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Agricultural knowledge centers: opportunities and challenges for ICT-enabled knowledge management in Ethiopia

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Based on empirical data collected through semi-structured questionnaires and focus group discussions, the paper presents the experience of the Livestock and Irrigation Value Chains for Ethiopian Smallholders (LIVES) project in working with agricultural development offices (ADOs) to establish and manage agricultural knowledge centers (AKCs) at zonal and district levels in four regions. The AKCs are basic knowledge infrastructure established to enable ADOs to effectively manage their organizational knowledge and improve access to and use of new knowledge and information. The paper finds that ownership and leadership by ADOs is critical to create demand for and to ensure proper management and utilization of the knowledge centers. The findings showed that knowledge management is constrained by organizational and social barriers. While there was a high demand from extension staff to use the knowledge centers, limited awareness and ownership by ADOs created narrow space for the staff to use the knowledge centers. Finally, the paper concludes that enhancing the use of knowledge centers requires a behavioral change in the broader institutional context of the extension service, which needs to recognize its role as a knowledge broker and provider.

Keywords: Knowledge management, agricultural knowledge centers, extension services, Ethiopia.

INTRODUCTION

The development objectives set forth by the Government of Ethiopia (GoE) in recent years provide a comprehensive set of strategies for the agricultural sector, including the market-led transformation of the smallholder agriculture. The agriculture sector is increasingly characterized by new policies, actors, and relationships that influence the ways in which information and knowledge is generated, accessed and used by extension staff, farmers and other users. Improved flow of information and knowledge to, from and within the extension system is key to realize agricultural transformation (Lemma, 2007). A well-functioning

knowledge management system is critical for market oriented agricultural development to increase access to external knowledge about markets, improved technologies, and new organizational forms.

Extension staff are key front line sources of agricultural information and knowledge for smallholder farmers (ATA, 2013). However, limited access to up-to-date and relevant information is one of the challenges extension staff face to effectively serve farmers and other users of extension services. ICTs can play a critical role in facilitating rapid, efficient, and cost effective access to agricultural information and knowledge by extension staff (Richardson, 2006; Asenso-Okyere and Ayalew, 2012; Yadav *et al.*, 2015). In fact, the ICT infrastructure development in Ethiopia holds a huge promise to change the landscape of extension service delivery.

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Advancements in ICTs provide an opportunity for harnessing and utilizing information and knowledge to improve production, productivity and marketing in the agricultural sector (UNDP, 2012; Nyirenda-Jere and Kazembe, 2014).

However, a lack of well-functioning knowledge infrastructure and locally relevant content limits the knowledge management capacity of ADOs to exploit these opportunities. Knowledge is not properly documented, shared and used due to a lack of functional knowledge management system and as well as an organizational culture that supports it. Usually knowledge and information is kept with individual staff, making knowledge sharing and transition difficult. There are no venues where extension staff meet and share knowledge and experience in a formal way. This situation limits the capacity of extension staff to access, generate, store and use new knowledge and information to effectively address the production and marketing challenges of farmers and other value chain actors.

Following the experience of the Improving Productivity and Market Success of Ethiopian Farmers (IPMS) project, the LIVES project is working with ADOs to establish and strengthen agricultural knowledge centers (AKCs) at zonal and district levels and develop institutional capacity to enhance the use of the knowledge centers. The project works in 10 zones and 31 districts of Amhara, Tigray, Oromia and SNNP regions. By March 2016, there were 2050 registered users in 41 AKCs, which are open to users from line and administration offices.

AKCs are basic knowledge infrastructures that were established to develop the knowledge management culture and capacity of ADOs by creating venues equipped with ICT tools that facilitate capturing, storing, sharing and utilization of knowledge to improve extension service delivery. The objective was to capacitate ADOs to access relevant and up-to-date information and knowledge that will enable them to deliver effective extension services.

AKCs provide services including that of traditional library, digital library, audiovisual center, online access point, and informal and formal meeting venue (ILRI, 2013). They provide extension staff and others with easier access to relevant knowledge and information as well as convenient venue to promote knowledge sharing culture intended to improve effectiveness of extension service delivery. The AKCs are equipped with computers, printers, TV sets, DVD players, digital cameras, LCD projectors, internet connections, and basic furniture. The computers and DVD players encourage experts to access knowledge stored on DVDs and CDs as well as develop and share reports. The knowledge centers are also equipped with project documents and audiovisual materials.

However, physical resources alone will not guarantee success and sustainability of the AKCs. The AKCs will be effective and sustainable only when the users have a

clear strategic outlook into the future and fully realize how the knowledge centers provide a unique opportunity to support market-oriented agricultural development. Without such attitudinal and behavioral change in the ADOs, AKCs can only be taken as add-on activities.

In this paper, we present the experiences of the LIVES project in promoting the knowledge culture of extension staff through establishment of agricultural knowledge centers. The paper discusses the role of knowledge centers, opportunities and challenges to promote and use the knowledge centers, and it finally concludes that organizational ownership and leadership is crucial to enhance and sustain the benefits of the knowledge centers.

Knowledge management and organizational culture: a brief literature review

Agriculture increasingly becomes more complex and knowledge intensive sector. A range of actors are engaged in agriculture related to service provision, production, processing and marketing (Lemma, 2007). Farmers and other users of extension services require access to reliable, timely, and relevant information. An effective knowledge management system is required to modernize agricultural production and marketing practices (World Bank and African Development Bank, 2012; FAO, 2013; Magesa *et al.*, 2014).

Knowledge management is the process of generating, storing, retrieving, transforming, disseminating, and using knowledge (Baskerville and Dulipovici, 2006). It involves planning, organizing, motivating and controlling people, processes and systems to improve and effectively employ organizational knowledge resources (King, 2009). ICTs offer opportunities to effectively manage this knowledge and organizational process. However, there are several socio-organizational factors that limit efforts to harness ICTs potential to support knowledge management for agricultural development (Disterer, 2001; Yadav *et al.*, 2015). Effective knowledge management typically requires an appropriate combination of technological, organizational, social and managerial initiatives (Marwick, 2001).

Several authors argue that knowledge management is more of a socio-cultural and organizational challenge than that of a technological challenge (De Long, 1997; Holsapple and Joshi, 2000; Disterer, 2001; Tahir *et al.*, 2010). It involves managing people, relationships, interactions and organizational processes. Organizational culture and personality factors influence knowledge culture of individuals and organizations. In fact, the biggest difficulty in managing knowledge is changing people's behavior, which is basically their attitude towards sharing knowledge with their colleagues (Yadav *et al.*, 2015). Since knowledge is created and shared through social networks, people issues are critical for the success of knowledge management and knowledge transfer initiatives (Disterer, 2001).

Knowledge culture needs effective incentive and reward systems to develop. Knowledge is not freely shared. People need incentives and rewards to work in teams, generate, share and use knowledge to improve organizational performance (Yadav *et al.*, 2015). Recognizing and giving reputations to people who actively generate and share knowledge can incentivize people to contribute to knowledge databases or work in teams to generate and share knowledge. Organizations, however, have to balance individual and team recognitions, as organizational learning and sharing is a collective process happening through social interactions and networks. Many organizations incorporate specific performance indicators for knowledge generation, sharing and team learning into their promotion and benefit policies (Disterer, 2001) to induce positive behavior which is supportive of knowledge sharing and learning. Knowledge management also requires consistent, reliable, plausible management behavior (Nguyen and Mohamed, 2011; Paliszkiwicz *et al.*, 2015). Organizational leaders must demonstrate that they are thoroughly convinced that knowledge needs to be captured, shared and used and that they even show firm commitment to financially support knowledge management initiatives (Weber, 2007).

MATERIALS AND METHODS

The paper is based on empirical data collected using individual interviews and focus group discussions. Semi-structured questionnaires were administered on thirty six AKC managers in four regions, namely Tigray, Amhara, SNNP and Oromia regions. The questionnaires focused on physical conditions and organizational factors influencing the management and utilization of knowledge centers. In addition, four focus group discussions were conducted with randomly selected knowledge center users in the Oromia and Amhara regions. With length of sessions between one and two hours, the focus group discussions typically involved 6 to 10 individuals representing gender, age and type of knowledge center users. A discussion checklist was prepared based on preliminary ideas, concepts from literature review, and personal experience. The checklist helped the researchers create a natural progression across discussion topics. The researchers were free to probe more deeply when necessary, skip over areas that have already been covered, and follow on new topics that arouse during the focus group discussions.

Field notes were used to record information, interactions and observations during focus group discussions. Recording dates of discussions and topical headings of questions that were asked contributed to the chronology and meaningful analysis of the field notes. The field note entries clearly differentiated between what respondents

literally said, the context of the social interactions, and the reactions of the researchers to the situation.

The paper also makes use of information from a review of project documents and research reports, including that of the LIVES and the Improving Productivity and Market Success (IPMS) of Ethiopian farmers projects. The authors also draw on their personal research experiences and insights into organizational learning and knowledge management in the agriculture sector.

RESULTS AND DISCUSSION

Role of AKCs in enhancing the knowledge culture of extension staff

Group discussions with knowledge center users indicated that AKCs have played key role in enhancing the learning and sharing culture of public extension staff. Documented cases showed that the knowledge centers helped increase access of extension staff to information and knowledge and created opportunities for personal development. For example, in West Gojam zone, North Gondar zone, West Shoa zone, Jimma zone and Sidama zone, knowledge centers played important role in familiarizing extension staff with ICT tools and social media, resulting in improved computer skills to access, share and use knowledge.

Internet connectivity has encouraged wider use of the AKCs, including e-mail services, and browsing and searching for specific information relevant to local contexts, needs and challenges. The availability of relevant reference and audiovisual materials also attracts more users. Extension staff have found these materials useful to gain new knowledge as well as to train farmers (Lemma *et al.*, 2010).

The availability of computers, LCD projectors and digital cameras has developed the knowledge capturing, sharing and learning culture of the extension staff. The use of the internet has made communication easier as extension staff share reports by email. It also facilitates the linkage of extension staff with researchers, experts and friends, asking for technical support and information. During focus group discussions in West Shoa and Jimma zones, extension staff explained that the use of the internet has facilitated linkages with relevant knowledge sources, enabling them to access new information and provide timely extension advice. In addition, the digital cameras and LCD projectors are used to capture knowledge sharing events, such as field days and good practices, which are shared in team meetings as well as in training activities.

Box 1. The story of Yohannes Eshetu

Yohannes Eshetu works at SekaChekorsa district of Jimma zone, Oromia region, as an irrigation expert. The LIVES project trained Yohannes in motor pump repair

and maintenance. With a thrust for knowledge, Yohannes is an active user of the AKC in the district. "Learning to learn is a capacity", said Yohannes. On return from the training, he used the computer and internet services of the knowledge center to study the CDs and other reference materials provided by the training facilitators.

According to Yohannes, the establishment of the AKC brings hope and enthusiasm for personal development and professional growth. Agricultural experts in the district have now access to information and knowledge to keep up-to-date with their profession. The knowledge center offers opportunity for experts to develop computer skills and operation and management of audiovisual equipment. Many of the experts have now email and social media accounts, enabling them to maintain social networks.

With the establishment of the knowledge center, agricultural experts are now connected to the outside world. Jaalallee, a knowledge center manager, agrees with Yohannes' view that the knowledge center increased motivation of experts, as they have a chance to search for information, develop computer skills, search for scholarship opportunities, and access to resources to upgrade their knowledge. She said that she was bored when she was assigned in the district as an irrigation expert, but now, since she also works as a knowledge center manager, she is happy to stay in the district. She said that the knowledge center helped her develop computer skills and get connected to her friends and expert networks.

In a study of the IPMS supported Woreda Knowledge Centers (WKC), Lemma *et al.* (2010) showed that the primary visitors were the staff of Woreda Offices of Agriculture and the main purposes of the visits were reading reference materials, computer use, and viewing audio-visual materials. Subject matter specialists were the most frequent visitors of the knowledge centers.

The IPMS supported WKC provided agricultural experts and others with better access to relevant knowledge and information (Lemma *et al.*, 2010; Shiferaw *et al.*, 2013). About 94 percent of the users found the resources and services at the knowledge centers relevant and useful in preparing them better to discharging their duties and responsibilities. Access to computers and the internet, enhanced skills to use the computers, and availability of reference and audiovisual materials have improved access by knowledge center users to relevant knowledge and information. The knowledge centers also served as venues for formal and informal knowledge sharing, including hosting graduate seminars and training events. However, success with AKCs depends largely on the information seeking and utilization behavior of agricultural experts and development agents, who need to have capacity and pressing demands to access and use new knowledge. A full scale utilization of the knowledge

centers requires increased knowledge demand from the end-users as well as a continuous supply of relevant and up-to-date knowledge. Information and knowledge demand from the end-users is particularly key to change the knowledge culture of the extension system. As the need for improved technology and information increases with the commercialization of agriculture, it is expected that farmers and other users will create more demands on extension services for new information, knowledge and technologies, which can create an incentive for extension staff to use the knowledge centers. Appropriate accountability mechanisms (such as key performance indicators for performance evaluations and promotions) are required to incentivize extension staff to respond to knowledge demands by the end users (Disterer, 2001; Yadav *et al.*, 2015).

Strengths and opportunities for enhancing the use of knowledge centers

The AKCs are at different levels of functionality with differing conditions and contexts of use and ownership. Analysis of the current status of AKCs shows that opportunities exist to promote the use of the knowledge centers.

The performance management system of the zonal and district civil service offices provides opportunities to enhance the utilization of the knowledge centers. The offices organize ICT training events for civil servants, which help develop ICT skills of public extension staff and other line offices staff to use the knowledge centers. Another aspect of the performance management system is the regular "network meetings" conducted to review weekly performance of the extension staff. A group of five extension staff meet regularly to review weekly performance, and leaders of each group also meet with work process owners to review performance at a higher level. The network meetings can be used to promote the knowledge centers by including knowledge center use into the discussion checklist, thereby holding extension staff accountable to demonstrate the utilization of the knowledge centers.

The availability of ICT experts in the zonal and district administrations and line offices is another opportunity to enhance the utilization of the knowledge centers. These ICT experts can provide technical and problem-solving support to AKC managers and can also facilitate computer skills training for public extension staff. ICT experts can also help link the AKCs with existing ICT infrastructure and knowledge platforms, such as the Ethiopian Agricultural Portal (EAP).

Above all, the age structure of the staff of the ADOs offers unique opportunity to promote the use of the AKCs, which provide those young extension staff with a range of opportunities to empower themselves in a number of ways. Young people appreciate new technologies and

Table 1. Percentage of AKC managers who assessed the physical condition of AKCs (n = 36).

Criteria	Good	Somewhat good	Not good
The AKC has enough space for users.	61%	31%	8%
The AKC is well illuminated.	75%	19%	6%
The AKC has enough air circulation.	70%	19%	11%
The AKC is conveniently located and accessible.	86%	8%	6%
The AKC room is clean and tidy with no cracks.	59%	33%	8%

innovations. The AKCs help young extension staff maintain social connections and support networks, access new information and knowledge more than ever before, and develop confidence and social skills. Research showed that ICTs are best platform to attract the use into agriculture (Irungue, Mbugua and Muia, 2015).

Box 2. The story of Tigist Gebrekidan

Tigist Gebrekidan has been working as a secretary in Bahir Dar zuria district, West Gojam zone of the Amhara region. With the establishment of the AKC, she was promoted to the position of ICT expert of the office. She said that initially there was low interest to use the knowledge center. She used informal ways to create demand for the knowledge center. She invited some of her close circles to visit the knowledge center. She helped them create email and social media accounts. "There were a lot of surprises from experts when they see photos of former acquaintances", said Tigist. She continued to interact with them and helped them explore information of their interest. Gradually, they became comfortable and confident in the use of the internet, as they developed computer and social skills.

She said that the experts are eager to use the knowledge center. They even came early before she arrived in office and helped her with the cleaning of the knowledge center. Even if they do not use the internet, they visit the knowledge center to read materials and do their work. She used to go home for lunch, but to allow users to use the knowledge center during lunch time, she started to bring her lunch to office. "I feel happy when knowledge center users get useful information and develop skills and confidence in the use of computers and the internet", said Tigist. She also made contacts with development projects in the region to mobilize training and other relevant materials for the knowledge center.

Though the use of the knowledge center is focused much on personal use, such as computer skills development and use of the social media, Tigist, like other AKC managers, is optimistic that gradually the users will move beyond social media to gain knowledge that is relevant to their work, as they develop skills in the use of the internet.

ADOs provided spaces and assigned knowledge center managers. The project provided training and coaching support for AKC managers and ADO heads to enhance the management and utilization of the AKCs. The ADOs take responsibility for the full operationalization and management of the AKCs with limited technical and material support from the project.

Appropriate location, cleanliness and ventilation of agricultural knowledge centers are physical conditions that attract more users to frequent knowledge centers. An ideal knowledge center must be a well-lighted, ventilated and clean room with adequate space to attract users to frequent it (IPMS, 2011). As Table 1 shows, on average, 70% and 22% of the AKC managers believed that the physical condition of the knowledge centers was "good" and "somewhat good", respectively, mainly considering location accessibility. Only 8% of the AKC managers reported that the room condition of the knowledge centers (walls, ceilings, floors, doors and windows) was not good and needed some improvement.

Challenges for enhancing the use of knowledge centers

Despite the opportunities, however, there are challenges to demonstrating the benefits of the AKCs, mainly related to organizational culture and ownership. Some features of organizational culture that support promotion and utilization of knowledge centers include a general belief in the value of learning and knowledge sharing, a focus on people, willingness to increase competencies and skills, and search for new solutions and experiences (De Long, 1997; Holsapple and Joshi, 2000; Disterer, 2001). In fact, the use of knowledge centers depends on organizational leadership and user characteristics (such as personal interest, learning culture, and demand for knowledge), and availability of relevant and adequate materials. Some individuals are more open to new learning and have a high level of information seeking and utilization behavior than others (Rogers, 2003).

Organizational leadership begins with ownership, which depends on existence of compelling needs for knowledge and evidence of the relevance of AKCs to avail this

Table 2. Percentage of AKC managers who evaluated the level of ownership and leadership for AKCs (n = 36).

Criteria	Agree	Somewhat agree	Disagree
As AKC manager, I know what I am expected to do and how well I am expected to do it.	28%	64%	8%
The agricultural development office (ADO) has developed mechanisms to promote and regulate the use of the AKC.	8%	35%	57%
I feel that my work as AKC manager is valued by my colleagues and the ADO management.	36%	56%	8%
The AKC is mainstreamed in the planning and budgeting process of the ADO.	6%	41%	53%
My role as AKC manager counts in job performance evaluations and promotions.	28%	35%	37%
I work full-time as AKC manager.	19%	0%	81%

knowledge. As the need for new technology and information increases, extension services will be increasingly demanded by the end-users. This can again create an incentive for extension staff to use the knowledge centers to access new information and knowledge.

As Table 2 shows, on average, 21%, 39% and 40% of the AKC managers believed that the ownership and leadership of ADOs in enhancing the utilization of the knowledge centers was “high”, “moderate” and “low”, respectively. Only 8% and 35% of the AKC managers agreed and somewhat agreed that the ADOs had mechanisms to promote and regulate the use of the knowledge centers, respectively. In 57% of the cases, AKC managers indicated that ADOs did not have mechanisms for proper management and utilization of the knowledge centers. The results show that appropriate incentive and accountability system (Disterer, 2001) is required to encourage users to make use of the knowledge centers. Such a mechanism can include incorporating key performance indicators for the use of the AKCs in performance evaluations, promotions and transfers of extension staff.

Ownership and leadership for AKCs is demonstrated in the planning, budgeting and reporting practices of ADOs. As Table 2 shows, 6% and 41% of the AKC managers agreed and somewhat agreed that the AKCs were mainstreamed in the planning and budgeting processes of the ADOs and that the necessary tools and supplies were available when and where they were needed, whereas 53% of the AKC managers indicated that this was not the case.

Group discussions with AKC users show that motivation and dedication of AKC managers is key to promote and properly manage knowledge centers. It can reflect organizational value given to knowledge centers and the commitment of the ADOs management, who need to ensure that AKC managers are provided with assistance in order to perform their jobs effectively.

However, as Table 2 shows, only 28% and 35% of the AKC managers agreed and somewhat agreed that their role as AKC manager is considered in job performance

evaluations, respectively. In addition, only 36% of the AKC managers felt that their work as AKC manager was valued by their colleagues and the ADOs management, receiving feedback on what they did well and what needed to change (mostly from colleagues).

During focus group discussions in West Shoa zone, AKC users indicated that the AKCs were not always open, since most AKC managers work on part-time basis. As Table 2 shows, only 19% of the AKC managers reported that they work full-time, whereas 81% of them indicated that they work part-time as AKC managers. This often conflicts with their other tasks and limits accessibility of the knowledge centers at all times.

The full-time AKC managers are ICT experts, whereas the part-time AKC managers are office managers, store keepers, information and documentation workers, and agricultural experts, who are present in offices to open the knowledge centers (Figure 1). In some cases, they sit in the knowledge centers to do their other tasks, allowing access to users. However, they do not fully dedicate their time to promoting the knowledge centers and providing assistance to the users all the time.

Analysis of the current status of the AKCs showed that efforts to develop the knowledge culture of extension services requires a high level of demand and commitment at the broader institutional level. AKCs can become effective and sustainable when ADOs have a clearly articulated vision and realize the opportunities the AKCs would bring and the requirements to sustain the benefits of the AKCs. Like any innovations, AKCs would take time to demonstrate relevance and to be accepted in the social system of the ADOs. It would take a series of actions overtime in order for the ADOs to evaluate and recognize the relevance and benefits of the knowledge centers and incorporate them into existing organizational processes.

CONCLUSIONS AND RECOMMENDATIONS

With the rapid expansion of ICT infrastructure, extension services require functional knowledge management

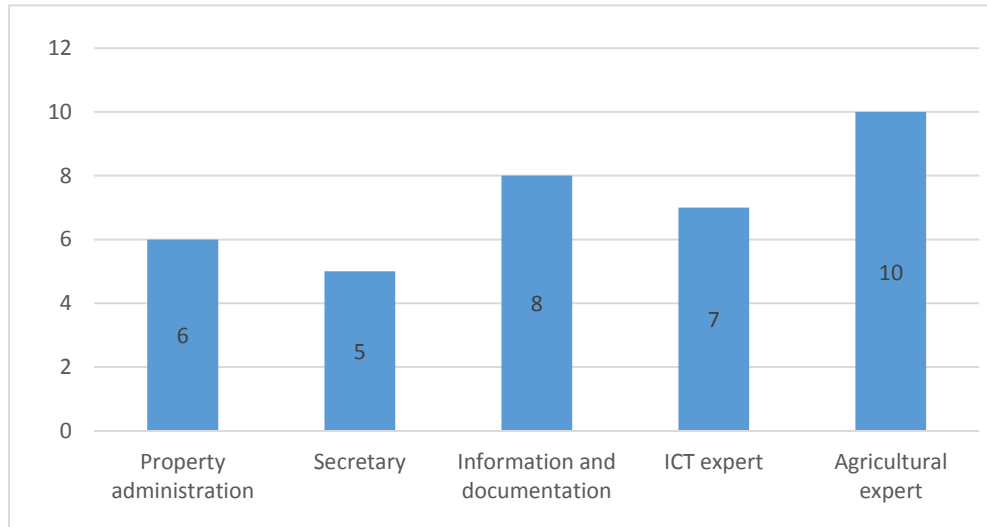


Figure 1. Main job responsibilities of AKC managers (n = 36).

infrastructure to identify, capture, synthesize and share knowledge to effectively serve farmers and other users. AKCs enable ADOs to access, store, transform, share and use knowledge from different sources, including own organizational processes. Knowledge management is largely an organizational activity that requires ADO managers to create enabling conditions and motivate extension staff to acquire, store, share and use knowledge in order to positively influence organizational performance.

The performance management requirements of the civil service office offered opportunity to enhance the use of knowledge centers. Knowledge centers can be used to conduct weekly performance review meetings, thus developing learning and sharing culture of experts. The civil service office also organizes training programs on basic computer skills, which again increases capacity and demand to use the knowledge centers. Experts and administrative staff are encouraged to practice computer use and social media tools.

However, knowledge management is rather constrained by social and organizational barriers. While there is a high demand from extension staff to use the AKCs to develop their computer skills, access social media and stay up-to-date with their disciplines, ADOs management awareness is limited to create space for the staff to use the knowledge centers. It is important that zonal and district administrations and line offices properly understand the role of the knowledge centers and have a clear vision and strategy to institutionalize the knowledge centers in the planning, budgeting and reporting functions.

Enhancing the use of the knowledge centers requires ownership and leadership of zonal and district administrators and heads of line offices. It is important

that ADOs develop strategic plans to institutionalize and sustain the benefits of the knowledge centers. This can include establishment of a high-level management committee drawn from relevant line offices tasked with resource mobilization to enhance the use of the knowledge centers.

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