Food and Agriculture Organization of the United Nations

# E-AGRICULTURE STRATEGY GUIDE

## A SUMMARY

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## *a summary*

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# Contents


*Page*

INTRODUCTION ..... 1

About this guide ..... 2

Putting in place an e-agriculture strategy – opportunities and benefits ..... 3

Why develop a national e-agriculture strategy? ..... 7

Part 1 CREATING A NATIONAL E-AGRICULTURE VISION ..... 11

How to identify the required e-agriculture components ..... 13

Managing the vision development process ..... 14

The current state of play and future goals ..... 14

Sharing knowledge and experience ..... 16

Building blocks for an e-agriculture strategy ..... 18

Developing strategic recommendations ..... 19

Part 2 DEVELOPING A NATIONAL E-AGRICULTURE ACTION PLAN ..... 21

Defining Outputs ..... 22

Identifying Activities ..... 22

Developing an Integrated Action Plan ..... 25

Part 3 MONITORING AND EVALUATION ..... 27

On the right track? ..... 29

Communicating progress to interested parties ..... 29

CONCLUSION ..... 31


**Note:** This is a summary of the E-agriculture strategy Guide developed by the (a) Food and Agriculture Organization of the United Nations (FAO) and (b) the International Telecommunication Union (ITU).

The FAO-ITU E-agriculture Strategy Guide and the toolkit can be downloaded from http://www.fao.org/asiapacific/resources/e-agriculture

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# Introduction

E-agriculture offers strong potential for driving economic growth and raising incomes among the rural poor through increased efficiency of agricultural production, improved livelihoods and value chain development. It can also play an important role in addressing some of agriculture's most pressing challenges, which include climate change, loss of biodiversity, drought, desertification, promoting agricultural trade, high individual risk and inefficient supply chains.

Put simply, e-agriculture involves designing, developing and applying innovative ways to use information and communication technologies (ICTs) with a primary focus on agriculture. The aim is to boost agricultural and rural development by improving access to valuable information that can help agricultural stakeholders to make the best possible decisions and use the resources available in the most productive and sustainable manner. ICTs that can be harnessed for e-agriculture may include devices, networks, services and applications. These can range from cutting edge Internet-based technologies and sensing tools to other technologies that have been around for much longer, such as radio, fixed telephones, televisions, mobile phones and satellites. In a sector that is becoming increasingly knowledge-intensive, having access to the right information, at the right time, in the right format, and through the right channel can make a crucial difference to the livelihoods of stakeholders involved in agriculture and related fields.

Setting in place a national e-agriculture strategy is an essential first step for any country planning on using ICTs for agriculture (ICT4Ag). Experience shows that committing piecemeal resources to ICT4Ag on an *ad hoc* basis results in higher costs and lower impacts. Any effective roadmap for e-agriculture will require a holistic, multi-stakeholder approach as ICTs are also driving other sectors critical for agriculture, namely banking, weather monitoring, insurance, logistics and e-governance. Aside from the development and application of ICT tools and infrastructures, key components of an e-agriculture strategy must include the provision of standards, norms and methodologies, as well as the development of individual and institutional capacities. Enabling policies will be crucial if e-agriculture is to flourish, with cross-cutting support spanning various

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

government ministries, including those dealing with ICTs, food production and processing, rural development, irrigation and water management, disaster management, telecommunication, governance, transportation, finance and commerce, amongst others.

**Figure 1.** ICTs in agriculture

*Source: FAO, ITU*

## About this guide

This abridged e-agriculture strategy guide is intended for use by agriculture sector managers/leaders in government ministries, departments and agencies who will manage the development of an e-agriculture strategy in close consultation with other existing and potential stakeholders.

The guide is designed to support the development of a national e-agriculture strategy for countries that have yet to put one in place. But it can also be used to improve on existing strategies, for countries that have already embarked on this approach. In all cases, it is expected to facilitate achieving the country's agricultural goals and priorities in a timely, effective and efficient manner.

Specifically, this guide addresses:

- Establishing a national e-agriculture vision
- Developing a national e-agriculture action plan
- Monitoring and evaluating the implementation of an e-agriculture strategy

For a more detailed step-by-step guide on how to develop a national e-agriculture strategy, see the full version of the FAO/ITU E-agriculture Strategy Guide available at www.fao.org/asiapacific/resources/e-agriculture

## Putting in place an e-agriculture strategy – opportunities and benefits

Having access to timely and accurate information that is tailored to specific locations and conditions can be critical in helping farmers to make the most of their resources in often changing circumstances. Examples include shifting weather patterns, fluctuating pest and disease epidemics and altered soil conditions. It can also enable them to tap into reliable credit sources and profitable markets, and engage with other important services, such as input supply and linkage to efficient value chains, etc.

Exploring the most effective channels for delivering information is an essential part of the e-agriculture approach. The rapid growth of mobile phone ownership, together with broadband – especially mobile broadband – provides an excellent opportunity for developing e-agriculture.

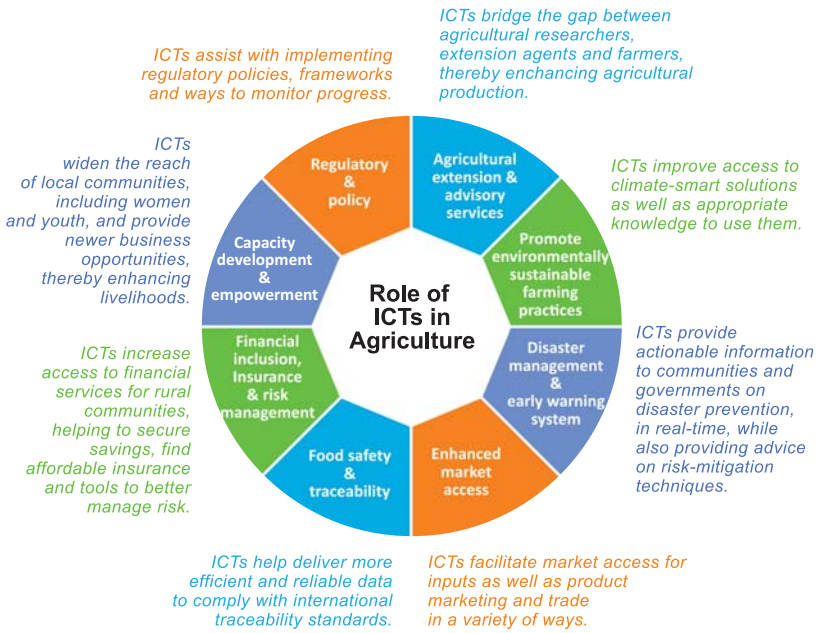
With potential to help a country meet its agricultural goals more effectively in a wide range of areas, e-agriculture can produce impacts in improved agricultural production, input supply, agricultural research and national agricultural information systems, extension and advisory services, postharvest handling, weather information gathering and dissemination, market access and trade, agricultural disaster management, social safety nets financial inclusion, etc.

But what can e-agriculture do to improve agricultural outcomes in concrete terms, and where is it currently producing results? E-agriculture creates opportunities for ICT-driven solutions to a whole range of agricultural challenges, from sourcing the best seed for a particular soil or climate, enabling planning based on weather information to offering valuable extension advice from a distance or helping farmers to fetch the highest price for their products. Taking the case of an agricultural value chain,

e-agriculture can transform the way that actors collect, analyse, store and share information, so as to make the most effective decisions.

Using e-agriculture can lead to greater efficiencies in agricultural extension, disaster risk management and early warning systems, enhanced market access and financial inclusion, as well as capacity development among rural communities, resulting in better market information for producers, lower transaction costs, improved market coordination and more transparent rural markets.

**Figure 2.** Role of ICTs in agriculture




*Source: FAO, ITU*

## Examples of e-agriculture include:

**Agricultural extension and advisory service:** IFFCO Kissan Sanchar Limited[1] (IKSL), India offers the farmer access to a unique Value Added Service (VAS) platform that will broadcast five free voice messages, based on farmers' requirements, on market prices, farming techniques, weather forecasts, dairy farming, animal husbandry, rural health initiatives and fertilizer availability etc. on a daily basis. In addition, the farmer can call a dedicated helpline, manned by experts from various fields, to obtain answers to specific queries.

[1] http://www.iksl.in/

Another example is the Grameen Foundation's Community Knowledge Worker[2] programme, which was initially launched in Uganda and has since been extended to Colombia. The system is based on a network of local advisors drawn from communities who use smartphone applications to give their fellow farmers information on weather and marketing prices and advice on caring for their crops and animals and treating pests and diseases.

**Promotion of environmentally sustainable production practices:** The 'Zero Cost' extension model used in e-Krishok[3] facilitates free extension related information and advisory services for farmers, bundled together with input packages. Every farmer who buys an input package is entitled to receive an information service package whose value depends on the value of products.

**Disaster management and early warning system:** The Famine Early Warning Systems Network[4], created by the US Agency for International Development (USAID), is a leading provider of early warning and analysis on acute food insecurity. Monthly reports and maps detailing current and projected food insecurity, timely alerts on emerging or likely crises and specialized reports on weather and climate, markets and trade, agricultural production, livelihoods, nutrition and food assistance are disseminated through the system.

**Enhanced market access:** In Africa, Esoko[5] has developed a mix of web and mobile apps to improve communication with farmers, linking them to up-to-date market prices and connecting them with buyers, together with a whole host of other information, including extension advice, weather forecasts, agronomic tips and crop calendars. E-agriculture can increase food and nutrition security and food production and processing by managing information flow, data gathering and analysis.

**Food safety and traceability:** Seafood in Thailand and Vietnam, the National Federation of Coffee Growers in Colombia, avocado producers in Rio Blanco, Chile, Italian coffee roaster Illycaffè, livestock in Korea, fresh vegetables from Kenya – these are all examples of traceability being used in the food supply system. Traceability improves the value of goods and suppliers' brand value, while providing confidence to the consumer. It also facilitates the introduction and enforcement of GAP (Good Agricultural

[2] http://www.grameenfoundation.org/what-we-do/agriculture/community-knowledge-worker
[3] http://wp.ekrishok.com/
[4] http://www.fews.net/
[5] https://esoko.com/

Practice), Hazard Analysis and Critical Control Points (HACCP) and other relevant standards to improve product documentation and traceability.

**Financial inclusion, insurance and risk management:** ACRE Africa[6], a service provider working with local insurance in the agricultural value chain, undertakes risk assessment, product development and risk monitoring to facilitate access to insurance products for smallholders. The system uses automated weather stations to monitor rainfall. Payouts are made based on the stations' measurements and a predefined formula of crop rainfall needs. If the weather stations' measurement and related rainfall formula shows that there is a payout, these are sent to individual farmers using M-Pesa (mobile phone wallet).

**Capacity development and empowerment:** The case of Digital Green[7], which uses videos for agricultural extension, has demonstrated that a participatory process of engagement combined with simple technology solutions can enable small-scale farming communities to produce and share information on best practices for improved productivity and sustainable livelihoods. This model was found to be more cost-effective than classic systems of agricultural extension.

**Regulatory and policy:** E-agriculture has the potential to make a valuable contribution to improving a country's agricultural policy and regulatory capability and awareness by offering access to timely, accurate and comprehensive information from the agriculture sector. ICTs can also improve dissemination of policies and guidelines to agriculture sector stakeholders.

Other benefits of e-agriculture include stimulating investment in ICT infrastructure, reducing wastage at various stages from the field-to-fork and spurring the development of agricultural value-added services. E-agriculture can facilitate the creation of information-sharing networks and help foster preparedness for climate change, natural disasters and other agricultural risks, as well as prompting responses when they happen. It can make a major contribution to improving relationships between value chain actors, forging stronger connections based on knowledge and information.

[6] http://acreafrica.com/
[7] http://www.digitalgreen.org/

## Why develop a national e-agriculture strategy?

Setting up a national e-agriculture strategy is a critical stage in developing or revitalizing a country's approach to the use of ICTs to further its agricultural goals and priorities. Building such a strategy is likely to prove invaluable for countries just setting out on the e-agriculture path. But equally, developing a national strategy will prove useful to countries that have already invested significantly in e-agriculture and are seeking to scale up and scale out. Whatever the starting point, e-agriculture efforts can best be strengthened, accelerated or aligned through a national strategic planning process. A cross-cutting approach will be crucial in drawing up any national e-agriculture strategy, ensuring it sits well with other government plans and that single, uncoordinated e-agriculture projects and services do not lead to dispersion and duplication.

Taking a national approach to e-agriculture will help to target areas where capacity development is required, while at the same time identifying the need for awareness-raising, effective engagement of key stakeholders and action to resolve issues of ICT access, especially in rural areas. Once the picture becomes clearer, specific policy measures and an enabling regulatory environment can be put in place, so that agricultural stakeholders can benefit from the potential of e-agriculture at an affordable price. Adopting a well-defined national approach will also help to improve the coordinated planning and funding of e-agricultural development, making interventions more cost-effective and providing clear direction for other players, including the private sector, donors and non-government organizations (NGO). It will also help countries to decide on pilots, giving preference to projects that have a higher priority within the strategy. Such alignment will enhance the potential of pilots to be mainstreamed.

E-agriculture services can be categorized based on the type of network connectivity. As we move from simple push-based to interactive, transactional and connected services, the complexity of devices and networks increases. However, the launch of solutions is not necessarily sequential, but is driven by the level of infrastructure in place or planned, and the priority given to the solution in the e-agriculture strategy.

### What is the framework for an e-agriculture strategy?

A country's e-agriculture strategy is guided by its national agriculture vision or goals, the opportunity offered by ICT development and the potential to leverage the adoption of ICT by other sectors critical for agriculture.

**Box 1.** E-agriculture strategy development in Bhutan and Sri Lanka

Bhutan and Sri Lanka were the pilot countries where FAO and ITU together with partners provided technical assistance in developing their national e-agriculture strategy. Taking care to adopt a multi-sectoral approach, both the countries has invested time and resources in setting up an e-agriculture task force to building an e-agriculture strategy. Key areas targeted for development includes 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 comprehensive strategy to identify, design and develop e-agriculture services and solutions for the country.

*The e-agriculture strategy for Bhutan is called as E-RNR Masterplan.*

The framework of an e-agriculture strategy comprises three parts:

Part 1: Establishing a national e-agriculture vision

Part 2: Developing a national e-agriculture action plan

Part 3: Monitoring and evaluating implementation of the strategy

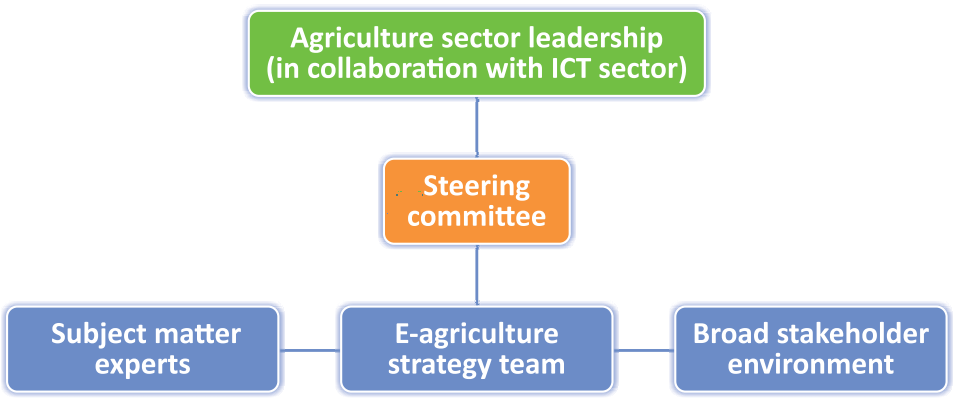
## What is a possible governance framework for the strategy?

A suggested 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. Other aspects, including national infrastructure, telecommunications, workforce development, education, finance, governance, irrigation and water management, disaster management, meteorology.
3. Stakeholder engagement and consultation.

The structure, reporting or accountability mechanisms can be flexible, depending on the organizational or ministerial structure, and the desired management of the process. The joint efforts of both agriculture and ICT sectors are required for the successful launch of an e-agriculture strategy. However, it is recommended that key leadership and ownership should rest with the agriculture sector.

**Figure 3.** Sample e-agriculture governance structure



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# Part 1

## *Creating a national e-agriculture vision*



Developing a national e-agriculture vision is the first step towards developing an e-agriculture strategy for any country. This stage helps to define why a national approach to e-agriculture is needed, what a national e-agriculture plan will achieve and how it can be accomplished. It will involve a three pronged approach – ensuring an enabling environment for e-agriculture to flourish, addressing the required national ICT environment overall and leveraging on the potential of ICT adoption by other sectors critical for agriculture. The first component is crucial to scaling up and sustaining ICT adoption in the agriculture sector with the prime intention of achieving the national agricultural goals. The second requires examining the national ICT market and overall penetration of computing and networking infrastructure. The third is aimed at ICT adoption in associated sectors, such as governance, banking and insurance, which can have a transformative impact on agriculture.

Individual countries may find themselves at various stages of progress along the e-agriculture pathway. Whatever the stage, the country context will influence the starting point, potential goals, stakeholders, direction and focus of a national e-agriculture vision. Key recommendations in all cases include the following:

- There should be clear ownership of the e-agriculture process and who has the mandate to implement the strategy.
- The right stakeholders should be identified and involved at every stage.
- Efforts should be made to incorporate all relevant ongoing projects/programmes involving ICT4Ag into the planning process.
- Defining clear roles and responsibilities for all participants is critical.
- Decision-makers should be involved at all levels of the process.
- The vision/strategy should respond to broad national, regional and international policies, plans and strategies.
- E-agriculture visions/strategies should be incorporated into future agriculture policies and plans.
- Resources should be available for development and implementation processes.

- Transparency and awareness-raising are crucial before and during the development process.
- Agricultural experts supported by relevant stakeholders from other key sectors (telecommunications and IT, governance, banking, insurance, disaster management, rural development, etc.) should be involved in the development of e-agriculture strategies.
- Clear business benefits for private sector stakeholders will promote long-term support and adoption.
- Content standards should be established at the early stage of e-agriculture implementation.

**Figure 4.** Path to developing the e-agriculture vision and developing strategic recommendations

A starting point to creating an e-agriculture vision will involve mapping the country's agricultural goals and challenges and describing the strategic context for e-agriculture. This will entail conducting a holistic examination of the country's agriculture sector, including a thorough analysis of current agricultural value chains and any existing agricultural strategy, as well as agricultural priorities and objectives, and socio-economic considerations connected to these. This process will help to identify specific entry points for e-agriculture, as well as targeting areas where investing in ICT can add value for agriculture and support rural livelihoods and overall economic growth.

**Figure 5.** Developing the strategic context for the national e-agriculture vision

**Box 2.** 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."

## How to identity the required e-agriculture components

Certain building blocks are crucial to setting an e-agriculture vision in place. These are:

- Leadership and governance – led by the agriculture sector, with support from others;
- Strategy and investment;
- Services and applications;
- Infrastructure;
- Standards and interoperability;
- Content, knowledge management and sharing;
- Legislation, policy and compliance;
- Workforce and capacity development.

The final outcome is a national e-agriculture vision, which clearly set out in the country context an e-agriculture vision, the expected outcomes and strategic recommendations to achieve them.

## Managing the vision development process

Developing a national e-agriculture vision is a complex process, requiring knowledge and expertise across several disciplines, sectors and ministries. Any country without the expertise within the agriculture or the ICT sector may need to draw from other resources (international or national) when assembling its core strategy team. Senior agriculture and ICT sector, ministerial or government representatives should also be a part of the team. The deadline for developing a national e-agriculture vision will vary according to each country's situation, but it is important to devote enough time and resources to this crucial planning stage, and to ensure that it is regularly monitored and updated.

Taking on board the inputs, engagement and endorsement of a broad range of stakeholders involved in the e-agriculture ecosystem will be crucial to building an effective national e-agriculture vision. These are likely to include government agencies, the private sector, media, farmers, development agencies, business associations, research institutes, academia, experts, NGOs and others. Coordinating each stakeholder's role, influence, knowledge and expertise can be complex and challenging, and in a number of cases will involve conducting extensive interviews to build up a complete and detailed picture. However, investment here in time and resources will pay off in terms of ensuring substance, support, adoption and sustainability for the e-agriculture strategy as it takes shape, as well as for planning implementation in the next stage of the process.

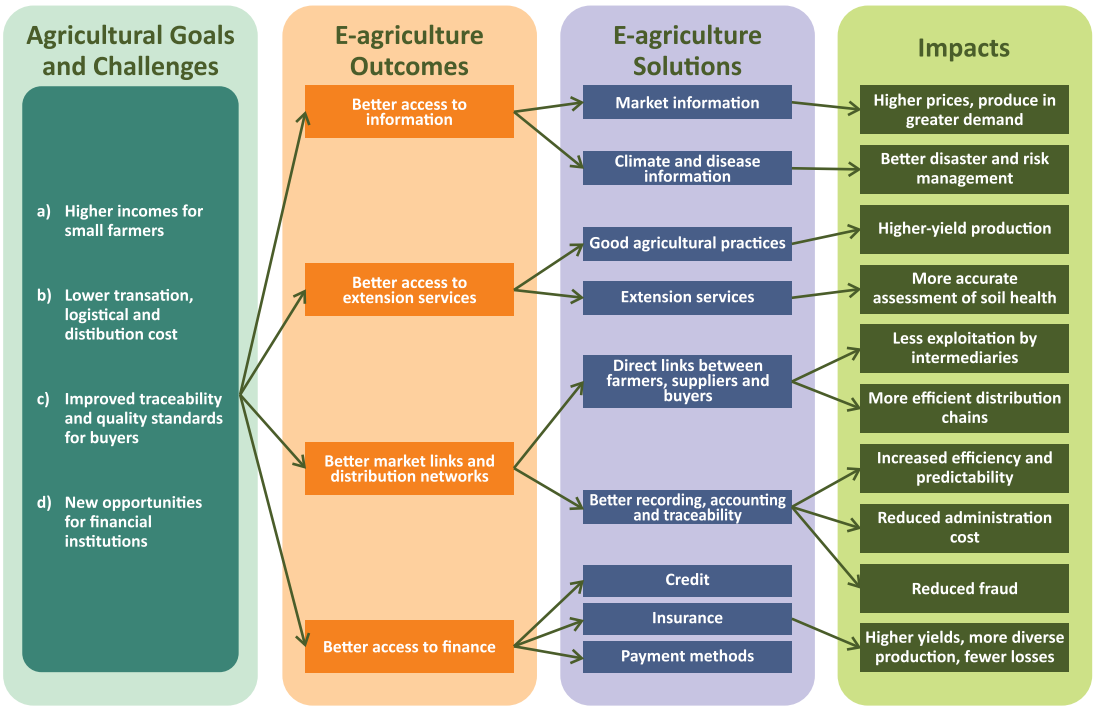
## The current state of play and future goals

Before embarking on any e-agriculture strategy, it is important to examine a country's current agricultural situation – and the commitment for improving on it. This will involve identifying 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. Put simply, it means exploring the state of agricultural value chains as they stand and pinpointing where the main challenges lie. This step may be a time-consuming process, since it is important to canvas a wide range of opinions, from both the public and private sectors, as well as from representatives of farmers themselves. But it will prove invaluable in building up a comprehensive picture of the current state of play, and highlighting where there are gaps and opportunities. A good approach is to conduct interviews with ministries, departments and agencies

responsible for agriculture, telecommunications, banking, insurance and information, as well as with NGOs, farmers' organizations, agro-entrepreneurs, mobile financial service providers, rural banks, rural development agencies, e-government service providers and different players in the agricultural value system. National workshops at critical junctures should also be conducted to share developments and gather ideas.

This stage produces a solid foundation for moving onto the next important step – identifying agricultural goals, as well as the associated challenges and priorities. Then the task of examining how ICTs can help to achieve them and where e-agriculture will have the most impact has to be done. Subsequently, or in parallel, it will be equally important to conduct a detailed inquiry into the current e-agriculture environment in the country, so as to ascertain if the building blocks for an ICT4Ag strategy are all in place. Part of this exercise will involve identifying opportunities, gaps and barriers to realizing the e-agriculture vision. This is a critical step because it will be the basis for refining the draft vision towards an aspirational, but pragmatic e-agriculture vision.

**Figure 6.** Agricultural development goals and challenges linked to information flows to achieve specific impacts




*Source: World Bank [adapted] (2011).*

## Sharing knowledge and experience

Many countries have already embarked on the path to adopting ICT in agriculture, and much can be learned by looking at how they are using this approach to address agricultural challenges. This exercise can generate valuable lessons, especially in settings that could be compared to those of your own country, which have similar difficulties and opportunities. How is e-agriculture being used in other countries and settings? What kind of goals or challenges is it helping to address? And what measurable benefits has it delivered, for example in improved yields and incomes? 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.

In drawing up an e-agriculture vision, it is important to:

1. Agree on the timeframe;
2. Define desired e-agriculture outcomes i.e., what will be achieved or changed through using e-agriculture, to achieve agriculture goals and/or to address the sector challenges;
3. Describe the rationale for each outcome and link it to the strategic context;
4. Develop an initial vision statement;
5. Describe what delivering the national e-agriculture vision will mean for stakeholders;
6. Develop one or more scenarios for putting the e-agriculture vision into practice;
7. Conduct a pre-mortem of the national e-agriculture vision, so as to understand any reasons why a national e-agriculture vision might fail;
8. Develop strategic recommendations that will achieve the desired e-agriculture outcomes.

**Box 3.** 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.

## Building blocks for an e-agriculture strategy

Once the initial vision for the national e-agriculture vision has been drafted, it is important to draw up a list of e-agriculture components, or building blocks, which will be needed for an enabling e-agriculture environment in the country.

**Figure 7.** Identifying required e-agriculture components

The first draft of the vision will need then to be refined and adjusted, to take account of gaps and opportunities identified, as well as risks and barriers. A final phase will involve gaining endorsement for the revised national e-agriculture vision, and communicating it to the broader stakeholder community, together with strategic recommendations for its delivery.

## Developing strategic recommendations

The vision process is completed by developing strategic recommendations that are needed 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.

***Example of a strategic recommendation for a national e-agriculture vision***

| Ref. | Recommendation | Rationale and specific actions |
|---|---|---|
| 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.<br><br>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.<br><br>**Specific actions would include:**<br><br>Identify organization(s) responsible for developing and certifying the content;<br><br>Identify agencies and agricultural service providers that can effectively deliver the content according to the agricultural cycle;<br><br>Establish a services' contract and service-level agreement for the operation; and<br><br>Establish a governance arrangement for oversight of the service/activity. |

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# Part 2

## *Developing a national e-agriculture action plan*

Building a national e-agriculture action plan enables a government to draw up a logistical roadmap for its strategy on ICT4Ag. This means identifying all activities and how they should be managed, funded and coordinated and pinpointing key stakeholders for the design and implementation of the e-agriculture strategy. However ambitious it may be, an e-agriculture strategy must be practical and actionable if it is to produce the desired outcomes for the agriculture sector, and improve rural livelihoods and food security as a result. It must also have adequate funding, for the planning, implementation and monitoring and evaluation stages. For this reason, now is the time to double check that the plan is truly feasible. Failure to do so may affect credibility and hence stakeholder buy-in, once the strategy is up and running.

The framework for an action plan involves developing e-agriculture outputs (i.e., specific achievements, deliverables, results or changes required to deliver a strategic recommendation or meet an outcome), activities, development of activity details for the plan and defining its implementation

**Figure 8.** Pathways to developing a national e-agriculture action plan

phases. In common with the vision development process, it is important to continue stakeholder engagement, conduct capacity development and manage the development process itself through an established governance mechanism.

## Defining Outputs

Any effective action plan will be constructed around a series of activities. To identify those activities, it is important first to pinpoint the outputs that will help to achieve the e-agriculture outcomes and implement the strategic recommendations made earlier as part of the vision. An example of an expected outcome is as follows: *Improving access to banking, credit and insurance services amongst farming community and associated stakeholders, using mobile and electronic payments.* Getting to this point will depend on certain outputs, which in this case, might be launching a mobile banking service. Other examples of outputs include creating an integrated natural resource management database, launching a weather forecasting service or creating a virtual trading floor for agricultural products. Defining outputs that will help to reach specific strategic recommendations and outcomes is a critical step, and each one should have key performance indicators (KPIs) to enable monitoring.

Prioritizing outputs is recommended, based on the degree of impact that a particular output has on the end results, and the level of feasibility. Establishing 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 improving the efficiency of extension systems.

## Identifying Activities

Next comes the task of identifying the specific high-level activities needed to produce these outputs. A particular output may entail just one activity or a number of activities. 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, organize the service providers' agreement and plan content delivery. Drawing up a draft e-agriculture action plan will help to plot how each activity is expected to contribute to the delivery of outputs and the timeframe for all stages of the process. This will subsequently need to be reviewed – and probably refined

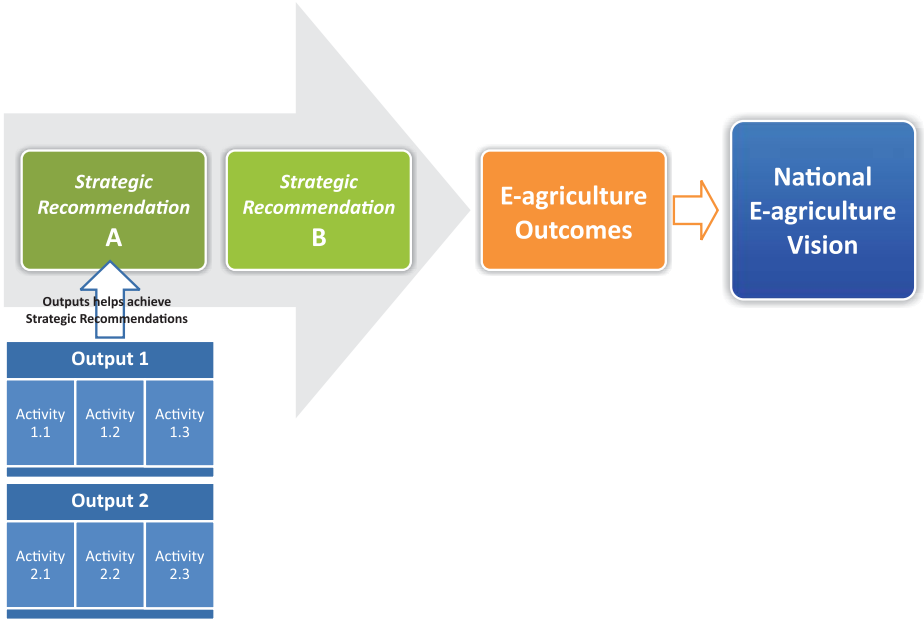
– to ensure that the plan is aligned with the country's agricultural goals, defined at the outset, as well as with its infrastructure readiness and the resources available.

Since 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 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 the required activities, and have greater responsibility for implementing them.

A very good strategy that has no 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 among the activities;

**Figure 9.** E-agriculture vision and strategic recommendations' development process



- 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;
- Risks associated with the activities.

As with many stages of the process, a participatory approach is essential through consultation with relevant stakeholders, to make sure there is broad consensus that the plan is on the right track. This is also the time to do some detailed costing and adjust the plan to take account of any budget constraints or, alternatively consider engaging partners – public or private – to share the financial burden. 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.

Resources required can be divided up into two stages:

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

If the prospect seems daunting from a logistical and financial viewpoint, it is worth remembering that not everything has to be done at once, and there is wide scope for adjusting timeframes to coincide with budget cycles. If necessary, the action plan can be broken up into three or four phases. For example, a 10-year plan could be split into three time periods of 0-3 years, 3–6 years and 6–10 years.

**Figure 10.** From strategic recommendations to defining the implementation phases

## Developing 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.

Defining the various phases for delivering the nation's e-agriculture vision is an important part of the process. This will involve identifying the logical implementation phases and describing the targets for each phase. Last, but certainly not least, communication to decision-makers and other important stakeholders about plans and progress at each stage of the implementation phases will be key to ensuring that the e-agriculture strategy has as much buy-in as possible. Given the complex nature of e-agriculture, there is always the risk that some parts of the agriculture sector may resist the notion, because they do not understand it, or grasp how it could help to address current challenges and deliver tangible benefits. Setting targets for each stage of the action plan will help to sharpen focus and support monitoring and evaluation later on.

## **Table 1.** Sample e-agriculture action plan

| | Action Plan in Phases (Outputs and Activities) | | | | | |
|---|---|---|---|---|---|---|
| | | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 |
| | Examples (non-exhaustive) of outputs | | | | | |
| **Solutions** | Interconnection of databases critical for agriculture *(e.g. GIS data, Land use, Soil map/land fertility, Forest resources, Irrigation and water management, biodiversity, 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* | |
| | *Weather Information Services and alerts* | | | *Activities* | *Activities* | |
| | *Certified higher yielding seeds, planting, breeding materials verification and* traceability | *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* | |
| **Change and adoption** | *Digital Literacy programmes for extension workers on modern ICT tools* | | | *Activities* | *Activities* | |
| **Foundation** | *Universal mobile broadband connectivity* | | *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* | | |
| **Governance** | *Set national e-agriculture council/committee* | | | *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) |

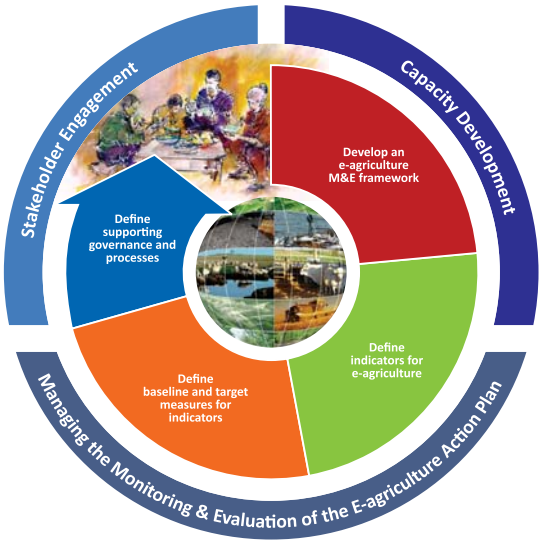
# Part 3

## *Monitoring and evaluation*

Building a national monitoring and evaluation (M&E) framework will be critical to ensuring that your country's e-agricultural strategy is both successful and sustainable. Indicators will need to be developed and targets measured, in order to gauge the progress made in putting the e-agriculture plan into action and the outcomes it has generated. To what extent has e-agriculture been adopted, and what have been the tangible results for agricultural and non-agricultural stakeholders? What solutions have been put in place to achieve those ends, and to what degree have they been effective?

Meaningful indicators should include the perspective of stakeholders, as this ensures that changes or improvements important to them are measured. Targets should be defined for a range of timeframes throughout the duration of the action plan. They should be realistic and achievable in order to remain relevant and motivating. 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.

**Figure 11.** Processes for monitoring and evaluation



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

- Agriculture sector policy-makers;
- Farmers, fishers, forestors 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;
- Agricultural researchers;
- Stakeholders from other sectors, who would benefit from growth in e-agriculture.

Examples of e-agriculture outcomes for farmers and fishers might include increased access to agricultural information and services. For agribusinesses, outcomes to monitor could be improved management of agriculture inputs and outputs throughout the production cycle, or better access to international markets through certification and interconnected commodity exchanges. For agricultural service providers such as extension agents, one criterion may be whether or not e-agriculture has enabled them to access agricultural information in the field and remotely interact with farmers and fishers. In the case of agricultural researchers, the outcome could be improved access to valuable agricultural literature, knowledge networks and resources. Other outcomes might be the result of ICTs related to weather, governance, logistics, irrigation, disaster management or financial services, such as payment mechanisms, insurance, loans and savings products.

Establishing a successful national M&E framework requires dedicated resources, time and effort, but the benefits are unquestionable. Governments should consider M&E as part of the planning and costing of their national e-agriculture programmes from the outset, rather than as an add-on, for which funding and staffing have to be found at the last minute.

**Box 4.** What is monitoring and evaluation?

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

## On the right track?

A good M&E framework will investigate three main areas, to assess what progress has been made and where adjustments may be needed:

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

**Table 2.** 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 having access to mobile phone who have been educated on how to use e-agriculture services | 0 | 60 | 90 | 100 |

## Communicating progress to interested parties

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 investment, adoption and investment in e-agriculture. Communicating the progress and results of the e-agriculture action plan is especially important to show policy-makers, investors, donors or funders how their money has been spent, and the impact of their investments. It can also help to build trust and understanding with potential funders, demonstrating how their contribution would be used to further the country's national e-agriculture programme.

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. Detailed advice on how to design and implement this important phase is given in the full version of the FAO/ITU E-agriculture Strategy Guide –
http://www.fao.org/asiapacific/resources/e-agriculture

**Box 5.** Indicators and baselines

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

# Conclusion

The three pillars of the strategy described in this booklet – developing an e-agriculture vision, drawing up an action plan and building a monitoring and evaluation framework – offer guidance on creating an overall objective for an ICT-enabled agricultural system. The guide also describes what needs to be done in order to get to this point and how to keep track of progress along the way. 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.

As with any large-scale transformation, the successful installation of e-agriculture in a country's strategy will depend significantly on having high-level leadership for this cause, which can carry forward a sustained vision and commitment throughout the programme. It is also critical to keep stakeholders – and especially farmers who will be the direct beneficiaries of e-agriculture – on board at all times, especially during the design phase. In the past, many e-agriculture programmes and projects have failed because of lack of adequate engagement with agricultural representatives in the design and delivery of e-agriculture transformation, leading to unsuitable technologies that add no value to their roles and practice. Later, during the monitoring and evaluation phase, it will again be essential to keep stakeholders on board, be they farmers, fishers, livestock herders, agribusinesses, service providers or researchers. Whatever their role, it is important that their opinions are canvassed through consultations, to ensure that their priorities are addressed and that they are involved in the process of measuring any results.

Adopting a cross-cutting approach that draws on the skills and contributions of a wide range of sectors and players will be critical to planning a successful e-agriculture strategy for your country. Although it may seem paradoxical, e-agriculture and the promise that it holds, is not just about agriculture *per se*. Equally, it is important to bear in mind that developing a national e-agriculture strategy is only the first step towards realizing the transformative potential of ICT for agriculture. At the end of the day, the impact of this approach, and all the planning that leads up to it, will also depend largely on effective implementation.

**Where to find more information**

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 (http://www.ictinagriculture.org/content/ict-agriculture-sourcebook)*, FAO's *ICT uses for inclusive value chains*, FAO's *Information and communication technologies for sustainable agriculture (http://www.fao.org/docrep/019/i3557e/i3557e.pdf)* and *Success stories on information and communication technologies for agriculture and rural development (http://www.fao.org/3/a-i4622e.pdf)*. All the above publications document applications of technology and innovations that serve as useful reference material in the process of developing an e-agriculture strategy.

## Examples of ICT innovations in agriculture and rural development

**On-line support**

The *Pinoy Farmers' Internet* is an extension support system set up to help farmers in the Philippines. The service provides on-line courses and SMS messaging on several crops and weather forecasts. The Farmer's Text Service allows producers to send data on their crops to request assistance and advice e.g. on diseased rice plants. Channels used are SMS, photos and videos.

**Connecting producers with markets**

Market pricing services, virtual trading floors and facilitation of payments via mobile phones are just some of the ways in which e-agriculture can promote market access and trade. Examples include *RML Information Services Pvt. Ltd.* (RML), which provides access to critical market information via mobile phone in India.

**M-banking takes off**

With almost 2.2 billion people in Asia, Africa, Latin America and the Near East excluded from formal financial services, such as banking and credit, mobile payment systems are expanding rapidly in developing countries. Among the most successful mobile money services is *M-Pesa*, offering banking and microcredit services in Kenya, South Africa and Tanzania.

**Information for fish farmers**

The *Chilean Aquaculture Project* (CAP) provides daily information about sea surface temperature, clarity of sea water and the amount of chlorophyll in the water. Information on the latter enables fish farmers to take action when harmful algal blooms multiply to a level where they threaten farmed fish.

**Farmer advice in local language**

*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.

**Cyber extension**

In Indonesia, the Lampung Fishery and Forestry Counselling Coordination Agency's (BKPPK) *cyber-extension programme* provides guidance and counselling to farmers via the Internet. This enables extension agents to support more farmers. The topics covered are crop information, horticulture, livestock, fishery and forestry.

**Linking sellers and buyers**

*FarmerNet* is a Sri Lankan ICT-based trading platform that enables farmers and traders to send information by SMS regarding availability/requirement of a particular commodity, including the quantity, price, location for delivery, etc. The user enters the database and is matched with another corresponding party so that a sale can be agreed.

**M-Farm mobile phone service**

*M-Farm* is a mobile phone service that gives farmers information about market prices across Kenya via text messages. Farmers send an SMS to access prices on products, buy inputs and find buyers. The service was created by university students to make the market more transparent to farmers. M-Farm's target group is small scale farmers in rural areas who do not have adequate access to information.

**Smart access to agri-inputs**

In Nigeria, *Mobiashara* uses Village Promoters (retailers) to help farmer clients use mobile phones to order and purchase agri-inputs, such as fertilizer. Payment is made through one of the mobile money partners such as M-PESA, Airtel or MTN. The system also has a fertilizer inventory system built-in.

**Crop insurance for farmers**

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) offers index-based crop insurance to farmers in East Africa, using ICT-enabled solutions.

**Be prepared**

Many effective models of early warning and disaster information systems have been developed to mitigate risks to agricultural production, especially for pests and diseases, weather-related events and other natural disasters. To disseminate such information rapidly on the ground, one of the most effective ways is via SMS. There is also strong potential for using e-agriculture to deliver insurance for agricultural disasters.

**Better information, higher yields**

Basmati rice growing farmers in Haryana, India, realized a 25 percent growth in yields and significant cost reduction for inputs and irrigation, when they were provided with tailor-made information by India's *IFFCO Kisan Sanchar Limited* (IKSL).

**IOT-based small-scale meteorological station**

This device can monitor a variety of outdoor environmental parameters as air temperature and humidity, light intensity, wind direction, wind speed, precipitation. These data can be accessed through the mobile app and website to understand the real-time environmental situation. It can also be coupled with systems to irrigate or fertilize the crops. *UjuziKilimo* uses sensors and data analytics to empower smallholder farmers in Africa.

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