

History and Status of Agricultural Research in Ethiopia: A Review

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Abstract

The paper reviews the historical development of agricultural research in Ethiopia. In about half a century of existence, the national agricultural research system has developed and released several improved crop varieties with their packages, but this is considered as a piecemeal approach and the research on livestock, mechanization and natural resources are lagging behind. Furthermore, food security, nutrition, healthcare and environmental sustainability are among Ethiopia's biggest challenges. Thus, Ethiopia needs to double food production without increasing the area of land under cultivation, by using high-tech manufactured goods because biodiversity in the country is under threat; it has to invest much in developing her national agricultural research systems (primarily infrastructure and human resource development) that are thought to contribute towards transforming traditional and subsistence farming. The country also needs to develop its own research capacity to assess the critical problems through local, regional and national institutions.

Key Words: Biodiversity, high-tech manufactured goods, research capacity, traditional farming

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Introduction

Historically, the performance of agriculture has been very poor in Ethiopia. To improve this situation, the country, in collaboration with other donor communities, has invested much in developing her national agricultural research systems (primarily infrastructure and human resource development) that are thought to contribute towards transforming this traditional and subsistence farming.

Thus, the objectives of the paper are to review the historical development, assess the current status of agricultural research, and identify the future challenges of agricultural research in Ethiopia.

Historical Development of Agricultural Research in Ethiopia

By African standard, agricultural research in Ethiopia started very late. The Ethiopian National Agricultural Research System is a relatively recent phenomenon, which is still in the making to fulfill public expectations towards poverty reduction and food security and accelerating production gains. It has been growing in the face of several challenges, opportunities and expectations. This section of the paper deals with the development of the Ethiopian NARS. It traces the history of NARS, explores evolutionary developments, and discusses institutional reforms undergone by NARS thus far. Achievements and current scenario of NARS are also discussed by assessing the key challenges, opportunities and future directions.

Organized agricultural research was introduced to Africa by European colonizers in about 1900. Over the next several decades, the research system of the region evolved largely within the context of that colonial legacy (Pardey *et al.*, 2003; Pardey and Beintema, 2001). Ethiopia, in contrast to

other African countries, presents a different experience regarding the emergence and historical development of its national agricultural research system. This section provides a historical and evolutionary overview of the Ethiopian NARS based on a review of several studies (Roseboom *et al.*, 1994; Getinet *et al.*, 1996; Demise, 2000; Beintema and Menelik, 2003; Demel, 2002; Demel 2003; Tesfaye *et al.*, 2004). The historical and evolutionary accounts are discussed based on three stages of development: the origin and early developments of NARS (late 1940s to 1966), the emergence and development of formal research system (1966 to 1991), and recent structural reforms and trends in institutional growth (1993 to 2003).

Modern agricultural research in Ethiopia began about 60 years ago. The three important phases of the institutional development of the Ethiopian NARS include:

Early phase (late 1940s to 1966)

Agricultural research in Ethiopia dates back to the late 1930s when some exploratory studies were conducted by Italian colonial invaders. However, the major impetus in the history of organized and publicly funded research can be traced to the establishment of three agricultural schools around the mid-20th century. These were the *Ambo* Agricultural School (1947), the *Jimma* Agricultural and Technical School (1952) and the Imperial Ethiopian College of Agriculture (1953), now *Haramaya* University (Pankhurst, 1957; Donham and James, 1986; IEG, 1956, 1962)

In 1953, the *Debre Zeit* Agricultural Research Station was established under the then Imperial Ethiopian College of Agriculture. The DZARC operated with staff focused exclusively on research. The College remained the major college-based research entity until 1966. By then, the Institute of Agricultural

Research (IAR) was established as a semi-autonomous institute under the then Ministry of Agriculture (MoA). After four decades of “research with a mission”, DZARC marked its transfer, in 1997, from AUA to Ethiopian Agricultural Research Organization (EARO), now Ethiopian Institute of Agricultural Research (EIAR). The major financial support to develop IAR was provided by the Food and Agriculture Organization (FAO) and the United Nations Development Program (UNDP). IAR subsumed the few and scattered research activities of MoA that preceded its establishment (FDRE, 1997; UNDP, 2001).

Other field experiments were initiated during the 1963 at *Kuyera* (near *Shashemene*) and at *Addis Ababa*; the major focus was screening for adaptability of selected crops and cultural practices. Varietal introductions and experimentation with dairy cattle and poultry were also conducted.

Instigation of well-coordinated NARS (1966-1992)

The establishment of IAR in 1966 and several other nationally mandated research centers over the 1970s and 1980s marked a significant development 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 modestly full-fledged national research system in many aspects. This section chronicles some of the major historical accounts of the research system during this period based on key institutional developments and trends.

Institute of Agricultural Research

Soon after its establishment, IAR rapidly evolved as the major entity in the national agricultural research system, taking over the role initially played by the then Imperial Ethiopian College of Agriculture. The objectives of IAR were to formulate national agricultural research guidelines, coordinate national agricultural research, and undertake research in its centers and sub centers located in various agro-ecological zones of Ethiopia (ICARDA, 1999; Tsedeke, 1995; Bechere, 2007).

In 1977, IAR underwent two major reforms: institutional reorganization, and a change in research program setting. The semi-autonomous institute later was reorganized as an autonomous institute governed by a Board of Directors. Members of the Board were from agricultural or related ministries and organizations. However, membership and chairmanship titles in the Board changed over time, often coinciding with changes in government structures. IAR conducted research undertakings on crops, livestock and natural resources. The research programs were carried out at the level of research centers, with the center manager being responsible for planning and managing the programs. In 1977, however, the programs were restructured into a departmental set-up. Eight research departments were established based on subject matter. These included field crops, horticulture, coffee, crop protection, animal science, soil science, agricultural engineering, and socio-economics.

Researchers were grouped into these departments each of which was led by a Department Coordinator. Coordinators were responsible for managing departmental research programs while the main duty of center managers focused on administering the center.

In 1979, multidisciplinary, commodity-improvement teams were established under the research departments. The aim in setting up research teams was to more effectively use the few research specialists scattered across the different departments. In the mid-1980s, the research set-up of IAR was once again restructured. The purpose of this reform was to harmonize the agricultural research and technology transfer system with the country's Agricultural Development Plan which was formulated by identifying Regional Development Zones. In the new IAR structure, regional research was, therefore, emphasized. A research center was designated in each regional zone and given the responsibility to coordinate IAR's research activities in that particular zone. The regional approach was also aimed at improving the research-extension linkage at a zonal level. In the new structure, some research centers were also given a national mandate, designated as national commodity research centers that coordinate national commodity improvement teams. IAR's eight research departments were reorganized into some fifteen research divisions (MOA, 1998 and 1999; Bechere, 2007).

Research Institutions of other Ministries

During the 1970s through the early 1990s, several agricultural research institutions evolved. These were established either as research projects, departments or national research centers of agricultural ministries or agencies. The main contribution that these initiatives made to the development of the national agricultural research system was a rapid expansion into new subject areas of research. Subjects that were not previously addressed by IAR such as fishery, forestry and animal health were included in the national research agenda. Sometime after their establishment, however, most of these research centers suffered from recurrent structural modifications in their ministries or agencies or during changes of government. The dilemma between the dual

duties of research and provision of development services also considerably affected most of the centers' growth, and contribution to the country, as research institutions in their specialized areas.

Two ministries were involved in agricultural research: MoA and the Ministry of State Farms (MSF). MoA initiated adaptive research during the late 1960s and 1970s through a scheme called "comprehensive package projects" that specifically targeted at the problems of smallholder farmers. Six projects were initiated in different regions. However, only the *Chilalo* Agricultural Development Unit (CADU), established in 1967, developed a long-standing research program. Its establishment was encouraged by the successes experienced with India's Integrated Agricultural Development Project (IADP) and Bangladesh's Integrated Rural Development Program (Comilla). The Swedish International Development Agency (SIDA) agreed with the Ethiopian government to start a similar project, and began CADU in 1967 (<http://en.wikipedia.org/wike>). The program included research, extension, marketing aspects, and credit and input supply schemes for smallholders. Its main impact was to show that significant increases in cereal yields were feasible through the use of fertilizers. Farmer extension services were an integral part of CADU's activities. Other similar projects were started in later years, but it was realized that implementing them throughout the whole country would not be feasible because of the high manpower needs and costs involved.

CADU tested and released many wheat and barley varieties. CADU also conducted research on farm implements, oil crops and horticulture. In the early 1980s, CADU was renamed as the *Arsi* Rural Development Unit (ARDU).

Some readers of this document may enquire why *Chilalo* was chosen for the Swedish Assisted project. The *Chilalo* District was not randomly selected. There were practical and historical reasons why *it* was selected as the focus of rural development effort in Ethiopia. The historical background was that as far back as the years of the Italian occupation of the country in 1934-41, the Italians had identified the potential of the region for massive agricultural development to produce millions of tons of wheat for export to feed the growing population of Italy. In anticipation of this bounty, the Italians had already built huge underground grain silos in the *Ethaya* plains. Unfortunately for them, but fortunately for Ethiopia, this project was not realized to the fullest scale because of the defeat of the Italians and liberation of the country in 1941. However, the identification they did and the aborted project was to emerge as CADU twenty-five years after the Italians were sent home. Only this time, the objective was not to develop commercial agriculture, but to raise the level of productivity of the peasant farmers and uplift the standards of living of the rural folks (CADU, 1972; <https://www.en.wikipedia.org>).

The practical reasons for the selection of *Chilalo* over the other districts in the country were even more compelling than the historical ones. The selected district was only a short distance away from the ever-growing population centers such as *Nazareth (Adama)*, *Debre Zeit (Bishoftu)*, and *Addis Ababa* itself (Mezgebou, 2001; CADU, 1972).

More significantly, a number of national research centers that operated under the control of MoA flourished. These included: National Veterinary Institute (1964), National Tse-tse and Trypanosomiasis Investigation center (1972), Fish Breeding and Research Center (1974), Wood Utilization Research Center (1979), Forestry Research Center (1979), National Soil Laboratory (1989), and Institute of Animal Health Research (1992). The Plant Genetic

Resource Center/Ethiopia (PGRC/E), established under IAR in 1975 to collect and preserve indigenous crops, was transferred to MOA in 1991.

The Ministry of State Farms (MSF) was another ministry that once existed and carried out some limited research activities. The Research and Advisory Department of this Ministry conducted field tests on research products of IAR and *Alemaya* University of Agriculture to verify their suitability for large-scale agricultural production by state farms. MSF also under-took applied research in some areas such as horticulture where IAR or AUA did not have active programs. In 1976, the Soviet Phyto-pathological Laboratory (SPL) was established at *Ambo* to conduct crop protection research. Later on, SPL evolved into the *Ambo* Agricultural Research Center (AARC). AARC was administered by the Ethiopian Science and Technology Commission (ESTC) until 1997 and later transferred to the administrative control of EIAR (Bechere, 2007; EARO, 2001 and 2003).

During this phase, agricultural research has been undertaken by different organizations without proper co-ordination. As a result, duplication of efforts and resources as well as conflicts among organizations were often the common phenomena.

Recent Structural Reforms (1993-2003)

The Ethiopian NARS underwent a significant structural reform in the early 1990s as a result of the decentralized political system introduced by the new government which led to the creation of federal and regional governments. This period is marked by the evolvement of federal and regional structures in the history of the NARS. A number of IAR research centers were transferred to the respective regional governments in 1993, thereby becoming independent centers coordinated by regional agricultural development

bureaus during the early days and later by the respective regional research institutes (RARIs).

In 1997, the federal research system was significantly restructured, leading to the establishment of the Ethiopian Agricultural Research Organization (EARO). EARO was established by the merger of the remaining federal research centers of IAR (nine) with the DZARC of AU and five national research centers. The national research centers include *Ambo* Plant Protection Research Center (APPRC), Forestry Research Center (FRC), *Sebeta* Fish and other Aquatic Resources Research Center (SFARRC), National Soil Research Center (NSRC), and *Sebeta* Animal Health Research Center (SAHRC). The Essential Oils Research Center was subsumed by EARO in December 2002. EARO soon became the major research entity in the Ethiopian NARS. EARO was established with the following objectives: (i) to generate, develop and adapt agricultural technologies that focus on the needs of the overall agricultural development and its beneficiaries; (ii) to coordinate research activities of agricultural research centers or higher learning institutes and other related establishments which undertake agricultural research on contractual bases; (iii) to build up a research capacity and establish a system that will make agricultural research efficient, effective and based on development needs; and (iv) to popularize agricultural research results.

EARO falls within the administrative responsibility of the Ministry of Agriculture and Rural Development (MoARD), currently renamed as Ministry of Agriculture (MoA). Since its establishment, EARO used to be governed by a board. In early 2004, however, the proclamation for the establishment of EARO (1997) has been amended, resulting in the replacement of the governing board with an advisory board. EARO's research was organized into 5 research directorates, 3 research coordination offices, 40

research programs, and 106 research projects. During the late 1990s and early 2000s, EARO that is now named Ethiopian Institute of Agricultural Research (EIAR), managed 15 federal research centers. More recently, the Institute also underwent institutional reforms based on business process reengineering principles. Moreover, since 2003 over five regional agricultural research institutes have been established to manage the research centers existing in their respective administrative regions (<http://www.eiar.gov.et>)

The current National Agricultural Research System is made up of three types of institutions:

1. The Ethiopian Agricultural Research Organization (EARO)

During the establishment of EARO, different research institutions/centers were consolidated to form it. Currently, these research centers employ 86% of the total full-time researchers and use 97% of the total financial resources of all the NARS.

2. The Regional Agricultural Research Institutions (RARIs)

These are the second largest of the NARS institutions which conduct research that addresses the specific needs of a particular region. They promote multidisciplinary research at the regional level. They also participate in collaborative national research programs in any one or more of the crop, livestock and natural resources commodity programs (Getinet and Tadesse, 1999). Currently, there are 39 regional Agricultural Research Centers of which some were established over the last five years with the financial support from The World Bank Supported Agricultural Research and Training

Project (ARTP). Even though the number of RARCs has increased significantly over the last five years and attempts have been made to cover agro-ecological zones that are not covered by EARO, given the country's ecological diversity, it will still take many years before technologies suitable to the different locations of the country are developed.

3. Agricultural Research Institutions of Higher Education (AIHE)

Some agricultural institutions of higher education are actively engaged in agricultural research through direct involvement of the staff, and graduate students' thesis research work. The most common institutions that take part in research are *Alemaya* University's College of Agriculture, *Addis Ababa* University's Faculty of Veterinary Medicine, Southern University's *Awassa* College of Agriculture, *Wondo Genet* College of Forestry, and *Mekele* University's Faculty of Dry-land Agricultural and Natural Resources. The research activities that are run by these institutions account for 13% of the total full-time researchers and 3% of the total financial resources of the NARS.

A few other institutions, namely, the National Herbarium of the Biology Department of *Addis Ababa* University (AAU) established 1959, the Ethiopian Nutrition Institute (ENI) in 1962, the Institute of Development Research (IDR) under AAU established in 1972, and the Agricultural Development Department (ADD) of the Ministry of Agriculture and Rural Development in 1980, renamed as Crop Production and Protection Regulatory Department, allocated some resources to agricultural research, but a precise inventory of their agricultural research activities and resources was not available (*Sasakawa* Global 2000, 1995)

Linkage among major actors

Research in itself is a collaborative and an interactive process which requires researchers to work in strong partnerships across discipline and sectors, with industry and government, where necessary, and across regions. Geography is no longer a barrier to collaborative research work (Juma and Seragelid, 2007). Science, technology and innovation can come about through innovative and well-managed partnerships between existing institutions at national and regional levels. This does not necessary (or always) require new buildings, but what it does need is visionary, quick-thinking leadership, workable plans, good management, and a certain amount of finance.

With the broad objectives of research in Ethiopia, the technological opportunities offered by research give agricultural research a central role in changing the livelihood of the people and supporting the Agricultural Development-Led Industrialization (ADLI) plan of Ethiopia. This is based on the assumption that agricultural research is a major mechanism for growth in agriculture, that there is a close liaison between research and development, and that policies and strategies will stay on track.

Research coordination occurs at two levels: interdisciplinary and inter-institutional. The diversity of the Ethiopian agro-ecologies and the limited human and material resources call for a multidisciplinary approach. Interdisciplinary coordination in the Ethiopian NARS has become important, especially after the research programs were organized by commodities in 1979, and has been operational since then. This seems to be working

relatively well although there is a need for establishing a mechanism for recognizing the contribution of all disciplines in an equitable manner.

There is no clear mechanism of linkage among the Ministry of Agriculture and Rural Development, the national agricultural research system, and agricultural institutions of higher education. However, partnerships exist among the different NARS institutions and between them and international organizations. On a national level, partnerships exist between EARO, AUA, ACA, MoARD, ESE, Regional Research Centers, ESTC, and SG 2000. On an international level, cooperative relations exist with CIAT, CIDA, CIMMYT, CIP, IBSRAM, ICARDA, ICRAF, ICRISAT, ILRI, the EU, and the World Bank (Tsedeke *et al.*, 2004; Solomon, 2020; ICARDA, 1999;).

Some notable achievements and constraints of NARS

Achievements

In about half a century of existence, the national agricultural research system in Ethiopia has developed and released several improved crop varieties with their packages. Depending on the crop types, farmers who used the improved varieties with the recommended fertilizer rates, have increased their yields 2-3fold. However, this is considered as a piecemeal approach because the research on livestock, mechanization, and natural resources are lagging behind. Moreover, the research on policy has never been touched/visited.

Constraints

As of 1997/98, one of the major bottlenecks of NARS has been the problem of brain-drain or retaining qualified staff, mainly due to the poor salary scale

and incentives. As a result, there is shortage of qualified, competent and experienced national staff to solve real farm problems.

The role of science, technology and innovation has not been well recognized in the economic development of the country. The research activities are not still based on the participatory approach; priority needs and expectations of farmers to identifying, documenting, analyzing and disseminating innovations in order to improve learning and knowledge-sharing. As a result, the rural development does not seem sustainable and durable.

Capacity building is one of the pillars of research to pursue studies in the area of agricultural science. In this regard, Ethiopia has limited human, financial and infrastructural resources to address both the national and regional challenges. The linkage among various stakeholders, and between agricultural and extension workers is too weak to address rural problems comprehensively as research and extension have been carried out by different bodies.

New ideas, innovative thinking or change of methodology were not either introduced or incorporated into the research programs. The same routine introduction, hybridization, international nurseries and entries, and pre-national and national variety trails were carried out from year to year. This has been, perhaps, a common problem in the entire agricultural research system of the country. As a result, the outcomes of research work have remained unsatisfactory.

Conclusions and recommendations

Conclusions

The need for coordination of the NARS has been felt since the establishment of IAR in 1966. Although IAR was mandated to coordinate research at the national level, its accomplishment in this respect has not been satisfactory because it did not have the means to enforce the rules; IAR had the technical know-how but budget allocation and release was done by an external institution. Initiatives have been taken by the Government in recent years to strengthen inter-institutional coordination.

The issuance of the National Agricultural Policy in 1993 and the subsequent establishment of the Ethiopian Agricultural Research Organization (EARO) renamed the Ethiopian Institute of Agricultural Research (EIAR) by the Ethiopian Government in 1997 was expected to resolve that problem. Major tasks of EARO/EIAR include developing agricultural policies, coordinating agricultural research on a national level, and advising the government on matters related to agricultural research and development. Accomplishments in this respect have not been yet satisfactory (EARO, 2001 and 2003).

The Federal Government of Ethiopia has recently upgraded the salary scale of researchers and lecturers as a means to improve their status and attract them. In addition, the Government has launched a program to improve the status of trained manpower by opening additional faculties and colleges. It is also sponsoring trainings abroad in various fields. Despite all these measures, retaining qualified research staff is still a problem.

The Ethiopian Government has formulated a national science and technology policy in the major economic sectors, including agriculture. In order to

encourage science, technology, and innovation, the Government has promised to allocate up to 1.5 % of the GDP to research activities but the promise has not been yet actualized/realized.

The Economic Development Policy of Ethiopia has given the highest priority to agriculture under the auspices/guidance of an Agricultural Development-Led Industrialization. In an effort to raise the productivity of the agricultural sector and to be self-sufficient in food production, the Government has recently formulated the National Agricultural Research Policy which focuses mainly on generating technologies that will enable improving agricultural production in quantity and diversity.

Recommendations

Science, technology and innovation can come about through innovative and well managed partnerships between existing institutions at national and regional levels. Agricultural development of advanced countries also stemmed from science, technology and innovation. This does not necessary (or always) require new buildings, but what it does need is visionary, quick-thinking leadership, workable plans, good management, and a certain amount of finance.

Food security, nutrition, healthcare and environmental sustainability are among Ethiopia's biggest challenges. To solve the problem, clusters of expertise and institutions need to be in close proximity to work together in sharing knowledge and ideas. The country needs to identify specific priority areas that offer high potential for national and regional R&D.

To improve commercialization and business capacity, Ethiopia needs to: (1) foster R & D cooperative partnerships at the local regional and national levels; (2) create policy instruments that enable business incubation and development; (3) develop functional market infrastructure for economic development; and (4) stress the role of science, technology and innovation, in general, and biotechnology, in particular, for policy development.

Ethiopia lacks physical, human, institutional and societal capacity in science, technology and innovation (STI). Emphasis should be placed on strengthening higher technical education, increasing female enrolment, merging research and education, and reforming existing knowledge-based institutions, specifically, universities to serve as centers of technology development and entrepreneurship. These activities should be done primarily in “Local Innovation Areas” which are clusters of expertise sharing knowledge, creative ideas, personnel and working on problems and projects collaboratively (World Bank, 2007).

Strong partnership among different stakeholders- policy makers, researchers, extension workers, civil society organizations, public and private sectors, and regional and national research organizations – are key actors to achieve agricultural research and development goals.

Challenges ahead

Today, biodiversity in Ethiopia is under threat. One of the most significant impacts of biodiversity loss is in the area of livelihoods. Most of the people in Ethiopia still depend on agriculture and forests because their livelihood and energy needs are met by wood. The potential to produce food is declining as climate change continues to impact on land and water. Land and water

degradation takes many forms. It includes desertification, deforestation, a decrease in arable and grazing land, a decline in soil productivity, pollution, and depletion of freshwater. Many of these issues are intertwined (Ashworth, 2005; Commission for Africa, 2005).

Ethiopia needs to double food production without increasing the area of land under cultivation by using high-tech manufactured goods in order to transform the country into middle or even high-income economies. We, therefore, need to develop our own research capacity to assess the critical problems through local, regional and national institutions.

Nitrogen and phosphorous are key limiting nutrients in the soil for crop production but their prices have been increasing over the years to the extent that they have become unaffordable to most small-scale farmers in rural areas. Phosphorous source or biological nitrogen fixation is a technology that has been adopted by many countries in Africa to overcome fertilizer scarcity.

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Notes of Contributors

The Journal of Agriculture and Development (JAD) is a bi-annual peer-reviewed journal published under the auspices of Institute of Agriculture and Development Studies (IADS), SMU. Ethiopia.

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The journal will cover agriculture, natural resources management and development areas and would publish peer-reviewed original research papers, case reports, systematic reviews and debates. Papers normally should not exceed 8000 words of text.

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