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Managing Agricultural Indigenous Knowledge among Smallholder Farmers in the East Showa Zone of Oromia, Ethiopia

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Abstract

Despite its immense contribution to sustaining agricultural development and ensuring national food security, attention given to indigenous knowledge (IK) by some modern communities in Ethiopia is weak. Thus, the purpose of this article is to investigate how smallholder farmers manage agricultural IK in the districts of the East Showa Zone of Oromia, Ethiopia. The study employed mixed research approaches based on quantitative and qualitative data. A field survey involving semi-structured interviews and focus group discussions was used for data collection. A total of 125 smallholder farmers were drawn from eight kebeles located in the four districts of the East Showa Zone through simple random sampling and probability proportion to size. Both quantitative and qualitative data analysis techniques were employed. The study revealed that agricultural IK was acquired and shared within small and family-based networks during social interactions and was dominantly preserved in individuals' minds through memorization, suggesting that there is a danger of losing IK in the studied communities as individuals with resident knowledge die. It was also found that IK utilization is limited to a few farming activities and varies across the studied districts. Thus, it can be concluded that the method of acquiring and sharing agricultural IK involves informal apprenticeship and socialization, where observing, questioning, consulting, imitating and practicing are applied by smallholder farmers. Therefore, more efforts should be made to strengthen social ties among smallholder farmers and encourage them to use a holistic knowledge management approach involving both tacit and explicit formats in the management of agricultural IK.

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Indigenous Knowledge, Management of Agricultural IK, Ethiopia.

Introduction

Agriculture is the mainstay of the Ethiopian economy and plays an enormous role in sustaining rural livelihoods. It contributes to more than 33% of the gross domestic product (GDP) and job opportunities for more than 77% of the working population (Agricultural Transformation Agency [ATA], 2016; Gebissa, 2021). The sector further provides most of the raw materials to agro-based industries, which include cotton ginning, textile mills, meat processing, beverages and brewery, and dairy and leather production systems (CSA, 2018). The conviction here is that the effectiveness of this sector will have a direct impact on ensuring national food security and economic growth, which requires key policy interventions.

In the 1990s, the Government of Ethiopia (GoE) launched the Agriculture Development Led Industrialization (ADLI) as an overall strategy for

national economic development, which strongly emphasized agriculture and rural development. Since then, the sector has been considered a main focus area of poverty reduction strategies in the country, which include the Sustainable Development and Poverty Reduction Plan from 2000–2005, the Food Security Strategy (FSS) from 2004, and the Plan for Accelerated and Sustained Development to End Poverty from 2005–2010. There have also been continuous government efforts to transform this sector via public extension programs since 1953, which were launched as key strategic interventions to improve agricultural productivity in terms of both quantity and quality.

The ongoing policy document, that is, the first and second Growth and Transformation Plans (GTP I and GTP II), began in 2010, and the establishment of the Agricultural Transformation Agency (ATA) also recognized the key role of agriculture in economic development. The agency aims to double the national economy by doubling smallholder output, aspiring to attain middle-income country status by 2025 (Yohannes, 2015). Within this context, policies and strategies are targeted to transform the agricultural sector by improving farming techniques, adopting modern inputs and knowledge-intensive agriculture, optimally using physical and natural resources, and producing high-value commodities. This is an apparent recognition of agricultural activities by the GoE as the crucial sector for achieving sustainable development and national food security.

Although high priority has been given to modern technologies, the achievement is far below expectations, and the sector is characterized by subsistence-traditional farming, low-input and low-output systems, poor technology adoption, and limited flow of localized information (Birhanu *et al.,* 2016; Diriba, 2020).

Smallholders' reliance on traditional farming and poor technology adoption are attributed to, among other factors, the weak integration of required knowledge systems into extension and development programs (Yohannes, 2015). However, it is only when smallholder farmers' indigenous knowledge (IK) systems are well understood and made an integral part of extension programs that they can provide relevant information and practical knowledge for decision making and thus can support sustainable development (Lwoga *et al.,* 2010).

The rationale behind the above assertion is that IK is still relevant for development, although it is differently structured and decoded compared to modern knowledge, which is explicit and codified, not to mention what is generated and promoted in universities and research centers (Haumba, 2015; Tamrat, 2015). IK is often distributed among many people's heads and has been used as a basis for local-level decision making in agriculture, food processing, health care, biodiversity conservation and a host of farming activities in rural communities (Akullo *et al.,* 2007; Lwoga *et al.,* 2010; Sarkhel, 2016). Needless to say, each of these farming activities and their arrangement within the socioeconomic conditions of the local community requires different but relevant and well-preserved IK in user-friendly forms.

Thus, there is a need to understand how smallholder farmers acquired, shared and disseminated, preserved and utilized agricultural IK in the districts of the East Showa Zone of Oromia, Ethiopia. Here, the traditional method of carrying out farming activities is referred to as agricultural IK; thus, the term indigenous knowledge is used to refer to both tacit and explicit IK.

Although Ethiopia, like many African countries, has adopted knowledge management, the focus has been on diffusing and preserving explicit knowledge generated by researchers and universities (Fanos *et al.,* 2012; Belay, 2014). In addition, the research-extension approaches of the country are still tending to follow a top-down pattern of technology transfer, neglecting farmers' ideas in problem identification and decision-making (Mengistie and Belete, 2015).

This approach leaves little room for understanding and integrating IK into the knowledge system because they are forced to adopt modern technologies recommended as 'one-size fit for all' (Birhanu *et al.,* 2016). This trend implies that IK has received less attention, focus and privilege than conventional practices by some modern communities in Ethiopia. This situation raises the question of how smallholder farmers can manage agricultural IK in the study districts to ensure its continued use and exploitation.

To this end, the objective of this article is twofold. (1) To ascertain how agricultural IK is currently acquired, shared and disseminated, preserved and utilized for improving the implementation of farming activities among smallholder farmers; and (2) to investigate the methods and tools used to better manage indigenous agricultural knowledge for farming activities in the study districts.

Materials and Methods

The Study Area

This study was carried out in the districts of the East Showa Zone of Oromia, Ethiopia, particularly at the grassroots level. Geographically, the East Showa Zone extends 7^0 33'50" North to $9^0$08'56" North and 38^0 24' 10" East to 40^0 05' 34" East, which indicates that it is located in both tropical and subtropical climatic zones. It shares the longest and shortest borders with the Arsi Zone and Afar National Regional State, respectively. The total area is estimated to be 9,547 km^2, and the altitude ranges from less than 1000 meters to more than 3000 meters above sea level. Figure 1 illustrates the location of the study districts.

The agro-climatic conditions of the study area are dominated by subtropical and tropical zones. Its rainfall distribution is mainly affected by variations in altitude, climate conditions, and the direction of rain-bearing winds (MoARD, 2010). The main economic activity is smallholder mixed farming systems dominated by crop and livestock production. Notable crops cultivated in the area include cereal crops such as *teff*, wheat, barley, maize and sorghum and pulses such as lentils, beans, chickpeas, haricot beans and field peas (CSA, 2018). Livestock husbandry, which involves the production of cattle, poultry, goats, mules, camels, donkeys and horses, is also common in the study area. Thus, the agro-ecology of the study area is best suited for diverse agricultural production systems.

Sampling Technique and Data Source

The target population for this article comprises all smallholder farmers who are living in the four districts of the East Showa Zone of Oromia, namely, Adami-Tulu Jido Kombolcha, Dugda, Lume and Ada'a. Two-stage cluster sampling techniques involving random sampling and probability proportion to size were employed to select the smallholder farmers. Rather than sticking into a single sampling frame, it is better to adopt a design involving multistage or cluster sampling when the study population is geographically dispersed and the costs associated with data collection are too high (Kothari, 2004; Creswell, 2009). Thus, the ten districts in the East Showa Zone were clustered into two broad categories based on their land use patterns.

In the first stage, four districts—the Adami-Tulu and Dugda districts—from the intensively cultivated cluster and the Lume and Ada'a districts—from the moderately cultivated cluster—were selected through random sampling techniques, for which the lottery method was used. In the second stage, two kebele administrations from each district were selected purposively based on their dominance in crop production. These are Haleku Gulenta and Oda Ashura from the Adami Tulu District; Wolda Qalina and Shumi-Gamo from the Dugda District; Nanawa and Ejere from the Lume District; and Ude and Dire from the Ada'a District. Finally, 125 smallholder farmers were selected using a simple random sampling technique on the basis of the Yamane (1973) formula. The following formula was used:

$$n = \frac{N}{1+N(\epsilon)2'} \qquad n = \frac{4,176}{1+4,176(0.09)2}$$

Where,

N= Population size
n= Sample size
e = margin of error (0.09) and 95% confidence level.

The data for this article were obtained through the use of semi-structured interview questionnaires and focused group discussions. A semi-structured interview schedule consisting of open-ended and close-ended questions formed the main data collection tool. A total of eight focus group sessions were also held in four districts, with two FGDs per district, and forty-four (44) respondents participated in the discussions. The discussions were structured around themes, and participants were directed in accordance with guidelines that were established in conjunction with these themes. This method allows participants to engage in an in-depth interviewing process in their natural setting by probing questions such as what, why and how they acquired, shared and preserved agricultural IK. Of the 125 smallholder farmers included in the semi-structured interviews, 115 (92%) were approached.

Descriptive statistics comprising frequencies, percentages, and means were used for the analysis and interpretation of the quantitative data, while a thematic approach was used to analyze and interpret the qualitative data collected using open-ended questions and FGDs.

However, the results obtained from qualitative and quantitative data were mixed to combine the findings for triangulation and comparison among the data sources (Creswell, 2009).

Results and Discussion

The Acquisition of Agricultural IK

The results of this study show that own experience (115, 100 percent), neighbor/friends (109, 94.7 percent) and demonstration plots (107, 93 percent) were the main sources of agricultural IK in the studied communities. However, only 35 (30.4 percent) and 42 (36.5 percent) of them indicated their regular acquisition from neighbors and demonstrations, respectively. During the FGDs, the discussants reported that their own experiences, relatives and observations were the most consulted sources of IK. Through these sources, smallholder farmers often acquired IK by preparing fields, planting schema, weeding and soil fertility, among others. These findings are consistent with those of Birhanu *et al.,* (2016) and Ramata *et al.,* (2017), who found that informal social networking is an important mechanism for acquiring and sharing IK.

However, the majority of the respondents, accounting for more than 60 to 80 percent, did not acquire agricultural IK from television, print media or NGOs on a regular basis (see Table 1). Only 39 extension workers (33.91 percent), 21 district agricultural offices (18.26 percent) and 16 radio offices (13.91 percent) were somewhat consulted from formal sources. This finding corroborates the data collected through FGDs. Most of the participants reported a greater preference for local sources to obtain information about climate conditions, seed varieties, fertilizers, and incidents of crop diseases and pests. These findings support those of Birhanu *et al.,* (2016), who noted that there is less consideration of the internet, TV, computers and print materials as sources of IK. Thus, there is no link in the acquisition of IK from external sources (institutional and mass media).

The participating farmers also reported that the information provided by mass media, such as newspapers, radio and TV, is mostly focused on entertainment and government issues. In addition, their information was limited to a few agricultural practices, preventing them from being considered a source of agricultural IK. For instance, a 52-year-old discussant in Dugda district reported the following:

"There is limited opportunity for us to access information about IK from external sources, including local institutions, TVs, publications, farmer cooperatives, district agricultural offices and FTCs, because they mostly focus on promoting modern farming knowledge rather than traditional knowledge. In addition, as you see most of us are illiterate who cannot read and write, and thus this could be challenging for the illiterate to obtain IK through print materials such as books and newspapers."

During the FGDs, the participating smallholders further explained that they acquired indigenous techniques by observing how others performed and consulted their families. They also opined that informal discussion and visiting other farms enabled them to acquire and share farming problems and possible solutions. This suggested that smallholder farmers had learned better through local and family-based links than through explicit links. However, the decline of prior social networks and modernization challenged them to acquire agricultural IK through this method alone. Thus, organizing available knowledge into structured formats and enhancing cohesive social networking are crucial for easier accessibility and utilization of farming knowledge in the studied districts.

The Sharing and Dissemination of Agricultural IK

As noted in Table 2, approximately 48 (41.7 percent) of the respondents had shared agricultural IK in sometimes bases, followed by 43 (36.5 percent) who affirmed their regular sharing. The remaining 24 (20.9 percent) of them opined that they never shared agricultural IK. Smallholder farmers did not share all acquired agricultural IK with the other farmers. This is further supported by the data obtained through FGDs. The major reasons for not sharing their farming knowledge were poor recognition of IK, declining social bonds, modernization and negative attitudes toward IK, among others.

The findings showed that the majority of the respondents (65, 71.4 percent) shared IK with friends, followed by 63 (69.2 percent) with neighbors and 40 (44 percent) with fellow farmers on a regular basis, with total scores of 156, 148 and 129, respectively. This signifies that smallholder farmers shared their farming knowledge with friends and neighbors. The results also indicate that 37 (40.7 percent) of the smallholder farmers regularly shared agricultural IK with extension workers. Similar observations were made by Lwoga *et al.,* (2010) in Tanzania, Haumba (2015) in Uganda and Ramata *et al.,* (2017) in Ethiopia.

The study revealed that knowledge of crop husbandry, field preparation and soil fertility was among the most

common types of IK. However, the majority, accounting for more than 65% to 78%, did not share their knowledge with researchers and children on a regular basis. These findings agreed with the findings of Ramata *et al.,* (2017) and Mugwisi (2018), who found that IK was poorly shared between smallholder farmers and knowledge intermediaries. Thus, strengthening and leveraging cohesive social networking among these groups are crucial for enhancing the creation and sharing of IK in the studied communities.

When asked how they share knowledge with others, the smallholders responded that they primarily share knowledge through interpersonal or oral channels. Approximately 65 (71.4 percent) of the respondents said they regularly share knowledge informally, followed by 50 (55 percent) during on-farm trails and 36 (39.6 percent) during meetings. Only 6 (6.6 percent) said they often share knowledge through print materials, indicating that they rarely use explicit formats in that regard. Since smallholders share knowledge primarily through oral channels, they are more likely to comprehend information disseminated through these channels than when it is shared through print or ICT tools. These findings agreed with the findings of Lwoga *et al.,* (2010) and Birhanu *et al.,* (2016), who confirmed that explicit formats for obtaining and sharing IK are less common.

Preservation of Agricultural IK

As indicated in Table 3, the majority of the respondents did not consider IK through explicit formats. This is further supported by the data obtained from the FGDs. Thus, memorization was the main method used to preserve agricultural IK in the studied districts. It seems that there is a danger of losing agricultural IK since most of these technologies are not yet systematically captured and documented. This agreed with the findings of Lwoga *et al.,* (2010), Zimu-Biyela (2016) and Ramata *et al.,* (2017). The authors noted that local communities used their own minds and oral traditions to document IK practices, suggesting that loss of knowledge was prevalent in most African countries.

When asked about how they preserved IK, approximately 27 (93.1 percent) of the respondents replied that they used oral traditions. Only 3 (10.3 percent) and 4 (13.8 percent) of them opined that they used print materials and ICT tools, respectively. The findings from the FGDs also showed that most smallholder farmers preserved IK in their minds and through storytelling, carving and activities. These responses indicated that explicit formats were less commonly used to capture and preserve agricultural IK in the studied districts. This agreed with what Birhanu *et al.,* (2016) and Ramata *et al.,* (2017) observed in Ethiopia.

Throughout the FGDs, the farmers who participated in the discussions stated that they had obtained IK verbally from informal and local networks, but none of them had been explicitly recorded. Nonetheless, they recognized the value of conserving local technologies, such as ox-plowing implements and local seeds, after discovering that tractor-plowed fields and pricey seed varieties outperform indigenous ones in terms of efficiency. The effectiveness, cultural values, financial ramifications, and low danger involved with such procedures were among the stated justifications for maintaining these technologies (IK). In Ethiopia, Ramata *et al.,* (2017) reached a similar conclusion.

The results further indicated that, unlike agro-chemicals, traditional weeding is more effective at aerating plants and does not have health risks, which encouraged them to utilize and preserve their farming activities. For instance, one of the discussants in Ada'a reported that:

"Although I believed the importance of preserving IK in formal documents, nothing has been taken thus far in rural areas. Rather, most people lived individually in their memories and remembered when they were performing farming activities. In addition, I think it is better to manage this knowledge with print and electronic formats so that other individuals can use it when the demand for these technologies arises. However, it was found that a lack of formal education and resources limited the extent to which IK was captured and preserved through explicit formats."

Most respondents preserved agricultural IK in their minds and through oral traditions rather than in an explicit format. This can be done orally using local dialects, which puts them at risk of extinction and distortion in the studied districts. During the FGDs, the participating smallholder farmers stated that a lack of education, a low level of interest and a negative attitude toward IK were the major challenges for preserving this knowledge.

These findings agreed with those of Lwoga *et al.,* (2011) and Ramata *et al.,* (2017), who reported that a lack of education and poor recognition of IK were among the factors affecting the management of IK.

Table.1 Distributions of the extent and sources of IK acquired (N=115)

Sources for acquiring IK (n=95)	Extent of sources used for acquiring IK							
	Regularly (2)		Sometimes (1)		Never (0)		Score	Rank
	Freq.	Percent	Freq.	Percent	Freq	Percent		
Personal experiences	62	53.9	53	46.08	-	-	177	1st
Neighbors/friends	35	30.43	74	64.34	6	5.2	144	4th
Observation & demonstration	42	36.50	65	56.53	8	6.95	149	2nd
Family members	44	38.26	59	51.3	12	10.43	147	3rd
Social gatherings	36	31.30	59	51.3	20	17.4	131	6th
Woreda agricultural offices	21	18.26	58	50.4	36	31.30	100	8th
Farmers groups	27	23.45	63	54.8	25	21.74	117	7th
Extension workers	39	33.91	60	52.2	16	13.91	138	5th
Print media (poster, books)	-	-	23	15.65	87	75.65	23	11th
Watching television	-	-	21	20.0	94	81.74	21	12th
Listening radio	16	13.91	29	25.22	70	60.87	61	9th
NGOs	-	-	47	40.87	68	59.13	47	10th

NB: Due to multiple response rates, the frequency percentage does not add up to 100

Table.2 With whom IK was shared and the methods used for sharing it (N=91)

With whom do you share IK?	Extent of sharing IK							
	Regularly (2)		Sometimes (1)		Never (0)		Scores	Ranks
	Freq.	Percent	Freq.	Percent	Freq	Percent		
Friends	65	71.43	26	28.57	-	-	156	1st
Neighbors	63	69.23	22	24.18	-	-	148	2nd
Children	19	20.87	24	26.37	48	52.74	62	5th
Extension workers	37	40.66	51	56.04	3	3.30	125	4th
Fellow farmers	40	43.96	49	53.85	2	2.20	129	3rd
Researchers	11	12.09	35	28.46	45	49.45	57	6th
Methods used for sharing IK	**Extent of using these methods for sharing IK**							
	Regularly (2)		Sometimes (1)		Never (0)			
	Freq.	Percent	Freq.	Percent	Freq	Percent		
Informal discussions	65	71.42	26	28.57	-	-		
Village meetings	36	39.56	41	45.10	14	15.38		
Print materials	6	6.6	26	28.57	59	61.44		
On-farm trails	50	54.95	27	29.67	14	15.38		
Over mobile phone	23	25.27	38	41.76	30	32.97		

NB: Due to multiple response rates, the frequency percentage does not add up to 100

Table.3 Methods used for preserving agricultural IK (N=115; n=29)

Do you preserve IK in some forms?	Yes	No
	29 (25.2)	86 (74.8)
Method used to preserve IK (n=29)	Frequency	Percent
Oral traditions (storytelling, or activities)	27	93.1
Print materials (reports, or books)	3	10.3
ICTs (audio-video recordings)	4	13.8

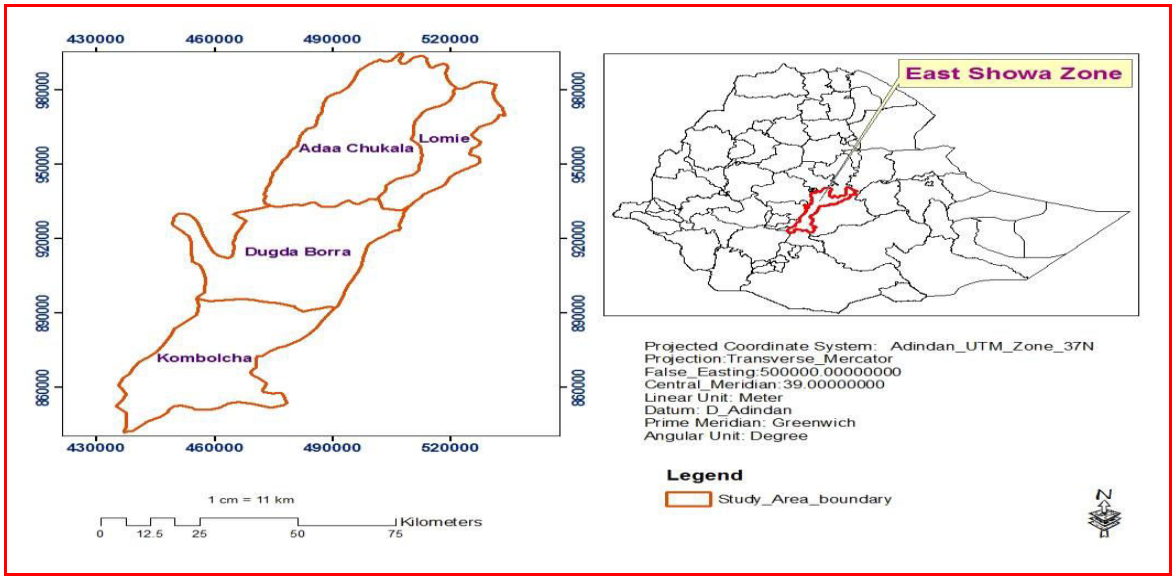
Source: Authors' survey results, 2022

Table.4 Distribution of respondents by extent of IK utilization (N=115, n=102)

Do you utilize IK?	Yes		No					
	102 (89.7)				13 (11.3)			
Types of IK	**Extent of utilizing IK**							
	Regularly (2)		**Sometimes (1)**		**Never (0)**		**Score**	**Rank**
	Freq.	**Percent**	**Freq.**	**Percent**	**Freq**	**Percent**		
Crop husbandry	60	58.82	30	29.41	12	11.76	150	1st
Postharvest techniques	18	17.65	31	30.39	53	51.60	67	8th
Climate forecasting	21	20.59	43	42.16	38	37.25	87	6th
Value added techniques	-	-	37	36.27	65	63.73	37	9th
Crop disease and pests	34	33.33	48	47.10	20	19.61	116	5th
Soil fertility	55	53.92	35	34.31	12	11.76	145	3rd
Weed control	54	52.94	36	35.29	12	11.76	143	4th
Clearing farm fields	58	56.62	31	30.39	13	12.75	147	2nd
Animal diseases	16	15.79	44	43.14	42	41.18	76	7th

NB: Due to multiple response rates, the frequency percentage does not add up to 100

Figure.1 Map of the study area (Adopted from East Showa Zone Properties, 2020)



Utilization of Agricultural IK

The respondents were asked an interview question on the utilization of agricultural IK to ascertain their levels and reasons for utilizing it. Their response indicated that the majority (102, 89.7 percent) of them utilized agricultural IK for farming activities. The remaining 13 (11.3 percent) of the smallholder farmers did not use IK in the studied districts. The results indicate that most smallholders often utilized IK, although the extent of their utilization varied and was limited to a few farming activities. These findings agreed with the findings of Tamrat (2015) and Ramata *et al.,* (2017) in Ethiopia, who confirmed that there is greater dependence on IK for crop production.

The findings showed that the majority of the respondents utilized IK for crop husbandry, with 60 (58.8 percent) utilizing IK on a regular basis and 30 (29.4 percent) utilizing IK on a regular basis. With regard to the frequency of utilizing IK for clearing farm fields, approximately 58 (56.6 percent) of the smallholders regularly utilized it, and 31 (30.4 percent) sometimes utilized it. A significant number of the respondents, 55

(53.9 percent), regularly utilized knowledge on soil fertility techniques, while 35 (34.3 percent) of them utilized physical knowledge. It seems that IK remains important for improving soil fertility and crop productivity. These findings agreed with what Akullo *et al.,* (2007) found in Uganda that the burning of crop residues and animal manures were among the local techniques used by farmers to enhance soil fertility.

Based on these findings, the most commonly used forms of IK in the districts under study were related to crop husbandry, soil fertility maintenance, and field preparation. Despite regional variations in their utilization, Tamrat (2015) found that Ethiopian farmers frequently employ IK for agronomic tasks. However, with scores of 37, 67, and 76, respectively, IK for value-added approaches, postharvest, and animal diseases was the least used. Smallholder farmers may employ alternative agricultural technology because not all of them use indigenous technologies in their farming activities.

Conclusion and Recommendations

The study revealed that IK was acquired and shared within a small and family-based network during social interactions and was dominantly preserved in individuals' minds. As a result, there is a risk that IK will be lost in the communities under study. The smallholder farmers acquired agricultural IK from their own experiences, observations and demonstrations, family members, friends/or neighbors, extension workers and social gatherings. Through casual conversations, meetings, and on-farm visits, they often shared IK with friends, neighbors, and other farmers. The use of IK varies and is limited to a few farming activities.

It is therefore concluded that the mode of IK sharing is limited to oral paths; thus, smallholders are more likely to understand the knowledge disseminated through this method than through print and ICT tools. This suggests that the method of acquiring and sharing agricultural IK is informal apprenticeship and socialization, where observing, questioning, consulting, imitating and practicing are applied by smallholder farmers. The study suggested that to improve IK acquisition and sharing, local communities should fortify their coherent social networking and build trustworthy relationships. In addition, agricultural IK should be systematically captured and preserved by smallholder farmers working with the main local actors. Our findings have important policy implications for smallholder farmers in decision making and implementation regarding IK management and usage to improve crop productivity in the face of limited access to resources, endless natural disasters and other climate-related challenges.

Conflict of interest

The authors declare no competing interests.

Abbreviations

IK: Indigenous Knowledge

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