Assessing agricultural innovation systems for action at country level

A preliminary framework

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Abbreviations and acronyms

AIS	Agricultural Innovation Systems
AKIS	Agricultural Knowledge and Innovation System
APAARI	Asia Pacific Association of Agricultural Research Institutions
CAS	Complex Adaptive Systems
CD	Capacity Development
CDAIS	Capacity Development for Agricultural Innovation Systems
CF	Common Framework
CIRAD	French agricultural research centre for international development
COAG	Committee on Agriculture of the Food and Agriculture Organization of the United Nations
DeSIRA	Development Smart Innovation through Research in Agriculture
FAO	Food and Agriculture Organization of the United Nations
GFRAS	Global Forum on Rural Advisory Services
ICT	Information and communications technologies
IPR	Intellectual property rights
OECD	Organisation for Economic Co-operation and Development
R&D	Research and development
RAAIS	Rapid appraisal of Agricultural Innovation Systems
S&T	Sciences and Technology
SWOT	Strengths, weaknesses, opportunities, threats
TAP	Tropical Agriculture Platform
WB	World Bank

Executive summary

The role of agricultural innovation systems (AISs) in improving agricultural productivity, diversity and nutrition outcomes, addressing climate change, and making agriculture more resilient, effective and sustainable cannot be overemphasized. In 2016, the FAO Committee on Agriculture (COAG), recognizing the importance of agricultural innovation in achieving sustainable rural development, recommended that "FAO plays a greater role in assisting countries and local communities in the development of their AIS strategies through comprehensive diagnosis and needs assessments in partnership with farmers, academia, private sector, research, extension institutions and other relevant stakeholders".

The rationale of the AIS assessment was developed in line with COAG's recommendation to support FAO Members to conduct a systematic and systemic assessment of AISs. Specifically, the assessment aims were to a) inform and provide practical guidance to actors of the national AIS including policy and decision makers, to create more enabling environments for innovation, b) support capacity development of AIS actors through joint learning, and strengthen collaboration between science and policy making processes, c) guide responsible investments geared towards strengthening AIS effectiveness and performance to tackle global challenges facing agri-food systems, and thus the achievement of the Sustainable Development Goals (SDGs).

The assessment framework is meant for actors of the national AISs, which include research, extension and advisory services, innovation support services (ISS) and universities, policy and decision makers within relevant ministries, or even development organizations, with a mandate or willingness to catalyze system innovation processes and to identify entry points for strengthening the AIS as a whole and taking action for developing capacities to innovate in a sector, a value chain, a territory or at country level. Considering the high level of complexity and diversity of AISs, the assessment implementers need to be guided to collect and analyze quantitative and qualitative data and information to generate evidence for improving decision-making and advocacy for strengthening their AIS in their specific context.

To meet these objectives, a preliminary assessment framework was developed to provide key concepts, the foundations of analytical and operational frameworks and guiding principles for country assessment teams. The preliminary assessment framework is meant to be tested in pilot countries. It is composed of analytical and operational frameworks, with implementing principles for customization and ownership by countries. The analytical

framework emphasizes a multiperspective assessment of the AIS, with the integration of structural, functional, capacity and policy analysis. The operational approach is based on a phased process which is actors-centered and process-led. It consists of four phases a) inception, b) customization, c) data collection, joint analysis and interpretation, and d) validation and communication. For each of these phases, a toolbox was developed and needs to be tested, customized and refined in diverse countries in partnership with end-users of the assessment outputs.

The preliminary framework will be tested and validated in the framework of the European Union funded project entitled "Developing capacities in AISs: scaling up the Tropical Agriculture Platform Framework", which is being implemented between 2019 and 2024 in nine countries (Burkina Faso, Cambodia, Colombia, Eritrea, Lao People's Democratic Republic, Malawi, Pakistan, Rwanda, and Senegal).

Introduction

Why develop AIS assessment guidance for countries?

The agricultural innovation system (AIS) concept represents a paradigm shift from linear and top-down models of technology transfer from research to extension to farmers, towards a system approach to agricultural innovation (Schut *et al.*, 2015a). AIS is defined as "a network of actors or organizations, and individuals, together with supporting institutions and policies in the agricultural and related sectors, that brings existing or new products, processes, and forms of organization into social and economic use" (TAP, 2016).

There is wide acknowledgment that well-functioning AISs are important drivers to foster, nurture, develop, and promote agricultural innovations needed for the transformation of agri-food systems.[1] A well-functioning AIS is one that is dynamic and continuously adapts itself in response to changing sector challenges and opportunities by enabling innovation of different kinds (World Bank, 2012).

At its 25th Session held in September 2016 in Rome (Italy), the Committee on Agriculture (COAG) of the Food and Agriculture Organization of the United Nations (FAO), recognized the importance of agricultural innovation in achieving sustainable rural development and recommended that "FAO play a greater role in assisting countries and local communities in the development of their AIS strategies through comprehensive diagnosis and needs assessments in partnership with farmers, academia, private sector, research, extension institutions and other relevant stakeholders" (FAO, 2016). The Committee recognized the importance of agricultural innovation in achieving sustainable rural development, particularly for addressing the challenges of employment for youth and rural women to alleviate rural poverty. It encouraged FAO to continue its work on AISs focusing on a) promoting an enabling environment for agricultural innovation, b) developing capacity to innovate at a country level, c) promoting public-private partnership, and d) advocating and monitoring improved investments and returns from AISs.

The recommendation to assess AIS was also echoed at the FAO's international symposium on agricultural innovation for family farmers entitled "Unlocking the potential of agricultural innovation to achieve the Sustainable Development Goals", held in Rome in November 2018 (FAO, 2018a). The assessment was highlighted as a key element for sustainable agricultural innovation. In his summary, the Chair of the Symposium indicated that assessment at national and subnational levels is required to inform appropriate interventions to unlock the potential of agricultural innovation for family farmers. Assessing AISs is a precondition for identifying key areas requiring strategic interventions (FAO, 2018b).

In line with these recommendations, FAO has embarked on the development of an AIS assessment framework from a capacity development perspective, targeting three objectives:

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[1] Operational unit of agriculture including all actors and organizations at local, regional and national levels involved in the production, processing and commercialization of agricultural commodities

a) informing and providing practical guidance to actors of the national AIS including policy and decision makers, to create more enabling environments for innovation, b) supporting capacity development of AIS actors through joint learning, and strengthening collaboration between science and policy making processes, and c) guiding responsible investments geared towards strengthening AIS effectiveness and performance to tackle global challenges facing agri-food system. These goals would, therefore, assist in realizing the Sustainable Development Goals (SDGs). The assessment framework is meant for actors of the national AISs, such as research, extension and advisory services, innovation support services (ISS) and universities, policy and decision makers within relevant ministries, or development organizations, with a mandate or willingness to catalyze system innovation processes or developing capacities to innovate in a sector, a value chain, a territory or at a country level.

To achieve these objectives, a user-friendly and customizable framework is needed. Considering the high levels of complexity and diversity of AISs, the assessment implementers need to be guided to collect and analyze quantitative and qualitative data and information to generate evidence for designing impactful capacity development (CD) interventions, improving decision-making and supporting advocacy for strengthening AIS in their specific context.

Process of guidance development

In order to develop guidance for customizing and operationalizing a common assessment framework in a way that would guide decision makers and CD interventions in different countries facing different types of challenges, the assessment framework was developed in two phases.

The first phase from 2018 to 2019 consisted in developing a preliminary framework with key concepts, foundations of analytical and operational frameworks, and guiding implementation principles (Toillier *et al.*, 2021). They were formulated through a research-led expert consultations between March and June 2018, and were meant to be tested and refined in diverse countries in partnership with end-users in a second phase. Early pilots were conducted in 2019 in United Republic of Tanzania and Thailand to get feedbacks on the guiding implementation principles that were incorporated in the preliminary framework. Also, the preliminary framework was presented and discussed at various meetings[2] for consolidation.

In the second phase (2019-2024), further refinements are planned in the context of

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[2] International CDAIS forum (Gembloux, 13 May 2019); OECD (Paris, 16 May 2019); APAARI Workshop on Innovation Strategies for Sustainable Agricultural Development (Bangkok, June 2019); European Seminar on Extension and Education (Acireale, 18 June 2019); EAS technical workshop, FAO Rome, November 2019.

the European Union funded project entitled "Developing capacities in agricultural innovation systems (AIS): scaling up the Tropical Agriculture Platform Framework", in short TAP-AIS, which is being implemented in nine countries (Burkina Faso, Cambodia, Colombia, Eritrea, Lao People's Democratic Republic, Malawi, Pakistan, Rwanda, and Senegal) between 2019 and 2024 (FAO, 2021). The TAP-AIS project aims to scale up the capacity development framework of the Tropical Agriculture Platform, with a focus on developing capacities of national stakeholders including innovation support service providers, decision makers and policy makers, and in the context of climate relevant issues, productive, and sustainable transformation of agriculture and food systems. The AIS assessment framework, approach and outcomes are part of the expected outputs of the TAP-AIS project. Each country will use it and provide feedbacks. Throughout this process, the preliminary assessment framework and practical guidance for countries will be revised by incorporating inputs and recommendations, as well as lessons learned from pilot countries.

Objectives and outlines of the preliminary framework

The main objective of the preliminary framework is to provide pilot countries with conceptual, methodological and practical orientations for testing, refining and customizing the assessment framework to their needs and realities.

The preliminary framework is structured in three main sections as follows:

- **Section 1. About agricultural innovation systems and their assessment:** provides a brief theoretical background on AIS with some key concepts and definitions, reviews existing assessments that support decision-making and sets the expected outputs, outcomes and potential users of the assessment;

- **Section 2: Analytical framework for an action-orientated assessment:** presents the overall approach, explaining how to combine different theoretical perspectives for assessing AIS and which parts of the framework are flexible;

- **Section 3: Operational Framework for an action-orientated assessment:** presents the description of the 4 phases for customizing and conducting the assessment in a country. It systematically walks the reader through the 4 phases of the assessment. Each phase is described with key activities, and some potential outputs and tools. Guiding implementation principles are proposed to effectively support the operationalization.

Target audience

The main target audience of the preliminary framework is :

• Actors and their organizations of the national AISs (e.g. research, extension and advisory services, innovation support services providers, and universities) of the pilot countries who will test, refine and customize the preliminary framework;

• Other targeted groups such as international or regional research organizations engaged in the development of AIS assessment framework in other countries, or trainers seeking reference materials on AIS assessment.
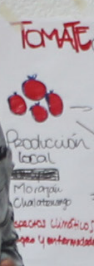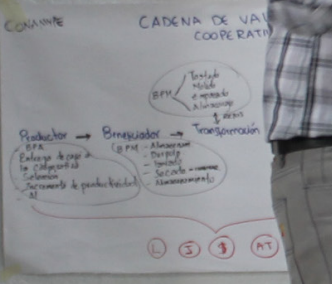
1 Assessing agricultural innovation systems for action at country level

1.1. A snapshot on AIS and related concepts

What is innovation?

Innovation is a broad term that is used widely today. Many definitions exist in the literature. For the AIS assessment, the definition of the Tropical Agriculture Platform (TAP) is used throughout. Innovation is defined as the process of putting knowledge into use, be it in the form of technology, practice, or a particular way of working (TAP, 2016). Innovation in agriculture cuts across all aspects of the production cycle along the entire value chain from crop, forestry, fishery or livestock production to the management of inputs and resources, to organization and market access. Innovation is a systemic, messy and long-term process, with complex unpredictable cause-effect relationships that operate across scales (Hall and Djikman, 2019).

Innovation results from interaction and networking between many actors involved in innovation processes, such as farmers, input industries, processors, traders, researchers, extensionists, government official and civil society organizations (Leuwis, 2004; Hall *et al.*, 2006). The role of actors, including that of the research community, in a given innovation process varies in nature and intensity over time (Barret *et al.*, 2018). The roles and interactions between the actors do not take place in a vacuum, but are shaped by laws, policies, and social norms.

It takes place at different scales, from the individual to nationwide where an entire sub-sector may change practices (Gildemacher and Wongtschowski, 2013 Faure *et al.*, 2018). Innovation processes are knowledge-intensive, non-linear, interactive and inherently unpredictable, and accompanied by risk, conflict and uncertainty (Hall and Clark 2010; Leeuwis and Aarts 2011; Smits 2002). It is this view of innovation as a predictable process with simple cause-effect relationships that persists and continues to frame how many development stakeholders engage with the transformation of agri-food systems (Hall and Djikman, 2019).

Finally, innovation, be it technological, social, organizational or institutional is considered as the cornerstone and key driver of sustained economic growth and agriculture development. The United Nations 2030 Agenda explicitly refers to innovation as a critical means of implementation, acknowledging its role in accelerating the realization of the Sustainable Development Goals (SDGs).

What are innovation systems?

Innovation systems are defined as the network of actors who interact to innovate by producing knowledge and mobilizing resources. A first meaning of the term refers to organizations dedicated to innovation (e.g. research, education, advisory services) and their interactions with other actors. In such a case, one can refer to a national, regional or sectoral innovation system. A second meaning refers to all the actors involved in innovation and their interactions. In this case, there is an innovation system by type of innovation studied (Barret *et al.*, 2018). For Sartas *et al.* (2020), innovation systems comprise the complex interplay between the core innovation and thee types of landscapes in which the core innovation is embedded. Theses landscapes may be defined as follows: i) innovation landscape (the enabling environment or complementary innovations that may impede or support the scaling of core innovations), ii) the intervention landscape (the sets of projects or programs that are working on similar problems, have similar objectives), and iii) the stakeholder landscape (the networks of stakeholders and their constituencies that can influence, develop or work on innovations).

Innovation systems frameworks perceive innovation as a process involving the co-evolution of technological and non-technological elements (Schut *et al.*, 2015a; Touzard *et al.*, 2015). Innovation systems do not exist "out there" as objective entities or realities but rather exist only "in the minds of those who define them" (Daane, 2010). Francis *et al.* (2016) stress that making sure that the system functions effectively, requires investments by the actors themselves. In that endeavor, the policy and institutional environment is critical, and applying an innovation system approach as a policy instrument is useful.

Representing agricultural innovation systems

Many definitions of AIS exist in the literature. For these guidelines, the TAP (2016) definition is used throughout. TAP defines AIS as "a network of actors or organizations, and individuals, together with supporting institutions and policies in the agricultural and related sectors that brings existing or new products, processes, and forms of organization into social and economic use. Policies and institutions (formal and informal) shape the way that these actors interact, generate, share and use knowledge, as well as jointly learn".

The AIS approach represents a paradigm shift from linear and top-down models of technology transfer, towards a system approach to agricultural innovation. It is also widely used as a framework to analyze and explore solutions to complex agricultural problems (Schut *et al.*, 2015a), or to analyze the organization of combined technological, social and institutional innovations in agriculture (Turner *et al.*, 2016). The AIS approach emphasizes

that agricultural innovation is not just about new technologies but also about institutional change (Spielman *et al.*, 2009; Klerkx *et al.*, 2010). The approach proposes to go beyond the linear models of technology transfer (from research to extension to farmers) and to adopt a system approach to tackle complex and intertwined challenges of agriculture development.

AISs are considered self-organizing systems whose properties cannot be analyzed by studying its components separately. They are formed by different actors, where each defines its strategy, reacts to the actions of other agents and to changes in the environment and tries to modify the environment in ways that fit his/her goals (Spielman *et al.*, 2009). AIS are context specific and respond to the stage of development in a particular country and agriculture sector. They are dynamic and open systems characterized by iterative learning, exchange, co-creation and diffusion of knowledge among actors. These actors, and their attitudes, practices, functions and patterns of interaction, institutional, policy, and historical context and the enabling environment, shape the AIS (World Bank, 2008).

The Tropical Agriculture Platform (TAP) proposes a conceptual diagram of AIS and its components (Figure 1). The diagram highlights four interacting components, which are interlinked:

- **Research and education:** that includes the agricultural research system and the education and training system of the country;

- **Bridging institutions:** which includes agricultural extension and advisory services, innovation support services, stakeholder platforms as well as contractual arrangements of the sector;

- **Business and enterprise:** involving agricultural value chains actors and organizations as well as consumers;

- **Enabling environment:** which entails agricultural policies, innovation policies and investments as well as informal institutions, practices and behaviors.

Figure 1. Key components of agricultural innovation systems
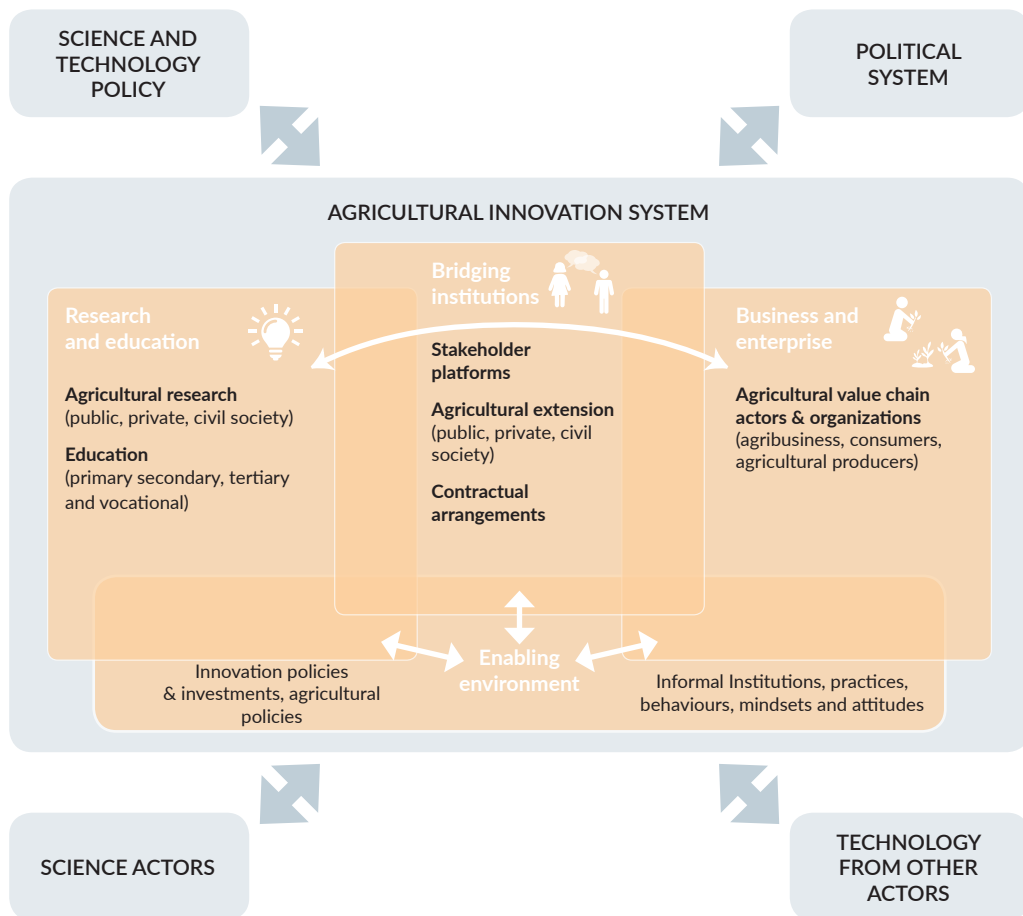
Though research, education and extension are key components of AISs, these are not sufficient to bring knowledge, technologies and services to farmers and entrepreneurs. Other important actors possessing different types of knowledge (e.g. farmer and industry associations, market intermediaries, consumer groups, policy makers, certifying agencies, credit and input suppliers) are also involved (Sulaiman, 2015).

1.2 Assessing agricultural innovation systems for decision-making

The role of AIS in improving agricultural productivity, diversity and nutrition outcomes, addressing climate change, and making agriculture more resilient, effective and sustainable is widely acknowledged. In the last two decades, many countries have reviewed their national AISs and have engaged in reforms to improve relevance to users' demand and broader policy priorities, as well as cost-efficiency. The focus of reforms has been to strengthen co-ordination and governance, develop interactions within the system, improve cross-country cooperation, and strengthen mechanisms for diffusion of innovation (OECD, 2013).

There is a wide acknowledgment that well-functioning AIS are drivers for the transformation of agri-food systems. Functioning AIS are critical to deal with complex agriculture problems (Schut *et al.*, 2015a). Spielman *et al.* (2008) characterized well-functioning AIS with the following features: a) learning within and between firms and organizations in order to innovate, b) developing individual and collective capabilities to innovate, c) demand and supply-driven science and technology, d) innovation agents focusing on complex and dynamic interactions, e) network-based knowledge dissemination, f) both embedded and non-embedded knowledge dissemination, and g) decentralized management of innovation processes.

However, the state of AISs in many countries is far from this ideal condition. In many countries, AISs have been underperforming due to a myriad of constraints (e.g. capacities, inappropriate policies, infrastructure, underinvestment, weak collaboration and interaction between actors). Reliable and timely data and information on AISs are seldom available, whereas the development of an AIS requires continuous decision making and management to obtain critical information to answer critical questions (Toillier *et al.*, 2021). AIS actors, policy and decision makers at various levels (national and sub-national) need insights on the system, i.e. how it functions, its constraints, opportunities, and challenges. Different categories of stakeholders need different types of information for decision-making in their management functions as illustrated in Table 1.

- **Policy level:** Managers and investors need to benchmark the performance of sectors and subsectors in terms of the capacity developed for innovation through innovation system interventions.

- **Investment program level:** Investment implies committing support to a program of activity to gain a desired return. Projections of future investments needed within an innovation system will benefit from collaborative diagnostic tools such as foresighting. Stakeholder engagement and learning that can lead to technical and institutional changes are facilitated through foresighting processes;

- **Organizational level:** Investment in an AIS anticipates technical innovation as well as institutional changes involving policy, program, and project implementation (how and when) and resources employed (who, what, and where) to obtain the highest possible potential for impact. Institutional assessments use multiple methods to capture existing and potential changes within and among organizations and their strategic activities;

- **Intervention level:** Actors and organizations in innovation systems are drawing on information from a wide range of sources to generate qualitative data and are used together with more traditional quantitative analysis and diagnostic case studies to enable learning that will improve the prospects for interventions to provide the best possible return on investment.

AIS assessment has the potential to provide stakeholders, including policy and decision-makers with information about strengths, gaps, weaknesses, and functionality of the system. This information should support the elaboration of recommendations for investments, and for supporting effective and coherent policymaking that foster greater innovativeness in agriculture.

Table 1. Management functions and decision-making at different levels of agricultural innovation systems

Level	Stakeholders involved	Key management functions
Policy	National policy makers, sector committee	• Track progress of the system and its functions • Coordinate agriculture with other sectors • Inform global or regional public policy networks • Design an enabling environment
Investment program	Finance Ministry Donors Private sector Technical team leaders	• Prioritize and allocate resources • Identify new investment opportunities or bottlenecks • Review effectiveness of past investments • Improve underlying theories of change of new investments
Organization	Executive officers Board of directors Research and extension organizations	• Assess organizational performance • Set organizational policy and program priorities • Enable organizational and institutional learning and change, and Respond to changing innovation
Intervention	Non-governmental organizations Private sector Research and extension program leaders Project managers	• Accountability to investors • Managing effectiveness of program/project implementation • Managing innovation processes, including effectiveness of networks, interactions and ways of working • Testing and reframing theories of change • Responding to unexpected outcomes • Responding to changing innovation environments

Source: World Bank, 2012

1. Assessing agricultural innovation systems for action at country level

1.3. Expected assessment outputs and potential users

The expected outputs of the AIS assessment are the following:

- a characterization of AIS and insights on its enablers and disablers, i.e. factors that influence system capacity to enable or disable inclusive and responsible innovations;

- identification of critical gaps, needs, opportunities, best practices, success stories, failures;

- and formulation of actionable recommendations aiming at strengthening and making AIS more effective and responsive to achieve the SDGs.

More specifically, these outputs should be supported by quantitative and qualitative data and information on key features such as composition, organization, evolution, interactions, functions, performance, strengths, weaknesses, opportunities, threats, capacities of AIS, that serve as facts and evidence for improved decision-making, and advocacy for responsible investments.

The outputs of the assessment are consolidated in a concise and informative report (country profile). The profile provides insights on the structural, functional, capacity and policy environment, and recommendations for strengthening AISs. For example, recommendations can span a wide range of areas including (not limited to):

• organizational capacity development including reforms;

• improving the policy environment; coherence of policies;

• promoting collaboration, networking and knowledge sharing; improved coordination; strengthen synergies (vertical i.e. with policy and decision makers and horizontal, i.e. among AIS actors);

• enhancing knowledge flows, and strengthening linkages between research and practices;

• reviews, adaptations, and design of effective policy instruments and strategies;

• support to digital transition in agriculture.

Box 1. Some examples of key findings of AIS assessments

- AIS are largely underperforming: capacity and role of the system to stimulate and facilitate interaction between actors are very limited, actors play a passive role, and budgets were limited;

- National AIS in low-income countries remain insufficiently connected to the local agricultural sector/economy. This is reflected in research priorities, education and training, and in the competences of extension services, which remain all insufficiently aligned with the priorities of farmers, farm cooperatives and agribusiness (Aerni *et al.*, 2015);

- Effective governance of AIS is necessary to maximize the payoffs to investments in agricultural research, development and extension. An institutional infrastructure that co-ordinates and encourages collaboration between AIS actors – including government, research institutions and the private sector – can help ensure policy coherence, create synergies and avoid unnecessary duplication of efforts (OECD, 2013);

- AIS differ in terms of ambitions, sizes and institutions. Top-down approaches continue to dominate in most AIS. (OECD, 2019);

- European Agricultural Knowledge and Innovation System (AKIS) are very diverse, not only in terms of their strength (EU SCAR, 2015). They also differ in terms of their degree of integration. In fragmented AKIS, several independent knowledge networks operate in parallel. In integrated systems, there is a coordinating structure acting on the basis on national policies on AKIS and aligned advisory services (Knierim *et al.*, 2015);

- Private sector investments appear to be focused on higher-valued, market-oriented commodities such as plantations and industrial and horticulture systems, and on agricultural inputs (OECD, 2016);

- Underinvestment in agricultural R&D in southern Asia and sub-Saharan Africa countries is considerable, and stronger linkages are needed to connect agricultural research agencies and their staff with the end users of their research to improve the relevance, effectiveness, and efficiency of research outputs (ASTI, 2019).

The primary users of the assessment outputs are policy and decision-makers as well as AIS actors (researchers, extensionists, academia, innovation support services, government) at national and sub-national levels. Non-state actors (e.g. development partners, United Nations agencies, non-governmental organizations, regional and sub-regional research organizations and networks, private sector organizations) can also use the outputs to guide the identification and formulation of specific investments

programmes/projects.

1.4. Expected assessment outcomes

The main purpose of strengthening AIS is to overcome societal challenges (climate change adaptation; achieving a circular economy; zero hunger) by (re)organizing the innovation system as needed in a given context.

AIS strengthening is not an easy and consensus-driven process. It is instead a political process that requires building up decision-making and strategic planning capacities not only of policy makers, but also of actors with a potential to influence AIS functions and purpose, such as actors from civil society or from the informal economy.

In this perspective, the AIS assessment approach is seen as a stage of a capacity development process, ultimately aiming at engaging collective action towards the strengthening of the AIS.

Outcomes, in terms of capacity development, are expected at the level of the different assessment contributors and users. In particular, outcomes are expected at the level of the interfaces between society, science and policy. The AIS assessment is expected to contribute to better collaborations between society, science and policy makers in order to foster mutual learning and stimulate reflection and discussion about innovation needs, innovation support and needed capacities at country level. AIS assessment outputs are meant to develop a better understanding of possible strategies and systemic policy instruments that can be developed to spur the changes desired in the overall functioning of AIS. Systemic innovation policy instruments focus on the innovation system level instead of focusing on specific parts of the system and support processes that play a crucial role in the management of innovation processes. The idea behind systemic instruments is that they aim to address problems that arise at the innovation system level and which negatively influence the speed and direction of innovation processes (Smits and Kuhlmann, 2004).

Increased policy capacities through joint assessment of the type of systemic problems to be addressed and selection of adequate policy instruments is considered as an important step to undertake an AIS strengthening process led by countries.

2 Analytical framework for an action-orientated assessment

2.1. The different perspectives for assessing AIS

Many approaches have been used for assessing AIS (Toillier *et al.*, 2021). In this section, we present few of these approaches. The approaches are all tied to the nature of the ultimate objectives of the assessment.

• **Structural assessment:** consists mainly of identifying and mapping AIS components. Structural analysis can be performed at a sub-system level (e.g. research and education system, agricultural advisory services, innovation support services, value chains) to obtain an in-depth understanding of one or more sub-systems. The structural components include the actors, their interactions and networks.

  – Actors including sub-categories, and their roles in innovation systems should thus be identified according to the interaction patterns they generate with other actors and which form a systemic perspective. Their presence/absence, capacities, strengths, weaknesses, functions are important elements to analyse. Table 2 below provides an overview of actors and their potential roles.

  – Interactions and networks reflect the dynamic relationships among actors and their networks. Formal networks are easily recognized, whereas, the identification of informal ones require discussion with experts and other actors or analysis of co-patenting, co-publishing or collaboration. Several types of interaction exist between actors and their environment.

Table 2. Actors and potential roles in agricultural innovation systems

Actors/sub-categories	Potential roles
Farmer/Farm Family	• Users and source of knowledge to create, test and adapt new technologies to field conditions • Applying and suggesting innovative products and practices to increase agricultural productivity and market accesses • Identifying problems, challenges and opportunities
Farmer Organizations (including commodity networks and platforms)	• Representing farmers (interests, needs, opportunities) in value chains and in the community and policy arenas • Facilitating access to agricultural inputs, credit and markets • Promoting specific innovation through collaborative research, providing advisory services • Lobbying
Advisory Services (private, nongovernmental and public)	• Brokerage of knowledge between farmers and other actors. • Making new technology and practices available • Forging networks and supporting farmers' organizations • Facilitating access to credit, inputs and outputs services, and to public or private interventions and programs around innovation • Promoting equitable participation
Agro-dealers (input suppliers and processing	• Providing (new) agricultural inputs and output markets (often combined with advice and credit). • Identifying, piloting and mainstreaming new market opportunities • Defining quality standards of agricultural products • Facilitating investment in physical and human resources for product and process development • Linking agricultural actors to the rest of the market
Tertiary education institute	• Improving general education level of all actors • Education and training of professionals in the agricultural sector. • Development of better knowledge and associated skills for farmers and other actors • Developing approaches and methods of experiential and multi-actor learning.

Researchers (public, nongovernmental, private & universities)	• Developing and improving technologies, practices, and processes relevant to local/regional/national contexts • Testing and validation of locally developed technologies and processes • Documenting the ways new practices and technologies are adapted • Cooperating with researchers of other countries/international organizations. • Cooperating with other actors like farmers organizations, NGOs, advisory services, brokering.
Policy makers (Regional, national, local level)	• Providing strategic orientation • Formulating, implementing and enforcing strategies, policies and regulations. • Allocating resources for research and human resources development. • Providing incentives to innovation and collaboration. • Enabling networks and partnerships
Development agencies	• Facilitating access to funds • Allocating resources for development
Consumer organizations	• Influencing research priorities and innovation practices. • Facilitating consumer acceptance. • Facilitating and brokering information of new products and processes.

Source: Based on Gildemacher and Wongtschowski, 2013; Sulaiman and Davis, 2012; World Bank, 2012

• **Functional assessment:** AIS perform multiple functions in innovation processes. Edquist (2004) states that the function of an innovation system is to pursue innovation processes to develop, diffuse and use innovations. The functional assessment focuses on "what is actually achieved in the system" (Bergek *et al.*, 2008), regardless of the structure. Functional analysis allows system failures to be assessed and the system's performance to be evaluated (Bergek *et al.*, 2008, Chaminade and Vang, 2008, Hekkert *et al.*, 2007, Negro *et al.*, 2007). Different functions have been identified in the literature. A brief overview is provided in table 3 below.

2. Analytical framework

Table 3. Functions of innovation system

Functions	Description
Knowledge development and diffusion	Ability to develop new knowledge through research, interaction and exchange. The function captures the breadth and depth of the knowledge base and how those change over time, including how it is diffused in the system
Resource mobilization	Involves the financial and human capital and resources needed to undertake activities within the innovation system.
Guidance of search	Is about creating a vision for the innovation system. It represents the selection function between various technological options
Market formation	Is about the creation of markets for novel products themselves, or existing products produced in different ways and with new attributes
Entrepreneurial activities/ experimentation	The role of the entrepreneur is to turn the potential of new knowledge, networks, and markets into concrete actions to generate and take advantage of new business opportunities. The presence of active entrepreneurs is a first and prime indication of the performance of an innovation system
Creation of legitimacy	A matter of social acceptance and compliance with relevant institutions in which the new technology and its proponents need to be considered appropriate and desirable by relevant actors in order for resources to be mobilized. Legitimacy also influences expectations among managers and, by implication, their strategy

Mapping and understanding the functions and their interactions are useful to identify the drivers and constraints of innovation and to provide information about the strengths and weaknesses of each function (Klerkx *et al.*, 2012). Multiple interactions exist between functions in a non-linear model. This affects, positively or negatively the overall performance of the system. While some functions are well documented in the literature such as knowledge brokering (Klerkx *et al.*, 2010) or knowledge development and dissemination (Palmieri and Rivas, 2007), others, such as resource mobilization, have been less investigated.

Functional analysis has emerged to complement the structural analysis, with a process-oriented analysis, identifying different functions of an innovation system, and assessing the performance of the system on whether all the functions are being performed effectively (Bergek *et al.*, 2008; Hekkert *et al.*, 2007).

- **Process view:** AIS are seen as complex adaptive systems thanks to the dynamic of the various innovation processes that develop within it. Due to their dynamics and non-linear nature, innovation processes are complex and change over time, in regards to the composition of the network of actors, the interaction patterns and artefacts (Klerkx *et al.*, 2010).

  The process view implies seeing innovation systems as self-organizing growing networks of actors connected to the development of a certain novelty, emerging from a dominant incumbent production system (characterized by certain technologies or practices) or value chain configuration and moving towards an alternative to the incumbent system or even replacing it (Ekboir, 2013; Hall and Clark, 2010; Klerkx *et al.*, 2010). AIS are seen as 'systems in the making'. According to this view, there is a central focus on how an agency of innovators is embedded within and supported by a broader socio-institutional and technological environment, or conversely, the efforts of innovators to change their socio-institutional and technological environment (Klerkx *et al.*, 2014)

- **Capacity view:** it aims at identifying the factors that enable or hinder the performance of AIS. The capacity view puts emphasis on the analysis of individual and collective capacities. The literature on capacity to innovate points to certain capacities needed to support innovation processes. For example, the Common Framework (CF) on capacity development for AISs developed by the Tropical Agriculture Platform (TAP) puts emphasis on five capacities (called functional capacities)

  - *Capacity to navigate complexity:* i.e., shift in mindsets, attitudes and behaviour to comprehend the larger system and to create an understanding of the whole system;

  - *Capacity to collaborate:* i.e., enabling actors to understand each other's perspectives and managing conflicts, managing diversity in order to combine individual skills and knowledge, and creating an awareness of their complementarity;

  - *Capacity to reflect and learn:* i.e., bringing stakeholders together, designing and leading processes of critical reflection and following a learning process leading to action and change (called "double loop learning" because of a double cycle of experiments, observations, reflection and new actions);

  - *Capacity to engage in strategic and political processes:* i.e., capacity to understand and influence political and power relations between individuals, within organizations and in society. These four capacities are the core of an overarching *capacity to adapt and respond in order to realize the potential of innovation*, shifting focus from reactive problem solving to co-creating the future. The five capacities are illustrated in the figure 2 below.

Figure 2. TAP Common framework 4+1 capacities

Capacity to Navigate Complexity

Capacity to Collaborate

Capacity to Reflect and Learn

Capacity to Engage in Strategic and Political Processes

Capacity to Adapt and Respond in order to Realize the Potential of Innovation
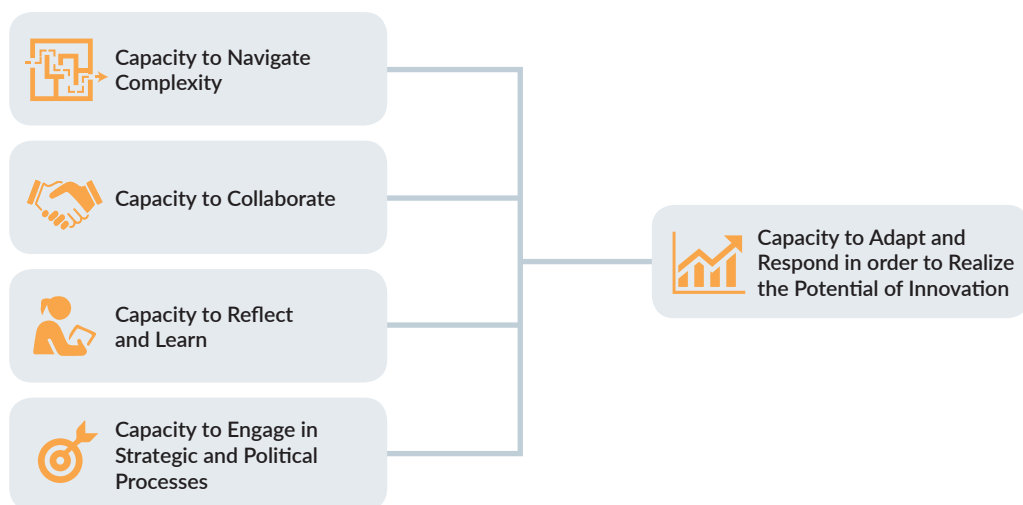
In summary, different views of AIS assessment have been reported in the literature. These are structural, functional, process and capacity. Their use depends on the objective of the assessment, the guiding question and/or hypotheses on the enablers/disablers of the AIS. Given the context-specific nature of AISs, there is no single approach to assess AIS across countries.

All views stress the importance of a careful design of the assessment, not only in terms of outputs but also the process. It should be inclusive to build consensus about the status and performance of the innovation system and agreement on actions, interventions and investments to strengthen any specific component. The following are suggested recommendations[3] for conducting AIS assessment:

a)   Understand the objective of the assessment and design the assessment methodology consequently;

b)   Adapt the existing methods to address the specific objective and guiding question;

c)   Strive for a good balance regarding the purpose and depth of the assessment;

The assessment should be demand-driven and led by AIS actors (including but not limited to policy makers), and be inclusive to develop capacities and facilitate understanding and use of findings to improve decision-making in terms of interventions and investments.

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[3] Report FAO-CIRAD experts' workshop (June 2018, Paris).

2.2. An integrated multidimensional analytical framework

The proposed analytical framework (Figure 3) draws on existing ones and experiences worldwide to assess AIS in a systemic way (TAP 2016; Schut *et al.*, 2015b, Lamprinopoulou *et al.* 2014) or its components (Spielman and Kelemework 2009, World Bank 2006; OECD 2013; Spielman and Birner, 2008, Wieczorek and Hekkert 2012, Bergek *et al.* 2015, Lamprinopoulou *et al.* 2014). The analytical framework is not inflexible. It should be adapted to the objectives and context of the assessment.

The framework puts emphasis on the integration and analysis of four analytical dimensions: structural, functional, capacity and enabling environment analysis. It highlights that analysis should go beyond these individual dimensions to take into consideration the interactions and relationships between the four dimensions, although it cannot be disconnected. The focus should be on how these analytical dimensions interact to affect the overall performance of the innovation system.

2. Analytical framework

Figure 3. Integrated analytical framework for a multiperspective assessment of AIS

STRUCTURAL ANALYSIS

(Actors, interactions and networks)

Who are the actors, what are their roles and interactions, how do they network and collaborate in innovation processes; what are power relations.

How actors, their interactions and networks contribute to innovation? And influence innovation functions?

How enabling environment influence the actors and their interactions?

FUNCTIONAL ANALYSIS

(Knowledge generation, access, learning, sharing, market development, guidance for search, creation of legitimacy entrepreneurial activities)

What are main functions performed? How and who perform these functions? What is the level of satisfaction; how collaboration takes place for a specific function, what are constraints for each function identified.

CAPACITY ANALYSIS

What are the capacities available, what are the gaps and needs? Capacity for why? for whom and for what? What are their capacities to perform a specific or group of functions, and what are the main challenges, constraints and opportunities related to fulfilling the functions?

ENABLING ENVIRONMENT

(Policies, investments, institutions, policy instruments, infrastructures)

What are policies, strategies related to agricultural innovation, how do they foster, promote, and facilitate innovations? How structural, functional and capacity is affected by policies? What are existing policy instruments? How effective are they? Are there infrastructures to support the emergence of innovation? What are major challenges to scaling of innovations?

In the following paragraph, a brief overview of the four analytical dimensions is provided.

- **Structural analysis:** mainly identifying and mapping actors (composition, diversity, presence, and roles; their interactions, complementarities and networks). A key output of the analysis is a map of the actors as well as their interactions and networks (e.g. power relations, influence and importance, decision making, resources sharing) and clarity of their roles in innovation processes. Some key questions to guide this part of the structural analysis include (but not limited to): *Who are the actors, what are their roles and interactions, how do they network and collaborate in innovation processes, and what are power relations. How actors, their interactions and networks contribute to innovation and influence innovation functions?*

- **Functional analysis:** addresses the functions performed within and by the system. A list of functions is provided that could be assessed. A key output is identification of functions performed, levels of satisfaction which will allow for identification of system failures. Multiple interactions exist between functions in a non-linear model. This affects, positively or negatively the overall performance of the system. Some functions are well documented in the literature such as knowledge brokering. Possible questions that can be asked: *What are main functions performed? How and who perform these functions? What is the level of satisfaction? How does collaboration take place for a specific function? What are constraints for each function identified?*

- **Capacity analysis:** focuses on the analysis of individual and collective capacities within the system. Capacities analysis include both technical and functional capacities. Technical capacities can be related to the mission and mandate of the actors or organizations while functional capacities focus on soft skills. Capacity analysis aims at identifying and analyzing existing or available capacities, desired capacities for achieving a desired objective in relation to the innovation system or function. Possible questions may include: *What are the capacities available? What are the gaps and needs? Capacity for why? For whom and for what? What are their capacities to perform a specific or group of functions? What are the main challenges, constraints and opportunities related to fulfilling the functions?*

- **Enabling environment analysis**: focuses on the analysis of policies, strategies, governance of innovation systems, infrastructure, and policy instruments (e.g. public-private partnerships, financial incentives for research and development) and how all these affect the innovation system. Key questions may include: *What are policies, strategies related to agricultural innovation, how do they foster, promote, and facilitate innovations? How structural, functional and capacity is affected by policies? What are existing policy instruments? How effective are they? Are there infrastructures to support the emergence of innovation? What are major challenges to scaling of innovations?*

The framework emphasizes a multi-dimensional analysis through various related lenses:

- How structures influence functions?

- What are capacities needed to fulfil specific function?

- Do actors have the capacities to fulfil the functions?

- How the environment is enabling or disabling the complex interrelationships between structure, functions and capacities?

2. Analytical framework

2.3. Flexible parts of the analytical framework

• **Scoping assessment questions and entry points in the AIS**

A set of scoping questions should be developed to guide the assessment and the use of the four dimensions of the analytical framework. Scoping questions are proposed in Section 4. The questions are indicative and should be reviewed and refined depending on the objective and context of the assessment. According to the scoping questions, some dimensions of the AIS can be assessed more thoroughly than the other dimensions. For instance, organizational capacity analysis of research actors can be selected as an entry point for a better understanding of the overall AIS performance.

Entry points are defined broadly as the areas that will be further investigated during the assessment and lead to subsequent action at country level for AIS strengthening. The entry points should mainly be related to factors that inhibit or constrain innovation processes. Entry points can also relate to systemic problems.

• **Defining indicators**

Indicators should be participatory defined and identified to guide the data collection process. Indicators should be selected if and only if they are relevant for the assessment. In other words, do they provide valuable insight on the issue? Not every single indicator should be used. There are a number of indicators defined in the literature that can be used, which are derived from national and international databases.

• **Selecting assessment tools**

A set of tools are proposed for data collection and analysis. The assessment team should discuss each tool to better understand the tool, what is it good for, how can it be used, what are the limitations and strengths of one tool vs another. The most appropriate tool should be used after evaluation of their potential for data collection and analysis. A toolbox with selected tools is proposed at the end of the document.

3.1 Overview of the four implementation phases

An overview of the approach is presented in Figure 4. It consists of four phases which are linked. Each phase consists of a number of activities. The approach should be tailored and adapted to each unique assessment situation in a country.

Figure 4. Flowchart of the approach

START

1. INCEPTION

2. CUSTOMIZATION

3. DATA COLLECTION, ANALYSIS AND INTERPRETATION

Data collection

Capacity strengthening, R&R and science-policy dialogues

Formulation of recommendations

Data analysis and interpretation

4. VALIDATION AND COMMUNICATION

FINISH
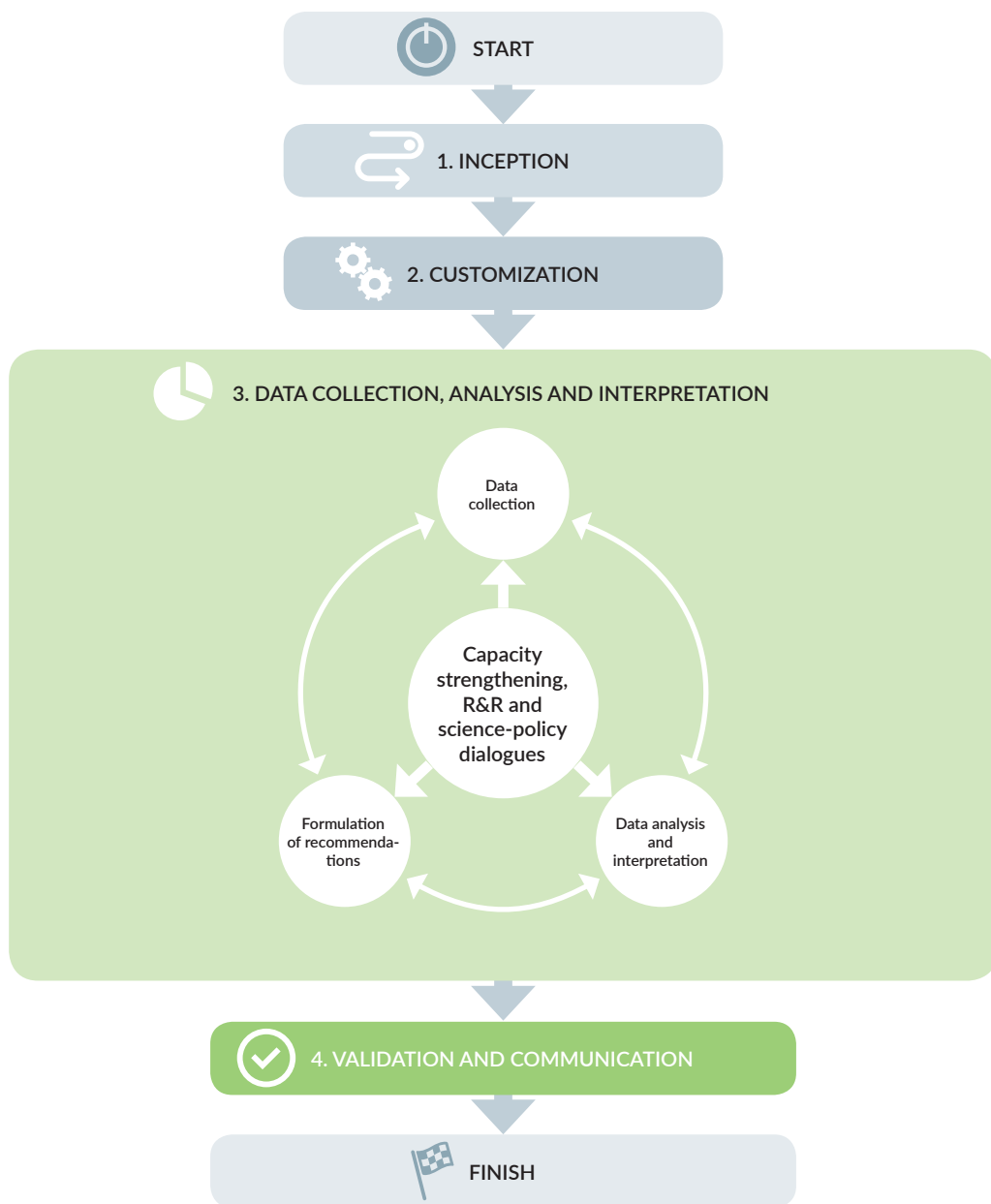
3. Operational framework

Each phase should be tailored to meet the objectives as well as to take into consideration capacities, resources, and time needed to effectively conduct the assessment. The approach proposes a number of reflection and refinement workshops as well as capacity development events. These events take place during the assessment itself (phase 4). At the end of each phase a simple checklist is proposed.

Phase 1. Inception

The inception phase aims to launch the process, galvanize commitment, develop buy-in of all relevant stakeholders, define the rationale and clarify expectations, and formulate some hypothesis for further investigation during the assessment. The duration of the inception phase can be between one to two months. It depends on the level of engagement and commitment, availability of resources, and facilitation by the lead organization. The following activities are proposed for the inception phase:

- establishment of an ad hoc committee;

- defining the rationale (why) of the assessment with specific objectives, clarify expectations, and if needed developing and agreeing on a vision of a desired future; identify some entry points for the assessment;

- brief characterization of the innovation system (scoping study) to take stock of key challenges, opportunities, constraints for innovation processes, mapping of actors, characterization of the boundaries of the system;

- organization of an inception workshop and definition of a first set of scoping questions from the AIS stakeholders' perspective;

- set up an assessment team;

- organize a training to build the capacities of the assessment team.

Phase 2. Customization of the assessment

The customization of the assessment is integral part of the capacity development process targeted at supporting actors who will form the assessment team. It aims are: a) to design a process that meets expectations and makes efficient use of resources and capacities available, and b) help the assessment team review and re-assess the expectations against the assessment framework.

The duration of this customization phase can vary from one to two months. It depends on the inherent capacity of the team as well as the resources available.

The following activities may be conducted:

- organization of team meetings to review and re-analyse the expected outputs of the assessment (seeking clarity following the inception phase and definition of the rationale);

- review and refine the list of scoping questions and hypotheses drafted during the inception phase;

- review and validate the boundaries of the system (characterization) as well as the main entry points for the assessment.

- selection and customization of tools and methods (qualitative and quantitative) of data collection, and preparation of matrixes or tables;

- selection of some key indicators for characterization and quantification whenever needed;

- identification of the list of AIS stakeholders, key informants and organizations to be involved in the assessment process;

- setup of a database whenever needed;

- review and taking stock of available resources and prepare detailed work plan.

Phase 3. Data collection, analysis and interpretation

The phase 3 consists of activities which are interconnected, a series of reflection and refinement mini-workshops as well as science-policy dialogue events. The duration of this phase can vary depending on the scope and depth, objective, expectations of the assessment, the level of engagement and mobilization throughout, and the capacity of the assessment team. The following indicative activities take place:

- Desk review and analysis of secondary data and information;

- Collection of data, using the approach and tools selected and customized in phase 2;

- Analysis and interpretation of data and formulation of preliminary recommendations;

3. Operational framework

- Organization of reflection and refinement mini-workshops for consolidation of recommendations;

- Preparation and sharing of a draft report of the assessment to seek feedbacks from diverse AIS stakeholders.

Phase 4. Validation and communication

In this phase, the results of the assessment are thoroughly and widely discussed with policy and decision makers and wider groups of AIS actors and then recommendations are validated. The validation and communication phase is not a once-off activity. It is continuous. The phase consists of a series of indicative activities as follows:

- organization of a participatory and multi-actor validation workshop;

- preparation of the final report with inputs, comments and suggestions collected during the validation workshop;

- organization of science-policy dialogue events;

- communication of the results.

In Figure 5, a timeline of the assessment is proposed. The assessment can be quick (three to four months), short (five to seven months) and long (+7 months), depending on many factors such as:

- objectives and expectations;

- leadership, facilitation by Lead Ministry and ad hoc committee, engagement, commitment and openness of all relevant actors;

- the existence and pace of on-going decision and policymaking processes;

- capacity and expertise of the assessment team;

- availability of resources, transparency, and political drive.

Figure 5. Timeline and major events for an action-orientated assessment

Assessment Report

Phase 4. Validation and communication (one to two months)

Validation

Phase 3. Data collection, analysis, interpretation Reflection and refinement workshops, science-policy dialogue events, preparation of draft report (three to seven months)

Mid-term

Phase 2. Customization (one to two months)

Phase 1: Inception (one to two months)

Inception

Participatory workshops

Training workshop of assessment team

Reflection and refinement mini-workshops

Science-Policy dialogue events

3. Operational framework

3.2 Guiding implementing principles

De Roo *et al.* (2017) suggested some common principles for conducting an assessment: clarifying the actors' objectives and expectations; balancing the breadth of the diagnosis with its depth; paying attention to power dynamics; avoiding an assumption of predictability; carefully combining quantitative and qualitative methods; and retaining a focus on informing action.

We propose a set of additional principles to guide the implementation of the four phases of the assessment:

- *National ownership:* the assessment should be owned by national actors. It should not be designed and implemented exclusively by external actors, nor internal actors only (risk of conflict of interest);

- *Consultation and inclusiveness:* actors should be consulted and invited to actively participate and seek their valuable inputs throughout the process. This is important if the outputs and recommendations are to be accepted. It is important to acknowledge that different stakeholders have different understandings of the assessment and have different capacities, and expectations;

- *Accountability:* actors involved are held accountable for their choices and decisions, and therefore the outcomes of the assessment;

- *Clarity of objectives and expectations:* objectives and expectations should be clearly defined and agreed among actors and entry points validated at the onset of the process;

- *Interactive, joint discovery and learning:* the assessment is an iterative process of joint discovery, experiential learning, reflection, capacity development and empowerment, negotiation and adaptive management;

- *Participation and peer learning:* actors of AIS are at the centre of the assessment process. The active participation (not representation) of relevant actors is a key element of success. The active participation is critical to ensure that the assessment is well adapted and respond to the needs and expectations of the actors. Collective reflection, peer learning, joint identification of issues, opportunities and shared visions, take place during the process. Participation and peer learning promote ownership, commitment and uptake of results and translation into actionable recommendations;

- *Integrated and systemic:* the assessment should be conducted through an integrated and systemic manner, focusing on the integration between structural, functional, capacity and enabling environment dimensions;

- *Simplicity:* while a good system analysis should be rigorous, it should remain a relatively simple process. There is a danger of being bogged down in the complexity of system analysis and spending too much time for mapping and analysing before moving to action;

- *Analysis should inform action (action-orientated):* ensure that the outputs of the assessment contribute and influence decision-making and capacity development of key actor.

3.3 Phase 1: inception

The inception phase aims to launch the process, galvanize commitment, develop buy-in of all relevant stakeholders, define the rationale and clarify expectations, and formulate some hypotheses for further investigation during the assessment. The inception phase is under the overall leadership and organization of the organization leading and managing the assessment. It could be the Ministry of Agriculture, but also other Ministry (e.g. Ministry in charge of Science, Research, Technology and Innovation). There is no single method nor a one size fits all solution for the inception phase, as the setup differs from one country to another. Due to the importance of this phase, it is advised to adopt an inclusive and participatory process involving key actors as well as policy and decision makers, whenever possible. The flowchart of Phase 1 is presented in Figure 6 below.

Figure 6. Inception phase flowchart

1. Establish or strengthen existing **ad hoc advisory committee**

2. Define the **rationale (purpose)** objectives and expectations

3. Conduct a **stocktaking** (scoping study)

4. Organize inception workshop

5. Set up assessment team

6. Organize a workshop to train the assessment team

3. Operational framework
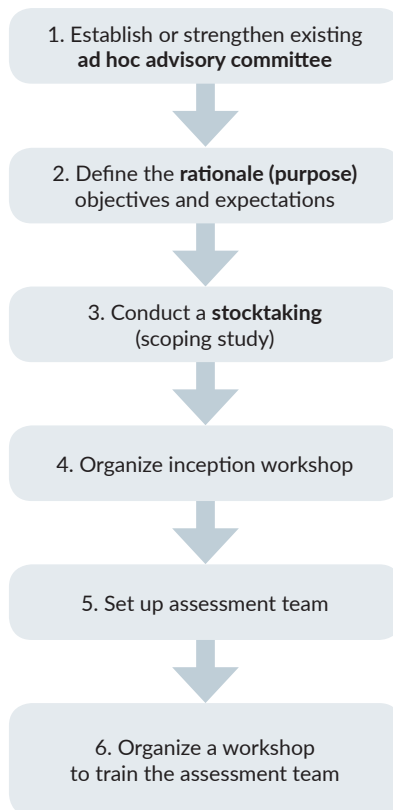
👉 Establish, or strengthen existing ad hoc advisory committee

At the onset of the process, the lead organization establishes an ad hoc advisory committee. The main focal point within the lead organization identifies the relevant stakeholders that could be designated as members of the committee. The ad hoc committee will provide strategic guidance and oversees the entire process. Ideally it should be composed of senior technical experts and policy and decision makers. Examples could include: experts from research organizations, extension and advisory services, representative of farmers organization, academia, private sector, policy and decision makers. To be effective and efficient, the ad hoc team should be of small size. The selection of the members of the ad hoc committee should be done in close collaboration of relevant stakeholders during the process. In some cases, existing committee can be strengthened.

Potential roles and functions of the advisory committee can include:

- oversee, coordinate and provide guidance throughout the assessment;

- provide and define the overall rationale, objectives and expectations of the assessment;

- prepare and communicate the rationale (why) of the assessment;

- provide regular feedback and strategic advice on overwhelming challenges encountered during the assessment;

- contribute to science-policy dialogue events;

- review and provide inputs to preliminary findings, review and validate the assessment report.

Potential outputs

- Ad hoc committee is established and operational.

👉 Define the rationale, objectives and expectations

The definition of the rationale, objectives and expectations should be done and agreed upon by the lead organization and corroborated by the ad hoc committee at the onset of the process. The definition of the rationale should help to define the boundaries of the assessment in terms of scope, breadth and depth. During the activity, a narrative of the desired change (practical visions) could be prepared. Practical visioning gives a positive and realistic picture of the desired future (MacKay, 2009). It answers the questions: where do we want to be, or what do we want to see happening in the future? Box 2 presents a sample of questions that can be used and adapted to help the ad hoc team in scoping the rationale of the assessment.

Box 2. Scoping questions to help define the rationale

- What is the vision of agricultural transformation?

- What are the priorities for agricultural development (productivity)?

- What are major challenges facing the agriculture sector, in particular agricultural productivity?

- Is there a vision for the national AIS?

- How do innovations emerge and develop in the agriculture sector?

- What are the main obstacles to innovation? What role innovation play in the vision for food and nutrition security, through increasing productivity and competitiveness of the agriculture sector?

- What are the causes of the low adoption of agricultural technologies and innovations?

- How effective is the AIS for supporting agriculture transformation?

- What is the general understanding about AIS?

- What major challenges AIS face?

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3. Operational framework

Potential outputs

- Rationale, objectives and expectations are clearly defined

Potential tools

- visioning;

- outcome mapping;

- rapid appraisal of AISs (RAAIS).

Conduct a quick stocktaking (scoping study)

Once the rationale (the "why") is defined, the next activity is to conduct a quick stocktaking (scoping study), in terms of:

- characterization and development of a baseline of the innovation system (mapping and identification of key actors);[4]

- quick review of their relations and interactions including power relations;

- quick analysis of strengths, weaknesses, opportunities and threats;

- overview of key enablers and disablers[5] of the innovation system performance;

- the environment that is shaping the innovation system (e.g. policies, infrastructures, strategies, finances, capacities, systemic instruments);

- identify systemic problems (Table 2).

---

[4] Table 1 can be used to map the actors and identify their potential roles.

[5] Example of enablers: articulation of expectations and visions, building of social networks, collective learning processes of multiple dimensions; disablers or innovation system failures: absence of infrastructure, lack of intellectual property rights, strong network failure, lack of technical and organizational capacities.

Examples of scoping questions to guide the stocktaking are provided in Box 3. In the report of the stocktaking a brief overview and analysis of the agricultural sector (e.g. major trends, challenges, vision for innovation) should be included. The report should provide priority entry points for the subsequent assessment of AISs. The report of the stocktaking will be presented and validated at the inception workshop.

Potential outputs

- report of stocktaking;

- entry points for the assessment identified;

Potential tools

- stakeholder analysis;

- social network analysis;

- focus group;

- semi-structured interviews;

- key informant interviews guide;

- problem tree analysis;

- strengths, weaknesses, threats and opportunities (SWOT);

- rapid appraisal of AISs.

3. Operational framework

Table 4. Systemic problems causing weakness or absence of the functions in the Ethiopian dairy sector

Innovation function	Observed weakness in innovation system functions (missing/weak)	Systemic failure (reason why system function is missing or weak)	Type of structural weakness
Knowledge development	• Education and research institutions underdeveloped until 1990s • Inadequate knowledge on institutional arrangements for coordinating complementary sources of knowledge • Little attention given to organizational innovation	• Narrow research focus on technology generation and dissemination • Research system lacks the capacity to analyse the bottlenecks in dairy value chains • Weak research capacity in socio-economics	Missing actors, capability failure, hard and soft institution failures, Interaction failure, merits in increased manpower training
Knowledge diffusion	• Adequate knowledge on livestock technologies is not accessible to farmers • Extension focus mainly on input supply • Smallholders left out of dairy development initiatives until 1980s • Few and weak dairy cooperatives	• Inadequate capacity in public extension system • Lack of coordination between agricultural departments • Budgetary constraints for extension agents to run activities • Extension agents overloaded with multiple activities • Extension agents lack guidelines to manage innovation processes	Hard and soft institution failures, interaction failure

Source: Kebebe *et al.* 2015

The stocktaking can be conducted by the lead organization or through independent consultants (a smaller team composed of two to three national consultants with strong record of similar assignments). It can last three to four weeks. It will mainly be based on secondary data analysis, key informants' interviews, focus groups discussion and semi-structured interviews.

Box 3. Examples of scoping questions for the stocktaking

- How is the national AIS structured?

- Who are the actors and their respective roles in the AIS?

- What are the major challenges to agricultural innovations?

- What are the key systemic drivers and barriers of innovation, notably with respect to innovation fostering sustainable development and the SDGs?

- What are the factors enabling or constraining innovation processes?

- What are existing innovations that have a high potential for scaling?

- How to ensure knowledge flows between innovative actors and regions and peripheral and underdeveloped regions in the country?

- What are the drivers and barriers of knowledge flows, learning, innovation collaborations and exclusion? And how can it be further strengthened?

- How inclusive is the AIS?

- What mechanisms have been developed to encourage cooperation between actors at national levels?

👍 Organize inception workshop

A one-day inception workshop is organized to launch the assessment. The workshop should be designed and prepared to allow interactions, knowledge sharing and open discussion between participants. This includes (inter-alia): clear objectives (see examples below) and expectations, facilitation, identification and selection of participants, venue, agenda, and follow-up plan. In addition of national participants, development partners, UN agencies, regional and international organizations, private sector, civil society organizations can be invited. Examples of objectives can include:

- Introduce and raise awareness about the assessment (its rationale, objectives and expectations);

- Galvanize commitment, mobilize stakeholders and develop buy-in for the assessment;

- Share and exchange knowledge and information about the results of the scoping study;

- Discuss ways to ensure an effective process and participation of all relevant stakeholders;

- Validate the main entry points for the assessment;

- Discuss the profiles and composition of the assessment team and roles and expectations of key stakeholders.

Potential outputs

- Awareness raised, commitment and engagement confirmed;

- Scoping questions and entry points for the subsequent assessment validated;

- Visibility and outreach about the assessment;

- Profiles of members of the assessment team agreed;

- Report of inception workshop.

Potential tools

- Icebreaking;

- Plenary session;

- Brainstorming;

- Focus group;

- Reflective feedback.

👉 Set up a team for the assessment

Based on recommendations of best fit profiles for the assessment team during the inception workshop, the lead organization assembles a small multi-disciplinary and multi-stakeholder team, composed of a mix of profiles and perspectives (about five to six members). Team members will be identified and selected from key organizations of the AIS (e.g. from research, extension, academia, policy, civil society organizations). Given the small size, not all actors can be represented in the team. Therefore, a transparent process should be established for the identification and selection of the best fit profiles and candidates. The assessment team should have combined skills and competencies on innovation systems studies, multi-stakeholder processes, participatory action-research, and strong analytical, communication, facilitation and lobbying skills. At least one team member should have a profile of policy or decision maker.

The team should be built. It should not be assumed that the team is automatically functional after identification and selection of its members. Expertise, roles and responsibilities of the team members should be well clarified. A team leader should be nominated. Team members will work under the leadership of the team leader who will be responsible for ensuring that the assessment is conducted in an effective and efficient way against the objectives and expectations. The lead organization in close consultation with the ad hoc committee may optionally recruit an independent and experienced freelance consultant to provide technical support and facilitation during the assessment. He/she should be a senior expert with a sound knowledge of AIS concepts and approaches as well as proven experience in assessment and evaluation, preferably in innovation system studies.

Potential outputs

•   Assessment team is established and operational.

3. Operational framework

👉 Training of the assessment team

The lead organization organizes a 3-day workshop to train the assessment team. The workshop should be facilitated by two to three independent experts (preferably external expertise if resources and time allow).
The duration of the workshop can be adjusted depending on needs, capacities available and gaps, and current understanding of AIS concepts and approaches and of the entire assessment process. The workshop should be conducted through an interactive and participatory process, encouraging collective learning from practical experiences, co-creation of vision, sharing views and experiences, planning, preparation of the assessment, identify and evaluate challenges, and agreeing on concrete actions, or strategies and make concrete suggestions regarding the assessment.

The training should combine both theory, learning/exchange and practical field testing. The training venue should be selected in a way to provide enough space for interactive work, and exchange.

At the end of the workshop, the assessment team should be familiar, internalize and understand well AIS concept, approaches and roles and functions of AISs. It should also be well acquainted with the guidelines and its analytical framework, the approach for assessment, and finally master the overall assessment process.

Potential outputs

• Capacities of assessment team strengthened on AIS and the assessment

• Draft work plan developed

• List of key informants and relevant organizations prepared

• Scoping questions prepared

• Selected tools identified and adapted

🔧 *Potential tools*

• Icebreaking

• Plenary session

• Brainstorming

• Focus groups

• Reflective feedback

🔍 **Checklist – Inception**

👉 Has the lead organization made explicit and unequivocal the purpose of the assessment and provided some rationale, objectives and expectations?
☐ Yes ☐ No

👉 Has the purpose of the assessment been communicated widely to promote buy-in, foster engagement and commitment?
☐ Yes ☐ No

👉 Has the lead organization agreed and allocated resources for effective implementation of the assessment?
☐ Yes ☐ No

👉 Has the ad hoc committee been established and operational with clear terms of reference?
☐ Yes ☐ No

👉 Has the scoping study been conducted and a system of interest (issues) identified?
☐ Yes ☐ No

👉 Has the inception workshop been organized?
☐ Yes ☐ No

👉 Is the assessment team established, and capacitated on concept, approaches, and tools on AIS and assessment?
☐ Yes ☐ No

If yes, the process can carry on. If no, the team (under the leadership of the team leader, and in consultation with the ad hoc committee) should re-assess the situation, evaluate options and strategize accordingly.

3. Operational framework

3.4 Phase 2: customization

The customization phase is an integral part of the capacity development process. Its objectives are to help the assessment team review and reassess the draft work plan prepared during the training workshop, and to further customize the assessment approach and process for meeting objectives and expectations.

Although the customization is proposed as phase 2, it should be considered as an on-going process of adaptation through the reflection and refinement workshops in phase 3 (conducting the assessment/diagnosis). The duration depends a lot on the inherent capacity of the team as well as the resources available for the assessment. Unlike the inception phase which is presented as a sequence of activities step-by-step, the customization phase is integrated and cyclic with a series of activities that can take place simultaneously. A schematic diagram is presented below (Figure 7).

Figure 7. Activities of the customization phase

Review and validate the boundaries of the system (characterization) as well as the main entry points for the assessment

Review list of scoping questions and hypotheses

Conduct additional field tests

Select and customize tools and methods (qualitative and quantitative) and prepare some or tables, as well as for tools for data analysis

Validate detailed plan of activities with budget

Customization

Develop a data architecture and setup/ construct database

Review and take stock of available resource (budget)

Select some key indicators for characterization and quantification

Review and finalize the list of key informants, and organizations to be interviewed

In the following paragraphs, a description of each activity is presented.

👉 Review and validate the boundaries of the system

The characterization of the innovation is reviewed further by the assessment team. The entry points (areas/issues that will be investigated further during the assessment for subsequent action at system level) will be reviewed and discussed. The boundaries can be actively defined by the actors making up the system. Feedbacks, inputs and specific guidance by the ad hoc committee can be sought at this stage to clarify further the expectations and validation of the issues to focus upon the assessment. Entry points can be systemic problems identified during the scoping study.

Potential outputs

- Innovation system is fully characterized;

- Some entry points to guide the assessment identified.

🛠 *Potential tools*

- Brainstorming;

- Reflective feedback;

- Context diagram.

👉 Review list of scoping questions and hypotheses

IIn this activity, a list of predefined scoping questions is reviewed to match the questions with the entry points according to the specific dimensions of the AI. It means that the scoping question could be of structural, functional, capacity, or enabling environment analysis nature. Formulating well constructed scoping questions is essential for the customization of the assessment approach and tools.

The scoping questions should be clear and focused, not too vague, not too specific, and not too broad. They are based on realistic hypotheses on enablers or disablers underpinning AIS performance.

Points to keep in mind are: does it address AIS stakeholders' concerns, is it focused and answerable, and will it add new insights for AIS stakeholders. Based on the entry points, open-ended questions will be prepared.

Potential outputs

- Hypotheses formulated;

- Predefined scoping questions are formulated.

Potential tools

- PICOT;

- FINER;

- What, how and why questions.

👉 Customize tools and methods

The assessment team prepares matrixes or tables, as well as tools for data analysis. The Common Framework on capacity development for AISs (guidance note on operationalization) of the Tropical Agriculture Platform (TAP) provides a series of tools with detailed description of each that can be used Tropical Agriculture Platform, 2016. Not all the tools should be used. The customization implies adapting the tools in relation to the scoping questions and associated indicators. Selected tools and methods during the training workshop will be reviewed and adapted based upon the scoping questions, the selected analytical dimensions and types of data to be collected. A series of tools are provided for each step of collecting, analyzing and interpreting data.

Potential outputs

- Selected tools and methods identified and customized;

- Matrixes for data collection designed.

👆 Select some key indicators for characterization and quantification whenever needed.

Based on the scoping questions, the assessment team decides on how to mobilize the analytical framework and concurrently identify a set of indicators. Indicators can be selected from a wide range of existing and available databases (e.g. databases from World Bank, FAO, or IFPRI/ASTI). Grovermann *et al.*, (2017) provide a list of selected indicators that can be used. The identification and selection of indicators should be done keeping in mind that not all indicators should be used. Indicators should be selected if and only if they are relevant from the perspective of AIS stakeholders for the stocktaking and analysis of the AIS (i.e., structural, functional, capacity, enabling environment).

Potential outputs

- List of key indicators prepared.

👆 Review and finalize the list of key informants, and organizations to be interviewed.

A refined list of key informants and actors (individuals and organizations) will be prepared based on the first draft prepared during the training workshop. The first list will be developed based on the stakeholder analysis and mapping. Key informants are defined as experts with firsthand knowledge, who have particularly informed perspectives on an aspect of the issue being evaluated. Key informant interviews are qualitative in general. The list can be extended using snowball sampling approaches. Snowball sampling is defined as a selecting participants/key informants by finding one or two key informants and asking them to refer the interviewer to other key informants. The sampling can go on and on till the time the interviewer has enough data to analyse and reach a level of saturation whereby no new information/data is collected.

Potential outputs

- List of key informants reviewed and validated.

🛠 *Tools*

- Key informant interviews guide.

👉 Develop a data architecture and database

The data collected during the assessment is a valuable resource. The assessment team shall prepare a data architecture, whereby all the data will be stored for further validation, cleaning and processing. If there is available database, it can be used, if not a simple and user-friendly structure shall be designed. A simple process for designing a database structure includes: a) identify the purpose of the database, b) define the type of data and organize the information required, c) turn information into columns and specific primary keys, d) set up the table relationships, e) lay-out a visual representation of the database (understanding relationships), f) normalization of the database and g) refine the design.

Potential outputs

- Database is designed.

🔧 *Tools*

- Mind map;

- Microsoft Access;

- SQLite;

- MySQL.

👉 Conduct additional field tests

A quick test of feasibility is conducted (assess the practicality of the process) through few interviews, visit and meeting with selected organizations. The testing is a reality check to ensure that the right tools and methods are selected and fine-tuned. The testing can allow for validating a specific tool, assessing its reliability and usability to collect data and information. The results of the testing will be used to review, adjust and standardize the tools and methods, review and refine matrixes, reframe the questions, assess alternative options, determine success factors, identify potential constraints and develop mitigation options. The field tests can be conducted once or twice depending on the duration of the fine-tuning step.

Potential outputs

- Research questions refined and validated;

- Tools refined and adapted.

👉 Validate a detailed plan of activities with budget

At the end of the customization phase, a comprehensive work plan and detailed budget should be prepared. Prior to the launching of the assessment, it is important to ensure that all resources allocated are made available for the assessment. The team leader should ensure that resources for the assessment are mobilized and made available. A meeting with the ad hoc could be organized to share the plan and to anticipate any last-minute change that may hinder the assessment process.

Potential outputs

- Work plan is refined and validated;

- Budget is confirmed and available.

Checklist – Customization

👉 Has the timeline for team meetings been designed and agreed upon by team members?
☐ Yes   ☐ No

👉 Has the innovation system been fully and clearly characterized?
☐ Yes   ☐ No

👉 Have scoping questions been clearly defined and validated by the assessment team?
☐ Yes   ☐ No

👉 Have tools and methods for data collection been refined and agreed upon by the team?
☐ Yes   ☐ No

👉 Have key indicators been defined and data to inform the indicators characterized?
☐ Yes   ☐ No

👉 Has the list of key informants been agreed upon?
☐ Yes   ☐ No

👉 Has a database been designed?
☐ Yes   ☐ No

👉 Have tests of feasibility been conducted?
☐ Yes   ☐ No

👉 Have a detailed work plan and budget been validated and agreed upon?
☐ Yes   ☐ No

3.5 Phase 3: data collection and analysis

Data collection and analysis consists of a series of activities which are interconnected with a number of feedback loops, a series of reflection and refinement mini-workshops as well as science-policy dialogue events. The phase can be quick (two to three months), short (four to six months) or long (> 7 months) depending on the objectives, expectations, and many other related factors. The activities (Figure 8) can be adapted and tailored to meeting the needs and objectives of the assessment.

Figure 8. Activities during data collection

Desk review and analysis of secondary data

Collect data based on scoping questions and hypotheses

Store, analyze and interpret data

Prepare a draft of preliminary findings, and formulate draft recommendations

Organize reflection and refinement mini-workshops

Organize science policy dialogue events

Organize mid-term workshop to share preliminary results and seek feedbacks

Share the draft for feedback

Data collection and capacity development events

The following sections provide a brief introduction to each activity.

3. Operational framework

👉 Desk review and analysis of secondary data and information.

The team will undertake a desk review and analysis of secondary data. Secondary data analysis and review involves collecting and analyzing a vast array of information. It is valuable for gaining knowledge and insight into an issue before embarking in primary data collection. It complements, but does not replace, primary data collection and should be the starting point for any research. Sources of secondary data include: official statistics, scientific articles, monographs, technical reports, and strategic documents. Secondary data is a source of valuable data information that can help tremendously in the analysis and the establishment of a baseline scenario.

Potential outputs

- Secondary data referenced;

- Key insights, data and information gathered.

👉 Collect data based on scoping questions, using tools selected and customized

Based on scoping assessment questions, and capitalizing on the secondary data analysis, specific data is collected. The data collection process combines a number of tools and methods (qualitative and quantitative). For data collection, it is important to know the difference between what is worth knowing and what is not, enabling the collection of information that is required for the assessment. This avoids collection of irrelevant data.

Types of data

Qualitative and quantitative data should be collected on the structural, functional, capacity and enabling environment (analytical framework with emphasis on the interaction between these four dimensions. To guide data collection, a number of scoping questions are proposed. The assessment team should review these questions and adapt each to the context, objectives and expectations, but also to ensure that by asking the questions, relevant data will be gathered to inform a specific indicator. The link and understanding of how starting from the question, an indicator can be defined and specific data should be collected is very important. This will avoid collecting unnecessary data.

The following are scoping questions formulated around the four dimensions of the analytical framework (structural, functional, capacity and enabling environment). Given the complex and adaptive nature of AIS with multiple interactions between actors with certain types of capacities and fulfilling specific functions with their environment, the scoping questions should be narrowed around the issues that are of interest during the assessment.

Scoping questions should be adapted based on the issue that is central to the assessment. The list is informative and should be carefully reviewed and reformulated by the assessment team. Additional scoping questions can be proposed. Efforts should be done to formulate questions that cut across a single dimension, instead of a crossroad of the four dimensions (structural, functional, capacity and enabling environment).

Sample of scoping questions for the structural analysis:

- Who are the actors and stakeholders, and what are their respective roles and mechanisms for interaction, collaboration and networking, and for learning and co-generation of knowledge?

- How inclusive is the system and what are the power relations within the networks? What are the mechanisms for decision-making within formal and informal networks?

The following activities can be conducted for data collection:

– *Visualize a timeline of the system, highlighting how it has evolved over time;*

– *Conduct a stakeholder analysis;*

– *Analyze interactions and networks between stakeholders.*

Sample of scoping questions for functional analysis:

- What are the functions performed within the AIS, by which actors, and how do they spur innovation processes?

- How do actors of AIS and their interactions/networks affect functions within the system? What are their capacities to perform a specific or group of functions, and what are the main challenges, constraints and opportunities related to fulfilling the functions?

- How is knowledge generated, shared, accessed, learned, diffused and used within the system? And what are the mechanisms used, challenges and constraints related to knowledge flows between actors?

- What are the mechanisms for resource mobilization within the system? How are they coordinated to ensure effectiveness and efficiency in supporting innovation activities?

The following activities can be conducted to collect specific data:

- Identification and description of the functions performed by and within the system;

- Analysis of each function independently in terms of who is performing the function, how, and how well;

- Analysis of the innovation system in terms of overall strengths, weaknesses and gaps regarding the functions and their root causes and impacts on AIS.

Sample of scoping questions for capacity analysis:

- What are the capacities available?

- What are the capacity gaps and needs?

- What are the constraints to capacity development?

The following activities can be conducted:

- Conduct capacity needs assessment

Sample scoping questions for enabling environment analysis:

- Is there an agricultural policy framework? How does it function? What are the strengths and weaknesses?

- What are the main characteristics of STI policies (governance, instruments, expenditure)? To what extent do science and technology policies, and associated funding, enable innovation either by supporting multi-stakeholder collaboration, scaling up innovation (such as incubators or venture capital), or leverage private research investments?

- To what extent do governments set the agenda for research and innovation and provide normative guidelines? To what extent do they participate in priority setting and decisions on funding?

- Are there specific measures to improve innovation processes?

The following activities can be conducted:

- Mapping and analysis of relevant policies (trade, infrastructure, agricultural, research, extension, education, investment);

- Analysis of the governance of AIS (identify governance mechanisms, challenges and constraints, opportunities);

- Analysis of regulatory frameworks (tax, intellectual property rights, policy instruments, incentives, trade, infrastructure, agricultural, research, extension, education, investment).

Potential outputs

- Data collected and analysed;

- Matrixes, graphs, diagrams developed.

 Tools

- Database architecture;

- Focus group;

- Semi-structured interviews;

- Key informant interviews guide;

- SWOT;

- Stakeholders analysis;

- Net Map;

- Organizational capacity assessment.

3. Operational framework

👉 Organize reflection and refinement (R&R) mini-workshops

The assessment team organizes mini-workshops (attended by its members and whenever needed relevant members of ad hoc committee) to reflect and refine the process. These mini-workshops might confront ideas, capture lessons (what went well, did not go well, what are the issues and how to handle each, what could be done differently, how and why) from the implementation of the assessment, identify issues and jointly agreeing on alternative options, adjust and refine specific tools, activities or data collection methods. The organization of R&R workshops should be guided by specific needs and issues. Depending on the scope and breadth, duration of the assessment and speed of the process of data collection, analysis and interpretation, R&R workshops can be organized every month or whenever needed. In fact, R&R should be seen as an ongoing process with a number of "pause" meetings to take stock, adjust and adapt. The R&R workshops can follow three basic questions: a) what just happened? (What?) = action and experience; b) what does it mean? (So what?) = reflection and generalization, and c) what will we do about it? (Now what?) = planning and application.

Potential outputs

- Methodology revised;

- Data curated;

- Challenges assessed and mitigation options agreed;

- Progress is assessed.

🔧 *Tools*

- Idea storms;

- Brainstorming.

👉 Organize meetings between the assessment team and policy and decision makers

In order to facilitate the appropriation of data and ensure effective uptake of the results and recommendations of the assessment, a number of science policy dialogue events will be organized. The team leader and the representative of policy or decision maker in the team should organize and facilitate the events. As for the R&R mini-workshops, the timeline of these events depends to a great extent on concrete outputs of relevance to the policy agenda. Once the issues have been identified or results have been generated, the event is organized. The team leader supported by the ad hoc committee should identify which part of government to engage with. Entry points should be identified (senior level or intermediary level depending on country). If issues cut across the responsibilities of several departments, it is important to then look for the 'best' entry point for advice such as cross-departmental committees or some existing policy platforms.

Meetings between assessment team and policy makers are short events (half day) and should be well organized. Events should be framed around issues of policy interest, involve relevant policy and decision makers, and use participatory and deliberative processes[6] with emphasis on two-ways active dialogue, and engagement and not lecturing.

Potential outputs and outcomes

- Gaps between science-policy narrowed;

- Changes in knowledge, attitudes and practices of understanding science policy interfaces;

- Capacities of the two groups strengthened;

- Joint strategic thinking and reflection on specific recommendations proposals;

- Policy adaptations/changes brainstormed.

🛠️ Tools

- World café;

- Focus group;

- Brainstorming;

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[6] Involve bringing together key stakeholders to combine different types of evidence, incorporate diverse opinions and to ground decisions in relevant, feasible and implementable advice.

- Plenary discussion;

- Role playing and simulations.

👉 Organize mid-term workshop to share preliminary results and seek feedback

Approximately one to two months after the initiation of data collection, analysis and an interpretation process and after the first R&R event, a mid-term workshop should be organized. The aim is to present and share preliminary findings gather feedbacks and suggestions and fine-tune the methodology, assess challenges and constraints encountered, and identify mitigation measures, as needed. It also serves to galvanize further commitment to the assessment and its results. The lead organization is responsible for the overall organization of the workshop. This shall be done in close collaboration (technical advice) with the ad *hoc* committee and the assessment team. Before the workshop, the assessment team prepares a short brief on the preliminary findings which is shared with the ad hoc team as well as some relevant actors that shall be invited. The assessment team prepares the agenda and workshop materials.

Potential outputs and outcomes

- Engagement and buy-in further strengthened through better understanding of issues at stake;

- Issues of interest are clarified and agreed;

- Feedbacks and recommendations gathered;

- Reflections and policy dialogues initiated, as well as exploration of concrete actions to overcome the issues and strengthen AISs;

- Decisions reached on ways forward;

- Draft of preliminary results improved.

 Tools

- Focus group;

- Plenary session;

- Reflective feedback;

- Brainstorming.

👉 Analyse data and prepare draft report of the assessment and formulate recommendations

Data analysis should be conducted iteratively during data collection. The analysis will focus on each dimension (structural, functional, capacity and enabling environment), but most importantly from an integrated systemic perspective. Matrixes combining two dimensions together can be used to support the gradual integration of the four dimensions in a final consolidated analysis. Once this consolidation is satisfactory, a first draft report of the assessment is prepared.

Potential outputs

- Draft report and country AIS profile is prepared with preliminary recommendations formulated.

👉 Share the draft profile with relevant stakeholders (policy makers, AIS actors, some development partners) to request feedback if relevant

The draft report with AIS profile is then shared with relevant stakeholders to request feedback. The draft should be seen as a working document. It should not be widely advertised. A report template is provided in Annex 1. The draft should be shared widely to communicate the outcomes of the assessment and allow stakeholders to prepare and provide their feedbacks in a timely manner. The report should be as informative as possible with an objective response to the assessment, and with concrete and actionable recommendations. It should be drafted in a user-friendly manner (use infographics, diagrams).

Potential outputs

- Feedbacks and insights on findings are collected;

- Draft report is reviewed.

Checklist – Conducting assessment

Has the team reviewed and referenced secondary data?
☐ Yes   ☐ No

Has all the data collected been stored and curated?
☐ Yes   ☐ No

Have the modalities of data analysis and interpretation been agreed?
☐ Yes   ☐ No

Is there a team consensus on main findings of the assessment?
☐ Yes   ☐ No

Have recommendations been formulated clearly and realistically, and implications for policy assessed?
☐ Yes   ☐ No

Has the assessment team prepared a draft of preliminary findings?
☐ Yes   ☐ No

Has the mini-workshop to share preliminary findings been organized and feedbacks incorporated through R&R workshops?
☐ Yes   ☐ No

Have the R&R workshops been conducted in an effective way?
☐ Yes   ☐ No

Have the science-policy dialogue events been organized?
☐ Yes   ☐ No

Has the draft report been prepared and shared widely?
☐ Yes   ☐ No

3.6 Phase 4 : validation and communication

In this phase, the results of the assessment are thoroughly prepared, discussed widely with policy and decision makers and wider AIS actors and then validated. The validation and communication phase is not a onetime activity. The following activities are proposed:

👉 Organize a validation workshop

The validation workshop is conducted at the end of the assessment. It aims at presenting the main findings, and key recommendations and their implications. The validation workshop is an important event that should be carefully and well organized. It could be organized for one or two days to allow and give a space to discuss sufficiently the findings and their implications. It should be organized by the lead organization supported by the ad hoc committee and assessment team. Given the importance of the event, a preparatory meeting of the workshop could be organized. The draft report of the assessment should be prepared and widely shared ahead of the validation workshop with key actors.

Potential outputs and outcomes

• Engagement and buy-in further strengthened through better understanding of issues at stake;

• Feedbacks, inputs and recommendations on findings and report are collected.

🛠 *Tools*

• Focus group;

• Plenary discussion;

• Brainstorming.

3. Operational framework

👉 Prepare the final report with inputs, comments and suggestions from the validation workshop

The preparation of the report is an on-going process which starts from the onset of data collection and analysis process and runs until the validation at the end of the assessment. It is not a oneoff activity done at the end of the assessment. It involves and implies a number of iterations, reflection and refinement during the data collection and analysis processes as well as continuous engagement with policy and decision makers. At this stage of validation, the report should have benefited from many inputs, suggestions and comments. The assessment team shall ensure that these valuable contributions are reflected in the final report.

Potential outputs

- Final report prepared with feedback and inputs collected during the validation workshop.

Checklist – Validation and communication

👉 Has the lead organization agreed to organize the validation workshop?
☐ Yes   ☐ No

👉 Is the ad hoc committee involved in the organization of the validation workshop?
☐ Yes   ☐ No

👉 Is there a need to organize a preparatory meeting ahead of the validation workshops?
☐ Yes   ☐ No

👉 Has the report of the assessment been edited and shared widely?
☐ Yes   ☐ No

👉 Have the agenda, workshop materials and venue prepared?
☐ Yes   ☐ No

👉 Has communication and outreach been included in workshop program?
☐ Yes   ☐ No

👉 Have all relevant actors and stakeholders been identified and invited?
☐ Yes   ☐ No

👉 Have the roles of lead organization, ad hoc committee and assessment team during the workshop clarified and agreed?
☐ Yes   ☐ No

👉 Is there a need to hire an independent facilitator to facilitate the workshop?
☐ Yes   ☐ No

👉 Is there clarity in terms of roadmap and ways forward post assessment?
☐ Yes   ☐ No

👉 Has the final report been edited and submitted to the lead organization (including all the database) and materials gathered during the assessment?
☐ Yes   ☐ No

3. Operational framework

Annexes

Annex 1. Suggested outline of the report of AIS assessment

Foreword

Executive summary

List of acronyms

Recommendations

Introduction

- About the report

- Research approach

- Structure of the report

1. Understanding the national context

- National development context

- Economic growth and performance/structure of the economy

- Agriculture sector and need for sector development to meet food security and other development goals

- Challenges, constraints to innovation

- Types of innovation,

- Vision for agriculture development and the role and contribution of AIS

2. Overview of the assessment process

3. Main findings of the assessment

4. Key recommendations and implications for policies

Conclusion

References

Annexes

Annex 2. Toolbox

- **Actor map:** visual depiction of the key organizations and/or individuals that make up a system, including those directly affected by the system as well as those whose actions influence the system. (available at: https://www.fsg.org/tools-and-resources/guide-actor- mapping#download-area; http://intersector.com/resource/system-mapping-a-guide- to-developing-actor-maps/)

- **Brainstorming:** used to solve a process problem, to develop new ideas or design innovations, to solve intergroup communication issues, to enhance customer service, to budget exercises, to develop initiatives. The approach fosters creativeness through a free flow of ideas. (available at: https:/ www.cabi.org/Uploads/CABI/about-us/4.8.5- other-business-policies-and-strategies/tap-guidance-note.pdf)

- **Context Diagram:** aims to identify and focus attention on external factors and events that should be when assessing the system functions and constraints. A system context diagram is often used early in a project to determine the scope under investigation. (available at: https://online.visual-paradigm.com/knowledge/system-context-diagram/what-is- system-context-diagram)

- **FINER:** Stands for feasible, interesting, novel, ethical, and relevant. The FINER framework is used for formulating research questions. FINER allows researchers to ponder the philosophical, logical, and scientific implications of writing research questions (available at: https://www.scalelive.com/finer.html)

- **Focus group:** is a way to gather together people from different backgrounds or experiences to discuss a specific topic of interest. The group of participants is guided by a moderator (or group facilitator) who introduces topics for discussion and helps the group to participate in a lively and natural discussion amongst themselves. (available at: https:// www.odi.org/publications/5695-research-tools-focus-group-discussion; https:// www.eiu.edu/ihec/Krueger-FocusGroupInterviews.pdf)

- **Formal surveys:** a survey is a research method used for collecting data from a pre-defined group of respondents to gain information and insights on various topics of interest. Surveys have a variety of purposes and can be carried out in many ways depending on the methodology chosen and the objectives to be achieved.

- **Icebreaker:** activity that allow the various people to get to know each other and become more comfortable with discussing the topic of discussion and with expressing dissenting views. The icebreaking tool offers an opportunity to establish a "culture" and set the tone for workshop.

- **Key informants interviews:** qualitative, in-depth interviews of 15 to 35 people selected for their first-hand knowledge about a topic of interest. Key informant interviews resemble a conversation among acquaintances, allowing a free flow of ideas and information. (available at: https:/ www.betterevaluation.org/en/ evaluation-options/ key_informant_interviews)

- **Microsoft Access:** is a desktop relational database management application. It allows users to create storage structures for data, manipulate and analyze that data, and format the data for output.

- **MySQL:** MySQL is an Oracle-backed open-source relational database management system (RDBMS) based on Structured Query Language (SQL).

- **Net-map:** tool developed to help understand and visualize how stakeholder goals work out in a multi-stakeholder partnership. This tool helps stakeholders to determine which actors are involved in a given network, how they are linked, how influential they are, and what their goals are. (available at: https://netmap.files.wordpress. com/2008/06/net-map-manual-long1.pdf; http://netmap.wordpress.com)

- **Organizational Capacity Assessment:** The method provides a checklist of issues used to help issues used to help decide how the organization(s) should be assessed; the checklist can also be used to verify that the issues mentioned have been addressed in the previous evaluation (available at: https:/ www.cabi. org/Uploads/CABI/ about-us/4.8.5-other-business-policies-and-strategies/tap-guidance-note.pdf; https://www.idrc.ca/en/book/organizational-assessment-framework-improving- performance?PublicationID=241)

- **Outcome Mapping:** used to capture the understanding and expectation of the different groups of people. Outcome mapping support innovation facilitators to understand the progress of change among direct partners. It therefore support them to think systematically and practically about what they are doing and to adaptively manage variations in strategies to bring about desired outcomes (available at: https://tapipedia.org/sites/default/files/outcomemapping.pdf)

- **Paired listening:** promote an active listening in order to assist the person who is talking. Listening actively the participants of the group is important to develop trust among partners. When the participants listen to other members of the group, they can unfold their thoughts (available at: https:/ www.gp-training.net/training/ communication_ skills/mentoring/listen2.htm)

- **PICOT:** used to form a research question and facilitate the information search. The framework PICOT can support the identification of a research question. PICOT

Annexes

stands for: Problem, Intervention, Comparison, Outcome and Time (available at: https://libguides.gvsu.edu/c.php?g=108494&p=702791)

- **Plenary Sessions and Discussions:** The plenary sessions bring together all the participants in a single space for group instruction or discussion. These sessions should occur regularly across the day, they can include an opening meeting with agenda setting, mid-day discussions, final presentations and closing remarks. Plenary sessions may be thought of as learning-focused complements to the other sessions. These sessions are essential to finding interconnections between the parallel processes that took place in groups and reaching agreements during the discussions.

- **Problem tree analysis:** helps identify a capacity issue as a core problem, as well as its effects and root causes. This method helps initiate and follow up on the collaborative design and implementation phase. It helps clarify the precise capacity development objectives that the intervention aims to achieve (available at: https:/www.tapipedia.org/sites/ default/files/tool_problem_tree.pdf; https://www.odi.org/publications/5258- planning-tools-problem-tree-analysis);

- **Rapid Appraisal of Agricultural Innovation Systems (RAAIS):** diagnostic tool that can guide the analysis of complex agricultural problems and innovation capacity of the agricultural system in which the complex agricultural problem is embedded. RAAIS focuses on the integrated analysis of different dimensions of problems (e.g. biophysical, technological, socio-cultural, economic, institutional and political), interactions across different levels (e.g. national, regional, local), and the constraints and interests of different stakeholder groups (farmers, government, researchers, etc.). (available at: https://www.wur.nl/en/article/raais-toolkit.htm)

- **Reflective feedback:** assist the participant in improving their knowledge, skills, attitudes or behaviors relevant to the project objectives and goals. In order to be constructive, the feedback must contain information upon which the participant can use to improve performance (available at: https://fid.medicine.arizona.edu/preclinical/feedback/reflective)

- **Role-plays and simulations:** With role play, participants assume different roles and act out scenarios, typically without any scripts. These spontaneous scenarios can be situated in reality or ones they are unfamiliar with. Role play and simulations contribute greatly to the learning of a participant, as they can understand several viewpoints in a demanding environment. (available at: https://academictechnologies.it.miami.edu/explore-technologies/technology-summaries/role-play-and-simulations/index.html)

- **Semi-structured interviews:** used to gather focused, qualitative textual data. It offers a balance between the flexibility of an open-ended interview and the focus of a

structured ethnographic survey. Semi-structured interviews are used to obtain specific quantitative and qualitative information from a sample of the population; to obtain general information relevant to specific issues, (i.e.: to probe for what is not known); and gain a range of insights on specific issues. (available at: http://evaluationtoolbox. net.au/index.php?option=com_content&view=article&id=31&Itemid=137; https:// www.fao.org/3/x5307e/x5307e08.htm)

- **Social network analysis:** practical tool that looks at the linkages present in an innovation network and monitors their development over time. It maps the relationships between the stakeholders in the network and highlights the changes between them. It considers the nodes of a network, which represent individuals, groups, organizations or institutions, and the links that connect the nodes to one another. (available at: http:/ www.managingforimpact.org/tool/social-network-analysis-sna)

- **SQLite:** SQLite is a software library that provides a relational database management system. The lite in SQLite means light weight in terms of setup, database administration, and required resource. SQLite uses dynamic types for tables. It means it is possible to store any value in any column, regardless of the data type (available at: https:/ www.sqlite.org)

- **Stakeholder analysis:** planning and management tool to identify and analyze the stakeholders involved and their interrelations. It sets the domain of people, groups and organizations (including donors) whose interests and influence on policy should be taken into account when conducting the impact analysis for a particular policy.

- **Stakeholder mapping:** tool to identify actors and to obtain a general overview of the stakeholder and organizational landscape.

- **SWOT analysis:** decision-making tool used to identify the strengths, weaknesses, opportunities and threats facing an organization or multiple organizations in a value chain or sector. It assesses the strengths and weaknesses of the organization's internal attributes, such as its capacity (i.e. the resources that an organization possesses and the processes used to manage them) and its motivation (i.e. the factors that influence the direction of the organization and the energy invested in its activities). (available at: http:// www.fao.org/3/a-i3538e.pdf; http:/ www. mspguide.org/tool/swot-analysis)

- **Timeline:** use when stakeholders embark upon the self-assessment phase of their innovation partnership or project. The tool divulges different points of view and displays them next to each other. Stakeholders are asked to recall moments they feel were significant for the partnership, from its beginning to the present. These moments can refer equally to positive or negative events, to breakthroughs or to

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challenges. Timeline tool factsheet: (available at: https://tapipedia.org/sites/default/files/tool_timeline.pdf. http://linkconsult.nl/files/Timeline-Guide-for-Facilitators.pdf)

- **Visioning exercise:** process of creating a compelling statement about what an organization aspires to be or to accomplish in the mid-term (i.e. five years from now) or in the long-term future (10 or 20 years from now). In the AIS context, the visioning process brings together representatives of actor groups to build on their common understanding of AIS and the need for a coordinated approach TAPipedia: (available at: https:// tapipedia.org/sites/default/files/overview_stage2.pdf; http:/www.fao.org/capacity-development/resources/practical-tools/multi-stakeholder-processes/visioning/en/)

- **What, How and Why questions:** This is a clear and efficient action planning tool that uses specific oriented questions to explain the tasks, obligations and resources for carrying out the assessment. The tool uses the questions below to direct the process:

- **World Café:** method for facilitating constructive dialogue, exchanging information and generating concrete opportunities in audiences of all sizes. (available at: https://www.cabi. org/Uploads/CABI/about-us/4.8.5-other-business-policies-and-strategies/tap- guidance-note.pdf)

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Glossary

Action-orientated assessment: assessment conducted and used to address a specific issue or problem with actionable recommendations to tackle the problem or specific issue.

Actors: individuals and organizations (civil society, private sector, enterprises, government ministries, non-governmental organizations, research and development institutes, extension services, universities and vocational training centers) involved in innovation process.

Agricultural advisory services: all the activities that provide information and services needed and demanded by farmers and other actors in rural settings to assist them in developing their own technical, organizational, and management skills and practices to improve their livelihoods and well-being (GFRAS, 2012).

Agricultural innovation: process whereby individuals or organizations bring existing or new products, processes and forms of organization into social and economic use to increase effectiveness, competitiveness, resilience to shocks or environmental sustainability, thereby contributing to food and nutritional security, economic development and sustainable natural resource management (TAP, 2016).

Agricultural innovation system: network of actors or organizations, and individuals, together with supporting institutions and policies in the agricultural and related sectors, that brings existing or new products, processes, and forms of organization into social and economic use (TAP, 2016).

Agri-food system: defined as the combination of activities and institutions around the production and consumption of a particular food item. Agri-food system activities include production, storage, processing, wholesaling and consumption. In addition to these activities, an agri-food system also includes a complex web of institutional and regulatory frameworks that influence those systems (IPES, 2015).

Capacity Development: process whereby people, organizations and society as a whole unleash, strengthen, create, adapt and maintain capacity over time (FAO, 2010). Capacity development is increasingly recognized as a multi-dimensional and multi-actor process that goes well beyond the transfer of knowledge and skills at the individual level and encompasses organizational and institutional dimensions (Pearson, 2011).

Capacity to innovate: ability of the different groups of stakeholders to continuously identify, prioritize problems and opportunities in the dynamic environment that they are in, and take risks and experiment new combinations of technical and institutional configurations and assess the trade-offs from these options (Lewis and Ricard, 2014).

Enabling environment: multifaceted setting within which, the agricultural sector and economy operates, comprising non-distorting and stable policies, adequate provision

of public goods, good governance through laws and regulations that are conducive to private-sector economic activity while addressing market failures, and strong and effective institutions through which government measures and actions are operationalized (Diaz-Bonilla *et al.*, 2014). TAP (2016) defined enabling environment of AIS as the set of factors that influence agricultural innovation, but that are controlled by governance, regulatory and policy-making organizational structures other than those directly linked to agricultural innovation. It is important to note that not all factors and conditions are enabling. Very often the environment is disabling. Factors contributing to this situation must be identified and analyzed.

Evidence-based policy making: discourse or set of methods which informs the policy process, rather than aiming to directly affect the eventual goals of the policy. It advocates a more rational, rigorous and systematic approach. The pursuit of evidence-based policymaking is based on the premise that policy decisions should be better informed by available evidence and should include rational analysis (Sutcliffe and Court, 2005).

Innovation: the process of putting knowledge into use be it in the form of technology, practice or a particular way of working. The context in which innovation takes place is not static. It evolves, develops, adapts and responds (TAP, 2016). Innovation can be technological, organizational and institutional. Innovation is different from invention in that innovation is a discovery or an idea which becomes available to potential users.

Innovation process: complex, interactive and unpredictable process, highly influenced by its environment and which is difficult or even impossible to manage. It consists of phases of acceleration, slowdown, and crisis, and involves many back-and-forth interactions between the research community and actions undertaken by its partners until the adoption and implementation of innovations by end-users (Barret *et al.*, 2018).

Innovation support services (ISS): ISS are immaterial and result from the interaction (activities) between suppliers and beneficiaries to solve a problematic situation within the innovation process. Services cover fostering technical and social design, enabling the appropriation and use of innovations, facilitating access to resources, helping to transform the environment and developing the capacities to innovate.

Innovation system: All the actors who interact to innovate by producing knowledge and mobilizing resources. A first meaning of the term refers to organizations dedicated to innovation (research, education, advisory) and their interactions with other actors. In such a case, one can refer to a national, regional or sectoral innovation system. A second meaning refers to all the actors involved in innovation and their interactions. In this case, there is an innovation system by type of innovation studied (Barret *et al.*, 2018).

Institutions: shared habits and routines used by actors in repetitive situations (soft institutions) organized by rules, norms and strategies (hard institutions). They are both formal and informal and determine how people engage with one another. Hard institutions refer to formal written laws, policies and regulations. Soft institutions deal with the values and unwritten rules of society regarding human behaviours and interaction (Weber and Rohracher, 2012).

National innovation policy: defines the roles and functions of actors and stakeholders within the national innovation system, provides an overall framework for innovation policies specific to particular sectors, and sets priorities across sectors and technologies. It creates positive conditions for innovation by investing in public goods essential for an innovative knowledge economy (World Bank, 2006).

National innovation system: open, evolving and complex system that encompasses relationships within and between organizations, institutions and socio-economic structures which determine the rate and direction of innovation and competence building emanating from processes of science-based and experience-based learning (Lundvall *et al.*, 2009).

Policy: refers to the problems and programs of policy fields. Policies are formed by the government and other social actors as governmental and nongovernmental organizations and agencies. Policymaking is a process that includes political decision-making as well as policy implementation and that is formalized in the policy cycle (Paschke *et al.*, 2019).

Policy environment: includes all aspects surrounding policymaking, such as social, economic or political aspects. It is not static, but changes in response to the political and economic circumstances, public concerns or international influences (Paschke *et al.*, 2019).

Policy instruments: a set of tools and techniques by which governmental authorities wield their power in attempting to ensure support and effect (or prevent) social change (Borras and Edquist, 2013). There are three main categories of instruments: 1) regulatory instruments, 2) economic and financial instruments, and 3) soft instruments.

Scaling (or change of scale): geographic extension of an innovation or increase in the number of its adopters (scaling out) or increase in the number of types of actors or arrangements between actors related to the deployment of an innovation (scaling up). Scaling implies a transformation of knowledge and techniques through the networks of actors involved in this change of scale, and the extension of learning processes (Barret *et al.*, 2018).

Systemic instruments: integrated coherent sets of tools designed for a specific innovation system to create opportunities and conditions for strengthening the previously weak or absent functions (Wieczorek and Hekkert, 2012). Systemic instruments focus on the level of the innovation system instead of focusing on specific parts of innovation systems and support processes that play a critical role in the management of innovation processes. The basic idea behind systemic instruments is that they aim to address problems that arise at the innovation system level and negatively influence the speed and direction of innovation processes.

Systemic problems (failures): factors that negatively influence the direction and speed of innovation processes, and impede the development and functioning of innovation systems (Wieczorek and Hekkert, 2012). Woolthuis *et al.*, (2005) distinguish four types of system failures in the science-innovation policy framework: i) infrastructural failures, ii) institutional failures, iii) interaction failures, and iv) capabilities failures.

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