Environment, Development and Sustainability
https://doi.org/10.1007/s10668-023-04136-6

Undoing the development army: a paradigm shift from transfer of technology to agricultural innovation system in Ethiopian extension

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Received: 2 October 2022 / Accepted: 31 October 2023

Abstract
Appropriate use of agricultural technologies and diversifying the farming activities is critical to addressing food security problems in Africa, including Ethiopia. The country is experimenting with the new Agricultural Innovation System (AIS) approach alongside the well-established Transfer of Technology (ToT) approach. This paper analyzes the gaps between policy discourses (as reflected in policy documents and strategic orientation documents) and extension practices (as reflected in the daily exchanges between farmers and the frontline staff of the Ethiopian extension system). It provides insights into the challenges faced and emphasizes the need for better coordination between policy formulation and implementation to enhance extension services. Policymakers, practitioners, and researchers can benefit from the valuable perspectives the findings offer. The study contributes to understanding the relationship between policy discourses and extension practices, and its implications can inform policy design and implementation in similar contexts. A qualitative research approach was deployed to analyze policy discourse and practice. Data were collected in Fogera, a district in Northwest Ethiopia, between August 2018 and February 2019. The data for the paper were obtained from 23 Focus Group Discussions conducted with men and women. 13 Informant Interviews (KIIs) were also carried out with personnel at different levels of government agricultural services and departments. Transcripts of recordings of the Focus Group Discussions (FGDs) and Key Informant Interviews (KIIs) were analyzed using a deductive approach. The study focuses on rice crops in the Fogera district, which are crucial for food security and reducing poverty. Although the geographic area is limited, the results can be used to improve the extension system in other areas facing similar challenges. Specifically, the study suggests switching from the traditional transfer of technology approach to the agricultural innovation system approach. Furthermore, the study's techniques, such as qualitative interviews, may have limitations and not fully capture the intricacies of policy and extension practices. The findings demonstrate that, although the policy documents strongly adhere to agricultural innovation system principles, top-down transfer of technology approaches continues to dominate in practice. Moreover, we have found potential discrepancies between the training content delivered and the specific needs of smallholder farmers. Practically, prescriptive systems are still used

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because agricultural innovation system approaches are not well understood by the Extension Agents. To realize a genuine agricultural innovation system, Ethiopia's extension apparatus should move forward with building committed and robust relationships between farmers, extension agents, researchers, private sectors, and non-governmental organizations. To this end, more research, enhanced training, and improved institutions are needed on what genuine agricultural innovation system could look like at the grass-roots level. This also includes understanding the roles that different actors within Ethiopia's development army should assume how a multi-actor policy dialogue can be organized.

Keywords Agricultural policy · FTCs · Qualitative research · Smallholder farmers

1 Introduction

On a global level, agricultural extension has a crucial role in agricultural development processes by promoting the adoption and use of new farming technologies and practices through educational procedures (Kebebe et al., 2015).

The Transfer of Technology model (ToT) has long-dominated technology development and diffusion in many low- and middle-income countries (Miller & Cox, 2006; Wahab et al., 2012). Although ToT approaches have manifested themselves in various ways, depending on factors such as research traditions and purposes (Wahab et al., 2012), the ToT model commonly assumes that new agricultural knowledge and technologies are created and validated by research scientists. It is up to extension services to disseminate this knowledge and persuade farmers to adopt these technologies, thus augmenting agricultural productivity or reducing negative environmental impacts. The resulting rigid hierarchy of institutional arrangements and interactions establishes communication as a linear, one-way, and top-down process that prevents feedback from or interaction with the technology users (Bachewe et al., 2018; Nigussie et al., 2017).

In academia, ToT has been criticized for several reasons. For example, it lacks genuine appreciation and integration of local knowledge (Anandajayasekeram, 2008; Lundy, 2007). Additionally, the specific environmental, social, and economic contexts are not well taken into account in the development of technology, knowledge, and information. Furthermore, the interaction among different agencies and the participation of end-users is too limited (Anandajayasekeram, 2008; Esposti, 2012; Lundy, 2007).

Addressing the critique of a lack of participation, different theoretical frameworks such as 'Farming System Research' (Budelman & Van Der Pol, 1992; Klerkx et al., 2012), 'Farmer-first approaches' (Chambers & Thrupp, 1994), and 'Agricultural Knowledge and Information System (AKIS)' (Röling & Engel, 1991) made farmers the primary sources of information, resulting in researchers and farmers becoming partners.

Inspired by Network Theory, the theory of Innovation Systems was first developed for the industrial sector and later adopted in agricultural research (Mundial, 2012; Odame et al., 2012). The resulting Agricultural Information System (AIS) framework acknowledges the complexity of agricultural technological change and innovation. Building upon and refining the theory of AKIS, AIS seeks to conceptualize innovation processes while integrating participatory technology development, participatory training and rural action, and participatory evaluation (Klerkx et al., 2012). AIS conceives innovation in research and development contexts as due to both technological and non-technological aspects such as social and institutional phenomena (Leeuwis, 2000). As Kebebe et al. (2015) and

Demiryurek (2014) stressed, the AIS addresses and recognizes the importance of markets, value chains, supply systems, and all the links between all actors within the agricultural extension system.

While AKIS focuses on the importance of public institutions for agricultural innovation, AIS targets a broader range of actors, including the private sector and NGOs (Sanginga et al., 2009). Platforms, networking, linkages, and social learning are considered essential components in AIS-based extension systems. Particularly in Sub-Saharan Africa, the literature increasingly points to the importance of so-called Innovation Platforms (IPs), in which all key actors from a sector or a geographical location convene in a context of collaborative governance (Ayele & Bosire, 2011; Hounkonnou et al., 2012). Typical examples are the District Stakeholder Panels in Malawi (Mikwamba et al., 2020) and the Concertation and Innovation Groups in West Africa (Klerkx et al., 2013). An outpouring of publications (see for instance Kamara et al. (2021), Hellin and Camacho (2017), van Paassen et al. (2014), and Hellin (2012)) and the organization of international conferences testify to the growing interest in AIS across countries (Aerni et al., 2015; Swanson & Rajalahti, 2010).

Agwu et al. (2008), Pant and Hambly-Odame (2009), Sanginga et al. (2009), (Klerkx et al., 2012) and other authors distinguished AIS from ToT by defining and comparing their respective attributes (see Table 1), which can be used to differentiate the two dynamics of extension. Our study adapted these attributes to understand the discrepancies between policy and implementation levels.

Although substantial literature concentrates on how agricultural extension impacts productivity and livelihoods (Gebrehiwot, 2015, 2017; Ragasa & Mazunda, 2018; Wossen et al., 2017), as well as on personal, socio-economic, and environmental determinants of technology adoption (Chandio & Yuansheng, 2018; Ferede & Bokelmann, 2008; Nigussie et al., 2017), there is limited academic research on the actual dynamics of the transition from traditional extension approaches such as ToT to AIS. This paper contributes to understanding such dynamics by means of a case study of the public extension system in Ethiopia, as Ethiopia is experimenting with the AIS approach alongside the well-established ToT (Berhanu, 2008).

Moreover, when the policies and practices for agricultural development are not adequately coordinated, crucial resources like funding, technology, and expertise may fail to reach the areas that require them the most. Consequently, there may be an inefficient allocation of resources and limited progress toward enhancing agricultural productivity and food security. The absence of support, training, and access to information can make farmers unaware of the advantages of adopting better agricultural techniques and technologies. This resource scarcity impedes progress in addressing food security challenges and prolongs less productive farming methods, making it challenging to encourage sustainable agricultural practices.

This paper contributes to the literature in two ways. First, it adds to the empirical evidence about the transitions from ToT to AIS in Ethiopia. Second, it focuses on the gap between the discursive and implementation levels of this ToT-AIS transition, introducing a novel approach to assessing this transition.

It has been observed that the grassroots level is not effectively addressing several significant issues inherent to the policy and extension strategy.

The paper is structured as follows. Section 2 introduces the Ethiopian extension system. Section 3 describes the case study and the methodological approach. Section 4, the results section, analyzes the ToT-AIS balance in the case study area in three parts (extension activities in the case study area, extension at the discursive level, and the implementation level). Sections 5 and 6 present the discussion and conclusion, respectively.

Table 1 Summarized attributes and operational definitions of ToT and AIS

Attributes	Definitions	ToT	AIS	References
Mental model of activities	Knowledge, information, and technology delivery mechanisms	Supplied through a top-down approach	Supplied through interaction and communication	(Klerkx et al., 2012; Klerkx et al., 2009; Van Mierlo et al., 2010)
Farmers' role	The stance of the farmers	Learn, conform, and adapt/adopt	Co-generate knowledge, process, and innovation	(Biggs, 1990; Klerkx et al., 2012; Thrupp & Altieri, 2001)
Scope	The scope of the extension practice	On-farm	On-farm and beyond the farm gate	(Hall et al., 2001; Klerkx et al., 2012; Pant & Hambly-Odame, 2009)
Core element	Presumed drivers of transformation	Modified packages to overcome constraints	Facilitated interactive innovation	(Klerkx et al., 2012; Sanginga et al., 2012)
Driver	The specific phenomenon that sparks change	Supply push from the research wing	Responsiveness to changing contexts	(Kamara et al., 2019; Klerkx et al., 2012; Zossou et al., 2020)
Key change sought	Improved form or condition	Farmers´ behavior	Organizational and institutional change in terms of interactions and relationships	(Klerkx et al., 2012; Spielman et al., 2012)
Intended outcome	The targeted result	Technology transfer and update	Enhanced capacities to innovate, affecting interaction and relationships	(Eakin et al., 2017; Hartwich et al., 2007; Klerkx et al., 2012)
Innovators	The actors accountable for innovation	Scientists/researchers	Potentially all actors	(Abebe et al., 2013; Klerkx et al., 2012; Maria et al., 2021)
Roles of research	What the roles of research are	Set priorities, conduct, and allocate resources for research	Strengthen the enabling environment and support, coordinate research system	(Adekunle et al., 2013; Klerkx et al., 2012)
Role of policy	What the roles of policy are	Enable actors to generate or disseminate technology independently regardless of social institutional factors	Enable actors to develop or disseminate innovation and consider social, political, economic, and agro-climatic context	(Agwu et al., 2008; Fieldsend et al., 2020; Klerkx et al., 2012)

2 The dynamics of different approaches to agricultural extension in Ethiopia

Although investments in large-scale agricultural enterprises between 2010 and 2020 have expanded, Ethiopian agriculture continues to rely—in terms of employment and (food) production—on smallholders responsible for 34% of the gross domestic product and 66% of employment in the country (WorldBank, 2017). The agricultural sector is not only the primary driver of the economy but also sustains the livelihood of a large majority of the Ethiopian population. However, the occurrence of repeated food crises—even during the recent period of sustained and impressive economic growth (Bachewe et al., 2015)—demonstrates the agricultural sector's difficulties in ensuring food security for the country's rapidly growing population (Berhanu & Poulton, 2014). The agricultural extension system is often pointed out as one of the culprits for perpetuating this situation, failing to effectively perform its part in transforming smallholder agriculture (Gebre-Selassie & Bekele, 2012).

Modern agricultural extension in Ethiopia started in the 1950s. For a long time, successive governments championed hierarchically organized, linear, top-down, and supply-driven approaches, which considered farmers as subordinate recipients of research results based on needs identified and perceived by expert scientists (Berhanu & Poulton, 2014). Stakeholder engagement beyond agricultural research institutes and the extension services themselves was limited. As a result, developed technologies were often not easily translated into significant benefits for farmers (Adekunle & Fatunbi, 2014). Moreover, extension approaches were biased against the livestock sector (Kebebe, 2019) and lacked technical support, access to technology, and financial services, as well as market incentives for producers to enhance their knowledge and skills (Assefa et al., 2021). Research and extension activities were carried out without proper coordination, resulting in often useless duplication of efforts and a waste of resources (Belay, 2003).

Since 1991, the Ethiopian People's Revolutionary Democratic Front (EPRDF) government has made efforts to foster service and support rural development by lunching new extension programs and facilities, including the Participatory Demonstration and Training Extension System (PADETES), the Farmer Training Centres (FTCs), and Agricultural Technical and Vocational Education and Training (ATVET) [see Table 2].

Following a critical evaluation of previous extension approaches, PADETES began as a federal agricultural extension program in 1995, with the intention of reaching 35 to 40 percent of all rural farm households. It aimed at increasing smallholder crop production and productivity through research-generated input and information packages, thereby contributing to both food self-sufficiency and to the supply of industrial and export crops. Simultaneously, it aimed to empower farmers to actively participate in the development process through training and demonstration. Moreover, PADETES established credit and input-providing institutions to support the dissemination of information packages (Belay, 2002). However, due to its focus on the production and distribution of farm inputs, PADETES was criticized for neglecting the creation of favorable market conditions. For instance, bumper maize productivity levels in 2001/02 culminated in a large over-supply, leading to a considerable drop in maize prices (Welteji, 2018)). Other weaknesses included the limited participation of women, insufficiently trained Extension Agents (EAs), and the lack of bottom-up strategies (Davis et al., 2010b).

FTCs, introduced from 2002 onward, aimed to contribute to the overall rural transformation of Ethiopia, as anticipated by the Agricultural Development-Led Industrialization

Table 2 Features of three extension approaches initiated since 1995

	PADETES	ATVET	FTCs
Start year	1995	2000	2002
Focus	Developing and disseminating agricultural packages for farmers' dominant crops	Enhancing human resources and capacity for frontline extension work	Local-level information, advice, field, and classroom demonstration and training for farmers—i.e., a strategic shift toward a knowledge-based approach
Targets	Farmers	Extension Agents	Farmers, including women farmers and rural youth
Main objective	Increasing smallholder food production (by means of access to inputs such as fertilizers and improved seeds)	Improve education of EAs	Enable farmers to engage in a shift from subsistence to market-oriented production and advice to farmers
Implementation strategy	Creation of credit and input-providing institutions	Establishment of ATVET	Outreach to the local level by establishing FTCs in all sub-districts' colleges in every region

(ADLI) strategy (Yesuf et al., 2005). According to the Ministry of Agriculture and Natural Resources (MoANR), close to 12,500 FTCs were established at the *kebele* (sub-district) level in 2002 (Hailu et al., 2020). The FTCs are farmers' property and are governed by a management committee of between 7 and 10 persons (EAs and farmers), including a representative from the women's association and the youth association. The *kebele* leader, who is also a farmer, chairs the committee. This committee plans, manages, and evaluates the FTC's training and demonstration program at its monthly meetings. It also organizes farmers to assist in the establishment and upkeep of demonstration fields. EAs, specialized in livestock, crop production, and natural resource management, respectively, provide information, demonstration, and training on technologies and practices and communicate with various agencies. However, most FTCs have not been equipped and staffed according to planned standards. Hence, they do not provide the required extension services to rural communities and lack the inputs necessary for demonstration sites to function appropriately (Buehren et al., 2017a).

Finally, starting in 2000, the government invested in Agricultural Technical and Vocational Education and Training (ATVET), organized by agricultural colleges, to train frontline EAs (CSA, 2017). So far, Ethiopia has more than 63,000 EAs graduated from 25 ATVETs (Mulugeta & Mekonen, 2016), thus boosting the human resources available for extension at farm level (Davis et al., 2010b). However, most of them remain insufficiently qualified for the multiple activities they are tasked with. Due to a lack of trust in the packages that EAs are supposed to convince farmers of, as well as significant staff turnover due to low motivation and insufficient incentives, their effectiveness in providing extension services is low (Belay & Abebaw, 2004; Berhane et al., 2018; Mengistie et al., 2015).

PADETES, FTCs, and ATVET reflect the central role of the public sector in providing agricultural extension, functioning in a deconcentrated way down to the sub-district level (Leta et al., 2017). However, universities play a significant role in the development of cities, contributing to economic growth and shaping the socio-cultural structures of communities (Cetin et al., 2021). Even when NGOs or private sector actors engage in extension activities, they are allowed to do so only through the government offices of agriculture. Thus, they only have a limited possibility of working independently. Addressing this concern, the Participatory Extension System (PES) framework, formulated by the Ministry of Agriculture in 2010, requires a wide array of actors to interact. PES professes farmer participation, increased stakeholder involvement, and a shift from supply- to demand-driven extension. Furthermore, it urges the integration of a multiplicity of perspectives using stakeholder dialogue (MOA, 2017). However, Pan et al. (2018) show that farmers are forced to take up recommendations without their socio-economic situation and other contextual factors being taken into account. Moreover, as the extension activities are highly instrumentalized for political control and obedience purposes (Berhanu & Poulton, 2014), it is often hard to distinguish between coerced and voluntary adoption in Ethiopian extension (Berhanu & Poulton, 2014).

At present, under the leadership of the Prosperity Party (PP), agricultural policies in Ethiopia, such as the National Vision 2030 plan, envision the creation of reliable interconnections and cooperation between agencies in development activities by providing a holistic development blueprint approach spanning all sectors of the economy (Bachewe et al., 2018). However, due to a lack of efficient coordination between all levels in the generation, validation, and adoption processes of innovations in the Ethiopian AIS, agricultural extension continues to fail in successfully sharing information (Knierim et al., 2019). For instance, Belay (2002) indicated that farmers' involvement in research problem identification, prioritization of problems, and extension program planning is minimal, while Deneke

and Gulti (2016) confirmed that research findings do not reach farmers and remain on the shelves of research centers.

In conclusion, the Ethiopian extension system has seen a gradual shift, from a mere technical approach to a more participatory approach. However, in the following sections, after presenting the study methodology, we will assess how and to what extent this apparent tendency to shift from ToT to AIS is visible in policy documents and materializes in on-the-ground extension implementation in the research area.

3 Research methodology

Data were collected from August 2018 to February 2019 in Fogera, a district free from relief assistance in Northwest Ethiopia, 615 km from the capital Addis Ababa (see Fig. 1). The district is divided into 30 rural and 5 urban *'kebeles'* (the smallest administrative unit—from now onward 'sub-district'). The district's total population is more than 230,000, of which only 11% is urban (CSA, 2017). There are 144 EAs in the districts. Rice holds great significance as a cash crop within the district.

A qualitative research approach was deployed for the analysis of both policy discourse and practice. To obtain an answer regarding how and to what extent the extension apparatus in Ethiopia has shifted from ToT to AIS at discursive level, the following documents were collected: Ethiopian Government's Rural Development Policy and Strategy (2003); National Rice Research and Development Strategy of Ethiopia (NRRDSE) (2010); National Strategy for Ethiopia's Agricultural extension system (2017); Extension policy documents, and the Second Growth and Transformation Plan (GTP-II) (2016). These national strategic policy documents were complemented with secondary data on the socio-economic environment derived from the Bureau of Agriculture and Rural Development

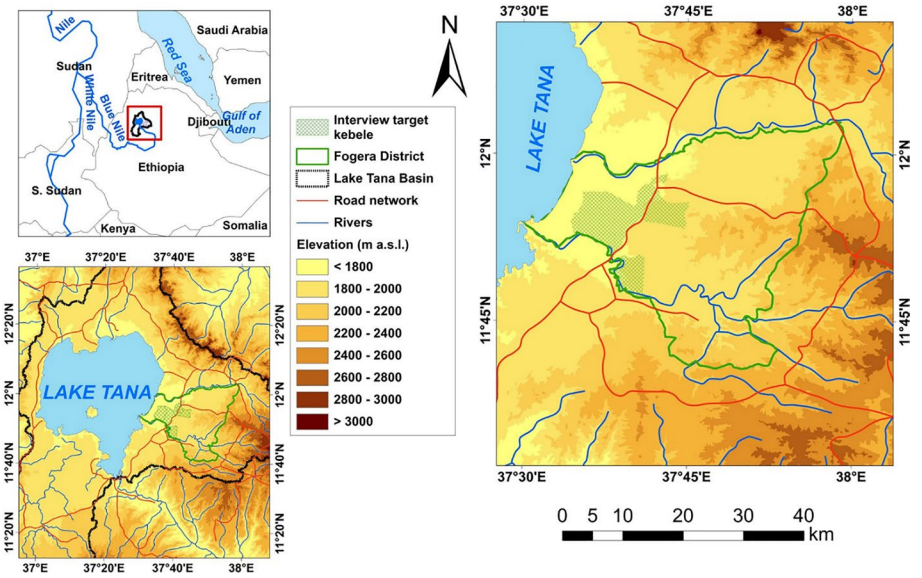

Fig. 1 Map of the study area: Fogera district, Amhara region, Ethiopia

(BoARD), the District Office of Agriculture, the District Extension Process Owner, research institutes, and cooperatives. Content analysis with an inductive approach (Bernard, 2016) was then done in the NVIVO Qualitative Data Analysis Software QSR International (2020) to develop themes grounded in the data.

To understand the dynamics at the implementation level, 23 Focus Group Discussions (FGDs, Bernard, 2016) with men and women were conducted. Each FGD had four to six rice growers as participants and lasted between one and a half to two hours. Discussions were held in Amharic and audio-recorded. The topics covered included farmers as a source of knowledge, information, and technology; farmers' contribution to innovation; traditional networks at the village level; contact with government organizations (GOs), NGOs, and private sector actors; and participation of farmers in innovation and knowledge sharing. The FGDs were geographically randomly distributed across the district and took place in diverse locations, such as farmers' homes, during religious gatherings, and EAs offices.

13 Key Informant Interviews (KIIs) were carried out with staff members of agricultural offices at different levels (see Table 3). For each type of actor, specific topic lists were used, in order to contextualize the interview. The interviews were also audio-recorded.

Furthermore, observations in the sub-districts and informal discussions were conducted to obtain additional information. Participant observation was also carried out during farmers' field days to learn about farmers' interactions with other actors and observe their responses to the demonstrated technologies. The first author translated, transcribed, and coded the KIIs and the FGDs using NVivo, version 12, to allow for a thematic, deductive approach (Brandão, 2015). Inductive coding was performed after reading each transcript line by line, generating a list of codes, and designing a system of categories. Next, triangulation was conducted by including information from observations made in the field. The resulting node tree and code structure allowed for a process of open, axial, and selective coding (Dhakal, 2022).

Table 3 Data collection at the implementation level

Key Informant Interview	Level	Type of actors	Number of interviews
Bureau of Agriculture	Region	Extension expert	1
Research Institute	Region	Socio-economics researcher	1
District office of Agriculture	District	Extension process owner extension monitoring and evaluation expert	1 1
Fogera National Rice Research and Training Center (FNRRTC)	National	Center director agricultural economics and extension unit coordinator Plant breeding expert	1 1 1
Agricultural Technical and Vocational Training (ATVET) College	Region	Community service coordinator	1
EAs	Sub-district	Plant, animal, and NRM extension experts	5
Focus group discussion Farmers	District	Rice growers	23

4 Results

The results section starts with a description of how extension in the study area is organized (4.1) and then elaborates on the ToT-AIS balance at the discursive level (part 4.2) and the implementation level (part 4.3). Finally, based on the attributes (Table 1), these descriptive results are discussed in Sect. 5.

4.1 Organization of agricultural extension in Fogera district

Agricultural learning and innovation in the research area occur within an institutional context characterized by a dualistic structure of informal farmer organizations (the result of well-established societal patterns) and formal organizational structures (the legacy of the past decades' centralized and hierarchical policy structure). Both types are discussed below.

Farmers revealed that for their social, economic, and religious activities, they organize in informal cooperative-like associations such as *idir* (wedding and funeral associations), *equb* (credit and savings associations), and *jiga*, *wonefel,* and *debo* (labor exchange groups). Extension agents at the sub-district (kebele) are responsible for liaising in with these informal cooperatives. These all contribute to building robust social relations of reciprocity. Meetings of these associations allow for discussing farming issues and for extension officers to disseminate information (e.g., input availability) or announce certain events (e.g., communal soil and water conservation works). However, the district offices rarely communicate with these informal associations, as the district officials do not work at the sub-district level.

Extension's formal organization is constituted by the 'development army,' a governmental term coined around 2016 and linked to the EPRDF vision of creating a state-driven developmental model. It underscores the government's ambition to fight hunger by having farmers follow orders strictly and obey prescribed package-related protocols, organizing skill training, including farmers in seasonal agricultural extension campaigns, pushing farmer participation through political direction, and promoting model farmers and EAs to provide agricultural advice service at the local level. It led to a stepped structure of 1:5 farmers' groups (with one model farmer leading four other farmers), combined into farmers' development groups of 25 to 30 farmers. It is instrumentalized as a structure of government control and propaganda, resulting in a large number of farmers being skeptical about the formal extension, not only because of the frequent and tiresome meetings of two days a week, but also because of their politicized character.

> "*We are farmers; we do not know the connection between farming and politics. To boost output, we only need improved seeds and other farm inputs*.'' (farmer, FGD, June 3, 2019).

District Offices of Agriculture provide farmers with numerous advisory and practical services through training (at FTCs). In general, training's primary topics are crop production, crop protection, post-harvest crop treatment, animal husbandry, preparation of

compost, and forage production. However, for rice growers, consistent extension services are lacking. The district's extension process owner[1] stated that the district's capacity to provide frequent extension services depends on a sufficient budget for the transport of EAs and experts at the sub-district and district levels. Some farmers claimed they had better knowledge and rice cultivation skills than their area's EAs or than the rice researchers. According to an extension expert at the regional bureau of agriculture, due to the limited knowledge of and expertise with rice, there are very few experienced staff available to occupy all rice extension services in the region at all levels.

Farmers in the study area have a number of challenges when producing rice, one of which is about ownership of the rice thresher. For example, they complained that the private sector's control of this equipment leads to abuse, reflected in the high price for the service and low quality of the service. Broken straw for instance prevents farmers from using this for thatching their house roofs.

At the national, regional, zonal, and district levels, the Agricultural Development Partners Advisory Council (ADPLAC) platform aims to link the different stakeholders in the system. They meet regularly, with the common aim of '*sharing experiences, drawing lessons and coping with challenges to execute the agricultural transforming agenda of the development partners*' (District Extension process owner, KII, May 12, 2019). ADPLAC comprises policymakers, educational institutes, NGOs such as AgroBIG, MEDA (Mennonite Development Association), World Vision (Ethiopia), Saudi-Star, diverse actors in the rice value chain, financial institutions, and selected model farmers.[2]

Fogera National Rice Research and Training Center (FNRRTC), established in 2018, conducts research and offers rice-related activities to transfer actionable messages and technologies. FNRRTC works closely with various national and international stakeholders, such as agricultural offices, federal and regional research centers, universities, the Japan International Cooperation Agency (JICA), Africa Rice, the International Rice Research Institute (IRRI), Agro-Business Induced Growth (AgroBIG) in Amhara regional state, Mennonite Economic Development Associates (MEDA), World Vision (Ethiopia), and Saudi-Star. However, as farmers indicated, they are slow to respond to farmers' concerns and do not meet end-users needs.

Several other actors complement this dualistic structure of formal and informal organizations. Some international NGOs are active in the area. Since 2015, the NGO AgroBIG supports the advancement of rice production in Fogera through a value chain strategy, implementing intervention with farmers, processors, and marketers. MEDA, funded by the Canadian government, also aims at developing the rice value chain. MEDA has assisted a 'principal farmer model' of extension services, marketing, and access to its financial resources, based on groups with five to seven farmers, with a model farmer directly accessing training designed by MEDA and its partners.

Since there are no commercial firms engaged in the production of accredited rice seed in Ethiopia, the Fogera Rice Research and Training Center, in cooperation with the NGOs MEDA and AgroBIG, has formed two cooperatives producing community-based certified rice seed.

[1] The District Agricultural Extension Process Owner is the Agricultural Extension Services Manager, accountable to district office of agriculture head, and leading the coordination of other agencies through the district ADPLAC forum.

[2] Model farmers are farmers who have a better level of production as a result of their 'best practices,' which they are intended to share with other farmers via peer-to-peer learning in farmer networks.

4.2 The extension approach at the discursive level

The analysis of the four key extension documents, namely Ethiopian Government's Rural Development Policy and Strategy (2003); National Rice Research and Development Strategy of Ethiopia (NRRDSE) (2010); National Strategy for Ethiopia's Agricultural extension system (2017); and the Extension policy document and the Second Growth and Transformation Plan (GTP-II) (2016), with triangulation through KIIs, reveals dominance of the AIS approach, as follows:

1. The cornerstone of the National Strategy for Ethiopia's Agricultural Extension System is 'to inform farmers of all elements of farming' (MoA, 2017, P.25). It is an integrated, 'full package' approach, without a separate extension system for individual crops and with the ambitious goal to increase the number of beneficiaries of the 'full package' (crops, animals, and natural resources) from 23 to 80% by the end of 2025. The strategy further states that governmental extension actors have to collaborate with concerned stakeholders in preparing the extension packages. Furthermore, extension workers should be provided with the necessary technical and infrastructural tools and means to allow for a farmer-centered extension process. The following information excerpt highlights this:

   > *It would be appropriate to assess and ensure a marketing system that integrates farmers (Second Growth and Transformation Plan (GTP-II), P. 130).*

2. The government's agricultural development strategy for the Amhara region is based on transforming Ethiopian agriculture from its present subsistence state into a market-oriented production system, with a pivotal role for agricultural extension. Therefore, the extension service's primary purpose is to create 'modern farmers' who can channel beneficial agricultural technology improvements while also coping with changing circumstances and constraints (MoA, 2017, P.3). Whereas until 2004, the focus was on improving production and productivity, with a primary objective of attaining food security. However, this has been redirected towards achieving at sustained growth in the agricultural industry. Thus, farmers are to become but one of several actors in a market-driven agricultural system. Acknowledging the actual lack of ties between the stakeholders in such a system, and in line with AIS philosophy, the strategy encourages reliable interconnections and cooperation between multiple actors, including but not limited to governmental agencies. Hence, the document calls for more cooperation and harmonization between private sector service suppliers and public sector organizations.
3. The National Rice Research and Development Strategy of Ethiopia (NRRDSE), developed by the Ministry of Agriculture in 2010, revolves around research, technology delivery, and capacity building. It aims to switch to high-value commodities to boost agricultural production, to ensure national food security, and to create a market system that benefits farmers and non-farm producers. The strategy claims that farmers' attitudes toward Farmers' Training Centers (FTCs) are crucial for the farmers to embrace innovative and commercial agriculture. Hence, the strategy considers the farmers as the cornerstone of Ethiopia's extension strategy toward more commercial, business-oriented small-scale farming and the FTCs to deliver proper services.
4. The National Strategy for Ethiopia's Agricultural extension system aims to transform Ethiopia's agriculture by implementing a pluralistic extension system that provides

demand-driven and market-oriented extension services. To this end, it wants to reinforce multi-purpose cooperatives, as collective action can lead to better bargaining power.

5. Agricultural extension is a component of the Extension policy document and the Second Growth and Transformation Plan (GTP-II) in general and a tool used by consecutive governments to stimulate agricultural and rural development. The extension policy document and the Second Growth and Transformation Plan proclaim the necessity to coordinate research, input supply, credit, and marketing systems, as well as the importance of adopting to agro-ecological diversity. The National Strategy for Ethiopia's Agricultural extension system defines the mission and goals of agricultural extension, the responsible agencies and personnel, the clientele to be served, and the broad programmatic areas to be addressed. At the same time, it confirms the importance of co-development of innovation through multi-actor processes and partnerships, and highlights the value of different types of knowledge: 'Knowledge is created through scientific (universities, research institutes, and others) and indigenous knowledge (farmers, farmers groups, local institutions), stored through written documents/publications and electronic media […] and is disseminated to wider audiences.' (National Strategy for Ethiopia's Agricultural extension system, P. 15). Unveiling farmers' indigenous knowledge is a vital concern of the extension policy document, which proposes that working with Farmers' Research Groups (FRG) is one of the participatory approaches to counter the traditional top-down approaches in research that fail to address subsistence and smallholder farmers' demands adequately.
6. Demand-driven extension services for improved livelihoods of different social groups of smallholders (male, female, and youth) require specific technical domains and innovative solutions to optimize benefits for them. Such extension services can address the challenges through enhancing institutional arrangements, coordination, and linkages among key agricultural development partners. According to the documents, the government of Ethiopia established ADPLAC in 2008 to enhance linkage and coordination among potential partners engaged in agricultural extension, research, and development from the federal to the district levels.
7. Additionally, as laid out in its second Growth and Transformation Plan (GTP-II), 2016, Ethiopia's Government is highly committed to sustainably increasing agricultural production by more than 8% per annum to meet the growing demand for food, industrial raw materials, and foreign currency earnings. Ethiopia's government is working to alleviate poverty by developing rural development policies and strategies highlighting the shift to a market-oriented production system.

To summarize, concerns have been expressed about the agricultural sector's performance, efficiency, and sustainability, particularly about current systems for providing extension services, improved seed, fertilizer, and credit. The Extension policy document and the Second Growth and Transformation Plan (GTP-II) (2016) have stated what needs to be done both directly and indirectly to bring about development in rural areas where agriculture is the primary source of income. They propose market orientation, partnership, and cooperation, emphasizing more participatory interaction and integration of farmers' knowledge. For these to be facilitated and encouraged, the Ethiopian Government's Rural Development Policy and Strategy (2003) and National Strategy for Ethiopia's Agricultural extension system (2017) suggest that the agricultural extension system builds human capacity, is demand-driven, and promotes adaptable technologies to increase farm productivity and improve natural resource management.

4.3 The extension approach at the implementation level

The main technological innovation in Fogera's rice cultivation, already introduced in July 1984, was 'flooded rice' (See Fig. 2). Before this, farmers used to move into the mountains during the rainy season to escape the nuisances of the flooding in the valley. The flooded rice (Fig. 2) now allows them to stay in the lowland year-round:

> "*Because of the introduction of flooded rice in our location, we have experienced significant improvements. The district was previously swampy and susceptible to flooding, but now we are self-reliant in terms of food, thanks to this valuable crop. However, there are concerns about the market. It would be even more beneficial if we could connect to more profitable markets."* (Farmer, FGD, June 5, 2019).

The introduction of flooded rice entails the adoption of new practices and technologies (such as weed machines, appropriate fertilizer application, the cut-and-carry system for the use of the straw, and the transplanting of the young seedlings), as well as organizational and marketing changes (strengthening the position of the farmers in the value chain, and the processing of the rice).

The data reveal a somewhat nuanced picture of how the extension apparatus coped with these two challenges at the implementation level.

The primary mission of EAs is to assist farmers in producing a large amount of rice, regardless of the quality. During the KIIs, the district's agricultural extension head remarked that:

> *"Extension agents are evaluated based on the quantity of rice production in quintals produced in each of the sub-districts, regardless of quality." (District* extension owner, KII, May 12, 2019).

Fig. 2 A household weeding the flooded rice field in the study area (picture: first author)

According to the regional extension director, the Bureau of Agriculture's primary role is to employ the extension staff to transfer technology to increase production and productivity. However, the region's total production in 2017/2018 was 102 million quintals, which did not meet the target of 153 million quintals mentioned in the Growth Transformation Plan (GTP-II).

Confronted with the endeavors of the EAs, farmers make decisions about whether or not to adopt new technology based on a cost–benefit-risk calculation: Does the adoption improve the income and livelihood of their families, and what are the risks involved? Often, the limited availability and high cost of inputs, such as fertilizers and improved seedling varieties, as well as the technology's complexity (which may be difficult to apply without comprehensive training), pose obstacles to a smooth adoption process. This can result in situations where new crop protection chemicals are stored in farmers' homes due to a lack of training. Additionally, mobile phones, which are essential for making informed farming decisions regarding agronomic practices, have limited uses farmers may lack sufficient knowledge about available devices and applications.

Market access is even more challenging: The value chains, both upstream (inputs) and downstream (produce), lack transparency and are difficult for farmers to access. This is primarily due to a lack of market knowledge and information, insufficient organizational strength (e.g., through cooperatives) to penetrate existing market mechanisms, and the absence of easily accessible rice-processing factories to prepare the produce for market. Also, unpredictable price fluctuations and the need for instant money rather than delayed payment (needed for purchasing, e.g., edible oil, house building equipment, or (smuggled) farm inputs) further complicate market access.

Hence, farmers' engagement in trade is limited, which investors and EAs interpret as:

> "*many farmers are not motivated to improve their lives by trading their produce*" (EA, KII, May 01, 2019).

The extension apparatus addresses this 'mismatch' between the challenges and the primary mission of the EAs by organizing a flow of information using the vehicles of ADPLAC, FTCs, and the Rice Research Centre. The ADPLAC platform seeks to prevent the various disruptions in the agricultural value chain by integrating different stakeholders into the platform and engaging farmers in a cooperative to be established. However, the voluntary participation is weak, as verified by the regional extension specialist, even though the structure is decentralized because the region still relies on the central (federal) government plan. The established FTCs serve as meeting places for farmers and EAs, where interaction often occurs in an atmosphere of mutual trust and learning. Nevertheless, despite the farmers' enthusiasm for the cultivation of flooded rice, the recently established Rice Research Centre concentrates on the popularization of traditional rice varieties for upland and lowland ecosystems rather than devoting research capacity to the further development of flooded rice varieties.

Thus, the development army, deploying this triad of ADPLAC, FTCs, and the Rice Research Centre, seems ill-equipped to create a well-functioning system for the generation and transmission of knowledge due to four interrelated causes. First, EAs do not disseminate the required information due to their own lack of adequate knowledge. For example, with the EAs being unable to explain the advantages of coated bags as post-harvest technology, very few farmers acquired the bags. Secondly, training mainly focuses on 'model farmers'. As a result, non-model farmers are reluctant to accept new technologies immediately after they are introduced by EAs. Moreover, the use of model farmers is expected to alleviate the burden of overworked EAs. In this situation, the government implements

various per diem incentives to compensate model farmers for the time and energy they devote to assisting other farmers. This then leads to distrust and envy among a majority of farmers, as the use of 'model-farmers' has evolved into a tool for top-down control of farmers, which identifies and favors better-off farmers and those with political ties. Thirdly, as many of the elements of the proposed packages require financial investment, the EAs often mainly focus on better-off farmers, who are often also model farmers. Finally, according to EAs, although FTCs have considerable revenue from the harvest of the demonstration fields (cultivated for free by the community), they suffer from a persistent lack of budget to deliver the services they are supposed to provide.

In this context of flawed flows of information and absence of participation, farmers have the self-confidence that they are also experts, as they have lifelong experience across generations. While they do need fertilizers and other agricultural inputs from EAs, together with the accompanying specific information, they also integrate the acquired knowledge with their tacit knowledge. Several examples show how the blending of local with formal knowledge and practices leads to well-established routines, such as particular seed selection techniques, timely removal of weeds, or rainfall prediction.

Farmers were also exploring and even anticipating what EAs would teach them. Before the EA knowledge had been communicated, farmers were already transplanting rice (which was not expected) without the EAs' consent. Farmers also took the initiative to gather information from diverse actors such as NGOs (MEDA and Agro-big), and sub-district administrators and integrated this with information obtained from farmers in other villages. EAs welcomed this strong social learning component in rice cultivation. This approach did not require their supervision or technical backstopping, thereby facilitating their tasks. Moreover, it empowered farmers to translate information into practices.

5 Discussion

This study identifies and analyzes the gaps—in terms of the shift from ToT to AIS—between policy discourses (the discursive level, as reflected in policy documents and strategic orientation documents) and extension practice (the implementation level, as reflected in the daily exchanges between farmers and the staff at the grass-root level of the Ethiopian extension system).

Based on the discrepancies summarized in Table 4, we will assess whether there is a delayed shift from ToT to AIS. According to policy documents, all farmers, regardless of their socio-economic backgrounds, should be involved in extension activities. However, EAs prefer to demonstrate and transfer technologies through the model farmers, as also shown by Hailemichael and Haug (2020). This suggests that model farmers have preferential access to information, technology, and new skills, while other farmers have limited sources of agricultural information in general and rice crop information in particular. This hinders innovation, as it restricts the interaction between a group of agents involved in creating, exchanging, and applying knowledge and others who are deprived of these.

The policy highly recommends that farmers participate in government-oriented formal organizations such as farmers' groups and Farmers' Research Groups (FRGs). In these organizations, farmers are expected to be actively involved in planning, implementing, and evaluating all activities. Thus, their voice can be heard and they are meant to benefit from researchers' and EAs' regular technical support. These findings agree with the conclusions of an earlier study by Agidew and Singh (2018) on factors affecting farmers' participation

Table 4 Discrepancies between policy and implementation levels. The attributes are elaborated in Table 1

Attributes	Discursive level	Implementation level
Mental model of activities	Organizing farmers to facilitate development or transfer of technology, information, and knowledge is crucial, and co-development of innovations involving multi-actor processes and partnerships is highlighted	EAs almost exclusively address 'model farmers' and better-off farmers. Only a small number of farmers adopt technologies
Farmers' role	Farmers are actively involved in participatory approaches of agricultural research, such as FRG (Farmers' Research Group)	Farmers exchange thoughts and expertise among themselves and partners, rather than with EAs
Scope	A market-oriented and demand-driven extension system meets the growing demand for food, industrial raw materials, and foreign currency earnings	EAs assist farmers in producing a large amount of staple crops regardless of quality and market demand
Core element	Increase the adoption of full packages (focusing on crops, animals, and natural resources)	Farmers are mainly trained in agronomic practices to adopt the packages entirely at FTCs
Driver	Transforming agriculture from subsistence to market-oriented production	Ordinary farmers are less likely to profit from the markets than selected model farmers and better-off farmers
Key change sought	The behavioral shift of farmers with FTCs as an entry point for bringing about economically sustainable among farmers and leading them to modern and commercial agriculture	FTCs are unable to provide farmers with the anticipated services by policy
Intended outcome	Research, technology delivery, and capacity building as strategic intervention	Farmers are offered technologies without comprehensive training or capacity-building on the applications
Innovators	Presence of interconnections and cooperation in joint meetings, workshops, and field days	Lack of efficient means of coordination linkage and across levels in the innovation generation, validation, and adoption process between extension personnel and researchers
Role of researchers Roles of policy	Working and carrying out research activities at FTCs and organizing demonstrations and field days. Create linkages with different actors to generate technologies/innovations	Poor partnership with individual farmers to test technologies. Inefficient linkage with zone and district agricultural offices and NGOs like ORDA, Agro-big, and MEDA to produce technology

Source: statements made by respondents and policy documents

in watershed management programs in the Northeastern highlands of Ethiopia. A possible explanation is that farmers' participation in the decision-making process will ease the creation of tailor-made solutions and gives them ownership over the issues, allowing them the freedom to express their views on different matters. However, in the research area, it was found that farmers wish to communicate with their colleagues and other organizations, rather than with researchers and EAs. A similar result was obtained by Franzel et al. (2019). Their study revealed the need for farmers to access advisory services from various sources, including fellow farmers. Surveys conducted in Malawi, Cameroon, and Rwanda show that most farmers rely on other farmers as their primary source of information about new technologies (Franzel et al., 2019). Furthermore, Nakano et al. (2015) asserted that farmer-to-farmer approaches successfully disseminated knowledge about rice cultivation in Tanzania. Improved practices spread to other farmers over five years, allowing them to exchange information in their local language and help smallholder farmers adapt to agricultural innovations.

Despite being mentioned in policy documents, the government policy implementation on the ground did not value co-learning, in which farmers' expertise and experience are pooled in a learning dialogue to create appropriate agricultural development methods and practices. Neglecting co-learning denies that agriculture as part of AIS is rooted in a complex and systemic environment and turns extension less into an educational tool for farmers and more into a means of conveying government policies and programs. Therefore, while farmers are regularly urged to embrace and use new technology by extension specialists, they are rarely promoting innovation and the adaptation of improvements to specific conditions. We propose four suggestions to support farmers in their innovative efforts:

- To keep up with the latest advancements in agriculture, farmers should gather information from multiple sources. They can connect with agricultural extension services and research institutions to stay informed about new technologies, practices, market trends, and policy changes.
- Farmers can participate in training programs, workshops, and seminars to improve their innovation skills They can also network with other farmers, join farmer organizations, and share their experiences and ideas through peer-to-peer learning opportunities.
- Being open to trying new approaches and experimenting to improve your farm requires an attitude that values innovation. Research and development activities that address local agricultural challenges and promote innovation should help cultivate and strengthen the development of such attitude.
- Monitoring market trends and utilizing effective strategies such as diversifying offerings, providing value-added products, and using direct marketing channels is advisable. Farmers can stimulate innovation and unlock new growth opportunities by being adaptable to the changing market demands.

Smallholders in the research area are currently considerably susceptible to exclusion from value chains due to weak organizational structures and poor cultivation practices. However, marketing issues are now being emphasized and incorporated in adequate agricultural policies and strategies (Devaux et al., 2018). Similarly, Ethiopia has formulated agricultural development strategies to encourage subsistence farmers to become more market-oriented and eventually integrate them into the market economy (Buehren et al., 2017b). Moreover, the Ethiopian government has shown a solid commitment to leading its extension system with a market-oriented approach. However, even though smallholder marketing issues

appear to be receiving more attention, extension services continue to be primarily production- and subsistence-oriented (Gebremedhin et al., 2012). This means that the less attention agricultural experts pay to market issues, the less likely farmers will strengthen their position in the value chain. The EAs in Ethiopia are focused on achieving food security by producing a large amount of produce regardless of the quality and market demand, indicating that policy changes have not trickled down to the lowest level of policy implementers, the EAs, due to a lack of training and resources (Moyo & Salawu, 2018). Moreover, EAs are still evaluated based on the quantity produced in the sub-districts where they work rather than on improved market access for farmers (Barua et al., 2021). In the Ethiopian Government's Rural Development Policy and Strategy (2003), the core element in the extension services is training on technological packages primarily for cereal crops (Belay, 2002). These are designed and formulated by the office of agriculture, BoARD, and actors working in the command areas. However, while a strong focus on agronomic practices and technology packages does facilitate technological adoption, it does not increase overall farm productivity (Mesfin & Zemedu, 2018), neither does it improve market access. Although the National Strategy for Ethiopia's Agricultural Extension System (2017) recommends that EAs should be adequately trained in soft skills (such as business management, entrepreneurship, farmer group development, etc.), trainings almost exclusively focus on the agronomic elements of the above-mentioned extension packages.

Since household cash resources were previously insufficient to cover fertilizer purchases, farmers' effective demand for fertilizer increased, and the government stopped selling fertilizer on credit. The fertilizer distribution system in the study area is becoming well structured, and farmers have already begun to obtain fertilizer without credit in exchange for cash. However, farmers also require other innovations such as environmental-related innovation (Chen et al.) and new technologies such as hand-operated pumps, sprayers, and rice thresher technology. To purchase these items, they need financial arrangements tailored to their needs. However, joint attempts to improve credit accessibility undertaken by EAs, other relevant bodies, and a variety of financial institutions, were unsuccessful. In addition, the financial system must provide sufficient capital to finance as it does for energy-efficient projects (Singh et al., 2023).

According to Ethiopian agricultural policy, market access for farmers is critical for smallholders to increase their incomes, improve their livelihoods, and contribute to local economic development. A study in Tigray region, Ethiopia by Teka and Lee (2020) asserted that the participation of households in the integrated package training programs has a positive impact on consumption expenditure and calorie intake per adult equivalent, but not on income and asset per capita of the households. This has also been observed in other countries, like China and Kenya (Alila & Atieno, 2006; Zhang et al., 2021). Smallholder farming can be transformed from a subsistence activity to a commercially profitable enterprise (Raj K & Hall, 2020). The implication is to improve smallholder farm productivity and increase farmers' incomes through joint efforts of stakeholders. Practically, even if there are some attempts to link farmers with markets, farmers are not likely to profit from the markets. The most likely reasons are limited extension programs to help smallholders connect with input and output markets, high interest rates in credit services, and an over-involvement of intermediaries in the market system. The finding also concurs with that of Ranjan (2017), who stated that horticultural farmers in West Bengal, India, tend to lose out to intermediaries, who extract the most profits from this trade. The findings of Wang et al. (2023) also suggest that farmers can mitigate marketing and production risks by accessing financial services. Therefore, we recommend (1) to minimize the role of intermediaries in value chains and encourage producers to sell their products directly sell their products

to the final consumers, and (2) that producers can create market cooperatives to establish robust producer–consumer connections to foster more direct relationships. According to an econometric analysis of the smallholder market, statistically significant variables for smallholder farmers participating in the market include the age of the household head, household family size, educational level, labor availability, market information, and distance from the marketplace, as evidenced by a study conducted in Ethiopia (Megerssa et al., 2020).

According to Ethiopian agricultural policy, FTCs are set up to increase household income (Wordofa & Sassi, 2018). It is clearly stated that the behavioral shift of farmers with FTCs is an entry point for bringing about economic changes among farmers and leading them to modern and commercial agriculture. However, at the grassroots level, the extension system is unable to ensure anticipated services such as farmer-and-market-driven crop demonstrations by self-sustaining FTCs. These results conform with those of Davis et al. (2010a) and Wordofa and Sassi (2018), who reported that the impact of training on farm income improvement and facilitating market access for products is poor in Ethiopia.

The intended outcome of agricultural extension policy is to promote research, technology delivery, and capacity building. This necessitates a well-managed research system, and good training of actors (farmers and EAs) is required to strengthen the extension system. Countries like Tanzania (Nakano et al., 2018) and Indonesia (Pratiwi & Suzuki, 2017) put the training of farmers and EAs at the center of their agricultural policy. However, in our case study in Ethiopia, farmers were offered technologies without comprehensive training and capacity-building activities, suggesting that farmers may be less likely to use the specific technologies provided. This finding aligns with what Abera et al. (2019) describe as farmers' irrigation committees not being effectively trained to tackle the most essential irrigation management problems for the sustainability of the schemes in Lake Tana Basin in Ethiopia.

At FTCs, a research center has conducted research, organized demonstrations and field days, and established connections with various players. However, the data reveal that the relationships between farmers and other actors are insufficient since enhanced rice crop technologies are widely disseminated but seldomly used by end-users (farm families). Technologies are developed with little participation of concerned stakeholders and without consideration of market demands. Colen et al. (2010) report that the development of new technologies should be done from a value chain perspective to ensure that rice produced by farmers is of the right quality, tailored to market demands and that contractual arrangements are established between farmers and millers, who are the private owners of post-harvest rice machinery. Moreover, Annys et al. (2020) found that no market links have been established yet by the Ribb Irrigation and Drainage Project in Northwest Ethiopia in the first five years after the project has become operational.

In general, some measures have been taken, which could be interpreted as an indication of the extension system having taken the path of transition from ToT to AIS. To gain a deeper understanding of the social aspects affecting extension system, researching the social network elements involved would be beneficial. This investigation could explore the complex relationships and connections among key players like farmers, input suppliers, traders, processors, and other relevant stakeholders. By examining these social network dynamics, researchers can gain insights into how information is shared, knowledge is exchanged, collaborations are formed, and decisions are made in the context of rice production. We recommend conducting further research to gain valuable insights into the social factors that affect the rice industry's extension system. This will help identify areas for potential interventions and improvements. Nevertheless, simultaneously, and despite the reforms, the efficiency and efficacy of the extension service in fostering technological

change, and coordinating different stakeholders involved in that process, are reported to leave much to be desired (Berhanu & Poulton, 2014).

6 Conclusion

Keeping in mind the caution frequently expressed by Ethiopian civil servants and farmers that 'the policy plan is like chicken sauce, but its implementation resembles more of a beans sauce' (in Amharic:
"ዕቅድ ዶሮ ክንውን ሽሮ"), our research objective aimed at identifying and analyzing the gaps, modifications and distortions that occur in the (iterative) move from policy to practice, and vice versa in terms of the shift from ToT to AIS.

Agriculture in Ethiopia is changing dramatically, from former subsistence farming systems, to more market-oriented economies. In line with this change, agricultural extension has become a structural policy instrument aimed at assisting farmers in becoming more competitive producers. Knowing that it is critical to understand the characteristics of extension dynamics to shape effective extension operations. To reach its objective, and using TOT and AIS perspectives, this paper reached its objective by analyzing policy discourses (the discursive level, as reflected in policy documents and strategic orientation documents) and extension practice (the implementation level, as reflected in the daily exchanges between farmers and the Extension Agents (EAs) at the grass-roots level). The empirical evidence on the transitions from ToT to AIS in the Fogera district, shows that the shift from ToT to AIS is not meaningfully reflected at the implementation level in the research area. More specifically, research provides technology without end-user imprimatur, and although participation is recognized as an appropriate path for the country's extension and research services, ToT remains ubiquitous in extension services on the ground. Additionally, while the ADPLAC (Agricultural Development Partners Advisory Council) institutional setup is pervasive all over the country, attempts to improve the interconnectedness between research, extension, farmers, and other players and to align efforts toward a shared goal continue to be complicated. For example, traditional organizations like *Edir*, *Equib*, and *Mahiber* are dominant contributors to information and knowledge, but are not involved in the ADPLAC attempts to create linkages. Moreover, EAs remain underappreciated and continue to feel not recognized for their steadfast commitment to providing professional services, in spite of their participatory role description in policy documents. Furthermore, despite establishing the development group and one-to-five farmers' groups, farmers' roles and responsibilities do not coincide with the original intentions of sharing work, joint learning, and collective action to extend best practices.

As the extension policy indicates, inclusive market-oriented extension activities could in theory advance the entire agricultural transformation. Yet, findings show that the grass-roots level does not address many of the issues inherent to the policy and extension strategy. We suggest that equitable and effective extension services to ensure equal access to resources, information, and opportunities for all farmers, regardless of their background, location, or circumstances, and that emphasis be placed on market facilitation to maximize the benefits of farmers and enhance competitiveness. Providing smallholder farmers with high-quality, relevant, timely information, and support is recommended. The role of the government is pivotal as it can facilitate the transition to AIS by providing training modules and seminars, as well as organizing multi-actor

policy dialogues on AIS for extension service system actors. We recommend organizing meetings, workshops, and forums centered around AIS to encourage collaboration between model farmers, smallholders, and extension agents. We can advance toward modernized extension services such as AIS by sharing goals, discussing challenges, and exploring potential solutions. These events offer a chance for positive conversations, exchanging knowledge, and forming connections based on mutual understanding. To this end, Ethiopia's extension apparatus should move forward with building committed and robust relationships between innovation actors, and to do so, more research is needed on what genuine AIS could look like at the grass-roots level, and which roles different actors within Ethiopia's development army should take on in order to realize a genuine AIS.

Acknowledgments The authors express their gratitude to the farmers who took the time to participate in the Focused Group Discussions (FGDs). We also extend our thanks to the agricultural experts and extension agents who participated in the Key Informant Interviews (KIIs) in the districts of Fogera and Mecha. A special appreciation is reserved for Hanibal Lemma, whose invaluable contribution made it possible to map the study areas.

Funding This research has been funded by VLIR-IUC.

Data availability The datasets generated during and/or analyzed during the current study are not publicly available due to reasons of privacy but are available from the corresponding author on reasonable request.

Declarations

Conflict of interest No potential conflict of interest was reported by the authors.

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