Strategy to Improve Ethiopia’s National Agricultural Research System (NARS)

VISION, SYSTEMIC BOTTLENECKS, STRATEGIC INTERVENTIONS AND IMPLEMENTATION FRAMEWORK
# Table of Contents

## Contents

### Acronyms

A note from the Minster’s desk

Acknowledgment

Executive summary

### Chapter 1: Introduction

1. Purpose and scope of the strategy document
2. Overview of the Current NARS
3. Major stakeholders and partners
4. Strategy development approach

### Chapter 2: The National Agricultural Research System and its Components

1. History of Agricultural research in Ethiopia
2. NARS today

### Chapter 3: Systemic Bottlenecks and Strategic Interventions

1. Coordination and Governance
2. Resourcing and Execution: Human resources
3. Resourcing and Execution: Physical resources
4. Research Commercialization and Dissemination

### Chapter 4: Implementation Framework

1. Monitoring, Learning and Evaluation

---

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acronyms</td>
<td>1</td>
</tr>
<tr>
<td>A note from the Minster’s desk</td>
<td>2</td>
</tr>
<tr>
<td>Acknowledgment</td>
<td>2</td>
</tr>
<tr>
<td>Executive summary</td>
<td>2</td>
</tr>
<tr>
<td>Chapter 1: Introduction</td>
<td>8</td>
</tr>
<tr>
<td>1. Purpose and scope of the strategy document</td>
<td>8</td>
</tr>
<tr>
<td>1. Overview of the Current NARS</td>
<td>8</td>
</tr>
<tr>
<td>1. Major stakeholders and partners</td>
<td>9</td>
</tr>
<tr>
<td>1.4. Strategy development approach</td>
<td>11</td>
</tr>
<tr>
<td>Chapter 2: The National Agricultural Research System and its Components</td>
<td>13</td>
</tr>
<tr>
<td>2.1 History of Agricultural research in Ethiopia</td>
<td>13</td>
</tr>
<tr>
<td>2.2 NARS today</td>
<td>13</td>
</tr>
<tr>
<td>Chapter 3: Systemic Bottlenecks and Strategic Interventions</td>
<td>16</td>
</tr>
<tr>
<td>3.1 Coordination and Governance</td>
<td>15</td>
</tr>
<tr>
<td>3.2 Resourcing and Execution: Human resources</td>
<td>31</td>
</tr>
<tr>
<td>3.3 Resourcing and Execution: Physical resources</td>
<td>37</td>
</tr>
<tr>
<td>3.4 Research Commercialization and Dissemination</td>
<td>43</td>
</tr>
<tr>
<td>Chapter 4: Implementation Framework</td>
<td>50</td>
</tr>
<tr>
<td>4. Monitoring, Learning and Evaluation</td>
<td>15</td>
</tr>
</tbody>
</table>
Acronyms

A partial of list of key technical acronyms used in this document are explained below. For a list of organizations whose names may be abbreviated in the body of the text, please consult Section 1.4: Major stakeholders.

ADLI  Agriculture Development Led Industrialization
ADPLAC  Agricultural Development Partners Linkage Advisory Council
ARTP  Agricultural Research Training Project
ASA  African Science Academies
ASTI  Agricultural Science and Technology Indicators
ATA  Ethiopian Agricultural Transformation Agency
CGIAR  Consultative Group on International Agricultural Research
EAP  Ethiopian Agricultural Portal
EARC  Ethiopian Agricultural Research Council
EARO  Ethiopian Agriculture Research Organization
EIAR  Ethiopian Institute of Agriculture Research
EAKP  Ethiopian Agricultural Knowledge Portal
ETB  Ethiopian Birr
GDP  Gross Domestic Product
GIS  Geographic Information System
GoE  Government of Ethiopia
GTP  Growth and Transformation Plan
HVC  High Value Crops
HLI  Higher Learning Institute
IAR  Institute of Agricultural Research
ICT  Information Communication Technology
MLE  Monitoring, Learning and Evaluation
MoA(RD)  Ministry of Agriculture (and Rural Development)
EARC  Ethiopian Agriculture Research Council
NARI  National Agricultural Research Institute
NARO  National Agricultural Research Organizations
NARS  National Agricultural Research System
NBC  National Biosafety Committee
NGO  Non-governmental Organization
PPP  Public-Private Partnership
RARI  Regional Agricultural Research Institute
RBoA  Regional Bureau of Agriculture
RCBP  Rural Capacity Building Project
RI  Research Institute
RRI  Regional Research Institute
A note from the Minister’s desk

Agriculture is one of the pillars of the Ethiopian economy and the overall growth of the country is highly dependent on the success of the agriculture sector. The Government of Ethiopia has demonstrated strong commitment to agriculture and rural development through the consistent allocation of over 10% of the national budget to deliver enhanced agricultural technologies and support services.

This working strategy document outlines a forward-looking approach to improving the National Agricultural Research System (NARS) and aims to align NARS affiliates’ on short- and long-term objectives, identify tasks and milestones to achieve those objectives, and outline an action plan to accomplish specific tasks within an established timetable.

The aim of this strategy document is to outline the vision, bottlenecks, and interventions needed to transform the National Agricultural Research Systems (NARS). The development of this strategy has included the collective efforts of many stakeholders from the public, private and NGOs sectors. Various syndication workshops attended by EIAR, RARIs, Higher Learning Institutes (HLIs), MoA and ATA were held to ensure that this document reflects the needs of all relevant parties. A wide range of public, veteran researchers’ and development partners provided valuable contributions that were incorporated into the strategy document.

The strategy is released as a working document to kick start implementation and guide NARS members and all others involved in research. The strategy will serve the remaining period of the GTP1 and the subsequent GTPs. In the course of implementation, this strategy document will be subjected to regular revisions and refinements based on feedback and lessons learned from the implementing stakeholders as well as emerging realities.

On behalf of the Government of Ethiopia, I would like to thank all stakeholders who were involved in the development of this working strategy document and encourage those and other stakeholders to build upon this commitment as we move into implementation of the interventions contained in the strategy.

I strongly believe that together, we will continue to create a highly effective agricultural research sector that fulfills the promise of sustainably improving the livelihoods of smallholder farmers, pastoralists and agro-pastoralists while contributing to the Ethiopia’s overall vision of achieving a middle income status by 2025.

Tefera Deribew

Minister, Ministry of Agriculture
Acknowledgements

It is with the support and contribution of many partners and stakeholders that this strategy document was developed for the Ethiopian National Agricultural Research System (NARS). Specifically, the efforts made by EIAR, RARIs and HLIs were significant to bring the strategy: **Improve Ethiopia’s National Agricultural Research System** to its final stage. In addition, sincere appreciation goes to MoA, Ethiopian Academy of Sciences (EAS), Oxfam America, all CGIAR –centers in Ethiopia, Sasakawa-Global 2000 and BMGF for their support. A partial list of stakeholders who contributed to the development of the strategy is given below.

**Federal**

Ethiopian Institute of Agricultural Research (EIAR)  
Ethiopian Academy of Sciences  
Ministry of Agriculture (MoA)

**Regional**

Amhara Regional Agricultural Research Institute (ARARI)  
Oromiya Agricultural Research Institute (OARI)  
Southern Agricultural Research Institute (SARI)  
Tigray Agricultural Research Institute (TARI)  
Somali Region Pastoral and Agro-pastoral Research Institute (SoRPARI)  
Afar Region Pastoral and Agro-pastoral Research Institute (ARPARI)  
Gambela Agricultural Research Institute (GARI)

**Higher Learning Institutions**

Mekelle University  
Haromaya University  
Jimma University  
Hawassa University

**International**

Oxfam - America  
Sasakawa- Global 2000  
CGIAR-Centers based in Ethiopia  
The Bill and Melinda Gates Foundation (BMGF)
Executive summary

Agricultural research is a key lever for transformational economic growth. In the past half-century, the world has seen a host of new agricultural technologies such as chemical fertilizers, irrigation, high-yield and pest-resistant varieties and biotechnology tools. These technologies, developed over years by researchers and disseminated to producers by extension with government support, contributed to dramatic increases in harvests in India, Pakistan, Bangladesh, China, Philippines, Mexico, and others. Accomplishing the same gains in Ethiopia will be essential not only to lifting smallholders out of poverty, but also to attaining food and nutrition security in the face of population growth and natural resource degradation as well as to increase the contribution of the agriculture sector to growth of the national economy.

Ethiopia’s National Agricultural Research System (NARS) comprises the federal Ethiopian Institute of Agricultural Research (EIAR), seven regional agricultural research institutes (RARIs), over twenty-five higher learning institutes (HLIs), NGOs, and private companies that conduct research. Research efforts are augmented by Consultative Group on International Agricultural Research (CGIAR) Centers that support different agricultural research projects in partnership with the government system. Together, these organizations share the following vision and mission of this research strategy document:

<table>
<thead>
<tr>
<th>Vision</th>
<th>Mission</th>
</tr>
</thead>
<tbody>
<tr>
<td>Integrated, demand-driven and transformative research improves the livelihoods of farmers, agro-pastoralists and pastoralists</td>
<td>To contribute to Ethiopia’s agricultural growth by generating, adopting and building on indigenous knowledge while popularizing and maintaining appropriate technologies, knowledge and information through a national research system that is organically linked to the extension system</td>
</tr>
</tbody>
</table>

To achieve this vision, the Ethiopian agricultural research system must successfully serve three core operational functions:

- **Coordination and governance:** Public research efforts are coordinated at all levels so that resources are efficiently used and rationally distributed, research agendas are comprehensively aligned, and findings are effectively shared throughout the system.

- **Resourcing and execution:** Research centers have the human, physical and financial capital necessary to effectively execute national research agendas, using modern and conventional scientific methods. For human capital, this means that the research system is able to train, attract, cultivate, reward, and retain high-caliber research staff conversant with modern and high-tech sciences. For physical capital, this means that institutes have adequate, timely and reliable access to modern facilities, equipment and consumables that they need to produce internationally accepted scientific results. The research institutes should also have adequate finance to ensure proper and timely implementation of the research agenda.

- **Research commercialization and dissemination:** Strong linkages exist between the research, extension and other actors at all levels to share agricultural research outputs quickly and reliably with farmers, and to enable both female and male farmers’ experiences in the field to shape the research agenda through effective participation and feedback. NARS should create strong linkages not only within itself but also with Agricultural Knowledge and Information System (AKIS), meaning agricultural research, extension, and education in one system.

This strategy identifies systemic bottlenecks and proposes key interventions that will help the research system bring transformational agricultural technologies to Ethiopian farmers. Thirteen systemic bottlenecks have been identified across the system’s functions, to be addressed by corresponding strategic interventions.
The interventions are specifically aimed at strengthening the research system’s three core operational functions by:

- **Establishing a strong, well-harmonized Ethiopian Agricultural Research Council** for better and efficient coordination and governance, research collaboration, creation of an enabling policy environment, staff development, and fundraising. ERAC has been established since this draft was prepared.

- **Investing in the physical and human capital of the NARS** through specific allocations for equipment, attractive salary and incentive structure, and targeted capacity-building of research centers of excellence, as well as mobilizing adequate funds.

  *Strengthening linkages between research and extension functions* for effective commercialization and dissemination of improved agricultural technologies to the farmers and ensure food security.

Table 1 provides a summary of objectives, systemic bottlenecks, and strategic interventions (Chapter 3 discusses these at a greater length).
### Table 1: Bottlenecks in the research system and corresponding interventions

<table>
<thead>
<tr>
<th>Bottlenecks</th>
<th>Interventions</th>
<th>Owner</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Coordination and governance</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Public and independent research efforts are coordinated at all levels so</td>
<td>Establish and empower a national agricultural research council. EARC has been established after</td>
<td>EiAR/RARIs</td>
</tr>
<tr>
<td>that resources are efficiently used, rationally distributed, research</td>
<td>the draft strategy was developed. Emphasis will therefore be given to empowering EIAR/RARIs</td>
<td></td>
</tr>
<tr>
<td>agendas are comprehensive and aligned, and findings are effectively</td>
<td></td>
<td></td>
</tr>
<tr>
<td>shared throughout the system</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.1 Duplication of efforts and wastage of resources</td>
<td>• Establish a national agricultural research council.</td>
<td>EARC/RARIs</td>
</tr>
<tr>
<td></td>
<td>EARC has been established after the draft strategy was developed. Emphasis will therefore be given</td>
<td></td>
</tr>
<tr>
<td></td>
<td>to empowering EIAR/RARIs</td>
<td></td>
</tr>
<tr>
<td>1.2 Limited funding via both domestic and international channels</td>
<td>• Create an external relations and grant sourcing directorate under the EARC</td>
<td>EARC</td>
</tr>
<tr>
<td>1.3 Limited access to germplasm</td>
<td>• Establish centers of excellence for nationally important commodities</td>
<td>EARC</td>
</tr>
<tr>
<td>1.4 Limited applicability of Monitoring, Learning and Evaluation Systems</td>
<td>• Strengthen MLE system in partnership with stakeholders</td>
<td>EARC</td>
</tr>
<tr>
<td>(MLE)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.5 Difficulty in accessing information on research findings and</td>
<td>• Develop national research database and conduct technology inventory</td>
<td>EARC</td>
</tr>
<tr>
<td>facilities</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.6 Biosafety proclamation is not enabling for the application of</td>
<td>• Create an enabling environment for biotechnology research and its application</td>
<td>EARC</td>
</tr>
<tr>
<td>modern biotechnology tools/technologies in research</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Resourcing and execution: Human resource capacity</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High caliber staff attracted, cultivated and retained in NARS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.1 High staff attrition at all levels of the research system,</td>
<td>• Improve researcher career path and incentive structure and ensure consistent implementation</td>
<td>EARC</td>
</tr>
<tr>
<td>particularly at senior levels</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.2 Limited efforts to address the capability of the research and</td>
<td>• Develop a coordinated national training program under EARC</td>
<td>EARC</td>
</tr>
<tr>
<td>support staff</td>
<td>• Improve staff performance through regular and standard evaluations and rewards</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Resourcing and execution: Physical infrastructure</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Provide research institutes with adequate, timely, reliable access to</td>
<td></td>
<td></td>
</tr>
<tr>
<td>facilities, equipment, and consumables that they need to conduct quality</td>
<td></td>
<td></td>
</tr>
<tr>
<td>research</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.1 Insufficient, outdated, and poorly maintained laboratory and field</td>
<td>• Ensure reliable funding for purchase and maintenance of modern, precise and efficient laboratory</td>
<td>EARC</td>
</tr>
<tr>
<td>equipment</td>
<td>and field equipment, vehicles, and farm machinery</td>
<td></td>
</tr>
<tr>
<td>3.2 Shortage and aging of laboratory facilities, vehicles and farm</td>
<td>• Implement standard protocols to manage institutional equipment (vehicles, lab equipment, and</td>
<td>EARC</td>
</tr>
<tr>
<td>machinery</td>
<td>farm machinery)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Leverage central EARC capacity to share resources among research centers</td>
<td>EARC</td>
</tr>
<tr>
<td>3.3 Limited availability of ICT</td>
<td>• Develop ICT infrastructure, information management system and ensure access to internet in all</td>
<td>EARC</td>
</tr>
<tr>
<td></td>
<td>research institutes and centers</td>
<td></td>
</tr>
</tbody>
</table>
### Table 1 continued: Bottlenecks in the research system and corresponding interventions

<table>
<thead>
<tr>
<th>Bottlenecks</th>
<th>Interventions</th>
<th>Owner</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Research commercialization and dissemination</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Strong linkages between research and extension at all levels to share agricultural research outputs with farmers and other users quickly and reliably, and to ensure farmers’ experiences in the field shape the research agenda.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.1 Limited accountability in the system to ensure research-extension-farmer linkage</td>
<td>• Install an accountable interaction mechanism between research and extension</td>
<td>EARC /MOA</td>
</tr>
<tr>
<td>4.2 Poor technology multiplication pathway</td>
<td>• Create an enabling environment for technology multipliers by:</td>
<td>EARC /MOA</td>
</tr>
<tr>
<td></td>
<td>o Developing/revising the technology evaluation, release and registration system</td>
<td></td>
</tr>
<tr>
<td></td>
<td>o Put in place an intellectual property right system</td>
<td></td>
</tr>
<tr>
<td></td>
<td>o Increase access to credit for agriculture technology businesses</td>
<td></td>
</tr>
</tbody>
</table>

**Implementation of these initiatives will require coordinated and timely action.** With Ethiopia’s national research system at a crossroads, stakeholders must act decisively to revitalize the research system and improve smallholders’ access to productivity and livelihood changing technologies for years to come.
1. Introduction

1.1. Purpose and scope of the strategy document

This document sets out a strategy to transform Ethiopia’s National Agricultural Research System (NARS), a system designed to play a pivotal role in the country’s agricultural growth by developing and popularizing appropriate agricultural technologies, information, and knowledge. The strategy aims to achieve three specific objectives:

- Identify the primary bottlenecks to the NARS in achieving its research objectives
- Design a set of comprehensive, actionable interventions addressing these issues
- Propose a series of key activities and appropriate owners to successfully carry out the strategy

The strategy is intended to guide the research system, the government and development partners in targeting their support to building the research capacity and put in place a governance system that will enhance effectiveness and efficiency of the system. This strategy will be implemented over a 10-year timeframe, and will be refined and updated as the system evolves.

1.2. Overview of the current National Agricultural Research Institutes (NARIs)

The public agricultural research system in Ethiopia consists of eight public research institutions (the Ethiopian Institute of Agricultural Research (EIAR) and seven regional research institutes (RARIs)) and 69 research centers under respective jurisdictions. In addition, over 25 regional and federal colleges and universities conduct agricultural research. Similarly, NGOs, and the Consultative Group on International Agricultural Research (CGIAR) Centers support different agricultural research projects that contribute significantly to research in partnership with the government system. Though the national agricultural research system is complex, the organizational framework in Ethiopia can be broadly identified into three levels or “components” (Figure 1). In addition, other players who act as “enablers” interact on multiple levels with federal and regional research players. The structure extends from the national level at the apex of the system, institutes level in the middle, to research centers implementing at the lower base. A history of NARS as well as a detailed briefing of the major components is provided in Chapter 2.
1.3. **Major stakeholders and partners**

To realize the vision contained in this document by 2023, stakeholders across all sectors and within government must be engaged and committed to implementing the interventions, with due attention given to jointly addressing the unique challenges in emerging regions. Below are some of the key stakeholders both inside and outside NARS who have been involved in the process of crafting this sector strategy, and who will become owners of specific interventions. The successful execution of this strategy will depend on their commitment and continued engagement over the next ten years.

**National Agricultural Research Institutes and HLIs**

The National Agricultural Research System plays a fundamental role in agriculture by generating, adapting, and adopting improved technologies, information, knowledge and practices to be disseminated to farmers with the objective of increasing agricultural productivity and production. The NARS is primarily comprised of EIAR, RARIs and higher learning institutions (HLIs). There are also other governmental research institutions (forestry, water, sugar, animal health, etc.) and private research organizations and NGOs that engage in more targeted research.

The National and Regional Agricultural Research Institutes and Higher Learning Institutions (HLIs) are the primary stakeholders in the national agricultural research strategy. This strategy draws upon their experiences.

---

1 The overview in figure 1 is not an exhaustive list of stakeholders rather structured to systematically identify bottlenecks and limit the scope to public agricultural research institutes
and expertise and the majority of the proposed interventions will be owned by stakeholders at federal, regional and local levels. (More details on NARS’ constituent organizations can be found in Chapter 2.)

**Ethiopian government stakeholders**

The **Ministry of Agriculture** (MoA) is responsible for developing and refining the overall national agricultural and rural development strategies and policies with input and support from the regions and other stakeholders. Several directorates and offices of the MoA are especially critical to the success of agricultural research. The **Extension Directorate**, overseeing Ethiopia’s extension system, is the key partner in research/extension linkage through efforts such as the Agricultural Development Partners Linkage Advisory Council (ADPLAC).

**Regional Governments** are responsible for managing, funding and capacitating RARIs. Regional Governments established RARIs following the country’s political decentralization in the 1990s and mandated them to formulate the regional agricultural research agenda, coordinate regional agricultural research and conduct more targeted research in their centers and sub centers located in various agro-ecological zones of the respective regions. Regional **Bureaus of Agriculture** facilitate coordination and alignment with the extension system and development partners to ensure coordinated technology delivery services are in place.

The **Ministry of Science and Technology** is responsible for preparing national science and technology programs, facilitating interaction and collaboration among stakeholders, facilitating capacity building and compiling innovation databases.

The **Ministry of Education** —through colleges and universities—plays a role in educating and training the human resources required for the NARS as well as the extension system. Currently, about twenty agriculture-related HLIs in Ethiopia support the agriculture sector in several areas, with a primary focus on training at B.Sc., M.Sc. and PhD levels in the areas of Plant Sciences, Animal Sciences, Agricultural Economics, Agricultural Engineering, and Biotechnology, among others, and cultivating talent to conduct agricultural research and promote generated technologies. The HLIs conduct both applied and basic research on their campuses and at research centers.

The **Agricultural Transformation Agency (ATA)** is an initiative of the Government of Ethiopia (GoE) established with the primary mandate of promoting agricultural sector transformation by supporting the MoA, RARIs, research institutes and other public, private and non-governmental partners to address systemic bottlenecks. The ATA provides implementation support in the form of continued problem identification and solving (see Figure 2 below for ATA’s approach to problem solving), capacity building, stakeholder coordination and implementation support to implementing partners at various levels of Ethiopia’s agriculture system.

**Civil society, non-governmental, and private stakeholders**

The **Consultative Group on International Agricultural Research (CGIAR)**, also called CG centers is a global partnership that unites organizations engaged in research for a food secure future. The research conducted by the CGIAR and their partners is dedicated to reducing rural poverty, increasing food security, improving human health and nutrition and ensuring more sustainable management of natural resources. The 15 CG centers generate and disseminate knowledge, technologies and policies for agricultural development through the CGIAR programs.

A number of NGOs in agricultural and rural development support the NARS in capacity building, funding, technical assistance, training, and knowledge sharing. In addition, NGOs such as **Oxfam America (OA)** and **Sasakawa Global 2000 (SG 2000)**, among others, are working through governmental and non-governmental organizations in technology dissemination and improving the agricultural extension system of the country.

**Technology multipliers** and **input suppliers** consist of, among others, seed enterprises, including the **Ethiopian Seed Enterprise (ESE)**, **Regional Seed Enterprises (RSEs)**, fertilizer and chemicals distributers, mechanical implements producers/suppliers and farmers’ cooperatives. Seed enterprises usually produce certified seed...
from the basic seed obtained from the research system. The research system typically interfaces with seed suppliers through ADPLAC with support from the extension system.

Farmers

Ethiopia has more than 14.1 million smallholder farm households who produce over 95% of the country’s agricultural output (Fisseha, 2009). According to IFPRI (2010), there are 21.8 million adults who are active in agriculture. Farmers are the main users of agricultural technologies. Farmers play a major role in research problem identification, prioritization, technology verification and technology use. Farmers are a diverse group with a range of socio-economic status, agro-ecology and demographics.

1.4. Strategy development approach

This research strategy was developed through a systematic and stakeholder-consultative process conducted over two years. The strategy development was led by a task force comprised of:

- Agriculture Transformation Agency
- Ethiopian Institute of Agricultural Research (EIAR)
- Regional Agricultural Research Institutes (RARIs)
- Regional Bureaus of Agriculture (RBoA)
- Higher learning institutes (HLIs)
- Representatives of relevant NGOs including Sasakawa Global 2000 and Oxfam America

The Term “Farmers” applies to crop and livestock production and other activities of raising living organism for food or raw material.
First, the taskforce in consultation with several partners developed a **vision** for the Ethiopia’s NARS, including how it might make transformational contributions to the lives of smallholder farmers, agro-pastoralists and pastoralists. Given the significant challenges present today, this vision statement aimed to be both inspirational and realistic, focusing on the previously identified **central objectives** of the research system.

Next, qualitative and quantitative data analyses were conducted to understand the issues and constraints that are **bottlenecks** to the achievement of the identified vision—the most critical of which are detailed in this document. All bottlenecks, interventions and activities have been identified through:

- A review of the research system including a comprehensive survey of NARS conducted by ATA in 2012 (ATA, 2013) and comparable data and country brief on agriculture science and technology indicators by ASTI/IFPRI;
- **In-depth discussions** and **systematic interviews** with key stakeholders, including the MoA, research organizations, CG centers, academia and other development partners;
- An **extensive review of relevant literature** including a thorough review of existing publications authored by local and international experts; and
- The **convening of a taskforce** to refine the draft strategy and identify and scope actionable activities.
Chapter 2: National Agricultural Research System and its components

2.1 History of agricultural research in Ethiopia

Early history (1940 to 1992): Organized and publicly funded agricultural research in Ethiopia began with the establishment of three agricultural schools in the 1940s and 1950s: the Ambo Agricultural School (1947), the Jimma Agricultural and Technical School (1952) and the Alemaya College of Agriculture (1953). A semi-autonomous institute, the Institute of Agricultural Research (IAR), was established under the Ministry of Agriculture in 1966. IAR had the mandate to lead and coordinate national agricultural research, formulate national agricultural research guidelines and conduct research in centers and sub-centers across agro-ecological zones. The establishment of IAR marked a significant development of agricultural research in the history of the national agricultural research system of Ethiopia. This development involved a rapid transition in the system from a limited start with some college- and ministry-based research activities to an institutionally networked, nationally coordinated, policy-oriented and fully-fledged national research system.

Decentralization (1992 to present): Following the end of the Derg regime and the establishment of a decentralized political system by the Ethiopian Peoples’ Revolutionary Democratic Front (EPRDF), the NARS underwent significant structural reforms in 1993, most important of which was the establishment of seven regional agricultural research institutes (RARIs). The decentralization of the system was intended to improve research-extension linkages at regional levels, and to better target regions’ specific problems. During this time, a number of the former IAR research centers including Adet, Hawassa, Mekele, Sinana and other centers were transferred to their respective regional governments to become independent centers coordinated by the RARIs.

IAR itself was significantly restructured in 1997 to become the Ethiopian Agricultural Research Organization (EARO) by merging the former federal research centers of IAR, the Debre Zeit Agricultural Research Center of Haramaya University, and five other national research centers from MoA and the Ministry of Industry. The EARO fell within the administrative responsibility of the MoA and was governed by a Board. In early 2004 the proclamation for the establishment of EARO was amended, replacing its governing Board with an Advisory Board and changing its name to the Ethiopian Institute of Agricultural Research (EIAR) (Tsedeke et al., 2011).

2.2 NARS today

The organizational framework in Ethiopia can be broadly categorized into three levels (or “components”): national governing institutes, mid-level independent research institutes, and research implementation through research centers. In addition, a number of players (“enablers”) interact on multiple levels with federal and regional research players.

Research system level 1: Governing institutes

Governing institutes focus on establishing a system that can promote a sustainable agricultural development through enabling proper execution and dissemination of research outputs. They formulate national research policy and maintain a governance system, which is aligned with the country’s political structure and development priorities, to ensure high-level functioning of the NARS. Their core function is to oversee and facilitate smooth operations of the NARS.
In the Ethiopian agricultural research system, the federal and regional governments are the major source of funding for the operational and capacity building investments required for running and establishing research institutes and centers in different agro-ecological zones of the country.

The objectives of governing institutes can be broadly grouped into three categories: 1) policy, strategy and governance; 2) resource and execution; and 3) research commercialization and dissemination (Error! Reference source not found.2).

### Table 2: Specific objectives of governing institutions

<table>
<thead>
<tr>
<th>Component</th>
<th>Objective</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Coordination and Governance</strong></td>
<td>1.1 Create a national policy and strategy to steer the research system&lt;br&gt;1.2 Establish a governance system that defines mandates, objectives, roles, and responsibilities&lt;br&gt;1.3 Set national/regional research priorities&lt;br&gt;1.4 Support, monitor and evaluate the performance of the research system</td>
</tr>
<tr>
<td><strong>Resourcing and Execution</strong></td>
<td>1.5 Ensure proper and equitable distribution of resources nationally to ensure an effective research system&lt;br&gt;1.6 Manage institutes’ performance&lt;br&gt;1.7 Provide funding to research institutions</td>
</tr>
<tr>
<td><strong>Research commercialization and dissemination</strong></td>
<td>1.8 Create a system to facilitate strong linkages between research, extension, technology users and development partners&lt;br&gt;1.9 Facilitate technology multiplication, dissemination and adoption</td>
</tr>
</tbody>
</table>

### Research system level 2: Research institutes

Research institutes are the key drivers of agricultural research in their respective regions and at the federal level. Research institutes focus on coordinating, overseeing, guiding and supporting their respective research centers to execute research that has either national and/or regional significance. Research institutes formulate nation-wide/region-wide strategies, resource and capacitate research centers, manage center performance and facilitate conditions for mutual support between research and the broader stakeholders (Table 3).

### Table 3: Specific objectives of research institutes

<table>
<thead>
<tr>
<th>Component</th>
<th>Objective</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Coordination and Governance</strong></td>
<td>2.1 Develop strategies to guide and support research centers (RC)&lt;br&gt;2.2 Create a career path and incentive guidelines for researchers&lt;br&gt;2.3 Coordinate research activities between centers under their jurisdictions</td>
</tr>
<tr>
<td><strong>Resourcing and Execution</strong></td>
<td>2.4 Build capacity of RCs, including physical, operational and human resources&lt;br&gt;2.5 Hire, allocate, and provide incentives that are consistent with national incentives for research staff&lt;br&gt;2.6 Establish new centers in representative agro-ecologies&lt;br&gt;2.7 Manage centers’ performance&lt;br&gt;2.8 Make funds available to RCs</td>
</tr>
<tr>
<td><strong>Research commercialization and dissemination</strong></td>
<td>2.9 Coordinate with national and international research institutes and universities&lt;br&gt;2.10 Facilitate conditions for mutual support between research and extension&lt;br&gt;2.11 Create and maintain knowledge databases</td>
</tr>
</tbody>
</table>
Research system level 3: Research centers

Research centers are where the research is conducted to generate, develop, validate and adopt agro-ecology-specific technologies. Centers are responsible for utilizing resources optimally for problem identification, research execution, technology generation, documentation and popularization and basic multiplication by:

- Identifying problems at the grassroots level
- Facilitating the conduct of research while ensuring resources are used for priority activities
- Maintaining well-equipped and functioning modern laboratories and office facilities to meet acceptable standards of scientific working environment

The specific objectives of research centers under the three spectrums are shown in Table 4.

### Table 4: Specific objectives of research centers

<table>
<thead>
<tr>
<th>Component</th>
<th>Objective</th>
</tr>
</thead>
<tbody>
<tr>
<td>③ Research centers</td>
<td></td>
</tr>
<tr>
<td><strong>Coordination and Governance</strong></td>
<td></td>
</tr>
<tr>
<td>3.1</td>
<td>Develop work plans to implement priority research</td>
</tr>
<tr>
<td>3.2</td>
<td>Provide feedback to governing institutes on center development</td>
</tr>
<tr>
<td><strong>Resourcing and Execution</strong></td>
<td></td>
</tr>
<tr>
<td>3.3</td>
<td>Conduct research to generate, develop, validate and adopt agricultural technologies</td>
</tr>
<tr>
<td>3.4</td>
<td>Manage research staff</td>
</tr>
<tr>
<td>3.5</td>
<td>Efficiently utilize and maintain well-equipped modern laboratories and office facilities</td>
</tr>
<tr>
<td>3.6</td>
<td>Interact with international research institutes for funding and technology exchange and germplasm acquisition</td>
</tr>
<tr>
<td><strong>Research commercialization and dissemination</strong></td>
<td></td>
</tr>
<tr>
<td>3.7</td>
<td>Involve farmers and extension in the technology development process</td>
</tr>
<tr>
<td>3.8</td>
<td>Disseminate research results through small scale multi-locational demonstrations, promotions, pre-scaling up and publications</td>
</tr>
<tr>
<td>3.9</td>
<td>Collaborate with technology multipliers to make available initial basic requirements</td>
</tr>
</tbody>
</table>
Chapter 3: Systemic Bottlenecks and Strategic Interventions

The long-term vision and mission for the national agricultural research system are as follows:

<table>
<thead>
<tr>
<th>Overall vision for Ethiopia’s research system</th>
</tr>
</thead>
<tbody>
<tr>
<td>Integrated, demand-driven and transformative research improves the livelihoods of farmers, agro-pastoralists and pastoralists</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Overall mission for Ethiopia’s research system</th>
</tr>
</thead>
<tbody>
<tr>
<td>To contribute to Ethiopia’s agricultural growth by generating, adopting and building on indigenous knowledge while popularizing and maintaining appropriate technologies, knowledge and information through a national research system that is organically linked to the extension system</td>
</tr>
</tbody>
</table>

To analyze the bottlenecks and develop interventions at each level of the research system, distinct responsibilities of each actor under the current system have been categorized into three core areas of operation: coordination and governance; resourcing and execution; and research commercialization and dissemination (Table). For each component, systemic bottlenecks were identified and analyzed.

A number of bottlenecks were identified as hampering the achievement of the specific objectives of each component and the overall vision of the research system. Each specific objective was assessed against the ideal conditions (“what needs to be true for the smooth functioning of the system”) to achieve the specific objectives. Data and expert input were then used to determine which conditions were satisfied and which were not.

<table>
<thead>
<tr>
<th>Table 5: The research system’s core areas of operation and their objectives</th>
</tr>
</thead>
<tbody>
<tr>
<td>No.</td>
</tr>
<tr>
<td>-----</td>
</tr>
<tr>
<td>3.1</td>
</tr>
<tr>
<td>3.2</td>
</tr>
<tr>
<td>3.3</td>
</tr>
</tbody>
</table>
3.1. Coordination and Governance

**Objective**

Public and independent research efforts are coordinated at all levels so that resources are efficiently used and rationally distributed, research agendas are comprehensive and aligned and findings are effectively shared throughout the system.

The restructuring of NARS into eight independent research institutes in the 1990s, to mirror the country's federal governance structures, was intended to produce several benefits including that research done in the 69 research centers in different agro-ecologies of the country (Error! Reference source not found.) could be more responsive to local needs. With governance now at the regional level, it was envisioned that the system would have better downward and upward communication with farmers. According to Senanayake (1990) in countries like Japan, with a long tradition of a decentralized system, the research and extension linkage problem appears to be less serious than countries with highly centralized system.

**Figure 3: Federal, regional and university research centers by agro-ecological zone**
At the same time decentralization also meant losing the natural efficiencies afforded by scale in administrative and coordination tasks like setting research priorities and agendas, accessing international funding, learning from best practices, and disseminating research outputs. To that end, proclamation No. 79/1997 gave EIAR (previously EARO) the mandate to strengthen and coordinate research activities of agricultural research centers and higher learning institutions. Despite this, EIAR did not establish and institutionalize a system that governs linkage among the research institutes and other development actors. About 80% of the respondents from the NARS study claimed that collaboration among RARIs and EIAR occurs largely on an ad-hoc basis (ATA, 2013).

EIAR’s difficulty in effective coordination of the research system may result from its dual mandate of coordinating agricultural research in the country and also conducting research itself, which may lead to a conflict of interest. Moreover, the proclamation was not followed by clear directives to put enforcement mechanisms in place and its board was not self-autonomous, therefore it lacked the authority to fully govern and decide on the strategic direction of EIAR (previously EARO).

The absence of an effective coordination and governance system has resulted in challenges in terms of planning, resource utilization, information communication and capacity building (Table 6).

Table 6: Challenges resulting from poor coordination and governance of the research system

<table>
<thead>
<tr>
<th>Bottlenecks</th>
<th>Interventions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Coordination and governance</strong></td>
<td></td>
</tr>
<tr>
<td>1.1 Duplication of efforts and wastage of resources</td>
<td>• Empower Ethiopian Agricultural Research Council. EARC has been established after the draft strategy was developed, but before its online release. Emphasis will therefore be given to empowering.</td>
</tr>
<tr>
<td>1.2 Limited funding via both domestic and international channels</td>
<td>• Create an external relations and grant sourcing directorate under the EARC</td>
</tr>
<tr>
<td>1.3 Limited access to germplasm</td>
<td>• Establish centers of excellence for nationally important commodities</td>
</tr>
<tr>
<td>1.4 Difficulty in accessing information on research findings and facilities</td>
<td>• Develop national research database and conduct technology inventory</td>
</tr>
<tr>
<td>1.5 Limited applicability of Monitoring, Learning and Evaluation Systems(MLE)</td>
<td>• Establish strong MLE system in partnership with stakeholders</td>
</tr>
<tr>
<td>1.6 Biosafety proclamation is not enabling for the application of modern biotechnology tools/technologies in research</td>
<td>• Create an enabling environment for biotechnology research and its application</td>
</tr>
</tbody>
</table>

**Bottleneck 1.1: Duplication of efforts and wastage of resources**

Without an effective coordinating apex body to develop a national strategy and determine how the federal and regional research institutes and HLIs will engage in executing the strategy, Ethiopia’s research system will continue to be characterized by duplication of efforts and inefficient resource allocation and wastage. As mentioned in the previous section, previous regional research institutes have a limited and inconsistent understanding of the national research strategy. Among the 87 percent NARS survey respondents who were aware of a national research strategy, interpretations varied significantly (Error! Reference source not found.), with many believing that regions work solely according to their own strategies. When regions set their own strategies without consulting the national agenda, there is a high probability that they are duplicating efforts and investing resources in research activities that are conducted elsewhere, resulting in wastage.
Wastage of resources is exacerbated by a poor information-sharing system among the research institutes (see discussion below). Of the NARS survey respondents, 67 percent claimed that their organizations did not look into developing knowledge portals or information sharing platforms (ATA, 2013). To the extent that findings are not being widely disseminated and research centers are likely to be duplicating work.

This points to two key opportunities for improvement: first, better coordination of the NARS that links budget allocation to responsibilities; and second, information sharing systems among the NARS actors to ensure that researchers advance, rather than duplicate, each other’s work.

**Bottleneck 1.2: Limited funding via both domestic and international channels**

Agricultural research in Ethiopia is supported by government, loans from development organizations and contributions from donor agencies. Limited funding also comes from other sources such as internally generated revenues from sale of agricultural outputs. Over the past decade, spending in public agricultural research sectors has increased significantly, though year-to-year funding has been volatile. In the 1990s, expenditure was between USD 30-40 million, all figures adjusted by 2005 PPP (Purchasing Power Parity), while it reached its peak at USD 100 million in 2003, retracted to USD 81 million in 2008 and further declined to 67 million in 2011 (ASTI, 2014). Compared to other countries that are recognized for their agricultural research and development – for example, Brazil, China and India – both total investment and spending per researcher in Ethiopia are relatively low. India, for example, outspends Ethiopia 28 to 1 and Brazil 16 to 1 in public agriculture research (Figure 5).
Moreover, the share of agricultural R&D spending as a percentage of agricultural GDP has declined continually from approximately 0.6% in 2000 to 0.27% in 2008 and 0.19% in 2014. Even by African standard, this ratio is among the lowest, placing Ethiopia in the bottom 25 percentile.

Error! Reference source not found.7 shows that in Ethiopia investment in research as a percentage of agricultural GDP is significantly lower than the 1% threshold recommended by the CAADP (Comprehensive Africa Agriculture Development Program), an initiative working to boost agricultural productivity in Africa. Some 30 countries have signed CAADP compacts, which are manifestations of country-level policy and strategy commitments. As one of its main four pillars, CAADP aims to improve agricultural research and systems in order to disseminate appropriate new technologies.

Table 7: Comparison of R&D expenditure as a percentage of agricultural GDP

<table>
<thead>
<tr>
<th>Country</th>
<th>Expenditure/Agric. GDP (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2008</td>
</tr>
<tr>
<td>Botswana</td>
<td>4.32</td>
</tr>
<tr>
<td>Mauritius</td>
<td>3.92</td>
</tr>
<tr>
<td>Kenya</td>
<td>1.30</td>
</tr>
<tr>
<td>Uganda</td>
<td>1.24</td>
</tr>
<tr>
<td>Senegal</td>
<td>0.82</td>
</tr>
<tr>
<td>Mali</td>
<td>0.64</td>
</tr>
<tr>
<td>Cote d’Ivoir</td>
<td>0.54</td>
</tr>
<tr>
<td>Rwanda</td>
<td>0.62</td>
</tr>
<tr>
<td>Eritrea</td>
<td>0.64</td>
</tr>
<tr>
<td>Tanzania</td>
<td>0.58</td>
</tr>
<tr>
<td>Mozambique</td>
<td>0.40</td>
</tr>
<tr>
<td>Sudan</td>
<td>0.26</td>
</tr>
<tr>
<td>Ethiopia</td>
<td>0.27</td>
</tr>
<tr>
<td>Guinea</td>
<td>0.16</td>
</tr>
</tbody>
</table>

Source: ASTI/IFPRI (2014)

---

3 Dollar values in both graphs (Figure 5) are in constant price; adjusted by 2005 purchasing power parity
Compounding the effect of low government investment, the system also suffers from a limited ability to mobilize funding from international sources. The share of international funding in Ethiopia’s agriculture research accounts for only 20% of the total budget, compared with Mali, Senegal, Uganda, Tanzania and Kenya, where international and private funding contribute 64%, 50%, 49%, 47% and 38% of total R&D expenditures, respectively (Error! Reference source not found.6). Though high dependency on external funding sources is not desirable for the long term sustainability of the research system, foreign assistance should be sought for capital expenditures whilst recurrent budget may be sourced domestically from the government.

Figure 6: Total research spending and share of non – government funding

![Graph showing the total research spending and share of non-government funding](chart)

Source: IFPRI/ASTI (2014)

One potential reason for Ethiopia’s relatively low proportion of international funding is the fragmentation of its research system, which limits opportunities for coordinated and consolidated national and international collaboration and fund-raising. This particularly affects RARIs’ ability to access foreign funds, since many bilateral and multilateral funding organizations work with national or federal organizations. The NARS survey commissioned by ATA shows that 79% of the respondents believed that ineffective coordination in a decentralized system negatively impacts research centers’ access to international funding (ATA, 2013). NARS currently does not provide incentives to encourage researchers to develop proposals and seek competitive grants from external sources. Researchers also lack training opportunities to develop proposal-writing skills in the early stages of their careers.

Low funding constrains NARS’ ability to invest in the human, technological and physical capacity of its research centers. The consequences are seen in human resource gaps (as discussed in Section 3.2), and in sub-standard laboratory infrastructure (as discussed in Section 3.3).

**Bottleneck 1.3: Limited access to germplasm**

Germplasm is indispensable in the development of improved crop varieties and animal breeds. Both classical and modern breeding methods rely on diverse germplasm with diverse characteristics such as high yield, pest and disease resistance, tolerance/resistance to stresses such as drought, acidity, alkalinity or climate change, conversion efficiency, etc. Procuring a variety of germplasm helps to widen the genetic pool of crops and livestock for the breeding program and accelerate improved variety/breed development.
Improving access to and exchange of germplasm by federal and regional research centers and HLIs would significantly improve the impact of agricultural research on food and nutrition security.

Many regional research institutes and centers have limited access to germplasm that comes from abroad due to, among others, limited access to international funding. Though some germplasm is collected from within the NARS, much of the germplasm originates from international or bilateral agricultural research organizations, such as CGIAR Centers.

Currently, EIAR is mandated to distribute germplasm for national trials to research centers and sites. However, regional institutes and centers tend to setup regional trials of the same germplasm procured from EIAR. This usually creates difficulty and conflict of interest due to the fact that the acquired germplasm is small in quantity to be simultaneously used for both purposes by all affiliates of the system. Among the NARS survey respondents, 86% noted that conflict of interest resulting from the dual mandate of EIAR to coordinate and conduct research at the same time had a “negative” or “very negative” effect on access to crop germplasm (Error! Reference source not found.7). Some respondents also felt that they are disconnected from CGIAR Centers and that they had to go through a long process to access germplasm through the regional office of agriculture.

**Figure 7: Impact of poor coordination on access of research centers to additional resources**

Source: ATA (2013)

Similarly, due to the absence of proper germplasm exchange mechanisms among research players within Ethiopia, regional centers and HLIs are also unlikely to share germplasm they acquire directly with federal or other regional research centers. This has jeopardized research effectiveness in NARS, especially in generating improved crop varieties.

**Bottleneck 1.4: Difficulty in accessing information on research findings and facilities**

With the NARS system decentralized across numerous locations, strong mechanisms for sharing information on research projects and results is necessary on a national level. Though research findings, data and other information can be disseminated through institutes’ publications, informal channels and in-person meetings, there is no common platform that can expedite this process. As a result, research findings and information generated with scarce resources are not routinely documented, compiled, or readily available for wider consumption and use.

Limited information sharing creates two major problems:

- **Wasted, duplicated and poorly aligned efforts.** Researchers in different centers often work independently to release the same technologies. In the NARS study, 85% of the respondents claimed that the absence of common platforms and database affected them “very negatively” as information collected by the different research institutes is not shared across the system. Not only has that resulted in wasted time, money and
other resources, but it also created unnecessary tensions among the national agricultural research institutes when multiple researchers have legitimate claim to an accomplishment, particularly crop varieties. Further, when results from projects are not available for easy access by succeeding researchers, the results can be forgotten and lost, reducing the centers ability to be impactful over time.

- **Technology multiplication and dissemination is significantly more difficult** without a systematized database that is up-to-date and easily accessed by researchers, information/extension officers, and other development partners.

The absence of a national research database has been identified by NARS survey as one of the key challenges to agricultural research growth in the country (Figure 8).

**Figure 8: Impact of poor information sharing**

![Impact of poor governance and Information sharing platform](image)

Source: ATA (2013)

To address this gap and promote institutional learning and dissemination of demand-driven and sustainable agricultural technologies and knowledge, EIAR had previously worked with the East African Agricultural Productivity Project (EAAPP) to establish the Ethiopian Agricultural Knowledge Portal (EAKP). However, this portal had a limited success for a number of reasons, including an unfriendly user interface, incomplete data, limited resource and infrastructure for centers to utilize the existing features, and lack of researcher awareness. International Service for National Agricultural Research (ISNAR), a former CGIAR center, used to support systematic collection of valuable information on public sector in developing countries. However, since ISNAR’s dissolution, systematic collection of information on the research sector has been more ad-hoc and dependant on donor support (Uma et al., 2010). The EAKP might have been affected by the dissolution of ISNAR.

Learning from tiny mistakes of this previous effort, NARS should ensure that centers are held responsible for constant sharing of research findings and data with a central coordinating office so that they can be used by broader stakeholders. In addition, internet services should be made available in all research centers (discussed in Section 3.4)

### Bottleneck 1.5 Limited Applicability of Monitoring, Learning and Evaluation (MLE) Systems

The MLE systems in agricultural research serve three major purposes: to monitor if implementation is going as planned or if corrective action is needed; to assess the impact of research on smallholders; and to institutionalize lessons for better performance and accountability. According to Oruko et al. (2011), MLE systems are lacking and ineffective across several African agricultural research and development institutions including in Ethiopia. The MoA (2012) found that although the nature of research projects requires constant follow up, a regular schedule for field visits and supervision of project sites was lacking and that planning and implementation of the project activities at field level remained inadequate.
MLE in the Ethiopian NARS is facing three significant challenges:

- Unavailability of standardized tools and processes, resulting from limited coordination and governance of the research system.
- Variations in effectiveness in functions and structures of MLE units across research institutions.
- Limited financial and technical capacity in establishing and operationalizing efficient monitoring, evaluation and supervision of research.

Absence of effective MLE leads to wasted resources, especially when projects overrun their timelines and budgets, become completely abandoned or do not match the standard laid out in approved proposals. Evaluation of the Rural Capacity Building Project (RCBP) revealed that implementation of most of the project components was delayed and their status unknown by the project management even as the project moved towards completion and in many cases research was discontinued simply because of poor monitoring (MoA, 2012). Compounding this problem, poor MLE has reduced the availability of data on previous projects in the national research system. As a result, there is limited opportunity to learn from previous activities, take timely corrective actions, and ensure mistakes are not repeated.

**Intervention: Empower the Ethiopian Agricultural Research Council**

The five bottlenecks identified above – duplication of efforts, limited funding, poor access to germplasm, difficulty in accessing information and poor MLE of research projects – underline the need for a new organizational structure and governance system. To that end, delegates from the research institutes have explored alternative models that have been successful in other federal countries. This has resulted in the establishment of an autonomous Ethiopian Agricultural Research Council in 2013 to coordinate and govern agricultural research at a national level.

Experiences from other countries—Brazil, India, Pakistan, Bangladesh, and others—indicate that a decentralized research system could be effectively coordinated and managed by establishing an autonomous apex organization governing agricultural research (Senanayake, 1990). The Indian Council of Agricultural Research (ICAR), Brazilian Enterprise for Agricultural Research, Pakistan Agricultural Research Council (PARC) and Bangladesh Agricultural Research Council (BARC) are primarily mandated to carry out policy formulation, research coordination, funding, infrastructure and human resource development, monitoring and evaluation and information dissemination.

The ICAR in India, for example, is responsible for managing and coordinating about 100 research institutions and 53 agricultural universities across the country. The establishment of the council allowed the system to rapidly develop its research capacity to utilize resources provided by the government and external donors. The ICAR has made a visible impact on the country’s agricultural transformation: since 1951 production of food grains has increased four-fold, horticulture crops six-fold, milk six-fold, and eggs twenty seven-fold (ICAR, 2010).

According to ISNAR (1989), eleven critical factors were identified for establishing a strong apex body to effectively coordinate and govern national agricultural research systems (Table 8).
Table 8: Critical factors for building an effective research system

<table>
<thead>
<tr>
<th>1. Policy context of agricultural research</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1 Interaction between national development policy and agricultural research</td>
</tr>
<tr>
<td>1.2 Formulation of agricultural research policy: priority setting, resource allocation, and long term planning</td>
</tr>
<tr>
<td>1.3 Structure and organization of the research system</td>
</tr>
<tr>
<td>2. Structure and Organization of agricultural research</td>
</tr>
<tr>
<td>2.1 Linkage between NARS and policy makers</td>
</tr>
<tr>
<td>2.2 Linkage between NARS, the technology transfer system and end users</td>
</tr>
<tr>
<td>2.3 Linkage between NARS and external source of knowledge</td>
</tr>
<tr>
<td>3. Management of agricultural research</td>
</tr>
<tr>
<td>3.1 Program formulation and budget</td>
</tr>
<tr>
<td>3.2 Monitoring and evaluation</td>
</tr>
<tr>
<td>3.3 Information management</td>
</tr>
<tr>
<td>3.4 Development and management of physical resources</td>
</tr>
<tr>
<td>3.5 Acquisition and management of financial resource</td>
</tr>
</tbody>
</table>

Source: ISNAR (1989)

In addition to the above critical factors, due attention should be given to the selection and placement of qualified managers at all levels supplemented by hands-on training and autonomy.

Consistent with those success factors, the Ethiopian Agricultural Research Council (EARC) is broadly expected to carry out the following functions, among others:

1) Develop or revise research policies, operational and commodity strategies and guidelines pertaining to the agricultural development of the country.

2) Establish strong coordination between research institutions, higher learning institutions, extension and other development partners in program planning, priority setting and research implementation.

3) Efficiently mobilize resources to support research from local and foreign sources, efficiently distribute among institutes and ensure accountable reporting.

4) Build infrastructure and modern research facilities as well as the human resource capacity of institutions and ensure appropriate and communal use of resources (laboratory, training center) by all organs of the research system.

5) Institutionalize efficient documentation and dissemination of research outputs and information to ensure broad utilization and scale up.

6) Put in place a strong monitoring and evaluation system.

While executing the above functions, special attention should also be given to the challenges of research institutes in emerging regions. The newly established pastoral and agro-pastoral research institutes in Afar, Gambela and Somalia, relative to the other four major regions, lack both manpower and basic infrastructure to formulate a regional research agenda, undertake research and align with the extension and development partners to provide services required. In doing so, the following unique features of research in pastoral areas need to be considered:

- The harsh work environment in pastoral areas may not be favorable in attracting qualified and senior researchers.

- Relative to the other regions, private and public technology multipliers do not consider the requirements of pastoral areas.
• Over the history of Ethiopian agricultural research, much focus was given by the government and development partners to crop production and rain-fed agriculture rather than livestock and irrigated agriculture.
• The agricultural challenges in pastoral areas tend to be more difficult compared to mid-altitude and highland areas because of their farming system and climatic conditions.
• Limited recognition by these respective regions about the importance of agricultural research.

The vision for the EARC includes directorates dedicated to drafting and upholding policy in each major area of research (crop, livestock, natural resource management, mechanization, biotechnology, and socioeconomics).

The administrative wing of the Council will include the following five directorates:

1) **Strategic Planning, Monitoring, and Evaluation Directorate** will liaise with the Government of Ethiopia, the Ministry of Agriculture, and each of the research institutes to develop a national research agenda informed by both top-down and bottom-up approaches. It will also strengthen the MLE system in the NARS to ensure investments in agricultural research are relevant, effective and efficient in terms of the implementation process. Key activities will include:
   ```
   • Assess organizational arrangements of the MLE system to identify strengths and improvement areas.
   • Ensure that guidelines are aligned with international best practices.
   • Build the data management capacity of the NARS, including personnel capacity in data management.
   • Set up an integrated MLE system in partnership with the extension system to track the impact of agricultural research.
   • Introduce an independent external MLE system for the NARS that will conduct an evaluation/audit every 2-3 years and use the results to evaluate the management of research institutes (RIs) and research centers (RCs).
   ```

2) **Finance and Procurement Directorate** will set budgets for the EARC and each of the research institutes, develop and execute sound financial tracking processes and train finance staff in constituent institutions. This department will work in conjunction with the External Relations and Grant Sourcing Directorate to ensure a match between expected costs and revenues.

3) **External Relations and Grant Sourcing Directorate** will source government and other domestic and international funding for proposed research projects. The Directorate will also be responsible for creating and managing linkages and collaborations with domestic and international organizations/departments such as the Extension Directorate at MoA, CGIAR centers, the private sector, development partners and other agricultural stakeholders.

4) **Human Resources Directorate** will develop, uphold, and periodically revise a set of transparent HR policies, develop processes and tools for research institutes and centers to manage their human resources, and determine and fulfill training needs according to aggregated needs assessments. A Training unit within the Human Resources Directorate will determine ongoing training needs and develop materials for constituent institutes to use; ultimately, this training directorate might have its own training center to deliver trainings to all research and support staff. (See section 3.2 for more on the human resource and training strategy that this Directorate should be charged with implementing). The Directorate will also be responsible to facilitate alternative arrangements to jointly utilize experts in HLIs and other research organizations at both domestic and international levels.

5) **Information Systems Directorate** will support all EARC institutes, centers and departments in collecting, analyzing, and disseminating data. In particular, information systems will focus on:
Creating and populating a searchable database on approved research outputs, for use by program directorates (e.g., crop, livestock, natural resources, social sciences), research centers, and external players (as described in Intervention 1.2).

Maintaining an up-to-date inventory for finance and procurement relating to research center infrastructure, vehicles and machinery, lab equipment, and consumables, and connecting this inventory to procurement processes to facilitate expedited implementation, as described in Intervention 3.2

Developing systems or platforms for research centers to document process learning and feed information into the MLE Directorate.

**Intervention: Develop National Research Database and Technology Inventory**

A knowledge portal offers greater coordination opportunities for researchers without significantly increasing demand on their time.

To develop national research database the following are proposed:

- Create a system of accountability, for instance by making it mandatory to share and upload research outputs and information to national database center before technology release, or after publication so that interested researchers and development partners would be able to access information, knowledge and technologies.
- Invest in modern and high tech information technology infrastructure, in particular the availability of internet services in all of the research centers.
- Strengthen information documentation and publication services in all NARS affiliates’ offices to provide effective and efficient knowledge and information management system
- Prepare implementation guidelines for effective and efficient management and use of the centralized research database, including the types of data that should be shared and stored among the stakeholders, sources of budget and access and control rights.
- Train stakeholders in database entry and use.

**Intervention: Establish “Centers of Excellence” for nationally important commodities**

The “Center of Excellence” (CoE) concept is associated with a research center that is specialized in one or two commodities/disciplines with multidisciplinary and professional team(s). Within agricultural research, a CoE should have a qualified leader, sufficient technically competent research staff, a well-equipped modern laboratory and other facilities and specialized training modules. Moreover, such centers should bring together experts from different disciplines and provide the necessary logistics and fund to conduct quality research at a national level. Currently there are no CoEs in the agricultural research system but only national coordinating centers. In the future, CoEs could evolve at the institute level - for example, Jimma Research Center could be a coffee research institute. A CoE executes its research activities in collaboration with other centers to represent the diverse agro-ecology of the country.

The establishment of CoEs will help develop competitiveness in a given area of specialization and save resources. CoEs enable concentration of expertise and scarce resources in a few well established centers where research and capacity building training can be efficiently conducted. International experience suggests major scientific and technological advance are made at such centers and that they have the potential to be true centers of institutional innovations.

In addition, the CoEs should ensure that organizations invest in the most valuable commodities and create economies of scale for their service offering.
The major responsibilities of CoEs would be to:

- Serve as a national source of technologies, scientific knowledge and information in the area(s) of specialization.
- Provide guidance to other researchers engaged in the same subject by developing standards, methodologies, tools, protocols, techniques and knowledge in their area of specialization.
- Provide support for all the nation’s research centers through training and skill development.
- Closely collaborate with the CGIAR Centers and other research organizations to remain up-to-date and to collaborate in developing new technologies.

The EARC should be responsible for identifying centers that can qualify to become CoEs based on a clear set of criteria developed in consultation with all research institutes and experts. In addition, standard measurement criteria should be developed to evaluate the already existing as well as emerging centers by considering, among other things, the available human resources, physical infrastructure and financial resources. The EARC should also consider best practices from other countries recognized for effective research system (see case study in Box 1).

**Box 1**

**India’s “Niche Area of Excellence” program**

India’s “Niche Area of Excellence” program aims to achieve global competitiveness in agriculture research, education and consultancy in specific national priority areas. It is intended to create at least one center of excellence in each priority area that can compete with the rest of the world. Niche Area of Excellence is characterized by the quality of human resources available; adequate infrastructure; access to latest information; the attitude and commitment of the faculty; and recognition and interaction with the best of peer groups in India.

Eligible institutions are required to submit a proposal to the Deputy Director of Imperial Council of Agriculture Research (ICAR) stating the reason for selecting the niche area, existing strengths and past achievements, available infrastructure and equipment, and measurable targets.

The proposal is evaluated by a committee comprised of delegates from responsible program in ICAR, universities and reputable scientists. The criteria for recommending the proposal are:

- The principal investigator of the project in Niche Area of Excellence should not be below the rank of Professor/Principal Scientist or equivalent and have minimum of 5 research papers published in refereed journals.
- A core faculty of at least five members with high academic and professional records.

Proposals recommended by the committee will be put to the DG of ICAR for approval.

*Source: “Guideline for Niche Area of Excellence”, Imperial Council of Agriculture Research*

**Intervention: Establish partnership with HLIs**

University staffs in government-funded HLIs are required to spend 25% of their time on research supporting both regional and national agricultural priorities. Yet, even when located in the same area and addressing the same topic, neighboring HLIs and RIs operate independently. This is a lost opportunity for coordinated efforts, staff training and resource use.
Different modalities could be implemented to develop strong partnership between the HLIs and RIs. Some potential approaches include:

- Research institutes and HLIs coordinate efforts on projects, combining and sharing staff, resources, and equipment
- Research institutes offer internship support to MSc. and PhD students by providing experimental plots, laboratories, research equipment, materials such as fertilizer and seed, with staff researchers as co-advisors on the theses research on priority commodities and problems.
- Research institutes work together with the universities to hire high caliber students after graduation.
- HLIs support researchers in training on cutting-edge methodologies, quantitative analysis, or other staff capacity-building.
- Research institutes and HLIs jointly appoint senior staff, permitting them to split time between instructing students and leading research.

This partnership should increase the quality of appropriate and demand-driven research both in HLIs and RRs by exchange of knowledge and skills, and through building useful connections between potential collaborators. Furthermore, it will channel high-caliber students into the research system, and better leverage scarce equipment and chemical reagents. Finally, since agricultural universities rarely provide agriculture students with practical training on farms, experience with practical research in RIs could be an important complement to the theory-based training.

**Bottleneck 1.6 Biosafety proclamation is not enabling for the application of modern biotechnology tools/technologies in research**

Agricultural biotechnology has the potential to make a considerable contribution to national priorities of Ethiopia, not only in increasing food security, but also in the production of industrial raw materials (e.g., cotton) and export of agricultural products. Unlike conventional techniques, which are often imprecise, cumbersome and time consuming, biotechnology techniques allow breeders to produce desirable varieties in a short time.

Four highly promising techniques are:

- **Rapid propagation of hybrids** in clonally propagated crops, double haploid line development in major food crops, embryo culture (rescue), suspension culture, disease diagnosis and cleaning, and high quality initial/nuclear seed production in high value crops
- **Finger printing**, which can allow characterization of genetic resources particularly for indigenous species, improved varieties used by farmers, local accessions of different crops, animals and microbes that will enable efficient genetic resource use, restore genetic purity and enhance conservation as well as increase precision in gene transfer for traits of economic significance.
- **Marker assisted breeding** is useful for traits that are difficult to measure using conventional breeding. These include traits that exhibit low heritability and/or are expressed late in development. This technique allows robust monitoring of genes both in crops and animals that control traits for disease resistance, crop productivity, abiotic stress, and/or quality.
- **Developing genetically modified organisms (GMOs)** to reduce chemical applications against diseases, weeds, and insects as well as improving the nutritional quality of food crops. This may have a positive effect on human and environmental health and also significantly increase the contribution of agriculture to the country’s economy. GMO development needs to be done in a manner that does not endanger the genetic wealth Ethiopia possesses by respecting standard safety rules and regulations.

Ethiopia should put in place an enabling biosafety proclamation, modern research facilities and human resources to conduct high quality, international standard biotechnology research.
The following challenges have restricted the use of biotechnology tools to date:

- **Restrictive biosafety proclamation and directives**: While careful regulation of advanced biotechnology is necessary, at present Ethiopia has a restrictive Biosafety Proclamation and associated directives, which treat low-risk activities – such as contained research and teaching – the same way as higher-risk commercial planting/environmental release activities. This makes undertaking meaningful biotechnology research and competent skill development difficult. Both researchers and technology providers are unable to meet the restrictive biosafety rules, hindering the introduction and use of advanced biotechnology tool and the developmental of new technologies such as new crop varieties and identification and cloning of noble genes that include recombinant DNA technology.

- **Absence of National Biosafety Committee**: Another problem associated with biotechnology and its use in Ethiopia is the absence of a national level biosafety committee to ensure that activities related to biotechnology comply with the Biosafety Proclamation, directives, and other government regulations and policies to safeguard human, plant and animal health and the environment. EIAR has only one institutional biosafety committee, but it was established to serve only EIAR, and not the other institutes that are involved in biotechnology research. Moreover, Ethiopia has no mechanism in place for a transparent, independent decision-making process and appeal system, nor does it have an institutionalized system to ensure regular revisions of the policy. By contrast, other countries in Africa that have introduced biotechnology safely, such as Egypt and Burkina Faso, have set up such independent committees to receive and review biosafety applications (ABNE, 2010).

- **Poor lab facilities**: Low availability of modern biotech lab equipment has constrained the use of biotechnology tools and techniques to undertake innovative and problem-solving research. Ethiopia has only one biotech lab at Holeta Agricultural Research Center, which due to inadequate lab facilities and the departure of senior biotechnology experts, is currently not working at the intended capacity.

- **Inadequate skilled human power**: Skilled personnel are required to undertake tissue culture, molecular and genetic engineering and equipment maintenance activities; in Ethiopia existing research and technical staff are young and with limited exposure to undertake full-fledged research.

- **Inadequate and untimely supply of consumables**: Equipment, laboratory and greenhouse inputs are routinely inadequate or not delivered on time due to budget limitation and a slow procurement process.

- **No sharing**: Absence of any viable mechanism for sharing scientific equipment and other facility maintenance among the different organizations.

**Intervention: Create an enabling environment for biotechnology research**

A revision of the existing Biosafety Proclamation has been underway since 2013. In order to ensure the success of this revision and implementation, a number of accompanying interventions should be pursued as outlined below. Increasing awareness and building the biotech capacity of RIs, will help biotechnology research and development grow safely and productively.

---

4 The biosafety proclamation is currently under review and awaiting approval by the government.
Updating the Biosafety Proclamation and Directives

NARS stakeholders have agreed to revise the Biosafety Proclamation and directives to (1) differentiate low-risk activities like contained and confined research and teaching from higher-risk commercial planting; (2) relax restrictions and import-requirements for proven and low-risk technologies; and (3) put in place an appeal mechanism related to importation of biotechnology products and advanced organisms both for research and teaching. As such, the revision process should be expedited to ensure the use and application of modern biotechnology tools for the best use of time and resource to complement government’s effort of food security and livelihood improvement for smallholder farmers. To complement this change, the following are important:

- **Establish a national biosafety committee** that will assist in the development and monitoring of biosafety applications in NARS and other institutes with the following responsibilities:
  - Ensure that the biosafety proclamation is properly applied and used by all stakeholders (e.g., applications for importing and testing new technologies developed using biotech tools to be submitted to biosafety committee). The committee could be under a relevant government body such as the Ministry of Science and Technology (MoST) or the Ministry of Environment and Forestry (MoEF).
  - Facilitate and harmonize the current Biosafety Proclamation and directives’ amendments with up-to-date international biosafety norms and guidelines, to ensure ratification and global approval of the revised biosafety guideline and implementation.

- **Develop a national policy and strategy for biotechnology** that ensures biotechnology policy and strategy are useful for Ethiopian smallholders. This should include identifying priority biotechnology research areas, developing criteria to undertake needs assessment of where new varieties may be most helpful, assessing environmental risks and building a human resource and physical capacity building plan. These determinations should be made on a scientific basis, with careful assessment of the risks of unwanted gene flow versus the potential of the technology in question. For example, new exotic crops that appear promising for Ethiopia (e.g., Bt cotton) may present lower risk of unwanted gene than new varieties of indigenous orphan crops (e.g., teff).

(i) **Promote discourse on biotechnology**

- **Establish and sustain the Ethiopian Chapter of Open Forum on Agricultural Biotechnology (OFAB).** OFAB is a platform that brings together all stakeholders to improve communication among scientists, higher administration, biotechnology entrepreneurs, farmers, media and consumers to clarify biotechnology policing, as well as to promote the benefits of biotechnology among stakeholders and the general public. For instance, in 2013, EIAR and the Ethiopian Academy of Sciences (EAS) supported by the Agricultural Transformation Agency conducted six public biotechnology lecture series and one workshop for policy makers. Subsequently African Science Academies (ASA) adopted a 12 point declaration in Addis Ababa in 2013 on “Biotechnology for Development in Africa” directed to Africa’s policy makers, academics, legislators and relevant ministries. The OFAB Ethiopia-Chapter has now been launched and is hosted by EIAR. To ensure its long-term success, researchers and policy makers should be committed to participate and support the Chapter.

- **Facilitate information and knowledge-sharing strategies by creating a Biotechnology Information Center (BIC) at national and regional levels.** The objective of a BIC is to provide an integrated approach to the use of gene and protein sequencing information and genetic engineering applications. BIC also works as a link between scientists and the public by simplifying scientific information to a level that may be understood by the general public. It also offers a professional environment that permits both the public and private sectors to work together as partners in a biotechnology program for the country’s benefit, particularly for

---

5 The issues identified under bottleneck 1.6 and proposed intervention 1.6 is in line with the ASA declaration
resource-poor farmers. Finally, these centers will be able to respond to specific information needs and monitor the local level agricultural biotechnology environment.

(iii) **Invest in infrastructure, human resources, and coordinating platforms for high-quality biotechnology research**

To take advantage of advanced biotechnology tools safely and effectively, Ethiopia needs to invest in human and physical capacity. Ethiopia’s Agriculture Research Council is in a position to support this effort in three primary ways by:

- **Enabling implementation of biotechnology R&D through building new modern and high tech laboratories and improving existing ones**, in conjunction with bio-safety standards. Improvement to Holleta biotechnology laboratory is an example of the type of infrastructure improvement required.

- **Creating private-public partnerships to promote biotechnology development**. In Ethiopia, private sector funding of biotechnology research and development is negligible compared to other countries. In addition to the strict Biosafety Proclamation and low awareness of biotechnology, this appears to be caused by two factors: first, limited *intellectual property rights*, and second, unclear legislation around *cost/benefit sharing in public-private partnerships*. These factors constrain the development of public-private sector partnership initiatives and curtail agricultural research, particularly biotechnology research and use.

- **Facilitate short and long term trainings** on Marker-assisted breading, bioinformatics, double haploids and other biotechnology techniques.
3.2 Resourcing and Execution: Human Resources

Objective

High-caliber research staff are attracted to the National Agricultural Research System and retained through training and appropriate rewards.

Researchers are the core of the agricultural research system. The effectiveness of the NARS depends on the capability of its staff. This means that system needs to be able to attract, develop, reward and retain high-caliber researchers. The public agricultural research institutes are staffed with close to 2,000 researchers, working across 69 research centers. Around 1,700 of the researchers work in the five major research institutes, namely ARARI, EIAR, OARI, SARI and TARI. Over the past two decades, the Government of Ethiopia and international organizations like the World Bank have allocated significant resources for national as well as more targeted staff capacity building projects. Still, human resource capacity is considered one of the most critical barriers to the implementation of quality research in Ethiopia. This limitation was cited by 88% of respondents in the ATA survey of NARS researchers in 2012 as the primary bottleneck to their success (ATA 2013).

The gaps in human resource capacity in the research institutes are most apparent when assessing the education qualifications of current staff. In the four major research institutes (ARARI, EIAR, OARI and TARI), the majority of research staff are BSc/BA holders (~51 per cent), while only 6 per cent are PhD holders. Compared to other Sub-Saharan African countries, Ethiopia has among the lowest percentage of post graduate degree holder researchers (Figure 94 Error! Reference source not found.). Out of the 29 surveyed countries in 2008, only Eritrea and Gambia had a lower percentage of PhD holders in the agricultural research system and only Eritrea had a lower percentage postgraduate researchers.

Figure 94: Comparison of postgraduate degree holders in African agricultural research system

Source: IFPRI (2014)
Although levels of education are powerful indicators of researchers’ qualifications, they are not the only means to improve researcher capacity. Instead, a more holistic approach to human resource management should incorporate three aspects:

- **Attract and retain talented staff** in a desirable work environment with attractive incentive and compensation packages, with remuneration increasing as researchers gain more qualifications and are potentially attracted to pursue other options.
- **Build the technical capacity of staff** by developing a national training program by benchmarking curricula for the different job levels and commodity areas. For practical training, specific centers need to be identified and strengthened for nationally coordinated training programs.
- **Cultivate high performance** through both monetary and non-monetary incentives, structured evaluations, and a strong performance culture.

Currently, Ethiopia’s RIs are not meeting their potential in any of these three areas. By pursuing these three strategies, NARS can improve researchers’ skills, qualifications and performance. Moreover, it is important to have an ambitious staff training strategy that takes into consideration a succession plan by estimating attrition rates in the future. While this may require significant investment, the investment should be balanced against the cost to the research system of qualified staff leaving to pursue other career paths.

**Bottleneck 2.1 High staff attrition at all levels of the research system, particularly at senior levels**

The research system suffers from high attrition which is particularly severe at more senior levels. Survey results (ATA, 2013) showed that 52% of the researchers served for less than five years and only 11% served for more than 20 years (Figure 50). In Kenya, by contrast, the corresponding figures are 7 per cent and 64 per cent, respectively (F. Murithi et al, 2011). The high proportion of less-tenured research staff suggests either high growth or high turnover; unfortunately, in Ethiopia high turnover is the stronger factor. While the number of research staff has grown in the order of 30% over the past five years, attrition has been higher, accounting for 33% of total researchers. Between 2008 and 2012, 587 staff left ARARI, EIAR, OARI and TARI (ATA, 2013).

**Figure 50: Number of researchers by length of service in the research institutions**

Source: ATA (2013)

Attrition has been most pronounced among the MSc and PhD holders, accounting for 74% of the departing staff (Figure 61). An assessment of staff ageing and turnover in five African countries (Burkina Faso, Kenya, South Africa, Senegal and Zambia) recommends keeping an attrition level...
below 5% (Louis Sène et al, 2011). The current trend in Ethiopia, if not reversed, will further exacerbate problems related to researcher capacity and the capability to conduct quality research.

**Figure 61: Percentage of staff attrition by educational qualification in ARARI, EIAR, OARI and TARI**

<table>
<thead>
<tr>
<th>Education level</th>
<th>Attrition in the four institutions from 2008 to 2012: # of researchers leaving</th>
<th>2012 attrition rate</th>
<th>Composition of total staff vs. leaving staff</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2008</td>
<td>2009</td>
<td>2010</td>
</tr>
<tr>
<td>BSc/BA</td>
<td>17</td>
<td>31</td>
<td>36</td>
</tr>
<tr>
<td>MSc/MA</td>
<td>61</td>
<td>71</td>
<td>75</td>
</tr>
<tr>
<td>PhD</td>
<td>19</td>
<td>20</td>
<td>15</td>
</tr>
</tbody>
</table>

Source: ATA (2013)

**Intervention: Improve researcher career and incentive structure and ensure consistent implementation**

Several factors play a role in the high staff attrition rate in both federal and regional research institutes, though the single most important factor as cited by 100% of the respondents in ATA’s national agricultural research survey is the low salary scale (Figure 72).

**Figure 72: Main causes for staff attrition**

<table>
<thead>
<tr>
<th>Main causes for staff turnover</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low salary</td>
<td>100</td>
</tr>
<tr>
<td>Unfavorable working conditions</td>
<td>84</td>
</tr>
<tr>
<td>Absence of transfer policy</td>
<td>47</td>
</tr>
<tr>
<td>Poor human resource management system</td>
<td>37</td>
</tr>
<tr>
<td>Absence of well-defined and clear promotion criteria</td>
<td>21</td>
</tr>
</tbody>
</table>

“Researchers have a lot of other opportunities and unless they are offered an attractive salary and incentive packages, they will not stay in the research system.”

“MSc and PhD students do not return to research after completion, but join NGOs that pay more and place the senior staff in urban areas.”

Source: ATA (2013)

- **Salaries were much lower than in comparable functions. Before May 2014**, NARI researchers earned less than their equivalents at HLIs, and both earned 50-70 percent lower than those in comparable
roles at NGOs or government corporations (Figure 83). The salaries have been revised since May 2012, but there is still a lot of room for improvement.

- **The situation was worst at senior levels.** NARS researchers’ salaries only used to increase by ETB 4,000/month between entry and senior-most levels—though senior researchers had twenty five years or more tenure and in many cases PhDs. Because of low salaries many senior researchers left the research system. The loss of senior staff means that junior officers are running whole research centers with limited opportunity of mentorship and coaching. This situation might improve because of the improved salary scale and incentive structure that has taken place since May 2014, but their real effect on improving the attrition rates and performance has not yet been assessed.

In light of the above challenges, a committee of researchers has developed a new researcher compensation scheme that suggests salary increases to be comparable to low/median opportunities in NGOs. The Ethiopian government demonstrated enthusiasm for reforms by approving the salary and incentive structures starting May 2014 for the federal and July 2014 for the regional research institutes. To further ensure stability of the system and maintain balanced distribution of qualified researchers between research institutes, regional government must be committed to consistently implement the newly approved salary scales and incentive packages.

*Figure 83: Comparative annual salary scales for NARS and equivalent opportunities by job grades* (*000 birr*)

Source: Civil Service Ministry and Concern Ethiopia (2012)

---

6 In the revised career path; the Junior researcher position (JR I and II) are merged as JR and Associate Researcher (AsR I and II) are merged as AsR I
Bottleneck 2.2 Limited efforts to address the capability of the research staff and the support staff

Despite the tremendous efforts of the government and projects, the research system has relatively lower skilled staff compared to HLIs. Considerable efforts have been made by the government and projects like the RCBP and agricultural research and training project (ARTP) in strengthening the capacity of both researchers and the support staff through long term (MSc and PhD) and short term trainings.

Currently, short-term trainings are offered on an ad-hoc basis. Most of these opportunities are available only through outside partners rarely and opportunistically, for example, when donors and foreign partners fund a small delegation of researchers to attend international trainings or host larger-scale in-country trainings for more research staff. The absence of agricultural training in turn means that the system is unable to take advantage of capacity building projects. The impact evaluation of the RCBP project, for example, indicated that some of the laboratory equipment purchased was not installed because of lack of adequate skills (MoA, 2012).

Human capacity development is particularly hampered by the high level of staff turnover. Taking the RCBP project again as an example, 229 researchers received support for long-term trainings while 777 support staff received short-term trainings on various topics (MoA, 2012). However, for this to bring about the desired impact there needs to be an effective system in place to retain those staff that were trained.

Intervention: Develop a coordinated national training program under EARC

Training needs should be assessed and a comprehensive master training plan and training modules developed for researchers and support staff at all levels. Other African countries organize training at system and national levels based on needs assessments and targeted training. For example, the Kenyan KARI training system, considered to be one of the most well established programs of its African peers, conducts individual needs assessments and offers trainings according to a master plan, in a well-coordinated and participatory approach. KARI staff receives paid study leave on the basis that they commit to return to the institute upon completing their training (Louis Sène et al., 2011). This system is also in place in the Ethiopian research system, though results are limited by high attrition.

Learning from the Kenyan success, EARC should establish a training department to develop a master plan for short- and long-term trainings (national and international) and bring well-qualified international trainers and qualified retired researchers through rehiring, sabbatical or other arrangements to enhance on-the-job training to ensure proper implementation of the master training plan and monitor standards of training.

Additionally, the EARC should develop and supervise national level mandatory training and assessment standards. EARC would be in charge of defining basic technical competencies for researchers, and devising mandatory training curriculum of continuing education to ensure all researchers have good levels of basic operating skills.

Intervention: Improve staff performance through regular and standard evaluation and rewards

Research institutes should improve human resource policies to make policies clear, transparent, and supportive, with new emphasis on employee performance management and overall hiring, retention, and capacity-building processes.

A 2011 study of five African agricultural research systems, measuring parameters like attrition, remuneration, and training, applauded the Kenyan performance appraisal system (Box 2) as highly effective and one that can serve as an example for other countries. A successful system has the following key characteristics (Louis Sène et al., 2011):
- **Fair and transparent**: Reviews are undertaken with transparency and consistency and do not focus on petty issues.
- **Structured and regular**: Reviews are competently conducted at regular intervals with the full sanction of the organization’s leadership.
- **Meaningful results**: Evaluation results are tied to remuneration and the promotion system for outstanding performers.

On top of the above performance appraisal systems, a contractual arrangement can be tied to the tenure structure where the contract of researchers is revised or terminated based on their performance. To be sensitive to the cultural and organizational attributes of research organizations, evaluations can leverage the concept of peer committee reviews familiar to scientists through the peer review process (a system used by KARI) as well as self-evaluation which is also helpful in cultivating a performance culture.

**Box 2**

**KARI’s performance-based appraisal evaluation process**

KARI employs a regular committee-evaluation system in an institutionalized process that occurs every three years. The highly participatory process begins with researchers first evaluating themselves. Self-evaluations and supporting evidence are then passed onto an evaluation committee established at each center. The committees check the forms for correctness, provide their own aggregate scores, and submit their forms to headquarters where evaluations are standardized.

KARI promotes the relevance of evaluations by integrating performance review with promotion and compensation. As part of the process, KARI management, guided by its board of directors, determines the number of scientists needed to fill different positions within programs. After establishing the distribution of all scores, the central evaluation committee determines the minimum aggregate scores required for promotion to a particular level. At senior levels, promotion also requires that candidates be interviewed by a committee of senior managers and board members. Scientists with borderline evaluation scores are considered for incremental salary increase rather than promotion, and those with poor scores are given a written warning requiring that they improve.

Source: F. Murithi *et al*, 2011
3.3 Resourcing and Execution: Physical resources

**Objective**

Research institutes are provided with adequate, timely, reliable access to modern facilities, finance and inputs that are needed to conduct quality research.

Physical resources like equipment, facilities, and inputs/consumables are required by all research institutes to generate technologies, knowledge, and information relevant to farmers’ needs across all agro-ecological zones in the country. Though these vary by location and research subject, the physical resources needed in NARS primarily comprise offices, laboratories, lab equipment, chemicals and biological reagents, residential houses, stores/warehouses, vehicles and irrigation facilities.

Compared to those of other countries, the research system of Ethiopia is significantly under-resourced in terms of basic equipment, facilities, and inputs. Ethiopian research institutes struggle with old and insufficient vehicles, farm machinery and lab equipment that significantly reduce performance. They also lack an effective system for managing, maintaining, and replacing the facilities they have.

Bottleneck 3.1 Insufficient, outdated and poorly maintained field and laboratory equipment

To achieve its objective of generating and popularizing appropriate technologies, the NARS requires sufficient modern lab and field facilities. In 2012, 75% of the surveyed NARS researchers identified outdated and non-functional lab equipment as a critical issue. According to the survey, most lab equipment used in NARS is more than 40 years old and can analyze only a fraction of what is desired (ATA, 2013).

The GoE has made significant efforts to build physical capacity in laboratories through the ARTP and RCBP projects (MoA, 2012). These projects also address human capacity by providing training and technical assistance to researchers (as discussed in 3.2). The fact that the physical capacity gap still remains a major constraint can be attributed to a number of factors:

- **A growing demand by research institutes.** The growth in the number of new centers and sub-centers throughout the country and the obsolete equipment available in the already established laboratories has increased the demand for the state-of-the-art laboratory facilities and equipment by most RIs.
- **Equipment is not shared among centers.** There is no mechanism for sharing laboratory facilities among the NARS constituents, resulting in lack of facilities in some labs, while in others facilities are underutilized.
- **Budget allocation limits.** The government does not allocate a sufficient budget for purchasing lab equipment, requiring institutes to purchase from project budgets which are typically limited by the conditions set by donors.
- **Limited attention given to strengthen agricultural research in emerging regions.** Over the past fifty years, research has mainly focused on crop production and rain-fed agriculture. The major commodity in the emerging regions is livestock and these regions are characterized by low rainfall, making them dependent on irrigation.
- **Difficulties in planning and management of equipment procurement.** There is no clear and effective system of planning and managing the procurement of lab equipment, nor equipment maintenance, disposal and replacement.
The low availability and outdated status of lab equipment has resulted in low capacity of research centers to undertake innovative and cutting-edge research.

**Bottleneck 3.2 Shortage and aging of vehicles and farm machinery**

The availability of a sufficient number of functioning vehicles and farm machinery plays a pivotal role in the NARS' ability to conduct effective agricultural research, monitor and evaluate research activities, demonstrate research findings, and multiply breeder seeds of new crop varieties, new animal breeds and other technologies. Despite investments in physical capacity-building by ARTP and RCBP, most research centers are constrained by inadequate transportation and farm machinery (tractors and other farm equipment) (ATA, 2013). 84% of researchers identified logistics and transportation as the single greatest barrier to successfully accomplishing their work (Figure 94).

**Figure 94: Constraints in fulfilling research mandate**

![Constraints in fulfilling research mandate](image)

Source: (ATA, 2013)

Strong researcher dissatisfaction with vehicle and equipment resources, as compared to other capacity gaps, can be explained by three key conditions:

- **Vehicles are old and require frequent maintenance.** In the NARS, many vehicles, tractors and combines are still being used after 40 years of service, despite their limited functionality. With age, these field vehicles require frequent maintenance, which research centers are not always well-equipped to provide because of lack of skills and high costs. Inadequate means of transportation has thus been identified as a critical constraint to research centers' activities (MoA, 2012).

- **Limited availability of farm machinery.** The serious shortage of vehicles and machinery has far-reaching consequences. Since old tractors and harvesting machines hinder timely field operations, they ultimately affect seed production capacity and availability of breeder seeds.

- **Budget allocation rules limit research centers' ability to procure and maintain equipment.** RIs are faced with inadequate funding for vehicles, both in terms of capital budgets to purchase newer machines and maintenance budgets to ensure the functionality of equipment they have.
General funding constraints in RIs are especially pronounced when it comes to funding for equipment, vehicles, and farm machinery. Further, the time sensitive nature of research requirements, both for inputs purchasing and operating costs, means that budgeting and process delays have real impacts on research success. These delays are mainly attributed to late budget release in the first quarter of the fiscal year.

**Intervention: Ensure reliable funding for the purchase and maintenance of modern, precise and efficient laboratory and field equipment, vehicles, and farm machinery**

Addressing the resourcing constraints in NARS in a systemic fashion requires a three-pronged approach: (1) Establish more reliable external funding for capital investments; (2) GoE should allocate more funds to RIs specifically for the purchase of equipment and vehicles; and (3) RIs should be permitted to reinvest their revenues in the purchase of inputs and equipment to bridge cash shortfalls.

(i) **Through an external fundraising department in the EARC, the Council should make persistent efforts to secure funds from external sources to procure vehicles, lab equipment and farm machinery.** Over the years, NARS has attracted considerable funding from multilateral and bilateral development partners to develop physical facilities of the research system. International donors remain a promising source for financing of physical capital, but the national approach to fundraising should be more organized and systematic in order to help RIs have a reliable access through:

- Centralized fundraising in EARC. This can help all RIs access funding more reliably and equitably
- Incentivize individual researchers through honorarium to apply for international funds, for example, through grant proposal development. The level of honorarium can vary based on sizes of grants.

(See Chapter 3.1, Governance, for more on EARC and the potential of improved centralized fundraising.)

(ii) **The GoE should allocate specific funding for equipment and vehicles.** Resource allocations currently prescribed in research institutes' budgets are too limited to provide flexibility in procuring equipment, vehicles and machinery. This is further complicated by the government’s hesitance to make capital investments available (MoA, 2012). External donors, too, often restrict funding to specific categories and may not provide enough for basic services like vehicle purchase and maintenance. This problem is most pronounced in recently established research institutes and centers, which have received even lower budget allocations for vehicle purchase than others in the past. Even when sufficient funding is provided for capital items, the specific categories of vehicles and equipment may not be adequately addressed because of high subsequent maintenance and operational costs.

(iii) **Permit researchers to use internal revenues for important purchases.** Currently, institutes generate revenues through a number of research-associated activities such as sale of basic seed and certified seed. These funds could be an essential piece of the RI’s strategy to ease funding shortfalls for capital and consumable investments. RIs are currently not allowed to reuse internal revenues but instead return these revenues to Central Treasury. Permitting researchers to employ generated funds to directly purchase capital items or to secure contracts for regular maintenance of them, will have among others, the advantage of:

- Incentivizing revenue-generating activities, thus enhancing capacity and performance of research institutes over time; and
- Providing funding in a timely manner for the purchase of reagents and other time-sensitive inputs.
Intervention: Implement standard protocols to manage institutional equipment (vehicles, lab equipment, and farm machinery)

Standard equipment management procedures are essential to ensure usability and quality of equipment over time. In combination with efforts to acquire more equipment, researchers and administrators should organize standard management procedures to assess equipment for functionality and ensure it is appropriately maintained and disposed.

At the level of governance and coordination, either at EARC or centrally within each research institute, this will involve the following steps:

- **Establish baseline equipment levels for research centers and undertake a quantitative gap assessment.** Define the basic capacity that research centers should have, in terms of lab facilities, farm machinery and vehicles. This kind of assessment across NARS will help policymakers understand quantitatively and objectively what resources are missing.

- **Develop equipment use and management protocols.** With researchers on the ground, define equipment use and maintenance procedures to increase the lifespan of equipment. By doing this, lab equipment will be maintained in good condition and calibrated properly to ensure that scientists can confidently produce internationally acceptable results.

- **Establish centralized lab equipment maintenance capacity.** Central capacity at the level of RIs would enable proper periodic checking, validation, repair, and installation as well as disposal of old lab equipment or replacement of out-of-use facilities.

Though much of this work can - and should - be done at the level of RIs, one of the key strategies to implementing equipment management is the centralization of some functions under the newly-established EARC structure, as discussed below.

Intervention: Leverage EARC’s capacity to share resources among research centers

The EARC offers many material advantages to managing equipment and resources across Ethiopian research institutes. Leveraging EARC’s structure, Ethiopia can improve management of equipment and physical plant resources.

- **Manage a central database of key equipment, machinery, and vehicles.** To begin with, EARC should create a database of all RI’s farm machinery, lab equipment, and vehicle resources and their current status. Undertaking such an inventory will allow NARS to facilitate other equipment services for RIs to understand capacity gaps, and to better justify funding applications and allocations. (For more on information-sharing within EARC, please see Section 3.1.)

- **Provide central equipment maintenance services.** EARC should explore options to support research centers in the maintenance of sensitive lab equipment through central EARC hiring of qualified technicians, or linking to private research organizations that have relevant internal capacity such as NGOs. As demand of any given RI for such expertise will be low, a central office can play an important role in providing helpful linkages for RIs upon demand.

- **Institutionalize equipment sharing mechanisms.** EARC should implement sharing mechanisms among the NARS’ affiliates to facilitate efficient and effective use of lab equipment within and among research institutes. This can take the form of certifying the lending of equipment without collateral, the leasing of surplus equipment from one RI to another or even joint purchase of equipment for shared use.

- **Centralize international procurement.** Centralizing the procurement process of some consumables, will contribute greatly to efficiency and improve price stabilization. Separate purchases of items, such as chemicals, does not leverage economies of scale, leading to high prices and supply difficulties. In addition, central procurement evaluation can help institutes procure items efficiently and effectively.
Information and communication technology (ICT) plays a pivotal role in modernizing agricultural research and development as a means of collecting, analyzing, and disseminating information among a broad range of stakeholders. In particular ICT:

- **Provides key tools for research.** Particularly in agriculture, modern ICT tools in the form of Geo-referenced Information System (GIS), modern scientific research procedures and knowledge portals can greatly enhance analysis and research.
- **Facilitates dissemination of research findings.** ICT can transform the means by which researchers communicate with rural agricultural communities that benefit from their work in a time- and cost-efficient manner.
- **Fosters collaboration in research community.** In a decentralized agricultural research system like that of Ethiopia, ICT facilitates interactions among various agricultural development actors, and permits collaboration with the international research community.

Given the importance of functional ICT for effective research, it is worrying that only 27 per cent of federal and regional government offices in Ethiopia are equipped with basic ICT tools, computer and internet (Aman, 2010). A gap assessment of NARS made by MoA identified the absence of well-functioning information management system and ICT infrastructure (MoA, 2012).

Assessment of the RCBP capacity building project, which aimed to strengthen information management system and electronic connectivity, indicates that only EIAR’s headquarters managed to establish and operationalize an information management system for its finance department. Other research institutes such as Afar Pastoral and Agro-Pastoral Research Institute (APARI) and Adami Tulu Agriculture Research Center have no internet connectivity, except for slow and unreliable connection using CDMAs purchased through project budgets. Three of the research institutions APARI, Somali Pastoral and Agro Pastoral Research Institute, (SoPARI) and Gambella Pastoral and Agro Pastoral Research Institute (GAPAPRI) have no website.

The capacity gap in ICT significantly impacts the ability of RIs to operate efficiently and cost effectively:

- **Key tools are inaccessible.** Institutes with poor ICT access are unable to leverage technologies like GIS, data portals, and current and scientific research techniques. Limited ICT infrastructure has also limited other initiatives to develop national databases and knowledge portals, contributing to higher transaction costs, information gaps, and duplication of efforts and wastage of resources.
- **Poor access to critical "technology shopping" research strategy.** Without ICT, researchers cannot interact with national and international research organizations. This has a significant impact for countries like Ethiopia where technology shopping is one of the main strategies, which heavily relies on identifying and importing appropriate technologies and best practices from all-over the world.
- **Reduced administrative coordination and efficiency.** An ICT-based information management system, which is essentially non-existent in Ethiopia’s research institutions, would also increase the efficiency of administrative staff in managing processes, communication, and shared resources.
**Intervention: Develop ICT infrastructure, information management systems and ensure access to internet in all research institutes and centers**

**Information management systems** would support all EARC departments and NARS’ affiliates in collecting, analyzing, documenting and disseminating data. In particular, information systems would focus on:

- **Conducting capacity assessment of ICT infrastructure** (including availability of internet access in all the research centers) as an input to a capacity building plan intended to solicit funding from the government and international donors.
- **Creating and populating a searchable database** on approved research outputs, for use by program directorates (e.g., Crop, Livestock), research centers, and external players.
- **Maintaining an up-to-date inventory for finance and procurement** on research center infrastructure, vehicles and machinery, lab equipment, and consumables, and connecting this inventory to procurement processes to facilitate expedited implementation.
- **Developing systems/platforms for research centers** to document process learning and feed information into the MLE Directorate.
- **Creating tools to track human resources data** including staffing, performance management, and training.
3.4 Research commercialization and dissemination

**Objective**

**Strong linkages between the research and extension systems at all levels to share agricultural research outputs quickly and reliably with farmers and agro-pastoralists, pastoralists and to enable farmers’ experiences in the field to shape the research agenda.**

The value of agricultural research hinges on its application to real issues facing farmers. Strong linkages must be established among agricultural actors to ensure the relevance and uptake of agricultural research. As Agbamu (2000) writes in his review of different countries’ research and extension systems, “for agro-technologies to be relevant to local needs, researchers, extension workers and farmers must play important roles in identifying research problems, adopting the recommendations to local conditions and providing feedback to researchers about the innovations that have been developed. Effective communication links between researchers and extensionists are vital in the modification of technological recommendations and in initiating further research; such links enable new technologies and management practices to be suited to local ecological conditions.” Detailed systemic bottleneck analyses and their interventions have been handled in detail in the Extension Strategy; here however, those that are research-related will be focused on.

Ideally, collaboration between research and extension takes place in the following sets of overlapping activities that ensure the feedback loop is appropriate and effective:

- **Review process for research proposals.** Extension experts should participate in research proposal review processes at different levels to ensure that research conducted by NARS aligns with the topics that extension agents and farmers see on the ground.
- **Validation of approved technologies.** NARS should support the testing and demonstration of new varieties and technologies, and work with the extension system on technology popularization and pre-scale up once it has been approved by the Variety Release Committee or other relevant channels.
- **Provision of trainings to DAs and extension experts.** Researchers, when requested by the SMSs, should help to develop training materials to support DA annual training updates before they are deployed in planting season.

While extension is the most critical link between research and farmers, for research to be fully responsive to farmers’ needs, NARS must also link to the private service providers who engage with farmers. These include input suppliers, microfinance institutions, NGOs, farmers themselves and other actors.

**Bottleneck 4.1 Limited accountability in the system to ensure research-extension-farmer linkage**

In Ethiopia, despite the availability of highly productive and appropriate technologies developed by research centers, a wide gap exists between agricultural yields achieved at research centers and in farmers’ fields. Knowledge and technologies generated at research centers have not been effectively transferred to producers due to weak communication and ineffective collaboration between research and extension. Importantly, successful linkage systems hold research players accountable for seeking information on farmer needs from the source, developing relevant research plan and sharing research outputs widely.

The current state of linkage between research and extension is among the most problematic areas of Ethiopia’s agricultural research and development. In a review of the linkage between the two systems, Belay Kassa (2007) lists a number of problems, including:

- The lack of integration and coordination between agricultural research and extension has resulted in a confusion as to who should undertake scaling up of available technologies;
Little or no feedback from farmers reaches research institutes about disseminated research outputs largely due to the loose link between research and extension and/or the physical separation of researchers from farmers; and

Lack of awareness by farmers of the existence of technologies developed by researchers.

Weak linkages between research, extension and farmers have implications for technology popularization, dissemination and use, and ultimately for agricultural productivity. Weak linkages render useless the research efforts many make across the system.

The Agriculture Development Partners’ Liaison Advisory Council (ADPLAC), a council that meets at the federal, regional, zonal, and woreda levels, is charged with “overseeing technology generation, packaging, and dissemination,” ensuring that appropriate technologies are generated based on farmers’ needs, tested and adopted in farmers’ fields, and disseminated via the extension system with support from research. ADPLAC has to date been viewed as not very effective, with limited coverage (an estimated 300 woredas as of 2010) and little participation of farmers and other stakeholders at their meetings (Error! Not a valid bookmark self-reference.5). Demeket al. (2010) found that, out of the expected agricultural development linkages in the Amhara region, only 36% actually existed and only 42% of the existing linkages were strong (Figure 116).

**Figure 105: ADPLAC establishment at the zonal and woreda levels**

Source: MOA, ADPLAC Office (2012)
ADPLAC’s key weakness is that it is not institutionalized (it runs on project funding and it lacks permanent staff), leading to an absence of accountability mechanisms. ADPLAC is not sufficiently incentivized as a body because its funding is not contingent on the body actually convening, responding to stakeholders’ concerns, or tangibly modifying research agendas. Its contribution to linking remains limited. ADPLAC’s contribution to strengthening linkages between research, extension, farmers and other actors is further discussed in a separate Extension Strategy.

**Intervention: Install an accountable interaction mechanism between research and extension**

To promote research and extension linkages, stakeholders on both sides must agree to establish and enforce accountable and ongoing processes to engage with each other in planning research activities, field-testing of potential technologies and transferring successful technologies to farmers. It may be unwise to rely on a single approach to strengthen the linkage; the following are possible ways which can be undertaken in a complementary fashion:

1. **Strengthen ADPLAC through designated staffing and accountability mechanisms.** One approach to strengthening research-to-extension linkages is to empower and institutionalize the existing ADPLAC platform at all levels. Permanent budget and staff should be allocated for ADPLAC, and leadership authorized to hold members accountable to their attendance and contribution. The ADPLAC general assembly, which is currently meant to meet twice per year, must do so consistently in order to identify problems, share responsibilities and report on the progress of the activities undertaken by lower-level ADPLAC committees.

2. **Establish official convening occasions and share official progress reports on an annual or a biannual basis.** Official meetings of research and extension staff at all levels to share experiences and set joint agendas that are taken up by each as part of their day-to-day work, would accomplish the core original objective of ADPLAC in a more targeted, bilateral setting. To ensure this method is successful, it should be accompanied by official reporting wherein research and extension officials exchange progress assessments on their individual and jointly decided projects.

3. **Assign official liaisons between the RIs and their respective MoA/BoA counterparts.** With officially assigned liaisons, research and extension linkages will be more easily monitored and tracked for accountability. Liaisons would be charged with ensuring that coordination meetings take place, informing each department of the others’ activities, and linking ad-hoc requests to the right departments.
4. Create a directorate within the EARC and a separate section under the extension directorate to be mainly responsible for managing linkages and collaborations among agricultural development partners. The directorate within the EARC should be responsible for compiling and communicating technologies developed by the research system, facilitate training-of-the-trainer and organize planning and progress review meetings. The section under the MoA should compile, prioritize and communicate challenges that require research attention and conduct monitoring and evaluation of technology uptake by the end users. In addition, the two directorates/sections should jointly develop binding guidelines to create formal working relationship among the stakeholders.

The mechanism used to align NARS and MoA/BoA stakeholders to jointly plan activities should incorporate the following strategically essential technology testing and demonstration activities:

- **Participatory planning and feedback sessions with farmers and extension unit in problem identification and research execution.** Feedback between farmers and extension workers will help researchers better solve farmers’ tangible problems.
- **“Proof of concept” demonstration trials of new developed technologies at FTCs.** Before new technologies are released and pushed for scale-up, they should be tested in “real” conditions at FTCs and ATVETs in large plots to reduce extrapolation errors that usually lead to exaggerations, and to better convince farmers, to take up technologies.
- **Efficient channels for research results sharing with extension and farmers.** ICT-based information sharing systems—computer- or mobile-based knowledge portals or any similar sustainable information sharing platforms—are a key tool for NARS to share research outputs with farmers, especially with respect to new methodologies, recommendations, or non-technology findings such as market information.

### Bottleneck 4.2 Poor technology multiplication pathway

Once developed, new technologies and practices must be supported by robust production, distribution, and promotion to be adopted by farmers. While formal agricultural extension has a role to play in informing farmers about new technologies and linking them to sellers, technology multipliers also have a critical role in bringing innovations to market.

**Agronomic practices (e.g., row planting, irrigation water management):** Agronomic practices and techniques are traditionally passed down through agricultural extensionists, from subject matter specialists to field DAs. The extension system is the primary multiplier of new practices and gives advice to farmers.

- **Improved seed varieties (e.g., quality protein maize, quncho teff):** Research institutions generate breeder, pre-basic and basic seed (self-pollinated crops) that is further multiplied into basic and certified seed by the Ethiopian Seed Enterprises (ESE), Regional Seed Enterprises (RSE), and other seed multipliers, including the informal sector. Currently, seed of improved varieties are produced but few seed is produced for horticultural crops (carrots, onions, pepper, etc.), cash crops like coffee and spices, and forage planting materials.

---

7 For more on the multiplication of seeds, please consult the seed strategy (ATA/MOA).
**Mechanical equipment (e.g., threshers, harvesters, irrigation pumps):** Mechanical equipment models and processes can enter the country first as imported consumer models and extension prototypes, or can be produced in the country collaboratively by different actors at federal and regional Agricultural Mechanization Research Centers (AMRC).

- **Fertilizer, pesticides, and other chemicals (e.g., DAP, urea, NPS, NPK, herbicides, insecticides and fungicides):** Agro-chemicals are imported centrally by the government through Agricultural Input Supply Enterprise (AISE). Currently, close to sufficient amounts are imported, but few farmers utilize correct rates due to high costs. This indicates that promoting the correct adoption behaviors will require both education and input supply efforts, such as fertilizer blending facilities within the country. See the national soil systems strategy for more (ATA/ MOA, 2013).

Key aspects of these distribution channels are outlined in Figure 7. While improved seed and fertilizer are popular with farmers, production quantities and distribution channels are insufficient to match needs. Other technologies – especially mechanization equipment – suffer significant barriers to adoption because of farmers’ skepticism toward novelty and risk and additionally finding the right equipment is a slow process.

> **Figure 17: Types of technology multipliers and their relative effectiveness in Ethiopia**

<table>
<thead>
<tr>
<th>Technology type</th>
<th>Primary multipliers</th>
<th>Technology adoption pathway</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improved seed varieties for cereals</td>
<td>EIA/RRIs, ESE/RSE, some HLIs, private multipliers; and commercial farmers</td>
<td><img src="image" alt="Diagram" /></td>
<td>Quantity produced is very low. Input collection and distrib through coops is slow and inefficient.</td>
</tr>
<tr>
<td>Improved seed for vegetables &amp; other HVCs</td>
<td>Primarily imported, sold through private channels. Some potato seed at Holota/Adet RCs</td>
<td><img src="image" alt="Diagram" /></td>
<td>Almost no domestic ESE/RSE production, though capability exists, esp in potato seeds.</td>
</tr>
<tr>
<td>Mechanization technologies</td>
<td>AMRCs promote equipment; public and private mfrs and distributors sell them</td>
<td><img src="image" alt="Diagram" /></td>
<td>Very limited capacity to produce, especially motor-powered eqipmt. High cost limits adoption.</td>
</tr>
<tr>
<td>Fertilizer, chemicals and pesticides</td>
<td>AISE imports and coops distribute; some domestic blending capacty exists</td>
<td><img src="image" alt="Diagram" /></td>
<td>Cost leads to under-application. Central import with coop-based distri has caused supply issues.</td>
</tr>
</tbody>
</table>

*Note: Supply refers to the production and import methods by which technologies are brought to market; distribution refers to the channels by which they reach smallholders, and adoption refers to farmers’ openness to and correct utilization of technology, when available.*

The distribution of seeds is discussed further by the Seed Strategy (ATA, 2013), the appropriate use of fertilizer is discussed by the Soil Strategy (ATA, 2013), and the distribution of mechanization equipment is discussed by the Mechanization Strategy (released online), all of which were developed by ATA and its key partners.

**Limited production and multiplication of improved seed:** Of the technology multipliers identified, the pathway to production and multiplication of seed of improved varieties is the most strongly linked to the NARS system, and the best developed technology multiplication pathway in Ethiopia. In the ideal process, NARIs and HLIs produce breeder, pre-basic and basic seed, supply it to the Ethiopian Seed Enterprises (ESE), Regional Seed Enterprises (RSE) and private seed farms. These in turn produce large quantities of basic and certified seed to be sold through cooperative unions and cooperatives. This official channel produced 70% of maize hybrid seed, while private seed multipliers produced 30%. Still, there are a number of problems with the improved seed pathway:

- **Comprises a limited number of crops,** mainly hybrid maize and wheat plus – in very limited amounts – teff, chickpea, haricot bean, barley and soybean. Other technologies such as seed of improved varieties of horticultural crops, including coffee and spices; forage crops; farm machinery and animal
breeds are made available to users in a very limited manner because of a small number of enterprises engaged in their multiplication.

- **Even for maize and wheat, the quantity of seed produced is low**, meeting only 11% of the cultivated land demand, partly due to the low capacity of ESE and the RSEs, but also because research institutes have low capacity to supply sufficient breeder and pre-basic seed for multiplication.

Table 9: Amount of certified seed produced by ESE in tons

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Cereals</td>
<td>18,152.6</td>
<td>19,573.4</td>
<td>22,695.4</td>
<td>30,288.3</td>
<td>52,430.3</td>
</tr>
<tr>
<td>Pulses</td>
<td>1678.3</td>
<td>1977.1</td>
<td>1968.9</td>
<td>2840.8</td>
<td>1484.7</td>
</tr>
<tr>
<td>Oil seeds</td>
<td>881.9</td>
<td>620.6</td>
<td>579.2</td>
<td>595.5</td>
<td>298.1</td>
</tr>
<tr>
<td>Horticultural crops</td>
<td>0.2</td>
<td>3</td>
<td>4.5</td>
<td>1.8</td>
<td>2.9</td>
</tr>
<tr>
<td>Fiber crops</td>
<td>24</td>
<td>--</td>
<td>3.3</td>
<td>--</td>
<td>100</td>
</tr>
<tr>
<td>Forage crops</td>
<td>8.9</td>
<td>10.3</td>
<td>--</td>
<td>17.6</td>
<td>9.3</td>
</tr>
<tr>
<td>Total</td>
<td>20,745.9</td>
<td>22,184.4</td>
<td>25,251.2</td>
<td>33,744.1</td>
<td>54,325.4</td>
</tr>
</tbody>
</table>

Source: ESE, taken from ESEAFSTA (2010)

Environment does not encourage private businesses to invest in innovative technologies, especially in production of mechanical equipment. For non-variety technologies, private multipliers are particularly essential for smallholder access, since there is no public organization responsible for the multiplication of these technologies. Firms that could engage in design, manufacture, import, and retail activities for mechanized agriculture, agro-chemicals, and improved varieties encounter prohibitive policies and poor access to finance due to:

- **Lack of enforcement of intellectual property right (IPR) infrastructure** to protect designers and manufacturers from imitators. IPR concerns may dissuade potential firms from entering the market or from investing in local production in Ethiopia.
- **Poor access to credit and funding**. Financial institutes are often not ready to bear the risk associated with investment in agriculture and demand high collateral for loans.
- **Slow adoption by farmers of high-cost technologies**. On the demand side, the market for higher-value products (e.g., farm machineries) is limited, since potential smallholder farmer customers also face significant credit constraints. High cost is also a key issue in adoption of correct fertilizer rates.

Compounded with limited domestic capabilities to produce these improved technologies, the factors listed above are prohibitive for the adoption of best practice technologies from abroad.

The critical shortage of technology multipliers has affected not only the wide-scale use of technologies that could improve agricultural productivity, but also has hindered the innovative capacity of the country. Inadequate supply of technologies means the country imports and uses unproven technologies from outside, spending foreign currency and making the technologies financially unaffordable to most farmers.

**Intervention: Create an enabling environment for technology multipliers**

Technology multiplication can be treated as two distinct issues. First, research institutes must focus on the link between multiplication and supplying sufficient technology starter materials (seeds of varieties, animal breeds, prototypes, etc.) for further multiplication with full technology packages that can be taken up by users at all levels (farmers, investors, industry). Second, stakeholders must seek to engage, incentivize and build the
capacity of the private sector to produce more innovative technologies and market them to farmers. While the first issue is being addressed by constant efforts of the research system—and must be duly emphasized—the second issue is addressed hereunder.

Enabling innovation requires a package of policy and investment solutions:

- **Reform the technology evaluation, registration and release system.** Currently, technology evaluation, registration and release strategy and guidelines are not in place, particularly for agricultural machinery and other important technologies such as animal breeds and soils. A robust evaluation, release and registration mechanism for agricultural technologies while also establishing centralized technology testing center would contribute to appropriate technology generation and improve adoption.

- **Put in place intellectual property right infrastructure** that protects technology creators’ rights to exclusively control the production and sale of their technologies/designs. Strengthening the patent system will be essential to encourage domestic innovators and to attract foreign technology firms to build manufacturing capacity in the country. This protection must extend to seed varieties as well. Historically, crop varieties have been developed by public research institutes which produce public goods and do not need any licensing; however Ethiopia’s comparatively weak varietal licensing discourages private firms from developing, releasing, and producing improved varieties in the country.

- **Increase access to credit for agricultural technology businesses.** Low financial capacity of the local technology multipliers results in low and limited technology multiplication and use by the farmers. This is mainly attributed to the fact that agriculture is viewed as highly risky and financial institutions are not willing to bear the perceived risk. A credit insurance system targeted at investors who participate in agricultural technology multiplication sector can address this challenge.

- **Structure opportunities for collective purchases of mechanized and other high-cost technologies by cooperatives and other farmer associations.** Cooperatives and other organizations representing farmers (e.g., NGOs, local governments) may be promising sources of demand for capital-intensive technologies, whether through a subsidy or through a purchase of shared equipment for collective use.

Appropriate enabling policies and incentives can promote vibrant private sector involvement in technology multiplication. At the same time, public stakeholders should continue to play a key role in research-extension collaboration, seed production, and demonstration of new technologies.
Chapter 4: Implementation Framework

Implementing the holistic set of interventions identified in this strategy requires the concerted effort of many different partners. As such, it will need to be coordinated and sequenced in a way that leverages partnerships and avoids duplications or gaps. To guide this process, a systematic implementation framework has been developed.

The interventions outlined in this document are grouped into four intervention areas. Implementation of each of the intervention areas and respective activities can be undertaken by relevant institutions both at federal and regional levels. Each area should have an institutional owner that is responsible for driving the implementation and monitor the progress.

At the national level, implementation of the strategy should be guided by the EARC. The Council may provide high-level guidance to ensure that implementation is on track by: overseeing resource allocation, reviewing progress and providing feedback. EARC will also take the lead in addressing emerging challenges and refining the strategy so that it remains relevant as the research system continues to evolve.

In addition to the EARC, the Ethiopian Institute of Agricultural Research and regional research institutes should be responsible for planning and implementing the interventions in their respective research centers. Table 10 shows a preliminary list of implementation owners for each intervention.

Interventions can be classified into three groups.

1. **Policy interventions**, which include laws, strategies, regulations and guidelines that govern the way the national agricultural research system should be structured and implemented.
2. **Capacity-building interventions**, including knowledge, physical infrastructure, equipment, staffing and others.
3. **Coordination and alignment interventions**, to ensure coordination and linkages among institutes so that their mandates and outputs are aligned to achieve consistent objectives.

Prioritization and sequencing of interventions

While the set of interventions proposed in this strategy document contribute to improving the governance and capacity of the national research system, achievement of the vision will not occur immediately. Instead, a careful sequencing of activities will be necessary to ensure that actors in the research system are strengthened and roles among all partners are made clear.

The interventions have different degrees of impact on the system. The feasibility of any given intervention is also taken into consideration based on the resources required, the time it is going to take to implement and the number of actors that are going to be involved.

The prioritization will help in determining the most critical interventions such that the highest-impact and most feasible interventions are sequenced in the first phase of the implementation.

In Table 1, the specific interventions proposed in the above sections have been prioritized according to expected impact and feasibility. This will enable organizations to allocate resources to the most pressing interventions.
### Table 10: Interventions that have already begun and their owners

<table>
<thead>
<tr>
<th>Interventions already begun</th>
<th>Owner</th>
</tr>
</thead>
<tbody>
<tr>
<td>1  Empower a national agricultural research council responsible for governing and coordinating the research system</td>
<td>EARC</td>
</tr>
<tr>
<td>2  Revise bio-safety law and establish OFAB Ethiopia</td>
<td>EIAR</td>
</tr>
<tr>
<td>3  Improve the career path and incentive structure of researchers and support staff</td>
<td>EARC/EIAR/RARI</td>
</tr>
<tr>
<td>4  Build the laboratory capacity of research centers</td>
<td>EARC/EAIR/RARI</td>
</tr>
</tbody>
</table>

### Table 11: Prioritization of interventions based on impact and feasibility

<table>
<thead>
<tr>
<th>Impact</th>
<th>Feasibility</th>
<th>Intervention</th>
<th>Owner</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>Low</td>
<td>Ensure reliable funding for the purchase of equipment, vehicles, and farm machinery</td>
<td>EARC, Establish and empower EARC</td>
</tr>
<tr>
<td>High</td>
<td>Low</td>
<td>Develop ICT infrastructure and information management system</td>
<td>EARC, Improve the career path and ensure consistent implementation</td>
</tr>
<tr>
<td>Medium</td>
<td>Medium</td>
<td>Create an enabling environment for technology multipliers</td>
<td>EARC, Establish “Centers of Excellence”</td>
</tr>
<tr>
<td>Medium</td>
<td>Low</td>
<td>Create external relations and grant sourcing directorate under EARC</td>
<td>EARC, Develop a coordinated national program</td>
</tr>
<tr>
<td>Medium</td>
<td>Low</td>
<td>Implement standard protocol to manage institutional equipment</td>
<td>EARC, Leverage EARC’s capacity to share resources among institutes and centers</td>
</tr>
<tr>
<td>Low</td>
<td>Low</td>
<td>Create an enabling environment for biotechnology research</td>
<td>EARC, Establish partnership with HLIs</td>
</tr>
<tr>
<td>Low</td>
<td>Low</td>
<td>Develop national research database and technology inventory</td>
<td>EARC, Strengthen MLE system</td>
</tr>
<tr>
<td>Low</td>
<td>Low</td>
<td>Improve staff performance through regular and standard evaluation and rewards</td>
<td>EARC, Develop an accountable interaction between research and extension</td>
</tr>
<tr>
<td>Low</td>
<td>Medium</td>
<td>Improve staff performance through regular and standard evaluation and rewards</td>
<td>EARC, Develop an accountable interaction between research and extension</td>
</tr>
<tr>
<td>Low</td>
<td>High</td>
<td>Improve staff performance through regular and standard evaluation and rewards</td>
<td>EARC, Ensure consistent implementation</td>
</tr>
</tbody>
</table>

Feasibility: Qualitative assessment of cost, time, already on-going or not and the involvement of multiple players or less
Impact: Qualitative assessment of systemic interventions in terms of the level of impact on research improvement and agriculture productivity

---

8 The institutional owners in table 11 will hand over the activities to EARC, as indicated in table 1, once the EARC secretariat office is fully functional
The proposed implementation of the strategy occurs in two phases, each lasting 5 years (Error! Reference source not found.8). Phase I will start 2014, considering some of the pending interventions that started either before the strategy was developed or in the course of release of the strategy, and assuming the strategy is fully agreed upon, signed off, and lunched during this period. The implementation plan as detailed in the next section is focused on this first phase.

Phase II will then run until the end of 2023. The strategy for this phase is already included in this document, but the precise interventions will be further detailed in a revised strategy that is expected by 2018.
This phasing allows for incorporation of learning from ongoing interventions and from Phase I implementations for successful implementation in Phase II.

Figure 18: Prioritization of intervention based on impact and feasibility
4.2. Monitoring, Learning and Evaluation

The Monitoring, Learning and Evaluation (MLE) framework for this strategy uses a results framework to check whether the activities on the ground are on track to meeting the planned objectives. The results framework consists of outputs, outcomes and impact, each of which has a set of indicators and targets. The outputs are the direct results of the interventions discussed in this document and to be implemented at federal and regional levels.

These outputs will be measured through indicators. The successful realization of these outputs will enhance the effectiveness and efficiency of the NARS, which is the anticipated outcome. These outcomes will also be measured through indicators. Finally, the outcomes should contribute to the ultimate impact of increasing productivity and improving livelihoods at the smallholder farmer level in a much larger area and on a wider scale.

### Impact

<table>
<thead>
<tr>
<th>Expected Results</th>
<th>Indicators</th>
<th>Targets</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contributions made to Increased productivity and income for smallholder farmers</td>
<td>1.1 % increase in average yields of crops and livestock at farm levels by 2018</td>
<td>30%</td>
</tr>
<tr>
<td></td>
<td>1.2 % increase in annual income for smallholder farmers by 2018</td>
<td>100%</td>
</tr>
</tbody>
</table>

### Outcomes

<table>
<thead>
<tr>
<th>Expected Results</th>
<th>Indicators</th>
<th>Targets</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improved research system developed that generates and demonstrates appropriate, demand–driven and agro-ecology-based technologies and practices</td>
<td>1.1 Increase in number of technologies delivered to uptake pathways in each value chain by 2022</td>
<td>50%</td>
</tr>
<tr>
<td></td>
<td>2.1 Research staff who believe there is no unnecessary duplication of efforts and wastage of resource by 2017</td>
<td>80%</td>
</tr>
<tr>
<td></td>
<td>2.2 Increase in NARS affiliates’ total research budgets by 2017</td>
<td>20%</td>
</tr>
<tr>
<td></td>
<td>2.3 Respondents in the research system feel there is a fair distribution of germplasm in the NARS</td>
<td>80%</td>
</tr>
<tr>
<td></td>
<td>2.4 Increase in international funding to the research system by 2017</td>
<td>50%</td>
</tr>
<tr>
<td>An enabling environment created for non-crop technology multipliers</td>
<td>3.1 Increase in generation and dissemination of non-crop technologies by 2022</td>
<td>20%</td>
</tr>
<tr>
<td>Improved human capacity of NARS to generate, release and popularize new technologies</td>
<td>4.1 NARS research staff trained at MSc/M.A and Ph.D. levels</td>
<td>20% MSc/MA; 10% PhD</td>
</tr>
<tr>
<td></td>
<td>4.2 Reduce the attrition rate of senior researchers by 2017</td>
<td>60%</td>
</tr>
<tr>
<td>Availability of knowledge, information and technologies on agricultural research enhanced</td>
<td>5.1 Farmers using newly released technologies increased by 2022</td>
<td>50%</td>
</tr>
<tr>
<td></td>
<td>5.2 Farmers adopting at least one improved technology developed in previous three years by 2022</td>
<td>50%</td>
</tr>
</tbody>
</table>
### Outputs

<table>
<thead>
<tr>
<th>Expected Results</th>
<th>Indicators</th>
<th>Targets</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1 Coordination and governance of the National Agricultural Research System (NARS) improved</strong></td>
<td>1.1 National Agricultural Research Council established, staffed and functional by end 2015</td>
<td>N/A&lt;sup&gt;9&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>1.2 National agricultural research agenda developed and implemented across NARC members by end 2015</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>1.3 National database for technologies created and functional by 2022</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>1.4 Research institutes implemented improved MLE system</td>
<td>50%</td>
</tr>
<tr>
<td><strong>2 Biotechnology research and utilization enhanced</strong></td>
<td>2.1 National biotechnology policy and strategy developed and implemented by end 2017</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>2.2 Revised biosafety proclamation issued and approved by end 2014</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>2.3 Amount of clean planting materials of selected commodities produced by tissue culture increased by end 2017</td>
<td>50%</td>
</tr>
<tr>
<td></td>
<td>2.4 National biosafety and Biotechnology coordinating committee established and start working by 2017</td>
<td>N/A</td>
</tr>
<tr>
<td><strong>3 National research strategy developed and owned</strong></td>
<td>3.1 National agricultural research strategy developed and implementation started by 2017</td>
<td>N/A</td>
</tr>
<tr>
<td><strong>4 Capacity of research institutes to generate, release and popularize new technologies improved</strong></td>
<td>4.1 Research “Centers of Excellence” established by 2017</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>4.2 Research centers implementing revised career path by 2015</td>
<td>100%</td>
</tr>
<tr>
<td></td>
<td>4.3 Research centers implementing revised incentive plan by 2015</td>
<td>100%</td>
</tr>
<tr>
<td><strong>5 Availability of knowledge, information and technologies on agricultural research enhanced</strong></td>
<td>5.1 A knowledge portal created under the control and responsibility of EARC by 2022</td>
<td>N/A</td>
</tr>
</tbody>
</table>

---

<sup>9</sup> N/A: Not Applicable, as the indicator cannot be quantified
References


Kristin et al. (2010). In-Depth Assessment of the Public Agricultural extension System of Ethiopia and Recommendations for Improvement. International Food Policy Research Institute

Louis Sène et al. (2011). *Staff Aging and Turnover in African Agricultural R&D: Lesson From Five Agricultural Research Institutes*. ASTI/IFPRI.


