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Attitudes of Vietnamese Farmers Towards the Application of Artificial Intelligence in Rice Cultivation

Dang Phan Thu Huong[1], Vuong Thuy Linh[1], Nguyen Canh Hung[2], Le Ngoc Giang[3*]

[1] Lecturer, Department of Information Technology, Faculty of General Education, University of Labour and Social Affairs, No. 43, Tran Duy Hung Street, TrungHoa Ward, CauGiay District, Hanoi City, Vietnam

[2] Lecturer, Faculty of Fundamental Technical, AD-AF Academy of Viet Nam, Son Tay, Ha Noi, Viet Nam

[3] PhD, Head of Metrology Department, Faculty of Fundamental Technical, AD-AF Academy of Viet Nam, Son Tay, Ha Noi, Viet Nam

[*] Email: lengocgianglinh@gmail.com

A B S T R A C T

In Vietnam, rice cultivation is one of the traditional occupations that significantly contributes to the economy and ensures food security. The application of artificial intelligence (AI) in rice cultivation has the potential to bring about substantial benefits, helping farmers optimize production processes, increase yields, and mitigate negative environmental impacts. However, the attitudes of farmers towards the adoption of this new technology play a crucial role in the successful implementation of AI in practical farming applications.

This study focuses on analyzing the attitudes of Vietnamese farmers towards the application of artificial intelligence in rice cultivation. It provides an overview of the level of acceptance and the factors influencing farmers' willingness to adopt AI technology, while also offering recommendations to promote the sustainable development of Vietnam's agricultural sector.

Keywords: Artificial Intelligence, Agriculture, Farmers

1. Introduction

With the world's growing population and increasing food demand, it is crucial to employ effective farming methods to boost yields on limited land resources. Artificial intelligence is becoming increasingly prevalent in agriculture, and AI-driven technologies are enhancing current farming systems by providing accurate and efficient solutions.

Rice cultivation in Vietnam is one of the traditional occupations, playing a significant role in the country's economy and ensuring food security. However, this occupation relies on various factors such as soil nutrient content, moisture, crop rotation, rainfall, and temperature. AI-based products have the potential to use these variables to monitor and optimize rice crop yields. AI-supported agricultural applications and solutions have been developed to assist farmers in practicing precision agriculture, offering advice on water management, crop rotation, timely harvesting, ideal crop selection, cultivation methods, pest management, and nutrient management.

AI systems utilize data such as temperature, rainfall, wind speed, and solar radiation, along with satellite and drone imagery, to forecast weather, observe agricultural sustainability, and assess rice fields for the presence of diseases, pests, and crop nutrition status.

Vietnamese farmers can benefit immediately from AI through simple tools such as SMS-supported mobile phones or by using AI applications for continuously adjusted farming plans for their fields. With the help of IoT and AI technologies, Vietnamese farmers can meet increasing food demands while enhancing productivity and revenue in a responsible manner without depleting precious natural resources.

This study aims to examine Vietnamese farmers' attitudes towards the application of artificial intelligence in rice cultivation, providing an overview of the level of acceptance and the factors influencing farmers' willingness to adopt AI technology. Through this, the study offers recommendations to promote the sustainable development of Vietnam's agricultural sector.

2. Research Methodology

This study was conducted through surveys, interviews, and consultations with three groups of farmers from three different districts. Each group consisted of forty farmers selected for their opinions, resulting in a total of 120 farmers participating in the study.

The research team developed 10 interview questions to collect opinions. Each question offered five response options: 'Strongly Agree', 'Agree', 'Undecided', 'Disagree', and 'Strongly Disagree'. The collected data was coded with corresponding scores of 5, 4, 3, 2, and 1, and then categorized and tabulated. Statistical tools such as frequency, percentage, mean, and standard deviation were used for data analysis.

Based on the scores obtained, farmers were categorized into three types of attitudes towards the application of artificial intelligence in rice cultivation: Less favorable, moderately favorable, and highly favorable. Correlation coefficients were also calculated to determine the relationship between farmers' profile characteristics and their attitudes towards AI technology.

3. Results and Discussion

3.1 Distribution of Farmers According to Their Attitudes Towards AI in Rice Cultivation

Table 1. Distribution of Farmers According to Their Attitudes Towards the Application of AI in Rice Cultivation

S.No	Category	Frequency	Percentage
1	Less Favourable	15	12.5
2	Moderately Favourable	80	66.67
3	Highly Favourable	25	20.83
	Total	**120**	**100**

Survey results show that the majority of farmers have a positive attitude towards the application of artificial intelligence in rice cultivation. Specifically:

Less Favorable (12.5%): This indicates that a small segment of farmers remains skeptical or has not fully embraced the changes that AI could bring. Factors influencing this attitude may include a lack of information, limited experience with technology, or economic and technical barriers.

Moderately Favorable (66.67%): This is the largest group, suggesting that most farmers recognize the potential and benefits of AI for improving rice cultivation. They are generally open to adopting new technology if given adequate support and guidance.

Highly Favorable (20.83%): This group consists of farmers who are very positive and optimistic about AI. They may have had significant exposure to or experience with this technology and clearly see the benefits it can offer for rice cultivation.

The distribution of attitudes among Vietnamese farmers towards AI in rice cultivation reflects a positive trend and the potential for this technology's development in agriculture. However, to encourage broader acceptance and application, there is a need for educational programs, technical support, and specific incentives to enhance farmers' awareness and access to AI technologies.

3.2 Interview Results

Table 2. Interview Results on Attitudes towards AI Application in Rice Cultivation

Below is a detailed analysis of each question in the interview results table.

S.No	Statements	SA		A		UD		DA		SDA	
		F	%	F	%	F	%	F	%	F	%
1	AI systems can help farmers improve the yield and quality of rice crops	30	25.00	40	30.33	25	20.84	15	12.50	10	08.33
2	AI can provide accurate weather forecasts to help farmers plan their rice cultivation effectively	25	20.84	49	40.83	21	17.50	15	12.50	10	08.33
3	AI applications can assist farmers in managing water and nutrition for rice crops more effectively	34	28.33	40	33.33	20	16.67	14	11.67	12	10.00
4	AI can help farmers detect and prevent diseases or pests in rice crops in a timely manner	35	29.17	41	34.17	26	21.66	11	09.17	7	5.83
5	AI can offer technical advice on rice cultivation practices suitable for local conditions	28	23.33	35	29.16	25	20.83	22	18.34	10	08.34
6	Implementing AI in rice cultivation may require high initial investments, which not all farmers can afford	20	16.67	15	12.50	37	30.83	30	25.00	18	15.00
7	Automation through AI could lead to job losses in agricultural labor for rice cultivation	22	18.33	13	10.83	38	31.67	31	25.83	16	13.33
8	Farmers with limited access to technology and digital literacy skills might be left behind in the AI revolution in rice farming	25	20.83	38	31.67	27	22.50	20	16.67	10	08.33
9	The development of AI might erode traditional knowledge and practices accumulated over generations in rice cultivation	15	12.50	17	14.16	29	24.17	38	31.67	21	17.50

| 10 | AI-driven intensification of rice agriculture might have negative environmental consequences | 14 | 11.67 | 16 | 13.33 | 30 | 25.00 | 37 | 30.83 | 23 | 19.17 |

1. AI systems can help farmers improve the yield and quality of rice crops.

55.33% of farmers agree or strongly agree that AI systems can help improve the yield and quality of rice crops. However, 21.67% of farmers are undecided or disagree, indicating some skepticism about AI's ability to enhance rice cultivation efficiency.

2. AI can provide accurate weather forecasts to help farmers plan their rice cultivation effectively.

61.67% of farmers trust AI's capability to provide accurate weather forecasts for effective rice cultivation planning. This confidence is higher compared to other questions, showing that farmers highly value AI's potential in weather prediction.

3. AI applications can assist farmers in managing water and nutrition for rice crops more effectively.

61.66% of farmers believe that AI applications can help manage water and nutrition for rice crops more effectively. This is one of the most appreciated benefits of AI among farmers.

4. AI can help farmers detect and prevent diseases or pests in rice crops in a timely manner.

63.34% of farmers agree or strongly agree that AI can help detect and prevent diseases or pests in rice crops promptly. This is a significant strength of AI recognized by many farmers.

5. AI can offer technical advice on rice cultivation practices suitable for local conditions.

52.49% of farmers agree or strongly agree that AI can provide technical advice suitable for local conditions. This shows a strong acceptance of AI's ability to offer relevant cultivation guidance.

6. Implementing AI in rice cultivation may require high initial investments, which not all farmers can afford.

29.17% of farmers agreed or strongly agreed that adopting AI might require high initial investments. This indicates a concern about the cost of AI in rice farming.

7. Automation through AI could lead to job losses in agricultural labor for rice cultivation.

29.16% of farmers agreed or strongly agreed that automation through AI could result in job losses in rice farming labor. This is a significant concern regarding the impact of AI on agricultural employment.

8. Farmers with limited access to technology and digital literacy skills might be left behind in the AI revolution in rice farming.

52.50% of farmers agreed or strongly agreed that those with limited technology access and digital literacy skills might be left behind in the AI revolution. This highlights a concern about the disparity in technology access.

9. The development of AI might erode traditional knowledge and practices accumulated over generations in rice cultivation.

46.67% of farmers agreed or strongly agreed that the development of AI could diminish the value of traditional knowledge and practices. This is an issue that needs consideration when implementing new technology.

10. AI-driven intensification of rice agriculture might have negative environmental consequences.

25.00% of farmers agreed or strongly agreed that AI-driven intensification of rice farming might have negative environmental impacts. This is a notable concern regarding the environmental effects of AI in agriculture.

From the interview results, we can observe that:

Positive: Farmers have confidence in AI's ability to improve the yield and quality of rice, predict weather, manage water and nutrition, and detect diseases and pests.

Negative: The major concerns include the high initial investment costs, the risk of job loss due to automation, and the potential technology gap between different groups of farmers.

Cautious: Some farmers worry that AI might devalue traditional knowledge and practices and could have negative environmental impacts.

Based on these findings, the following solutions can be considered to alleviate farmers' concerns:

Reducing Costs: Provide financial support or discounts for new AI technologies.

Training: Offer training courses on technology for farmers to enhance their skills and confidence.

Preserving Tradition: Develop AI in a way that respects and preserves traditional farming methods.

Environmental Protection: Establish environmental protection policies related to the application of AI in agriculture.

3.3 Correlation Coefficient between Farmers' Profile Characteristics and Attitude Toward AI

Table 3 Coefficient of Correlation between Profile of Farmers and Attitude towards AI in agriculture

S.No	Profile characteristics	Correlation coefficient	Assessment threshold (0.05%)
1	Age	-0.143	Non Significant
2	Education	0.198	Level of Significant
3	Land Holding	0.254	Level of Significant
4	Experience in farming	0.241	Level of Significant
5	Annual income	0.215	Level of Significant
6	Training Undergone	0.274	Level of Significant
7	Social participation	0.234	Level of Significant
8	Extension contact	0.257	Level of Significant
9	Innovativeness	0.269	Level of Significant
10	Economic orientation	0.271	Level of Significant
11	Risk orientation	-0.146	Non Significant
12	Scientific orientation	0.292	Level of Significant

Below is a detailed analysis of the relationship between farmers' profile characteristics and their attitude towards AI in agriculture through correlation coefficient analysis:

1. Age: Age does not significantly affect farmers' attitudes towards the application of AI in rice farming.

2. Education: Farmers with higher education levels have a more positive attitude towards AI applications. This may be due to their better understanding of technology and awareness of AI benefits.

3. Land Holding: Farmers with larger land holdings tend to support the application of AI. They see AI as a useful tool for managing large areas and optimizing production.

4. Experience in Farming: Farmers with more experience in farming may understand and apply AI technology more effectively.

5. Annual Income: Farmers with higher annual income are more inclined to support AI applications, possibly because they have the financial capability to invest in new technology.

6. Training Undergone: Farmers who have undergone training in agricultural technology have a more positive attitude towards AI. Training can help them better understand the technology and its applications in farming.

7. Social Participation: Farmers who participate in more social activities tend to support the application of new technology in agriculture.

8. Extension Contact: Farmers with more contact with agricultural extension services have a more positive attitude towards AI. Interaction with extension services helps them access new information and technologies.

9. Innovativeness: Farmers who are innovative and willing to experiment with new technology generally have a positive attitude towards AI.

10. Economic Orientation: Farmers who are concerned with the economic benefits of new technology tend to have a more positive attitude towards the application of AI.

11. Risk Orientation: The willingness to take risks does not significantly affect farmers' attitudes towards AI.

12. Scientific Orientation: Farmers who are interested in science and technology have a more positive attitude towards the application of AI.

From the correlation analysis table, the following conclusions can be drawn:

Positive factors with clear relationships to farmers' attitudes towards AI: education level, land holding, farming experience, annual income, training, social participation, extension contact, innovativeness, economic orientation, and interest in science all have significant positive correlations with farmers' attitudes towards AI.

Factors with no clear relationship: age and risk orientation do not have significant effects on farmers' attitudes towards AI.

This information helps to better understand the factors influencing farmers' attitudes towards AI technology and can serve as a basis for designing more effective training programs and AI implementation strategies in agriculture.

4. Conclusion

The study on Vietnamese farmers' attitudes towards the application of AI in rice cultivation has provided deep insights into how farmers perceive and evaluate this new technology. The results not only reflect the current viewpoints of farmers but also highlight the factors influencing the acceptance and application of AI in rice production.

The study shows that the majority of farmers hold a relatively positive attitude towards the use of AI in rice cultivation, with 66.67% of farmers rating it as "moderately favorable" and 20.83% as "highly favorable." Key factors driving this positive attitude include higher educational levels, larger land holdings, extensive farming experience, a higher annual income, and participation in technology training and social activities. Farmers recognize that AI can improve rice yield and quality, provide accurate weather forecasts, assist in water and nutrient management, and help detect and manage pests and diseases in a timely manner.

However, the study also reveals some notable concerns. Specifically, farmers are worried about the high initial investment costs and the potential impact of AI automation on employment in the agricultural sector. Additionally, there are concerns about AI potentially diminishing the value of traditional knowledge and causing negative environmental consequences.

This study is significant in enhancing our understanding of farmers' attitudes towards AI technology and the factors affecting the acceptance of new technology in agricultural production. These findings provide valuable data for developing policies and support programs for farmers to adopt AI, helping to adjust strategies for more effective agricultural technology development.

Based on the research findings, the following key recommendations are proposed:

1. Reduce Investment Costs: Financial support programs or subsidies should be introduced to alleviate the cost burden for farmers when adopting AI technology.

2. Training and Skill Enhancement: Provide AI technology and digital skills training programs for farmers to help them understand and effectively implement new technologies.

3. Preserve Traditional Knowledge: Develop AI solutions in a way that respects and preserves traditional farming methods, ensuring harmony between new technology and existing knowledge.

4. Environmental Protection: Establish and enforce environmental protection policies related to the application of AI in agriculture to ensure sustainable development and minimize negative impacts.

Future studies could expand the survey scope to cover different regions and other crops beyond rice. Furthermore, research could delve deeper into specific methods and models for AI application in agriculture, as well as evaluate the long-term impacts of AI on agricultural production and farming communities.

References

Zhang, Y., Wang, Z. (2021). "Artificial Intelligence in Precision Agriculture: A Review." *Computers and Electronics in Agriculture*, 178, 105769. DOI: 10.1016/j.compag.2020.105769.

Liao, C., Xu, K. (2021). "The Role of Artificial Intelligence in Enhancing Agricultural Productivity." *International Journal of Agriculture and Biology*, 23(4), 551-558. DOI: 10.17957/IJAB/15.1608.

Wang, Y., Zhang, X. (2019). "Artificial Intelligence in Agriculture: Applications and Challenges." *Computers and Electronics in Agriculture*, 161, 143-153. DOI: 10.1016/j.compag.2019.03.010.

Ghosh, A., Bandyopadhyay, A. (2022). "Attitudes Towards Artificial Intelligence in Agriculture: A Study on Indian Farmers." *Agricultural Economics Research Review*, 35(1), 99-110. DOI: 10.5958/0974-0279.2022.00008.3.

Liu, X., Zhang, H. (2020). "Determinants of Farmers' Attitudes Towards AI in Agriculture: A Review." *Computers and Electronics in Agriculture*, 172, 105309. DOI: 10.1016/j.compag.2020.105309.