internal research and analysis

Information may be available from national, state and regional agriculture departments as well as from other organizations and groups that focus on the development of e-agriculture. It is important to improve the statistics collection for providing inputs to the relevant e-agriculture strategy component. Research should span both the public and private agriculture sector. Reports from international agencies, such as FAO and ITU, can also be used to support this step.

Stakeholder consultation

Experience suggests that considerable information can be obtained through interviews and consultation with the following agriculture sector stakeholders:

- Individuals within agricultural value chains, including farmers, extension agents, input suppliers, buyers, agricultural service providers and so forth;
- Agricultural associations or industry bodies;
- Ministry of Education, and other industry stakeholders and NGOs involved in promoting digital literacy;
- Individuals from national, state, regional and local agricultural departments and organizations;
- Ministry of Telecommunications/ICT, regulatory authorities and TSPs;
- Ministry of Finance, banking regulators, banks and insurance providers;
- Ministry of Commerce and Chambers of Commerce;
- Department of Irrigation and Water Management, Department of Transportation, electricity authorities; and
- Other relevant stakeholders.

Other suggestions and insights

A broad focus should be taken to allow identification of useful components within the wider public and private sectors. The fact that something is not referred to as e-agriculture, or not currently used by the agriculture sector, does not automatically exclude it from being relevant to delivering a national e-agriculture environment. For example, e-government components that have been developed through other programmes could potentially be utilized as part of a national e-agriculture environment. Examples may include unique identification schemes, ICT infrastructure and organizational components.

It should be ensured that this step does not consume the development of the national e-agriculture vision. Vision and strategy development projects are often negatively affected by spending too much effort and time collecting and analysing information regarding the current environment. Instead, the focus should be more oriented towards the future environment. To minimize this risk, this step should be time-limited.

It is important, too, that the e-agriculture team members (steering committees) do not intentionally or unintentionally constrain their thinking during this step. The focus has to be on gathering information on the current e-agriculture environment, not assessing what the information means for delivering the national e-agriculture vision.

Recommended outputs

A detailed list of the existing or planned e-agriculture components that exist within each component area that can be used to identify opportunities for re-use and sharing, as well as any gaps that will have to be addressed in the e-agriculture action plan.

8.1 Leadership and governance

This part focuses on identifying the actors who will play a role in leading the e-agriculture strategy implemention at the national and local level. It will help to identify potential champions, as well as the cohesiveness among different stakeholder groups. Questions to investigate include:

1. What is the present organizational structure of the agriculture sector? This should include parliamentary committees, ministries, associations and other stakeholders.
2. Is there political commitment and/or are there initiatives that exist in the area of e-agriculture? If yes, who are driving them?
3. What are the hierarchical structures and decision-making mechanisms within the government agencies that are involved in e-agriculture?
4. Does the government have a national vision for e-governance? If yes, does it include any specific vision for e-agriculture?
5. Are there any organizations or groups that are currently engaged in e-agriculture at the national level?
6. Do government agencies have the capacity and funding to support rolling out e-agriculture?

7. Which agencies or organizations manage national information networks for agricultural data such as market price information, weather and pest and disease outbreaks?
8. Which organizations and groups are dedicated to the development and implementation of e-agriculture at the national and local level? What is their current role?
9. What expertise and capacities do the above actors have to deliver a national e-agriculture vision and relevant activities/programmes? For example, ask whether there is competing and capacity for:
    - Designing/developing programmes;
    - Executing the programmes;
    - Ensuring compliance; and
    - Measuring programme impact.
10. Do these actors currently collaborate, and if not, for what reasons?
11. What authority and mandate do these entities have to direct action at the various levels of the agricultural system (i.e. national, state and regional) to drive the development of a national e-agriculture environment?
12. Which authorities from non-agriculture sectors are responsible for or have a controlling stake in components of e-agriculture services? (e.g. ministry of finance, banking regulator, telecommunication ministry/regulator, meteorological department, standardization bodies, e-government department or those dealing with e-government).
13. What level of autonomy do these actors currently have regarding investment in e-agriculture? What level of fragmentation exists between them?

8.2 Strategy and investment

This part will focus on identifying the existing strategies and resources available to support e-agriculture. Questions to investigate include:

1. Which organizations, bodies and other mechanisms are responsible for agricultural strategy and planning at national, state, regional and local levels?
2. How well integrated is agricultural strategy and planning among the national, state, regional and local levels?
3. Are there any government initiatives related to e-agriculture strategy development and planning? If yes, which organizations are responsible for them? Have any of these initiatives stalled? If so, why?
4. What are the major sources of funds and investment for e-agriculture?
5. Are there any government programmes or schemes through which funding is available for investing in e-agriculture services, applications and infrastructure?
6. Who are the major players and investors in e-agriculture services, applications and infrastructure development in the country?
7. Which government organizations or bodies perform investment management roles for the development of national infrastructure?
8. What are the other closely-linked e-strategies in the country? For example, e-governance strategies, e-education or digital literacy strategy, ICT/broadband master plans etc.

8.3 Services and applications

This step will help you to identify the existing e-agriculture services and applications currently available, including the local relevance of their content. Questions to investigate include:

1. Which e-agriculture services and applications have been or are being implemented across the agriculture sector, and what was the reason for their introduction? (e.g. supply chain management, knowledge-based services, financial services, advisory services, information and communication services).
2. Who is implementing these services and applications (e.g. government, MNOs, NGOs, other third-party service providers)?
3. What agricultural challenges are these services and applications attempting to address?
4. What level of diversity exists among the agricultural ICT applications and products that are used today within the agriculture sector? For example, are there applications or products that have a strong presence across the sector, or is there a proliferation of different applications or products in use to address local needs?
5. Can existing e-agriculture services and applications be integrated with other services and applications, or scaled up beyond their current use to support larger populations?
6. Which ICT channels are being used to deliver e-agriculture services? (e.g. mobile phones, radio, television, locally screened videos).
7. What national agriculture or other information and knowledge sources exist today?
8. What level of adoption of e-agriculture standards has occurred among existing e-agriculture services and applications?
9. How is investment in e-agriculture services and applications being funded (e.g. publicly, privately, other)?
10. What types of business models are used for the delivery of e-agriculture services and applications? Who pays for service delivery? Are the services bundled with any other services or stand alone?
11. What are the challenges or barriers to the introduction and use of e-agriculture services and applications within the nation's agricultural system?
12. Have there been any large-scale e-agriculture services or application projects that have failed or stalled? If so, what were the primary reasons?
13. What is the level of mobile application development in the country and what e-agriculture services are delivered using these applications?
14. What is the level of development of e-market/e-commerce in the country with respect to agricultural goods and services?
15. Is there a quality of service or consumer protection framework around the e-agriculture services?

8.4 Infrastructure

This part will help you to determine the physical infrastructure and connectivity status of the country, in order to identify any gaps that may exist. Questions to investigate include:

1. Where does your country rank on the ICT Development Index[58] relative to others in your region?
2. What is the penetration and geographic coverage of individual access to ICTs (e.g. mobile phones, Internet, broadband, computer access, smart phones, and tablets) in your country? The ITU's statistics[59] and GSMA Intelligence[60] are both useful resources for this information at an aggregate level, although you may need to consult with other stakeholders for a more accurate representation of access in more remote communities or among disenfranchised population groups.
3. What types of mobile devices are farmers most likely to own (e.g. basic phone, feature phone, smartphone) across the country? Disaggregate by gender, where possible.
4. What is the penetration and coverage of shared access points in your country (both urban and rural)?
5. What percentage of the population has access to dependable electricity? How affordable is access? The World Bank's World DataBank[61] has data on access to electricity for many of the world's countries.
6. What percentage of the population has access to financial services (including banks and mobile financial services)?
7. What is the cost of access for voice and SMS via mobile phone?
8. What is the cost of access to the Internet via mobile and fixed line?
9. How do these prices compare against the average income of farmers and fishers?
10. How advanced are agribusinesses and agricultural service providers in their adoption of ICTs (e.g. farmer and supply chain management tools)?
11. What national, state and regional computing infrastructure exists across the country, including components such as server farms, data centres, support systems and personnel, etc.?
12. Can existing infrastructure components scale up to support broader national use?
13. What kind of infrastructural development will be required to implement your national e-agriculture vision at the national and local level?
14. Is there a consideration of Cloud-based services in the country? What are the applicable interoperability and security considerations?
15. How easy is it to deploy infrastructure to provide e-agriculture services? What are the eligible criteria? (networks, applications, services)
16. What is the level of data accessibility for application developers to provide services?
17. What is the level of the sensor-based network existing in the country and what are the existing plans?

[58] http://www.itu.int/ITU-D/ict/publications/idi/
[59] http://www.itu.int/en/ITU-D/Statistics/Pages/stat/default.aspx
[60] http://gsmaintelligence.com/
[61] http://databank.worldbank.org/data/home.aspx

8.5 Standards and interoperability

This part will help you to analyse current standards and interoperability as they relate to e-agriculture, as well as help you to identify any gaps. It will also help you to identify who is responsible for setting standards and managing interoperability. Questions to investigate include:

1. Which government agencies or organizations are responsible for setting standards and interoperability requirements for e-agriculture?
2. Do any interoperability requirements and/or standards already exist for e-agriculture services and the networks and services?
3. Do any standards exist for how agricultural data (including personal information) is collected, stored and managed? Who has access to these data?
4. How the agriculture statistics data collection and dissemination can be improved in quality, quantity and speed using ICT?
5. What work has been done on establishing common terminologies in agriculture?
6. Which organizations or bodies are currently developing e-agriculture standards and other material to support interoperability across the agriculture sector, and what is the scope of their work?
7. Is there a requirement to develop interoperability standards for infrastructure and services critical to e-agriculture (open data access, Cloud services, inter-platform interoperability, security and privacy, m-banking/m-transaction, etc.)?
8. Which organizations/authorities issues certificates for specialized services and businesses in the agriculture sector?
9. What certification bodies exist relevant to e-agriculture (e.g. organic certification bodies)?
10. Have there been e-agriculture standards or interoperability initiatives that have failed or stalled? If so, what were the primary reasons?

8.6 Content, knowledge management and sharing

This part will help you to identify what agricultural content already exists that is relevant to e-agriculture, as well as help to identify any gaps. It will also help to identify entities already working in this area. Questions to investigate include:

1. Which government agencies, academic and research institutions, NGOs, private sector service providers and other stakeholders are already collecting, developing, adapting, managing and/or disseminating content around agriculture?
2. What are the reputations and levels of trust for the knowledge and advisory services offered by each identified provider?
3. Do any central repositories of agricultural knowledge exist in the country? If so, who manages them?
4. Have there been any attempts to coordinate among multiple agricultural content providers? If so, what were the results?
5. What, if any, validation process exists for e-agriculture content and services? Which organization(s) are responsible for such validation?

6. Are there any organizations or groups responsible for validating the accuracy and checking the quality of agricultural content?
7. How much of the locally-accessible agricultural knowledge is available in local languages?
8. How is local content developed? And who certifies/authenticates the content?

8.7 Legislation, policy and compliance

This part will help you to analyse the existing legislative, policy and compliance frameworks that exist in relation to e-agriculture, as well as how they are being enacted. It will also help you to identify any gaps that may exist and areas for future action. Questions to investigate include:

1. Which government agencies are responsible for setting national policies and regulations for e-agriculture components (including agriculture, telecommunications, banking, insurance, governance etc.)? Do they collaborate with each other?
2. What are the applicable policy and regulatory frameworks for infrastructure and services critical for e-agriculture development?
3. Is there any existing policy or regulation to protect data? What major areas of data does it cover?
4. If various data protection legislation and regulatory frameworks exist at different levels (e.g. national, state, regional), are they consistent with one another?
5. Which authorities are mandated to ensure compliance with policies and regulations related to e-agriculture?
6. To what extent does existing legislation or policy support electronic and mobile transactions within agricultural value chains?
7. What existing agricultural policies and broader economic and national policies directly or indirectly support e-agriculture? Conversely, are there policies that would act as a barrier or risk to investment in e-agriculture?
8. Which organizations or bodies are currently responsible for development of the agriculture sector and broader national standards?
9. Which organizations or bodies are currently responsible for undertaking conformance, compliance and accreditation of products and services, including ICTs, used in the agriculture sector?
10. Have there been any failed or stalled attempts to develop e-agriculture policy and legislation, or e-agriculture compliance processes? If so, what were the reasons?
11. Do the regulatory frameworks support or constrain the sharing of agricultural information across geographical and sectoral boundaries?
12. What are the roles of stakeholders in developing e-agriculture policy and regulatory frameworks? Was an inclusive consultation process followed when developing these policies and regulatory frameworks?
13. Are there policies for equity of access to information, including for gender and other sociocultural groups?
14. What policies exist to stimulate and manage innovations such as who is responsible for introducing change and innovation, how risks are managed and how to evaluate appropriateness, feasibility and utility?

15. What policies exist to promote e-commerce and services' provision (for example, e-signatures) in all sectors?

8.8 Workforce and capacity development

The combination of ICT skills and agricultural expertise within the workforce is crucial in order to effectively implement e-agriculture. This part will help you to identify the current capacity of the workforce in relation to e-agriculture, as well as existing institutional (academic and research) capacity of the country to develop a workforce skilled in both agriculture and ICT. It will also help you to identify gaps that exist and areas that need to be addressed. Questions to investigate include:

1. Do any national agricultural research bodies exist? If so, how do they function?
2. What academic programmes are available for studying agriculture at the secondary and tertiary/university level? Do these institutes have ICT facilities?
3. Which organizations or authorities are responsible for the development of education and training curricula for universities, training institutions and professional associations, in particular for agricultural training centres?
4. What national research organizations (public and private) are working in the field of agricultural research?
5. Are these research organizations equipped with ICT facilities and other related resources? If so, what kinds of facilities are available?
6. How many individuals trained in agriculture and/or ICT enter the workforce annually?
7. Are there any accreditation requirements regarding the use of e-agriculture by agricultural training providers? If so, what are they and who manages them?
8. What level of consistency or commonality exists between different training programmes focused on applying e-agriculture to support the delivery of services to individuals?
9. What training programmes exist to provide education in the design and implementation of ICT in agriculture, e-agriculture and extension services?
10. Are there recognized qualifications in the domains of e-agriculture and extension?
11. What is the market and availability of professionals with experience in e-agriculture?
12. What services are available to facilitate ICT learning for farmers and agribusinesses?
13. Are there any programmes available to promote digital literacy amongst farmers, fishers and other stakeholders?

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CHAPTER 9 Assess opportunities, gaps, risks and barriers

This chapter focuses on assessing the current e-agriculture environment to identify opportunities, gaps and barriers to realizing the e-agriculture vision.

This chapter builds on the work completed in the previous chapter, combining knowledge of the e-agriculture components and current e-agriculture environment to identify opportunities for re-using or sharing components, gaps to be addressed and potential risks or barriers to doing so. This is a critical stage of the process because it will be the basis for refining the draft vision towards an aspirational, but still pragmatic, e-agriculture vision.

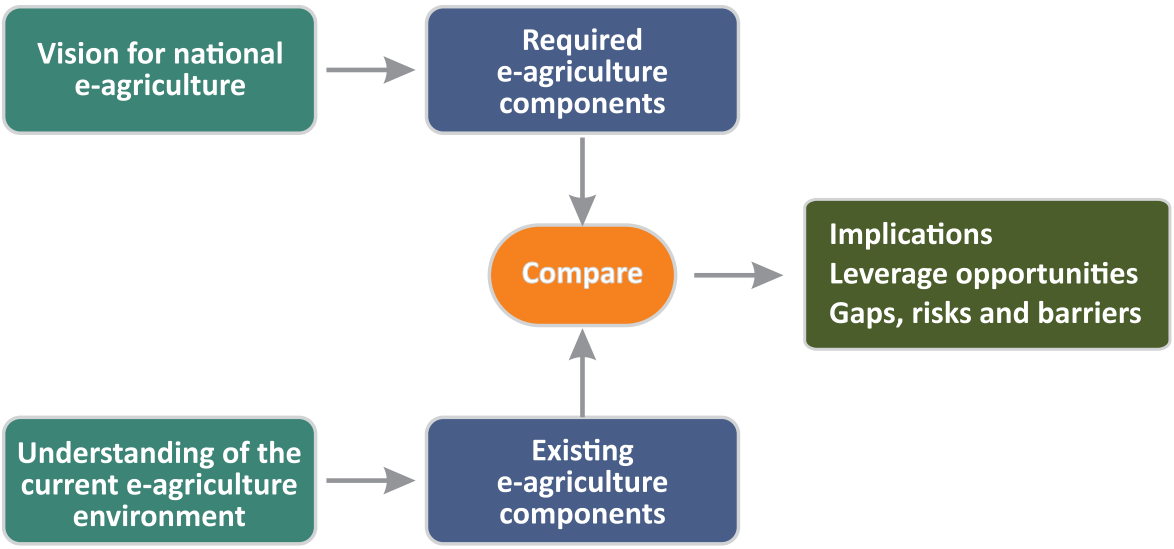
This chapter focuses on identifying three main elements:

- *Re-use and sharing opportunities:* What existing e-agriculture components can be used in the delivery of the national e-agriculture vision? What components from other e-strategies could be leveraged in e-agriculture?
- *Gaps:* Where there is no suitable existing e-agriculture components identified as needed in the draft vision.
- *Risks and barriers:* What risks and barriers may affect the ability to deliver the required e-agriculture components?

The required e-agriculture components (Chapter 7) are compared with the existing e-agriculture components (Chapter 8) to determine the opportunities, gaps, risks and barriers.

See Figure 1.9.1 for an illustration of what this process looks like.

Figure 1.9.1. Identifying leverage opportunities, gaps, risks and barriers



The key activities include assessment of existing or planned e-agriculture components against the required components, across the following areas:

- Leadership and governance;
- Strategy and investment;
- Services and applications;
- Infrastructure;
- Standards and interoperability;
- Content, knowledge management and sharing;
- Legislation, policy and compliance; and
- Workforce and capacity development.

Outputs

A description of:

- Existing e-agriculture components that might be re-used or shared by a national e-agriculture environment;
- E-agriculture components that do not exist and will need to be developed; and
- The risks and barriers associated with opportunities and gaps identified.

The worksheet for assessing the e-agriculture environment in Annex 1.9.1 can be used to complete this task. Also, include those components that were identified and organized in chapters 8 and 9 into this worksheet, and determine what opportunities, gaps, and risks and barriers exist for each one.

9.1 Assess existing e-agriculture components against required components

9.1.1 Identify re-use and sharing possibilities

The following questions can be used to help you identify re-use and sharing possibilities:

- What existing or planned e-agriculture components could partially or completely deliver a required e-agriculture component?
- What are the other e-strategies (e.g. e-government, ICT master plan, and broadband plan) that can be leveraged to deliver e-agriculture services, and vice versa?
- What is the timeline for the delivery of planned e-agriculture components, and what is their delivery dependent upon (e.g. legislation, funding, policy, other components, etc.)?
- How would an existing (or planned) e-agriculture component need to be modified to permit it to be used within the national e-agriculture environment?
- What would be the broad time frames for modifying or extending existing components?
- What would be the broad costs to modify or extend existing components?
- Which stakeholders should be consulted on the use of an existing or planned component?

9.1.2 Identify gaps

The following questions can be used to help you identify any gaps that may exist:

- Which required e-agriculture components in the draft vision have no existing components to build on (components do not exist or are inadequate)?
- What investment in e-agriculture components will be required to support these gaps, including where an existing (or planned) component needs to be augmented or extended as it only partially delivers a required e-agriculture component?
- What actions or activities need to occur as part of this investment?
- Does undertaking these activities depend on any other activities (e.g. legislation, funding, policy, other components, etc.)?
- What would be the broad time frames for making this investment?
- What would be the broad costs to deliver this investment?
- Which stakeholders should be consulted and involved in designing, implementing and operating these investments?

Some of the gaps that may exist include:

- Inadequate leadership;
- Inadequate stakeholder participation;
- Inadequate understanding of the unique ICT needs and socio-economic context of rural communities by e-agriculture providers;
- Inadequate privacy, confidentiality and security in agricultural financial services;
- Weak national ICT policy development and strategies for e-agriculture;

- Poor agricultural content development and integration of indigenous knowledge;
- Fragmented institutions and legislative framework for e-agriculture;
- Agricultural value chains not well coordinated or integrated;
- Lack of interoperability amongst e-strategy datasets and platforms;
- Lack of awareness of existing e-agriculture services;
- Lack of research investment in e-agriculture;
- Inadequate capacity development initiatives for integration of ICT into agriculture;
- Inadequate penetration of ICT network (e.g. broadband, sensing networks, IT solutions);
- Inadequate enabling environment for other services critical to e-agriculture's success, e.g. e-governance, m-banking, telecommunication services, IT solutions, etc.; and
- Lack of capacity to build and sustain IT software, hardware and networks at a reasonable price.

9.1.3 Identify risks and barriers

The following questions can be used to help identify risks and barriers:

- What risks and barriers are associated with using an existing or planned e-agriculture component in the national vision? Examples of potential risks include:
  - Ability to engage effectively with and gain the support of stakeholders;
  - Availability of skills, knowledge and expertise;
  - Existing cultural practices and attitudes, and resulting adoption of e-agriculture;
  - Existing legislation and regulatory frameworks;
  - Existing agricultural and other government policy;
  - Dependencies on other e-agriculture components;
  - Stability and continuity of political and bureaucratic agriculture sector leaders;
  - Provision of adequate ICT infrastructure and skills in a timely manner;
  - Availability of investment funding; and
  - Ability to achieve consensus, buy-in and action across stakeholder groups.
- What would be the impact on the e-agriculture vision of not addressing these risks and barriers?
- Do any of the risks and barriers highlight missing e-agriculture components?
- What actions should be taken to mitigate these risks and barriers?

Some of the potential risks and barriers include:

- Poor ICT and e-agriculture infrastructure;
- Accessibility and inclusivity problems due to the diffusion of inappropriate ICT;
- Marginalization of women with respect to ICT use in agriculture;
- Not taking an inclusive approach with ICTs – attention to differently abled, semi-literate/illiterate users;
- Low levels of e-agriculture best practices, customization and personalization;
- High cost of e-agriculture services and lack of sustainable business models; and
- Decline of public expenditure on agriculture in developing countries.

This step requires a combination of internal assessment supported by consultation with stakeholders to validate and refine the outcomes of the assessment.

The assessment process should include four steps:

1. Compare e-agriculture components required by the initial e-agriculture vision with the understanding of the components that exist or are planned to exist in the current e-agriculture environment.
2. Identify and describe the opportunities to re-use or share existing e-agriculture components.
3. Identify and describe the gaps in delivering the components required by the initial e-agriculture vision (i.e. those instances where there appear to be no suitable existing components in the current e-agriculture environment).
4. Identify and describe the risks and barriers identified during the analysis of re-use and sharing opportunities and gaps, along with any other broader sectoral or environmental risks and barriers that should be considered.

Stakeholders should be consulted to confirm whether e-agriculture components can indeed be re-used or shared, as well as additional considerations, risks and barriers that may have to be considered. This input can be used to validate or refine the assessment. There may not be an immediate stakeholder, or set of stakeholders, associated with a particular gap, risk or barrier.

In this case a stakeholder reference group may identify stakeholders who should be consulted.

ANNEX 1.9.1. Worksheet for assessing the e-agriculture environment

Component	How can it be reused or shared?	What gaps presently exist?	What risks or barriers presently exist?
Leadership			
Strategy and investment			
Services and applications			
Infrastructure			
Standards and interoperability			

Component	How can it be reused or shared?	What gaps presently exist?	What risks or barriers presently exist?
Content, knowledge management, sharing and advisory services			
Legislation, policy and compliance			
Workforce and capacity development			

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CHAPTER 10 Refine the vision and develop strategic recommendations

The objective of this step is to refine the initial vision by considering the opportunities and gaps that have been identified, along with other risks and barriers to the delivery of a national e-agriculture environment. This creates an aspirational yet pragmatic vision for national e-agriculture. It will be followed by developing a set of strategic recommendations.

The activities include the following:

- Adjust the scope and focus of the national e-agriculture vision;
- Refine the initial national e-agriculture vision;
- Develop strategic recommendations; and
- Gain endorsement and communicate national e-agriculture vision and strategic recommendations.

Outputs

- An aspirational yet pragmatic vision for national e-agriculture;
- A set of strategic recommendations for delivering the required e-agriculture components, applications and services that underpin the refined vision;
- Endorsement of the vision recommendations by decision-makers; and
- Communication of the vision to the broader stakeholder community.

Please refer to Annex 1.1.1 for a suggested structure of the e-agriculture vision document.

10.1 Adjust scope and focus

Countries will have varying commitment, components and resources to implement a national e-agriculture vision, and accordingly will have different entry points for establishing it. Some countries will be able to focus on delivering all the e-agriculture components identified in Part 1-Chapter 7, while others will focus on a subset. Prioritization is therefore considered critical and is an iterative process, influenced by internal and external factors. See Table 1.10.1 for an example of some of the internal and external factors that needs to be considered for prioritizing your focus.

Table 1.10.1. Internal and external factors in e-agriculture prioritization

Type	Description	Example
Internal	Knowledge, insights and learning experienced over the course of developing the national e-agriculture vision.	• Opportunities to re-use or share existing components; • Gaps that need to be filled; • Risks and barriers associated with opportunities and gaps; • Dependencies on the establishment of other components; and • Magnitude of funding and duration to establish the required components.
External	Guidance and direction provided by political and agriculture sector decision-makers and stakeholders. The level of readiness of critical non-agriculture sector input (e.g. mobile broadband, mobile banking)	• The choice of agricultural subsector; • Desire for a national e-agriculture vision and how it should balance: – Short-term e-agriculture outcomes (1-3 years); and – Long-term e-agriculture outcomes (5-10 years). • Opinions on what is likely to be achievable within the time frame given the political, agriculture sector and other critical sector landscape; and • Likely available resources and funding that the country has (or will have) to direct towards implementing the vision.

This process examines the vision against the following criteria:

- Is it realistic, given the opportunities, gaps and risks?
- Do e-agriculture outcomes align with agricultural priorities?
- Is there enough support?

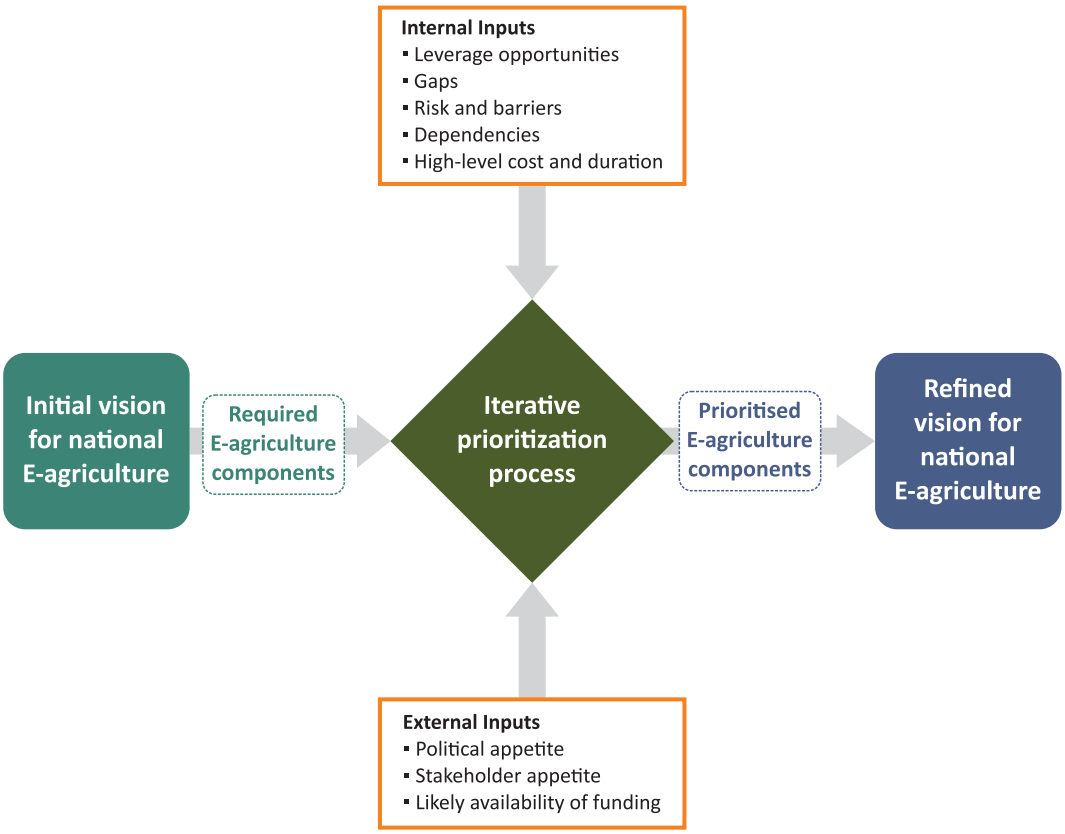
It is not the intention of this step to develop a detailed roadmap of prioritized activities, but rather to identify the broad set of e-agriculture components that should be delivered within the time frame of the national e-agriculture vision (Part 2 of the guide focuses on the development of a national action plan). It is also not the focus of this chapter to develop

a detailed business case, covering benefits and costs. While funding is explored more in detail in Part 2, the development of a detailed business case is beyond the scope of the guide.

The expected output is a description of e-agriculture components that will be delivered and the rationale for their selection.

This step is an iterative process consisting of internal analysis, supported by consultation with political, agriculture and other critical sector stakeholders (Figure 1.10.1; Table 1.10.2).

Figure 1.10.1. Steps for refining the e-agriculture vision



While the figure and table would suggest a structured and linear approach to this prioritization, in reality the process needs to be flexible in moving between these various steps as knowledge and direction are provided by political and agriculture sector stakeholders. It is also important to recognize that this step focuses on prioritization at a strategic level, not a programme planning level. Detailed planning and associated prioritization is the focus of Part 2 of this guide.

Table 1.10.2. Steps for refining your national e-agriculture vision

Step	Inputs	Sample questions	Possible outcomes
1	Analysis of e-agriculture environment: Re-use and sharing opportunities; Gaps; Risks and barriers; and Vision time frame.	Given the identified re-use and sharing opportunities, gaps, risks and barriers, which e-agriculture components could realistically be, put in place within the required time frame? What do political and agriculture-sector stakeholders think can be realistically delivered within the required time frame? What is the target time frame for availability of critical inputs from non-agriculture sectors (e.g. telecom, governance, banking etc.)?	An understanding of the e-agriculture components that can be realistically delivered within the desired time frame.
2	Outputs of step (1); Understanding of agricultural system outcomes; Understanding the e-agriculture outcomes and their priorities; Comprehending the services that will be delivered on the ground and their feasibility; Understanding of the role of stakeholders along agricultural value chains; and Understanding of non-agriculture sector outcomes.	What agricultural system and broader non-agriculture sectoral outcomes will the proposed e-agriculture components enable? How well do these outcomes align with short- and long-term strategic agricultural priorities? How well will the interest of the stakeholders in the agricultural value chain and agribusiness are integrated in e-agriculture?	An optimized set of e-agriculture components; or a need to revisit the time frame for the national e-agriculture vision.
3	Outputs of step (2); Political commitment for national e-agriculture vision stakeholders' commitment to the national vision; and Likely funding that will be available to deliver the vision.	Are these outcomes acceptable to political and agriculture sector decision-makers and stakeholders? Given the funding that will likely be available, what e-agriculture components can be delivered? Should the agricultural system goals and challenges be revisited to limit or extend the scope of e-agriculture components that should be delivered?	A supported and prioritized set of e-agriculture components; or a need to revisit the strategic agricultural priorities that the vision should respond to; or a need to revisit the time frame for the national e-agriculture vision.

10.2 Refine the initial e-agriculture vision

This step attempts to refine the initial e-agriculture vision to reflect the outcomes of the prioritization process.

Examples of the types of questions that should be explored are given below:

- How effectively can the e-agriculture outcomes defined in Part 1-Chapter 6-Section 6.2, be achieved with the prioritized set of e-agriculture components?
- What revision to the e-agriculture outcomes is required to reflect accurately the prioritized set of e-agriculture components?
- What changes to the initial vision statement for e-agriculture are required as a result of revision to the e-agriculture outcomes?
- What do these changes mean for each of the stakeholder groups for whom the initial e-agriculture vision was originally described, and how do these descriptions need to be updated?

This step should update the outputs developed in Part 1-Chapters 6 to reflect the prioritized set of e-agriculture components. Outputs to be updated include:

- E-agriculture outcomes (Section 6.2);
- The e-agriculture vision statement (Section 6.4);
- Descriptions of what the vision means for important stakeholder groups (Section 6.5); and
- Scenarios that demonstrate the vision in practice (Section 6.6).

Content that is no longer required is maintained rather than deleted, and referred to as potential future directions for e-agriculture. This ensures that work is not lost and can be revisited at a later point in time, potentially as part of the process of revising the national e-agriculture vision.

This should be an internal activity, because it focuses on refining previously-developed material. The outputs of this step should be reviewed by the stakeholders who were originally involved in the development of the initial e-agriculture vision.

10.3 Develop strategic recommendations

This step describes the strategic recommendations for delivering the refined e-agriculture vision. Strategic recommendations should be high level, focused on outcomes. Strategic recommendations describe the high-level actions required to deliver the national e-agriculture environment. These actions may describe how new e-agriculture components will be delivered, or how existing e-agriculture components will be repurposed or extended. Dependencies between strategic recommendations should also be identified, along with the associated risks and barriers. An understanding of dependencies, risks and barriers will form important input into Part 2 of this guide.

10.3.1 Recommended outputs

Each strategic recommendation should be uniquely referenced to enable traceability to the national action plan (to be developed in Part 2) and should include:

- The rationale for the recommendation;
- A description of the high-level actions to be undertaken;
- Dependencies with other recommendations, and the nature of this dependency; and
- Risks and barriers.

An example is provided in Table 1.10.3. The strategic recommendations worksheet in Annex 10.1 can be used to input your own findings. Actions are indicative and are intended to assist with understanding the implications of the strategy. These actions will be refined during the detailed planning conducted in Part 2.

Table 1.10.3. Example of a strategic recommendation for a national e-agriculture vision

Ref.	Recommendation	Rationale and specific actions	Dependencies
R.1	Provide access to reliable and quality local multimedia content (text, voice and visual) on best practices in agriculture in all local languages	Access to reliable and quality local content in local language is currently extremely limited, which has an impact of farmers' knowledge of improved farming practices and is impeding their agricultural productivity. Making information on best practices available in all local languages and in multiple formats, such as text, voice and visual, increases farmers' exposure to this content, thereby improving farmer productivity. Specific actions would include: Identify organization(s) responsible for developing and certifying the content; Identify agencies and agricultural service providers that can effectively deliver the content according to the agricultural cycle; Establish a services' contract and service-level agreement for the operation; and Establish a governance arrangement for oversight of the service/activity.	R. 5, R. 7

This step should be an internal activity that will involve brainstorming and working sessions to formulate a set of recommendations that collectively deliver the e-agriculture components taking into consideration the refined actions. The strategic recommendations should be tested and refined with stakeholders, who should provide input on each recommendation.

10.4 Gain endorsement and communicate national e-agriculture vision and strategic recommendations

This step involves obtaining endorsement of the finalized national e-agriculture vision and associated strategic recommendations, and then communicating these to the broader stakeholder environment. It concludes the development of the national e-agriculture vision and marks the beginning of the transition towards the development of the action plan.

The expected output of this step is endorsements by the appropriate decision-maker(s) and communicating them to the broader stakeholder community. It also facilitates their understanding and support ahead of the development of the action plan.

This step involves presenting, reviewing and obtaining endorsement of the national e-agriculture vision and associated recommendations by the appropriate decision-maker(s). This will typically be the steering committee that was established to govern the development of the national e-agriculture vision.

Once endorsed, the national e-agriculture vision and strategic recommendations should ideally be published and communicated to the broader stakeholders including policy makers; farmers, fishers, livestock herders' organizations; agribusinesses; telecom service provides, banking organisations, meteorological organisation and agricultural development organizations. This launches a period of education and awareness building of the national e-agriculture vision and what it will mean for your country. This period requires listening and responding appropriately to views, opinions and feedback. Some input may also trigger adjustment to some aspect of the vision or recommendations.

The period of education, awareness building and listening will vary in duration, depending on the urgency to proceed with developing an action plan. For example, some countries may opt to have a period of broader consultation regarding the national e-agriculture vision and recommendations, potentially in the form of inviting public submissions and comments. This may precede the final refinement of the national e-agriculture vision. Other countries, on the other hand, may be comfortable that the stakeholder engagement was sufficient and that developing the action plan should proceed. This period may also overlap with the mobilization of the team that will be responsible for the plan's development. These activities are described in Part 2 of this guide. Part 2 also concerns the need to revise the national e-agriculture vision to reflect the availability of funding.

Annex 1.10.1. Strategic recommendations worksheet

Reference: R1

Recommendations:

Rationale & specific actions:

Dependencies:

Reference: R2

Recommendations:

Rationale & specific actions:

Dependencies:

Reference: R3

Recommendations:

Rationale & specific actions:

Dependencies:

National E-agriculture Action Plan

PART 2
DEVELOPING A NATIONAL E-AGRICULTURE ACTION PLAN

PART 1 National E-agriculture Vision

PART 2 National E-agriculture Action Plan

PART 3 National E-agriculture Monitoring & Evaluation

PART 2

DEVELOPING A NATIONAL E-AGRICULTURE ACTION PLAN

Part 2 builds on the national e-agriculture vision and the strategic recommendations to create a realistic action plan, referred to as the 'ICT for Agriculture Master Plan', 'E-agriculture Plan' or any other nationally-acknowledged term. In this document we refer to it as the **National E-agriculture Action Plan.**

- Chapters 1 covers the need to develop an action plan; and
- Chapters 2-4 provides detailed guidance on preparing the detailed action plan.

It is important to re-emphasize that the action plan is part of the larger national e-agriculture strategy, including the vision (Part 1), an action plan (Part 2) and a monitoring and evaluation (Part 3) component. However, countries may like to implement them in full or adopt only part of them (e.g. only the action plan) based on their own unique circumstances and existing components of the strategy.

Output

To understand the framework for development of e-agriculture action plan and the linkage between vision, strategic recommendations, outputs and activities.

CHAPTER 1

Need for developing a national e-agriculture action plan

1.1 Framework for an action plan

An action plan enables a government to:

- Identify all activities and details on how they should be governed, funded and coordinated to ensure that results are achieved at a national, state and local level; and
- Identify key stakeholders and engage with them effectively in designing, implementing and sustaining the activities.

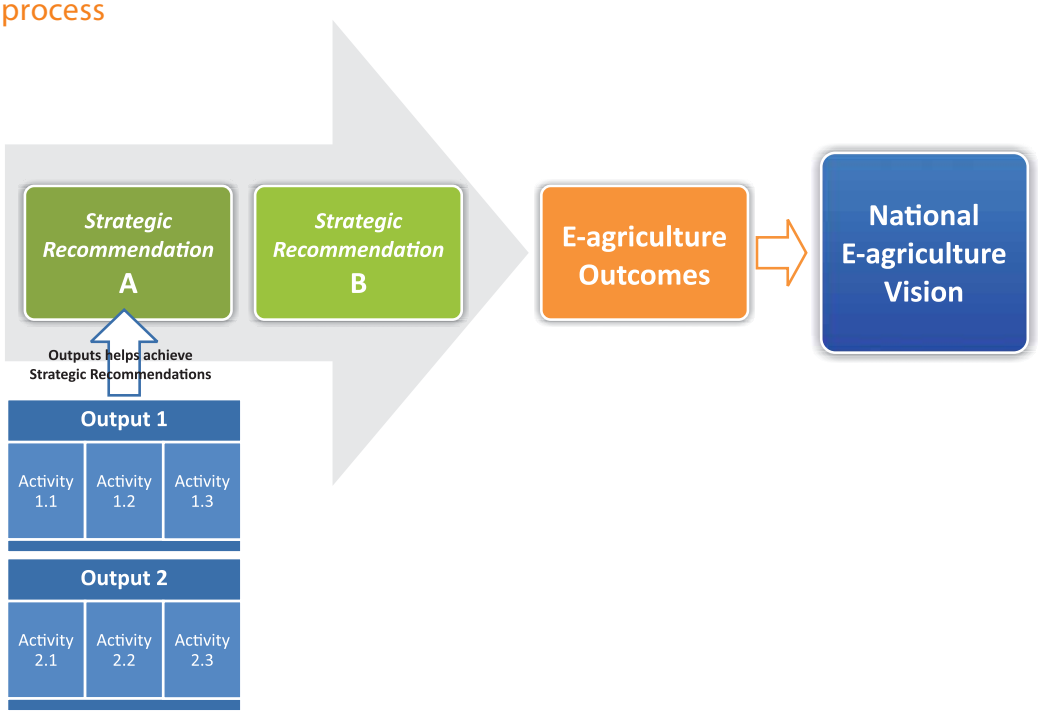
At this stage, the national e-agriculture vision and the strategic recommendations (see Part 1) would have been endorsed by agriculture sector leadership and would have acquired wider support of critical stakeholders from other related sectors (e.g. ICT, banking, e-government). An awareness-raising exercise is also expected to have been completed amongst the broader stakeholders. The figure below shows the key processes that would have been undertaken to arrive at the e-agriculture vision and the strategic recommendations.

The vision and the strategic recommendations, once implemented, are expected to achieve the desired e-agriculture outcomes (Refer to Part 1 Chapter 6) and in turn facilitate meeting the larger agricultural goals.

1.2 Recommendations, outputs and activities

The strategic recommendations are aimed at building up the e-agriculture components that can deliver the desired e-agriculture outcomes. These recommendations are implemented by achieving a number of outputs, which in turn are delivered through a number of activities (Figure 2.1.1). The outputs can also be termed as solutions in this context.

Figure 2.1.1. E-agriculture vision and strategic recommendations' development process



Some of these activities, which are similar in nature, can be combined to facilitate ease of implementation.

1.3 Detailing activities

It is important that the action plan is practical and actionable. Although the strategy in itself is expected to bring about considerable and audacious change in the agriculture sector, it is important that the means to achieve these changes (i.e. activities and outputs) are easy to understand and perceived feasible by all stakeholders. A very good strategy without a practical implementation plan is unlikely to receive serious support from stakeholders when rolled out. To check feasibility, the action plan development process should take into consideration:

- Feasibility of its implementation;
- Interdependencies amongst the activities;
- Availability of a champion and buy-in of critical stakeholders;
- Level of impact of each activity on the outputs/strategic recommendations;
- Resource requirements (human, financial, logistical, technical etc.);

- Reasonableness of the timeline;
- Stakeholders' level of preparedness;
- Availability of infrastructure;
- Appropriate enabling environment; and
- Risks associated with the activities.

A prioritization exercise is often required amongst activities or outputs based on these factors.

1.4 Estimate the funding required for delivering the action plan

The feasibility of action plans is often constrained by the funding resources available. Some activities will need to be delayed if adequate resources are not immediately available.

Two levels of resource assessments are proposed:

Part 1 – Resources required for preparing, guiding and monitoring the national e-agriculture action plan.
Part 2 – Resources required for implementing and monitoring the national e-agriculture action plan.

1.4.1 Resources required for preparing the national e-agriculture action plan

Preparation of a detailed e-agriculture action plan is resource-intensive and can extend for several months. Further, monitoring and evaluation of the strategy would also entail ongoing costs over years. For example, convening of working group meetings, steering committee meetings and periodic evaluation at regular intervals require resources on regular basis.

The sharing of costs amongst lead and key stakeholders is important and should be agreed upon amongst the concerned stakeholders.

1.4.2 Resources required for implementing the national e-agriculture action plan

A budget estimate of the activities involved is often required at the planning stage to assess the financial feasibility of the plan. The required funding for implementation can be done at activity level and then collected at output level. In general, outputs can serve as cost centres.

1.5 Develop the e-agriculture action plan

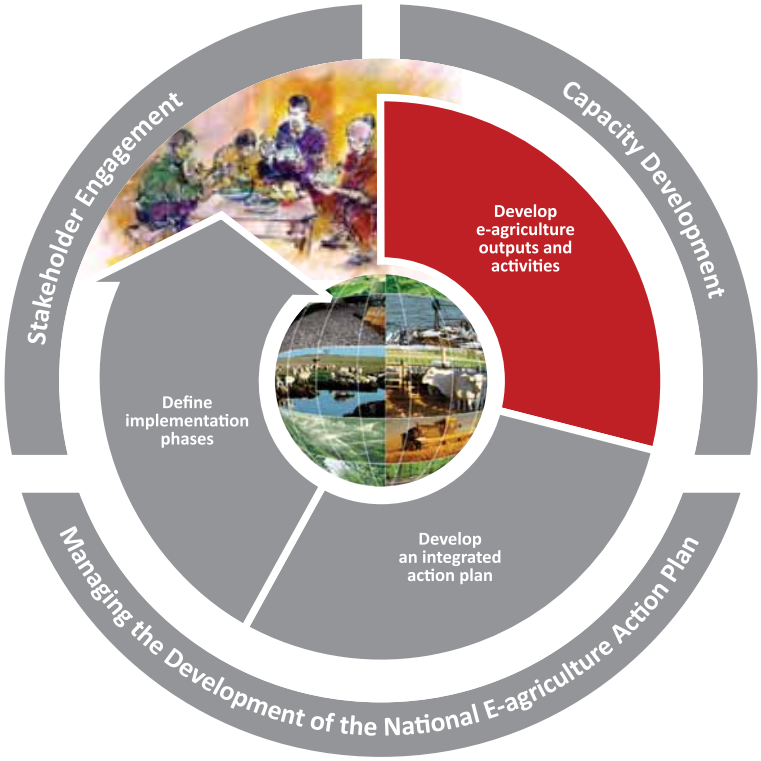
An e-agriculture action plan can be presented in a number of ways depending upon the audience and purpose. The framework in this chapter describes the core components to be considered in developing it. Table 2.1.1 suggests a structure for the plan, which can be modified as needed for the primary audience.

Table 2.1.1. Suggested structure for an e-agriculture action plan

E-agriculture Action Plan	Examples of Strategic Recommendations, Outcomes, Outputs and Activities Linkages				
		Year 0	Year 1	Year 2	Year 3
Strategic Recommendation 1	**Establish e-market to buy and rent agriculture goods and services**				
	Output 1-1 (e.g. Web based e-Agriculture Market Information System)	Activity 1-1-1	Activity 1-1-2		
	Output 1-2 (e.g. Credible e-Agriculture market platform with customer redressal system)		Activity 1-2-1	Activity 1-2-2	
	Output 1-3 (e.g. Electronic and mobile transaction facilities on e-Agriculture platform)	Activity 1-3-1	Activity 1-3-2	Activity 1-3-3	Activity 1-3-4
Strategic Recommendation 2	**Enable easy access to credit and improved credit management**				
	Output 2-1 (e.g. Guidelines for mobile and electronic banking and transaction services)	Activity 2-1-1			
	Output 2-2 (e.g. Credit availability and management service for farmers and fishermen)		Activity 2-2-1	Activity 2-2-2	
	Output 2-3 (e.g. Micro insurance service for low income farmers and fishermen)		Activity 2-3-1	Activity 2-3-2	Activity 2-3-3
Strategic Recommendation 3	**Improve data collection and availability (weather station data, market data, satellite data, soil quality data etc.)**				
	Output 3-1 (e.g. Framework for sharing and access to data critical for agriculture sector)	Activity 3-1-1			
	Output 3-2 (e.g. Portal for collecting and disseminating data to users)		Activity 3-2-1	Activity 3-2-2	
	Output 3-3 (e.g. Export driven advisory and investment services)		Activity 3-3-1	Activity 3-3-2	Activity 3-3-3
Strategic Recommendation 4	**Improved and better informed advisory service for production**				
	Output 4-1 (e.g. RFID identification for farm inputs)		Activity 4-1-1	Activity 4-1-2	
	Output 4-2 (e.g. Credible agriculture content (text, audio, video) for extension workers on mobile, broadcast and electronic platform)	Activity 4-2-1	Activity 4-2-2		
	Output 4-3 (e.g. Wider adoption of tablets and smart phones amongst extension workers)	Activity 4-3-1	Activity 4-3-2		
Strategic Recommendation 5	**Others**				

CHAPTER 2 Developing e-agriculture outputs and activities

The next step in developing the action plan is to identify the outputs and activities that would realize the e-agriculture outcomes and implement the strategic recommendations.



Output

- A list of outputs (also termed as solutions) and activities. Each activity should have identified risks, dependencies and linkages with strategic recommendations identified at the end of Part I.

2.1 Establishing outputs and linking them with Strategic Recommendations

Outcomes are referred to in this guide to provide an indication of whether the goals are being achieved. Outcomes are usually partly, but not entirely, within the control of the organization. For example, 'Improving access to banking, credit and insurance services amongst farming community and associated stakeholders using mobile and electronic payments' are expected outcomes. However, to meet this outcome completely, it requires cooperation from banking, insurance and ICT sector regulator and service providers. The outcome is also driven by demand and the level of adoption of these services by the target end users. An example of output is the start of mobile banking service, which is within the control of suppliers.

The strategic recommendations are aimed at building the required e-agriculture components that will deliver the desired e-agriculture outcomes and bring about the envisaged change. These changes are realized by a series of outputs. Defining outputs that would assist in

meeting each strategic recommendation is a critical step. For the purposes of this guide, outputs are referred to as the final tangible results, deliverables, products and services. They can be treated as cost centres and should have key performance indicators (KPIs) linked for monitoring. Each output should have an identified leader (institutional and individual) and key partners. Some examples of outputs include creating an integrated natural resource management database, launch of weather forecasting service, establishing incentive fund to encourage the development of priority e-agriculture solutions, or creating a virtual trading floor for agriculture products.

It is quite common for one output to have an impact on more than one strategic recommendation or outcome. Prioritization of outputs is recommended based on the extent of impact a particular output has on the end results and the level of feasibility. Establishment of an open e-agriculture content sharing platform is an example of an output that would improve dissemination of information services across multiple delivery channels (mobile, radio, television, print brochures etc.), improve the awareness of farmers and fishers, as well as improve the efficiency of extension system.

2.1.1 Activities

The next step is to specify high-level activities, which are various actions for transforming resources (inputs) into outputs. A particular output may have only one activity or a number of activities. They are derived by analyzing what steps need to be taken to deliver the envisaged results. For example, to develop an agricultural market information service, it is necessary to design and build up the platform and application, determine the availability of market content, deliver content and information using phone, service providers' agreement to host and deliver the content and so forth. Each activity should be detailed in terms of its scope, duration, resource requirements and interdependencies. Figure 2.2.1 provides a template for developing an activity.

As agriculture is cross-sectoral in character, different stakeholders may be accountable for delivering different outputs. For example, mobile banking services that are critical for agricultural services are linked more with telecommunication and banking sector regulators and the service providers in those sectors. Linking quality of soil with agricultural land records would require close cooperation between departments of land, e-governance authorities and agriculture. Understanding the potential leadership and accountability for a particular output (or activity) allows these stakeholders to be identified so that they can be involved in defining and have greater responsibility in implementing the required activities.

Questions to identify the stakeholder(s) accountable for a particular output (or activity):

- Who has the policy and regulatory responsibility for this output (or activity)?
- Who has the mandate or authority?
- Who has the capability and capacity to deliver the output (or activity)?
- Who is perceived by the agriculture sector and/or public as being the right entity to deliver the output (or activity)?
- Who is able to engage effectively with and influence agriculture and non-agriculture sector stakeholders?
- Who has access to the appropriate financial resources?

Figure 2.2.1. A template for developing an activity

	TITLE OF THE ACTIVITY										
	Activity Number	**e.g.1-1-1**									
Brief description	Provide a brief description of the activity										
Stakeholder engagement	Lead facilitator										
	Co-facilitators (wherever applicable)										
	Critical stakeholders to be consulted										
Linkage with strategy	Linkage with Output (s)										
	Output 1-1										
	Output 4-1										
	Linkage with Strategic Recommendation (s)										
	Recommendation 1										
	Recommendation 2										
Identifying dependencies	Critical pre-requisite activities (activity number and title)										
	Activities critically dependent on this activity (activity number and title)										
				Output 1-1					Output 4.1		
			Year 0	Year 1	Year 2	Year 3		Year 0	Year 1	Year 2	Year 3
			This can also be done Quarterly or Monthly					**This can also be done Quarterly or Monthly**			
Approximate budget provisions (Example)	Human resources (salary)										
	Technical resources (software & hardware)										
	Coordination activities (meetings, workshops etc.)										
	Agriculture content creation and management										
	Promotion and adoption activities (awareness, training etc.)										
	Travel and other related operational costs										
	Recurring operational costs of ICT equipment maintenance (if any)										
	ICT usage costs (cost of bandwidth, telecom resources, licenses etc.)										
	Administration, monitoring and evaluation costs										
	Others										
	Total Budget (By Output)										
Implementation plan			Year 0	Year 1	Year 2	Year 3					
			This can also be done Quarterly or Monthly								
	Start and end of activity		Start		Complete						
	Please prepare detailed implementation plan (if the activity is complex)										
	Monitoring and Evaluation			Review							
Key Risks Associated											

2.2 Identifying dependencies between activities and risk assessment for their delivery

This step identifies the dependencies between the activities. Dependencies affect the sequence, timing and delivery of activities, and in turn the delivery of a particular service.

2.2.1 Identify risks associated with the delivery of activities

It is quite normal for activities in an action plan to have risks associated with them. These risks can come from multiple sources:

- Leadership and governance (e.g. change in leadership, loss of project champions, uncertainty of governance functioning, changes in legislative structure, lack of interest from other sector governing bodies);

- Uncertainty of financial resources (e.g. lack of requisite investment in a strategy following successful pilots, overestimation of investment potential);
- Dependency on other prerequisite activities (e.g. mobile coverage, permissions to launch services, availability of data, e-governance services, availability of adequate logistics, availability of a secure applications platform);
- Technological risks (e.g. choice of non-scalable/non-reliable technologies, lack of interoperability, absence of a roadmap for a particular technology, unavailability of proven technology);
- Consumer protection and awareness (e.g. unavailability of an adequate consumer protection framework for e-agriculture services, lack of awareness of products and services, inadequate digital literacy); and
- Lack of interest from stakeholders (e.g. lack of interest from telecommunication operators to invest in unprofitable agricultural areas or provide coverage at sea for fishers, lack of interest from insurance or banking sectors to develop products and grow services in these areas leveraging on ICTs).

It is important to list the risks associated with each activity and work out a contingency plan in the activity template. Summary of states from strategic recommendations to defining the implementation phases is given in figure 2.2.2.

Figure 2.2.2. From strategic recommendations to defining the implementation phases

CHAPTER 3 Develop an integrated action plan

The stage is now set to combine the activities and outputs into a draft e-agriculture action plan. The plan should clearly show how each activity contributes to the delivery of outputs and towards meeting the strategic recommendations.

Output

An action plan with all identified outcomes, outputs and activities spread across timelines;

3.1 Review the draft e-agriculture action plan for alignment with agricultural goals

This step explores whether the action plan aligns with the priorities of the national agricultural system and expectations of the stakeholders. It is important to recall that at the starting point of the e-agriculture action plan there were agricultural goals and the challenges from where e-agriculture vision, e-agriculture outcomes, strategic recommendations and the e-agriculture outputs (solutions) were developed. The action plan is intended to meet the broad agricultural goals and should be aligned accordingly.

Internal analysis supported by consultation with relevant stakeholders is required to explore their views on priorities for the action plan and to seek their guidance regarding the options for improving alignment of these priorities with their ongoing plans and activities (Table 2.3.1).

Table 2.3.1. Description of steps for exploring alignment of the action plan

Step	Description	Questions to consider (examples)	Outputs
1	Review alignment with national agricultural system priorities.	How well aligned are the outputs of the action plan with the priorities of the agricultural system, i.e. e-agriculture outcomes and agricultural goal? How well aligned are the timing of outputs with the time frames for meeting strategic goals and challenges?	An understanding of the alignment of the action plan with agricultural system priorities.
2	Review alignment with stakeholder and funder expectations.	How well aligned are the outputs with the expectations of key stakeholders and decision-makers? How well aligned are the outputs with the expectations of likely funders? Does the action plan deliver tangible benefits early enough or fast enough to address the expectations of stakeholders?	An understanding of the alignment of the action plan with stakeholder and funder expectations. For example telecom infrastructure roll out plan, e-government plan, mobile plan, export-import targets, private sector service plan etc., A stakeholder consultation at this stage is recommended.
3	Develop options for aligning the action plan with agricultural system, stakeholder and funder priorities.	What type of balance should the action plan be attempting to achieve? What options exist for improving the alignment with agricultural system and stakeholder priorities? What options exist for delivering benefits earlier or faster? What risks does each option present?	A range of options for improving alignment with agricultural system and stakeholder priorities, and the associated risks of each option. Identify areas of priority and funding agency (internal and external) priority areas.
4	Recommend the most appropriate option(s) for modifying the action plan to align it with agricultural system, stakeholder and funder priorities	What option(s) are most acceptable to key stakeholders and decision-makers, in terms of balancing achieving agriculture-system and stakeholder priorities? Are the options increasing delivery complexity and risk to unmanageable levels?	The preferred option for refining the action plan.

Consultation with stakeholders (agriculture and non-agriculture sector) is very important at this stage. It will reconfirm stakeholders' expectations and assess options for refining the action plan to improve alignment.

Based on the outcome of the alignment process, the action plan can be refined.

3.2 Refining the action plan

The draft action plan now requires a review in terms of applicable budget constraints and availability of the enabling ecosystem in the proposed timeframe before the outputs and activities are optimized. For example, integration of agricultural and other critical databases requires the prescription of standard formats, the skills and awareness amongst data owners, the requisite guidelines for sharing and the availability of technical and application platform. Creation of an integrated database may be of very high importance but building one as a priority without having the ecosystem in place may not be productive.

The optimization exercise is not purely a financial activity but needs to take into account its strategic importance.

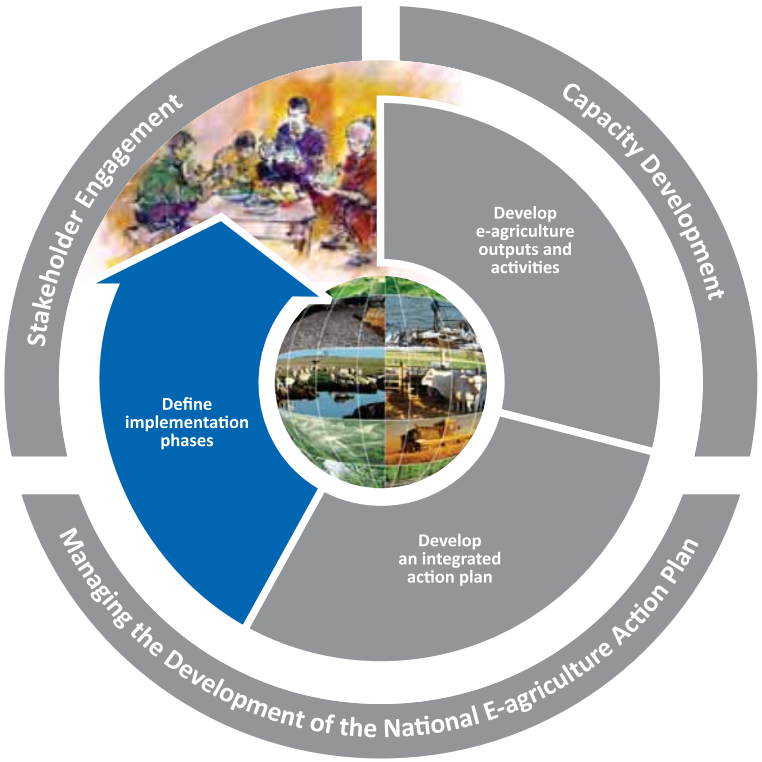
Some relevant issues to consider in the prioritization exercise are:

- How critical is the activity in meeting the outputs and strategic recommendations?
- What is the level of impact that ICT solutions can make on delivering the e-agriculture outcomes?
- What is the feasibility of implementing this activity in the stipulated time frame?
- Will the enabling ecosystem be in place when the activity is completed?
- Is there possibility of clustering similar activities together to reduce the budget?
- Can the budget constraints be overcome by engaging partners (public or private)?
- What is the impact of delaying or scaling down this activity on other activities?
- What is the level of risk associated with this activity?

Taking these factors into account, a refinement at activity level (scaling down, omitting or replacing) or at the output level (scaling down or omitting) can be undertaken.

CHAPTER 4 Define implementation phases

This stage focuses on defining the various phases for delivering the nation's e-agriculture vision.



This stage defines implementation phases which can be used to communicate the often complex content of the action plan for e-agriculture in a manner that can easily be grasped. Targets for the development and use of e-agriculture can also be defined for each phase.

These activities include:

- Identifying the logical implementation phases;
- Defining the stakeholder communication messages for each phase; and
- Describing the targets for each phase.

Outputs

- A set of implementation phases, associated targets and communication messages for the action plan.

4.1 Identify the logical implementation phases

This step focuses on identifying the logical phases of implementation activity in the action plan. An implementation phase describes the strategic focus during a particular period of time.

This step will identify three to four implementation phases, including the strategic focus and time period of each phase.

It requires internal analysis to identify three to four implementation phases for the action plan. Country experience suggests that decision-makers and stakeholders find this easier to understand, manage and fund (Table 2.4.1). It is also important to align the phases with national plans and budgetary cycles. For example, annual budgets, biennium budgets, five year plan, etc.

Table 2.4.1. Approach to identifying implementation phases

Step	Description	Examples of questions to consider	Outputs
1	Divide the action plan into three or four time periods.	What is a sensible set of time frames to break up the action plan into three or four phases? What is the national planning cycle? What are the ongoing agricultural project cycles? For example: A 10-year plan could be split into three time periods of 0–3 years, 3–6 years and 6–10 years. A 5-year plan could be split into three periods of 0–18 months, 18–36 months and 36 months to 5 years.	An action plan that has been split into three or four time phases.
2	Analyse the strategic focus within each of these time periods.	What are the various activities that occur within each of the phases identified in step (1)? What are these activities collectively attempting to accomplish in terms of the nation's e-agriculture environment? Are there any development or evolutionary themes that can be used to simply communicate what this phase is attempting to deliver?	An understanding of the strategic focus of each implementation phase.
3	Refine time periods based on the identified strategic focus.	Are there other activities outside an implementation phase whose intent or focus matches the strategic focus of that implementation phase? How might the timings of an implementation phase be refined to capture these additional activities, while avoiding overlap of implementation phases? Are there any external timing requirements that may influence the timing of implementation phases, such as political (re-election), implementation target for telecom infrastructure or donor funding cycle?	Finalized set of implementation phase timings.

4.2 Define stakeholder communication for each phase

This step defines the communication message for each implementation phase. These messages describe the strategic focus of each implementation phase to decision-makers and other important stakeholders and should be based on the theme or purpose of the various activities within an implementation phase. These include:

- The tangible outputs or changes that an implementation phase will deliver;
- The progress towards the national e-agriculture vision that an implementation phase will achieve; and
- Specific expectations of decision-makers and stakeholders regarding particular aspects of the country's e-agriculture programme that need to be drawn out.

This step will produce a set of stakeholder communication messages for each implementation phase, which describe the strategic focus or intent of that phase.

Initially the focus should be on developing a set of stakeholder communication messages for each of the implementation phases. It is expected that the analysis and knowledge developed will be an input to the development of these messages. The messages should not be overly lengthy or complicated, but instead be concise and tailored to the intended audience.

There may be value in informally testing the initial set of messages with a small group of stakeholders. This may assist in identifying concepts, language or other aspects that need to be further refined before being communicated to the broader stakeholder environment.

4.3 Describe the targets for each implementation phase

This step describes the targets for e-agriculture development and adoption that each implementation phase will deliver. The targets are described in terms of the improvements that important stakeholder groups, such as those for which the national e-agriculture vision was described in Part 1 of this guide, will experience as they interact with the agricultural system.

This step is an internal activity focused on defining the targets for each implementation phase. This will require an analysis of the activities within each implementation phase to determine:

- What each activity or set of activities will have been delivered by the completion of an implementation phase; and
- What impact the activity or set of activities has had on important stakeholder groups in terms of improving their interaction with the agricultural system.

Table 2.4.2. Sample e-agriculture action plan

Action Plan in Phases (Outputs and Activities)	Year 0	Year 1	Year 2	Year 3	Year 4
Examples (Non-exhaustive) of Outputs					
Interconnection of databases critical for agriculture *(e.g. GIS data, Land use, Soil map /land fertility, Forest resources, Irrigation and water management, Bio-diversity, Weather forecasting, Fire history etc.)*		*Activities*	*Activities*	*Activities*	*Activities*
E-market place and information system for agriculture *(Creation of e/m-market place, market information and scalable payment systems for national and international, promotion and awareness raising on use of e/m-services;)*	*Activities*	*Activities*	*Activities*		
Agriculture e-advisory services *(Advisory services offered by extension workers, consultants, researchers in country or abroad through electronic media (phone, Internet, email, video chat), face to face meetings or paper reports)*	*Activities*	*Activities*	*Activities*	*Activities*	
Farm mechanization information and service *(Creation of online machine and equipment information system linked with machine availability and rentals)*			*Activities*	*Activities*	
Universal mobile broadband connectivity	*Activities*	*Activities*	*Activities*		
Logistics management concerning storage and transport *(Information management linking agriculture service providers and markets)*			*Activities*		
Electronic pest surveillance system		Activities			
Traceability of agro-chemical movement through value chain			Activities	Activities	
Weather Information Services and alerts		Activities			
Guideline on data sharing, data classification, data formats, secure e-documents	Activities				
Credible GAP content aggregation and packaging *(Creation of Agriculture content and packaging for information delivery on ICT channels (video, audio, website, text), streamlining interoperability of future content creation, capacity building, awareness raising)*	*Activities*	*Activities*	*Activities*		
Certified higher yielding seeds, planting, breeding materials verification and traceability			Activities	Activities	
	PHASE 1 FOCUS (example) Strengthening existing services, Launch of high impact feasible services, Creating enabling environment for advanced services, Content creation and alignment, Capacity building, Partnerships development, Digital Literacy.		**PHASE 2** FOCUS (example) Launch advanced services, Interoperability of databases and application platform, Promote take up of existing services, Enhance integration with existing e-services, Increase private sector engagement, Digital literacy		**PHASE 3** FOCUS (example)

Annex 2.4.1. Structure for an E-agriculture Action Plan

This annex outlines a suggested structure and list of contents for a national action plan for e-agriculture (Box 2.4.2).

Box 2.4.2. National e-agriculture action plan

Foreword

- Purpose
- Audience
- How to read this document

Executive summary

1. Overview
   - 1.1 Implementation phases
   - 1.2 Strategic focus of each implementation phase
   - 1.3 High-level overview of the action plan
   - 1.4 Targets for implementation phases
2. Action plan
   - 2.1 An integrated action plan
     - 2.1.1 Outputs
     - 2.1.2 Linkages to strategic recommendations
     - 2.1.3 Leadership and accountability
     - 2.1.4 Activities and classification into key thrust areas
     - 2.1.5 Dependencies
     - 2.1.6 Risks and challenges
3. Delivering the action plan
   - 3.1 Skills and expertise
   - 3.2 Strategic approach towards implementation
   - 3.3 Funding estimates

Communication plan

4. Next steps

Appendix A – List of stakeholder consultations

Appendix B – References

Annex 2.4.2. Examples of e-agriculture activities

This annex provides additional information about potential activities that may fall within each of the four common e-agriculture thrust areas. This is not intended to be an exhaustive list of activities from which countries should select, but to assist readers in understanding the appropriate level and types of activities they should be attempting to identify and describe. The activities that a country will need to pursue will be driven by their e-agriculture vision and the high-level implementation approach that they have chosen to pursue to deliver that vision.

Governance activities

These activities focus on those e-agriculture components that provide coordination, visibility and oversight for e-agriculture implementation. These are the components that will manage the delivery of the action plan, and govern the broader development of the e-agriculture environment. It would establish governance structures and mechanisms for accountability, transparency and leadership of a national e-agriculture programme (Table 2.4.3).

Table 2.4.3. Examples of governance activities (not exhaustive)

Design and establish a national e-agriculture steering committee and collaboration framework	Focuses on the design and establishment of a committee that has accountability for setting overall national e-agriculture direction and priorities, for reviewing and approving national e-agriculture strategy and funding decisions, and for monitoring of national e-agriculture strategy progress and evaluating outcomes.
Formalize governance interactions with other national, regional and local governance bodies in multiple sectors	There is a need to identify and formalize the relationships with governance functions within different sectors and different geographic regions within the agriculture sector. It is also important to clearly define how they will interact with relation to e-agriculture strategy, investment and coordination.
Establish a coordination mechanism on cross-sector and multiple stakeholder governance issues	It is important to establish a mechanism for cross-sector coordination and monitoring noting the cross-sectoral nature of the e-agriculture systems.

Foundation activities

These activities include those that build foundations at the national level or across other sectors essential to deliver e-agriculture components that support service delivery across a country's geographical and agriculture sector boundaries. Examples include

- Develop and approve standards and terminologies;
- Develop a generic and common applications' platform for e-agriculture or for wider e-services;
- Identify content development, certification and sharing frameworks that can be applied across provinces (states) or districts;

- Review national frameworks for sensing and computing infrastructure, their standardization, sharing practices and applications;
- Agree and adopt a nationally-consistent regulatory framework for agricultural consumer protection;
- Establish mechanisms to improve computing infrastructure for agricultural information and knowledge management;
- Development of credible public and private advisory services including appropriate legal frameworks;
- Develop a regulatory framework for data availability, storage, security, privacy and sharing;
- Establish guidelines for Cloud services and big data analytics; and
- Develop the necessary cross-sector (e.g. telecommunications, IT, banking, governance) cooperation structure, necessary guidelines, policies, regulations and legislations;
- Establish alignment with other e-strategies (e.g. e-Governance).

Table 2.4.4. Examples of foundation e-agriculture activities (not exhaustive)

Develop high-level requirement and design for e-agriculture service	The implementation of foundation e-agriculture services (e.g. national agricultural identifiers, national authentication, electronic agricultural directories, etc.), begins with understanding the high-level requirements for the services and defining a high-level design for how the services would be delivered for the country.
Assess capacity and capability of existing government organizations or agencies to build, implement and operate an e-agriculture service	Some nations may already have government organizations or agencies experienced in developing and operating national e-agriculture or similar services. In particular, developments such as e-government, m-banking, land use, meteorological and weather data are critical. These should be identified and assessed as part of determining the most suitable approach for sourcing the detailed design, construction and operation of a foundation e-agriculture service.
Select an implementation partner(s) to perform detailed design and construction of an e-agriculture service	This involves identifying, evaluating and selecting an implementation partner or partners to undertake the detailed design and implementation of an e-agriculture service that adheres to the high-level requirements and design.
Deploy and operate the e-agriculture service	Once developed, the e-agriculture service will need to be deployed and operated reliably so that it supports the nation's e-agriculture environment.
Define the e-agriculture standards and guidelines development process	National e-agriculture standards are essential to ensuring that agricultural information can be exchanged across geographical and agriculture sector boundaries. This requires a clear process for developing, reviewing, approving, publishing and sharing necessary standards and guidelines for e-agriculture.
Develop and approve high-priority agricultural information standards	Depending on the agricultural system goals and challenges, a number of agricultural information flows will likely have been identified as being a priority for delivery. Examples may include market prices, climate and disease information, financial transactions, agricultural extension services and so forth. Enabling the exchange

Table 2.4.4. (continued)

	of them across agriculture sector and geographical boundaries requires the appropriate development of information standards that define the message.
Develop and approve standard terminologies	Ensuring that agricultural information is communicated and interpreted in a consistent and accurate manner requires a standard language for all areas of interest like food, nutrition, agriculture, fisheries, forestry, etc. This requires the development of standard terminologies.
Agree and adopt a nationally-consistent regulatory framework for agricultural information protection	Ensuring private and confidential information exchange requires a nationally-consistent regulatory framework for agricultural information protection. This is often a requirement where data protection legislation and frameworks differ, or conflict, at national, state or regional levels. Developing and adopting such a framework ensures that data protection, privacy, access and consent are approached and managed consistently at a national, state and regional level.
Establish mechanisms to improve computing infrastructure within agricultural organizations and providers	A barrier to the adoption of e-agriculture can be the poor quality of computing infrastructure that exists across different parts of the agriculture sector. Infrastructure can include PCs, network connectivity and agricultural information systems. There may be a need to undertake activities that design and establish mechanisms to encourage agricultural organizations and providers to invest in and improve their computing infrastructure. By these means, they provide the foundation required for collecting, recording and sharing electronic agricultural information.
Define minimum computing infrastructure requirements for agricultural organizations and providers	Assisting the agriculture sector to improve its computing infrastructure requires a clear understanding of the appropriate levels of that infrastructure which need to be put in place, and maintained and refreshed on an ongoing basis.
Identify high-priority providers and communities requiring 'fit for purpose' data connectivity	Data connectivity is a key foundation for sharing e-information among agricultural service providers, and for the provision of agricultural services through electronic channels (e.g. e-agriculture). This activity needs to identify the priority agricultural provider segments and communities that require investment in 'fit for purpose' data connectivity.
Develop data connectivity implementation design and plans	Investing in data connectivity infrastructure will require a high-level design as to how data connectivity to priority agricultural providers and communities can be achieved, and how this will be extended to the broader agriculture sector and population.
Select implementation partner(s) to develop data connectivity infrastructure	Countries will most likely need to select data connectivity infrastructure providers and operators to assist in developing the required data connectivity infrastructure.
Deploy high-priority data connectivity infrastructure	Countries will work with selected providers and operators to deploy data connectivity infrastructure that enables high-priority parts of the agriculture sector and population to interact with and benefit from the national e-agriculture environment.

Solutions and services' activities

These activities focus on encouraging the development and use of high-priority e-agriculture services and applications to improve the efficiency and effectiveness of agricultural management and delivery. This often focuses on ensuring that individuals, agricultural service providers and managers have access to the services and applications that allow them to access, view, use and share agricultural information. These services and applications will often utilize e-agriculture components established through the activities delivered via the foundation thrust areas (Table 2.4.5).

Table 2.4.5. Examples of solutions for e-agriculture activities (not exhaustive)

Develop investment rules and criteria	Develop the rules and criteria required to guide the allocation of investment funds and establish appropriate investment fund governance, processes, control mechanisms and functions.
Foster development of high-priority e-agriculture solutions	Engage with the agricultural ICT industry and the broader agriculture sector to build awareness and understanding of available investment funds and encourage the development of high-priority e-agriculture solutions.
Develop high-level requirement and design for priority national e-agriculture services and applications	The national e-agriculture vision may have identified a number of priority e-agriculture services or applications that should be developed and deployed on a national scale. This activity defines the high-level requirements and designs for these priority services or applications. Examples may include the national electronic weather alerts' system, agricultural extension information services, agricultural information portals, market prices and agricultural information datasets.
Select an implementation partner(s) to perform detailed design and construction of national e-agriculture service or application architecture	This involves identifying, evaluating and selection of an implementation partner or partners to undertake the detailed design and implementation of a national e-agriculture service or application architecture that adheres to the high-level requirements and design. This should also include design of the common technical platform(s) for service and applications.
Deploy and operate e-agriculture services or applications	Once developed e-agriculture services or applications will need to be deployed and operated reliably so that it can be accessed and used by the intended users (e.g. individuals, agricultural organizations and providers, agricultural managers and administrators).

Change and adoption activities

These activities focus on motivating, preparing and supporting the agriculture sector in adopting and using e-agriculture as a core part of the agricultural services and systems. An important aspect of this is enabling participants in the agricultural system to adopt e-agriculture services and applications and to change their work practices so as to be able to use them effectively (Table 2.4.6).

Table 2.4.6. Examples of change and adoption e-agriculture activities (not exhaustive)

Identify and assess high-priority change and adoption targets	Identify the priority consumer, agricultural provider and agricultural manager stakeholder segments that should be targeted for e-agriculture adoption, assess their readiness to adopt specific e-agriculture solutions and identify opportunities to build momentum.
Develop e-agriculture awareness campaigns	Develop awareness campaigns that utilize appropriate communication mechanisms and forums to promote awareness of e-agriculture, specific e-agriculture services and applications, digital literacy and their benefits.
Roll out e-agriculture awareness campaigns	Roll out awareness campaigns to high-priority change and adoption targets, and in time extend these to the broader agriculture sector and public.
Establish a framework for measuring the effectiveness of engagement and awareness activities	Define clear criteria and targets for e-agriculture awareness and progress, and periodically measure actual awareness and programmes against them, to assess the effectiveness of e-agriculture change and adoption activities across consumers, agricultural providers and agricultural managers and administrators.
Establish a national e-agriculture knowledge repository	Establish a national, Web-based knowledge repository that captures e-agriculture project successes and enables sharing of learning across the national agriculture sector.
Develop a financial incentive regime	Design a financial incentive programme to encourage the adoption and use of high-priority e-agriculture services and applications. This needs to include conditions of funding, eligibility criteria, application and approval processes, funding administration, and associated roles and responsibilities.
Develop a financial incentive communications' programme	Develop a communication strategy and materials to publicize incentives and put in place necessary mechanisms to support this, including funding guidelines, information and application forms.
Roll out the financial incentive communications' programme	Roll out the communications' programme to high-priority change and adoption targets, and in due course extend this to the broader agriculture sector.
Monitor e-agriculture solution adoption	Monitor adoption of priority e-agriculture solutions in target segments over time and scale back financial incentives and other change and adoption activities as the tipping point is reached.
Define a standard e-agriculture competency framework	Develop a standard e-agriculture competency framework for agricultural workers and agricultural ICT practitioners. This framework would provide an understanding of required e-agriculture knowledge, skills and attributes for these various professional groups.
Identify education and training course changes	Determine the changes that need to be made to existing education and training courses to ensure the development of e-agriculture workforce capabilities.
Implement education and training course changes	Work with education institutions (e.g. universities, vocational training institutions, professional bodies) to insert e-agriculture into their curricula.

Table 2.4.6. (continued)

Establish specialized e-agriculture courses and qualifications	Identify and establish nationally-recognized tertiary qualifications in e-agriculture (e.g. agricultural informatics) and implement formalized training/education programmes designed to recognize and promote the spread of e-agriculture skills and expertise.
Design targeted stakeholder reference and working groups	Global experience suggests that the lack of meaningful engagement of agricultural participants is often a significant barrier to the development of a national e-agriculture environment. This activity designs a set of targeted stakeholder engagement forums that have clear goals, objectives and deliverables.
Identify cross-sectoral representatives	Identify the participants to participate in targeted stakeholder engagement forums, ensuring broad and appropriate representation across agricultural providers, professionals, governments, vendors, industry, consumers, community and other relevant stakeholder groups.
Engage and consult with stakeholder reference and working groups	Regularly engage and involve stakeholder reference and working groups throughout the development of the country's e-agriculture environment. These groups should be involved in exploring particular issues and risks related to the development of the country's e-agriculture environment, and the identification of acceptable solutions to them.
Develop communication to convey agriculture a profitable business	Identify cases to communicate agriculture as a profitable business.

Annex 2.4.3. Examples of e-agriculture activity risks

This annex provides additional information regarding the potential risks that may be associated with the activities within the action plan. This is not intended to be an exhaustive list of risks but rather a means to assist readers in understanding common areas of risks that should be explored.

Leadership and governance risks

This area encompasses those risks which may impact the ability to deliver effective leadership and governance of the e-agriculture action plan. Table 2.4.7 describes examples of leadership and governance risks.

Table 2.4.7. Examples of leadership and governance risks (not exhaustive)

Lack of credible and high-profile leader(s) to drive e-agriculture change	Like any large-scale change and transformation, e-agriculture transformation requires a credible and high-profile leadership that will provide top-level, sustained vision, leadership and commitment throughout the programme.
Inadequate governance and oversight mechanisms	Poor or inadequate oversight mechanisms may lead to impaired decision-making, and in turn result in delivery delays and higher costs of delivering the action plan.
Conflicting agendas	Decision-makers from different levels of government, regions or parts of the agriculture sector may have conflicting agendas and will be unable to reach agreement on implementation approach, activities and other aspects of the action plan.
Resistance to change existing governance mechanisms	Stakeholders may resist making changes to existing governance mechanisms that are required to support the delivery of the action plan, which will delay effective governance and oversight of activities.

Stakeholder engagement and buy-in risks

This area encompasses those risks which may impact the ability to effectively engage with stakeholders and achieve their support as part of delivering the action plan for e-agriculture (Table 2.4.8).

Table 2.4.8. Examples of stakeholder engagement and buy-in risks (not exhaustive)

Inadequate engagement with agricultural stakeholders	Many e-agriculture programmes and projects have failed as a result of not ensuring adequate engagement and participation of agricultural representatives in the design and delivery of e-agriculture transformation. This may result in technology and process changes that are not relevant to stakeholders and do not add value to their roles and practice.
Fragmentation in the agriculture sector	Fragmentation of the agricultural system may increase the complexity and effort associated with achieving effective stakeholder involvement.
Non-organized stakeholders	Some important stakeholders may not be organized in a manner that permits them to be easily engaged as part of delivering the action plan, yet their involvement is critical to the delivery of the plan.
Resistance to e-agriculture	Some parts of the agriculture sector may resist the notion of e-agriculture, particularly those organizations, providers and individuals that do not understand what e-agriculture is, how it could be applied to address current challenges and the benefits that it may deliver.
Inability to meet expectations	The activities within the action plan may not meet with the expectations of various political, agriculture-sector and other important stakeholders even if the programme delivers in accordance with objectives and scope.

Resource and funding risks

This area encompasses those risks related to the resources and funding required delivering activities within the e-agriculture action plan (Table 2.4.9).

Table 2.4.9. Examples of resource and funding risks (not exhaustive)

Lack of skills and expertise	The successful delivery of activities within the action plan is dependent on skills and expertise which are difficult to access by the country.
Competition for resources	National or international programmes or projects may exist that generate competition for particular resources that will also be required to deliver activities within the action plan.
Insufficient resource capacity	The successful delivery of activities within the action plan requires a greater number of skilled resources than are available to a country.
Imbalanced geographical distribution	The resources required to deliver the activities within the action plan may not be geographically located where they will be required.
Scarcity of funding	There may be an inability to secure sufficient funding within the required time period to make the necessary investments in e-agriculture, meaning that the vision cannot be achieved.

Implementation approach risks

This area encompasses risks related to the implementation approach that is selected to deliver one or more strategic recommendations. An implementation approach is characterized by a set of inter-related activities that collectively seek to deliver outputs that support a strategic recommendation. Identifying these types of risks may require a broader analysis across a set of activities (Table 2.4.10).

Table 2.4.10. Examples of implementation approach risks (not exhaustive)

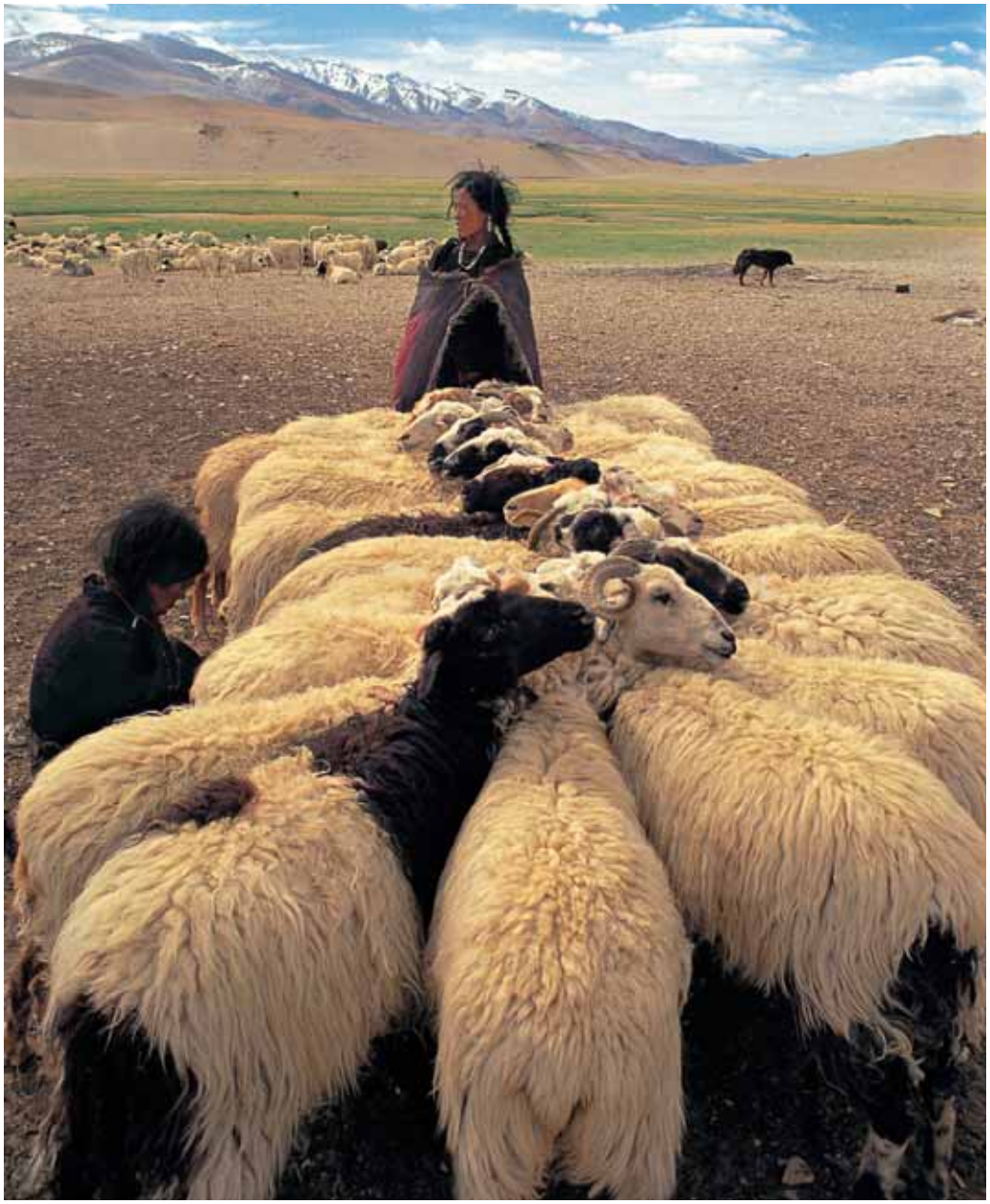
Implementation focus too broad	Activities may attempt to focus too broadly within the agriculture sector, rather than targeting its specific, high-priority needs and segments.
Ability for the sector to accept change	Activities may be too aggressive in driving towards particular outcomes and not take account of the sector's capacity to accept and support activities, and the associated level of change that these activities will seek to deliver.
Not delivering early enough or fast enough	The implementation approach may not deliver tangible benefits early enough or fast enough to address the expectations of stakeholders. This may impact perceptions about the ability of the government and other partners to deliver the programme, as well as delay the realization of benefits, and encourage ongoing investment in ad hoc e-agriculture solutions across the sector.

External dependency risks

This area encompasses risks arising from dependencies on elements that are not within the control of the action plan (Table 2.4.11).

Table 2.4.11. Examples of external dependency risks (not exhaustive)

Required infrastructure not available	The action plan is dependent on the delivery of technology, business or other infrastructure, but this will not be available when required. It may also include upgrading needs for telecommunication and IT networks, which the owner is unwilling to undertake.
Required standards and guidelines not available	The action plan is dependent on the delivery of data, technical or other standards but this will not be available when required, or is not interoperable.
Inability to re-use, interoperate or share	The action plan is dependent on external systems or infrastructure that may prove unsuitable for re-use or sharing or may not interoperate with other IT infrastructure.
Vendor product and solution changes not available	The action plan is dependent on vendors having changed their products and solutions to support the national e-agriculture environment, but these will not be available in the marketplace when required. Unavailability of capacity to maintain and upgrade existing e-agriculture systems.



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National E-agriculture Monitoring & Evaluation

PART 3
MONITORING AND EVALUATION

PART 1
National E-agriculture Vision

PART 2
National E-agriculture Action Plan

PART 3
National E-agriculture Monitoring & Evaluation

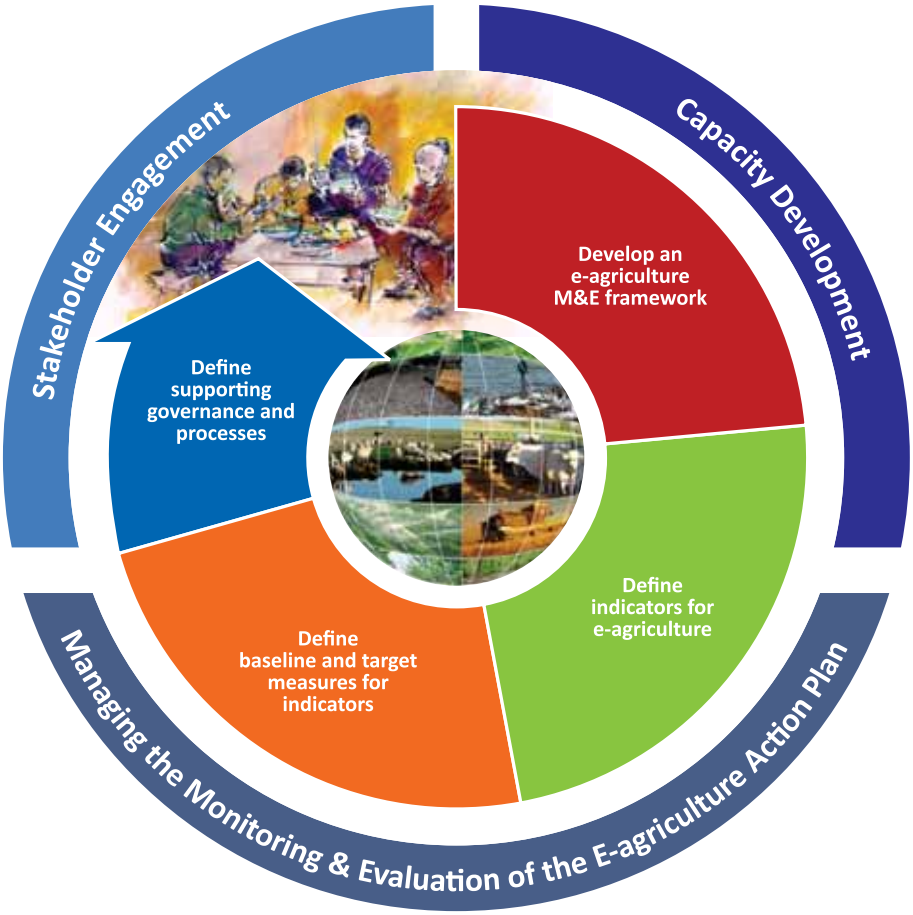
PART 3

MONITORING AND EVALUATION

Part 3 is a guide to establishing a framework to monitor the action plan developed in Part 2, and to evaluate the outcomes. The main aspects of this work are the development of indicators and targets to be measured, and the definition of the governance and processes required. At this stage, the financial and technical resources as well as the responsible stakeholders would also have been identified and agreed upon.

Part 3 provides guidance on establishing a national monitoring and evaluation framework.

- The introduction summarizes the outputs of Part 2 and how these relate to monitoring and evaluation;
- Chapters 1 covers the elements of a monitoring and evaluation framework, and the method by which the framework is developed; and
- Chapters 2-4 provides detailed guidance on defining a national monitoring and evaluation framework.



Monitoring and evaluation framework for e-agriculture

By this point, a government would have established its national e-agriculture vision and the e-agriculture action plan following Parts 1 and 2 of this guide. The action plan would have been endorsed by the agriculture and ICT sector leadership and supported by the broader stakeholder environment.

A monitoring and evaluation (M&E) framework enables a government to track and assess the results of implementing the e-agriculture action plan. 'Results-based management' is the management strategy used by the United Nations[62] and adopted in this guide. This approach focuses on performance and achievement of outputs, outcomes and impacts by:

- Defining indicators that provide insight into the adoption of e-agriculture and the tangible results for agriculture and non-agriculture stakeholders;
- Identifying indicator baseline and target measures to allow monitoring and evaluation of progress over the duration of the plan; and
- Describing the governance and processes required.

A clear distinction should be made between an M&E framework for a national e-agriculture strategy and the programme management activities that are designed to implement and manage a large-scale e-agriculture action plan.

Programme management monitors the execution of the action plan, and is central in answering the question of *whether the country is on track in terms of its implementation of a national e-agriculture environment*. It focuses on three main components:

1. *Programme inputs:* funding, budgets, resources and other inputs required to deliver the e-agriculture action plan.
2. *Programme activities:* these correspond to the activities defined in the action plan.
3. *E-agriculture outputs:* the deliverables, such as e-agriculture components, resulting from the activities undertaken.

By contrast, an M&E framework *complements* programme management by looking primarily at results. It overlaps programme management and enables a country to determine whether it is on the right track. But it goes further to answer the question of whether the action plan is delivering the outcomes, impact and level of change anticipated. It also focuses on three main components:

1. *E-agriculture outputs:* the deliverables, such as e-agriculture components, resulting from the activities undertaken (as above).
2. *E-agriculture outcomes:* the strategic outcomes that e-agriculture outputs enable, or contribute to enabling.
3. *Impact:* the change that e-agriculture outcomes create for agriculture and non-agriculture sector stakeholders.

[62] https://undg.org/wp-content/uploads/2014/06/UNDG-RBM-Handbook-2012.pdf

An M&E framework assigns accountability (who), and determines the approach (how) and timing (when) for measuring the results. Countries seeking information on programme management should refer to one of the programme management frameworks that are widely in use, such as PMBOK®[63] or PRINCE2.[64]

Monitoring and evaluation plays an essential role in demonstrating the progress that a country is making towards the development of its national e-agriculture environment, and the results or changes that these efforts are delivering. The outputs of M&E form a critical part of ongoing communication regarding a country's national e-agriculture programme, which in turn is essential to building the support of stakeholders for further adoption and investment in e-agriculture.

In particular, communicating the progress and results of the e-agriculture action plan is important in demonstrating to donors or funders the impact of their investments. It can also help in building trust and understanding with potential funders as to how their contribution would be used to further the country's national e-agriculture programme.

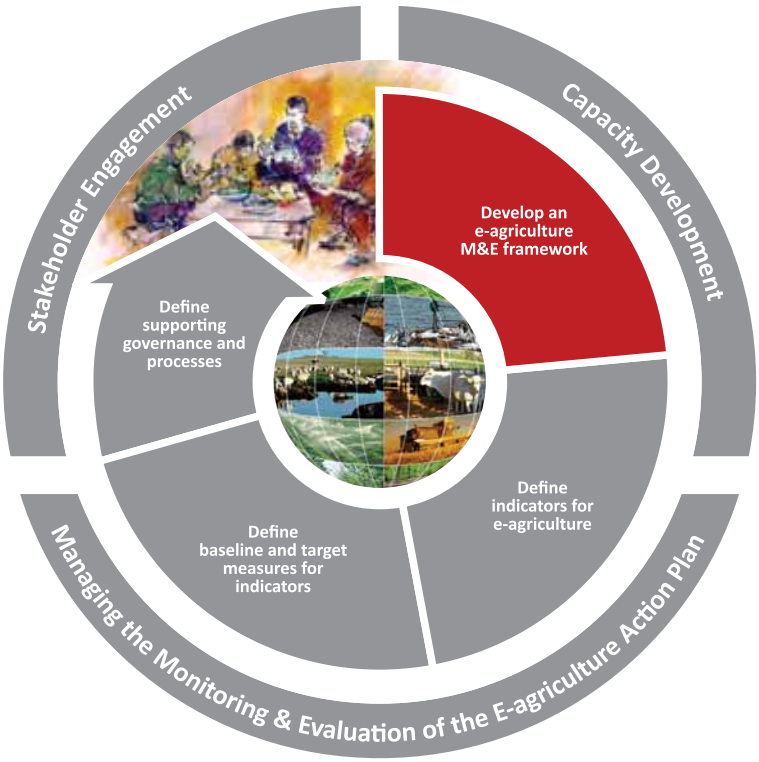
Establishing a successful national M&E framework requires dedicated resources and effort, often at various levels, to develop, manage and operate an effective process. Governments should consider M&E as part of the planning and costing of their national e-agriculture programmes, thereby ensuring that appropriate resources are dedicated to the work.

Countries using their own results-based management approaches are encouraged to ensure that they encompass the concepts described in the results chain.

[63] www.pmi.org

[64] http://www.prince2.com, accessed 19 November 2014.

CHAPTER 1 Developing an e-agriculture monitoring and evaluation framework



This section describes the elements to be considered in establishing an M&E framework for a national e-agriculture programme.

1.1 Indicators for e-agriculture

An effective M&E framework is constructed around a set of meaningful indicators, the measurement of which provides insight into the adoption, use and results that e-agriculture is delivering.

Meaningful indicators should include the perspective of stakeholders, as this ensures that changes or improvements important to stakeholders are measured. Developing and selecting these indicators requires an understanding of e-agriculture outcomes (formed during Part 1) and outputs (formed during Part 2) that are important to each stakeholder.

There are two types of indicators to consider.

1. *Output indicators* provide information and insight on the adoption of e-agriculture.
2. *Outcome indicators* provide information and insight on the results obtained.

1.2 Indicator measures

Monitoring the progress of the action plan requires an understanding of where a country is starting from (baseline measures), and what it is expecting to achieve (target measures). Targets should be defined for a range of time frames throughout the duration of the action plan.

1.3 Governing, monitoring and evaluation

National governance provides oversight, coordination and guidance for M&E efforts, and ensures timely intervention when there appears to be divergence between what is actually happening and what a country was aiming to achieve through its e-agriculture programme. Governance must be supported by processes that direct how the adoption and results of e-agriculture are monitored and evaluated.

1.4. Developing the framework: overview

This section describes how an M&E framework can be developed. This is a sequential process that begins with determining the indicators to be monitored and outcomes to be evaluated. Baseline and target measures are set for each indicator. Targets serve as the basis for tracking actual progress against planned progress, and determining whether corrective action is required. An M&E framework also describes the governance model and processes through which national M&E will be performed. Stakeholders are consulted throughout the process in order to gain commitment and understanding, as well as to ensure that their roles are considered in the governance structure and processes.

The development of an M&E framework is closely linked to the outputs of Parts 1 and 2 of this guide, and in particular:

- The important agriculture and non-agriculture-sector stakeholders;
- The *e-agriculture outputs* that the action plan will deliver;
- The *e-agriculture outcomes* expected as a result of these outputs; and
- The implementation phases and timing for delivery of these outputs.

A considerable portion of developing an M&E framework involves using this existing knowledge.

1.5 Define indicators for e-agriculture

This step determines the purpose of M&E, based on the e-agriculture vision, action plan and stakeholder perspectives. It focuses on developing a set of e-agriculture output and outcome indicators that will measure the results that e-agriculture delivers. An important aspect is to consider the consultations completed with stakeholders in Part 1, and to link a number of the indicators to outcomes important to stakeholders. It is also important to link indicators to time frames for measuring other agriculture outcomes, where possible, to show the contribution

of e-agriculture to these outcomes and to avoid creating separate reporting processes (for example, productivity figures that are already being reported).

1.6 Define baseline and target measures for indicators

This step validates the baseline measures and creates target measures for each indicator. Target measures are defined for different time frames so that progress can be monitored throughout the execution of the plan.

1.7 Define supporting governance and processes

This stage defines the governance and processes within which the M&E of e-agriculture adoption and associated results will be undertaken. Experience shows that monitoring the progress and evaluation of e-agriculture may be carried out at multiple levels and by multiple parties. It is important that these various efforts are planned and executed within an overall national M&E model. More specifics on this process can be found in Part 3-Chapter 4.

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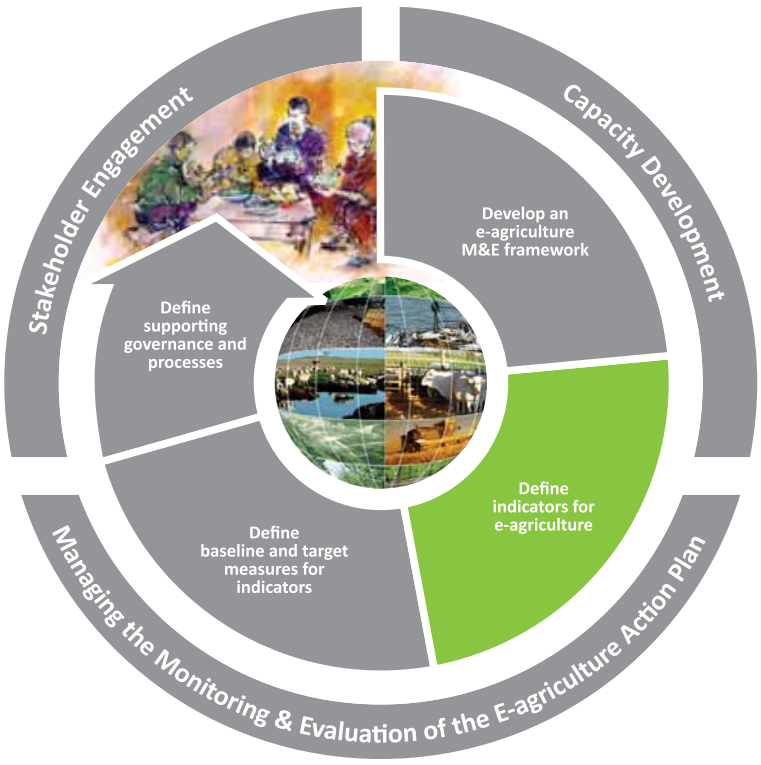
CHAPTER 2 Define indicators for e-agriculture



This step defines e-agriculture output and outcome indicators that will assist in measuring the results of the e-agriculture action plan. Indicators should be linked to the stakeholders and outcomes identified in Part 1, so that the progress of e-agriculture implementation is monitored effectively.

In this context it is necessary to:

- Identify priority stakeholders for whom it is critical to show results in e-agriculture;
- Review e-agriculture outcomes for priority stakeholders;
- Identify the e-agriculture outputs that will lead to these outcomes;
- Review and confirm focus areas with priority stakeholders; and
- Develop e-agriculture output and outcome indicators.

The following outputs should then be generated:

- E-agriculture output indicators, which will be used to measure the adoption and take-up of e-agriculture within the agriculture sector; and
- E-agriculture outcome indicators, which will be used to measure the results of the adoption and take-up of e-agriculture.

Use the Indicator Worksheet in Annex 3.2.1 to organize the outputs from each of the steps below.

2.1 Identify priority stakeholders

This step prioritizes the agriculture and non-agriculture sector stakeholders identified in Parts 1 and 2 for whom it is important to show results of the e-agriculture action plan. The development of indicators should be informed by the perspective of stakeholders, minimizing the risk that indicators are based on programme delivery alone.

2.1.1 Recommended outputs

This step should determine the priority agriculture and non-agriculture sector stakeholders for whom it is especially important to demonstrate e-agriculture outcomes. It is recommended that stakeholders are described at the level of an organization, group or role, rather than as a specific individual or political party, because these will change with time. For example, a stakeholder could be defined as the 'Department of Agriculture' (organization level) or the 'Agriculture Minister' (role level) rather than the particular individual fulfilling the role of the agriculture minister. An example of a stakeholder group could be 'Smallholder farmers aged 40 years or older'.

2.1.2 Approach

This step is based on the knowledge of multisector stakeholders developed in Parts 1 and 2. As this may be a long list, this step should focus on stakeholders for whom the demonstration of progress and outcomes of e-agriculture is important in building support and momentum for further adoption of and investment in e-agriculture.

Stakeholders for whom e-agriculture outcomes may be especially important are:

- Agriculture sector policy makers;
- Farmers, fishers, furesters and livestock herders;
- Agribusinesses, including small and medium local enterprises, as well as large multinational firms;
- Agricultural service providers, such as extension agencies and NGOs; and
- Agricultural researchers.

Funding bodies, such as socio-economic development agencies and other donors, should also be considered. While they are not direct beneficiaries of e-agriculture programmes, these bodies may have stipulated requirements for monitoring implementation progress and the results of their investment in a national e-agriculture programme (as part of their provisions of funding).

2.2 Review e-agriculture outcomes for priority stakeholders

Objective

This step identifies the outcomes that delivering the e-agriculture action plan will have for the stakeholders identified above. As delivering the outcomes leads to concrete improvements and results for stakeholders, indicators should be based on them. The outcomes should be

linked to each of the prioritized stakeholders and explored from each shareholder's perspective in order to describe what delivering each outcome will mean for them. For example, the improvements or changes that a particular stakeholder will experience through the realization of a particular e-agriculture outcome.

Recommended outputs

This step should describe the expected outcomes (concrete improvements) for each prioritized stakeholder. These will be based on the e-agriculture outcomes described in Part 1-Chapter 6. Table 3.2.1 gives a non-exhaustive list of e-agriculture outcomes for stakeholders.

Table 3.2.1. Examples of e-agriculture outcomes for stakeholders (non-exhaustive)

Stakeholder	Examples e-agriculture outcomes
Policy makers	• Improve dissemination of policies and guidelines within agriculture sector stakeholders; • Support more informed policy, investment and research decisions through access to timely, accurate and comprehensive information from the agriculture sector; • Improved monitoring of e-agriculture services
Farmers and fishers	• Improve the ability of farmers and fishers to access relevant agricultural information and services; • Improve access to financial services, such as payment mechanisms, insurance, loans and saving products; • Improve access to trade via new markets and connections; • Improve livelihood of farmers and fishers; • Improve access to quality inputs and reduce prevalence of counterfeit inputs through verification mechanisms.
Agribusinesses	• Improve management of agriculture inputs and outputs throughout the production cycle; • Enable payments to farmers via mobile or electronic channels rather than cash; • Improve access to international markets through certifications and interconnected commodity exchanges; • Improve management of and the delivery of relevant services to growers.
Agricultural service providers	• Improve the ability of providers to access agricultural information in the field; • Enable providers to remotely interact with farmers; • Enable providers to monitor and track services provided to farmers and adoption rates; • Enhance the efficiency and credibility of extension services; • Enable providers to access knowledge, evidence and expertise to support skills' development and the delivery of agricultural extension services within local communities.

Table 3.2.1. (continued)

Stakeholder	Examples e-agriculture outcomes
Agricultural researchers	• Provide researchers with greater access to evidence-based information to support decision-making, design and assessment; and • Improve access to agricultural literature, knowledge networks and resources.

2.2.3 Approach

This step is based on the e-agriculture outcomes developed during the development of the national e-agriculture vision in Part 1. Formulating the vision involved defining a set of *e-agriculture outcomes*, which answered the question of *what will be achieved or changed through using e-agriculture*? The process of developing the vision also involved exploring what each of these e-agriculture outcomes would mean for stakeholders.

This activity should take these e-agriculture outcomes and refine them where required to describe the concrete results that the vision is expected to deliver to each stakeholder. The descriptions should be concrete enough to support the identification of indicators that will allow these outcomes to be measured.

2.3 Identify e-agriculture outputs that will lead to these outcomes

This step identifies the outputs of the e-agriculture action plan that will lead to the e-agriculture outcomes identified in Part 1-Section 6.2. This understanding provides the context for identifying e-agriculture output indicators.

The e-agriculture outputs and associated activities defined in the action plan (Part 2) should be linked to the e-agriculture outcomes defined in the previous step.

This step should define a set of outputs for each e-agriculture outcome (Table 3.2.2).

Table 3.2.2. Examples of e-agriculture outputs (non-exhaustive)

Stakeholders	E-agriculture outcomes	Associated e-agriculture outputs
Farmers and fishers	Improve the ability of farmers and fishers to access relevant agricultural information and services.	• Agricultural information services available and accessible via mobile phone and the Internet; • Localized weather information available; • Mobile network coverage available in rural communities; • Awareness programmes delivered regarding service options and usage.

Table 3.2.2. (continued)

Stakeholders	E-agriculture outcomes	Associated e-agriculture outputs
Agribusinesses	Improve management of inputs and outputs throughout the production cycle.	• Systems developed and deployed for logistics and supply chain management; • Traceability and verification systems developed and deployed; • Digital payment systems in place to facilitate seamless transactions.
Agriculture service providers	Enable providers to access knowledge, evidence and expertise to support skills' development and the delivery of agricultural extension services within local communities.	• National agricultural extension information portal established; • Mobile-based knowledge and decision support applications developed and deployed; • Mobile network coverage available in rural communities.
Agricultural researchers	Provide researchers with greater access to evidence-based information to support decision-making, design and assessment.	• National database of agricultural and market data established; and • Web-based community of practice for agricultural researchers established.

This step is based on the e-agriculture outputs developed in Part 2.

Note that some e-agriculture outputs will be delivered progressively over time (such as the adoption of a particular e-agriculture solution by service providers) while others will represent a 'point in time' event.

2.4 Review and confirm focus areas with priority stakeholders

This step confirms the e-agriculture outcomes and outputs for M&E, which involves reviewing with stakeholders. This step allows the relative importance of different e-agriculture outcomes and outputs to emerge. This is particularly important given that the resources to undertake M&E will likely be limited and therefore measuring 'everything' is unlikely to be possible.

This step also provides an opportunity to:

- Build stakeholder support;
- Gather stakeholder input on indicators that could be used; and
- Communicate the expected outcomes relevant to stakeholders.

This step should produce a list of the e-agriculture outcomes and associated outputs that will be the focus of national M&E efforts.

It will require consultation with stakeholders to review and confirm the e-agriculture outcomes and outputs that are of particular importance to them. Consultation should focus on understanding those aspects that 'must' be monitored and evaluated, versus those that 'should' or 'could' be measured. Typically this discussion will tend to focus more on stakeholder priorities in the short to medium time frames.

Once e-agriculture outcomes and outputs are prioritized, stakeholders should also be consulted regarding the indicators that they regard as being practical and appropriate to measure.

2.5 Define e-agriculture output and outcome indicators

This step defines the indicators that will be used throughout the execution of the e-agriculture action plan. Two types of indicators should be considered.

- *E-agriculture output indicators* provide information and insight into the adoption of e-agriculture; and
- *E-agriculture outcome indicators* provide information and insight into the results for stakeholders.

Output indicators are derived from the e-agriculture outputs.

Outcome indicators are derived from the e-agriculture outcomes. These indicators are closely related in that the rate of adoption (measured by e-agriculture output indicators) will drive the expected improvements (measured by e-agriculture outcome indicators).

This step should produce meaningful indicators that can be used to monitor and evaluate the results of implementing the e-agriculture action plan (Table 3.2.3).

Table 3.2.3. Example of e-agriculture outcome and output indicators (non-exhaustive)

Stakeholders	E-agriculture outcomes	Outcome indicators	Output indicators
Policy Makers	Improve dissemination of policies and guidelines within agriculture sector stakeholders	Percentage of farmers and fishers accessing policies and guidelines electronically	Percentage of farmers and fishers having mobile phone; Percentage of policies and guidelines made available electronically; Percentage of policies and guidelines information sent on mobile.
Farmers and fishers	Improve the ability of farmers and fishers to access relevant agricultural information and services.	Percentage of farmers and fishers using agricultural information services; Percentage increase in the number of farmers and fishers who adopt	Percentage of farmers and fishers with access to mobile phones; Percentage of farmers and fishers who have been educated on how to use the services.

Table 3.2.3. (continued)

Stakeholders	E-agriculture outcomes	Outcome indicators	Output indicators
		improved farming techniques; and Farmers and fishers' satisfaction regarding their use of e-agriculture services to improve their access to agricultural information and services.	
Agribusinesses	Improve management of agriculture inputs and outputs throughout the production cycle.	Percentage decrease in spoilage of outputs; and Percent decrease in counterfeit inputs sold.	Percentage of agribusinesses using logistics and supply chain management software, services or applications; Percentage of agribusinesses using digitized traceability and verification services.
Agriculture service providers	Enable providers to access knowledge, evidence and expertise to support skills' development and the delivery of agricultural extension services within local communities.	Percentage increase in service providers using national portals; Percentage increase in use of mobile-based services by service providers; Percentage increase in number of farmers serviced by service providers; and Providers' perceptions of issues/challenges impacting their use of e-agriculture to support agricultural extension services.	Percentage of service providers who have access to portals; Percentage of service providers who have installed or subscribed to mobile-based services.
Agricultural researchers	Provide researchers with greater access to evidence-based information to support decision-making, design and assessment.	Percentage increase in the number of publications produced by researchers; and Percentage increase in active usage of portals and the community of practice.	Percentage of researchers registered for portals; and Percentage of researchers registered for the community of practice.

Quantitative indicators minimize the level of ambiguity regarding the results achieved. Some outcomes require the use of qualitative indicators, which are usually derived from surveys, questionnaires, feedback and other evaluation mechanisms, and may also allow for greater insights into the potential cause(s) of divergence from expected results. The choice of indicators is explored further in the following section.

This activity requires internal analysis to define a set of candidate e-agriculture output and outcome indicators, which can then be confirmed with stakeholders. It also requires working through each outcome or output, and answering the question of *what needs to be monitored or measured to monitor progress towards that outcome or output*.

Consultation with stakeholders should focus on confirming the initial set of candidate indicators and identifying any others that should be considered. This may include confirming that indicators meet the criteria that they are observable, reliable and controllable (Table 3.2.4). Subject-matter experts and stakeholders may be consulted on how best to measure a particular e-agriculture outcome or output.

Table 3.2.4. Suggested criteria for selecting indicators

Criteria	Meaning
Linked to objectives	Indicators should provide information that can be linked to and support the M&E of e-agriculture outcomes and outputs.
Quantifiable	Indicators should be concrete, as opposed to conceptual, and should be measurable and easily expressed in relevant units of measurement.
Observable	Measurement data exist (or will exist) that will allow an indicator to be derived.
Reliable	The data used for the indicators should not be arbitrarily derived and should reflect accurate, verifiable information as much as is possible.
Controllable	Indicators should measure the results of delivering the e-agriculture action plan, and should be selected to control the potential impact of activities that fall outside the scope of the plan.
Ongoing and comparable	Indicators should provide information that is comparable and relevant across periods, rather than being 'one time' indicators of progress.

There is little value in defining a set of indicators where the data do not exist or cannot be regularly collected, analysed and reported. This step should consider the reality of the country's current environment, in particular the challenges or barriers that exist to gathering the required data. The result of this may be the need to consider using a mixture of quantitative and qualitative indicators.

Since e-agriculture initiatives are often undertaken by numerous stakeholders independently of each other (e.g. mobile network operators, NGOs, government agencies and mobile service providers might all be managing separate e-agriculture services), it is important to coordinate with each of these stakeholders to see what data can easily be collected from them.

In practice, a country will use a mixture of both quantitative and qualitative measures over the course of implementing the plan. Both types of measures can play a useful role in understanding whether the desired outcomes and outputs are being delivered, as well as providing insights into the results obtained. Countries need to ensure that the appropriate skills and expertise exist to do both types of research.

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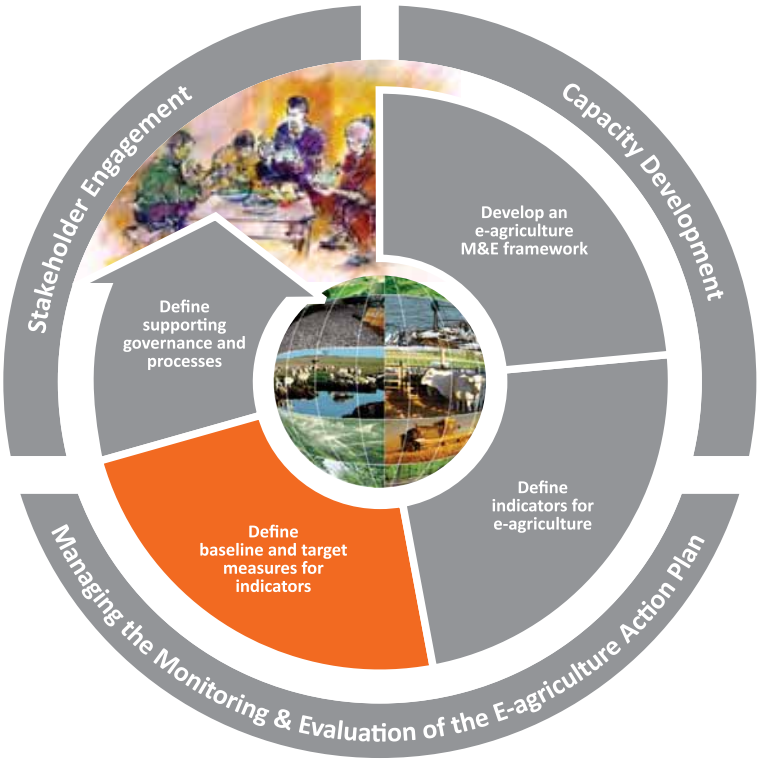
Annex 3.2.1. E-agriculture indicator worksheet

Stakeholders	E-agriculture outcomes	Outcome indicators	Output indicators

CHAPTER 3 Define baseline and target measures for indicators

This stage focuses on defining the baseline and target measures for each of the defined indicators.



Objective: This stage defines baseline and target measures for each indicator along with the time frames for measuring indicators against targets.

Baseline measures provide an understanding of a country's starting point and assist in defining realistic and achievable targets, which allow evaluation of the progress in implementing the plan (i.e. Are we achieving what we set out to achieve?). Evaluating indicators against targets should occur at regular intervals to ensure that the programme is delivering tangible results to stakeholders in a timely manner and that potential problems are identified and addressed as soon as possible.

In this context the following activities are required:

- Determine national M&E time frames;
- Identify baseline measures for each indicator;
- Define target measures for output indicators; and
- Define target measures for outcome indicators.

Outputs: The following outputs are expected:

- Indicator M&E time frames; and
- Agreed baseline and target measures for e-agriculture output and outcome indicators.

Use the Indicator Tracker Worksheet in Annex 3.3.1 to organize the outputs from each of the steps below. In addition to serving as a document to keep track of indicators, it can also be used to track progress against those indicators at a high level.

3.1 Determine national M&E time frames

This step defines the time frames for national M&E.

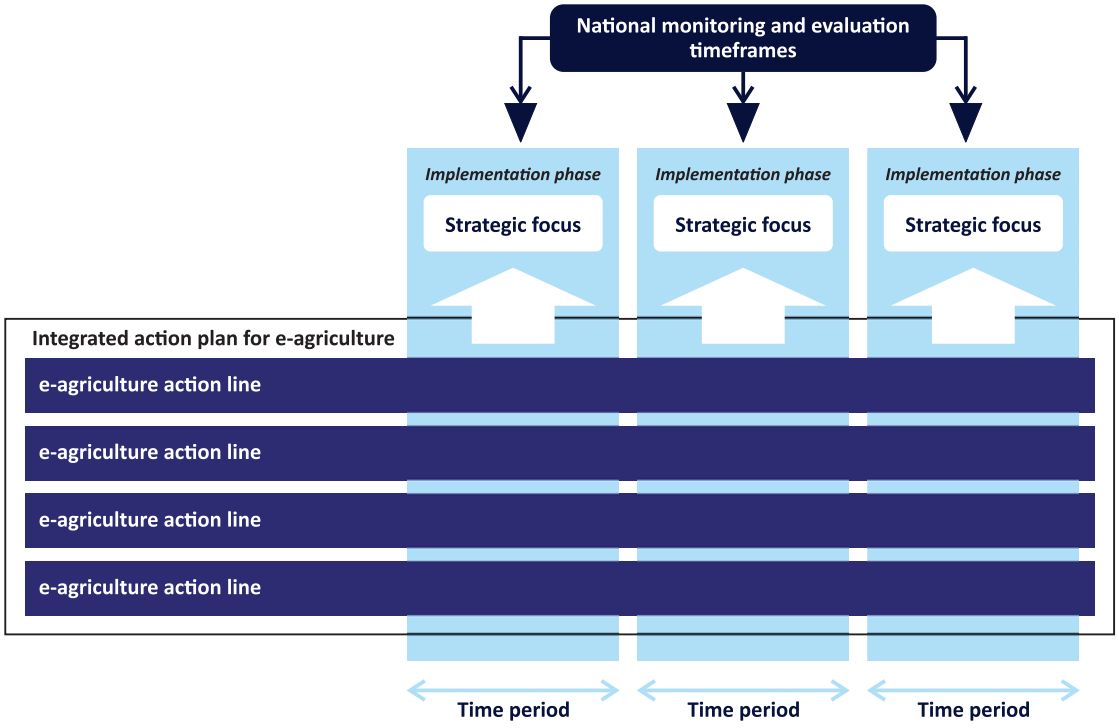
Regular M&E allows a government to:

- Determine whether the action plan is delivering the expected results;
- Identify issues and challenges affecting the delivery of results, for which corrective actions can be applied; and
- Regularly communicate the results to stakeholders, which will assist in building further momentum and support for e-agriculture.

This step establishes the intervals for national monitoring and evaluation. Ideally, a single set of consistent time frames should be defined for all indicators but this may not always be possible due to the nature or requirements of a particular indicator.

Monitoring and evaluation time frames should align with the implementation phases defined in the action plan (Figure 3.3.1).

Figure 3.3.1. Aligning national M&E time frames with implementation phases



For example, a country may define a set of implementation targets that align with the strategy's three implementation horizons, which in turn lead to the definition of quantitative and qualitative implementation targets for time frames of three, six and ten years.

While the implementation phases provide a good starting point, other factors may require using different time frames.

- *Specific stakeholder requirements*, such as those related to reporting requirements that may need to be met as part of the provision of funding;
- *Political and funding cycles*, government national planning funding cycles, which may influence when reports on the results of investing in e-agriculture are required; and
- *Level and timing of e-agriculture implementation activity*, which in turn drives when indicators should be measured. Monitoring and evaluation time frames have little point if nothing is expected to be delivered during them. Conversely, periods of very high e-agriculture activity may require closer monitoring of particular indicators.

3.2 Identify baseline measures for each indicator

This step defines the baseline measure for each e-agriculture output and outcome indicator. Evaluating the progress of e-agriculture adoption and the results flowing from this requires identification of the starting point (current status) for each indicator that will be monitored.

This step should identify baseline measures for each e-agriculture output and outcome indicator, which represents the value of that indicator at the start of the action plan.

This step will require research and analysis to determine baseline measures for each indicator. As a first step, it is suggested that countries determine whether their overall starting position warrants further effort in identifying a baseline measure for a particular indicator.

For example, consider a government that defined an e-agriculture outcome indicator to measure 'the percentage increase in use of mobile-based services by agriculture service providers'. If that country has few or no mobile-based agricultural services in place, it may opt to define a baseline measure for this indicator as zero. A country where there has already been substantial investment in mobile-based agricultural services, however, would need to research and identify an appropriate baseline measure to allow the results of further investment to be quantified and demonstrated.

Once it has been confirmed that a baseline measure for an indicator is required, a country will need to analyse historical data that allow a baseline measure to be calculated. If no historical data are available, the country may need to consider using a proxy source of data to infer a baseline measure for the indicator.

Examples of potential sources of historical data are shown below.

- Agricultural ministries and authorities;
- Industry and representative groups;
- Advocacy groups;
- Research, studies and official publications; and
- NGOs.

In practice, many countries may not have the people, processes or infrastructure in place to support the collection of data. They may need to develop this capacity over time and incorporate it into the action plan. It is important to include statistical data collection and analysis ICT for monitoring as well.

3.3 Define target measures for e-agriculture output indicators

3.3.1 Objective

This step defines target measures for each e-agriculture output indicator. This allows monitoring of the adoption of e-agriculture. Target measures for output indicators must be defined prior to defining targets for outcome indicators, because the latter depend on the former.

Targets should be realistic and achievable in order to remain relevant and motivating.

3.3.2 Recommended outputs

This step should produce a set of achievable target measures for each e-agriculture output indicator within a given time frame (Table 3.3.1).

Table 3.3.1. Example of target measures for e-agriculture output indicators

Stakeholder	E-agriculture output indicators	Baseline measure (%)	Target measures (%)		
			3 years	6 years	10 years
Farmers and fishers	Percentage of farmers and fishers with access to mobile phones	30	60	80	99
	Percentage of farmers and fishers who have been educated on how to use services	0	60	90	100

This step should begin within internal analysis, although it may be extended to involve input from subject-matter experts and other agricultural experts (Figure 3.3.2).

Figure 3.3.2. Suggested approach to defining target measures for e-agriculture output indicators

Internal analysis should focus on drafting an initial set of targets for each output indicator. Defining targets is an estimation exercise that considers the various questions below:

- *Baseline measures and time frame:* What is the starting point for this indicator and what can be realistically achieved within the monitoring time frame?
- *E-agriculture activities:* What other activities (in the action plan) are occurring in the same time frame and how will this influence what can be achieved?
- *External research:* What have other relevant national programmes achieved and what time frames were associated with this output?
- *Target measures for other e-agriculture output indicators:* What relationships exist between e-agriculture output indicators, and how do target measures that have been defined for other indicators influence the targets for this indicator?

This step should also take as input the implementation targets that were defined during the development of the action plan. These targets describe, at a broad level, the targets for each implementation phase of the plan and may provide direction as to the specific targets for e-agriculture output indicators.

This internal activity should establish a set of draft targets for e-agriculture output indicators, supported by rationale as to why these measures represent achievable adoption targets.

3.3.5 Input from subject matter experts and multisector stakeholders

Subject matter experts and stakeholders can provide insight into achievability of the draft target measures for output indicators through knowledge of:

- Similar initiatives or change programmes, and the outcomes that these were able to deliver;
- The particular risks, challenges and barriers to adoption of e-agriculture; and
- Other national or international programmes, initiatives or events that may influence the adoption of e-agriculture in the country.

The draft indicators should be reviewed in consultation with relevant subject-matter experts and multisector stakeholders to refine the targets and ensure that the rationale is sound.

3.4 Define target measures for e-agriculture outcome indicators

3.4.1 Objective

This step defines targets for each e-agriculture outcome indicator across the previously-defined time frames. These targets allow the evaluation of the results for stakeholders.

The targets set for the e-agriculture outcome indicators should accurately reflect the results that can be realized given the target rates of e-agriculture adoption. Targets should be ambitious but realistic.

3.4.2 Recommended outputs

This step should produce a set of targets for each e-agriculture outcome indicator across the previously defined time frames (Table 3.3.2).

Table 3.3.2. Example of target measures for e-agriculture outcome indicators

Stakeholder	E-agriculture outcome indicators	Baseline measure (%)	Target measures (%)		
			3 years	6 years	10 years
Farmers and fishers	Percentage of farmers and fishers using agricultural information services	10	35	66	90
	Percentage of farmers that adopt improved farming techniques	0	30	45	80

3.4.3 Approach

The process for identifying targets for outcome indicators is similar to that used for output indicators to identify target measures for e-agriculture output indicators. Universities can be leveraged to conduct such research.

3.4.4 Internal analysis

Internal analysis should focus on drafting an initial set of targets for each e-agriculture outcome indicator by considering the questions below:

- *Related e-agriculture output indicators:* What results can be achieved given the targets that have been defined for related output indicators?
- *Baseline e-agriculture outcome indicator measures:* What is the country's starting point in terms of the tangible results that are to be measured? Are there results already delivered that need to be accounted for?
- *Monitoring and evaluation time frames:* What results can be realistically achieved within the M&E time frame?

This internal activity should establish a set of draft target measures for e-agriculture outcome indicators which will reflect the tangible results that can be expected, given the rates of adoption of e-agriculture anticipated.

3.4.5 Input from subject matter experts and multisector stakeholders

Subject matter experts and stakeholders can provide insight into the potential to realize tangible results for stakeholders, given the levels of e-agriculture adoption anticipated and targeted by the e-agriculture output indicators.

Consideration should be given to the questions below:

- Given the level of adoption of e-agriculture services or solutions, what do they anticipate this will mean in terms of delivering agricultural services to farmers and fishers?
- Given the change in the ability to deliver agricultural services, what does this mean in terms of agricultural outcomes?
- Is the proposed target realistic, given the level of adoption anticipated?

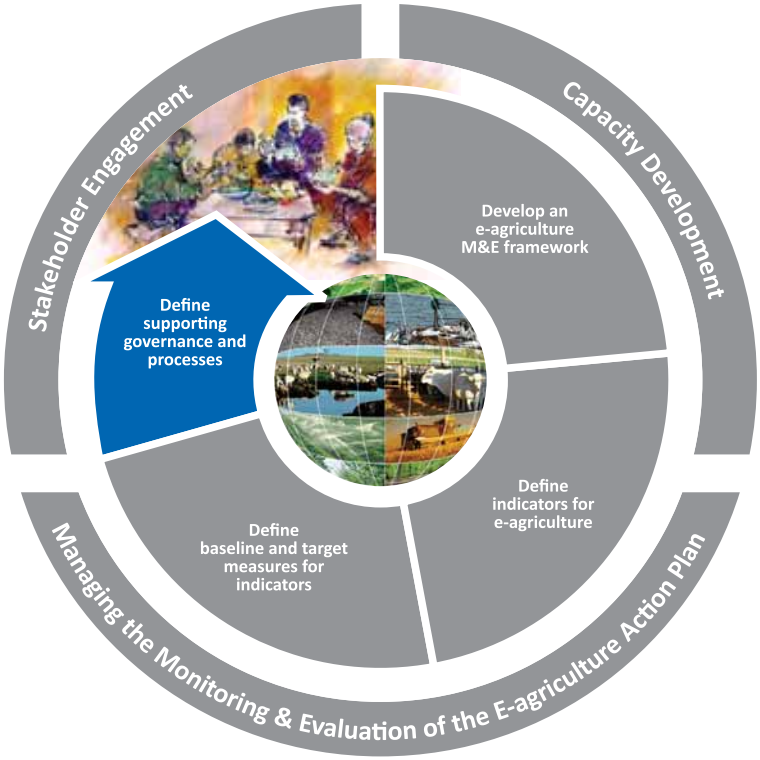
The draft list of indicators and rationale should be reviewed with relevant subject-matter experts and stakeholders.

Annex 3.3.2. Indicator tracker worksheet

Stakeholder	E-agriculture indicator	Indicator type (output/ outcome)	Baseline measure (%)	Target measures (%)			Individual(s) responsible for collecting	Current progress (%)	Date current progress was last reported
				3 years	6 years	10 years			

CHAPTER 4 Define supporting governance and processes

This stage focuses on defining the national governance and processes for monitoring and evaluating the results of implementing the e-agriculture action plan.



This stage defines the governance and processes through which the stakeholders brought together for e-agriculture M&E.

In this context the following activities are required:

- Define a governance model for national M&E; and
- Define a process for it.

The following outputs are expected:

- A governance model for national M&E; and
- A high-level process for undertaking it.

4.1 Define a governance model for national M&E

This step defines a governance model for national M&E of the adoption of e-agriculture and the tangible results flowing from this. This model should describe the governance functions and structure within which national M&E will be undertaken. Monitoring and evaluation is typically an effort performed by various parties. A governance model provides the structure by which these collective efforts are aligned.

The governance model is distinct from the broader programme management function, which provides overall governance and oversight of the execution of the e-agriculture plan. Monitoring and evaluation of e-agriculture adoption and associated results is a specialized role that is typically separate from broader programme management, yet it also complements it. This also ensures an independent perspective on programme progress.

A governance model consists of a range of functions and the required mechanisms to deliver them (Table 3.4.1). It is recommended to align the statistics collection and dissemination framework with the M&E for e-agriculture.

Table 3.4.1. Example functions for governing national M&E

Function	Description	Parties responsible
Monitoring oversight and steering	Provide executive-level oversight in regard to national monitoring and reporting (i.e. input, escalation, review and endorsement of deliverables).	Ministry of Agriculture – executive committee (steering committee)
Project management	Provide overall management of national monitoring and reporting functions (i.e. planning and scheduling, progress monitoring, financial issues, risk management).	Ministry of Agriculture – performance management business unit
National indicator development	Develop national e-agriculture output and outcome indicators to enable monitoring of the delivery of the e-agriculture action plan, and through doing so, the national e-agriculture vision.	Ministry of Agriculture – performance management business unit.
National measures' definition	Define national baseline and target measures for e-agriculture output and outcome indicators, against which national progress can be measured.	Ministry of Agriculture – performance management business unit.
National capacity development	Develop national monitoring processes and supporting frameworks, tools and templates, and the communication and education of others regarding these processes and timelines.	Ministry of Agriculture – performance management business unit.
Activity monitoring and evaluation	Define activity-specific indicators and targets aligned to national indicators and targets, and the subsequent monitoring and reporting of these.	Ministry of Agriculture – performance management business unit.
Agriculture sector M&E	Define agriculture sector-specific indicators and targets (if required) aligned to national indicators and targets, and the subsequent monitoring and reporting of these.	Ministry of Agriculture – performance management business unit. Public and private agriculture service providers and agribusinesses.

Table 3.4.1. (continued)

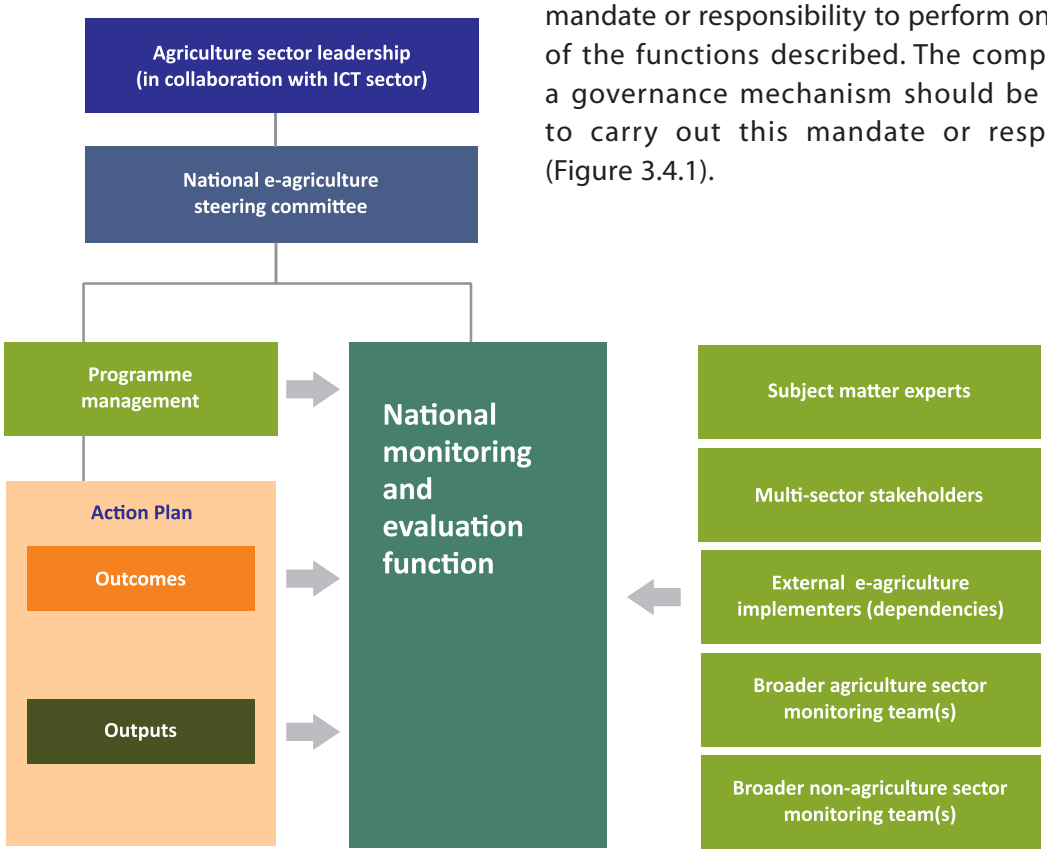
Function	Description	Parties responsible
Non-agriculture sector M&E	Define broader non-agriculture sector indicators and targets (if required) aligned to national indicators and targets, and their monitoring and reporting.	Ministry of Agriculture – e-agriculture programme management office. Non-agriculture sector infrastructure governance, and service providers.
National analysis and evaluation	Collate and analyse activity, agriculture sector and non-agriculture sector reporting to report against national indicators and targets, and identify where corrective actions may be required.	Cross-sector coordination authority or committee

4.1.1 Recommended outputs

The step should produce a definition of the governance model required to monitor and evaluate e-agriculture. It should identify and describe:

- The governance mechanisms required; and
- The structure and relationships between them.

Figure 3.4.1. Sample governance model for national M&E



A governance mechanism is a steering committee, council, team or special group that has the mandate or responsibility to perform one or more of the functions described. The composition of a governance mechanism should be designed to carry out this mandate or responsibility (Figure 3.4.1).

In the above-mentioned example, the responsibility for M&E at a national level belongs to the *national monitoring and evaluation function*. This complements programme management and provides an independent view of e-agriculture adoption and associated results to the programme steering committee. This function could be implemented as a new organizational group, or could sit within an existing government entity or e-agriculture agency.

Individual e-agriculture projects, including external projects on which the action plan is dependent, are responsible for monitoring their own progress within the overall national framework. External projects include those undertaken outside the scope of the national action plan (Table 3.4.2). The framework enables the rolling up of project-level performance into the defined output and outcome indicators.

Table 3.4.2. Role of governance mechanisms as they relate to national M&E

Mechanism	Responsibilities
Agriculture sector leadership	Acting as the vocal and visible champion of the national e-agriculture strategy; and Accountable for the delivery of national e-agriculture adoption and associated results.
National e-agriculture strategy steering committee	Provides M&E oversight and steering, which includes: Providing guidance and input to definition of national indicators, measures and M&E time frames; Reviewing and endorsing national indicators, measures and M&E time frames; Assisting in resolving risks, issues and conflicts related to M&E; Reviewing and endorsing recommendations on corrective actions to the programme to address divergences between actual and target targets; and Ensuring targets are being achieved and that corrective actions are being made to the e-agriculture strategy to resolve divergences.
Programme management	Ensuring M&E processes and tools are aligned and integrated with broader programme management processes and tools; Working with the national M&E function to identify options for taking corrective action to address divergences between actual and target indicator measures; and Undertaking corrective actions that have been endorsed by the steering committee.
National M&E function	Project management (i.e. day-to-day management of activities, progress, finances, risks and issues); Development of national e-agriculture output and outcome indicators; Development of baseline and target measures; Liaising with subject-matter experts and stakeholders to gain input into the definition of indicators and baseline/target measures for indicators; Confirm indicators, and associated baseline and targets, with decision-makers;

Table 3.4.2. (continued)

Mechanism	Responsibilities
	Develop and communicate processes, schedules, templates, etc., for the operation of the national M&E process; Collate and analyse activity, agriculture-sector and non-agriculture sector reporting to assess against national indicators and targets, and identify where corrective actions may be required; Develop recommendations regarding corrective actions, and advise the steering committee (note: the national M&E function does not have accountability for correcting actions); Provide expert support in the monitoring, analysis and evaluation of e-agriculture adoption and associated results; and Provide broader analytical capabilities to support M&E, including the provision of data and insights from other national programmes.
Subject-matter experts	Provide input into the definition of and insights into the achievability of the draft target measures for indicators; and Provide input into corrective actions that may be appropriate to address divergence.
External e-agriculture implementers	Define e-agriculture output and outcome indicators and targets aligned to national indicators and targets; Undertake M&E of activity-level indicators; and Report on activity-level indicators to the *national M&E function* in accordance with defined processes, schedules, templates and tools.
Broader agriculture sector monitoring team(s)	Same as the external e-agriculture implementers except that their focus is on the e-agriculture outputs and outcomes within a particular part or segment of the country's agriculture sector.
Broader non-agriculture sector monitoring team(s)	Same as the external e-agriculture implementers except that their focus is on the adoption e-agriculture outputs and outcomes in other sectors (e.g. ICT industry), and broader socio-economic development linked to e-agriculture.

4.1.3 Approach

A suggested approach for defining a governance model for national M&E involves a number of steps:

- Confirming the functions required;
- Identifying existing governance mechanisms that could be used, based on:
  - *Mandate:* the scope of responsibilities officially given to that governance mechanism;
  - *External perception:* the perception of that governance mechanism within the wider agriculture sector, which enables that mechanism to perform its role;
  - *Engagement and influence:* the ability of that mechanism to engage with, influence and consult with stakeholders; and
  - *Internal capabilities:* the capability of that mechanism to fulfil its responsibilities.

- Defining a pragmatic governance model that will deliver the required governance functions, taking into account the existing governance mechanisms that can be used, and new mechanisms that need to be developed to address gaps. The role and responsibilities of each governance mechanism, and the nature of the relationships and interactions between them, also need to be clearly defined.

4.2 Define a process for national monitoring and evaluation

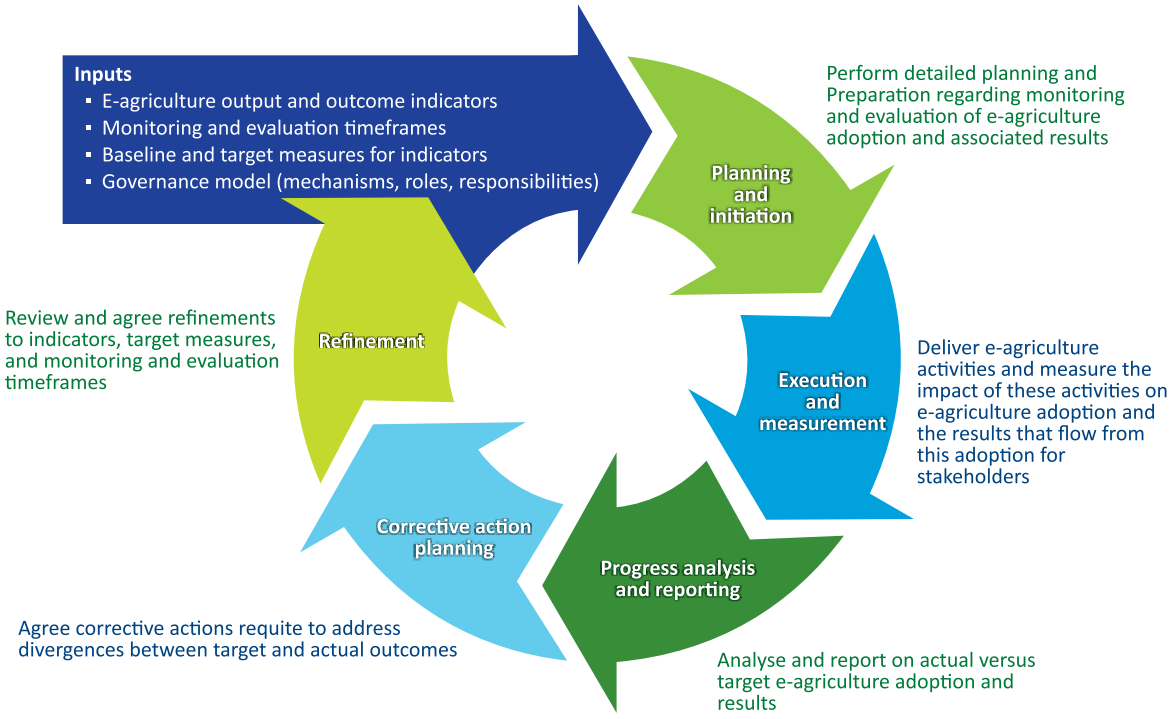
This step defines the national M&E process. It will be an ongoing process, in the background of the implementation programme, with M&E undertaken at the agreed time frames for each of the indicators.

It is not the focus of this step to define detailed processes that will occur at the e-agriculture activity level, such as within specific initiatives and projects in the action plan. The specific M&E processes for e-agriculture activities should be aligned with the national approach (Table 3.4.3).

4.2.1 Recommended outputs

This step should produce a description of the national process for monitoring and evaluation of e-agriculture during the implementation of the action plan, including the governance required to ensure that it will be done (Figure 3.4.2).

Figure 3.4.2. Example of a national M&E process



4.2.2 Approach

Defining a pragmatic M&E process is a complex undertaking, particularly for large-scale e-agriculture programmes in which many parties will be involved.

Table 3.4.3. Example of national- and activity-level M&E activities

Planning and initiation	• Define and communicate national evaluation schedule and milestones; • Develop and communicate national M&E frameworks, tools and templates; and • Provide advice and support to activity-level teams in defining appropriate indicators and targets that support national-level indicators and targets.	• Establish local M&E roles and responsibilities; • Define detailed M&E timelines and milestones that align with national timings; • Develop and deploy detailed M&E procedures, tools and templates that align with national requirements; • Define detailed indicators that support measurement of national indicators; • Define target measures that support national targets; and • Define indicator measurement approaches.
Execution and measurement	• Provide advice and expertise to activity-level teams on developing indicator measures to assess current performance.	• Collect measurement data while activity is being undertaken; • Develop and track current indicator measures; and • Identify and resolve issues in developing current indicator measures.
Progress analysis and reporting	• Collate activity-level reports on actual versus target performance for indicators; • Liaise with activity-level teams to explore performance and understand causes of divergences; • Develop reports that describe actual versus target performance for national-level indicators; and • Identify causes of divergences in actual and target performance at the national level.	• Develop reports that describe actual versus target performance for activity-level indicators; and • Identify causes of divergences in actual and target performance at the activity level.

Table 3.4.3. (continued)

Corrective action planning	• Liaise with activity-level teams to understand corrective actions that can be taken to address activity-level and programme-level divergences; • Identify and assess programme-level corrective actions to address divergences in actual and target performance at the national level; • Assess impact, costs and risks of implementing programme-level corrective actions; • Review and gain endorsement of programme- level corrective actions with the programme steering committee; and • Manage changes in the scope of the national programme (if required) to implement corrective actions.	• Identify local actions that can be taken to address divergences in actual and target performance for activity-level indicators; • Identify programme-level actions that can be taken to address divergences in actual and target performance for activity-level indicators; • Assess impact, costs and risks of implementing local and programme-level actions for the activity in question; and • Manage changes in scope (if required) to implement corrective actions.
Refinement	• Identify national target measures for indicators that may be unrealistic or unachievable within the required time frame; • Liaise with activity-level teams to understand changes to activity-level targets; • Understand implications on national-level target measures for indicators; • Develop revised national target measures for indicators; and • Review and gain endorsement of revised national target measures with the steering committee.	• Identify activity target measures for indicators that may be unrealistic or unachievable within the required time frame; • Refine target measures for indicators to be realistically achievable; and • Agree changed target measures for indicators for future monitoring periods.

Annex 3.4.1. Results-based Management

Results-based management (RBM) has become increasingly important for the United Nations and its specialized agencies as they have sought to improve their ability to respond to new demands within the limits of resource constraints, and to demonstrate that they have delivered on expectations. It is also of direct relevance to the establishment of M&E for a national e-agriculture strategy.

The goal of RBM

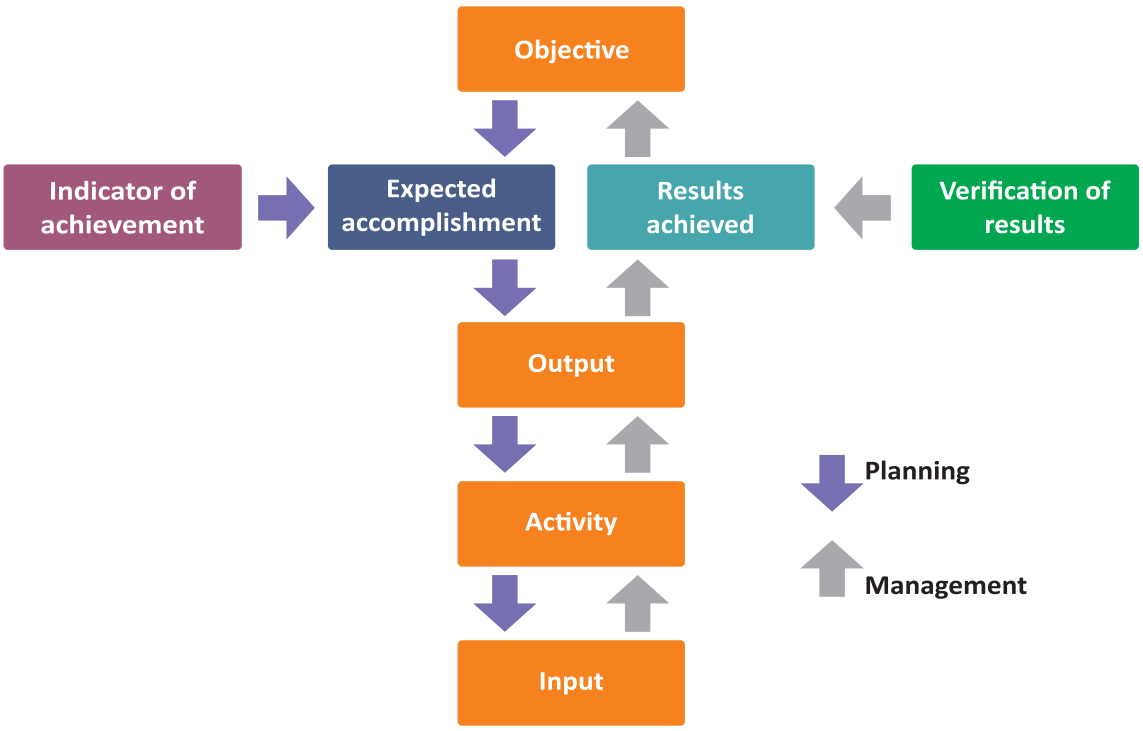
The goal of RBM is to shift managerial and administrative emphasis from a process-focused approach to one based on performance and results (outcomes). It is a management strategy that focuses on performance and achievement of outputs, outcomes and impacts. Organizations and programmes that apply RBM seek to:

- Focus the organization or programme efforts and resources on expected results;
- Improve the effectiveness and sustainability of operations (or programme activities); and
- Improve accountability for resources used.

Key concepts in RBM

Figure 3.4.3 highlights the key concepts in RBM, and lays out a logical framework in which to guide the planning and execution of an RBM approach.

Figure 3.4.3. Logical framework for RBM



Results-based management is both a planning process from the top down and a management process in the reverse direction. Planning starts with defining objectives – future end-states, deciding what accomplishments are expected if the objective is to be achieved, determining which outputs will lead to those accomplishments, defining the activities necessary to produce those outputs and, finally, identifying the inputs that are necessary to carry out the activities.

The management process is exactly the opposite. The inputs are acquired and deployed to carry out the activities, the activities lead to the production of outputs and, if they are well designed and executed, the output will lead to the expected accomplishments (or expected results) (Table 3.4.4).

Table 3.4.4. M&E concepts

Objective	An overall desired achievement involving a process of change aimed at meeting certain needs of identified end-users within a given period of time (i.e. is the situation that would be observed at the end of a specific period).
Expected accomplishment	A desired outcome involving benefits to end-users, expressed as a quantitative or qualitative standard, value or rate. The direct consequence or effect of the generation of outputs leads to the fulfilment of a certain objective. It is a change that can be observed to have taken place. It is something that has to happen if an objective is to be achieved.
Indicators of achievement	The measures of whether and/or the extent to which the objectives and/or expected accomplishments have been achieved. They correspond either directly or indirectly to the objective or the expected accomplishment for which they are used to measure performance. All results should have a corresponding indicator of achievement.
Results achieved	The actual outcome that delivers benefits to end-users, expressed as a quantitative or qualitative standard, value or rate. It describes what has actually been achieved.
Verification of results	The actual measures that demonstrate that a particular result has been achieved.
Output	Tangible products or services delivered by a programme to end-users in order to induce outcomes. Outputs are produced by activities.
Activity	An action taken to transform inputs into outputs.
Input	Personnel and other resources necessary for producing outputs and achieving accomplishments. Inputs are the objects of expenditure that are used to undertake activities.

Monitoring and evaluation in RBM

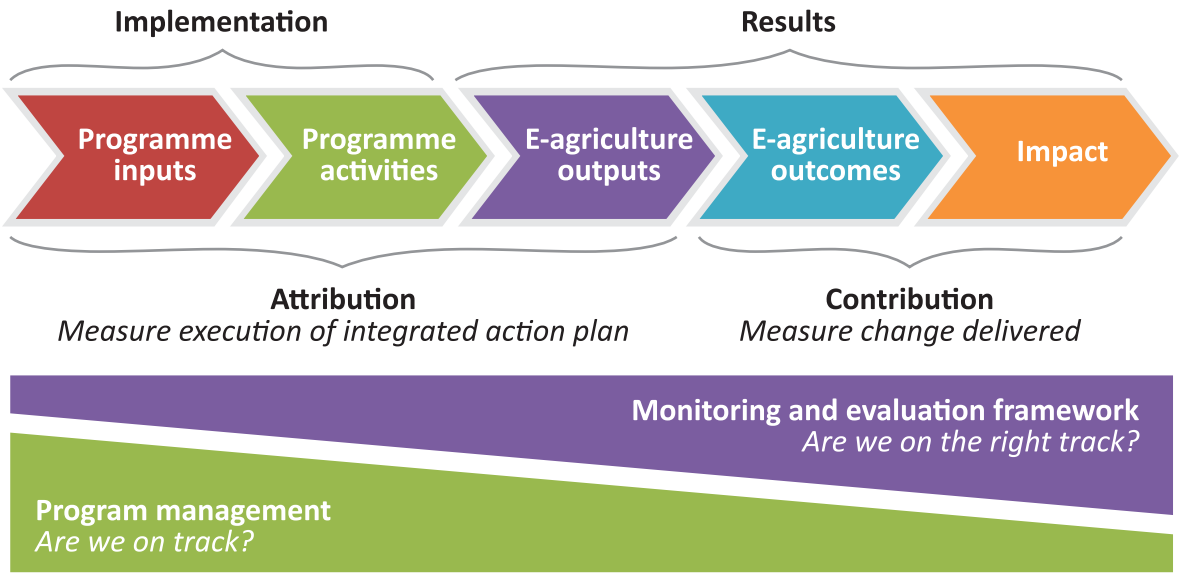
Monitoring and evaluation is an integral part of RBM:

- Monitoring is the continuing function of collecting data indicating the extent of progress and achievement of objectives, and progress in the use of allocated funds; and

- Evaluation is the process that seeks to determine as systematically and objectively as possible the relevance, effectiveness and impact of an activity in light of its goals, objectives and accomplishments.

The focus of M&E is best demonstrated by understanding its relationship to the key concepts that were introduced in the previous section (Figure 3.4.4).

Figure 3.4.4. Relationship of M&E to the results chain



Monitoring primarily focuses on implementation and the measurement of execution. Evaluation primarily focuses on measuring the change and impact that implementation has had in terms of the objectives and results that were originally sought.

An effective M&E programme requires the following:

- Understanding the expected accomplishments of the e-agriculture strategy;
- Ensuring that expected accomplishments can really be evaluated;
- Reviewing performance indicators to ensure that they are pragmatic, simple and achievable;
- Determining when the strategy will be evaluated, which may be at specific times in its implementation or at other key events (e.g. problem is perceived, results are supposed to have happened);
- Planning for the collection of information to support evaluation, including:
  - Data sources;
  - Collection method;
  - Baseline data for performance indicators;
  - Time required for collection; and
  - Responsible organization/personnel.
- Collecting and analysing evaluation data, and drawing appropriate conclusions; and
- Developing recommendations (including corrective actions) and lessons learned.

CONCLUSION

CONCLUSION

Development of a National E-agriculture Strategy is only the first step towards realizing the transformative potential of ICT in agriculture. The impact can only be realized through effective implementation. The three pillars of the strategy viz., the vision and strategic recommendations, the action plan, and the Monitoring and Evaluation framework provides guidance on how we envision an ICT embedded agriculture system, what we need to do to get there and how do we keep track of our progress. In dynamic and cross-sectoral areas such as ICT and agriculture, it is important that a periodic review of the strategy is undertaken to keep up with the changing demands, emerging goals and new technologies.

The E-agriculture Strategy Guide web space at

http://www.fao.org/asiapacific/resources/e-agriculture will be constantly updated with improved tools and techniques to assist countries in developing their e-agriculture strategy.

ANNEX A Definition of terms used in the guide

Part I: Establishing a national e-agriculture vision	Strategic goals and challenges	Strategic agriculture sector goals and challenges and/or other national development goals that can be best supported by e-agriculture. While there may be many different agriculture sector goals and challenges, only some of these can be directly supported by e-agriculture.
	E-agriculture outcomes	What will be achieved or changed through using e-agriculture, and how will the agricultural system and services change by: • Improving the information flows relating to the agriculture sector; and • Improving electronic access to agricultural services and information.
	E-agriculture vision	High-level statement that describes the strategic benefits and outcomes for the country in general or for the agricultural system and population through the strategic changes to the agricultural system and services introduced by e-agriculture (e-agriculture outcomes).
	National e-agriculture environment	The national e-agriculture environment is made up of e-agriculture components representing the enabling and foundation elements for e-agriculture as well as technical capabilities that form together an 'ecosystem' for e-agriculture in a country.
	E-agriculture components	The building blocks of a national e-agriculture environment this will allow the e-agriculture outcomes to be achieved. They describe what is needed to be introduced or strengthened to achieve the e-agriculture vision.
	Strategic recommendations	Strategic recommendations describe the high-level actions required to deliver the national e-agriculture environment. These actions may describe how new e-agriculture components will be delivered, or how existing e-agriculture components will be repurposed or extended.
Part 2: Developing an e-agriculture action plan	E-agriculture outputs	The specific achievements, deliverables, results or changes required to deliver a strategic recommendation or meet an outcome.
	Activities	The set of activities which need to be undertaken to deliver a particular output.
Part 3: National e-agriculture monitoring and evaluation guidelines	Output indicators	Indicators that provide insights into the adoption and take-up of e-agriculture within the country's agriculture sector.
	Outcome indicators	Indicators that provide insights into the tangible results for stakeholders that arise from the adoption and usage of e-agriculture.

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ANNEX B *Examples of ICT innovations in agriculture and rural development*[65]*

The following examples are meant to provide basic information on just a few examples in the use of ICTs for agriculture and rural development. The primary use of this supplement therefore is to generate ideas and a need to investigate potential solutions further.

Information Services: Productivity, Extension services		
Project name	**Description/services provided**	**Links/other resources**
mKRISHI	TCS' mKRISHI platform uses mobile technology to cater to the absolute needs of the rural sector. It offers personalized advisory services in voice and visual using communication devices like mobile phones. mKRISHI has also enabled the possibility for information exchange between various stakeholders of the rural economy.	http://www.tcs.com/offerings/technology-products/mKRISHI/Pages/default.aspx
e-Krishok	A 'Zero Cost' extension model which will facilitate free extension related information and advisory services for the clients (farmers) which is bundled with input packages. Every farmer who buys an input package will be entitled to receive an information service package whose value will depend on the value of products.	http://wp.ekrishok.com/
Question Box	Question Box is an initiative to reach people in remote areas who might otherwise struggle to access agricultural information they need because of language or technology barriers. It uses simple technology, such as a phone box set up in a village and a trained operator with Internet access waiting to answer people's questions on the other end (who knows the local language).	http://questionbox.org/ *Other links:* Question Box brings world of information to villagers http://www.scidev.net/en/news/question-box-brings-world-of-information-to-villagers.html
Indian Government's Farmers's Portal	Maintained by the Department of Agriculture & Cooperation and Farmers Welfare, Ministry of Agriculture and Farmers Welfare, Government of India, this website provides information on inputs, crop management, post-harvest, risk management and export and import. Animal husbandry related information as well as GIS related data is also made available.	http://farmer.gov.in/

[65] Updated with inputs from the FAO publications on ICT uses for agricultural value chains and Mobile technologies for food security, agriculture and rural development.

* Examples listed here are just illustrative and are not exhaustive or an endorsement.

m-Kisan	Developed and maintained by the Ministry of Agriculture, Government of India, this portal gives information/services/advisories to farmers by SMS in their language, preference of agricultural practices and locations.	http://mkisan.gov.in/ *Other links:* http://mkisan.gov.in/images/Detailed%20Writeup%20on%20mKisan.pdf
Kisan Call Center	The Kisan Call Center (KCC) has a system of telecommunication infrastructure, computer support and human resources organized to manage the queries raised by farmers in the desired local language. KCC has the objective to resolve farmer queries and problems related to agricultural topics such as agronomy, horticulture, plant pathology, soil sciences, animal husbandry, entomology, agriculture economics, farm management, plant breeding and genetics.	http://www.manage.gov.in/kcc/kcc.asp *Other links:* Department of Agriculture & Cooperation http://agricoop.nic.in/
National Farmers Information Service (NAFIS)	NAFIS converts text to audio in English or Kiswahili. Farmers then use landlines or mobile phones to place queries for voice-based information. The system provides information on disease outbreaks, weather reports and which crops are most suitable for a specific area.	http://www.nafis.go.ke/ *Other links:* Text to speech service supporting farmers in Kenya http://www.new-ag.info/en/news/newsitem.php?a=1947
Nutrient Manager for Rice Mobile (NMRiceMobile)	NMRiceMobile assists farmers and extension workers to provide "Site-Specific Nutrient Management (SSNM)" for rice. NMRiceMobile essentially helps determine the best application of fertilizer for particular fields or areas. The farmer or extension worker calls the toll-free number and enters site specific data on the number keypad. NMRiceMobile then sends a text message with a fertilizer recommendation.	http://webapps.irri.org/nm/phmobile/ *Other links:* International Rice Research Institute (IRRI) www.irri.org
FrontlineSMS (also pricing services)	FrontlineSMS builds and distributes free and open-source software to lower barriers to driving transformative social change using mobile technologies. Most of the 20+ applications of the FrontlineSMS software in the area of agricultural development provide either falls under information services or pricing information to farmers throughout Africa, Asia and Latin America.	http://www.frontlinesms.com/ *Other links:* Kiwanja.net http://www.kiwanja.net/
HARITA-PRIYA	HARITA-PRIYA project in Andhra Pradesh, India acquires micro-climate information from farmer fields using Wireless Sensor Networks (WSN), thereby enabling the dissemination of location specific advisories to farmers. 'Decision Support Models' are executed based on the data received from the field and alerts are generated for pest/disease forewarning and irrigation scheduling. Based on the alerts generated by the system, Agricultural Officers of the state government send personalized crop advisories to the farmers in the regional language, Telugu, via SMS.	haritapriya.ap.gov.in/ *Other links:* Center for Development of Advanced Computing http://cdac.in/

iCow	Green Dreams Tech Ltd. developed iCow, an SMS information system, with the main motivation being to enable small-scale farmers to maximize their returns by helping them to track analytics about their cows, ranging from gestation to immunization, and access information about diseases, find local veterinarians and optimize their animals' healthcare.	http://www.icow.co.ke/
EcoMarketPeru	IICD supported a web-based platform in Peru, which mobilizes consumers and entrepreneurs to create and meet the demand for agro-ecological organic products. By connecting 2951 families of ecological producers from six regions of the country to alternative markets and offering information on organic household production, the online platform improves awareness of the availability of organic products, makes trade fairer, provides producers with market access and raises their income and thus ultimately their quality of life.	http://www.ecomercadoperu.com/
Digital Green	Digital Green uses an innovative digital platform for community engagement to improve lives of rural communities across South Asia and Sub-Saharan Africa. In partnership with local public, private and civil society organizations to share knowledge on improved agricultural practices, livelihoods, health, and nutrition, using locally produced videos and human mediated dissemination.	http://www.digitalgreen.org/
Somalia Water and Land Information Management (SWALIM)	SWALIM is engaged in assisting Somali communities whose lives and livelihoods depend directly on water and land resources. The program aims to provide high quality water and land information, crucial to relief, rehabilitation and development initiatives in Somalia, in order to support sustainable water and land resources development and management.	http://www.faoswalim.org/
Esoko	Esoko is a communication tool for businesses, government, NGOs and others to connect with farmers. Users can use any mix of Esoko's web and mobile apps, original agricultural content, and on-the-ground deployment services for marketing, monitoring and advisory needs.	https://esoko.com/
Farmerline	Farmerline provides a range of supply chain innovation products and services that help small-scale farmers and organizations that work with them to benefit from such solutions. This also includes reliable daily information on weather forecast and climate information to the target audience.	http://farmerline.org/
Farmers Mailbox	The Ministry of Agriculture's Farmers Mailbox of the PR China has many services related to agriculture that farmers could use.	http://www.zjnm.cn
aAqua	The aAQUA eAgriService is a problem-solving system dedicated to find solutions to problems posed by Indian farmers – small and large.	https://aaqua.persistent.co.in/aaqua

Kissan Kerala	An Integrated, multi-modal agricultural information system, which provides several dynamic and useful information and advisory services for the farming community across Kerala, India	http://www.kissankerala.net/home.jsp
The Talking Book	The Talking Book is a handheld audio computer which records locally produced agricultural and literacy information for Ghanaian farmers to play back in their own language. They respond by pressing any of the ten buttons. For example, pressing the right and left arrows navigates through categories such as livestock, fish farming, and health.	http://www.literacybridge.org/talking-book/ *Other links:* Literacy Bridge http://www.literacybridge.org/
Philippine e-Extension Portal	Philippine e-Extension portal was designed for agricultural extension workers to improve their assistance to farmers and fishermen. ATI offers online certificate courses on agricultural technology and best practices for several agricultural crops. The courses are delivered through a combination of on-line learning and "face-to-face interaction with experts." Farmers also can engage one another in discussions and access other resources on-line.	http://e-extension.gov.ph/aggregator/sources/3 *Other links:* Agricultural Training Institute (ATI) http://ati.da.gov.ph/ati2/
Africa Soil Information Service	The Africa Soil Information Service (AfSIS) is developing continent-wide digital soil maps for sub-Saharan Africa using new types of soil analysis and statistical methods, and conducting agronomic field trials in selected sentinel sites. These efforts include the compilation and rescue of legacy soil profile data, new data collection and analysis, and system development for large-scale soil mapping using remote sensing imagery and crowdsourced ground observations.	http://africasoils.net/ *Other links:* Global Soil Map.net http://globalsoilmap.net/
e-Srilanka	The e-Sri Lanka initiative utilized Information and Communication Technologies (ICT) to develop the economy of Sri Lanka, reduce poverty and improve the quality of life of the people.	https://www.icta.lk/current-projects/

Market Access – Pricing Services		
Project name	**Description/services provided**	**Links/other resources**
myRML: Agri Information Application	myRML arms Indian farmers to take informed decisions by providing them an easy access to personalized & unbiased agriculture insights, latest updates on local wholesale market (*mandi*) prices, weather, news, crop advisory as per their location in their preferred language. It provides rich agriculture content and actionable information at every stage of crop cycle: From pre-sowing, to harvest, to selling. Farmers can choose from over 450 crop varieties, 1,300 markets, and 6,200 weather locations across 50,000 villages and 18 states of India.	http://www.rmlglobal.com/
Labaroun Kassoua – market information system	Labaroun Kassoua is a mobile phone based market information system providing prices on livestock and crops from markets across the country. The system was developed by Orange, a mobile phone service provider.	http://www.orange.ne/labaroun.html
The Hector Kobbekaduwa Agrarian Research and Training Institute	The Hector Kobbekaduwa Agrarian Research and Training Institute (HARTI) provide daily whole sale price information collected from various wholesale markets in Sri Lanka. Information is fully verified and validated by HARTI and entered to the system according to the market and product availability. Customer needs to dial 6666 to connect in to the IVR which is available in Sinhala and Tamil languages. Information can be browsed product wise or market wise.	http://www.harti.gov.lk/index.php/en/
M-Farm	M-Farm is a mobile phone service that gives farmers information about market prices across the country through text messages. Farmers have access to prices on products, buy inputs and find buyers. M-Farm's target group is small scale farmers in rural areas who do not have adequate access to information.	https://mfarm.co.ke/
Food Price Monitoring and Analysis Tool	FAO's Food Price Monitoring and Analysis Tool provides easy access to over 1,100 consumer price series in 85 countries and 43 international cereal export price series. The tool is being adapted for use at country level. The tool can be linked to existing data collection systems and will permit countries to easily monitor, analyse and disseminate prices for a wide range of commodities in markets of their choice with daily, weekly or monthly frequency.	http://www.fao.org/giews/pricetool/
AGMarknet	Agmarknet portal is a portal on agricultural marketing backed by a wide area information network. The Portal provides both static and dynamic information relating to agricultural marketing in India. The dynamic part comprises of price-related information.	http://agmarknet.dac.gov.in/

Freedom Fone	Freedom Fone's Interactive Voice Response (IVR) system can be used in a variety of ways. However in this particular case, a local radio station's use of Freedom Fone allowed farmers to call into the radio station to listen to broadcasts if they missed it, request agricultural product pricing and to leave voicemail messages for a call-back – all in two local languages.	http://www.freedomfone.org/ *Other links:* The Kubatana Trust of Zimbabwe, http://www.kubatana.net/ Farm Radio International, http://www.farmradio.org/

Market Access – Trading		
Project name	**Description/services provided**	**Links/other resources**
E-purjee	E-Purjee issues permits and billing information by Short Message Service (SMS) to growers for the sale of sugarcane to the 15 state-owned sugar mills. As of January 13th, 2012, e-purjee reports on its website that it has helped facilitate almost 500,000 permits, process 826,000 metric tons of sugar cane and produced 47,000 metric tons of sugar.	http://www.epurjee.info/ *Other links:* Access to Information programme (A2I) http://www.a2i.pmo.gov.bd/
Kenya Agricultural Commodity Exchange Limited (KACE)	KACE is a private sector firm launched in Kenya in 1997 to facilitate competitive and efficient trade in agricultural commodities, provide reliable and timely marketing information and intelligence, provide a transparent and competitive market price discovery mechanism and harness and apply information and communication technologies (ICTs) for facilitating trade and information access and use, initially in Kenya but to scale out to the East African Community subsequently.	http://www.kacekenya.co.ke/
FarmerNet	FarmerNet is a mobile – online trading platform to support small farmers in rural Sri Lanka. Farmers and traders can upload their selling or buying information using SMS. It also works as a spot trading platform and automatically checks the matching parties (i.e. sellers and buyers) and inform them via SMS messages.	http://www.farmer.lk/ *Other links:* Fusion http://fusion.lk/
Mobiashara	MoBiashara is a platform that allows business owners to quickly and easily build a mobile storefront and begin selling their products online. It focuses on leveraging mobile technology to enhance value chains, from bottom-of-the-pyramid subsistence agriculture to top-of-the-pyramid aviation transportation companies.	https://www.mobiashara.com/
G Soko	G-Soko is a process that involves a collection of apps that allows users of the apps to manage inventory (warehouse & generator), trade produce (trade portal & clearing and settlement) and request for bank loans (bank portal). The platform also provides an app for payments of services (voucher) and farmer's data collection (researcher).	http://www.virtualcity.co.ke/what-is-g-soko/

E-Choupal	E-Choupal means "village meeting place" and is a virtual market place where farmers can transact directly with buyers to realize better prices for their produce. E-Choupal also transmits information (e.g. weather, prices, news), transfers knowledge (farm management, risk management). Village internet-enabled kiosks are provided and managed by entrepreneur sanchalaks, often farmers themselves.	http://www.echoupal.com/ *Other links:* Indian Tobacco Company (ITC) http://www.itcportal.com/businesses/agri-business/e-choupal.aspx
Arid Lands Information Network (ALIN)	Farmers must first be members of the local Maarifa (knowledge) center, where capacity development of farmers on weather patterns, farming techniques, climate change among other agriculture related topics are done. It also links to a digital commodity trading and information system.	http://www.alin.net/
SOKO+	Soko+ is a digital commodity trading and information system, linking small scale farmers to end retailers/bulk purchasers of produce. SOKO+ provides commodity prices from major markets around the areas of operation and beyond, e-extension services and a listing of various technical and logistical support providers.	http://sokoplus.sokopepe.co.ke/

Market Access – Traceability		
Project name	**Description/services provided**	**Links/other resources**
Livestock Identification Trace-back System (LITS)	LITS uses radio frequency identification (RFID) technology to capture data on individual cattle "transmitted directly, error-free, to a central database." The RFID tags are located in the stomachs of more than 135,000 cattle, which can be individually identified and traced throughout their lives. The database helped Botswana's meat export industry obtain EU certification exports, and is a critical information source for livestock farmers, state veterinary services and health authorities.	http://www.gov.bw/en/Ministries—Authorities/Ministries/MinistryofAgriculture-MOA/Tools—Services/Livestock/Livestock-Identification-and-Traceability/?p_id=3191 *Other links:* LITS: tracking Botswana's livestock using radio waves http://ictupdate.cta.int/en/Feature-Articles/LITS-tracking-Botswana-s-livestock-using-radio-waves
Akashganga	Akashganga designs, develops and produces automatic milk collection systems (AMCS) and connects the collection, storage and processing of milk (and payment) to all players involved for data monitoring. Data is collected and shared between collection points, chilling centers, and dairy plants, for example. SMS messages can be sent to milk producer farmers to confirm that their milk has been deposited and Smart Cards care used for confirming and processing transactions.	http://www.akashganga.in/Whyakashganga.htm
TraceNet	TraceNet is an internet based electronic service for facilitating process certification for export of organic products from India which comply with the NPOP or NOP standards. TraceNet collects stores and reports – forward and backward traces and quality assurance data entered by the operators/producer groups and certification bodies within the organic supply chain.	apeda.gov.in/apedawebsite/TracenetOrganic/TraceNet.htm

NamLITS	The Namibia livestock identification and traceability system is implemented to create the ability to track and trace animals for the purposes of- managing animal disease surveillance and control programs; managing animal disease emergencies; validating animal health status claims and meat safety guarantees; verifying the FAN Meat quality assurance scheme and facilitating regional and international trade.	http://www.namlits.com/
OpsSmart	OpsSmart and OpsSmart Express provide a cross industry food safety traceability solution that meets all critical success factors required for a global food safety assurance solution with many benefits.	http://www.opssmartglobal.com/
TraceVerified	TraceVerified is a unique electronic traceability service from Vietnam, first of its kind in the country. TraceVerified is a bridge of verified information between manufacturers and buyers with the aim to make Vietnamese food production more transparent.	https://www.traceverified.com/en

Financial Inclusion – Microfinance, Transfers and Payments		
Project name	**Description/services provided**	**Links/other resources**
GCASH and Smart Money	Smart Money (Smart Telecom, an MNO) and GCASH (Globe Telecom, an MNO) mainly provide money transfers from family living abroad (international remittances) and for family living in Filipino cities sending money home in rural villages (domestic remittances). Smart Money and GCASH both focus mostly on domestic remittances, airtime purchase and bill payments (though most rural users do not use the bill pay service.) GCASH in particular has also begun a money transfer pilot with the Filipino government on its Conditional Cash Transfer (CCT) program of benefits to the poorest, and often rural, Filipinos (Government-to-person or G2P). Smart's product is a pre paid card which can be accessed using an ATM, a credit card terminal or mobile phone (using 4,000 cash-in/out points). GCASH's money transfers primarily occur through using a mobile phone (and visiting local GCASH agents in over 18,000 points). Most of GCASH's customers are urban, while about half of Smart Money's customers are rural.	http://gcash.globe.com.ph/ http://www1.smart.com.ph/money/what/
La Coordinadora de Integración de Organizaciones Económicas Campesinas, Indìgenas y Originarias de Bolivia (CIOEC-BOLIVIA)	CIOEC, the apex organization for Economic Farmers Organizations (OECAs) in Bolivia, assists farmers through accessing public investment. CIOEC created a database and e-mail system for communication between CIOEC and the remote OECAs to inform them on which opportunities are available and how to submit applications and follow-up on their request.	http://www.cioecbolivia.org/

BASICS	Bhartiya Samruddhi Investments and Consulting Services (BASICS Ltd.) provides fee-based business right from the outset by offering consulting services in microfinance and livelihood promotion, training, HRD and institutional development (ID) and information technology (IT) applications for microfinance and livelihoods.	http://subk.co.in/about-sub-k/basix-group *Other links:* BASIX http://www.basixindia.com/
East Africa Voluntary Savings and Lending Associations (VSLAs)	CARE in East Africa is experimenting with connecting its Voluntary Savings and Lending Association (VSLAs) groups with the formal banking system. Each group has a single group account tied to a bank which can be tracked and managed via a mobile phone. Each individual member can also send in their savings transaction through a phone. The advantage to these links and use of ICT is one of access to additional products from the bank (while the bank aggregates small customers rather than dealing with each individual), reduce the likelihood of theft or loss of the savings (previously savings were kept in a lock-box), and improve the management and accounting of the VSLA's finances (reducing the potential for fraud and error).	http://edu.care.org/Documents/VSLA%20Linkages%20in%20Rwanda.pdf *Other links:* CARE http://www.care.org/ MTN Rwanda http://www.mtn.co.rw/ Rwanda: Rural Savings Groups to Be Linked to Mobile Banking http://allafrica.com/stories/201108120952.html
FAO-GIZ MicroBanking System (MBWin)	MBWin banking software was initially designed and developed for the use in rural banks and financial cooperatives but currently is used in a wide range of banks, microfinance organizations and other financial intermediaries. It is a low cost software solution which enables an automation and management of banking operations in rural areas, and reduces the costs usually associated with such operations. This project addresses the need for assistance sought by many developing countries that had recognized the importance of savings and credit facilities in rural areas as a way of improving economic activities and banking the unbanked.	http://www.mbwin.net/
Gramin Suvidha Kendra (GSK)	MCX, through its Gramin Suvidha Kendra (GSK) program, provides information for farmers at over 500+ (and growing) post office locations in five states, as well as provides SMS messages directly to inform farmers and traders of commodity spot and futures price movements. Some of these locations install self-service internet kiosks that provide the information, and at most locations, the local postmaster also posts prices on a simple black board on a daily basis (some prices are even posted on the electronic notice boards at train stations as well). The farmers benefit from better price information but also access to finance (using product as collateral) and risk management techniques such as locking in prices on the futures market.	http://gsk.mcxindia.com/AboutGSK.htm *Other links:* MCX http://www.mcxindia.com/

Financial Inclusion – Insurance		
Project name	**Description/services provided**	**Links/other resources**
Kilimo Salama	The Syngenta Foundation piloted Kilimo Salama (Swahili for "safe agriculture") with its insurance partner, UAP Insurance, in Kenya to provide weather insurance that guarantees at least a partial recapture of the capital investment made if certain weather conditions occur. The farmer has the option of being automatically enrolled in the insurance program when s/he purchases inputs from one of the Kilimo Salama partners who sell seeds, fertilizer, etc., as the stockist scans the barcodes of the product with a simple camera phone. To determine who should receive claims payments, when and how much, Kilimo Salama has emplaced "30 automated solar-powered weather stations" throughout Kenya that collect weather data. As soon as one of the weather stations records too much or too little rainfall, a claim and payment is automatically triggered for each affected farmer in a 15-20 kilometer radius. The affected farmer receives an SMS message through his/her mobile phone, informing him/her of the claim and payout. The program distributes insurance payments to farmers using M-PESA.	http://kilimosalama.wordpress.com/about/ *Other links:* https://kilimosalama.files.wordpress.com/2010/02/kilimosalama_v031.pdf Syngenta Foundation http://www.syngentafoundation.org/ https://kilimosalama.files.wordpress.com/2010/02/kilimo-salama-fact-sheet-final11.pdf M-PESA http://www.safaricom.co.ke/personal/m-pesa

Forestry		
Project name	**Description/services provided**	**Links/other resources**
G2C Services (Bhutan)	In Bhutan, citizens can obtain permit for rural timber through the community centre, where Government to Citizen services are offered. Citizens can apply for this service from any community centre/Divisional forest office/Park Office/Range office with the duly endorsed subsidized timber for rural use form by the Gup. The permit for rural timber is delivered at the Community Centres/ºDivisional forest office/Park Office/Range office. Other forestry service services offered through G2C services include Issuance of permit for firewood, flagpoles and fencing poles, Approval for removal of forest produce from private registered land, Issuance of permit for sand, stones, boulders, bamboo, leaf moulds, top soils, Issuance of permit for non-wood forest products (NWFP).	https://www.citizenservices.gov.bt/issuance_rural_timber_permit *Other links:* https://www.citizenservices.gov.bt/list-of-services
Forest asset management Bhuvan (India)	The service provides and tracks geo location of forest assets, wildlife, and fire using geo spatial map.	http://bhuvan-noeda.nrsc.gov.in/projects/forest/kfd.php

Geographic Information Systems/Remote Sensing – Drones		
Project name	**Description/services provided**	**Links/other resources**
Open Forests – Drone Mapper & Satellite Mapper	Open Forests provides drone-based imagery for forests and landscape mapping for your project. It provides a new perspective for valuation, monitoring and research and facilitates the acquisition of high-resolution drone imagery that complements satellite imagery efficiently. Satellite imagery for forest mapping and monitoring provides multi sensor satellite images to analyze your forest estates. Satellite images provide valuable data for various applications in forest and landscape management.	https://openforests.com/drone-mapper/ https://openforests.com/satellite-mapper/
AIRINOV	Airinov provides drone-based remote sensing for precision farming. Remote sensing allows non-destructive sampling to observe agronomic indicators every square meter. UAV technology brings a new method to make objective sampling.	http://www.airinov.fr/en/uav-sensor/principle-and-concept-for-agriculture/
PROGIS	PROGIS Software GmbH is a GIS-software developing expert, dedicated to the developments of applications for the rural area-sector. Based on the core-product WinGIS, a Windows based object oriented GIS; PROGIS is offering a wide range of applications for agriculture, forestry, ecology and rural area management.	http://www.progis.com/en/
SenseFly	SenseFly develops and produces aerial imaging drones and microdrones for professional application. To facilitate precision farming, drone or UAV assist in capturing highly accurate images of fields, covering up to hundreds of hectares/acres in a single flight. By using image processing software you can then transform these shots into one large 'orthomosaic' image. Apply algorithms like Normalized Difference Vegetation Index (NDVI) to this image and you create a reflectance map of your crop.	https://www.sensefly.com/
Google Earth Engine	Google Earth Engine combines a multi-petabyte catalog of satellite imagery and geospatial datasets with planetary-scale analysis capabilities and makes it available for scientists, researchers, and developers to detect changes, map trends, and quantify differences on the Earth's surface. Earth Engine stores satellite imagery, organizes it, and makes it available for the first time for global-scale data mining. The public data archive includes historical earth imagery going back more than forty years, and new imagery is collected every day.	https://earthengine.google.com/ *Other links:* https://itunes.apple.com/us/app/fao-in-emergencies/id756483910?mt=8

Disaster management and early warning		
Project name	**Description/services provided**	**Links/other resources**
Avian Influenza alert system	The FAO's Avian Influenza alert system, used in Bangladesh, extensively uses mobile technology to track the outbreak of the deadly avian (H5N1) virus in a resource deficient country. Short message services (SMS) were used to collect and manage information from a large number of grassroots level volunteers, thereby enabling a coordinated and real-time response to contain the outbreak. This showed how mobile technology could be used for active surveillance systems.	http://www.youtube.com/watch?v=eEj0gVV44V0 *Other links:* https://itunes.apple.com/us/app/fao-in-emergencies/id756483910?mt=8
UN SPIDER – Knowledge portal	United Nations Platform for Space-based Information for Disaster Management and Emergency Response (UN-SPIDER) is a platform which facilitates the use of space-based technologies for disaster management and emergency response. UN-SPIDER's knowledge portal is a hub for pertinent information, links and resources.	http://www.un-spider.org/
Fire Information for Resource Management System (FIRMS)	The Earth Observing System Data and Information System (EOSDIS) is a key core capability in NASA's Earth Science Data Systems Program. It provides end-to-end capabilities for managing NASA's Earth science data from various sources – satellites, aircraft, field measurements, and various other programs. FIRMS were developed to provide near real-time active fire locations to natural resource managers that faced challenges obtaining timely satellite-derived fire information.	https://earthdata.nasa.gov/earth-observation-data/near-real-time/firms
Livestock Information Network and Knowledge System (LINKS)	Livestock market information is an integral part of early warning systems. It helps track changes in terms of trade particularly with regard to comparing trends in grain marketing in order to identify potentially critical food shortage trends. LINKS also provides regular livestock prices and volume information on most of the major livestock markets in Ethiopia, Kenya and Tanzania along with information on forage conditions, disease outbreak, conflict and water supply to support decision making at multiple scales.	http://www.lmistz.net/Pages/Public/Home.aspx

Field Survey Applications		
Project name	**Description/services provided**	**Links/other resources**
Survey Solutions	The Computer-Assisted Personal Interview technology developed by the World Bank assists governments, statistical offices and non-governmental organisations in conducting complex surveys with dynamic structures using tablet devices. The software can be tailored to the needs of the clients, allowing them to successfully complete simple and more sophisticated projects: from basic evaluation questionnaires to complicated multistage panel surveys. The software is offered free of charge, its development being co-financed by the World Bank, Bill and Melinda Gates Foundation and the Food and Agriculture Organization of the United Nations. Surveys can be conducted on low-cost Android tablets	https://solutions.worldbank.org/account/login?ReturnUrl=%2f
Openforis	Open Foris is a set of free and open-source software tools that facilitates flexible and efficient data collection, analysis and reporting.	http://www.openforis.org/

Others		
Project name	**Description/services provided**	**Links/other resources**
Nano Ganesh	A mobile-based controller for irrigation pumps. This greatly benefits rural communities where the timing for release of water for irrigation and electricity for the irrigation pumps are erratic. The irrigation pump could be switched on and off from a distance through any mobile phone as long as there is mobile connectivity at the irrigation pump where the device is installed.	http://www.nanoganesh.com/

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