Research Article

Kurnia Suci Indraningsih*, Ashari A, Syahyuti S, Iwan Setiajie Anugrah, Sri Suharyono, Saptana S, Arief Iswariyadi, Adang Agustian, Tri Bastuti Purwantini, Mewa Ariani, Maesti Mardiharini

Factors influencing the role and performance of independent agricultural extension workers in supporting agricultural extension

https://doi.org/10.1515/opag-2022-0164
received September 29, 2022; accepted December 7, 2022

Abstract: Extension activities play a significant role in the success of agricultural development programs. Farmers still need agricultural extension workers (EWs) in the form of assistance, technical guidance, and management intensively and continuously. With the limited number of government EWs, the role of independent agricultural extension (IAE) workers has become crucial. In Indonesia, IAE worker has been recognized since 2006, although it has not been effective. This article aims to: (1) identify conditions and characteristics of IAE and (2) analyze the influencing factors on the role of IAE officers in supporting agricultural extension. Data collection was carried out with a structured questionnaire using Google Forms involving 161 respondents. The analysis method uses inferential statistics, namely the structural equation modeling. The results showed that the factors that directly affect the role of IAE workers are work motivation and quantity or workload. The number of IAE workers directly influences their performance. A favorable working environment is required to achieve the ideal role of IAE workers. In addition, improvement of work management, horizontal and vertical relations, and regulations posit IAE workers as an essential part of agricultural extension activities. It is necessary to have a regional regulation that legalizes the allocation of regional budgets as regular incentives to facilitate the activities of agricultural EWs.

Keywords: extension workers, competence, motivation, workload of extension, farmer-to-farmer extension

1 Introduction

The extension is an essential component in the overall agricultural development activities. The level of mastery of farmer technology is still limited, requiring intensive and continuous technical and management guidance assistance [1]. The study found a significant relationship between the role of extension workers (EWs) and the decision-making process of hybrid rice technology in Myanmar [2]. An extension can also improve the efficiency of technology adoption in China [3], encourage sustainable food production [4], and empower and ensure the sustainability of farmers' livelihoods [5]. In addition, counseling is quite effective in making farmers aware of the impacts of climate change [6]. The need for extension services is increasingly felt by smallholder farmers, even in Europe, which is classified as intangible services [7].

The effectiveness of EWs as facilitators of development needs to be supported by a professional extension system [8] by involving various parties. A study in South Africa stated that local agricultural universities transfer technical skills to farmers [9]. In Ethiopia, EWs are involved in national strategic programs to become facilitators of effective coordination of the National Nutrition Program [10]. EWs can act as facilitators, communicators, motivators,

* **Corresponding author: Kurnia Suci Indraningsih,** Research Center for Social Welfare, Village, and Connectivity, National Research and Innovation Agency, Jalan Gatot Subroto 10, Jakarta 12710, Indonesia, e-mail: kurniasuci@yahoo.com
Ashari A, Adang Agustian, Mewa Ariani: Research Center for Behavioral and Circular Economics, National Research and Innovation Agency, Jalan Gatot Subroto 10, Jakarta 12710, Indonesia
Syahyuti S, Saptana S, Maesti Mardiharini: Research Center for Cooperative, Corporation, and People's Economy, National Research and Innovation Agency, Jalan Gatot Subroto 10, Jakarta 12710, Indonesia
Iwan Setiajie Anugrah, Tri Bastuti Purwantini: Research Center for Social Welfare, Village, and Connectivity, National Research and Innovation Agency, Jalan Gatot Subroto 10, Jakarta 12710, Indonesia
Sri Suharyono: Indonesian Center for Agricultural Socio-Economic and Policy Studies, Jln Tentara Pelajar 3B, Bogor 16111, Indonesia
Arief Iswariyadi: Universitas Multimedia Nusantara, Jl. Scientia Boulevard, Tangerang, Banten 15810, Indonesia

consultants, and institutional developers of young farmers to strengthen the process of farmer regeneration [11].

Kamara et al. [12] showed extension and research professionals' enthusiasm and interest in improving the innovation system. It is attested by the training for seniors and the involvement of junior staff in designing the Agricultural Information System (AIS). According to Ubochioma et al. [13], competent EWs require several skills, including teaching skills, program planning, implementation, adequate education/information, evaluation programs, and managerial knowledge.

In Indonesia, agricultural extension activities at the sub-district level are faced with several problems, including the limited number and ability of EWs in information technology. This condition is also found in developing countries. Most farmer groups and EWs have limited access, knowledge, and capacity to information and communication technology [14]. In addition, the ideal workload for each EW in each location has not been evenly distributed, including supporting infrastructure for the implementation of tasks, the reach and area of the target area, the number of services to farmers, farmer groups, and other tasks outside the officialdom as the task and function of EWs. The agricultural extension system in Ethiopia to disseminate agricultural knowledge and information could be done using information and communication technology [15].

The Indonesian government has made various efforts, but the number and distribution of EWs are not ideal. The increase in the number of new workers recruited by the government is not comparable to the number of civil servant EWs entering retirement. This condition ultimately demands other alternative efforts by opening up opportunities for farmers willing to become independent agricultural extension (IAE) workers to partner with the government EW. According to Law of Agricultural, Fisheries, and Forestry Extension System Number 16, 2006, IAE is defined as farmers who succeed in their farm business and other society of the community who, with their consciousness, are willing and able to become EWs. Nationally, in 2021, the number of IAE workers was recorded at 29,860 from a total of 78,317 national EWs [16].

The existence of IAE workers is independent to meet the needs of companions for leading actors and agricultural business actors. The main task of IAE workers is to carry out agricultural extension activities following the agricultural extension work plan prepared based on the agricultural extension program in its work area. In the case of India, the women's self-help group has proven effective in improving women's access to information and their participation in the decision-making of agricultural activities [17].

Previous researchers have widely carried out studies on the role and performance of agricultural extension [5,18–21]. However, studies on the role and performance of independent EWs in supporting agricultural extension services are still relatively limited [1,22]. The results of research by Azumah and Zakaria [23] revealed that the method of counseling from farmer to farmer (F2F), the use of pilot land, and the method of household counseling proved significant for communicating information to farmers. However, in Indonesia, the role of self-help EWs has not been optimal until now. Several factors are presumed to cause the underperformance; therefore, it is fascinating to study so that corrective steps can be taken in the future. Therefore, this study aims to study the factors that influence the role and performance of IAE workers support agricultural extension. Therefore, this study aims to: (1) identify conditions and characteristics of IAE and (2) analyze the influencing factors on the role of IAE officers in supporting agricultural extension.

2 Literature review

A F2F extension approach is expected to be increased in the future, especially in Indonesia. F2F extension is defined as the provision of training by farmers to farmers voluntarily [24]. F2F is usually established through farmer promoters or farmer trainers. Studies in Sub-Saharan Africa, such as Cameroon, Kenya, and Malawi, found that the agricultural extension model was becoming more decentralized and participatory, motivating individuals to volunteer as farmer leaders, and utilizing informal communication among farmers [25–27]. The F2F approach helps establish effective and farmer-centered extension systems and empowers farmers as agents of change to improve the livelihoods of outlying communities. F2F is expected to support a bottom-up extension approach or farmer-lead extension, which is defined as a process of multidirectional communication between EWs and farmers that shares and develops knowledge and skills to meet farmer needs and develop innovative capacities among actors [28].

Those who becoming F2F, known as self-help EWs, are usually progressive farmers. Progressive farmers play an active role model, influencing their communities, strengthening the motivation of young people in the regeneration process of agricultural actors, and acting as an agent of change [19,29,30]. Moreover, they suggested that the capacity of progressive farmers is good competency and good motivator in encouraging youth interest in the agricultural sector. Meanwhile, Hailemichael and Haug [31] showed that this new

approach has increased the scope of counseling, the dissemination of information and technology, and the number of households involved in extension and consulting networks.

The method of counseling from F2F, the implementation of field demonstrations, and direct household counseling are the most apparent extension mechanisms in disseminating technology to farmers [23,32]. The existence of a F2F EW and mass media improve knowledge and adaptation of agricultural technology [33,34]. The effectiveness and sustainability of the dissemination of agricultural extension program depend on voluntary farmer trainers (VFTs) and the role of civil servants. As VFTs, they must have technical skills and be problem solvers. The incentives for VFTs need to be considered, even though it has yet to be known how they affect performance [35,36].

There were differences in extension materials between F2F and conventional methods. In F2F, the extension focuses on encouraging the commitment and motivation of farmers to run agricultural businesses commercially, the availability of financial resources to ensure the sustainability of production, the willingness to reinvest profit, and access to farmland for future expansion. In contrast, traditional extension approaches focus more on group-building efforts to address marketing challenges and diversify agricultural enterprises and good agricultural practices. F2F has a role in addressing information and knowledge access issues that can hinder technology adoption [37]. In adoption of Conservation Agriculture (CA) technology, the motivation of farmer leaders increased the effectiveness in spreading CA practices, became essential in adopting CA, and played more of a role in raising awareness than adopting CA practices [38].

The significant driving factors of farmers' decision to join and participate in the Business Development Group (BDG) on a new approach to agricultural extension were farmers with a more extensive and intensive business scale desire to access information from other farmers. Farmers of this type have a greater chance of participating in the BDG program [39]. Meanwhile, Silvert et al. [40] examined the perception that smallholder coffee farmers can influence their involvement in extension movements involving fellow farmers and collective activities. The study results showed that farmers felt there was a benefit from collective action and wanted to work with their peers. This study implies a need for support for extension systems and technical assistance for a F2F extension approach [39].

The previous literature above has explored the definition of F2F, the benefits, the role, and the criteria of F2F EWs. However, there needs to research on what factors affect the role and performance of F2F. Role and performance will determine the success of the extension program and sustainability in the future. Therefore, this study will fill the gap in the study more comprehensively.

3 Methods

3.1 Research location

The research was conducted in two regions, in Java, and outside Java regions. West Java and Banten provinces were chosen to represent the Java region, while Lampung Province represented the outer region of Java. One regency was intentionally selected in each province, which is the center of rice production, namely Karawang Regency, West Java Province; Lebak Regency, Banten Province; and Central Lampung Regency, Lampung Province. Respondents consisted of (1) officials of the agricultural service, (2) IAE workers, (3) civil servant EWs, and (4) freelance daily workers – agricultural extension assistance workers

3.2 Data sources

Data, including secondary and primary data, were collected from July to October 2021. Primary data were obtained from respondents of IAE workers by filling out *a google form* questionnaire by accessing *the link* provided via *cellphone*/android or computer. The number of respondents for IAE workers in the Karawang, Lebak, and Central Lampung regencies was 36, 37, and 88, respectively. Thus, the total number of respondents was 161 people. Supporting information was obtained through *virtual* and offline Focus Group Discussion (FGD) at the district level (Agriculture Office) and the sub-district level (Agricultural Extension Center). FGD was done to explore the role, performance, and problems of IAE workers as well as alternative problem solving to improve the performance of IAE workers in the future.

Informed consent: Informed consent has been obtained from all individuals included in this study.

3.3 Data analysis

This research uses statistical analysis of inference, namely structural equation *modeling* (SEM), to obtain an empirical model of the causality relationship between the exogenous

and endogenous variables. The exogenous includes the competence of IAE workers, work motivation, work facilities, and quantity/load, while the role and work of IAE workers are endogenous variables. The measurement of perception of variables uses the Likert scale, which is 1 (strongly disagree), 2 (disagree), 3 (agree), and 4 (strongly agree). The Likert scales were set into 4 (four) categories. The categories aimed to avoid respondents answering the middle category. To describe the responses of respondents, class intervals were constructed. Since using four Likert scales, class intervals were obtained by dividing the range (the largest scale substracted the lowest scale) by 3, i.e. (4 – 1)/3; therefore, the interval class is 1 (one). Those intervals were: (1) 1.00–2.00 is disagree to less disagree; (2) 2.10–2.00 is less disagree to agree; and (3) 3.01–4.00 is agree to strongly agree. At the same time, inference analysis used SEM, which determines the dominant influential factors or the path with a stronger impact. The data processing used the Stata statistical application. The research framework of the study is presented in Figure 1.

3.4 Research framework

Extension workers as the agents of change due to they have played a role, namely (1) developing the need to change; (2) establishing an information exchange relationship; (3) problem diagnosis; (4) fostering an intention of change in the client; (5) embodying an intent in action; (6) establishing adoption and preventing termination; and (7) achieving the final relationship, to develop self-

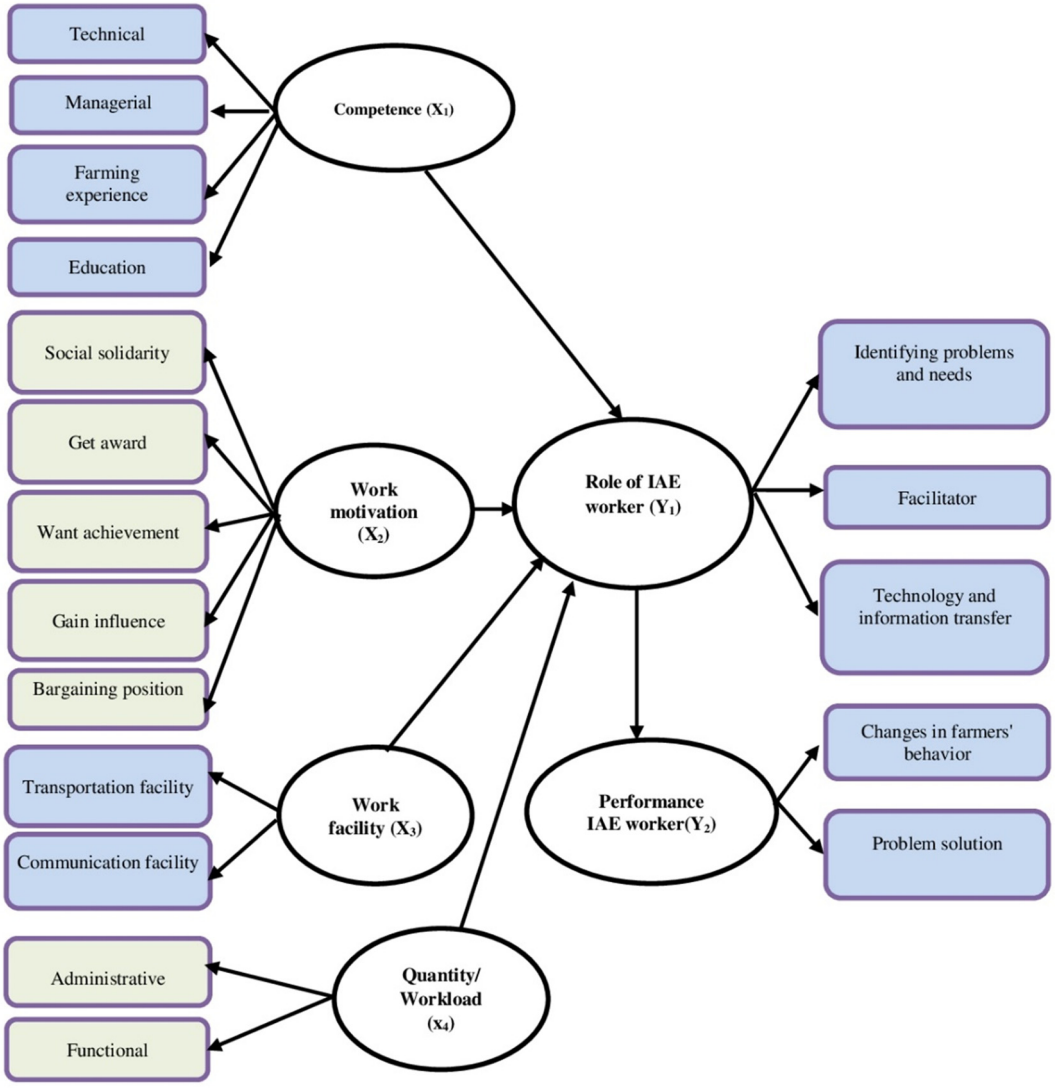

Figure 1: A hypothetical framework of research variables.

renewing behavior in the client [41]. EWs' roles are determined by competence, motivation, work facilities, and workload [1]. These variables are used in this study to measure the role of EWs. The explanation of the variables is explored as follows.

3.4.1 Competence

Competence or self-ability is the main factor in the role of extension. The competence consists of technical aspects, managerial, experience, and education. Competence largely determines performance, motivation, and independence [42] and is an integral part of the EW performance variable [43].

Competence is built on multiple sides. The research on the case of agricultural EWs' competencies in Ghana shows that the core competencies of EWs are in terms of interpersonal relationships, communication, personal qualities, and technical knowledge [44]. Interpersonal relationships correlate with organizational performance [45]. Work experience and access to training are also necessary [46], including access and the ability to utilize information and communication/ICT technologies [47].

3.4.2 Motivation

Motivation is the power that allows a person to act toward a specific goal [48] and can encourage the individual to act to achieve the goal [49]. Thus, motivation can determine the result in perseverance, role, performance, and productivity. Motivation positively influences an activity's performance, including extension activities [50].

IAE worker's motivation is an encouragement to be able to achieve counseling goals. In general, motivation can be seen from the IAE worker's self and motivation from outside the IAE worker. Motivation from within the IAE worker is mainly related to the main tasks and functions that must be carried out which have an impact on the achievement of the IAE worker's performance, while motivation from outside the IAE worker is the enthusiasm to develop the work area supported through good cooperative relations with farmer groups [51].

IAE work motivation and organizational culture positively and significantly affect performance [52]. In the context of extension, the work motivation of IAE workers and organizational culture affect the role and performance of IAE workers. In carrying out an activity, people do not always expect wages, including for IAE workers. However they intend to sharing knowledge and skills. A person's career can also inspire life [53,54]. Material and nonmaterial rewards are only a means of determining a person's motivation at work but are not the main reason an employee wants to stay within the organization [55]. Four significant motivational factors are independence, the need to excel, social recognition, and financial appreciation [56,57].

Assessment of IAE worker motivation includes the field of motives/needs (including basic needs fulfillment, security needs, social/affiliation needs, awards, and self-realization) areas of awards (including wage increases, promotion, awards or recognition, acceptance of co-workers, and achievements), and incentives (including wages/salaries and benefits and promotion) [51]. Based on the explanation above, the assessment of IAE motivation in this article includes social solidarity, get an award, want achievement, gain influence, and bargaining position.

3.4.3 Work facilities

Employees use work facilities to carry out tasks and facilitate work implementation. This facility is essential for companies/organizations because it can support employee performance. A study by Rahmana et al. [58] proves that work facilities affect the productivity of sales workers. They will be more productive if they get transportation facility.

Based on the product-moment correlation test, there is a positive and significant influence of the use of work facilities on staff performance in government offices [59,60]. The regression test showed that together there was a positive influence between work environment and work facility on the performance of employees of the Lampung Quarantine Center [61]. In comparison, the case of teleworking shows that workers with a communication facility (comfortable workspace and a good internet network) tend to be more productive. Teleworking is not problematic if the work facilities are adequate [62]. The facilities needed by EWs in carrying out their activities are transportation, namely vehicles used by agricultural EWs in carrying out extension services in the form of motorbikes or cars [63]. Many organizations compensate F2F for some costs, such as transportation or communication costs for cellular cell phones [64].

In contrast, Mamahit et al. [65] found that inadequate facilities for family planning EWs affected the performance of extension activities, especially for non-State Civil Apparatus employees. The facility does not work merely for employees but is also needed to encourage farmers to remain consistent in farming. Based on a study

in Saudi Arabia, Shayaa Al Shayaa et al. [66] stated that there must be incentives and facilities to keep farmers loyal to farming, including facilitating the existence of agricultural EWs who continue to educate farmers.

3.4.4 Workload

The workload is a process or activity that a worker must complete within a certain period [67]. Workload refers to a person's ability to carry out his work, whether physical, cognitive, or limited to receiving the load. The workload consists of physical and mental burdens [68]. The workload of independent EWs is also related to the competency of extension agents which can be categorized into two indicators: administrative and functional capabilities. Pramono et al. [69] broke down these indicators into knowledge of regional potential, knowledge of farmer needs, introduction of information technology, knowledge of effective communication, and knowledge of preparing reports. There was a positive correlation between workload and performance in completing job tasks. If the effect on mental workload is positive, then the impact on task performance is more likely to be positive and vice versa [70].

During the COVID-19 pandemic, it was revealed that workload is one factor affecting the performance of nurses in carrying out their duties [71]. These results align with the study of Pourteimour et al. [72], which mentions that workload is a challenge due to the increasingly complex visits of health EWs to the community in Ethiopia. Other challenges include poor road access, insufficient supervision, inadequate supply of medicines and equipment, and shortage of human resources and budgets [73].

Meanwhile, Nabawi [74] stated that simultaneously the work environment, job satisfaction, and workload significantly affected employee performance in Aceh Tamiang Regency. The relationship between workload and academic performance among university academic staff in Malaysia. The results showed that workload has a negative and noticeable relationship with the performance of academic staff. As for the workload balance, it can cause employees to be more comfortable [75]. Employee perceptions of workload balance significantly affect job satisfaction. Thus, it can be concluded that the workload can affect the role and performance of a worker [76].

The performance of EWs is a reflection of the proportion of role functions that can be carried out following functional (the goals and expectations). Performance is defined as the organization's achievement of the goals set. Performance management is aligning individual goals with organizational goals and ensuring that individuals hold the organization's core values. Effective performance management is considered very important. It helps them align their resources through formal and informal processes and systems to meet their strategic objectives [77].

A theoretical framework of research changers was created to determine the effect of an exogenous variable on endogenous variables (Figure 1). The theoretical framework is then operationalized to formulate a model of measurement equations and a model of structural equations by the rules of SEM. The model of the equation and the theoretical framework of the study are as follows:

Structural model equations:

1. Role of IAE workers model

$$Y_1 = \gamma_0 + \gamma_1 X_1 + \gamma_2 X_2 + \gamma_3 X_3 + \gamma_3 X_3 + \gamma_4 X_4 + \zeta_1 \quad (1)$$

2. IAE worker's performance model

$$Y_2 = \beta_0 + \beta_1 Y_1 + \zeta_2 \quad (2)$$

Y_1 – the role of IAE workers, Y_2 – performance of IAE workers, X_1 – competence of IAE workers, X_2 –work motivation, X_3 – work facilities, X_4 – quantity/workload, γ_0 – constant on model 1, γ_{1-4} – coefficient, ζ – Galat model, β_0 – constant on model 2, and β_1 – coefficient on model 2.

4 Results and discussion

4.1 Conditions and characteristics of IAE

The number of EWs in 2021 varied in status or capacity in every region. The extension is essential in serving local communities in Hawaii, including helping farmers during the pandemic [21]. Farmers identified five needs: (1) community involvement and networking, (2) information and education sharing, (3) funding, (4) research, and (5) sustainability of the local activity.

There is a government limitation in the implementation of agricultural extension, especially in the fulfillment of agricultural EWs; therefore, working together with competent partners is not avoidable. Table 1 shows the distribution of EWs in some regions. The EWs consist of IAE, State Civil Apparatus/Candidates for Civil Servants (SCA/CCS) extension partners, Government Employees with Work Agreements (GEWA), Daily Freelancing Agricultural Extension Assistance Workers (DF-AEAW), and Regency Contract Workers (RCW). The number of IAE Workers among other EWs was the highest. The percentages of the IAE were 59.90, 48.50, and 38.70 of total

Table 1: Number of EWs SCA, CCS, GEWA, DF-AEAW, RCW, and IAE at the research site, 2021

Location/regency	Extension (person)							Amount village	Village/EW
	SCA	CCS	GEWA	DF-AEAW	RCW	IAE	Total		
Lebak[1]	49	24	51	1	34	150	309	340	1.1
Karawang[2]	69	44	—	109	—	331	553	309	0.6
Central Lampung[3]	58	50	86	53	—	156	403	301	0.7
Indonesia[3]	24.931	1.493	10.677	10.677	t.a.	30.212	78.325	83.820	1.1

Source: [1]Lebak Regency Agriculture Office, 2021; [2]Karawang Regency Agriculture Office, 2021; [3]Agricultural Extension Management Information System, 2021.

EWs, and those were in Karawang Regency, West Java Province, Lebak Regency, Banten Province, and Central Lampung Regency, Lampung Province, respectively. This condition shows that IAE is an important part of other EWs.

To overcome the shortage of EWs requires recruiting IAE workers. The task of IAE workers is to assist the Head of Regional Technical Implementation Units and EWs in listing farmer groups that are actively assisting the Ministry of Agriculture programs in 2017. Given the limited number of EWs, the appointment of IAE workers is something urgent and strategic to do. However, some IAE workers are no longer active.

The involvement of IAE is beneficial. Without them, each EW from SCA, DF-AEAW, RCW, and CCS must serve almost two villages, 222 EWs to 309 villages. Meanwhile, with the involvement of IAE, each agricultural extension can serve half of the village, with 553 EWs in 309 villages. To increase farmers' knowledge, such as pest control techniques, they need extension services in the field [78]. To provide effective services and be able to reach farmers effectively, EWs should increase their visits to farming communities. On the other hand, farmers can also increase their knowledge by visiting extension offices. Each agricultural extension service should ideally serve only one agricultural extension work area (one village). However, due to limited resources for EWs, one EW should sometimes cover 2–3 regions (villages).

The results of research by Haryanto et al. [22] in Bogor, Karawang, Majalengka, and Sukabumi regencies (West Java, Indonesia) show that government extension services and private agencies have good support for increasing the capacity of progressive farmers. The strengthening of advanced farmers as progressive farmers is carried out by strengthening their role as self-help EWs in rural areas by increasing individual capacity and independence. The involvement of independent extension agents also happened in other parts of the world in the last decade. Many countries tried to boost public and private roles in intensifying food production, commercializing small farm products, and developing a sustainable agricultural market [79]. IAE is essential in fulfilling voids in disseminating agricultural technology and farmer capacity [35]. The role of IAE Workers has increased since the diminishing of the government's ability to reach all farmers in the agricultural extension services, especially since the 1980s [30].

The F2F extension model approach has improved the dissemination of agricultural and information technology and enabled the inclusion of almost all farm households. This approach controls top-down activities and identifies farmers committed to advancing agriculture together [31]. The F2F agricultural extension services in some countries already existed before the government conducted the agricultural extension services. The increased role of IAE Workers was due to the decreased government role in Ghana from 1983 to 2006 [80]. In addition, the F2F extension model occurs in Latin America, Far East Countries, and Sub-Saharan Africa [81].

As in the Decree of the Minister of Agriculture of the Republic of Indonesia No. 26/Kpts/SM.200/I/07/2020 about the Guidance of IAE Workers and Private Agricultural Instructors, the special requirements for IAE Workers are (1) managing on-farm and/or off-farm businesses in agriculture that are successful and can be imitated by the surrounding community, (2) having leadership spirit, (3) having technical competence in agriculture, and (4) having self-reliance in carrying out the agricultural extension. The results of an empirical study related to "Transformational leadership and Digital Skills in Higher Education Institutes During the COVID-19 Pandemic" show that leadership has a strong positive correlation with transformational leadership and a negative correlation with passive-avoidance leadership. It confirms that higher transformational leadership implies greater employee efficiency and satisfaction [82]. Table 2 shows the education of the IAE workers. Most IAE workers have high education (high school/college graduates). Most also have long farming experience, i.e., more than 16 years.

4.2 Influencing factors on the role of IAE officers in supporting agricultural extension

4.2.1 Validity test

Validity comes from the word validity meaning the extent to which the accuracy and precision of a measuring instrument perform its function [83]. In addition, validity is a measurement showing that the variables being measured are the variables the researcher intends to study [84]. The study results can be assumed valid if the data collected are real data indicating the variables being studied [85]. Research instruments would be highly valid if the instrument can measure the intended measurement in the study. Item validity is indicated by a correlation between an item and the total item (total score); the calculation is carried out by correlating the item score with the total item score. Using more than one factor means testing the item's validity by correlating the item score with the factor score and then proceeding to correlate the item score with the total factor score (the sum of several factors).

The correlation coefficient resulting from the calculation is used to validate such item whether that item is good to use or not. To test the significance of the correlation, it will use a 0.05 level of significance. To find the item's validity, R values are used and compared to the R table with df = $N - 2$ and a p-value of 0.05. This study's total number of respondents was 161, so the R table equals 0.1508. The item is considered valid if the R-value is greater than 0.1508. Table 3 depicts the validity test results.

Table 3: The results of the validity test on the variable

Variable	Pearson correlation	*R* table	Information
Technical ability	0.835	0.1508	Valid
Managerial ability	0.8249	0.1508	Valid
Farming experience	0.4683	0.1508	Valid
IAE education	0.4584	0.1508	Valid
Social solidarity	0.8368	0.1508	Valid
Get award	0.7063	0.1508	Valid
Achievement desire	0.8359	0.1508	Valid
Gaining influence	0.7889	0.1508	Valid
Bargaining position	0.7653	0.1508	Valid
Transport	0.9666	0.1508	Valid
Communication	0.9072	0.1508	Valid
Administration	0.8954	0.1508	Valid
Function	0.8627	0.1508	Valid
Identification of problems and needs	0.869	0.1508	Valid
Facilitator	0.8577	0.1508	Valid
Technology transfer	0.9242	0.1508	Valid
Behavior	0.8697	0.1508	Valid
Solution	0.8914	0.1508	Valid

4.2.2 Reliability test

The reliability test measures the consistency of the questionnaire, meaning that the research tool can be used in other similar research and result in the same responses. The reliability test tool commonly used is Cronbach's alpha, which assesses an instrument's reliability with a Likert scale.

The reliability test can be carried out simultaneously on all items or statement items in the research questionnaire [86]. The basis for decision-making in the reliability test is as follows: (1) if Cronbach's alpha value is >0.60, then the questionnaire is declared reliable or consistent and (2) if Cronbach's alpha value is <0.60, then the questionnaire is declared unreliable or inconsistent. The reliability test results on the variables show that the variables used are reliable, as shown in Table 4.

Table 2: Characteristics of IAE workers at the research site, 2021

Variable	Category	Lebak Regency (%)	Karawang Regency (%)	Lampung Tengah Regency (%)	Total (%)
Education					
Low	Did not finish elementary school – finished elementary school	10.8	8.3	3.4	6.2
Moderate	Junior high school graduate	21.6	25.0	8.0	14.9
High	High school graduate/college	67.6	66.7	88.6	78.9
Farming experience (years)					
Low	<10	18.9	8.3	10.2	11.8
Moderate	10–15	29.7	27.8	29.5	29.2
High	≥16	51.4	63.9	60.2	59.0

Table 4: The results of the reliability test on the variable

Variable code	Item	Item test corr	Inter-item cov.	Cronbach's alpha	Result
x1.1	Technical ability	0.6664	0.364655	0.8942	Reliable
x1.2	Managerial ability	0.7104	0.354314	0.8927	Reliable
x1.3	Farming experience	0.2642	0.399478	0.9070	Reliable
x1.4	IAE education	0.2705	0.401981	0.9039	Reliable
x2.1	Social solidarity	0.7319	0.359555	0.8920	Reliable
x2.2	Get award	0.6367	0.373601	0.8954	Reliable
x2.3	Achievement desire	0.6969	0.358060	0.8931	Reliable
x2.4	Gaining influence	0.7109	0.354640	0.8926	Reliable
x2.5	Bargaining position	0.6896	0.358990	0.8934	Reliable
x3.1	Transport	0.2285	0.405687	0.9041	Reliable
x3.2	Communication	0.2164	0.408979	0.9035	Reliable
x4.1	Administration	0.5224	0.371321	0.9004	Reliable
x4.2	Function	0.7378	0.355441	0.8916	Reliable
y1.1	Identification of problems and needs	0.7875	0.345986	0.8895	Reliable
y1.2	Facilitator	0.7432	0.355652	0.8915	Reliable
y1.3	Technology transfer	0.8154	0.342305	0.8883	Reliable
y2.1	Behavior	0.7417	0.353568	0.8914	Reliable
y2.2	Solution	0.5110	0.372899	0.9007	Reliable

4.3 SEM

The influence or relationship between variables can produce a model that can be used to formulate the concept of improving IAE performance. The intended structural model explains the prediction or hypothesis of the relationship between the causal variables and the effect variables. A total of 18 indicators derived from four exogenous variables and two endogenous variables formed a hypothetical model.

A SEM analysis was performed using the STATA 15 software to test the model. SEM is a model capable of simultaneously testing complicated correlations among variables. According to Ferdinand [87], SEM model is suitable since SEM can estimate unknown coefficients of a structured linear model and accommodate latent variables, error measurement, interdependence, and reciprocal and simultaneous relationship. The model testing was aimed to (1) test the overall suitability of the model and (2) individually test the significance of the results of the estimation of model parameters. The first test is closely related to generalization, namely the extent to which the estimation results of model parameters can be applied to the population. Meanwhile, the second test is related to testing the proposed hypothesis.

The goodness of fit test (GFT) tests the model's suitability. The two main measures of GFT are the calculated p-value and the root mean square error of approximation (RMSEA) value. Based on the two GFT measures, the model is said to fit with the data if the model can produce a p-statistic value of greater than 0.05 and an RMSEA value of smaller than 0.08. The estimated parameters are presented in Figure 2.

The coefficients and Z-statistic of the effect of exogenous variables on endogenous variables Y_1 and Y_2 are shown in Tables 5 and 6.

The competence, work motivation, and workload of IAE variables directly and significantly affected the performance of IAE with the values of 0.226, 0.483, and 0.687, respectively. Competence is one of the components that affect the performance of IAE. As agricultural EWs who are also farmers, technical competence is the main requirement for IAE workers. In addition, one competency affects the instructor's performance, namely social competence. Social competence is important for EWs because it is directly related to their duties in interacting with farmers [88]. Strategies that can be done to improve the social competence of EWs are by increasing social knowledge and skills. The results of an empirical study show that the quality of EWs and soft skills positively affect farmer productivity [89]. Therefore, this study recommends adopting participatory agricultural extension methods, such as improving the soft-skill competence of farmers, to facilitate the dissemination and exchange of information between farmers and agricultural EWs. In addition, efforts should be focused on increasing the motivation of farmers to improve their technical skills and choosing extension technologies that can increase the economic benefits of farming.

Another requirement in observing a model is that the loading factor value (standardized regression weights)

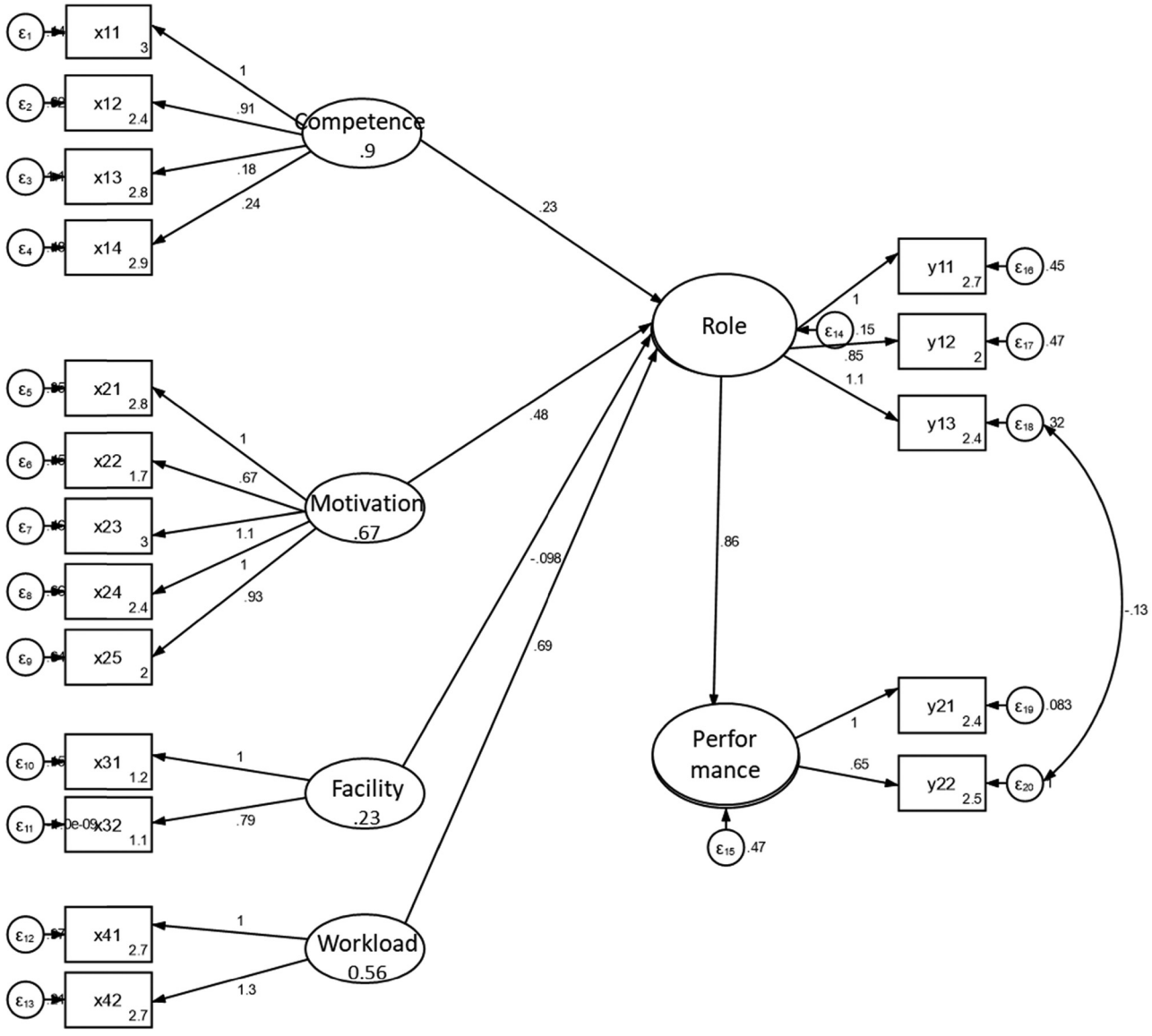

Figure 2: Estimated parameters of model 1.

should not exceed 1. Loading factor >1 indicates that there is a model error. Errors can be caused by the model specification, the presence of outlier data, only using two indicators for latent variables, and the existence of a population correlation close to 0 or 1, which causes under-identification and bad starting values in the maximum likelihood estimation. Figure 2 shows several loading factors whose values are more than 1, namely X_2 to X_{23}, X_4 to

Table 5: Coefficients and *Z*-statistic the effect of exogenous variables on endogenous variables Y_1

No.	Variable relationship		Direct influence	*Z*-statistic	GFI	Significance
	Exogenous	Endogenous				
1.	Competence of IAE	Role of IAE workers	0.226	2.76	0.809	Yes
2.	Work motivation of IAE workers	Role of IAE workers	0.483	4.64	0.809	Yes
3.	Work facilities of IAE workers	Role of IAE workers	−0.098	−0.86	0.809	No
4.	The workload of IAE workers	Role of IAE workers	0.687	5.81	0.809	Yes

Table 6: Coefficients and *Z*-statistic the effect of exogenous variables on endogenous variables Y_2

No.	Variable relationship		Total coefficient of influence		*Z*-statistic
	Endogenous	Endogenous	Direct	Indirect	
1.	Competence of IAE workers	Performance of IAE workers	—	0.226	2.76
2.	Work motivation of IAE workers	Performance of IAE workers	—	0.483	4.64
3.	The workload of IAE workers	Performance of IAE workers	—	0.687	5.81
4.	Role of IAE workers	Performance of IAE workers	0.856	—	10.45

X_{42}, and Y_1 to Y_{13}. The estimation of model 2 is shown in Figure 3.

After reducing the variables X_2 to X_{23}, X_4 to X_{42}, and Y_1 to Y_{13}, it turns out that there are still variables that have a loading factor value of >1, namely the X_1 variable (competence) to the X_{12} variable. Thus, reducing the variable X_{12} to X_1 must be carried out. The estimation of model 3 parameters is presented in Figure 4.

Model 3 has no loading factor >1, so the model is relevant. Thus, the designed model 3 can be used to make generalizations about the phenomenon under study. The results of the model 3 suitability test are listed in Table 7.

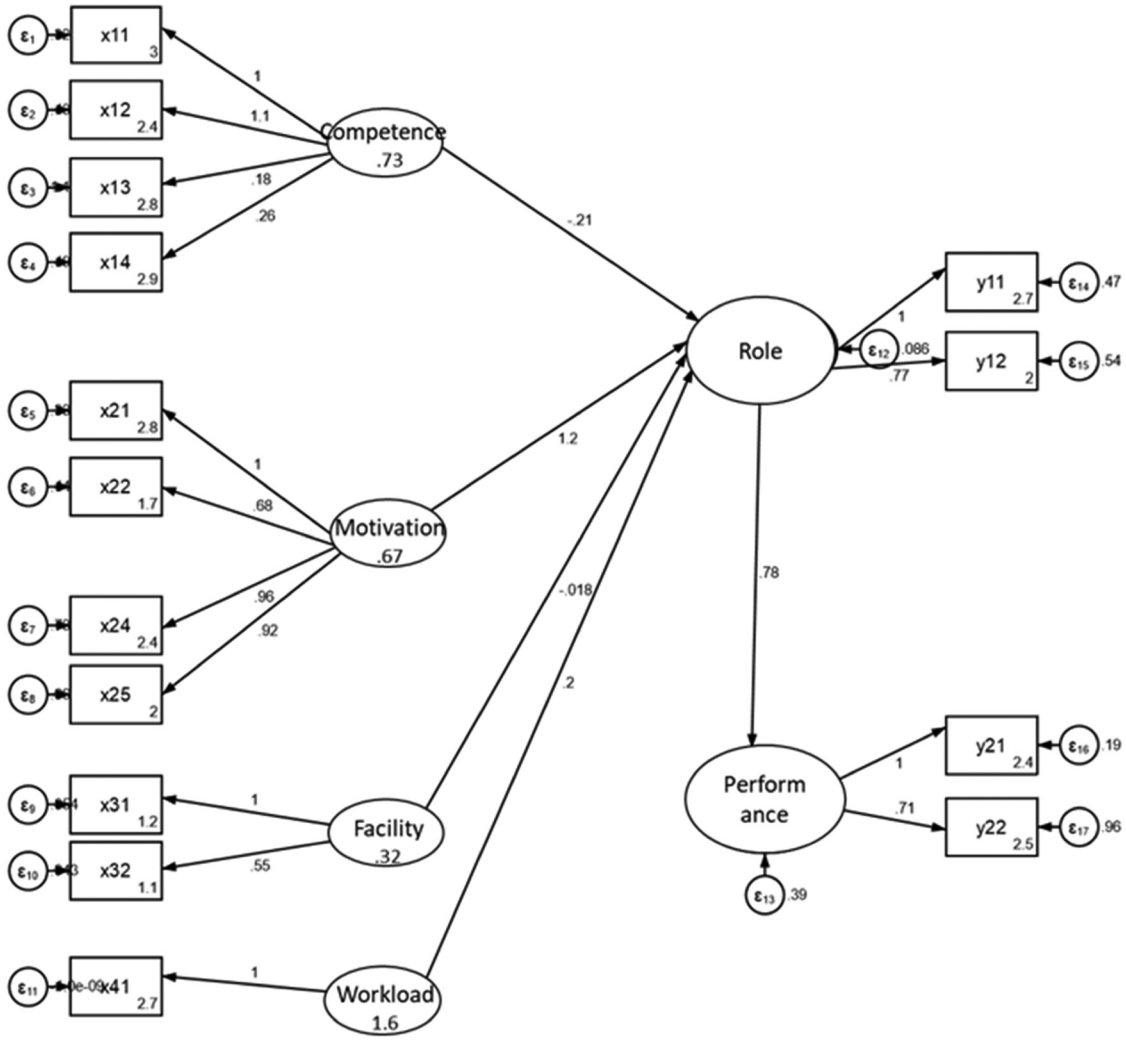

Figure 3: Estimated parameters of model 2.

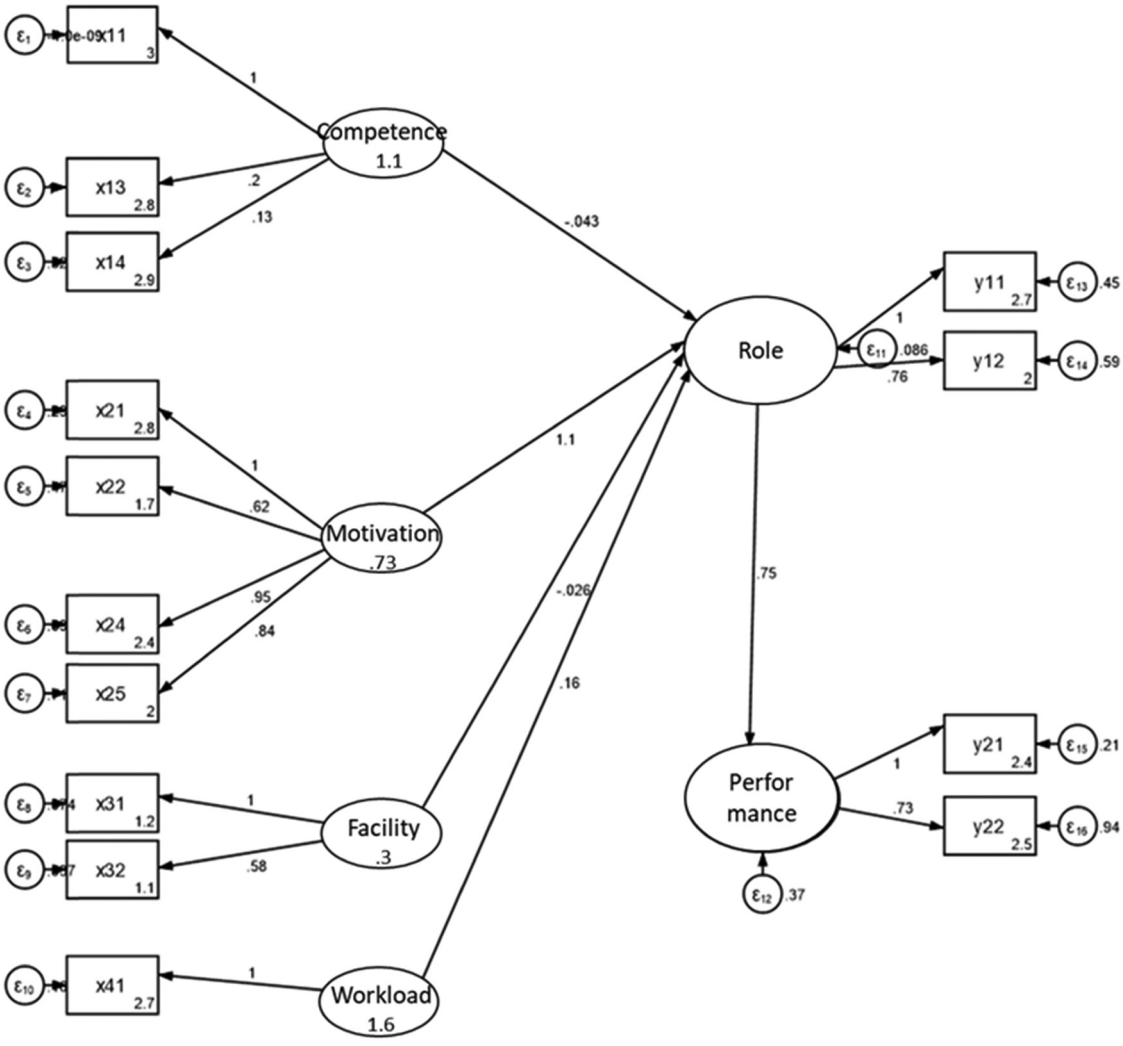

Figure 4: Estimated parameters of model 3.

Table 7: The results of the suitability test for the third model

No.	Measures of goodness of fit test	Statistic
1.	Chi-square	366.197
2.	Free degrees	146
3.	RMSEA	0.130
4.	CFI	0.797

Table 8 shows the relationship between exogenous and endogenous variables, whether direct or indirect. The direct effect of the IAE work motivation variable on the role of IAE (1.05) was highly significant. The IAE workload also significantly directly affects the role of IAE, with a value of 0.16. Meanwhile, the work motivation and workload of IAE significantly have an indirect effect on the performance of IAE with values 1.05 and 0.16, respectively. This finding was consistent with the results of Nataliningsih and Sugiyanto [51], which examined the effects of competence, motivation, and work environment on the performance of agricultural extension.

Moreover, Koesmarjaya and Fatchiya [90] also found that the work motivation and creative-innovative character of IAE workers influenced their performance of IAE workers. In addition, the influencing factors that affected the performance of IAE were variables of institutional support, such as the support of the agricultural office and the support of companies or banks.

Research by Meresa [20] also supports the finding of this study that the role of agricultural extension in technology socialization to farmer groups in Walayta Sodo Zuria Regency, Ethiopia, could motivate farmers to adopt new technology that was previously carried out in traditional farming activities. However, the impact of the

Table 8: The variable relationship among variables

No.	Variable relationship		Total coefficient of influence		*Z*-statistic
	Exogenous	Endogenous	Direct	Indirect	
1.	Work motivation of IAE workers (X_2)	Role of IAE workers	1.05	—	8.00
2.	Workload of IAE workers (X_4)	Role of IAE workers	0.16	—	2.60
3.	Work motivation of IAE workers (X_2)	Performance of IAE workers	—	1.05	8.00
4.	Workload of IAE workers (X_4)	Performance of IAE workers	—	0.16	2.60
5.	Role of IAE (Y_1) workers	Performance of IAE workers	0.75	—	9.08

transformation strategy intervention was constrained by inadequate funding and logistics, insufficient field staff, and non-participatory technology transfer. High-tech protected agriculture, biotechnology, advanced irrigation systems, and nanotechnology must be developed to ensure the success and sustainability of agricultural production. This technology can increase agricultural productivity and farm profitability [91].

The analysis results indicate that increasing IAE workers' roles requires attention to motivational factors and workload. Motivation can be said as a force that can move, activate, or encourage someone to take action. The sources of motivation could come from IAE workers themselves (intrinsic motivation) or from outside (extrinsic motivation), as a result study by Musabyimana et al. [92].

The F2F extension approach is an alternative to overcome inadequate access to agricultural extension services. Extension from farmers focuses on encouraging farmer commitment and motivation to the agricultural business, availability of financial resources needed for all production, willingness to reinvest, and access to agricultural land for future expansion. Government agricultural extensions encourage group formation to address marketing challenges, diversification, and good agricultural practices. It is necessary to have multi-extension approaches to ensure farmers have access to the necessary information [93].

Extension from F2F has an impact on increasing the coverage of extension areas, and the dissemination of agricultural information and technology can reach most of the farming households, so that they can be served, encourage commitment and motivation toward farming activities, assist technical farming, and maintain local wisdom [19,31,37]. The F2F model can reduce the operational costs of extension services and the workload of government EWs, as in a large country where the ratio of EWs to farmers is very large [27].

IAE workers' intrinsic motivation can be increased through training activities. In contrast, extrinsic motivation can be increased through incentives and formal recognition from the local government in the form of a certificate/decree from the head of the local technical service. To increase motivation, the increase in the role of IAE workers should be relatively larger than the increase in the quantity/workload of IAE workers.

The results of the study by Americo et al. [18] showed that the characteristics of the instructor, competence, motivation, and independence significantly affected agricultural extension. Such characteristics indirectly affect the performance of pig farmers. The performance of agricultural EWs directly affects the performance of farmers. Agricultural extension competence and performance affect the performance of pig farmers in Timor-Leste.

Likewise, a result of research in Bogor Regency, Indonesia, showed that farmer participation in extension activities was high (77.4%), and most had agribusiness sustainability potential (87.1%). The factors influencing the sustainability of farmers' agribusiness are training, apprenticeship, perception, motivation, extension activities, and farmer participation in extension activities [94]. Adopting agricultural technology is very important for small-scale farmers in Sub-Saharan Africa. F2F training can increase technology adoption and productivity. F2F extension programs for small-scale farmers in Sub-Saharan Africa are considered adequate and potential through conventional farmer training approaches with relatively low costs [95].

5 Conclusion

Profile of IAE is a companion and conveys information technology, government programs, and market information. In general, IAE has good competence in the technical skills of agricultural cultivation. However, they still need to improve in mastery related to farming management, post-harvest handling, processing management, and marketing of agricultural products. IAE workers are generally active in some organizations such as farmer

groups, farmer group associations, Community Food Distribution Institutions, cooperatives, and Farmer-Owned Enterprises. They are local farmer leaders who work directly on agricultural land and also as a business entity. The typology of IAE is divided into (1) IAE as a community mover; (2) assisting farmers in technical cultivation of agriculture; (3) becoming a reformer in information, knowledge, and farming practices; and (4) becoming a business actor who has access to information and markets.

In carrying out their extension functions, IAE performs well in conveying information on new technologies to farmers, participatory learning processes for farmers, developing farmer institutions, and coordinating meetings and technical meetings with farmers and business actors. On the other hand, the performance of the implementation of IAE is low in planning agricultural extension activities, carrying out agricultural extension activities according to the work plan, and compiling reports on agricultural extension activities. The problem is that administrative activities and program plannings are the duties and functions of government agricultural EWs, so IAE feels that no one is obligated to carry out these activities.

The study's results indicate that the factors that directly influence the role of IAE workers are work motivation and quantity or workload. The role of IAE has a direct effect on its performance. To achieve the ideal role of IAE in the future, more conducive working conditions are needed, improved work management, horizontal and vertical relations, and regulations that position IAE workers as an important part of agricultural extension activities.

In addition, there is a need for adequate support from the Government (Central and Regional) in infrastructure and other facilities for IAE workers who act as facilitators and gatekeepers. Such support can be in the form of (1) the existence of regulations and policies that guarantee the facilities and infrastructure to support extension activities within the scope of the Agricultural Extension Center; (2) the existence of a Regional Regulation that regulates the allocation of regional budgets in the form of routine incentives as transportation costs to facilitate the activities of IAE workers in carrying out their duties; and (3) the existence of training and technical guidance to increase the capacity of IAE workers to be more motivated in carrying out extension services to farmers.

Some policy recommendations are suggested, i.e., (1) support from the Government and Regional Government in facilitating IAE to enhance their roles as facilitators and gatekeepers; (2) the existence of government regulations and policies that ensure the availability of facilities and infrastructure to support agricultural extension activities; (3) the existence of a Regional Government Regulation that regulates the allocation of regional budgets in the form of incentives for IAE to carry out their duties and functions; and (4) the existence of education and training, as well as technical guidance to increase the capacity of IAE, both in terms of technical skills and managerial capabilities.

Acknowledgments: The author would like to thank the Director of the Indonesian Center for Agricultural Socio-Economic and Policy Studies (ICASEPS), who supported and financed this research. Special gratitude to the Agricultural Services Officer in Karawang, Lebak, and East Lampung Districts, also to all leaders of farmer groups and EWs for their willingness to assist during the survey.

Funding information: The work was financed with sources of Indonesian Center for Agricultural Socio-Economic and Policy Studies.

Author contributions: All authors have an equal contribution as the main contributors to this manuscript.

Conflict of interest: The authors state no conflict of interest.

Data availability statement: The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

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