

THE ROLE OF AGRICULTURAL EXTENSION WORKERS AND THEIR PERFORMANCE IN THE DIGITAL ERA: A CASE STUDY OF GAPOKTAN BEJI MAKMUR, JUNREJO DISTRICT, BATU CITY

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Abstract. Agricultural extension workers play a strategic role in the development of the agricultural sector, serving as educators, facilitators, and advisors to farmers. This study aims to evaluate the level of farmer satisfaction with the performance of agricultural extension workers in Kelompok Tani Beji Makmur, located in Beji Village, Junrejo District, Batu City. The study uses a qualitative descriptive approach with a population of 269 farmers. A total of 73 respondents were selected randomly using a proportional sampling method. The aspects examined include the performance of extension workers and the level of farmer satisfaction, both measured using a Likert-scale questionnaire. The collected data were analyzed using the Importance Performance Analysis (IPA) method. The results show that the majority of respondents were dissatisfied (42.5%) or very dissatisfied (16.4%) with the performance of the extension workers. Meanwhile, 23.3% of respondents gave a neutral response, while only 13.7% were satisfied and 4.1% were very satisfied. The elements requiring improvement were identified in Quadrant I of the IPA matrix, particularly indicators number 2, 6, and 9. This study concludes that the performance of agricultural extension workers at Kelompok Tani Beji Makmur has not yet been optimal. Therefore, continuous improvement in the quality of extension services is needed to support the productivity and welfare of farmers.

Keywords: Digital; Extension Worker; Satisfaction; Technological

INTRODUCTION

Agricultural extension workers play a strategic role as key informants who connect farmers with up-to-date agricultural innovations to enhance productivity and farmer welfare. According to Ariana et al., (2021), through training, technical guidance, and outreach activities, extension workers help farmers adopt simple yet sustainable farming practices, which ultimately lead to increased crop yields and income. Therefore, agricultural extension workers can be regarded as a central pillar in advancing the agricultural sector and improving the quality of life for farming communities.

The core responsibilities of extension workers include assisting and mentoring farmer groups to become more skilled and effective in managing their agricultural activities. Collaboration between farmers and extension personnel is essential to support sustainable agricultural development. Extension workers act not only as facilitators but also as mentors, organizers, and motivators (Lini et al., 2018). Numerous studies have emphasized their contribution to increasing productivity and reinforcing farmer group institutions (Shibli et al., 2021; Sudarmansyah et al., 2021; Wulandari et al., 2021; Faisal, 2020).

Technological advancements particularly the rapid expansion of the internet and digital connectivity have transformed various sectors, including agriculture. According to Kotler, (2019), the acceleration of modern times has drastically shifted existing power structures. The internet, with its inherent connectivity and transparency, is a major driving force behind these changes. Similarly, Savitri, (2019), emphasizes that the internet now functions not only as a medium for information sharing but also as a connector between individuals, businesses, machines, and logistics in an integrated system known as the Internet of Things (IoT).

The development of information and communication technology (ICT) offers significant opportunities for extension workers to access and disseminate agricultural information efficiently using both offline and online channels (Koten et al., 2013). In the digital era, extension workers are

increasingly expected to adopt digital tools, including mobile applications and social media platforms, to support extension activities. However, innovation gaps persist, as extension workers often face challenges in assisting farmers to resolve agricultural problems using digital resources (Sumardjo, Baga & Mulyandar, 2010), extension workers often face innovation gaps when assisting farmers in solving agricultural problems.

As technology evolves, both farmers and extension workers are expected to understand and utilize various media to meet their needs in the digital era (Oktarina et al., 2019). Although digital platforms rapidly provide information, some extension workers still lack trust in the reliability of internet-based sources (Eksanika & Riyanto, 2017). While the internet can assist extension workers in seeking agricultural information, its actual use among them remains relatively low (Elian et al., 2014). Erlinnawati & Purwanto, (2024), even assert that information technology can deliver extension services across different agricultural sectors and plays a critical role in agricultural development, resulting in various transformative changes.

Through extension services, farmers are expected to identify and address their problems, leading to improved outcomes and the sustainability of their agricultural businesses (Mutolib et al., 2023). According to Nurmayasari et al., (2020), one way to assess the effectiveness of extension workers is by evaluating their performance in the field. Research by Sutrisno, (2018), shows that the performance of agricultural extension workers in empowering farmers is still at a "moderate" level, or in other words, has not yet reached its full potential. This indicates the presence of challenges within the extension process itself. These issues may stem from various factors, such as limited resource support, inadequate facilities, or insufficient training for extension workers.

Despite the growing relevance of digital technologies in agriculture, previous studies have rarely examined extension workers' performance within the specific context of the digital era, particularly from the perspective of farmer satisfaction. Most existing research focuses on traditional extension roles or general ICT adoption, leaving a gap regarding how digital tools influence service effectiveness at the farmer level. This study addresses that gap by evaluating farmers' satisfaction with the performance of agricultural extension workers in Gapoktan Beji Makmur, with particular attention to the challenges and opportunities arising from the digital transformation of extension services. The findings are expected to provide insights into the current effectiveness of extension services, identify obstacles in the adoption of digital technologies, and offer recommendations to enhance extension worker performance in the future.

METHODS

2.1. Research Methods

This study employs a descriptive qualitative method combined with quantitative analytical techniques to produce a more comprehensive understanding of farmer satisfaction toward extension workers' performance. According to Sugiyono, (2022), qualitative methods are used to explore natural conditions of research subjects, supported by triangulated data collection, and analyzed inductively to interpret meaning rather than generalize findings.

In this study, the qualitative component was used to explore contextual information related to extension activities, farmers' perceptions, and digital technology adoption. These qualitative insights served as a basis for formulating variables and indicators measured quantitatively using the Importance Performance Analysis (IPA) method. Thus, the qualitative and quantitative approaches were integrated sequentially: qualitative exploration informed the development of measurable indicators, while IPA quantitatively evaluated farmers' satisfaction toward those indicators. This integration ensures methodological consistency by aligning qualitative findings with the quantitative measurement framework.

2.2. Place and Time of Research

This research was conducted from February 3 to March 15, 2025, in Beji Village, Junrejo District, Batu City. The location was selected because Gapoktan Beji Makmur has a well-managed organizational structure, facilitating data collection related to extension activities, technology usage, and levels of farmer satisfaction. The strategic location also enabled the researcher to interact directly with farmers and extension workers, which supported both qualitative exploration and quantitative data collection.

2.3. Population and Sample

According to Suharsimmi, (2020), a population refers to the entirety of subjects in a study. In other words, a population consists of individuals who share similar characteristics, even if the degree of similarity is minimal, or in simpler terms, all individuals who will serve as the objects of research. Meanwhile, Sugiyono, (2015) defines a population as a generalization comprising objects or subjects that possess certain qualities and characteristics determined by the researcher to be studied and from which conclusions are drawn. Based on these definitions, the researcher determined the population of this study to be the members of farmer groups in Beji Village, Junrejo District, Batu City. The sample was selected from this population using the proportional random sampling technique. A total of 73 samples were drawn from 11 farmer groups, who served as the study's respondents.

2.4. Data Analysis Methods

Data analysis in this research was conducted by integrating qualitative interpretation and quantitative evaluation. First, qualitative data obtained through observations, informal interviews, and field documentation were used to identify key aspects of extension service performance and farmer expectations. These qualitative findings guided the development of indicators measured using a Likert scale. The Likert scale was used to measure farmers' attitudes and satisfaction levels toward each performance indicator. Table 1 presents the scoring categories.

Table 1. Likert Scale Assessment

No	Information	Score
1	Not Satisfied	1
2	Less Satisfied	2
3	Quite Satisfied	3
4	Satisfied	4
5	Very Satisfied	5

The quantitative analysis employed the Importance Performance Analysis (IPA) method. According to Supranto, (2011), IPA is used to evaluate satisfaction by comparing the perceived performance level with the level of importance placed on each indicator. The IPA framework in this study provides a quantitative mapping of which aspects of extension performance meet farmers' expectations and which require improvement. To maintain methodological consistency, the qualitative findings were used not only in designing the indicators but also in interpreting the IPA results. Thus, the final analysis presents a combined interpretation: the IPA illustrates numerical priorities, while qualitative insights explain the underlying reasons for high or low satisfaction scores.

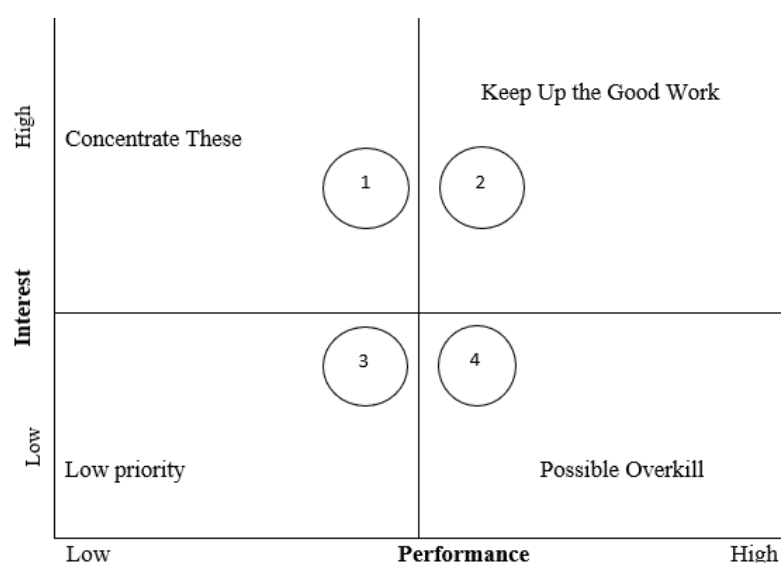


Figure 1. Importance-Performance Map

RESULTS AND DISCUSSION

3.1. Respondent Characteristics

Respondent Characteristics Based on Gender

Gender is a biological characteristic that distinguishes between men and women. In the context of participation in the agricultural sector, this difference can affect the level of involvement and roles in agricultural activities.

Table 2. Distribution of Respondents Based on Gender

No	Gender	Number of people	Percentage (%)
1	Male	52	71.23
2	Female	21	28.77
	Total	73	100

Source: Processed Data (2025)

Based on Table 2, it can be seen that the majority of respondents are male, totaling 52 people (71.23%), while the female respondent number 21 people (28.77%). This composition reflects the dominance of men in agricultural activities at the research location. This dominance can be linked to the characteristics of agricultural work, which often require physical strength, high mobility, and resilience to challenging field conditions. In general, men tend to be better able to meet these demands compared to women. Therefore, in terms of quantity and functional capability, men make a greater contribution to the agricultural sector, both in direct involvement and in work effectiveness in the field.

Respondent Characteristics Based on Age Group

The age characteristics of the respondents in the study conducted in Beji Village, Junrejo District, Batu City, are presented in Table 3 below.

Table 3. Distribution of Respondents Based on Age Group

No	Respondent Age	Number of people	Percentage (%)
1	30-37	6	8,11
2	38-45	19	25,68
3	46-53	18	24,32
4	54-61	17	22,97
5	62-69	12	16,22
6	70-77	2	2,70
	Total	73	100

Source: Processed Data (2025)

Based on Table 3, the age group with the highest percentage is respondents aged 38–45 years, totaling 19 people (25.68%). Meanwhile, the age group with the lowest percentage is respondents aged 70–77 years, with only 2 people (2.70%). These findings indicate that the majority of farmers are in their productive age, which generally corresponds to optimal physical and cognitive capacities for carrying out farming activities. The productive age group tends to have a better ability to receive, understand, and adopt innovations and new technologies in agriculture. Conversely, as age increases, a person's ability to absorb information and technology tends to decline, which can affect the effectiveness of implementing technological updates in agricultural practices.

Table 4. Distribution of Respondents Based on Education

No	Education	Number of people	Percentage (%)
1	Elementary school	46	55.42
2	Junior high school	15	30.12
3	Senior high school	11	13.25
4	Bachelor degree	1	1.20
	Total	73	100

Source: Processed Data (2025)

Respondent Characteristics Based on Education

Education level is one of the important factors that influences farmers' ability to receive and apply information, particularly regarding agricultural technology and innovations. The distribution of respondents based on education level in Beji Village, Junrejo District, Batu City, is presented in Table 4. Majority of respondents have an elementary school education level, totaling 46 people (55.42%). Meanwhile, the education level with the lowest percentage is a bachelor's degree, represented by only 1 person (1.20%). Although most respondents have basic education, the distribution of respondents with junior high school and senior high school education levels is also quite significant, at 30.12% and 13.25% respectively. The presence of one respondent with a higher education background is expected to contribute to broadening perspectives and encouraging the adoption of technology and improvements in farming productivity in Beji Village. A higher level of education generally correlates with better analytical skills and openness to change, which are crucial in the context of modern agricultural development.

Respondent Characteristics Based on Farming Experience

Farming experience is an important indicator for assessing farmers' ability to manage land, make decisions, and adopt agricultural technologies. The distribution of respondents based on their length of farming experience in Beji Village, Junrejo District, Batu City, is presented in Table 5 below.

Table 5. Distribution of Respondents Based on Farming Experience

No	Length of Farming (Years)	Number of people	Percentage (%)
1	5-12	18	24.66
2	13-20	23	31.51
3	21-28	4	5.48
4	29-36	15	20.55
5	37-44	10	13.70
6	45-52	1	1.37
Total		73	100

Source: Processed Data (2025)

Based on Table 5, most respondents have 13–20 years of farming experience, totaling 23 people (31.51%). Meanwhile, the fewest respondents are in the 45–52 years of experience group, with only one person (1.37%). These findings indicate that the majority of farmers fall within a relatively long range of work experience, which has the potential to positively impact their ability to manage farming operations efficiently. In general, the longer a farmer's experience, the better their understanding and skills in running farming activities, including adapting to market dynamics and implementing modern agricultural technologies.

Table 6. Distribution of Respondents Based on Land Area

No	Land Area (m ²)	Number of people	Percentage (%)
1	100-1.000	20	27.40
2	1.000-2.000	32	43.83
3	2.000-3.000	13	17.81
4	3.000-4.000	3	4.11
5	4.000-5.000	3	4.11
Total		73	100

Source: Processed Data (2025)

Respondent Characteristics Based on Land Area

The distribution of respondents based on the size of land owned in Beji Village, Junrejo District, Batu City, is presented in Table 6. Land size is one of the important indicators that can affect production capacity, business scale, and the level of technology adoption in agricultural activities. Based on the group of respondents owning land sized 1,000–2,000 m² is the largest, totaling 32 people (43.83%). Meanwhile, respondents with land sized 3,000–4,000 m² and 4,000–5,000 m² each number only 3 people (4.11%), making them the groups with the lowest proportions. This distribution indicates that the majority of farmers in the research location fall into the category of small-scale farmers with land areas of less than 2,000 m². This condition has important implications for strategies to improve agricultural

productivity, as limited land size can affect farmers' efficiency, income, and ability to invest in agricultural technology and innovation.

3.2. Level of Interest, Level of Satisfaction and Level of Extension Performance

Level of Farmers' Interest in Agricultural Extension Workers

Importance is defined as a form of farmers' responsiveness to services, information, innovations, and community empowerment programs delivered through extension activities. This concept also reflects the main function of agricultural extension activities themselves (Prayoga et al., 2019). The level of farmers perceived importance toward agricultural extension agents in Beji Village is presented in Table 7 below.

Table 7. Level of Farmer Interest in Extension

No	Class Interval	Number of people	Information	Percentage (%)
1	69-73	12	Not Important	16.4
2	74-78	25	Less Important	34.2
3	79-83	23	Quite Important	31.5
4	84-88	3	Important	4.1
5	89-93	10	Very Important	13.7
Total		73		100

Source: Processed Data (2025)

Based on Table 7, the majority of respondents (34.20%) rated the presence of extension agents as less important, followed by 31.50% of respondents who considered them quite important. Conversely, only 4.10% of respondents perceived extension agents as important, and 13.70% considered them very important. Meanwhile, 16.40% of respondents even categorized extension agents as not important. Overall, the level of rejection toward the presence of extension agents (combining the "not important" and "less important" categories) reached 50.6%, indicating that more than half of the respondents have a negative view or show a lack of support for the role of extension agents in agricultural activities. These findings are consistent with the study by Adawiyah et al., (2018) in East Java, which showed that most farmers rely more on farmer groups, the internet, and personal experience in running their farming businesses. This is further supported by the study by A.F & Setyawan, (2022), which emphasized that in the digital era, extension agents who lack information technology skills tend to lose relevance in the eyes of modern farmers.

Table 8. Farmer Satisfaction Level towards Agricultural Extension Workers

No	Class Interval	Number of people	Information	Percentage (%)
1	49-53	12	Not Satisfied	16.4
2	54-58	31	Less Satisfied	42.5
3	59-63	17	Quite Satisfied	23.3
4	64-68	10	Satisfied	13.7
5	69-73	3	Very Satisfied	4.1
Total		73		100

Source: Processed Data (2025)

Level of Farmer Satisfaction with the Performance of Agricultural Extension Workers

The level of farmers' satisfaction with extension agents in Beji Village is presented in Table 8. Satisfaction is an important aspect in evaluating the effectiveness of extension services. Satisfaction is a feeling of pleasure or disappointment resulting from comparing expectations with the actual performance of a product or service. Ilahi (2022) states that satisfaction or dissatisfaction is a consumer's response to evaluating the discrepancy between expectations and reality. Satisfaction is an affective response based on consumption experience, reflected in an evaluation of the alignment between expectations and actual outcomes. From these various definitions, it can be concluded that farmers' satisfaction is a function of the difference between their initial expectations and their perceptions of the actual performance of agricultural extension agents after the interaction process.

Based on the data in Table 8, the majority of respondents stated that they were less satisfied (42.5%) with the performance of the agricultural extension agents. A total of 16.4% reported being

dissatisfied, while only 13.7% felt satisfied and 4.1% stated they were very satisfied. Meanwhile, 23.3% of respondents fell into the “fairly satisfied” category, indicating a neutral stance or a lack of a strong opinion. These findings indicate that more than half of the respondents tend to be dissatisfied with the extension services they received. This aligns with the statement by Darmawati & Ningrum, (2020) who noted that farming success is more often assessed based on production results and market access, rather than extension services alone. Research by Triman Tapi et al., (2024), showed that although extension agents play a strategic role in technology transfer, their presence does not always correlate with farmers’ satisfaction levels, especially in areas with independent and digital information access. Therefore, to improve farmers’ satisfaction, it is necessary to enhance the quality of extension services, including extension agents’ ability to utilize information technology, provide practical solutions, and better understand local farmers’ needs.

3.3 Performance Level of Agricultural Extension Workers

The performance of agricultural extension agents can be reviewed from two main perspectives. First, performance is influenced by the individual characteristics of the extension agents, such as knowledge, skills, motivation, and attitude. These characteristics play an important role in determining the behavior and effectiveness of extension agents in carrying out their duties. Second, performance is also the result of situational factors surrounding the extension system in each region, such as institutional structure, staffing, program planning, and funding (Lubis Rafiqah Amanda, 2016). The level of farmers’ perceptions of the performance of extension agents in Beji Village, Junrejo District, Batu City, is presented in Table 9 below.

Table 9. Performance Level of Agricultural Extension Workers

No	Class Interval	Number of people	Information	Percentage (%)
1	49-53	11	Very bad	15,1
2	54-58	35	Not good	47,9
3	59-63	14	Quite good	19,2
4	64-68	10	Good	13,7
5	69-73	3	Very good	4,1
	Total	73		100

Source: Processed Data (2025)

From Table 9, it can be seen that most respondents (47.90%) rated the performance of the extension agents as poor, while 15.10% rated it as very poor. Only a small proportion of respondents gave positive ratings, with 13.70% stating it was good and 4.10% stating it was very good. Meanwhile, 19.20% of respondents fell into the “fair” category. These findings indicate that the performance of agricultural extension agents in Beji Village is still considered suboptimal by most farmers. This poses a challenge for extension agents to improve their professionalism, communication approaches, as well as technical and social skills in assisting farmers. Although structurally, extension agents have a strategic role in supporting farm development, several studies show that this role does not always directly impact farmers’ satisfaction or success. Factors such as the limited number of extension agents, advances in information technology, and the increasing ability of farmers to independently access information also affect the relevance of extension agents’ performance in the field. The effectiveness of extension agents in improving farmers’ productivity tends to decline as farmers’ use of digital technology becomes more widespread. In this context, the role of extension agents has shifted more toward that of a facilitator or passive companion, while farmers obtain technical information directly through digital media, farmer groups, or personal experience. Therefore, improving the performance of extension agents is determined not only by technical competencies, but also by their ability to adapt to changing times, especially in integrating information technology into extension strategies.

3.4 IPA Analysis (Importance Performance Analysis)

In this study, farmers were asked to assess two main dimensions related to the role of agricultural extension agents: the level of importance (expectations) and the level of performance (satisfaction) regarding a number of extension service characteristics. The assessments were conducted using a five-point Likert scale, with 16 attributes evaluated.

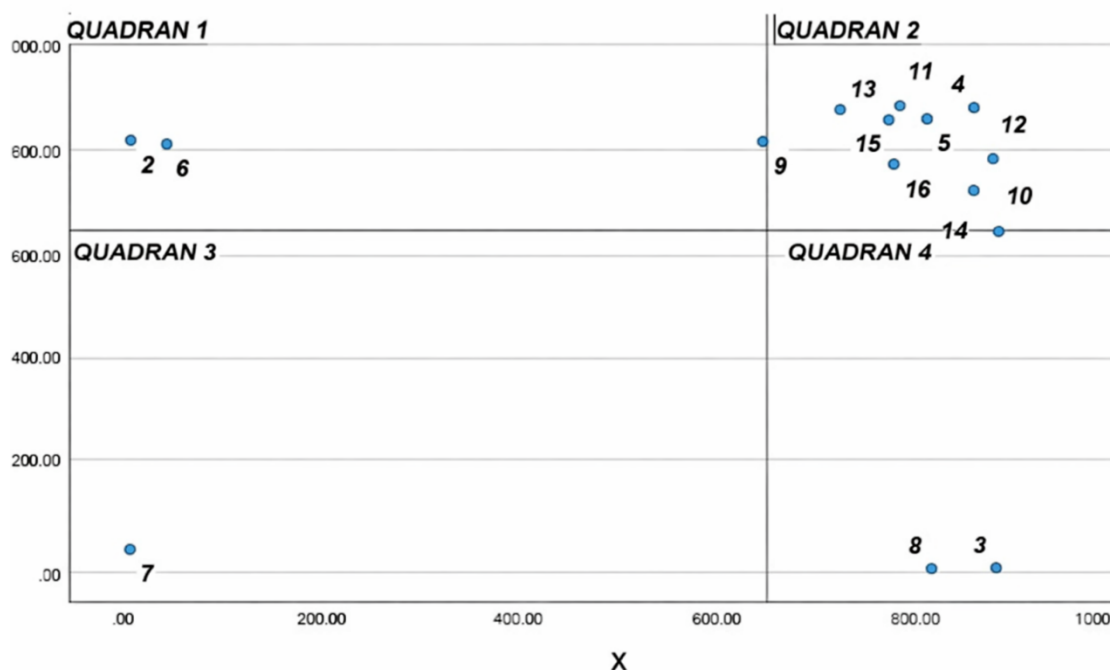


Figure 2. Analisis Importance Performance Analisis (IPA)
Source: Processed Data (2025)

Based on the Importance-Performance Analysis chart (Figure 2), the fifteen performance attributes of the extension agents are distributed across four Cartesian quadrants, which illustrate the strategic improvement priorities as explained in Table 10.

Table 10. Mapping of Quadrants I, II, III and IV

Attribute	Question
Quadrant I	
2	Digital materials (videos, PDFs) are easy to access and use
6	Provision of reading materials during extension
Quadrant II	
4	Accurate and reliable digital technology information
5	Routine assistance by extension workers
9	Responsiveness to farmer complaints
10	Assistance in using digital applications/platforms
11	Materials according to farmer needs
12	Extension workers are easy to contact or meet
13	Extension worker competence in digital technology
14	Ability to answer farmer questions directly
15	Learning guides are delivered in detail and clearly
16	Understanding farmers' difficulties in digital technology
Quadrant III	
7	Latest information on agricultural technology
Quadrant IV	
3	Use of digital platforms (WhatsApp, Zoom, YouTube) by extension workers
8	Assistance in preparing farmer group administration

Source: Processed Data (2025)

Quadrant I: Top Priority for Improvement

Quadrant I represents attributes that farmers consider highly important but are currently performed at a low level, indicating a critical gap in the delivery of extension services. The limited accessibility of digital materials, the lack of structured reading resources, and the insufficient responsiveness to farmer complaints reveal that extension workers have not fully adapted to the demands of a digitally driven agricultural environment. These shortcomings demonstrate a need for stronger

digital literacy, more coherent digital content management, and better communication channels within extension services. Improving performance in this quadrant requires extension workers to receive systematic training in digital content creation and distribution, while also strengthening mechanisms for two-way communication so that farmers can report issues and receive timely feedback. To support these efforts, agricultural institutions and local governments should incorporate digital competencies into official extension standards, expand ICT infrastructure, and establish monitoring systems that evaluate both the quality and timeliness of extension interactions. These measures would enhance the responsiveness and digital capability of extension workers and ensure that critical farmer needs are addressed more effectively.

Quadrant II: Maintain Performance

In contrast, Quadrant II comprises attributes that are rated high in both importance and performance. These results suggest that extension workers are already proficient in delivering essential services such as providing accurate information, offering routine assistance, and maintaining strong communication with farmers. Sustaining performance in this quadrant is important for maintaining trust and encouraging farmers to adopt digital agricultural innovations. To ensure that extension workers remain effective, institutions should continuously update their digital extension training through collaboration with universities, agricultural technology companies, and research institutions. By keeping extension workers informed about emerging technologies and best practices, agricultural institutions can ensure that farmers receive reliable and relevant guidance. Furthermore, recognizing extension workers who demonstrate strong digital engagement can help reinforce a culture of continuous improvement and professional excellence.

Quadrant III: Low Priority

Quadrant III contains attributes with low importance and low performance, particularly related to the delivery of the latest agricultural technology information. Although these attributes are not prioritized by farmers, their low performance indicates a potential gap in the digital readiness of rural communities. Farmers' limited interest in advanced technologies may stem from resource constraints, small landholdings, or low perceived benefits from high-tech solutions. Consequently, digital extension efforts should be calibrated to match local conditions rather than promoting innovations that may exceed farmers' practical capacities. Policymakers should therefore emphasize low-cost, easy-to-use digital tools that are suitable for smallholder farmers, while also assessing village-level digital readiness before implementing broader technology diffusion initiatives. Encouraging peer learning through digitally skilled farmers can also help maintain relevance and ensure that information aligns with community needs.

Quadrant IV: Excessive Performance

Quadrant IV reflects attributes with high performance but low importance, suggesting that extension workers may be investing significant effort in areas that farmers do not prioritize. Extensive use of digital platforms and administrative support, although performed well, may not align with farmers' immediate expectations or preferred modes of learning. This misalignment underscores the importance of continuously assessing farmer needs to ensure that extension services remain relevant and impactful. Extension institutions should guide workers to channel their time and resources toward activities that demonstrate stronger value for farmers, such as developing context-specific digital content or offering practical field-based digital coaching sessions. By reorienting efforts toward areas that directly influence farmer outcomes, extension systems can strengthen the effectiveness of digital agricultural programs.

CONCLUSION

Based on the findings regarding the importance, satisfaction, and performance levels of agricultural extension workers in Beji Village, Junrejo Subdistrict, Batu City, it can be concluded that farmers' expectations and satisfaction with extension services remain relatively low. Most respondents expressed dissatisfaction with the performance of extension workers, particularly in areas that farmers consider highly important but are not yet implemented effectively. The results of the Importance Performance Analysis (IPA) show that attributes such as the delivery of materials in digital formats, the availability of reading materials, and the responsiveness of extension workers to farmer complaints fall into Quadrant I, indicating that their performance is still inadequate despite being prioritized by farmers.

This gap illustrates the need for extension services to better align with farmers' expectations and the evolving demands of agricultural development in the digital era.

Improving extension performance requires strengthening the digital competence of extension workers through targeted information technology training, enabling them to deliver materials more effectively and interactively. Extension content should also be adapted to farmers' needs using simple, contextual language that supports comprehension and practical application. Moreover, establishing a more structured and responsive complaint-handling system is essential to enhance trust and ensure timely problem resolution. Participatory approaches and continuous evaluations remain crucial to maintaining the relevance and sustainability of extension programs.

Beyond the local context, these findings offer broader implications for agricultural extension policy and rural digital transformation. Strengthening digital capacities within extension systems, improving access to agricultural information technologies, and integrating farmer-centered digital tools can help accelerate modernization in rural areas. Policymakers and institutions should view digital extension not merely as a technical innovation but as a strategic pathway for enhancing service quality, empowering farmers, and supporting inclusive agricultural development across rural communities.

ACKNOWLEDGMENTS

The author would like to express his deepest gratitude to the farmers and agricultural extension workers in Beji Village, Junrejo District, Batu City for their cooperation and valuable input during this research. Gratitude is also expressed to the Rector of Tribhuwana Tungga Dewi University for his support so that this research can be completed.

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