

Research Article

Factors Affecting the Competence Level of Agricultural Extension Agents: A Comprehensive Analysis of Core Competencies in Northwestern Ethiopia

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The participatory method is supported by the recent expansion of the Ethiopian agricultural extension system through technological scaling-up or the implementation of best practices for technology transfer at larger stages. Agricultural extension workers are active in a number of agricultural and rural development initiatives. This study was a thorough effort that intended to examine the competence level and determinant aspects of the competence development agent's (DA) level. The investigation was done in the East Gojjam Zone, Northwest Ethiopia. The research included both qualitative and quantitative research designs. Six main skill areas were determined using information from the literature research and the regional state council's job description for DAs. In this study, 149 DAs from four districts participated as respondents. Ordinal logistic regression analysis was utilized to assess the important parameters influencing DA competency and motivation. According to the mean score findings, DAs performed above average in the communication and program implementation competence categories, with total mean scores of 3.51 and 3.24, respectively. Furthermore, they scored below average in the remaining four competency categories, with information communication technology (ICT) scoring the lowest with a mean score of 1.94. According to the regression model, independent variables such as education level, relationship with coworkers and farmers, supervisor's visit, and appraisal have a substantial influence on extension agent competency. As a result, competence-specific on-the-job training should be structured to meet the short-term demands of DAs. As the finding suggests, building social capital and investing in education through curriculum development seem more important than interventions to sustain the agricultural extension competencies of DAs. Moreover, digitalizing the extension system could have promising outcomes as most of the DAs are young and their ICT competence has been recorded as higher compared to the older DAs.

1. Introduction

Food demand is increasing globally due to rapid global population growth. Based on the prediction made by Da Silva [1], the world population will exceed 9.7 billion people by 2050, and food production should be increased by 60% to meet future food demand. New agricultural technologies must be adopted in order to meet the world's growing demand for food [2]. As a result of similar worries in the past, the green revolution was a program that promoted the increased use of high-yielding cultivars, mineral fertilizers, and tractors among

smallholder farmers in developing countries [3]. Unleashing the creativity of millions of front-line extension workers to distribute new technology and practices in ways that benefit smallholder farmers and agribusiness operators worldwide is a challenge for agricultural extension [4].

With a population of ~94 million people, Ethiopia is the second most populous African country after Nigeria [5]. The country's economy is mainly based on subsistence agriculture, which accounts for 46% of GDP and almost 80% of employment [5]. According to many researches, among the primary issues that the industry has faced for decades include

low productivity, food insecurity, lack of access to improved seeds, and ineffective agricultural information distribution channels [6, 7]. The recent El Niño-related drought put more than 10 million people in need of urgent food relief assistance [8]. Thus, developing a strong and resilient agricultural system as well as well-equipped agricultural practitioners is a key to improving agricultural practice. In doing so, the Ethiopian government adopted agricultural extension as a national intervention strategy, which is a major component of the country's development policy called Agricultural Development Led Industrialization [9, 10].

Ethiopian agricultural extension work began in 1931 with the construction of the Ambo Agricultural School, one of the country's oldest institutions and the country's first agricultural high school, which provided broad education with a major emphasis on agriculture. Agricultural extension is crucial for agricultural development and rural change in Ethiopia [11]. "Extension is conceived of as a policy instrument and a legitimate tool for a government to effect desired changes in political, socioeconomic, cultural, and environmental aspects." Because of dynamic agricultural systems, evolving science and technology, altering sociodemographic, intensifying globalization, and increased competition for resources, there is today a greater need and demand for extension professionals to demonstrate a higher degree of skill. Because of all of these challenges, agricultural extension professionals should be informed about the technical aspects of their fields of specialization, as well as the protocols and methods for providing services [12].

Several authors claim that the responsibility of putting agricultural policies and strategies on the ground as well as the responsibility of transferring technology to farmers rests on the shoulders of development agents (DAs) who are assigned in rural areas [13, 14]. DAs are focal persons at the local level who are responsible for improving the living standards of rural households through the transfer of agricultural technologies and facilitating farmers' access to inputs and credit. According to Anaeto et al. [15], DAs have various roles such as advisors, technician, middleman, consultant, advocate, planner, and manager. As a result, knowledgeable extension specialists are valuable assets to agricultural extension services in particular and agricultural growth in general. If extension personnel failed to obtain and provide reliable information from farmers and research institutes, agricultural research objectives would remain mostly intellectual (without solving field concerns). The technical components of developing useful technologies are the emphasis of research, while the acceptance and adoption of those technologies by consumers are the subject of extension [15].

According to the Agricultural Transformation Agency [9], the government of Ethiopia is making a significant effort to increase the number of DAs and farmer training centers. The aim is to deploy three DAs and establish one farmer training center in each kebele. In order to support this strategy, the government established 25 agricultural, technical, and vocational training colleges that train DAs. Currently, Ethiopia has 14,065 farmer and pastoral training centers (F/PTC) and 90,138 (16,169 female) DAs, where one DA could serve 476 farmers, which is the highest DA-to-farmer

ratio in Africa [16]. However, there is no significant improvement in the lives and livelihoods of agrarian communities.

Therefore, it is important to assess the competency gaps of DAs, who are vital to adopting new changes. Researchers have so far concentrated on the nonacademic components of the agricultural extension system, including poor linkages among actors, a lack of infrastructure, a lack of improved technology, and the top-down nature of the agricultural extension system. Nonetheless, extension agents must be taught, motivated, and competent in order to anticipate and deliver quality services [9, 15, 17, 18]. As a result, it is critical to define extension professionals' abilities, knowledge, motivation, and attitudes, as well as to periodically analyze extension education programs and build a job analysis system, all of which are absent in most developing nations [19–22]. Moreover, the core competencies of DAs are poorly defined and assessed by Suvedi and Ghimire [12] and Sarkar [23].

Despite the large amount of resources invested into the system by the government, Ethiopia's agricultural extension system confronts a number of major issues. Various forms of studies were undertaken on DAs' performance, work motivation, and job satisfaction. Asayehegn et al. [14] investigated the job motivation and performance of DAs in 15 different regions, two of which were in the Amhara region. Lower income, limited access to internal promotion, the challenging nature of the profession itself, a very high workload, duties and obligations irrelevant to the profession, and complex lines of command were recognized as factors of lower motivation levels in the study. Regarding job performance, the research tried to measure the self-reported and observed performance of DAs by using their job description activities, which were rated in 5-point scales ranging from "very well done" to "unable to do."

The rating was again analyzed as low, medium, and high performance. According to the study, most of the DAs classified themselves as medium or low performers. Those previous studies were focused on the general job performance of DAs, whose performance can be influenced by environmental, psychological, institutional, and demographic factors. This research focused on the competence of DAs, which relates to the basic skills, knowledge, and attitude of DAs. Furthermore, this research also analyzed the competence of DAs in responding to current global changes in the extension system in general and the changing roles of DAs in particular. Moreover, the research will try to link academic institutions, including the curriculum and their roles, with the competence of DAs, which was missed in most of the previous studies. Thus, this study is focused on assessing the competence level of agricultural DAs in the study area and identifying the determinant factors that affect agricultural DAs' competence and motivation.

2. Literature Review

2.1. Concepts and Definition

2.1.1. Extension. The definition of an extension system has changed over time. Traditional definitions include Gaaya's [24]

definition, which states that extension is a service that provides educational assistance to rural people and is important in improving farming methods, increasing productivity, improving their standard of living, and raising the social and educational standards of rural life. Extension, according to Umeh et al. [25], is a system of education that extends beyond the classroom to persons on the farm and is available to every member of the family. Similarly, Moris [26] defined extension as a means for delivering information and technology to farmers.

Agricultural extension systems, on the other hand, have typically been top-down, supply driven, and extension agent led, with little beneficiary participation in the extension process. On the other hand, the fast-changing agricultural backdrop because of globalization, population increase, and climate change has revolutionized how knowledge is generated and used [27, 28]. Traditional extension systems, however, do not ensure demand-driven agricultural development and farmer engagement. Several scholars, however, have underlined the need of farmers actively participating in the extension process, including decision making and good communication and collaboration among farmers, researchers, and extension professionals, rather than one-way top-down information flow [29, 30].

For this research, a definition given by Christoplos [31] was used, who defined the extension to include: "systems that should facilitate the access of farmers, their organizations, and other market actors to knowledge, information, and technology; facilitate their interaction with partners in research, education, agribusiness, and other relevant institutions; and assist them in developing their own technical, organizational, and management skills and practices."

This definition was adopted for this thesis because it counters the limitations of the traditional definitions explained above. It emphasizes the active participation of farmers and a bottom-up approach to extension. The researcher also claims that the extension must encompass competency areas, such as technical knowledge, facilitation, brokering, coaching of multiple actors to promote market access, coping with changing risk patterns, and environmental protection. Furthermore, extension occurs inside complex systems that include both old and new service providers as well as information and communication technologies such as mobile phones, Internet, radio, and television.

2.1.2. Development Agents (DAs). DAs are workers of an extension organization (Agriculture and Rural Development office) who work at the community (Kebele) level under the supervision of the Kebele agriculture office head. DAs are front-line employees who work with farmers. According to the ANRSC [32] guideline, DAs are expected to carry out extension programs such as conducting socioeconomic assessments, motivating farmers for development, community mobilization, conducting participatory annual plans, sharing best practices, holding weekly community meetings, strengthening farmer training centers, organizing demonstrations, providing technical assistance to farmers, promoting new technologies and inputs to create demand, and preparing for market.

2.1.3. Competence. Historically, competency growth has been evaluated based on work responsibilities. Yet, according to Lawler [33], it is more important to develop abilities on the job based on the desired objectives, including human interaction. Al-Athari and Zairi [34] defined competencies as the application of knowledge, technical skills, and personal qualities that are constructed around the abilities individuals and groups require to operate effectively on the job and to make human resource decisions. The definition emphasizes that competency is a comprehensive set of knowledge and skills that are vital to performing responsibilities on the one hand and personal characteristics such as behavior, communication, and a positive attitude that smooth human relations on the other.

According to Shavelson [35], another dimension of competence is its measurability. Competence is demonstrated under standardized conditions and can be judged as "adequate," "proper," or "qualified" by some level or standards of performance. Furthermore, it is something that can be improved with appropriate training, experience, and supervision. Issahaku [18] provided a similar explanation. Defining competency as the quality of being adequately or well qualified and capable of performing a job. In the context of agricultural DAs, competence refers to the behavioral characteristics of knowledge, skills, attitudes, and judgment that are generally required of an extension agent in order to perform an assigned job and/or task effectively and successfully [17]. Although all the above definitions are relevant to conceptualize competence in general and DAs' competence in particular, the concept of "core competency" is more relevant in this study because it gives more tuned explanations on the basic knowledge, skills, and attitudes that extension professionals need. They refer to those skills and knowledge areas which are most relevant for the job.

2.1.4. Core Competencies. Different scholars have tried to identify the basic competencies that DAs should possess to ensure significant contributions in the extension system and sustainable agriculture development regardless of the type of extension approach. Although each scholar defines competencies differently, the majority of them focus on the major functions of DAs, which are planning, program implementation, evaluation, and information and communication technologies. Seevers et al. [36] coined the term "core competency" to describe the fundamental knowledge, skills, attitudes, and behaviors that contribute to workers' professional excellence (e.g., extension education and extension services). Cooper and Graham [37] and Scheer et al. [38], on the other hand, identified nine professional core competencies that adequately address the needs of demand-driven, decentralized, pluralistic, and participatory extension systems. These are planning, coordinating, and collaborating to implement communication, good public relations, valuing diversity, using information communication technology (ICT), and evaluating to show results and update knowledge. Suvedi and Kaplowitz [39] recently expanded the concept by categorizing core competencies into two major groups: process skills and technical skills. Process skills are related to the

competencies needed to function and establish positive relationships with clients, including facilitating group formation, resolving conflicts, and engaging stakeholders in program planning. On the other hand, technical skills refer to competency areas directly related to the knowledge and practice of science.

Some of the major activities are conducting needs and potential assessments, preparing annual plans, providing technical support to farmers, preparing work schedules, introducing new technology packages, providing training to farmers, labeling farmers based on their performance, monitoring progress, facilitating demonstrations in farmer training centers, organizing experience sharing, preparing progress reports, and documenting best practices. Six main skill categories were established for this study using information from recent literature, notably Suvedi and Kaplowitz [39]. The six key skills are extension program planning, extension program implementation, monitoring and evaluation, communication, subject matter, and information and communication technology. Additionally, among the 38 specific abilities mentioned by Suvedi and Kaplowitz [39] under each core competency area, 28 were chosen for this study based on their relevance to carrying out the Ethiopian government's 21 agricultural extension obligations or activities. The table below describes the six core competence areas and 28 specific competencies defined for this study to assess the level of competence of agriculture extension and DAs in the East Gojjam Zone.

2.2. Theoretical Perspectives

2.2.1. Competence Theory. According to this theory, job scarcity is a driving force that pushes people to aspire to be professionals by getting appropriate educational qualifications and getting employed. However, getting a diploma by itself should not be the final goal but rather a means to grasp the necessary competence required to perform tasks. Educational institutions should equip students with standards in working situations [21]. According to Grant et al. [40], the fundamental cause of the competence movement was the divergence between education and the job market, which aided educational institutions in reworking their curricula to adapt to hiring companies and societal demands. The notion inspired higher education institutions that began to establish competence-based education programs in the late 1970s, primarily in the United States. They restructure their curriculum to emphasize competence-based education. It was spreading at the time in the health teaching, administration, and welfare professions.

"Competence-based education tends to be a form of education that derives a curriculum from an analysis of a prospective or actual role in modern society and that attempts to certify student progress on the basis of demonstrated performance in some or all aspects of that role," Grant et al. [40] defined. In theory, such demonstrations of competency are unrelated to time spent in formal educational environments.

It highlights the relevance of competence in relation to performance, motivation assessment, and performance development, as well as education and innovation, which are all vital in building professional and practice-based learning of

good quality. Other researchers, such as Boyatzis [41], Rosier [42], and Hampden-Turner and Tropenaars [43], established core competency models for various occupations that provided a more comprehensive picture of the basic competencies required in each profession. They underlined that without competence, professionals would be unable to act effectively in their professional contexts. However, this does not imply that the emphasis is on the job but rather on the person who uses competence for both effective performance and an effective relationship with the environment, as specific actions and behaviors are intersections of the individual's competencies, job demands, and the organizational environment. According to proponents of the theory, competence is not limited to the knowledge and skill required to perform a certain job; rather, it relates to the overall characteristics of an individual who is expected to have an effective interaction with the environment.

2.3. Competence Theory's Point of View on the Curriculum of Higher Educations. Proponents of the theory argue that competence should be defined as the ability to effectively interact with one's social and intellectual surroundings and that educational institutions should prepare students for this. They contended that curricula must be modified to meet essential competence domains, that teaching and learning materials must be available, that teaching personnel must be prepared to apply these curricula, and those educational examinations must be matched with the curriculum and competence [40, 44, 45]. McClelland [44] attacked educational institutions for testing students for IQ rather than ability. They contended that intelligence testings do not accurately predict occupational performance. Furthermore, Rosier [42] underlined the importance of competence-based curriculum creation in undergraduate colleges of diverse professions. They argued for competency-based education, which requires a curriculum based on a study of potential or present roles in modern society.

2.4. Competence Theory in Agriculture Extension Profession. As previously stated, the concept of competency affected the evolution of competence-based education in higher education and professional learning. Since the 1970s, it has been used in a variety of professions such as health management, welfare, finance, information systems, sales, and marketing in the United States and Europe [21]. In addition to the above-listed professions, Karbasioun et al. [45] applied a competency-based approach to generate a competence profile for agricultural extension professionals in Iran. Several studies on competence-based training in other professions, he claimed, generated interest in the competence-based approach in vocational education and training (VET), including agricultural extension.

This concept stems from the notion that VETS should help learners to gain the skills required for their actual careers. A competency job profile, according to Karbasioun et al. [45], is a set of competencies specific to extension professionals that include underlying employee characteristics (e.g., motives, traits, skills, aspects of one's self-image, social role, or body of knowledge) that result in effective and superior job

performance. According to the researcher, competency modeling research helped to discover the intrinsic and extrinsic obstacles that farm professionals experience during their professions. He also provided facts that demonstrated the necessity for them to strengthen their abilities in order to achieve effective output delivery.

2.4.1. Job Characteristics Theory. Job characteristics theory emerged in the 1960s and 1970s as a response to the then prevailing attitude toward work, which held that jobs should be simplified in order to optimize output [46]. Work unhappiness resulted from the mindset being subjected to very routine and repetitive chores. As a result, it was advocated that jobs be enhanced in ways that increase motivation. The work quality hypothesis arose as a result of this point of view. The theory's proponents, Hackman and Oldham [47], identified five key job qualities. These are skill variety, task identity, task significance, autonomy, and feedback, which are thought to influence work-related outcomes such as internal motivation, job satisfaction, performance quality, absenteeism, and turnover.

According to theorists, employees achieve personal- and job-related outcomes through three psychological states: experienced meaningfulness of the work, experienced responsibility for the outcome of the work, and knowledge of the results of work activities. Eventually, they added three moderators: growth need, strength, knowledge and skills, and context satisfaction, which influence the relationships between job quality and psychological states, as well as psychological states and outcomes. Furthermore, the idea showed that job features have a direct effect on an employee's work-related attitudes and behaviors, as well as individual variances in development needs.

Most crucially, in addition to the theory, Hackman and Oldham [47] developed two assessment tools (the job diagnostic survey and the job rating form). A job diagnostic survey assesses jobholders' impressions of the five fundamental job qualities, their psychological condition, their growth needs, and their outcomes, whereas a job rating form assesses external observers' perceptions, such as supervisors. They have promoted that work design should be done based on empirical findings. That means any shift or modification in a certain job setting should be backed by scientific evidence rather than be mere decisions.

2.5. Empirical Studies. Different studies were conducted globally on agricultural colleges and DAs, including their competency, job performance, motivation, and roles as agricultural training institutions. However, studies at the national level focused on evaluating factors affecting the adoption of new varieties or technologies and other impacts of agriculture extensions. Regarding DAs, studies focused on work motivation, job satisfaction, and performance of DAs. There was no study dedicated to the curriculum profile of training institutions or the competency of DAs. This made it difficult to present empirical evidence showing the national context of training institutions and the competency of DAs. Therefore, studies conducted on the job performance and motivation of

DAs in Ethiopia and competency and curriculum-related studies conducted in other countries are presented below.

2.5.1. Curricula of Training Institutes. Agricultural Education and Training offers a variety of educational activities with the primary goal of attaining human resource development in practically all nations' rural economies [48]. Similarly, in Ethiopia, Agricultural Technic, Vocational, and Training Colleges have comparable obligations in meeting the learning demands of agriculture extension programs. Wallace and Nilsson [48] investigated the influence of agricultural education and training in increasing the performance of support services for the renewable natural resource sector in sub-Saharan African settings. They stated that recent research in sub-Saharan Africa produced many significant inventions but was unable to achieve their objectives because agricultural education and training were unresponsive to changing their patterns. After reviewing Agricultural Education and Training (AET), institutes in Kenya, Malawi, Mozambique, Zimbabwe, and Uganda, they have indicated that the institutes are not able to catch up to the rapid changes occurring in rural economies. A lack of a solid policy framework, failure of donor and government funding, disruption of training programs, loss of experienced teaching personnel, and low recruitment of women as teachers and trainees are all factors contributing to this failure.

They proposed actions to improve the design and management of AET, as well as to reinforce the policy framework through which support and direction are directed. There is also a need to improve the relations between AET institutes and the formal education sector, as well as AET institutions' connections with local communities, NGOs, and other intermediary groups. In this case, research findings may be easily communicated, and new ideas (including new skills and knowledge required by DAs) can be easily adopted. Wallace and Nilsson [48] highlighted five common difficulties in most agricultural training schools. Several countries lack a defined policy framework for AET and inadequate methods to coordinate the various organizations involved, particularly the ministries responsible for training and education. Second, AET institutions are frequently cut off from extension and research services, as well as from rural communities themselves. Finally, identifying training needs (including rural labor market studies) is frequently lacking, or the findings are not used in curriculum design procedures. Fourth, the curriculum rarely adapts to new challenges (such as sustainability, women, farmer engagement in research and extension, and shifting employment patterns) or to local diversity. Involvement of key stakeholders (including researchers and extension workers, farmers, and agribusinesses) in curriculum review and training evaluation is still unusual. Fifth, many institutions lack the entrepreneurial leadership required for growth.

The above critical findings clearly indicate that in sub-Saharan countries, training institutions face problems such as a lack of policy framework, being isolated from research services, leadership inefficiency, and curriculum-related problems. In order to mitigate these problems and make training

institutes meet emerging requirements, Wallace and Nilsson [48, p. 3] made recommendations such as offering more transferable skills, providing part-time farming and rural enterprise niches, incorporating new perspectives, and reaching more vulnerable groups. As indicated under the “New Thoughts” section of this research, the recommendations forwarded look very critical in equipping agricultural colleges to respond to the emerging roles of DAs. In addition to training institutions, the following improvement areas were also recommended by the scholars:

- (i) Most nations require clearer policy frameworks for AET to provide coherence across government agencies (especially education ministries), donors, NGOs, training institutions, and community organizations.
- (ii) Adoption of new learning paradigms is required to allow for the incorporation of indigenous knowledge, more holistic and multidisciplinary problem-solving methodologies, and a stronger emphasis on experiential learning.
- (iii) Current or new curricula must be revised with the participation of all important stakeholders, including “client” groups, and by incorporating themes, such as gender, environment, sustainability, and participatory development.
- (iv) AET can be strengthened by the implementation of new learning modes and procedures, including various forms of distant learning, reformed library services, and use of IT. The research findings must also be more firmly pushed within AET institutions.

The paper emphasized that curricula should be responsive to changing demands through active participation of stakeholders during curriculum development, including local farming communities. Curriculum development should be considered as an ongoing process that includes regular evaluation and feedback from previous trainees as well as periodic evaluations in order to provide relevant up-to-date information and skills.

In today’s world, skills such as entrepreneurial ability, linguistic competencies, computer and technology use, communication, and management should be included in agricultural training college curricula. Because women are underrepresented in AET and extension, gender is another priority that should be considered in curriculum revision. Garton et al. [49] investigated the entrance criteria used by agricultural institutions as predictors of students’ academic achievement. They examined admission factors as potential predictors of academic performance and retention. Examinations, high school core grade point average (GPA), and high school class rank are among the criteria. Furthermore, the preferred learning styles of students were explored as a prospective predictor of academic achievement and retention. The study found a substantial positive correlation between high school GPA and academic success at agricultural colleges measured by freshman cumulative GPA ($r=.61$), high school class rank ($r=.52$), and a moderate correlation with entrance exams ($r=.47$).

2.5.2. Competence Level of DAs. Suvedi and Kaplowitz [39] attempted to uncover the necessary competences that effective front-line extension workers should possess after completing research in Cambodia, Nepal, Malawi, and India. They divide agricultural extension workers’ responsibilities into two categories: process skills (also known as functional competencies) and technical abilities. Process skills are associated with the competencies required to operate and build meaningful relationships with clients, such as networking with local groups, promoting group formation, dispute resolution, and including stakeholders in program planning. On the other hand, technical skills refer to competency areas directly related to the knowledge and practice of science. Technical competencies include identifying the cause organism of maize disease, assessing soil acidity and interpreting the results, and presenting a practical demonstration on how to execute artificial insemination on dairy calves. A good DA must be proficient in both process and technology. That is, simply being knowledgeable and/or intelligent does not imply that a person is a successful and efficient worker because a worker’s performance is determined by his or her knowledge as well as abilities and attitudes. As a result, extension experts should be rated not just on their technical subject matter expertise, but also on how skilled and capable they are in providing services to their clients. The scholars identified four competencies that DAs should acquire: observation, communication, conflict resolution, and human interaction skills. Suvedi and Kaplowitz [39] identified 38 competencies under the core competence areas, which are program planning, program implementation, program evaluation, and communication and information technology.

Similarly, Seevers et al. [36] coined the phrase “core competency” to characterize the fundamental knowledge, abilities, attitudes, and behaviors that contribute to workers’ professional excellence (e.g., extension education and extension services). Cooper and Graham [37] and Scheer et al. [38], on the other hand, identified nine areas of core competency that can sufficiently satisfy the needs of demand-driven, decentralized, pluralistic, and participatory extension systems. They are planning, coordinating, and collaborating to put communication, effective public relations, diversity, ICT, and assessing to exhibit results and update knowledge into action.

Ghimire [27] conducted a study to evaluate the fundamental skillsets of Nepali agricultural extension specialists. Eight fundamental abilities were defined by him, including; program planning, implementation, communication skills, educational and information technology, program evaluation, diversity, personal and professional growth, and technical subject matter competence. They gathered information from 344 extension workers, and by utilizing the coefficient of variation method, he was able to assess the level of their ability. In order to determine the areas with the best and lowest scores, he was also able to compare the findings of each competency area. The study also demonstrated variations in populations’ levels of competency. For instance, Nepal’s extension organizations are divided into three categories (the Department of Agriculture, Department of

Livestock, and NGOs). A one-way analysis of variance (ANOVA) was calculated to examine the differences in the level of competency among respondents from these three organizations. Similar comparisons were made among people with different education levels [50].

2.5.3. Motivation of DAs. When we see the Ethiopian context, there was no research conducted on the competence level of DAs as previous studies focused on their performance and motivation. As the studies themselves indicated, performance is an output or result that is affected by both internal and external factors. The performance of DAs may be affected by factors outside of their control, such as being overburdened with nonprofessional assignments and a lack of basic materials to perform their job [13, 51, 52]. In other words, competent DAs are also subjected to these factors. So, it is difficult to review empirical studies that are focused on the competency of DAs due to this; those studies on performance are discussed below to get an overview of the study topic. Yohannes [13] studied the work motivation levels of DAs in the southern region of Ethiopia by using 5-point Likert-type scales. They found out that most (57.1%) of the DAs have a medium level of motivation, followed by 22.7% with low motivation, while the remaining 20.7% are highly motivated. Belay et al. [52] also conducted similar research by taking respondents from all regions, which helped to paint a national-level picture of DAs' motivation. The research indicated that 29.3% of DAs had low motivation, while 67% fell into the medium category, and only 4% were highly motivated.

In determining the performance level of DAs, the works of Lakew [51] and Belay et al. [52] showed that the majority of DAs had a medium performance level. Lakew [51] studied the performance of DAs in the Eastern Harerege of the Oromia region, finding that 23.5% had low performance, 51.5% had medium performance, and the remaining 25.5% were highly performing. Although in Belay et al.'s [52] study, 9% were low in their performance while 58% were medium and the remaining 33% had high-performance level.

2.6. Factors Affecting the Competence and Motivation of DAs. Khalil [53] conducted a study to ascertain the connections between extension workers' job performance in Yemen and their competences, organizational commitment, and job satisfaction. Their study's findings demonstrated a link between effective leadership and extension employees' job performance. They also said that extension employees' job effectiveness is predicted by their expertise in program evaluation. According to some studies, the best single predictor of work performance ratings is interpersonal skills [54]. Similar findings were made by Koopmans et al. [55], who found that social skills were the single most effective predictor of performance ratings for task performance, job devotion, interpersonal facilitation, and overall performance rating.

According to Lakew's [51] study, factors influencing DAs' job performance include their background in agriculture, their marital status, their commute time to work, the nature of their supervision, their relationships with coworkers, their working environment, their recognition, and the

nature of the work itself. In accordance with his research, the working environment and amenities nearby had a favorable and significant impact on DAs' performance at a level of significance $<1\%$. Regarding the determinants of motivation, Yohannes [13] found variables such as advancement, recognition, attractive salary, the work itself, fair organizational administration, achievement, and perception of distance from home as independent variables that affect the motivation of DAs. According to the study, the three most significant independent variables found to exert relatively high influence or significantly influence the work motivation of DAs were recognition, the work itself, and organizational administration.

2.7. Conceptual Framework. This research examines the level of core competencies and determinant factors among agricultural DAs in Ethiopia. Similar previous studies tried to assess the performance level of extension agents determined by other factors such as additional nonprofessional assignments given to DAs, absence of transportation, and lack of resources. But this research is completely grounded in the competency-based approach to human resource management, which indicates gaps in core competencies so that they can be improved to enhance organizational output.

This study also relates the competency of DAs with the curricula of training institutions, arguing that education programs in training institutions should be designed to equip DAs with integrated sets of knowledge, skills, and attitudes that are necessary to effectively deliver the expected job results. They should have both process skills and technical competencies. In addition, training institutions should adapt their education programs to the changing roles of DAs due to changes in the agricultural system by incorporating new knowledge and skills. This requires assessing the competency of DAs and conducting curriculum revision periodically. Such a trend is important to identify gaps in competency and help design training and education to address the identified gaps.

Therefore, this research was designed to assess the profile of agricultural training colleges (including the selection process of DAs) as well as DAs' perceived responses to their competency level by assuming that they are able to articulate their level against the presented competence areas. Based on this, as shown in Figure 1, the admission process of agricultural colleges, what DAs learn in agricultural colleges, how they get hired, and the demands of the agricultural system (and farmers) should align with each other. Education and training are two ways to develop competencies. Training and education, when done well, can increase a person's competitiveness and the efficiency of their services. Evaluation of educational programs' efficacy is crucial, for this reason. Agriculture extension experts that are skilled and capable of addressing extension issues are created through in-service and preservice training. This can only occur if education and training are adapted to the specific requirements of each field.

The figure illustrates how the admission process, educational programs, and work environment are related to preparing DAs with core competencies. It enables us to see the

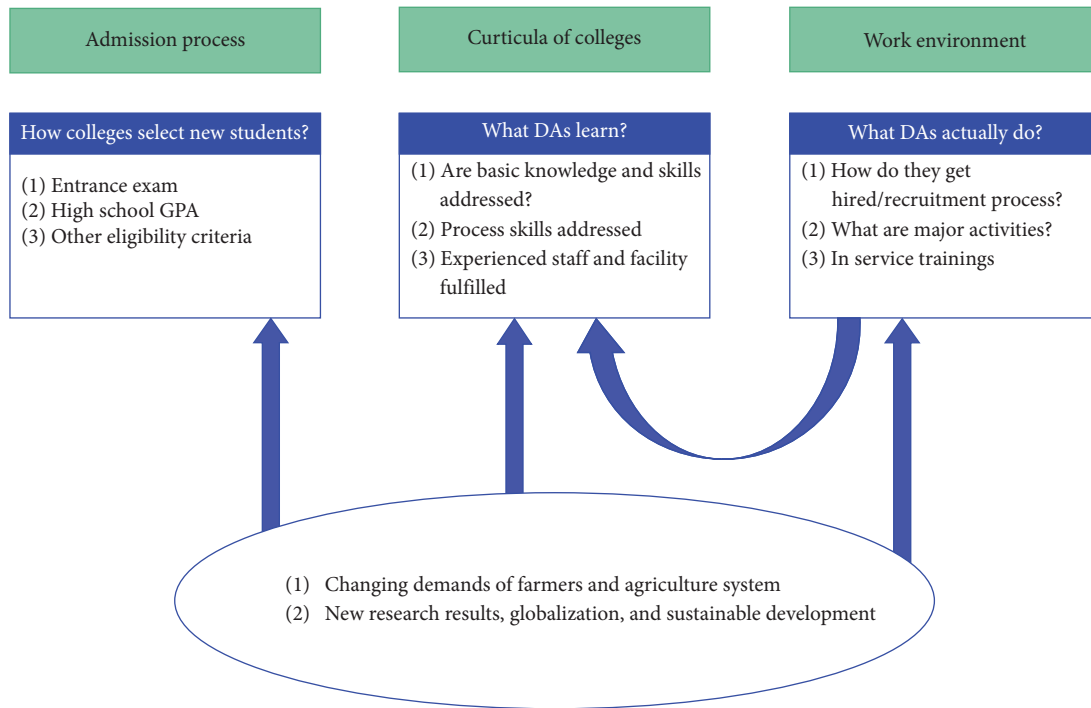


FIGURE 1: Framework of relationship among colleges, work, and changing environment.

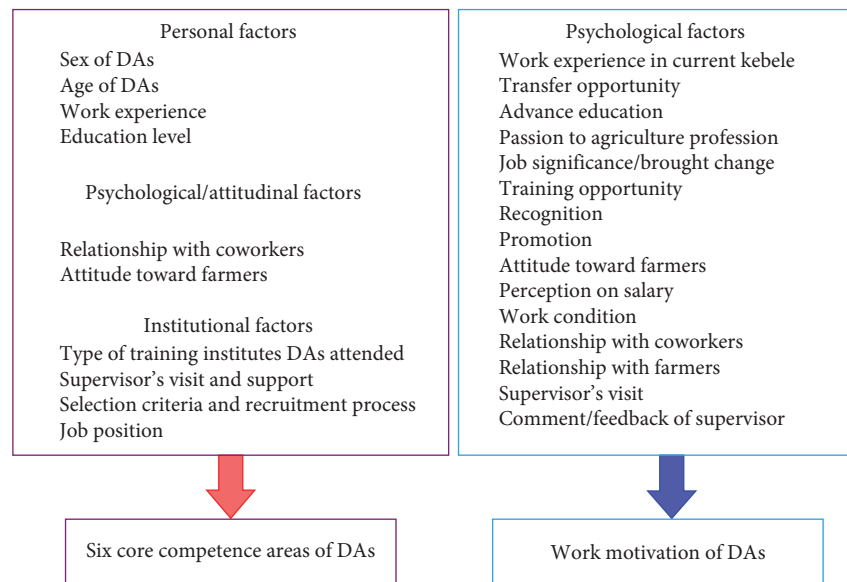


FIGURE 2: Conceptual framework. Six-core competence areas are agriculture extension program planning competence, extension implementation competence, extension monitoring and evaluation competence, extension communication competence, subject matter expertise competence, and education and information communication technology competence.

whole picture of issues interrelated with the competency of DAs. The admissions process refers to selecting the best-qualified people who are ready to acquire the basic knowledge, skills, and attitudes required by the job. Moreover, the education programs of agricultural colleges and what DAs are actually expected to do after graduation should align with each other. Both colleges and the work environment should

adapt to the changes happening globally and in local contexts that affect agriculture systems.

The relationship between independent variables and dependent variables can finally be understood using a new framework that was developed. It was created based on own experience as well as an earlier empirical investigation by Belay et al. [52]. As indicated in Figure 2, institutional,

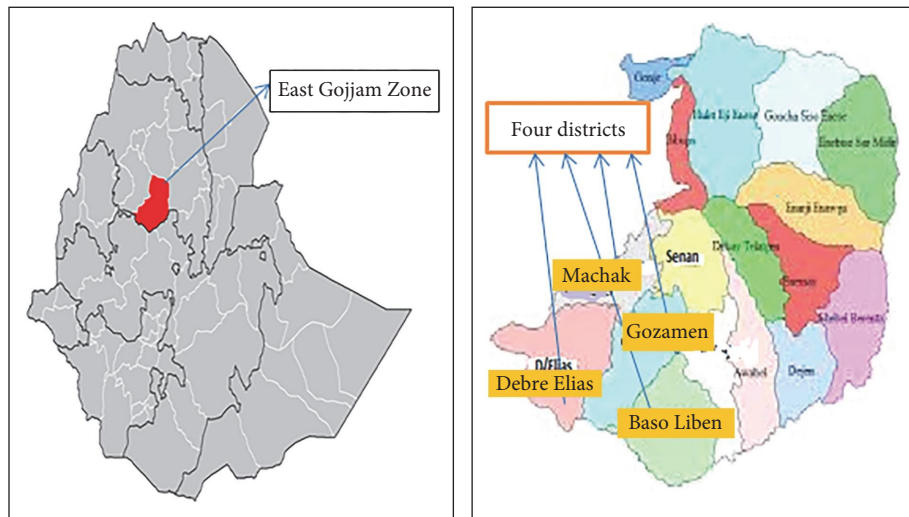


FIGURE 3: Map of Ethiopia showing the relative location of East Gojjam Zone and the selected districts of East Gojjam Zone.

personal, and psychological factors are assumed to have an impact on the work competency and motivation of DAs.

3. Methods

3.1. Study Area. East Gojjam is located in the northwestern part of Ethiopia. It covers an area of 14,004 km² and is divided into 16 district (locally called woreda) administrations. The zone's total population is estimated to be 2.4 million people [5]. Debre Markos is a zonal capital town located 300 km from Addis Ababa. This research was conducted in four districts (woredas) of the East Gojjam Zone, namely, Gozamen, Debre Elias, Machakel, and Basoliben.

3.2. Study Design and Period. This study included both qualitative and quantitative research methods. Throughout March and April 2019, a community-based cross-sectional study methodology was used to obtain quantitative data. The primary data were used to gauge the perceived level of DAs' ability in relation to their primary competency categories. Similarly, explorative key informant interviews and focus group discussions (FGDs) were undertaken among DAs, district-level agricultural experts, and agricultural educators in the agricultural colleges.

3.3. Sample Size and Method of Sampling. The two-stage sampling procedure was used to identify study areas and target respondents. First, East Gojjam Zone and four representative districts, namely, Gozamen, Michakel, Baso, Liban, and Debre Elias (Figure 3), were selected purposefully as they were pilot centers of the International Centre for Agricultural Research in the Dry Areas (ICARDA's) Improving Agricultural Extension System for Wider Adoption of Technology Project, and the three ATEVET colleges (Kombolcha, Woreta, and Mertolemarim) were also selected purposefully as most of the DAs in the Amhara region are graduates of these colleges. Then, we use the list of DAs deployed in the four districts as a sampling frame to select sample respondents for the survey by using the simplified Yamane's [56] formula

to calculate the sample size of the DAs. Based on the formula, the authors grabbed 149 sample respondents and distributed them proportionally across each district. Finally, the researchers used a systematic random sampling technique to collect survey data from sampled respondents.

The formula is given as:

$$n = \frac{N}{1 + N(e^2)}, \quad (1)$$

where n is the statistically acceptable sample size, N is the population size, and e is the level of precision [57] and at 95% confidence level, and $e = .05$.

3.4. Methods of Data Collection. The survey data were collected from 149 randomly selected DAs among four districts. The survey was mainly focused on factors that have a direct influence on the competence of DAs, including education background, work experience, transfer, and education-work relatedness. The questionnaire includes self-rating questions where DAs rate their competency and motivation levels using scales. After the questionnaire was developed in English, it was retranslated into Amharic to make it easier for a self-administrative survey. Pretesting was also undertaken on 19 randomly selected DAs in the Gozamen district, and validation of the questionnaire has been undertaken to check for opacity, redundancy, and other technical and editorial issues.

Qualitative data were collected from 39 KIIS, who were selected with specified and inclusive criteria aimed at grasping the perspectives of respondents from different social groups. In addition to their job positions' relatedness to the topic under study, the selection criteria also included years of work experience as DAs and the education level of DAs. Both junior- and senior-level DAs were selected mainly based on gender, age, and remoteness of their workplace. Three FGDs were conducted with DAs who were selected using purposive sampling. FGDs were needed to understand groups'

perspectives on what makes a good DA and how their knowledge and skills contribute to performing their jobs.

A FGD checklist was developed in advance, which consisted of questions and discussion topics. Female and male group discussions were held separately to avoid male dominance. More flexible approaches were used, and each participant got their own flip chart and stick notes to write her/his ideas and share their views with the rest of the participants by posting them on the wall. The process helped the researcher ensure the active participation of all participants and to triangulate the data recorded from KIIs. Moreover, desk review and document analysis were also used to strengthen the qualitative data collected from primary sources. First, numbers of related research articles were collected from websites, and the most relevant and appropriate references that were appropriate for the study were selected for further discussion in the research. For secondary data, agricultural-extension-related reports at district and kebele levels, hiring and benefit guidelines, efficiency evaluation reports, and curricula of training institutions were reviewed.

3.5. Methods of Data Analysis

3.5.1. Quantitative Data Analysis. Regarding quantitative data, SPSS version 21 was used for encoding, processing, and analysis. The data concerning the demographic traits of the respondents, such as sex, education, and job experience, were summarized using descriptive statistics, such as frequency, percentages, means, and standard deviations. The χ^2 test was also employed to look for differences in the competency level of DAs between the four districts.

In addition, the degree of relationship between the curricula of different educational programs and core competences possessed by DAs was analyzed by using Spearman's rank correlation coefficient. The association between these two variables is expressed in a range ($-1 \leq r \leq 1$). It shows both the direction and degree of relationship between the two variables under study. The type of correlation can be either positive or negative. The positive correlation is when the values of the two variables are changing in the same direction and it will be negative if the values change in opposite directions. The value of "r" shows the strength of the relationship as -1 means there is perfect negative correlation, 1 means perfect positive correlation, and 0 means there is no correlation between the two variables.

3.6. Model Specification

3.6.1. Ordered Logit Model. The primary elements influencing DAs competency and motivation level have been assessed using ordinal logistic regression analysis due to the ordinal character of the dependent variables [58]. The ordered logit model is specified as follows:

$$y^* = \sum_{k=1}^k \beta_k \chi_k + k + \epsilon, \quad (2)$$

where y^* is undetected and might be considered the underlying tendency of an observed phenomenon because it is not seen.

ϵ is a random term that is presumptively symmetric with a mean of zero and supposed to follow a normal or logistic distribution. What we do observe is:

$$\begin{aligned} y &= 1 \text{ if } y^* \leq \mu_1 (= 0) \dots \\ y &= 2 \text{ if } \mu_1 < y^* \leq \mu_2 \\ y &= 3 \text{ if } \mu_2 < y^* \leq \mu_3 \\ y &= j \text{ if } \mu_{j-1} < y^* \end{aligned}, \quad (3)$$

where y is observed in j categories, μ_s are the unknown threshold parameters separating the neighboring categories to be approximated with β_s . The general form for the probability that the observed y falls into category j and the μ_s and β_s are to be estimated using an ordinal logit model is:

$$\text{Prob}(y = j) = 1 - L \left(\mu_{j-1} - \sum_{k=1}^k \beta_k \chi_k \right). \quad (4)$$

In addition to the ordinal regression methods, multiple linear regressions have also been conducted for the total sum score of the competence variable, which was considered the continuing variable. Then, predictor variables having a significant effect were discussed. To assure the quality of the data, multicollinearity and heteroskedasticity tests were performed to check for econometric problems. The contingency coefficient was used to perform a multicollinearity test between independent variables.

3.7. Definition of Variables. As indicated in the conceptual framework, the dependent variable is the competency of DAs in the study area. It was described based on core competency areas derived from two major sources. The first one is the responsibilities of DAs set by the regional government, and the second one is the core competencies identified by Suvedi and Kaplowitz [39]. As indicated in the theoretical framework of the study, competence comprises the vital knowledge, skills, and attitudes that DAs should possess to deliver an extension system. Six core competency areas were developed and measured by the DAs themselves as perceived competencies. Each competency area was rated on a 5-level scale (1 = very low, 2 = low, 3 = moderate, 4 = high, 5 = very high) and finally changed into low, medium, and high categories. Very low refers to the fact that the job holder is unable to do or perform a given task due to a lack of knowledge and/or skills required to perform the given task. Low means that the job holder possesses only partial knowledge and skills to perform the task. It represents a competency level that needs improvement. Medium refers to the fact that the job holder reaches a satisfactory level in most of the competence areas but sometimes may face difficulties. High means that the job holder can perform the task without any difficulty and sometimes with excellence (commendable) and very high implies the job holder is doing very well and executing the tasks beyond what is expected. General competence was also measured as a continuous variable by using the total sum score of all Likert-type scales. Based on this, the

TABLE 1: Discretion of independent variables that determine the competence level of development agents.

Variable	Description of variables	Expected effect
College or university DA graduated from	The types of previous education institution you attend your education (1 = public, 2 = private)	±
Specialization	It is a dummy variable measured specialization of DA (1 = general, 2 = specific specialization)	±
Age	Age of respondents in year categorical variable (1 = under 25 years, 2 = 26–30 3 = 31 and above)	+
DA level work exp.	The experience of DAs measured in the number of years categorized into four groups (1 = below 2, 2 = 2–5, 3 = 5–10, and 4 = above 10 years)	+
Gender	Is a dummy variable (takes a value of 1 if the respondent is male and 0 otherwise)	+
Education level	It is a dummy variable measures education level of DAs (1 diploma and below, 2 = BSc and above)	+
On station exp.	Continues variables measured on the number of years that DAs stayed in their current duty station (kebele)	+
Training access	Access to capacity-building trainings that focus on enhancing core competences of agricultural extension (0 = no, 1 = yes)	+
Satisfaction on their salary	It measures satisfaction level of development agents on their salary and incentives for their work (1 = yes, 0 = no)	+
Relationship with farmer	It is 5 level categorical variable that defines relationship of development agents with farmers (from very low to very high)	+
Relationship with coworkers	It is 5 level categorical variable that defines relationship of development agents with their coworker scale from very low to very high	+
Supervisor's evaluation	If clear and objective feedback of supervisor is given after follow-up (1 = yes, 0 = no)	+
Previous job-related awards	It is frequency of rewards given from their supervisor	+

variable is measured from 28 (the lowest possible score) to 140. This is used to run ANOVA tests and multiple linear regression. The possible independent variables supposed to determine the level of competency of DAs are listed in Table 1.

3.8. Qualitative Data Analysis. Qualitative information collected through key informant interviews and FGD techniques was transcribed and then analyzed using coding and categorization methods. Similar ideas were highlighted with the same color and will have the same code. It was thematically categorized based on these concepts. Then, the relationship among concepts was examined in terms of sequence similarity and oppositional characters. The data have also been supported by quantitative data and other secondary sources.

In order to review training institutions, Strength, Weakness, Opportunities, and Threats (SWOT) analysis was used. According to Austin Community College [59], a SWOT analysis refers to “a subjective assessment of data that is organized into a four-dimensional SWOT matrix, similar to a basic two-heading list of pros and cons.” This enabled the generation of a comprehensive understanding of the SWOT of agricultural colleges. Strength implies in what way the institutions excel? What aspects of institutions are not addressed well and will impede their progress? (Weakness), what factors are taken as an advantage that might enhance

the quality of training institutions in the future? (Opportunity), and what external factors could negatively affect the future of training institutions? (Threat).

4. Results and Discussion

4.1. Competence Level of DAs in the Study Area. To measure the competency level of DAs, a Likert scale questionnaire was developed, which consisted of items measuring six core competence areas. The scale was consisted of a series of Likert-type items that was merged into a single composite score or variable throughout the data processing procedure. Each item had five points (a “Likert-type scale”), where 1 = very low, 2 = low, 3 = medium, 4 = high, and 5 = very high. The six-core competence areas are agriculture extension program planning competence, extension implementation competence, extension monitoring and evaluation competence, extension communication competence, subject matter expertise competence, and education and ICT competence. On the scale of 1–5 (the lowest and highest), the respondents indicated that they had the highest level of competency in communication ($M = 3.51$, $SD = 0.598$); followed by program implementation skills ($M = 3.24$, $SD = 0.66$); monitoring and evaluation ($M = 2.89$, $SD = .583$); technical subject matter expertise ($M = 2.88$, $SD = 0.574$); program planning ($M = 2.77$, $SD = 0.542$); and least level of competency in ICT which was $M = 1.94$, $SD = 0.724$. DAs perceive that

TABLE 2: Likert scale items with different competence level results ($n = 149$).

Competency areas	Likert items	Percentage of 5 Likert points				
		Very low	Low	Medium	High	Very high
Ext. planning	Being familiar with extension system goal	7.4%	24.8	55.7	10.7	1.3
	Knowing extension strategies	4.7	33.2	54.4	7.4	1.3
	Ability to use need assessment tools	6.7	45.6	38.3	9.4	
	Ability to identify indigenous resources and knowledge	2.0	26.8	55.7	14.1	1.3
	Prepare workable plan	.7	16.8	61.1	17.4	4.0
Implementation	Demonstrate teamwork	2.0	13.4	54.4	25.5	4.7
	Training facilitation and presentation skill	2.0	15.4	55.7	21.5	5.4
	Demonstrate good prof. ethics		4.7	38.3	47.7	9.4
	Comprehend life world of farmers	.7	14.8	56.4	20.1	8.1
	Manage conflicts	1.3	21.5	52.3	19.5	5.4
Monitoring and evaluation	Conduct monitoring and evaluation in extension program	2.7	17.4	58.4	20.1	1.3
	Develop/design data collection instruments/survey, interview, FGD, observation	6.7	38.3	45.0	9.4	.7
	Conduct data analysis/qualitative and quantitative	2.7	37.6	47.7	10.7	1.3
	Write report of monitoring results/success stories, lessons learned	1.3	26.8	48.3	20.8	2.7
	Prepare genuine and quality performance reports	2.7	10.7	57.7	22.1	6.7
Communication	Respecting local social values		2.0	38.3	47.0	12.8
	Demonstrate respectful attitude toward all farmers/ understand individual situation of farmers	.7	5.4	37.6	45.0	11.4
	Demonstrate good listening skill		8.1	32.9	47.7	11.4
	Demonstrate explanation of technical issues using local language/avoiding jargons		14.8	56.4	24.8	4.0
	Trace and resolve misunderstandings		7.4	51.0	31.5	10.1
Subject matter	Basic bioveterinary competencies	24.2	37.6	32.2	5.4	.7
	Animal production competencies (animal nutrition, poultry, and dairy)	8.1	34.2	38.9	15.4	3.4
	Crop production/land preparation, pest and disease control, seed selection	4.0	8.7	47.0	30.9	9.4
	Apply basic tools for value chain approach	4.0	28.2	52.3	14.1	1.3
	Demonstrate soil conservation works	4.7	6.7	47.7	31.5	9.4
ICT	Make good use of computers	43.0	43.0	12.1	.7	1.3
	Make good use of ICTs access and use web-based resources	23.5	45.0	24.2	5.4	2.0
	Make use of internet for email and exchange information	33.6	45.6	16.8	4.0	

Source: own survey 2019. ICT, information communication technology.

they have the lowest competency in ICT-related competencies such as the use of computers, followed by planning competency, which requires knowledge of policy documents and strategies, the ability to conduct need assessments using tools, and the ability to prepare workable plans. Moderate competence is observed in monitoring and subject matter competencies and higher competence was observed in program implementation and communication.

Regarding specific knowledge and skills under each competence area, DAs scored the lowest competence level on the ability to conduct need assessments and the ability to use computers and ICT. As indicated in Table 2, the proportion of DAs with low competence levels in these three competencies exceeds 50%. For instance, 52.3% of DAs reported that they have low and very low competence levels in their ability to conduct assessments using different need assessment tools.

Similarly, 86% of them responded that their skill to use computers is low. On the other hand, DAs respond with a higher level of competence in professional ethics, listening skills, and knowledge of and respect for local values. Each item's result is presented in Table 3.

A one-way analysis of variance (ANOVA) was calculated to examine the differences in the level of competency among respondents who passed through three different education programs (government agricultural colleges, government universities, and private colleges). The results show that DAs who attended government universities have a higher level of competency in all competency areas than the other two groups. Those who graduated from government agricultural colleges were better than those who came from private colleges, except for ICT, this finding is in line with Tarekegne et al. [60] (Table 3). As a result, there was no

TABLE 3: Differences in competency level by type of higher education.

Core competency	Higher education institutes						F-value	p-value
	Government agricultural colleges (n = 88)		Government universities (n = 40)		Private colleges (n = 21)			
	Mean	SD	Mean	SD	Mean	SD		
Planning competency	2.70	.457	3.06	.519	2.51	.697	9.777	.001
Implementation competency	3.13	.514	3.54	.637	3.09	.677	7.990	.001
Monitoring and evaluation competence	2.84	.494	3.13	.720	2.66	.518	5.552	.005
Communication competence	3.48	.538	3.75	.684	3.22	.517	6.266	.002
Subject matter expertise competence	2.77	.517	3.21	.596	2.7	.531	10.281	.001
ICT	1.78	.610	2.25	.921	2.06	.534	6.685	.002

Source: own survey results, 2019. ICT, information communication technology.

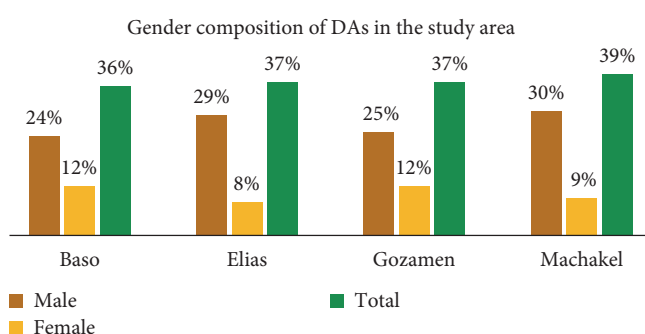


FIGURE 4: Gender composition of respondent DAs among the four districts.

significant mean difference found except in the ICT competency area. The value for ICT competency level was significant ($F=5.507$, $p=0.001$) in the groups. The significance value of homogeneity in the variance assumption test was .088, which indicated that the assumption of homogeneity was not violated.

To determine where the differences lie, a post hoc test was used, which helps to see multiple comparisons. Based on this, the least experienced group is significantly different from the next two groups. In addition, as the following finding shows, DAs with <2 years of work experience had higher ICT competency than the other groups, and there is a dramatic drop in the next groups. As the qualitative data indicates, one of the factors for this was that ATVETs had no computer and internet facilities up until recently. For instance, according to the academic vice dean of Woreta College of Agriculture, the college got internet access 1 year ago. So, recently graduated DAs had better exposure to computers and the internet than their seniors.

4.2. Socioeconomic Status of the Respondents. A proportional number of DAs responded to the survey questionnaire among the four districts (Baso = 36, D/Elias = 37, Gozamen = 37, and Machakel = 39). In terms of gender, the majority of the respondents were male (108, or 72.5%). This figure is almost proportional to the overall composition of DAs disaggregated by gender. Of the total, 238 DAs who work in the four districts, only 71 (29%) are female [61]. Baso and Gozamen

districts had a better representation of female DAs than Machakel and Debre Elias (Figure 4).

When DAs lead a more settled life inside the community, they are supposed to acquire life experiences from the community. This may have positive implications for the agricultural extension service they deliver, and the age of the DAs may have a positive contribution to this. In our survey, the mean age of the respondents was 26.4 years, with a standard deviation of 3.32, which implies that most of the DAs are in the younger age category. Similar studies indicated that the age of DAs is almost similar in different parts of Ethiopia. For example, Lakew [51] in the Eastern Oromia region indicated that the mean age of DAs was 25.85 years, and Yohannes [13] in the Southern region indicated 29 years.

However, this finding is quite different when compared with other developing countries' experiences. For example, in Nepal, 79% of extension professionals were above the age of 35 years [27]. In addition, a study conducted by Awang [17] in Malaysia indicated that only 8.1% of them were between 26 and 30 years old, and about 61.3% of them were above 36 years old. Similarly, Msuya et al. [62] conducted a similar study in nine African countries, including Ghana, Tanzania, Botswana, Cameroon, Senegal, Malawi, South Africa, Uganda, and Nigeria, where most extension workers were predominantly middle-aged and worked for more than a decade.

Education level: In our assessment, we classified the education level of DAs into five categorical levels: BSc degree levels 3–4 or diploma levels 1–2 or certificate, and short-term training (3–7 months). Of the total 149 DAs sampled, 48 (32.2%) were BSc graduates and 95 (63.8%) were diploma graduates.

4.2.1. Field of Specialization. In our assessment of the field of specialization, DAs had engaged in 11 different fields of specialization, of which plant science and crop production contained the highest proportion with 38.3%, followed by animal science with 24.9% (Table 4).

4.2.2. Work Experience. The experience of DAs in their current position ranges from 1 month to 16 years, and the standard deviation was 3.11. The average work experience was 4.4 years. As indicated in Table 4, 71.9% of the

TABLE 4: Socioeconomic characteristics of respondents.

Socioeconomic characteristics (<i>n</i> = 149)	Frequency	Percentage (%)	
Work experience in extension	<2 years	40	26.9
	2–5 years	67	45
	5–10 years	33	22.1
	>10 years	9	6
Highest education	BSc	48	32.2
	Level based	101	67.8
Type of college or university	Private college	21	14.1
	Public/government	128	85.9
Current position/field of specialization	Crop production	53	35.6
	Animal science	38	26.5
	Natural resources	45	31.2
	Irrigation dev't	13	8.7
Birth place of DAs	Rural	128	85.9
	Urban	21	14.1

Source: own survey results, 2019.

respondents had <5 years of work experience, and only 6% had more than 10 years of experience. When we see the case of Nepal, 75.92% had more than 10 years of work experience, of which 27% have worked as extension professionals for more than 30 years. In other African countries, the finding of Msuya et al. [62], current position ranges from 1 month to 16 years, and the standard deviation was 3.11. The average work experience was 4.4 years. As indicated in Table 4, 71.9% of the respondents had <5 years of work experience, and only 6% had more than 10 years of experience. When we see the case of Nepal [63], 75.92% had more than 10 years of work experience, of which 27% have worked as extension professionals for more than 30 years.

In other African countries, the work of Msuya et al. [62], who conducted a study on the role of extension workers in nine African countries, indicated that respondents' worked for 5 months to 38 years, with an average work experience of 12 years. When we see work experience by districts, D/Elias (*n* = 37) is the least in terms of experienced DAs, where 37.8% (*n* = 14) of respondents were below 2 years of experience and 51.4% (*n* = 19) of them worked between 2 and 5 years, followed by Baso district with 27.8% below 2 years and 52.8% with 2–5 years of work experience. In explaining why DAs have such a small amount of work experience, one of the key informants explained that most DAs consider the job to be a transient one. They always aspire to get office-based positions in agriculture or other jobs outside of the profession. This aspiration is unachievable due to their low high school results, and the only place that they will get accepted is in agricultural colleges. So, they join an agricultural college to be DAs, and graduating from the college will qualify them to pursue their education in other professions. Due to this, it is very rare to get the most experienced DAs due to the high turnover. In terms of their birthplace, 128 of them (85.9%) were born and raised in rural areas, while the rest 21 (14.1%) were born in urban areas.

4.2.3. Recruitment Process of DAs. According to key informant interviewees from district agriculture offices, there are two ways of recruiting DAs. The first way is for high school graduates to be selected by the government based on interest. Usually, those who achieved lower scores (with a minimum of 2.0 points) and are unable to join grade 12 due to financial and social reasons are recruited in this process. These students were then assigned to government agriculture colleges to study for diplomas or "level-based certificates," and they signed agreements to work as DAs in any place where the government assigned them. The second way is for people who study agriculture fields either privately or in public universities on their own. Agriculture offices announce vacancies for vacant positions and hire the best qualifier. The researcher understands that the requirement process could not uptake academically competent professionals, and DAs used these jobs as low-level and transitional jobs.

Similarly, key informants in the training institutions reported that they have no significant role in the recruitment process. KIIs confirm that applicants did not sit for the entrance exam, and most of the time the selection process is held so late after other sector screening is completed (health extension, teaching and TVET, and private colleges). So, only those who cannot get in anywhere else choose to be DAs. KIIS reported that what motivates applicants is that they have no other alternative but to pursue their college-level education. They use their diploma as a transition to learning other disciplines and have no strong commitment to work at all. So, being a DA is a transitional profession until they get what they need. It is indicated by Garton et al. [49] that admission criteria such as the entrance examination, high school grade, point average, and high school rank have a positive correlation with the academic performance of students in agricultural colleges. That means those who have good GPAs will most likely be the best performers in college. However, these quality-maintaining selection

requirements are not being applied in Ethiopian agricultural colleges.

The second recruitment method is hiring people through vacancy announcements. In this case, people have already graduated on their own. So when there is a vacant position, the district agriculture office will inform the civil service office to hire someone for the vacant position. In order to hire a person who fulfills the required competency, the civil service office will make a vacancy announcement (there is a civil service guideline). Interested applicants will go through a screening process, and those who fulfill the minimum requirements will sit for a written exam and interview. The exams are prepared by the related department and office agriculture experts. For example, based on the most recent recruitment in the Machakel district for a plant science position, questions related to seed amount, fertilizer amount, and how to use chemicals.

The exam was prepared by the Plant Science Department, and all questions were focused on technical competencies, where 90% is a written exam and 10% is the interview. It was confirmed by the extension unit head that there is a very rare chance for extension department/unit staff to engage in the hiring process of DAs because the exams are about technical expertise. So, applicants are only examined on their technical expertise, and no extension-related competencies will be part of the examination. Different scholars argue that extension agents' competence should be in accordance with the task areas in which they will be assigned to operate in order to perform successfully [36, 38, 39, 64]. So, using only technical expertise as a hiring criterion may not ensure the general competence of candidates. Because DAs are expected to be equipped with integrated sets of knowledge, skills, and attitudes that are necessary to effectively deliver the expected job results. As mentioned in the theoretical framework of this research, proponents of competence theory criticize the way educational institutions test education more for intelligence than for competence. They argue that intelligence tests do not predict job success because competence is not limited to technical knowledge [43, 44].

4.2.4. Findings on Curriculum and Profile of Training Institutions. Three training institutions (Woreta, Mertolemarium, and Kombolecha) were selected for curriculum review. In doing so, three major issues were reviewed. The first one was an issue related to specialization and how different departments are recruiting entry students? Second, how do the training institutions shape the attitude of DAs? and third, match between the courses given in training institutions and the actual job descriptions of DAs? Since 2007, Woreta College has been offering level-based (level 2–4) programs in three departments: plant science, animal production, and natural resource management. But currently, due to government directions for colleges to specialize in one or two fields of study, the college has stopped offering natural resource management (which is taught at Mertolmarium College). In addition to level-based programs, colleges also offer BSc affiliation programs to universities. BSc programs include animal health, animal science, natural resource management, cooperatives,

plant science, water resources, and irrigation management. Woreta College is affiliated with Gondar, Bahir Dar, and D/Tabor universities, while Mertolemarium University is affiliated with D/Markos University.

Curriculum development and revision of level-based programs are done by Federal TVET, while BSc programs are done by affiliated universities. Departments in training institutions have no role in either developing or revising curriculum. The colleges' authority is limited to module modification when it is necessary. According to key informants in training institutions, the curriculum for level-based students is designed by Federal TVET and the Ministry of Agriculture. When there is a need for revision, colleges may report or inform the regional agriculture office and then reports to Federal TVET. After the revision, the feedback follows the same line. But it was confirmed by all respondents that there has never been a case of following such a process to revise a certain curriculum. Because teachers are mostly very busy completing the courses, they have no time to pause and think about challenges.

4.2.5. What Makes a Good DA? It was observed that there has been a difference among training institutions in understanding what makes a good DA. There was no uniformity in the definitions given by different departments in the same institutions and among institutions as well. Responses are given to competencies that make good DAs differ from one department to the other. For comparison, five definitions given by different departments are presented below. The first two definitions were the academic level where department representatives coined their understandings. "...three domains of competency that DAs should acquire; knowledge and concepts and a good DA should have adequate technical knowledge, able to implement that knowledge in practice (skills) and respect his profession...." This definition looks more at theoretical competencies and it ignores the social capital where DAs should develop while working with farmers.

The deflation from the mother "Agricultural Extension" department stated that "A DA is the one who knows the extension methods that are used to diffuse the extension packages and is able to mobilize the community using different mobilization skills, this one is more on how to disseminate extension packages to communities and the mobilization skills of DAs." However, the representative KII from District level agricultural office also reported that "A good DA is the one who has better knowledge than farmers, has a good attitude toward farmers, assumes farmers' living conditions, and builds a good relationship among every farmer with proficient communication." The DAs themselves defined what makes a good DA as: "A good DA always knows the reason why he/she is hired and strives to achieve the objective. Accountability is also the main quality of good DA. A person who is ready to serve the farmers with humility and honesty. A person who can execute assignments effectively. Dedicated to tasks."

Overall, the authors understand that there is an inconsistent understanding of the role of DAs among academicians

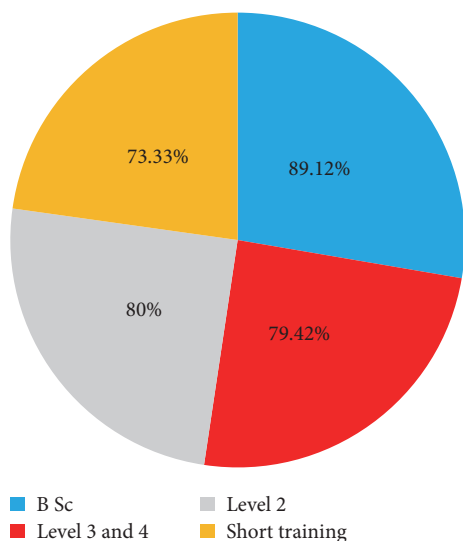


FIGURE 5: Total competency of DAs by their education level.

and office-level agricultural workers. By limitation of setting a clear framework of the objectives, DAs should reach at the end of their training. There is also a mismatch between training institutions and district offices in defining the competencies that make good DAs. This affects the quality of education and the qualities that a competent DAS should possess. Therefore, assimilation of objectives and putting in place a communal mission among academicians and office-level workers are essential to producing competent and self-determined DAs.

4.2.6. Education Level. Educational background was another variable computed to see the mean difference in competency level among DAs attending different education programs. This helps to see whether DAs who passed through different programs/curriculum may differ in their competence as well, and one-way ANOVA indicated that there was a statistically significant mean difference between the groups ($F=7.657$, $p = .001$). Figure 5 shows the descriptive mean differences.

4.2.7. Discussion on the Level of Each Core Competency. Three different analysis procedures were applied to determine the competency level of DAs. The approaches enable to see the scenario from Garcia [65] classification of coefficient of variation (CV%) using mean and standard deviation: it is a widely used method in agricultural surveys that researchers used to measure the variability of their experiments [66, 67]. Therefore, classification was done based on, $CV\% \leq \bar{x} - SD$ rated "low"; $\bar{x} - SD < SV\% \leq \bar{x} + SD$ rated medium; $CV\% > \bar{x} + SD$ rated high, where \bar{x} is the sampling mean while SD is standard deviation. Simply, here DA's competency level was determined as low, medium, and high based on the deviation from the mean score distribution and the competency level is discussed one by one as follows.

(1) Planning Competence. Planning competence involves the knowledge and skills of DAs that are necessary to produce workable planning. It includes adequate knowledge of national agricultural extension goals and strategies, which

need assessment, conducting tools, social mapping techniques, and the ability to prepare weekly, monthly, and annual plans. Based on Garcia's proposal, the planning competency of DAs was categorized as low, medium, and high using the deviation from the mean score distribution. As indicated in Table 5, the mean score was 13.86 with a standard deviation of 2.71. Based on this, 14.8% ($n=22$), 77.2% ($n=115$), and 8.1% ($n=12$) of DAs had low, medium, and high planning competencies, respectively.

The results indicated that most (77.2%) DAs rated themselves as having a medium level of planning competence, which consists of basic expertise vital for effective planning. However, it is not quite enough to get into the realistic competence level of DAs because it is determined by the standard deviation and mean. In another word, DAs giving a similar score will affect the result by hiding the real competence level of DAs. So, there is a need to fill this limitation by using other ways of determining the competency of DAs. In order to overcome the limitations mentioned above, the extension organization efficiency evaluation scale was applied to categorize the planning competencies of DAs.

(2) Extension Implementation Competence. A similar approach was applied here as well, where three different ways were used to determine the implementation competence of DAs. DAs' ability to implement extension programs was measured by considering important competencies such as teamwork, training, facilitation and presentation skills, professional ethics, comprehension of the lives of farmers, and managing conflicts. After computing the total sum score of the items designed to measure implementation competence, mean, and standard deviation to categorize DAs' scores as low, medium, and high, the minimum score was 9 while the maximum score was 25. The mean and standard deviation were 16.32 and 3.17, respectively. Based on this categorization, the implementation competences of most DAs fall at the medium level. However, based on human resource professionals' Bell curve, 10% is the highest possible threshold for low-level employees in one organization. It is considered that the normal distribution of employees is low (10%), average (70%), and high (20%) [68].

Although it is debatable among professionals whether to use the Bell curve as the ultimate standard, it is still a widely accepted method that organizations adopt to categorize their employees. HR professionals recommend that it is unhealthy if there are more than 10% of low-performing staff in one organization who need urgent staff development. So, based on this, 14.5% of DAs have a low level of competency. Similar results were generated when the score was categorized based on the government efficiency evaluation scale, which confirmed 14.8% ($n=22$) as a low level of implementation competence. This requires more attention because the measurement is based on the core competencies necessary to perform the primary tasks of DAs.

(3) Extension Monitoring and Evaluation Competence. In this competence level, the DAs are expected to master in order to monitor and evaluate extension programs. Competence requires the ability to design data collection instruments, conduct data analysis, prepare quality reports, and

TABLE 5: Average competence level of DAs categorized as low, medium, and high competence category.

Competence level	Competence category	Score	Frequency	Percentage (%)	Mean	SD
Planning competence	Low	<11	22	14.8	13.86	2.71
	Medium	11–17	115	77.2		
	High	>17	12	8.1		
Extension M&E competence	Low	<11	20	13.4	14.46	2.917
	Medium	11–17	112	75.2		
	High	>17	17	11.4		
Extension communication competence	Low	<15	19	12.8	17.56	2.992
	Medium	15–21	114	76.5		
	High	>21	16	10.7%		
Specific subject matter competence	Low	<11	21	14.1	14.40	2.869
	Medium	11–17	109	73.1		
	High	>17	19	12.8		
Education and ICT competence	Low	<4	42	28.2	5.83	2.173
	Medium	4–8	93	62.4		
	High	>8	14	9.4		
Total competence of DAs ($n = 149$)	Low	<69	14	9.4	82.44	12.725
	Medium	69–95	115	77.2		
	High	>95	20	13.4		

Source: own survey results, 2019. ICT, information communication technology.

write success stories and/or lessons. Based on the deviation from the mean score distribution, the monitoring and evaluation competence levels of development were categorized into three categories: low, medium, and high. The mean score was 14.46, the standard deviation was 2.917, and the minimum and maximum scores were 7 and 23, respectively. The result indicates that DAs have a higher competence level in monitoring and evaluation than in planning and implementation. But still, 13.4% have a low competence level, which is higher than the “Bell curve” threshold. The increases when it is computed based on the government performance efficiency standard, which shows that low-competent DAs reached 36.9% ($n = 55$).

(4) *Extension Communication Competence*. As DAs who serve as liaisons between extension organizations and communities, communication skills are a core element that enables them to establish positive relationships with coworkers and community members. They are expected to deliver information to farmers effectively without creating any ambiguity. They are also expected to learn local knowledge, lessons, and challenges from farmers. To do so, they should respect local social values, demonstrate a respectful attitude toward all farmers, regardless of their differences, demonstrate good listening skills, and resolve misunderstandings (Table 5).

(5) *Specific Subject Matter Competence*. This refers to the competence level of DAs in their technical expertise such as basic bioveterinary competencies (anatomy, physiology, and biochemistry), animal production competencies (animal nutrition, poultry, and dairy), crop production competencies (land preparation, pest and disease control, seed selection), knowledge of basic concepts and tools for the value chain approach, and soil conservation works (acidity treatment, compost preparation, and fertilizer usage). Based on the total sum score of the 5 Likert-type items, the minimum and

maximum scores were 7 and 23, respectively. The mean score was 14.40, with a standard deviation of 2.869.

(6) *Education and ICT*. Competency in ICT is a newly emerging competence area that is becoming increasingly important in a globalized world. However, DAs were found to be the least competent of the six core competence areas. The minimum and maximum scores were 3 and 14, respectively. Based on mean and standard deviation classification, 28.2% were in the low competence category, while 62.4% and 9.4% were in the medium and high categories, respectively.

(7) *General Competency of Development Agents*. The overall competency level of respondents was also measured using the total mean score and total sum score by merging the six competencies. The minimum and maximum scores of general competence were 51 and 119, respectively, while the mean score was 82.44 and the standard deviation was 12.725. By using the government efficiency and performance rating standard, 27.5% ($n = 41$) of the DAs had low general competence, while 59.7% and 12.8% of them had medium and high competency levels, respectively.

4.2.8. *Factors Affecting the Competence of DAs*. Multiple linear and ordinal regression models were used to determine factors that affect the competence of DAs. The predictor variables were examined to predict the general competency of DAs. The explanatory variables included in the regression analysis were relationship with coworkers, relationship with farmers, education level, sex, and specialization in the field of study, work experience, supervisors' clear and objective visits and evaluations, age of DAs, type of training institutions where DAs attended, and current position. Based on the analysis, of the 10 independent variables, seven had a significant influence on the competence level of DAs (Table 6).

TABLE 6: Factors that influence the competence of DAs/multiple linear regression model.

Variable	Coefficients/estimate	SE	T-value	Sig. level
(Constant)	–	7.425582297	4.482992491	0.015339137
Sex of DA	0.167145768	2.099335343	2.26103097**	0.025321789
Relationship with coworkers	0.221996995	1.293218584	2.594233587**	0.010503648
Relationship with farmers	0.175680687	1.542896629	2.013144009**	0.046044448
Supervisors visit and evaluations	0.140448486	0.839912309	1.939311627*	0.054503731
Education level recoded	0.286054446	1.962968445	3.955039516***	0.000121809
Institution recoded	0.129357404	2.878495545	1.637977179	0.103704607
Age of DA categorized	–0.060625701	1.99158532	–0.613494627	0.540559221
Work experience recoded	–0.165544304	1.442713647	–1.707844533*	0.089913782
Specialization category	0.123765083	2.620588209	1.721398711*	0.087419397
Position	–0.073214302	0.788657411	–1.032657068	0.303570758

ANOVA model fit measure = 0.591754; $p = 0.001$; ***, **, * represent significant at 1%, 5%, and 10% level of significance, respectively. Source: own survey results, 2019.

(1) *Sex of DAs*. This variable had a positive and significant influence at <5% level of significance on competency. Male DAs were found to be more likely to be competent than females. There might be different issues that explain this variance. For example, during key informant interviews, the academic vice dean explained how difficult the campus was for “mother students” who brought up their infants with them. They could not use the free dormitories given by colleges as they are shared by other students as well; rather, they were forced to rent houses nearby and pay for caretakers. This affects their education as they miss classes very often. Another possibility is the one raised by female FGD participants about the attitude of farmers toward females. They said that it is easier for males to get acceptance from community members because little attention is given to women. Finally, as the upgrading program requires the back and forth of DAs, it probably is more difficult for women to maintain work–life balance than for men.

(2) *Relationship with Coworkers*. It has a positive and significant influence on competency at a level of significance of <5%. The variable accounts for 22% of the variation in competency level. The positive association suggests that the likelihood of being competent increases when the DA’s relationship with their coworkers changes to a positive one. Literature also supports the idea that competency is not just expertise, knowledge, or technical ability. It also has a functional part that helps it function, including building relationships with clients, networking with local organizations, conflict resolution, and mobilization [39]. So, establishing positive relationships with coworkers lays the foundation for DAs to enhance their process skills.

(3) *Relationship with Farmers*. Establishing good relationships with farmers was also found to have a positive and significant influence on the competency of DAs at a <5% level of significance. It also covers 17% of the variance in competency among DAs. Two major explanations could explain this. First, recent agricultural extension systems found that information exchange should be two-way between farmers and research. Top-down approaches that frame farmers as having little expertise and knowledge and being ignorant of new technologies are now outdated. Recent approaches

promote the non-nominal participation of farmers in research and decision-making about extension systems. Based on this reality, development, agents who establish a good relationship with farmers will have a higher chance to learn from them, discover local knowledge, understand the rationale behind their decisions, and be able to dig out problems and find solutions together. They have a chance to learn and grow in many aspects of both process skills and technical competencies. Second, having a good relationship with farmers is also the key to building trust, transparency, and accountability between a DA and farmers, where farmers feel free to genuinely evaluate and comment on the DA who is working with them.

(4) *Education Level*. It is the only variable with <1% level of significance. It is the highest education that DAs attended. It accounted for 28% of the variance in competency among DAs. Those DAs who have BSc degrees were found to have better competency than level-based graduates. This could be mainly due to curriculum differences: BSc graduates take more courses in theory and practice than level-based graduates. As mentioned in the discussion of the objective one, there are numerous problems related to the curriculum and performance of agricultural colleges. Although it is expected to be a difference between BSc and diploma (level) holders, the variance is significant as they work at the same job position.

5. Conclusion

DAs are expected to possess competencies in many diverse areas, and it is the responsibility of agricultural colleges and extension organizations to identify the core competencies required for extension agents in their working environment. The research findings indicated that there is a significant competence difference between BSc graduates and level-based graduates in all competence areas. Entrance examinations and high school GPA were found to be the best predictors of academic performance in agricultural colleges. However, ATVETs in the study area do not entertain such privileges because all selection processes are usually done via the Bureau of Agriculture. The majority of DAs in the study are male, and most are in the young age group with <5 years

of work experience. Due to the high turnover, most DAs have short and intermediate years of work experience. From the six competence areas, DAs scored below average on four of them, namely, program planning, monitoring and evaluation, subject matter expertise, and ICT. In this research, low competency was observed in all core competence areas that were below the benchmark. This indicates the need for critical diagnostics of competency development and for designing training and development programs appropriate for overcoming the weaknesses. Strengthening intra- and inter-social capital has been found to be a predictor variable that determines the competency level of DAs. The research confirmed that smooth communication with coworkers and building positive relationships with farmers have shown significant competency when compared to those who do not have good relationships. Likewise, the education level and gender of the DA have also indicated a positive and significant impact on the competency level of DAs.

6. Recommendations

- (i) Therefore, compliance-specific on-the-job training needs to be designed to address short-term demands of DAs.
- (ii) As the finding suggests, building social capital and investing in education through curriculum development look like important interventions to sustain the agricultural extension competencies of DAs.
- (iii) Moreover, digitalizing the extension system could have promising outcomes as most of the DAs are young and their ICT competence has been recorded as higher compared to the older DAs.
- (iv) Clearer policy frameworks are needed that ensure coherence among the Ministry of Agriculture, the Federal ATEVET, the Ministry of Education, agricultural colleges, and community members. This will help to create an alignment between what colleges teach, what DAs are required to perform extension programs, and what farmers demand.
- (v) In addition, the majority of DAs have no interest in working as DAs. So, in order to change this, there is a need to implement evidence-based, applicable motivational packages. There is also a need to check on the way supervisor's forward feedback to DAs.

Data Availability

The authors state that they are willing to submit the data at any moment if the publisher requests it. The datasets utilized and/or analyzed in this study will be made available upon reasonable request.

Additional Points

Study Limitations. The study was carried out in four districts of the East Gojjam Zone Administration. It is a comprehensive analysis that intends to examine DAs' competence and motivation levels as well as review the curricula of three

agricultural training institutions, including the recruitment process. Some skills and expertise may be required for these activities. However, this research will be limited to assessing only a few but essential competence areas, which are referred to in this study as "core competences" (a detailed definition of core competence is presented in the literature review section of this research). In reviewing agriculture colleges, the study was limited to reviewing the curricula of institutions only. It did not cover other profiles such as infrastructure, manpower, budget, and organizational structures. Further studies should focus on the gaps not covered in this finding.

Ethical Approval

Ethical clearance letters were collected from Bahir Dar University College of Agriculture and Environmental Sciences Research and Community Service Vice Dean Office and Gozamen, Debre Elias, Machakel and Basoliben Woredas Administration Offices to care for both the study participants and the researchers.

Consent

Each kebele in the target woredas where data collection was targeted and informed received an official letter. Each client provided verbal consent, and confidentiality was preserved by assigning codes to responses rather than recording their names. Participants in the study were informed that they had the complete right to quit or decline to participate in data collection. As a result, all research participants, including DAs, agriculture office experts, agricultural college department heads, academic vice deans, and supervisors, were fully informed about the study's aims and approached in a courteous and open manner.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

Authors' Contributions

Yosef Getahun Aregaw: contributed in proposal development, data collection, supervision, analysis, and writing the manuscript. Emam Adem Endris: participated in data supervision, clerk, discussion, writing and manuscript preparation, and editorial issues. Elias Bojago: analyzed the logistic regression part and revised the manuscript and prepared the manuscript, edited the text, and participated in data cleaning and analysis

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