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Agricultural Research and Extension Linkages: Challenges and Intervention Options

Belay Kassa[1] and Dawit Alemu[2]
[1] *Pan African University, African Union Commission, Addis Ababa, Ethiopia*
[2] *Ethiopian Institute of Agricultural Research, Addis Ababa, Ethiopia*

አህፅርኦት

ይህ ፅሁፍ በኢትዮጵያ የተደራጀ የግብርና ምርምር እና ኤክስቴንሽን ከጀመረበት ኤ.አ. ከ1950ዎች ጀምሮ የግብርና ምርምር እና ኤክስቴንሽን ትስስር ታሪካዊ ሂደትን የቃኘ ነው። የዳሰሳውም ውጤት እንደሚያሳየው ባለፉት አመታት ቀጣይነት ያለው የምርምር ኤክስቴንሽን ትስስር መሻሻሎች በኢይነትና አሰራር ታይተዋል። ከዚህም የትስስር መስኮች በዋናነት የሚጠቀሱት፤ 1) ተቋማዊ ትስስር በምርምርና ቴክኖሎጂ አባዥ ተቋማት መካካል፣ 2) የግብርና ምረምር ስርዓት አካላት ከፌደራልና ክልል የግብርና ልማት አካላት ጋር በመቀናጅት የሚከናወኑ የቴክኖሎጂ ማስተዋወቅ እና ቅድመ ማስፋ ሥራዎች፣ 3) የግብርና ምረምር ስርዓት አካላት የአርሶ አና አርብቶ አደር የምርምር ቡድን አሰራርን ለግብርና ቴክኖሎጂ መፍለቅና ለተጠቃሚ እንዲደር በስፋት መጠቀም፣ 4) ለተመረጡ የግብርና ምርቶች የተለየ የምርምር - ኤክስቴንሽን- ልማት ተስስር መፈጠሩ፣ 5) የተከያዩ ግብርና ነክ መልክቶች በህትመት መልክ በምርምር ሥርዓቱ በሰፊው መቅረባቸው እና 6) ከፌደራል እስከ ወረዳ የተቋቋሙ የግብርና ልማት አካላት ተስስር አማካሪ ካውንስሎች የግብርና ምርምር እና ኤክስቴንሽን ትስስር መድረኮች እነየሆኑ መምጣት ናቸው። ሆኖም ግን የተጠቀሱት የተለያዩ የምርምር ኤክስቴንሽን ትስስር ዘዴዎች የበለጠ ውጤታማ ሆነው የአገሪቱን የግብርና ትራንስፎርሜሽን አጃንዳ ስኬት ለማገዝ እንዲችሉ በዚህ ፅሁፍ ለተለዩት ዋና ዋና የፖሊሲና ልማት ማነቆዎች ለመፍታት ተገቢዉን ትኩረት መሰጠት ይገባል።

ቁልፍ ቃላት: ግብርና ምርምር፣ ኤክስቴንሽን፣ የምክክር መድረክ፣ የግብርና ልማት አካላት ግንኙነት አማካሪ ካውንስል

Abstract

The article presents the historical evolution of attempts made in Ethiopia to strengthen the agriculture research and extension linkages since the start of formal agricultural research and extension in the early 1950s. The result reveals that there is a gradual improvement with increased types and mechanisms of the research-extension linkage in recent years that are related with (i) institutional linkages of actors of the National Agricultural Research System (NARS) with actors of formal agricultural technology delivery systems, (ii) technology demonstration and popularization promoted by the NARS in collaboration with MoA and Regional Bureaus of Agriculture (RBoA), (iii) Farmers' Research Groups (FRGs) approach promoted by the NARS in collaboration with MoA and RBoA, (iv) Technology specific special pre-extension activities promoted by the NARS, (v) Publications made available by the NARS, and (vi) Agricultural Development Partners' Linkage Advisory Councils (ADPLACs) as research-extension linkage platforms. However, there are number of challenges that need policy and development attention to fully exploiting the potentials these approaches offer in strengthening the linkage, which is crucial for the aspired agricultural transformation.

Key words: ADPLAC, NARS, extension, agricultural research, platforms

Introduction

Ethiopian agriculture is virtually small-scale, subsistence-oriented and crucially dependent on rainfall. About 90 percent of the country's agricultural output is generated by subsistence farmers who use traditional tools and farming practices (MoFED, 2006;

Dercon *et al.*, 2009). Low productivity characterizes Ethiopian agriculture. The average grain yield for various crops is only about one metric ton per hectare (Byerlee, Spielman and Alemu, 2007). The livestock sub-sector plays an important role in the Ethiopian economy. The majority of smallholder farms depend on animals for draught power, cultivation and transport of goods. The sub-sector makes also significant contribution to the food supply in terms of meat and dairy products as well as to export in terms of hides and skins which make up the second major export category[1]. However, the productivity of the sub-sector has not been growing as a result of poor management systems, shortage of feed and inadequate health care services (FDRE, 2010).

Despite the importance of agriculture in its economy, food insecurity has been an enormous challenge to Ethiopia. In this connection, it is important to note that over the last three decades Ethiopian agriculture has been unable to produce sufficient quantities to feed the country's rapidly growing population. In recent years, commercial food import & food aid have been accounting for a significant proportion of the total food supply in the country (USAID, 2010; Cochrane, 2011; Lefort, 2011).

Available evidence shows that yields of major crops under farmers' management are still far lower than what can be obtained under research managed plots (Abate, 2006; EIAR, 2007). In this regard, Ahmed, Kelemework and Abate (2006), noted that under Ethiopian conditions, the potential yields of improved varieties of haricot bean, durum wheat, bread wheat, finger millet, and sorghum are 2.0, 3.5, 3.6, 2.8 and 2.4 metric tons per hectare, respectively. This is a clear indication of the gap, which exists between researchers and farmers. The absence of effective linkage between agricultural research and extension systems has repeatedly been reported as one of the major reasons for the low productivity of Ethiopian agriculture. There had been no forum where this linkage problem had not been raised as a result of which it has become a concern among policy makers, researchers, development workers and funding organizations (Belay, 2003; Agricultural Research Task Force, 1996; Task Force on Agricultural Extension, 1994a, FDRE, 1999).

The objective of this paper is to assess the historical development and current status of research-extension linkages in Ethiopia. The study is based on a thorough review of existing literature on research and extension linkages in the country. The rest of the paper is organized in four sections. Section II focuses on the concepts and implications of research and extension linkage. The third section discusses the origin and development of agricultural research and extension systems in Ethiopia. The fourth section examines the evolution and current status of the research and extension linkages in the country. The last section summarizes the main findings of the study and draws appropriate conclusions.

[1] According to Sintayehu *et al.* (2010), livestock continue to be a significant contributor to economic and social development in Ethiopia at the household and national level. At a national level, livestock contribute significant amount to export earnings in the formal market (10 percent of all formal export earnings). Moreover, livestock account for 15 to 17 percent of total GDP and 35 to 49 percent of agricultural GDP.

Research-Extension Linkages: A Short Literature Review

The term linkage as used in this study encompasses a broad range of collaborations and exchange of useful information among all actors of the technology generation, dissemination and utilization system. The concept of linkage used in this study is borrowed heavily from Havelock (1986) who emphasized that linkage is a term used to indicate that two systems are connected by messages so as to form a greater system. He argues that if the barriers between two systems are permeable enough for messages and responses to flow out of each to the other, then a link has been created between the two. According to Munyua, Adams and Thomson (2002), agriculture research and extension are examples of two systems that can be linked by information flow and feedback. The farmer falls in between research and extension and is expected to be the main target and beneficiary of their activities. The research-extension-farmer relationship should be viewed as an interdependent and inter-related continuum. More precisely, interdependence among the researchers, extension workers, and farmers prevents isolation, which impedes technology transfer. Close bonding among the three key players also promotes development of relevant technologies that provide directly measurable results or perceived benefits to the target population and adapted to local conditions.

In traditional research and extension linkage system agricultural technology development and transfer have tended to be largely based on a 'top-down' one-way communication model with information flowing from researchers to end users. In this respect, Watkins (1990) notes that the earlier approaches of technology transfer, including those modelled after the land grant university system, followed a 'top-down' model of research and demonstration where farmers are considered as passive recipients of research results based on perceived needs identified by scientists. This model also viewed farmers, extensionists and researchers as three separate strata and the links between them have been weak or non-existent. The top-down model of technology development and transfer has led to a situation where farmers had limited options in making decisions on technologies appropriate to their specific farming needs and those within their local social, cultural, economic, and political environment (Faylon and Acoba, 2002).

Earlier empirical studies in developing countries have identified weak links between research and extension as the major factor limiting the flow of information, knowledge, useful new technologies, and resources among actors in the technology-delivery-utilization system and recommend measures to overcome the widely acknowledged weaknesses (Agbamu, 2000; Anderson and Feder, 2004; Asiabaka, 2002; Belay, 2002, 2003; Eponou,1996; FAO, 1984; Munyua, Adams and Thomson, 2002; Purcell and Anderson, 1997; Task Force on Agricultural Extension, 1994a & 1994b). The poor research and extension linkage emanating from the earlier model of technology transfer was best summed up by Quimsumbing (1984) when he noted that the extension workers often see researchers as working in an ivory tower generating technologies not applicable to the farm, whereas researchers often question the ability of the extension agents to perform their jobs effectively. In the same vein, the World Bank (1985) pointed out that bridging the gap between research and extension (strengthening their linkages) is the most serious institutional problem in developing research and extension programmes. In this respect, the principal objective of strengthening research and extension linkages must be to

cultivate greater and more effective interaction among stakeholders in the agriculture sector so as to increase agricultural production and productivity and thereby raise the living standard of the rural population. It should, however, be emphasised that strategies aimed at strengthening research and extension linkages will differ from country to country depending on historical working relationships between research and extension organisations as well as their organizational structures, responsiveness to the ever-growing challenges and how divergent or convergent their goals are (Agbamu, 2000).

Since the late 1980s, policy makers, the academic community and development practitioners have recognized the central role of farmers in the technology development and transfer process. As a result, they have been substantiating that the whole process of technology identification, development and transfer must shift from a 'top-down' conveyor belt system towards one in which the research-extension system becomes more demand-driven, customized to local conditions and needs and responsive to farmers' pressing problems. This shift in approach was based on ample empirical evidence that pointed to the fact that non-adoption of technologies by farmers emanated from the fact that the technologies in question had been either unresponsive or inappropriate to the needs of the farmers and as a result had not provided directly measurable results or perceived benefits. Consequently, it was emphasized that the whole process of technology development and dissemination must be based on equal partnership between farmers, researchers and extension agents who learn from each other and contribute their knowledge and skills.

Available evidence reveals that in recent years, in many developing countries, relation between research and extension systems has become increasingly a two-way process and farmers who are key stakeholders in the development and dissemination of agricultural technologies have become the target and the hub around which researchers and extensionists focus their actions (Agbamu, 2000; Asiabaka, 2002; Belay and Degnet, 2004; Purcell and Anderson, 1997). More precisely, farmers have found their place in this link-chain mechanism through which they can articulate their problems and needs and influence research and extension priorities.

Origin and Development of Agricultural Research and Extension Systems

Agricultural extension work in Ethiopia began in 1931 with the establishment of the Ambo Agricultural School which is one of the oldest institutions and the first agricultural high school offering general education with major emphasis on agriculture. Apart from training students and demonstrating the potential effects of improved varieties and agricultural practices to the surrounding farmers, the school did not do extension work in the real sense of the term that we understand today. It was with the creation of the Ministry of Agriculture in 1943 that the country witnessed the commencement of limited extension activities in different areas[2]. Even then, as there was no separate division in the

1. Up until 1943 the responsibility for agricultural matters in Ethiopia had been vested in the Ministry of Commerce, Industry and Agriculture. By a law issued early 1943, a Council of Ministers and twelve Ministries were set up. One was the Ministry of Agriculture.

Ministry responsible for extension work, it was the various divisions of the Ministry that made available different services to farmers. According to Haile Selassie (1959), the services rendered were more of regulatory in nature and included providing advice in: soil conservation through the grow-more-trees campaign; better variety of seeds and seedlings; cleaning and seed selection; protection of game fish; preservation of hides and skins, etc.

However, real agricultural extension and research work began in the early 1950s following the establishment of the Imperial Ethiopian College of Agriculture and Mechanical Arts (IECAMA now Hramaya University) with the assistance of the United States under the Point Four Program. The academic program of the College was modelled on the Land Grant College system with three fundamental but related responsibilities which are: training of high level manpower; promotion of agricultural research; and dissemination of appropriate technologies. In the decade following its establishment IECAMA had been active in building the national agricultural research and extension systems.

In August 1963, the Imperial Government transferred the mandate for agricultural extension from the College to the Ministry of Agriculture, with the suggestion that the IECAMA concentrates its outreach efforts in its vicinity. Since this time, the Ministry of Agriculture has been the sole authority responsible for the national agricultural extension system. Following the transfer of the responsibility for national extension administration to the Ministry of Agriculture, extension service became one of the departments in the Ministry.

Over the years the Ministry has implemented different extension approaches, such as the comprehensive package programme, the minimum package programme, the peasant agriculture development extension programme, and the Participatory Demonstration and Training Extension System. A closer scrutiny of the different extension approaches reveals that they have been planned and implemented without the participation of the very people for whom they have been designed. Apart from being biased against the livestock sub-sector, these approaches have captured farmers located only few kilometres from both sides of all-weather roads (Belay, 2003). It is evident that the success of extension work depends partly on the quality and number of the front-line workers. However, the number of extension personnel in the country was also very small when viewed in relation to the number of farmers they had to serve (Belay, 2004).
In recognition of this problem and in view of ensuring delivery of agricultural extension services at the level of each Peasant Association across the country, beginning in 2001, the Ethiopian Government established Agricultural Technical and Vocational Education and Training (ATVET colleges, which train middle level agricultural manpower in the areas of Animal Health, Animal Sciences, Cooperatives, Natural Resources Management and Plant Sciences[3]. The total duration of study in ATVET colleges is three years, two years of study on campus and a ten-month apprenticeship with close supervision in the final

[3] Peasant associations are the lowest administration units in rural Ethiopia. According to the Ethiopian Federal Democratic Republic administrative hierarchy, the regional states are divided into zones, districts and Peasant Associations (*kebeles* in urban areas), in that order.

year. The training programmes of ATVET colleges are designed in such a way that 30 % of the programme would focus on theoretical aspects and the remaining 70 % on hands-on practical training, which includes the ten-month apprenticeship in the final year. Graduates from ATVET colleges are placed at the level of Peasant Associations and work as Development Agents. In the 2003/04-2010/11 period a total of 73, 000 trainees graduated with a diploma from the 25 ATVET colleges and were assigned at the level of peasant associations to work as development agents (MOA, 2013). The current approach to the provision of extension services envisages that in addition to providing regular extension services, development agents are to conduct a range of farmer training courses (Ashworth, 2005). They are also expected to provide practical demonstrations of technologies and farm systems.

Available empirical literature points to the fact that public sector agricultural extension system in Ethiopia has not been effective in terms bringing large scale adoption of improved technologies and practices by small scale farmers. A short list of the causes for the poor performance of the agricultural extension system includes: the distraction of extension workers by their involvement in input supply, collection of taxes and loan repayments; the limits of standardized packages, and the emphasis on input targets rather than affordability and profitability; failure to involve farmers in research problem identification, problem prioritization and extension program planning; extension agents' ignorance of farmers' traditional and experience-based knowledge system; lack of relevant research results; inadequate planning and coordination, and lack of interaction with research; and the formulation of extension programs and policies without due consideration to the farmers' opinion and traditional knowledge system. (Belay, 2002, 2003; Belay and Degnet, 2004; Byerlee, Spielman and Alemu, 2007; EIAR, 2007; Task Force on Agricultural Extension, 1994a & 1994b).

As to the agricultural research, as discussed earlier, it was first initiated by IECAMA. In fact, for more than a decade, the College and its central experiment station at Debre Zeit had a national mandate to carry out and co-ordinate agricultural research. In 1966, the Imperial Government transferred the responsibility for agricultural research to the newly established Institute of Agricultural Research (IAR). The IAR was established in February, 1966 with a mandate to formulate the national agricultural research policy, to carry out agricultural research on crops, livestock, natural resources, and related disciplines in various agro-ecological zones of the country, and to coordinate national agricultural research (Negarit Gazeta, 1966). With the establishment of the IAR, agricultural higher education, agricultural research and extension split up and were made answerable to three separate and independent administrative structures. This structural change nipped in the bud the burgeoning linkage among agricultural research, extension and education systems. This weakness persisted until now during which there has been no clear mechanism of linkage among the Ministry of Agriculture, the national agricultural research system and agricultural institutions of higher education.

Since the establishment of IAR, Ethiopia has a national agricultural research system with an autonomous management and with major and minor stations covering the major ecological zones, and the major commodity and discipline groups. Until its replacement by the Ethiopian Agricultural Research Organization in 1997, the IAR had been the only organization in the country with a clear mandate solely for agricultural research. Over the

years other organizations, which had been involved in agriculture related research activities, had been established. These included: the Plant Protection Research Centre (PPRC), which was established in 1972 and operated under the Ethiopian Science and Technology Commission and was merged with IAR in 1995; the Plant Genetic Resources Centre of Ethiopia, which was founded in 1974, which later became the Biodiversity Institute (BDI); the Forestry Research Centre, which was established in 1975; the Wood Utilization Research Centre, which was founded in 1979; the National Soils Laboratory (NSL), which was established in 1989; and the Institute of Animal Health Research (IAHR), which became operational in 1992 (Getinet and Tadesse, 1999).

In addition to the aforementioned organizations, other organizations, such as some divisions of the Ministry of Agriculture, the Coffee and Tea Development Authority and the former Ministry of State Farms Development had been engaged in experimental work in support of their development activities. Moreover, some institutions of higher learning, have been doing some agriculturally related research.

Agricultural research underwent significant reform in the 1990s when the new government committed itself to put in place a decentralized political system in the country. More precisely, in 1993, some IAR centres were decentralised to create independent research centres run by the respective regional governments, and became the Regional Agricultural Research Centres) generally under their respective regional bureaus of agriculture. However, over the past ten years, seven of the nine regional states of the country, namely the Afar, the Amhara, the Gambella, the Oromia, the Somali, the Southern and the Tigray regions have established their respective Regional Agricultural Research Institutes (RARIs), which have agricultural research as their central mandate and coordinate research activities of agricultural research centres within their respective regions.

As discussed earlier, agricultural research has been undertaken by different organizations without proper co-ordination. The end result was duplication of efforts and wastage of resources which proved to be an extravagance the country could ill afford (Agricultural Research Task Force, 1996; Belay, 2004; Goshu, 1995). The problem seems to have been appreciated by the current Government for it reorganized the national agricultural research system, in June 1997, under the umbrella of the newly created Ethiopian Agricultural Research Organization During its establishment EARO merged all the existing agricultural research institutions (IAR, BDI, FRC, WURC, IAHR, NSL and the Debre Zeit Agricultural Research Centre) except the Regional Agricultural Research Centres. Proclamation number 79/1997, which established the EARO states that its objectives are: to generate, develop and adapt agricultural technologies that focus on the needs of the overall agricultural development and its beneficiaries; coordinate research activities of agricultural research centres or higher learning institutes and other related establishments which undertake agricultural research on contractual bases; build up a research capacity and establish a system that will make agricultural research efficient, effective and based on development needs; and popularize agricultural research results (Federal Negarit Gazeta, 1997). In view of rationalising agricultural research governance

and avoiding redundancy of efforts and wastage of resources, EARO prepared a ten-year strategic plan that would guide agricultural research policy in Ethiopia[4].

The Ethiopian National Agricultural Research System (NARS) is made up of five types of institutions:

- The Ethiopian Agricultural Research Organization which is renamed the Ethiopian Institute of Agricultural Research (EIAR) on 25th October 2005 (consisting of the different research institutions/centres which were merged within EARO during its establishment).
- The Regional Agricultural Research Centres/Institutions (RARCs/ RARIs)

These are the second largest of the NARS institutions. The RARCs/ RARIs 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 programmes in any one or more of the crop, livestock, and natural resource commodity programmes. EIAR funds the budget requirement of research projects that are approved by a national review forum and have national implications. Regional governments fund the remainder of research projects that focus on the specific agricultural problems of the agro-ecological zones in each region. 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 the EIAR, given the country's ecological diversity, it will still take many years before technologies suitable to the different locations of the country are developed.

- Institutions of Higher Education (IHE)

Among the IHE those that are actively engaged in agricultural research both through direct involvement of the staff and graduate students' thesis research work include Addis Ababa University's Faculty of Veterinary Medicine, Department of Biology and Institute of Development Research, Ambo University's College of Agriculture, Bahir Dar University's College of Agriculture, Haramaya University's College of Agriculture, Hawassa University's Awassa College of Agriculture and Wondo Genet College of Forestry, Jimma University's College of Agriculture and Veterinary Medicine and Mekele University's Faculty of Dry land Agriculture and Natural Resources. Some of these IHE have specialized research institutes/centres. These institutes/centres do not have institutionalized linkage to the national and regional agricultural research institutes.

- Commercial Farm Operators(large commercial farm operators and farm operators in the high-value export sector)

Commercial farm operators are known to have been engaged in some experimental work in support of their development activities which often take the form of adaptive research. Though they are not formally recognized as part of the wider NARS, given their contribution to the national economy and their heavy reliance on imported

[4] The strategy is based on 18 agro-ecological zones and 7 main focal areas. These are: crops; animal science; forestry; soil and water; dry-land agriculture; socio-economics; and regional extension and farmer linkages.

technologies, there is a need to create strong linkages between these commercial farm operators and other components of the NARS.

- Non-governmental Organizations that have a culture of undertaking adaptive/applied research to support the development needs of their intervention areas.

A closer look at the mandates of EAIR and RARIs reveals that there is no clear functional delineation between EAIR and RARIs. It must be noted also that there exist no institutionalized or formal mechanisms of linkage. Currently, the collaborations between the EIAR and RARIs and among RARIs are largely ad-hoc, not institutionalized and depend heavily on personal inclinations and initiatives. This situation has at times resulted in conflict of interest between EAIR and RARIS, leading outside observers to believe that these entities had no complementary roles to play. The existing institutional set-up of the national agricultural research system brought difficulty in working together to the extent that it appears as if there were many national agricultural research systems.

Recognizing the challenges facing EIAR to fulfil its mandate of national coordination of agricultural research in the country, the National Agricultural Research Council was established in 2014 with a secretariat composed of coordinators for crop research, livestock research, land and water research, socioeconomic research, and bioinformatics.

With regard to the performance of the national agricultural research system, in its fifty years of existence, it has developed and released 960 improved varieties of crops (Table 1). In addition to these improved crop varieties, more than 96 improved technologies for livestock management, 45 for natural resources management, nine for agricultural engineering (farm implements), and five for forestry had been identified, evaluated and recommended (MoA, 2014, Abate, 2006).

Table 1: Improved Varieties Released by the National Agricultural System

Commodities	1970-1979	1980-1989	1990-1999	2000-2007	2008 - 2014	Total
Cereals	15	23	56	101	150	345
Pulses	11	11	30	42	94	188
Oil crops	6	9	8	15	52	90
Root & tubers Vegetables	0	4	15	40	149	174
Fruits	0	0	0	6	30	35
Spices	0	0	0	1	20	36
Fiber crops	4	5	4	0	14	29
Stimulants	0	12	5	3	16	27
Forage crops	3	5	1	0	150	36
Total	39	69	119	208	525	960

Source: EIAR (2007), MoA (2014)

It should be noted that most of the released varieties were developed and tested in high potential areas of the country where most of the agricultural research centres are located. Given that the research centres in the country are very limited and do not represent all the agro-ecological zones, it was not uncommon to see some technologies developed and tested in specific areas being disseminated in other areas without proper adaptability trials[5]. Various empirical studies identified numerous causes for the limited impact of both research and extension systems (Agricultural Research Task Force, 1996; Belay, 2003; Belay and Degnet, 2004; EIAR, 2007; FDRE, 1999; Task Force on Agricultural Extension, 1994a; Sandford, 1997). A short list of these causes includes:

- The researches have not been generally based on the real problems of farmers and they rarely took into account farmers' circumstances in terms of objectives, resources and limitations;
- Until recently the researches had been conducted in an environment which was totally different from that of small farmers and whatever little research outputs were disseminated to farmers had been directly given to extension workers without prior on-farm verification for their acceptability;
- The lack of integration and coordination between agricultural research and extension has resulted in a confusion as to who should undertake on-farm verifications and pre-extension trials before making technologies directly available to farmers;
- There had been little or no feedback from farmers to research institutes about disseminated research outputs due largely to the loose link between research and extension and/or the physical separation of researchers from farmers; and
- Many of the farmers are not aware of the existence of technologies developed by researchers; and
- Limited capacity of actors of the technology multiplication and delivery systems

As part of a move to strengthen the linkage between the agricultural research and extension systems and improve their performance, the Ethiopian Agricultural Research Organization (now EAIR) was made accountable to the Federal Ministry of Agriculture and Rural Development (now MoA) in March 2004. This reorganization brought the national agricultural research and extension systems under one umbrella.

Evolution of Research–Extension Linkages

The first attempt to establish a formal research extension linkage was made with the formation of joint Institute of Agricultural Research (IAR) and the Extension Project Implementation Department (EPID) outreach program in 1974. Before this period, the linkage was through personal contacts and publications of research results (Beyene Seboka and Aberra Deressa, 1997). The next concrete step to create functional linkages between the research and extension systems was taken in 1986, following the adoption of

[5] Most of the research centres are located in the major agro-ecological zones of the country. However, the arid and semi-arid zones, mainly the north western and northern drought-prone sub-moist zones, and the eastern region of the country comprising western and eastern Hararghe and the Somali and Afar regions, are least addressed.

a new extension approach called the Peasant Agriculture Development Extension Program (PADEP) by the Ministry of Agriculture. Until this time, apart from occasional and irregular meetings between researchers and subject-matter specialists and the pre-extension technology promotion activities run by the research, there was no other evidence of routine linkage mechanisms between research and extension.

PADEP was designed to bring perceptible changes in peasant agriculture through concerted and coordinated efforts in the areas of agricultural research and extension. The strategy was prepared based on the critical evaluation of past extension strategies and underscored the importance of stratifying the country into relatively homogeneous zones, decentralizing the planning and execution of agricultural development activities, empowering and giving considerable attention to zones which were to be the centres of development efforts (Task Force on Agricultural Extension, 1994a). Accordingly, on the basis of resemblance in climatic conditions, cropping patterns, natural resource endowments and geographical proximity, the country was divided into eight agricultural development zones.

PADEP had different objectives for the different agricultural development zones. However, the principal ones were: increasing food production, at least, to the level of self-sufficiency; developing the production of cash crops for export, and raw materials for domestic industries; increasing rural sector employment opportunities; supporting and encouraging the development of rural cooperatives; preventing further soil depletion and introducing suitable farming system in erosion prone areas of the country.

As the poor research-extension linkage was considered to be a primordial factor affecting the efficiency of extension work, Research Extension Liaison Committees (RELCs) were formed in 1986 both at the national and zonal levels.

The establishment of the national RELCs was believed to provide a suitable forum for consultation among different stakeholders. The national level RELC was chaired by the Vice Minster of Agriculture and its members consisted of the General Manager of the Institute of Agricultural Research, Directors of research centers, and heads of the technical units of the Ministry of Agriculture. The national RELC was responsible to provide overall policy direction and capacity building. More precisely, it was commissioned to undertake diagnostic studies on weaknesses of the national research and extension systems as well as on factors affecting the adoption of potentially useful technologies developed by researchers in view of formulating new research and extension strategies (FDRE, 1999).

The zonal RELCs were established in all eight agricultural development zones and were chaired by the heads of the respective zonal agricultural development offices. Other zonal RELC members included the heads of the technical units of the zonal agricultural development offices, managers of the research centers and representatives of institutions of higher learning located in the zones and representatives of other agricultural sector support services. The zonal RELCs were responsible to appraise improved technologies recommended by zonal research centers before they were released to farmers. The zonal RELCs were also commissioned to design training programs for subject matter specialists and development agents on improved technologies to be disseminated to farmers.

Moreover, the zonal RELCs were mandated to review and approve research proposals submitted by research centers. They were also planned to serve as a forum where the views of extension workers were taken into account in identifying research problems for the formulation of research topics. This was thought to help ensure that both researchers and development agents address the real problems that farmers faced (Agricultural Research Task Force, 1996; FDRE, 1999; Goshu, 1995).

The weakness and strength of these committees varied from zone to zone depending on the motivation of the individuals in charge of the committees' leadership. However, available evidence shows that both the national and zonal RELCs had limited impact and had not lived long to be of practical use due to, among others, the following reasons: some of the newly created agricultural development zones had no research centres and lacked the capacity to steer the extension role through staff development, support and reward; local government officials' poor technical know-how and skills in monitoring and evaluating research and extension activities; serious funding constraints to undertake linkage activities; absence of decision making power of RELCs and clear working guidelines; ad-hoc and non-institutionalized nature of meetings; lack of representation of farmers (even though it was clearly stated in the official documents that farmers must be represented in RELCs); frequent changes in the organizational structure of the Ministry of Agriculture and the resulting repeated reshuffling of RELCs members and shortage of relevant technologies that were proven to provide directly measurable results or perceived benefits (Agricultural Research Task Force, 1996; Belay, 2003; FDRE, 1999; Goshu, 1995; Task Force on Agricultural Extension, 1994a). It is also important to note that linkage activities were totally considered as part-time work because no incentive was there for committee members. Being a committee member of RELC did deserve nothing except extra workload on top of the routine activities of the members for which they were employed (FDRE, 1999). The activities of the committees were interrupted in 1991 because of the change in government, which resulted in the dissolution of the zonal agricultural offices and the transfer of their roles to the newly created Regional Bureaus of Agriculture[6].

Following the change in government in 1991, a locally-adapted Training & Visit (T&V)-like extension approach was adopted as a national extension system with major government financing until its replacement by the Participatory Demonstration and Training Extension System (PADETES) in 1995. The major objectives of PADETES included increasing production and productivity of small-scale farmers through research-generated information and technologies; increasing the level of food self-sufficiency;

[6] With the change in government in 1991, the country was divided into 9 semi-autonomous administrative regions on the basis of ethnic, linguistic and cultural identity, one federal capital (Addis Ababa) and one special administrative division (Dire Dawa). At present, extension activities are the entire responsibility of regional agricultural bureaux. The extension division of the federal Ministry of Agriculture is charged with the task of co-ordinating inter-regional extension work, providing policy advice on nationwide agricultural extension issues, advising regional bureaux of agriculture in the areas of extension management and administration, developing extension training materials and organizing training programs in agricultural extension for regional extension personnel. The regions are given full autonomy in the planning, execution, monitoring and evaluation of extension programs.

increasing the supply of industrial and export crops; and ensuring the rehabilitation and conservation of the natural resource base of the country. The system gives special consideration to the package approach to agricultural development. Initially, PADETES promoted cereal production packages and the beneficiaries were mainly those farmers who live in high rainfall areas of the country. Over the years, however, the packages have been diversified to address the needs of farmers who live in different agro-ecological zones of the country.

In the late 1990s, the issue of research-extension linkage resurfaced and the Federal Government developed in 1999 a strategy which was meant to strengthen the loose linkage between research and extension. The linkage strategy aims at bringing together all stakeholders in the entire process of technology generation, development, transfer, utilization and feedback under the umbrella of one institutional setup. This has been materialized through the establishment of legalized Research-Extension Advisory Councils (REACs) at three levels: the federal, regional, and zonal (research center based)[7]. The institutions established are known as: the Federal Research Extension Advisory Councils (FREAC); the Regional Research Extension Advisory Council (RREAC); and the Zonal or Research Center Based Research Extension Advisory Councils (RCB-REACs)[8]. The main objectives of these councils were (i) review of research programs, (ii) development of technology packages for extension work, and (iii) provision of technical backstopping through facilitation of training to extension workers (MoA, 2011). Whereas the Federal REAC was accountable to the Ministry of Agriculture and Rural Development, the Regional REAC and RCB-REAC were accountable to the Regional Bureau of Agriculture and Rural Development and the zonal Division of Agriculture and Rural Development, respectively (FDRE, 1999).

A closer look at the FREAC reveals that though it was established in November 2001 in practice it had not been able to carry out its functions according to the original plan (Ahmed, Kelemework and Abate, 2006). Apart from the fact that, FREAC has not been holding its annual meetings, as planned farmers have not been represented in the council. The council was dominated by officials of the federal and regional research institutes and bureaus of agriculture and rural development.

RREACs were established in all regional states of the country except in the Harari National Regional States. The latter is located in close proximity to the Haramaya University, which has a strong tradition of undertaking agricultural research in the Eastern part of the country. The University served as a focal point and coordinator of the Eastern Ethiopia RCB-REAC which brought together the Harari National Regional States, the Eastern and Western Hararghe zones of the Oromia Region, the Dire Dawa Administrative Division and the University.

[7] According to the Ethiopian Federal Democratic Republic administrative hierarchy, the regional states are divided into zones, districts and Peasant Associations (local administration units), in that order.

[8] At the zonal level, the Councils are designed to be a research center-based entity. However, certain zones may not have research center at all; in such cases several zones may be grouped together to form RCB-REAC.

With respect to the performance of RREACs, the reports presented by the eight RRECs during the Second Annual Federal Research and Extension Advisory Council Meeting on May 8 2007 reveal that only four of the eight RREACs, namely those of the Amhara National Regional State, the Oromia National Regional State, the Southern Nations Nationalities and Peoples Regional State (SNNPRS), and the Tigray National State had accomplished some linkage related activities although not as much as expected and required. As to the remaining RREACs, they were reported to be at the infancy stage of their development in that they had not carried out any significant work in view of bridging the gaps among research, extension and farmers (Tesfaye, 2007).

The Research Center Based Research and Extension Advisory Councils have been established in all federal research centres as well as in some of the Regional Research centres of the Amhara, Oroimia, and SNNPRS regional states (Ahmed, Kelemework and Abate, 2006). The RCB-REACs that were established both at the federal and regional research centres' level had not been effective in terms of discharging fully their functions of establishing effective research-extension-farmer linkages. Their activities had been limited to the establishment of Farmer Research Groups (FRGs), convening periodic meetings of researchers and extension workers and undertaking on-farm trials.

At the grass roots level, the strategy adopted to make agricultural research and extension systems responsive and relevant was to involve small farmers in the selection of research and extension priorities and in research planning and implementation through the establishment of Farmer Research Groups (FDRE, 1999). Farmer Research Groups are groups that farmers voluntarily form to undertake experimentation (research and extension) on their own fields. The formation of groups is based on farmers' production constraints as identified and prioritized by farmers themselves. An FRG may have a chairperson and secretary elected by members (the only proviso being that there must be women's representative), a membership, which consists of those people, which register with the group for a particular season's activity. The membership of FRGs is not fixed. People flow in and out of them, although a core of members will always provide continuity from one season to the next. Research and Extension Divisions at each research centre take the initiative to set up and facilitate the establishment of farmers' research group[9]. According to Tesfaye (2007), the rationale behind the formation of FRGs is to make agricultural research and extension client-oriented and thereby develop informal, collaborative relationships and partnership which will enhance the impact of research and extension activities. So far, only the FRGs established by three of the federal research centres, namely the Debre Zeit, the Holeta and the Kulumsa research centres have been fully operational and registered success in working closely with farmers (Ahmed, Kelemework and Abate, 2006).

[9] This in a way is a new paradigm of doing research with farmers. Rresearchers and extension workers hold regular planning and review meetings with farmers where farmers decide on the type of experiment that they would like to undertake. Treatments in experiments are also selected together with farmers and the role of researchers and extension workers is more of a facilitator.

As noted earlier, it has clearly been stipulated in the research-extension-farmer linkage strategy issued by the Federal Government in 1999 that the REACs were charged with the responsibility of ensuring the prompt transfer of proven technologies to users via fostering an efficient linkage mechanism between researchers, extension organizations and users (FDRE, 1999). However, much sought-after strong research-extension linkage was not achieved. Some of the organizational and operational weaknesses inherent in the structure of the REACs that were key for the poor performance are summarized below.

All the REACs were not institutionally anchored and there was not a conducive ground that gave room for sufficient interaction among farmers, development agencies and researchers. Rather, as in the past, coordination of linkage activities was done on ad-hoc basis and there was lack of sustained follow-up of linkage related activities mainly as a result of the absence of permanent secretariats for REACs at national, regional and zonal levels. Moreover, the RELCs had been suffering from a serious shortage of financial resources to carry out their planned activities. More precisely, it was only in 2007 following the instruction from the Office of the Prime Minister that both the Federal and Regional Governments allocated budget for linkage related activities.

Even though efforts were made to bring different stakeholders through REAC meetings so as to ensure effective research-extension-farmer linkage, these efforts were not successful in doing so mainly because meetings were not held on regular basis. Even worse, when meetings were convened once in a while they tended to focus on issues which were not on farmers' priority list.

Another serious limitation of the REAC based research-extension linkage was that neither the FREAC nor the RREACs had considered farmers' representatives in their membership. However, it was interesting to note that all the REACs recognized, in their official documents, the need to involve farmers in the technology development and dissemination process in order to make research, development and transfer of technologies more responsive to their needs. The non-representation of farmers in FREAC and RREACs could partly be due to the fact that there were no farmer-based organizations at the zonal, regional and federal levels.

Recognizing the weaknesses of the previous attempts (RELC and REAC), the MoA has decided in 2009 to institutionalize the linkage through allocation of regular finance and accountable institutional setup within MoA. Accordingly, the council was renamed as Agricultural and Rural Development Partners' Linkage Advisory Council (ARDPLAC) and it was decided to establish it at federal, regional, zonal and also *woreda* levels. Its members were also expanded to include more stakeholders including farmers' organizations, private actors, non-governmental organization involved in agricultural development (MoA, 2011). The ARDPLAC was later renamed as Agricultural Development Partners' Linkage Advisory Council (ADPLAC) following the name change of the Ministry. The following section presents the current status of the research-extension linkages along the different approaches followed to strengthen the linkage.

Status and challenges of Research – Extension Linkages

Linked with the country's first Growth and Transformation Plan (GTP I), which was launched in 2010, the issue of research-extension linkage has received in momentum. The plan targets the use of improved agricultural technologies along with transformation of the nation agricultural technology delivery mechanisms mainly the national seed system are considered as one of the key interventions in the transformation of the agricultural sector and also to achieve the target of doubling agricultural production by 2015 (MoFED, 2010). This required designing and implementing new and strengthening previous approaches in the agricultural research and development endeavours to ensure improved availability of agricultural technologies along with their timely delivery to end users, the farmers and pastoralists.

Accordingly, the following approaches and mechanisms are put in place to ensure stronger research-extension linkage: (i) institutional linkages of actors of the National Agricultural Research System (NARS) with actors of formal agricultural technology delivery systems, (ii) technology demonstration and popularization promoted by the NARS in collaboration with MoA and Regional Bureaus of Agriculture (RBoA), (iii) Farmers' Research Groups (FRGs) approach promoted by the NARS in collaboration with MoA and RBoA, (iv) Technology specific special pre-extension activities promoted by the NARS, (v) Publications made available by the NARS, and (vi) Agricultural Development Partners' Linkage Advisory Councils (ADPLACs) as research-extension linkage platforms, where the research system at federal, regional, zonal and *woreda* levels play key role.

Table 2 presents the summary of these approaches in terms of their respective major interventions and associated challenges facing them.

Table 2. Summary of approaches and mechanisms of research-extension linkages in Ethiopia

Mechanism	Key interventions	Main challenges
Formal institutional linkages with actors of formal agricultural technology delivery systems	• delivery of initial /source /prototype technologies for actors of technology multiplication and distribution, • Joint preparation of extension packages and manuals by the NARS and Ministry of Agriculture (MoA) /Regional Bureaus (RBoA)	• Still limited capacity of initial technology multiplication liked with resource (land, finance) and technology limitation (outdated machineries and equipment); • Limited internal quality control system for multiplication of initial technologies specially quality control for basic seed multiplication; • Development agents that are expected to implement as per the extension package often face challenges of time of supply, quality challenges and required amount of inputs as per the package
Technology demonstration and popularization	• Creation of awareness about newly released technologies to (i) farmers/pastoralists and other end users, and (ii) extensionists, technology multipliers and other public and non-public stakeholders; • Organization of field days where all relevant stakeholders; • Wider awareness creation for technologies for which adequate demonstration is done	• Existence of extended technology demonstration and popularization using known technologies; • Application of diverse approaches of demonstration and popularization activities and some approaches are not appropriate for the purpose of demonstration and popularization
Farmers' Research Groups (FRGs)	• Participatory research approach with critical engagement of farmers and the steps are: (i) undertaking situation analysis and identification of needs; (ii) selection of FRG member farmers; (iii) selection of FRG leader/management; (iv) activity planning; (v) implementation of planned activities; (vi) capacity building; (vii) participatory monitoring & evaluation; and (viii) sharing experiences to other FRGs and farmers.	• Need to design exist strategy to ensure sustainability of the formed FRGs • The need to continuously capacitate researchers about the FRG approach and its principles
Technology specific special pre-extension activities	• Value chain empowerment based technology promotion • Technology promotion through enhancing community Seed System • Integrated technology demonstration (ENATT- project)	• The need to address institutional mandate/responsibility issues; •
Publications made available by the NARS	• EIAR research report series • National and regional workshop proceedings • Production manuals and guidelines • Web-based scientific information	• Still there is limited accessibility
Agricultural Development Partners' Linkage Advisory Councils (ADPLACs)	• It is a research-extension linkage platforms • Its mechanism of operation of ADPLACs the bi-annual meetings at federal, regional, zonal and *woreda* levels, and members of the National Agricultural Research System (NARS) are either chairs, co-chair or secretary of these platforms at different levels • Assignment sharing to respective members of the ADPLAC and reporting back achievements	• Challenges related with holding the meetings regularly; • Diverse achievements across the regional, zonal and *woreda* ADPLACs • Increased cost of running ADPLAC • Association of ADPLAC funding with projects, e.g. currently, only Agricultural Growth Program (AGP) *woredas* are running ADPLAC activities

Conclusion

This paper examined the historical evolution and current status of the linkage between agricultural research and extension systems in Ethiopia. The results of the historical review reveal that research-extension linkage was generally weak and that neither research nor extension was sufficiently conscious of the need to understand the constraints and potentials of different farming systems as a basis for determining relevant technology and technology-development requirements. The problem has been compounded by the fact that that agricultural research and extension have been carried out by two different bodies with very limited contact and working relationships. Experience from other parts of the world shows that under separate management structures and incentive structures, research systems give little weight to the extension service's opinions and priorities. Because the performance of research systems is often assessed according to the recognition it receives within the scientific community, research priorities are not necessarily aligned with those of extension managers or the farmers they come in contact with (Anderson and Feder, 2004). The institutionalization of the ADPLAC and strengthening of the different mechanisms and approaches on technology transfer and research and extension linkage are expected to address the main challenges facing.

In the light of the results of this study it is imperative that policy makers and public authorities pay utmost attention to problems affecting effective research-extension linkage. In this respect, issues which need immediate attention include, among others,

- allocating adequate funding for linkage activities at all levels, ensuring representation of farmers at all levels of ADPLAC, making ADPLACs real forums for consultation among different stakeholders (researchers, extension agents, NGOs, farmers, input suppliers etc.),
- Strengthening the institutionalizing research-extension linkage at regional, zonal and *woreda* levels,
- Adopting a long term strategic approach to create a seamless wave between research and extension systems;
- the initiative of assessing best practices for wider-scaling up need to be further strengthened and be considered within the ADPLAC framework; and
- Strengthening the monitoring and evaluation of research-extension linkage activities

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