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Job Performance of Agricultural Professionals in AI-Enabled Agricultural Extension Services: A Descriptive Assessment of Five Performance Components

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Abstract

Artificial intelligence (AI) and digital technologies are increasingly influencing agricultural extension by improving access to information, facilitating communication, and supporting professional decision-making. The present study evaluated the job performance of 243 agricultural professionals across five functional dimensions: knowledge building and communication, help seeking, knowledge updating and facilitation, need assessment, and technology development. Based on the reported mean scores, knowledge updating and facilitation emerged as the highest-performing domain (14.01), followed by knowledge building and communication (13.04) and help seeking (12.49). Comparatively lower mean scores were recorded for need assessment (11.60) and technology development (10.76). Overall, more than half of the professionals (55.14%) exhibited a medium level of job performance, while 27.16% demonstrated a high level and 17.70% a low level of performance. The findings suggest that agricultural professionals are relatively stronger in updating their knowledge and facilitating access to information and technologies, whereas greater attention is required for systematic need assessment and active involvement in technology development. Strengthening practical training, field-level exposure, participatory need assessment, and collaboration among extension professionals, researchers, farmers, and technology providers could further enhance job performance in AI-enabled agricultural extension.

Keywords: Artificial intelligence, agricultural extension, job performance, digital agriculture, extension professionals, technology development, knowledge facilitation

Introduction

Agricultural extension systems are undergoing a gradual transformation from conventional information dissemination toward more technology-driven and digitally supported approaches. The increasing use of digital platforms has created new opportunities for extension professionals to access, exchange, and disseminate agricultural information more efficiently. These developments can improve the timeliness and reach of advisory services while enabling professionals to respond more effectively to the information requirements of farming communities. FAO notes that digital agricultural extension and advisory services can improve accessibility, delivery and scope, while also emphasizing persistent challenges associated with digital skills, infrastructure and unequal access. (FAO, 2023).

The emergence of artificial intelligence (AI) has further expanded the possibilities within agricultural extension. AI-based applications can support information processing, decision-making, forecasting, advisory services, and the interpretation of large volumes of agricultural data. Consequently, the responsibilities of extension professionals are also evolving. Recent evidence from India also indicates that agricultural extension professionals have meaningful awareness of AI-related technologies, while actual utilization

remains an area requiring capacity building (Patel et al., 2024). In this context, job performance represents a multidimensional aspect of the functioning of agricultural extension professionals. It encompasses not only communication and information dissemination but also continuous knowledge enhancement, facilitation of technological access, identification of farmers' needs, professional help seeking, and participation in technology-related activities. Therefore, the present analysis focuses on the dimensions using the empirical data contained in the source study.

1. Objectives

The present study was undertaken with the following objectives:

1. To evaluate the job performance of agricultural professionals across five major dimensions, namely knowledge building and communication, help seeking, knowledge updating and facilitation, need assessment, and technology development.
2. To assess and compare the relative performance of agricultural professionals across the identified functional dimensions.
3. To determine the distribution of agricultural

professionals according to their overall level of job performance as low, medium, and high.

4. To identify the major functional areas where enhanced capacity building, training, and institutional support are required for improving job performance.

2. Methodology

3.1 Study population and sample

The present study was carried out in the state of Madhya Pradesh, The state is presently served by two agricultural universities, namely Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya (RVSKVV), Gwalior, and Jawaharlal Nehru Krishi Vishwa Vidyalaya (JNKVV), Jabalpur. Both universities are actively engaged in teaching, research, and extension activities aimed at advancing agricultural development and improving farming practices.

A sample of 243 agricultural professionals was selected using the Taro Yamane formula to determine the required sample size.

3.2 Research Design

Descriptive research design is used for the present study.

3.3 Measurement of Job performance

It consisted of 20 statements on a four-point continuum namely, “more frequently”, “frequently”, “occasionally” and “never” with score of 4, 3, 2 and 1, respectively. The job performance score of all the items was summed up to get the individual scores and respondents were grouped into three categories - low, medium and high based on the mean and standard deviation.

4. Results and Discussion

4.1. Knowledge Building and Communication

The Knowledge Building and Communication component showed an overall mean of 13.04 and ranked second among the five components. The highest individual activity was providing AI-generated field insights and farmer feedback to support timely agricultural solutions (mean 3.35), followed by identifying farmers' knowledge gaps and training needs related to AI-based agricultural technologies (3.31). Communicating AI-generated weather forecasts and early-warning advisories recorded 3.21, while presenting AI-assisted field trial and demonstration results recorded 3.17. This pattern suggests relatively strong performance in information interpretation and communication, with comparatively greater scope for strengthening the dissemination of AI-assisted field validation results.

4.2. Help seeking

Help Seeking had a component mean of 12.49 and ranked third. Professionals most frequently sought AI expert support for tools, datasets and digital advisory resources (3.30). Technical support for AI-powered mobile applications and digital advisory platforms scored 3.18, while consultation with AI experts on machine learning and predictive analytics scored 3.10. Receiving training on practical AI applications for crop production, pest management and resource optimization had the lowest score in this component (2.92). The result points to a distinction between seeking assistance

when needed and obtaining structured practical training. Institutional capacity-building programmes could therefore move beyond ad hoc support toward recurring hands-on training.

4.3. Knowledge Updating and Facilitator

Knowledge Updating and Facilitator was the strongest component, with a mean of 14.01. Accessing updated AI knowledge through webinars, mobile advisories and digital literature recorded the highest item mean in the entire assessment (3.58). Facilitating farmers' access to AI-powered mobile applications and digital decision-support tools and facilitating collaboration among farmers, researchers and technology providers both scored 3.49. Participation in in-service training on AI, precision farming, remote sensing, drones and digital agriculture scored 3.45. The results indicate a comparatively strong orientation toward continuous learning and facilitation, which is consistent with the evolving role of extension personnel in digitally mediated advisory systems.

4.4. Need Assessment

Need Assessment recorded a component mean of 11.60 and ranked fourth. Assessing farmers' needs for AI adoption in crop production, resource management and agricultural marketing had the highest score (3.02), followed by identifying training needs for AI-powered mobile applications and digital advisory services (2.93). Identifying location-specific agricultural challenges addressable through AI solutions (2.82) and collaborating with researchers to prioritize AI research based on farmers' needs and field problems (2.80) were comparatively weak. Because needs assessment is the basis for matching technologies to real field problems, this component represents an important improvement priority.

4.5. Technology Development

Technology Development was the weakest of the five components, with a mean of 10.76. Promoting AI-powered mobile applications for improved farm management had the highest item score within the component (2.87), followed by seeking AI-based scientific information to develop and disseminate farmer-oriented extension and digital advisory materials (2.85). Participating in testing and refining AI-enabled technologies before recommending them to farmers scored 2.53, while using AI tools to analyze weather forecasts and provide timely farmer advisories scored 2.51. These results suggest that professionals may be more comfortable promoting or accessing technologies than directly participating in their technical validation and operational application.

Table 1: Component-wise Job performance

Component	Mean score	Rank
Knowledge Building and Communication	13.04	II
Help Seeking	12.49	III
Knowledge Updating and Facilitator	14.01	I
Need Assessment	11.60	IV
Technology Development	10.76	V

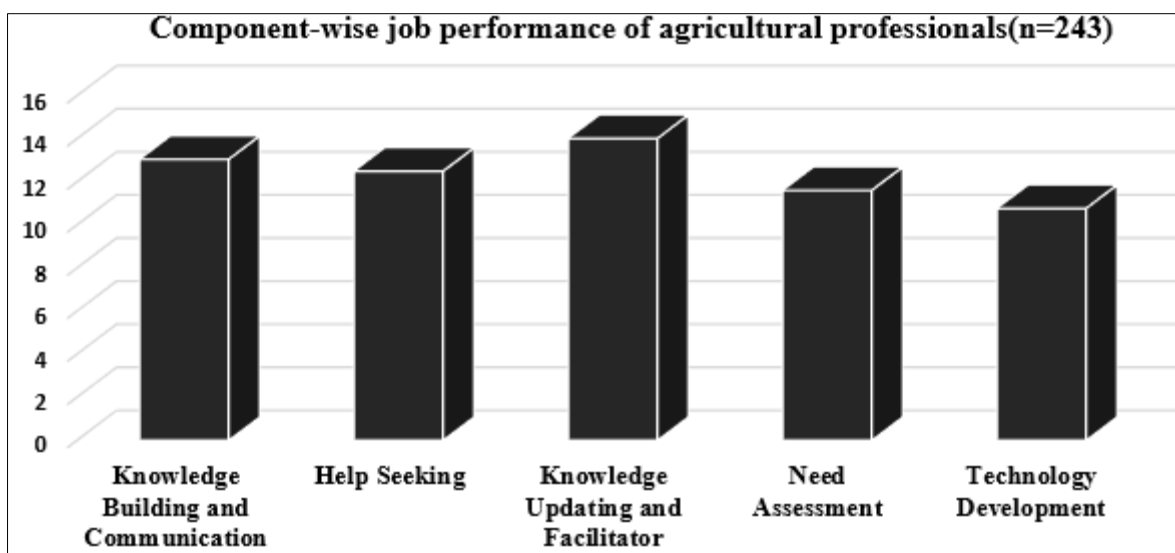


Fig 1: Component-wise job performance of agricultural professionals

Table 2: Overall performance of agricultural professionals

Category	Frequency	Percentage
Low level of job performance	43	17.70
Medium level of job performance	134	55.14
High level of job performance	66	27.16
Total	243	100.00

Mean: 61.92 Std. Deviation: 11.75

More than half of the respondents (55.14%) were classified at the medium level of overall job performance. High performers constituted 27.16%, while 17.70% were in the low category. The predominance of the medium group suggests that the workforce has a functional base for AI-enabled extension, but substantial room remains for moving professionals toward consistently high performance.

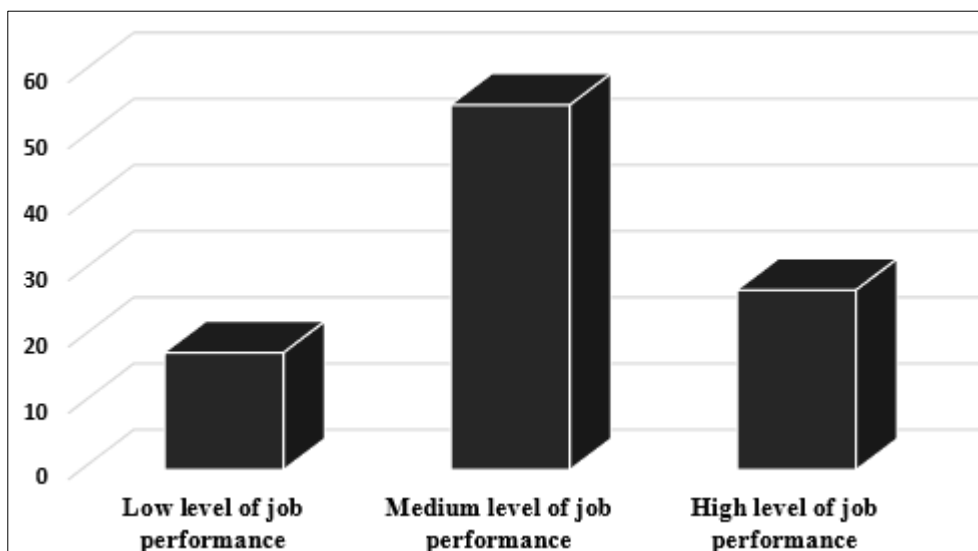


Fig 2: Overall distribution of job performance

5. Implications of study

Capacity development should emphasize practical AI application rather than only awareness or information access. Extension organizations should strengthen mechanisms through which professionals jointly identify farmer problems with researchers and technology developers. Hands-on training in weather analytics, AI-based decision support, validation of digital tools and interpretation of AI outputs should be institutionalized. Digital extension strategies should account for infrastructure, digital literacy and unequal access so that technology-supported advisory services remain inclusive. AI tools should complement professional

judgment, with appropriate validation and accountability before recommendations reach farmers.

6. Conclusion

The study demonstrates a differentiated pattern of job performance among 243 agricultural professionals working in an AI-enabled extension context. Knowledge Updating and Facilitator emerged as the strongest functional area, indicating a comparatively high orientation toward accessing current knowledge and facilitating digital agricultural services. Knowledge Building and Communication and Help Seeking also showed relatively favorable performance. In

contrast, Need Assessment and especially Technology Development were weaker. The overall distribution, dominated by the medium-performance category, indicates that strengthening practical competencies could be more valuable than simply increasing exposure to AI information. Future interventions should therefore prioritize field-level needs assessment, collaborative problem definition, technology testing and refinement, and applied use of AI-based advisory tools.

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