



Embracing Change: Analyzing the Impact of Farmers' Knowledge and Risk Perception on the Adoption of Innovations in Agribusiness

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Abstract: Recognizing the significance of technological advancements and novel practices in modern agriculture, it becomes imperative to understand the determinants that shape farmers' decision-making processes regarding the adoption of these innovations. Through a comprehensive literature review and empirical analysis, this research investigates the relationship between farmers' knowledge and information and risk perceptions and attitudes toward adopting innovations in agribusiness. The study employs a quantitative survey to gather data. The results highlight the significant role of farmers' knowledge in facilitating the adoption process and the influence of risk perception on their willingness to embrace change. Furthermore, understanding the factors that affect farmers' adoption of innovations has practical implications for policymakers, researchers, and agribusiness stakeholders. By identifying the key drivers and barriers to adoption, policymakers can develop targeted interventions and strategies to promote the uptake of beneficial innovations in the agricultural sector. Additionally, agribusiness stakeholders can tailor their communication and extension programs to effectively disseminate knowledge and mitigate risk perceptions, encouraging innovation adoption.

Keywords: *Farmers' knowledge and information, risk perception and attitude, adoption of innovations, theory of diffusion of innovations Agribusiness*

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I. INTRODUCTION

The agricultural sector has always been at the forefront of change and innovation, driven by the need to feed an ever-growing global population while addressing the challenges posed by climate change, limited resources, and evolving consumer demands [1]. In this dynamic environment, the adoption of innovations in agribusiness becomes crucial for farmers to enhance productivity, sustainability, and profitability [2]. The adoption of innovations reflects the extent to which farmers incorporate new technologies and practices into their farming operations [3]. This includes the use of improved seeds, modern

machinery, precision agriculture techniques, farm management software, and sustainable farming practices. The adoption of innovations can vary across different farming systems, regions, and farmer demographics. However, the successful adoption of innovations depends on the availability of technological advancements and farmers' knowledge and risk perception, which shape their attitudes and decision-making processes [4].

Farmers' knowledge and information, risk perception and attitude, and the adoption of innovations are intertwined, forming a complex network that shapes farmers' behavior and decision-making processes [5]. Farmers'

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knowledge and information refer to their understanding and awareness of the latest agricultural technologies, practices, and market trends. It encompasses both formal knowledge acquired through education, training, and extension services, as well as informal knowledge gained through experience, peer networks, and cultural practices. Moreover, risk perception and attitude play a crucial role in shaping farmers' behavior towards adopting innovations. Risk perception refers to farmers' subjective evaluation of the potential risks and uncertainties associated with adopting new technologies or practices [6]. It encompasses factors such as perceived financial risks, technological risks, market risks, and social risks. Farmers' attitude toward risk, influenced by their individual characteristics, experiences, and cultural beliefs, further influences their willingness to embrace change and take on the associated risks [7].

While previous research has explored the factors influencing farmers' adoption of innovations, a significant academic gap still needs to be addressed [6]. Existing studies have predominantly focused on the role of technological factors, such as the effectiveness and compatibility of innovations, in driving adoption. However, limited attention has been given to the critical role of farmers' knowledge and risk perception in shaping their decision-making processes [8]. Furthermore, the existing literature on innovation adoption in agribusiness tends to be context-specific, focusing primarily on developed countries or specific agricultural sectors. There is a limited understanding of the adoption process in different geographical regions, diverse farming systems, and various socio-economic and cultural contexts. This study seeks to address this contextual gap by examining the impact of farmers' knowledge and risk perception on the adoption of innovations in agribusiness among the farmers of a developing economy, Indonesia, providing relevant and applicable insights to the region.

Hence, this study aims to bridge the academic gap by comprehensively analyzing the interplay between farmers' knowledge, risk perception, and the adoption of innovations in agribusiness. By incorporating individual and contextual factors, we seek to capture a holistic understanding of the complexities involved in farmers' decision-making processes. The primary objectives of this research are;

- To analyze the impact of farmers' knowledge and information on adopting innovations in agribusiness.
- To analyze the impact of farmers' risk perception and attitudes on adopting innovations in agribusiness.

- Provide recommendations for policymakers, agricultural extension services, and agribusinesses to promote the adoption of innovations, considering the findings and insights derived from the study.

By addressing these research objectives, we aim to contribute to the existing body of knowledge, inform policy and practice, and empower farmers to embrace change and drive sustainable development in agribusiness.

II. THEORETICAL FOUNDATION AND HYPOTHESES

A. *Theory of Diffusion of Innovations*

The theoretical foundation of this study is based on the Theory of Diffusion of Innovations. This theory provides a comprehensive framework for understanding how new ideas, technologies, or practices are adopted and spread within a social system [9]. According to the Diffusion of Innovations theory, adopting innovations emphasizes the role of communication channels, social networks, and opinion leaders in the diffusion process [10]. Information flows through interpersonal communication networks, where opinion leaders, individuals with high social status, expertise, or credibility, play a vital role in shaping the perceptions and decisions of others [11]. These opinion leaders serve as influencers, disseminating information, providing social proof, and reducing uncertainty regarding the adoption of innovations. Drawing upon the Theory of Diffusion of Innovations, this study seeks to explore the factors influencing farmers' adoption of innovations in agribusiness. The theory provides a comprehensive framework to examine the relative advantage, compatibility, complexity, trialability, and observability of innovations and the role of communication networks and opinion leaders in shaping farmers' decision-making processes [12]. The application of this theory allows for a deeper understanding of the mechanisms underlying the adoption of innovations in agribusiness. It helps identify the factors that facilitate or hinder the adoption process, enabling policymakers, agricultural extension services, and agribusinesses to design targeted interventions and strategies that promote the diffusion of innovations among farmers.

B. *The Impact of Knowledge and Information on the Adoption of Innovation*

Knowledge and information are pivotal in influencing the adoption of innovation in agribusiness [13]. Farmers' access to relevant and up-to-date information and knowledge about new technologies and practices significantly shape their attitudes, perceptions, and, ultimately, their decision to adopt innovations [14]. Knowledge acts as a

catalyst for change. Farmers with adequate knowledge about innovations are more likely to understand their benefits, applications, and potential impacts on their farming operations. They can effectively assess the relative advantage of adopting the innovation, weighing it against their existing practices and experiences. Knowledge empowers farmers to make informed decisions based on a clear understanding of the potential gains, such as increased productivity, reduced costs, improved resource efficiency, and enhanced sustainability [15]. Furthermore, access to accurate and reliable information is critical in overcoming barriers to adoption.

Farmers need access to information on the availability and accessibility of innovations, their performance, and the support services and resources available to facilitate adoption. Timely and relevant information can address uncertainties and alleviate risks associated with the adoption process [16]. It enables farmers to navigate challenges such as financial investments, technical know-how, and market integration, making adopting innovations a more viable and feasible option. Moreover, knowledge and information foster learning and capacity-building among farmers [17]. When farmers are exposed to new ideas, techniques, and best practices, they can expand their knowledge base and acquire the necessary skills to effectively implement and manage the adopted innovation.

Access to information through agricultural extension services, research institutions, farmer networks, and digital platforms can provide learning opportunities, training programs, and demonstrations, enabling farmers to develop the required competencies for successful adoption [18]. Additionally, knowledge and information contribute to social learning and the diffusion of innovations. When farmers are aware of their peers' successful experiences with adopting innovations, they are more likely to perceive them as feasible and beneficial [19]. Peer-to-peer communication and exchanging knowledge and experiences within farmer networks create social proof and build confidence in the adoption process. This leads to a positive social contagion effect, where the adoption of innovations becomes more widespread and accepted within the farming community. Hence it can be postulated that;

H1: *There is a positive impact of farmers' knowledge and information on their adoption of innovation.*

C. The Impact of Risk Perception and Attitude on the Adoption of Innovation

Farmers' subjective evaluation of the potential risks and uncertainties associated with adopting new technologies or practices and their attitudes towards risk-taking

significantly impacts their willingness to embrace change and adopt innovations [20]. Risk perception acts as a powerful determinant of farmers' adoption decisions. Farmers assess the risks and uncertainties associated with adopting innovations, including financial, technological, market, and social risks [7]. The perceived level of risk and the potential negative consequences influence their willingness to embrace change and adopt the innovation.

Higher perceived risks may create resistance and skepticism, leading to a reluctance to adopt innovations, whereas lower perceived risks may encourage farmers to take the leap and explore new possibilities [7]. Moreover, farmers' attitudes toward risk influence their adoption decisions. Attitudes are shaped by individual characteristics, experiences, and cultural beliefs. Farmers with a positive attitude towards risk-taking are more likely to be open to innovation and willing to take calculated risks [21]. They view the adoption of innovation as an opportunity for growth, improvement, and staying competitive in the market.

Conversely, farmers with a more risk-averse attitude may be hesitant to adopt innovations, fearing potential losses, disruption of familiar practices, or negative social consequences. Furthermore, the influence of risk perception and attitude extends beyond individual farmers. Social norms, opinions of influential peers, and community pressure can shape farmers' risk perception and attitude toward the adoption of innovation. Positive social support, encouragement, and the endorsement of successful adopters can mitigate perceived risks and foster a more favorable attitude toward change. Hence, it can be postulated that;

H2: *There is a positive impact of farmers' risk perception and attitude on their adoption of innovation.*

D. Theoretical Framework of the Study

The theoretical framework of this study is presented in Figure 1, based on the Theory of Diffusion of Innovations and relevant literature.

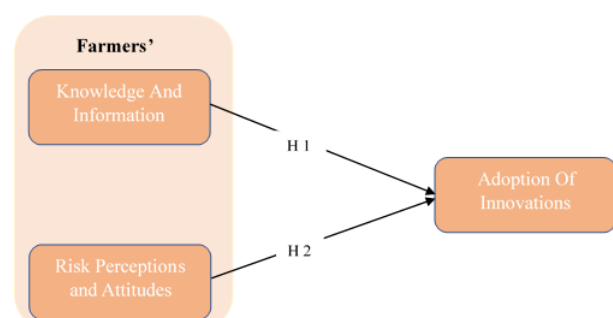


Fig. 1. Theoretical framework of this study

III. RESEARCH METHODOLOGY

This study involved the collection of data through a structured survey questionnaire administered to 350 farmers in the South Sulawesi region of Indonesia. The data collection process took place over a period of three months, starting from January 1, 2023, and concluding on March 31, 2023. A combination of random and purposive sampling techniques was employed to ensure a representative sample. First, a list of farming communities in the South Sulawesi region was obtained from the local agricultural authorities. From this list, a random sample of communities was selected. Within each selected community, a purposive sampling approach was used to identify and recruit individual farmers who were actively engaged in agribusiness. The survey questionnaire was carefully designed to capture relevant information on farmers' knowledge and information sources, risk perception and attitude towards adopting innovations, and adopting them in their agribusiness operations. Throughout the data collection period, regular monitoring and supervision were conducted to ensure the completeness and accuracy of the collected data.

A. Demographic Characteristics

The majority of the respondents were male, accounting for 65% of the sample, while female farmers constituted 35% of the respondents. The age distribution of the respondents varied, with the highest percentage (40%) falling in the age range of 30-45 years. The age group of 46-60 years comprised 35% of the sample, while farmers below the age of 30 accounted for 25% of the respondents. In terms of education level, 20% of the re-

spondents had completed primary education, 45% had attained secondary education, and 35% had received higher education, including vocational training or university degrees. The respondents represented a diverse range of farm sizes. Small-scale farmers with less than 1 hectare of land accounted for 30% of the sample, while medium-scale farmers with 1-5 hectares constituted 45% of the respondents. Large-scale farmers with more than 5 hectares of land made up 25% of the sample. The respondents had varying levels of farming experience. Farmers with less than 5 years of experience comprised 15% of the sample, while those with 5-10 years of experience accounted for 30% of the respondents. Most respondents (55%) had over 10 years of farming experience.

Measures of the Study

Farmers' knowledge and information about specific innovations or agricultural practices were measured with 6 items adapted from [22]. This scale measures the extent of knowledge on various aspects, such as technical features, benefits, and implementation methods. To measure farmers' perception of risks and attitudes an 8 items scale developed by [23] was used. It assesses farmers' perception of financial risks, technological risks, and market risks associated with adopting innovations. Adoption of Innovations among farmers was measured with 12 items adapted from [24]

B. Descriptive Statistics

Table 1 presents the mean, standard deviation (STD), skewness, and kurtosis values for the variables of interest in the study.

TABLE 1
DESCRIPTIVE STATISTICS

Variables	Mean	STD	Skewness	Kurtosis
Farmers' Knowledge and Information	4.23	0.86	-0.21	1.08
Risk Perception and Attitudes	3.79	0.92	0.34	0.78
Adoption of Innovations	4.10	0.76	-0.09	0.95

The mean values represent the average scores for each variable. For example, farmers' knowledge and information had a mean of 4.23, indicating a relatively high level of knowledge among the respondents. Risk perception and attitudes had a mean of 3.79, suggesting that, on average, farmers had a moderate level of perceived risk associated with adopting innovations. The adoption of innovations had a mean of 4.10, indicating embracing change and adopting innovations. The standard deviation values provide information about the variability or dispersion of the data. A higher standard deviation in-

dicates a greater degree of variability in the responses. For instance, the standard deviation for farmers' knowledge was 0.86, suggesting a moderate level of variation in knowledge levels among the respondents. Skewness measures the asymmetry of the distribution. A skewness value close to zero suggests a relatively symmetrical distribution. In this case, the skewness values for all the variables are relatively close to zero, indicating a nearly symmetrical distribution of responses. Kurtosis measures the peakedness or flatness of the distribution. A kurtosis value greater than zero indicates a relatively peaked

distribution, while a value less than zero suggests a flatter distribution. In this study, the kurtosis values for all the variables are positive, indicating relatively peaked distributions.

C. Correlation Analysis

The correlation matrix (Table 2) presents the correlation coefficients between "Knowledge and Information," "Risk Perception and Attitude," and "Adoption of Innovations."

TABLE 2
CORRELATION MATRIX

Study Variables	1	2	3
Knowledge and Information	1.00	0.42	0.68
Risk Perception and Attitude	0.42	1.00	0.56
Adoption of Innovations	0.68	0.56	1.00

In this study, the correlation analysis reveals correlation coefficient between "Knowledge and Information" and "Risk Perception and Attitude" is 0.42, indicating a moderate positive relationship. This suggests that farmers with higher levels of knowledge and information are more likely to have a positive risk perception and attitude toward adopting innovations. The correlation coefficient between "Knowledge and Information" and "Adoption of Innovations" is 0.68, indicating a strong positive relationship. This implies that farmers with higher levels of knowledge and information are more likely to adopt

innovations in their agribusiness operations. Finally, the correlation coefficient between "Risk Perception and Attitude" and "Adoption of Innovations" is 0.56, indicating a moderate positive relationship. This suggests that farmers with positive risk perceptions and attitudes are more likely to adopt innovations.

D. Regression Analysis

The regression analysis was conducted to examine the predictive power of the variable's knowledge and information and risk perception and attitude on the adoption of innovations.

TABLE 3
REGRESSION ANALYSIS RESULTS (DV= CROP YIELD OPTIMIZATION)

Predictor Variables	Beta	t-value	p-value
Knowledge and Information	0.44	6.78	<0.001
Risk Perception and Attitude	0.23	3.96	0.002

As shown in Table 3, the results indicate that both predictors significantly impact the adoption of innovations. In this study, "Knowledge and Information" has a Beta coefficient of 0.44, indicating a positive and significant relationship with the "Adoption of Innovations." This suggests that a one-unit increase in farmers' knowledge and information is associated with a 0.44-unit increase in the adoption of innovations, holding all other variables constant. The t-value of 6.78 indicates that this relationship is statistically significant ($p < 0.001$). Similarly, "Risk Perception and Attitude" also have a significant impact on the "Adoption of Innovations." It has a Beta coefficient of 0.23, indicating a positive relationship. This implies that a one-unit increase in farmers' risk perception and attitude is associated with a 0.23-unit increase in the adoption of innovations, holding all other variables constant. The t-value of 3.96 indicates that this relationship is statistically significant ($p = 0.002$).

IV. DISCUSSION AND CONCLUSION

The present study aimed to examine the impact of Farmers' Knowledge and Information on the Adoption of Innovations in agribusiness. The findings revealed a significant positive relationship between these variables, highlighting the influential role of knowledge and information in driving the adoption of innovations among farmers. The regression analysis results demonstrated that farmers' knowledge and information substantially impacted the adoption of innovations. This finding suggests that farmers with higher levels of knowledge and access to relevant information were likelier to embrace and adopt innovative practices in their agricultural activities. These results align with the existing literature, which consistently emphasizes the importance of knowledge and information in facilitating the adoption of innovations in agribusiness [14, 22].

Farmers who are well-informed and knowledgeable about new technologies, improved practices, and market

trends are better equipped to make informed decisions regarding the adoption of innovations. Access to up-to-date information, such as through extension services, agricultural publications, and online resources, empowers farmers to stay abreast of emerging trends and advancements in the field [25]. Moreover, the positive relationship between farmers' knowledge and information and the adoption of innovations can be attributed to the potential benefits associated with innovation adoption. Farmers who are aware of the advantages and potential positive outcomes of adopting innovations, such as increased productivity, enhanced efficiency, and better market opportunities, are more motivated to embrace change and integrate innovative practices into their farming operations.

The findings revealed a significant relationship between risk perception and attitude with the adoption of innovations in the agribusiness sector, highlighting the influential role of risk perception and attitude in driving the adoption of innovations among farmers. The regression analysis results indicated that risk perception and attitude had a notable impact on the adoption of innovations. This finding suggests that farmers with positive risk perceptions and attitudes were more likely to adopt innovations in their agricultural practices. The results align with existing research emphasizing the importance of risk perception and attitude in innovation adoption [23]. Farmers who perceive lower risks associated with adopting innovations and hold a positive attitude toward change are more inclined to embrace and adopt innovative practices. Positive attitudes can stem from various factors, such as perceived benefits, confidence in the effectiveness of the innovation, and trust in the information sources promoting the innovation. Risk perception plays a crucial role as well. Farmers who perceive lower risks associated with adopting innovations are more willing to take the necessary steps to integrate these practices into their farming operations [21]. This perception can be influenced by factors such as prior experience with innovations, information availability, and trust in the innovation providers.

A. *Theoretical Implications*

The present study has several theoretical implications, particularly in relation to the diffusion of innovation theory. The adoption of innovations in agribusiness is a complex process influenced by various factors, and understanding these dynamics is essential for effective policymaking and implementation. For instance, the findings of this study provide empirical support for the diffusion of innovation theory in the context of agribusiness. The theory posits that the adoption of innovations occurs in

a sequential manner, with certain individuals or groups being early adopters while others follow later. By examining the impact of farmers' knowledge and information, as well as risk perception and attitude, on the adoption of innovations, this study contributes to our understanding of the factors that influence the diffusion process. The results demonstrate that knowledge, information, risk perception, and attitude play significant roles in driving the adoption of innovations among farmers. Moreover, the study highlights the importance of knowledge transfer and information dissemination as key mechanisms for promoting innovation adoption. The diffusion of innovation theory emphasizes the role of communication channels and social networks in spreading information and influencing adoption decisions. In line with this, policymakers and agricultural extension services should focus on developing effective knowledge transfer strategies and communication networks to ensure farmers can access relevant and accurate information about innovations. This can include utilizing various channels such as extension programs, farmer-to-farmer knowledge exchange platforms, and digital technologies to disseminate information and facilitate knowledge sharing.

B. *Practical Implications*

The present study has important practical implications for stakeholders involved in promoting the adoption of innovations in agribusiness. The findings provide valuable insights into the factors that influence farmers' decision-making processes and can guide the development of practical strategies to enhance innovation adoption rates. One practical implication of this study is the need for targeted knowledge transfer and information dissemination initiatives. Policymakers, agricultural extension services, and other relevant organizations should prioritize developing and implementing effective knowledge-sharing programs. These programs should aim to provide farmers with accurate, up-to-date information about innovations, their benefits, and successful case studies. Utilizing multiple channels such as workshops, training sessions, field demonstrations, and online platforms can ensure that farmers have access to a variety of information sources. By equipping farmers with the necessary knowledge and information, stakeholders can empower them to make informed decisions about adopting innovations. The study also highlights the importance of addressing farmers' risk perception and attitude toward innovation adoption. Practical interventions should focus on reducing perceived risks and fostering positive attitudes. This can be achieved through showcasing successful cases of innovation adoption, providing evidence of the benefits, and offering

support mechanisms to address potential challenges. Creating platforms for knowledge sharing and collaboration among farmers, such as farmer groups or networks, can also play a vital role in building positive attitudes and mitigating perceived risks. Furthermore, policymakers and stakeholders should consider the role of incentives and support mechanisms in promoting innovation adoption.

C. Limitations and Future Directions

One limitation of this study is the potential limitation in sample representativeness. The data were collected from 350 farmers in the South Sulawesi Region of Indonesia, which may not fully capture the diversity and variations in farming practices and socio-economic conditions across different regions. Future studies could consider expanding the sample size and including farmers from other regions or countries to obtain a more comprehensive understanding. Another limitation is the reliance on self-reported data, which may be subject to response biases or inaccuracies. Participants' responses regarding their knowledge, risk perception, attitude, and adoption behavior could be influenced by social desirability bias or recall bias. To mitigate this limitation, future research could incorporate objective measures or observational data to complement self-reported data and provide a more robust assessment of the variables under study. The present study focused on the impact of farmers' knowledge and information and risk perception and attitude on the adoption of innovations. However, it is important to acknowledge that there may be external factors beyond the scope of this study that could influence innovation adoption, such as economic factors, market conditions, government policies, and cultural factors. Future research could consider incorporating these external factors into the analysis to provide a more comprehensive understanding of the adoption process and identify additional drivers or barriers to innovation adoption.

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