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PRIMARY RESEARCH

The role of sustainable agriculture practices and knowledge in shaping farmer attitudes and attachment to agriculture

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Keywords

Attitude toward agriculture
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Abstract

This cross-sectional, quantitative study investigates the intricate relationships between farmers' attitudes towards agriculture, sustainable farming practices, and the application of planned behavior theory, and how these factors are associated with their attitudes towards agriculture production and attachment. Additionally, the study explores the mediating and moderating roles of agriculture knowledge and technology adoption behavior. A sample of 373 farmers was collected through convenient sampling, and the data was analyzed using Smart-PLS. The findings reveal several significant relationships and dynamics within the agricultural context. First, the study demonstrates that farmers' attitudes toward agriculture significantly influence their attitudes toward agriculture production, emphasizing the pivotal role of personal attitudes in shaping production-related decisions. Furthermore, attitudes towards agriculture also have a substantial impact on farmers' attachment to the agricultural domain, highlighting the emotional dimension of their connection to the profession. Sustainable farming practices emerged as a crucial factor, significantly affecting both attitudes towards agriculture production and attachment. This underlines the growing importance of eco-friendly and resource-efficient agricultural methods in shaping not only production processes but also farmers' emotional ties to the industry. Planned behavior theory, applied within the framework of this study, offers valuable insights into the interplay of attitudes, subjective norms, and perceived behavioral control in influencing farmers' intentions and behaviors related to agriculture. This theoretical framework helps to explain the underlying motivations and decision-making processes of farmers in the agricultural context.

INTRODUCTION

Indonesia is located in the third-largest wetland area in the entire globe, reported to be 148,300 square kilometers or 8.2% of its total land area. The Indonesian archipelago is home to a large number of swampy peat bogs, including Papua, the eastern coasts of Riau, Jambi, and South Sumatra, the western coast of Aceh province in North-West Sumatra, and the stretch from West to East Kalimantan (Apriyana et al., 2021). These environments are renowned for having a wide range of plant species and significant biodiversity. 215 tree species and 92 non-tree species were identified in the Sebangau tropical peat swamp forest according to a recent study. Furthermore, 1,441 distinct plant species can be found in Southeast Asian wetlands; of them, 32 are unique to Indonesian peat swamp forests and 41 are unique to Borneo. One of the main sources of income for the people living in the Indonesian province of South Kalimantan, which is located in the country's east, is agriculture (Prayitno et al., 2021). The rising demand in South Kalimantan for agricultural products needs to be counter-balanced by certain government initiatives. Technological advances that are appropriate, efficient, and successful are necessary for the development of strategies, that farmers may implement in a socially and technically sound manner (Pawa, 2020; Tata,

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2019).

Farmer's land is a reservoir of emotions and a location to raise crops, work, and enjoy recreational activities. It is also a site rich in history and poignant symbols (Caffaro et al., 2020). Farmers' interest in farming is lowered as a result of the change in land usage, which causes feelings of loss Dong et al. (2022), joy, grief, and nostalgia (Alexander et al., 2020). Changes from the boundary are regarded as inefficiency, which means that given the existing use of production components, the present level of production could be raised or a lesser proportion of the production components might be generated (Pawa, 2020). Therefore, waste in terms of either manufacturing output or resource utilization during production is characterized as production ineffectiveness. The degree of inefficiencies as well as the connections between productivity and the characteristics of farms and/or the regulatory setting in which farms are located have previously been investigated through efficiency analysis (Alexander et al., 2020; Li et al., 2019). The attitudes of farmers towards different factors that impact agriculture production, for instance, have been the subject of several recent studies (Adnan et al., 2019; Li et al., 2019; Sulewski et al., 2020; Valizadeh et al., 2020); as well as the personality traits of farmers (Nguyen et al., 2019; Pawa, 2020; Tama et al., 2021).

Agriculture attachment is characterized as one of the social circumstances. In the literature on rural studies, the relationship between farmers and landowners has been extensively examined and debated. According to Dong et al. (2022), farmers are more likely to defend their land the more connected they are to it. Additionally, several works Kaler and Ruston (2019); Pawa (2020); Tama et al. (2021) have described a similar link with nature. Place attachment, which is defined as an emotional connection between people and their surroundings, seems to shed light on how people react to change (Cavanagh, 2015; Prayitno et al., 2021; Valizadeh et al., 2020). Although location and social attachments have been examined by several disciplines, both are seen to seem similar (Dessart et al., 2019). Furthermore, research has demonstrated that farmers require a lifelong dedication to the land (Apriyana et al., 2021; Kaler & Ruston, 2019). In general, farmers take great care to preserve their land, even if they are aware that they cannot do so forever (Tama et al., 2021; Zaremohzzabieh et al., 2022). Population expansion has led to changes in land use, which have resulted in rural areas becoming urban areas (Syuaib, 2016; Valizadeh et al., 2020).

When it comes to the rate of technical acceptance of farming system control and automation, the agricultural industry is now significantly behind other industries. Because the majority of antiquated or traditional farming methods have seldom ever produced the intended results in terms of maximum output or lowest production costs. In these systems, insecticides and fertilizers are used as inputs to raise output levels with the aid of cutting-edge, contemporary technologies (Singh et al., 2020). Thus, over the past few decades, experts have become more interested in closely examining the decision to embrace agricultural technology (Purwanto et al., 2021; Ramayah et al., 2018; Tama et al., 2021). Developed countries have examined certain technologies and identified variables that contribute to their acceptability (Pu & Zhong, 2020; Singh et al., 2020). Farmers must comprehend the phenomenon in order to optimize their adoption decision-making (Prayitno et al., 2021).

In recent years, there has been a growing body of study on the variables influencing farmers' adoption of ecologically friendly practices. There is a growing body of work in this literature that examines the impact of behavioral factors Gao et al. (2020); Li et al. (2021) and other scholarly attempts to assess the factors influencing farmers' adoption of sustainable practices Caffaro et al. (2020); Li et al. (2019) did not specifically focus on the role of behavioral factors, which frequently led to an incomplete overview and limited conceptual knowledge about how and why these factors affect making choices. These evaluations span multiple fields Ahmed et al. (2021); Dessart et al. (2019), and all but Ahmed et al. (2021); Caffaro et al. (2020) are older than ten years. A list of the behavioral elements affecting farmers' adoption of sustainable practices has been attempted in policy circles Adnan et al. (2019); Alexander et al. (2020), but the disciplinary breadth of these attempts was limited to behavioral economics and communication sciences. A comprehensive knowledge base based on an awareness of ecosystems, soil health, crop diversification, and resource management forms the foundation of this project (Apriyana et al., 2021). The principles of sustainable agriculture are based on this understanding. It gives farmers and other stakeholders the information they need to make wise decisions, encouraging actions that improve resilience, lessen their negative effects on the environment, and maintain the long-term viability of our agricultural systems. Researchers examine how new digital innovations interact with these trends to affect the performance of agricultural knowledge and advice networks in the future by using more conventional (Dessart et al., 2019; Hansson et al., 2020).

Farmers' attitudes toward risk have a significant role in determining how to allocate inputs, Fielke et al. (2020). Therefore, it is preferable to take into account a model

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that incorporates both production risk and attitudes toward agriculture. Because of this, risk affects every aspect of technology as well. Gao et al. (2020) highlighted many years ago that risk-averse farmers were using less input than was ideal, which could result in a decline in the farm's potential efficiency. The decreasing stability of production and financial circumstances in agriculture in recent years has made it increasingly important to understand the mechanisms by which farmers make production decisions in the face of unpredictability (Caffaro et al., 2020; Fielke et al., 2020). The present study determines that attitudes toward agriculture, and sustainable agriculture methods impact farmers' attitudes toward agriculture production and agriculture attachment and the mediating role of agriculture knowledge and moderating role of technology adoption behavior, as well as planned behavior theory involved in this study. This is how the rest of the paper is structured. The theoretical framework and literature assessment on farmers' attitudes towards agriculture production and agriculture attachment are presented in Section 2. Methodology is explained in Section 3. The results are presented in Section 4; the discussion, conclusions, limitations, and plans for further research are included in Section 5.

LITERATURE REVIEW

Planned Behavior Theory

Numerous models have been put forth in recent years to look into farmers' attitudes towards agriculture production and their attachment to it (Zaremohzzabieh et al., 2022). The Theory of Planned Behavior (TPB) is a paradigm that evaluates how farmers' attitudes become certain behaviors and aims to comprehend individual behavior. The theory of planned behavior, which continues to garner attention in a number of domains and is extremely pertinent to the agricultural and farming fields, is one of the best models in this regard (Tama et al., 2021). The foundation of the theory of planned behavior is the idea that people who have positive attitudes toward a situation or subject tend to judge them favorably, which affects how they behave toward that subject (Stone, 2016). Scholars are continuously adding constructs to the theory of planned behavior in order to enhance its predictive power and explain why positive intentions do not always translate into action (Alam et al., 2019; Kaler & Ruston, 2019; Sok et al., 2021). This is in keeping to comprehend behavioral intention in various contexts. Although the TPB has been used to explain behavior in research pertaining to agriculture (Stone, 2016; Tama et al., 2021; Zaremohzzabieh et al., 2022) the model itself has not yet been modified for use in this industry. The effects of agricultural education, the advancement of sustainable agriculture and agricultural knowledge, farmers' attitudes towards agriculture, sustainable agriculture practices, and agriculture attitudes all require further research. The creator of the theory of planned behavior, Sok et al. (2021), describes intention as an individual's immediate conduct or the factor that determines their particular behavior.

One of the most important theories for comprehending and forecasting human behavior and decision-making is the theory of planned behavior (Kaler & Ruston, 2019). The theory of planned behavior has been extensively utilized to forecast behavior; however, in numerous investigations, it has also been utilized to forecast behavioral intention in a range of practical settings, including agriculture. The desire to act is the direct prelude to an individual engaging in the behavior, according to the theory of planned behavior (Zaremohzzabieh et al., 2022). Therefore, willingness to act is determined by behavioral intention. The underlying hypothesis of the present investigation is that intention accurately predicts intended behavior, particularly when the behavior is hard to monitor or has not happened (Stone, 2016; Tama et al., 2021). Similarly to this, the real behavior of students' involvement in agriculture after graduation has not yet happened because of the design of the current study. Despite the fact that the two concepts are different, intention models have been shown to correctly predict behavior in a number of studies (Sok et al., 2021). Therefore, predicting students' intentions is useful for future farmers and policy makers who are worried about food security. Agriculture knowledge is a collection of facts kept in memory about a certain issue or circumstance (Alam et al., 2019). By giving people access to factual information that supports their formulation of convincing arguments for the protection of the environment, knowledge has been shown in several studies to affect both behavioral intention and behavior (Alam et al., 2019; Kaler & Ruston, 2019; Sok et al., 2021; Stone, 2016; Tama et al., 2021; Zaremohzzabieh et al., 2022). Knowledge of agriculture in this topic encompasses concepts related to farming practices and their economic viability.

Attitude toward agriculture

Previous research has repeatedly shown how significantly these attitudes affect a variety of agricultural characteristics (Kaler & Ruston, 2019). It has been established that a person's attitudes towards agriculture have a significant role in determining how attached they are to agricultural practices and how involved they are in the industry. Sulewski et al. (2020) conducted research within the framework of the Theory of Planned Behavior, which demonstrated the

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importance of farmers' attitudes in shaping their intentions and subsequent actions concerning the adoption of sustainable farming practices. Ahmed et al. (2021) discovered that farmers who had favorable opinions about contemporary agricultural technologies and practices were more inclined to use creative and effective solutions, which raised their total production. Alexander et al. (2020) found that those who felt strongly attached to agriculture were more likely to support sustainable farming practices and display pro-environmental behaviors. Dessart et al. (2019); Li et al. (2021) studies point to the critical role that attitudes play in determining agricultural attachment; favorable attitudes are frequently associated with higher levels of involvement, the adoption of contemporary techniques, and sustainable farming behaviors, all of which have an impact on the overall trajectory of agriculture. Thus, it is essential to comprehend and deal with these mindsets in order to advance sustainable agricultural growth (Gao et al., 2020).

These attitudes have a major influence on how farmers conduct their producing operations, as many previous studies have shown. In the context of the Theory of Planned Behavior, Pu and Zhong (2020) emphasized the importance of farmers' attitudes and showed how favorable attitudes toward particular farming practices were associated with the intention to adopt and use those practices. Additionally, Tama et al. (2021) discovered that farmers were more likely to increase their total yields and agricultural production efficiency if they had positive attitudes toward risk management techniques and the adoption of contemporary agricultural technologies. Stone (2016) found that farmers' attitudes play a crucial role in determining whether or not they embrace sustainable agricultural practices. These practices have the potential to improve long-term sustainability and reduce resource depletion, which can have a substantial impact on output outcomes. Together, these studies highlight the significant influence that farmers' attitudes have on the ways in which they produce agricultural products, underscoring the significance of comprehending and resolving these attitudes in order to advance more sustainable and effective agricultural production techniques (Pu & Zhong, 2020; Singh et al., 2020).

H1: Attitude toward agriculture has a significant impact on agriculture attachment.

H2: Attitude toward agriculture has a significant impact on farmer's attitudes toward agriculture production.

Sustainable agriculture method

Every farmer has a unique reason for choosing to follow more sustainable farming methods, such as cultivating cover crops, repairing hedgerows, or going organic. Examples of these included what meal they chose to eat at a canteen, how much energy they used at home, and whether or not they asked for a receipt at the restaurant (Prayitno et al., 2021). In contrast to these processes of decision-making, farmers' decisions to adopt more sustainable practices are primarily business-related, happen less frequently, frequently have long-term effects on both the individual and the economy, may entail significant financial outlays and a sustained commitment (such as taking part in voluntary land conservation programs), and are primarily related to the provision of public goods. Additionally, the choices made by farmers to adopt more sustainable practices can also be anticipated to be more tightly regulated and well-thought-out Alexander et al. (2020); Hansson et al. (2020); Pan et al. (2021) when contrasted to the aforementioned examples of consumer or citizen decision-making.

Agricultural development in Indonesia has progressed at a steady pace; however, the total production has not been able to meet the country's needs for food, and the majority of farmers continue to be low-income citizens (Apriyana et al., 2021). Moreover, increasing the use of chemicals and fertilizers in some agricultural production systems may endanger the natural areas that surround farmlands. Looking ahead, the real challenge facing agriculture is to continue increasing production while simultaneously minimizing environmental damage, conserving resources, and reducing poverty, hunger, and starvation. This does not imply, however, that the choices made will be unbiased or devoid of heuristics or biases, nor that the result will be sensible (Dessart et al., 2019). A more nuanced understanding of actual behavior, as opposed to proposed behavior, is prevented by a belief in logic, which, while providing a roughly approximate and frequently accurate account of farmer decisions, is unsuitable when examining the interactions between farmers and their surroundings (Ahmed et al., 2021). Because of these essential distinctions between farmers and the initial goals of an adoption technology behavioral strategy, not all behaviors informed activities aimed at farmers and citizens will be applicable or successful when it comes to farmers choosing to use more sustainable practices. The relationship between agriculture attachment and sustainable agricultural practices has been the subject of numerous prior investigations (Ahmed et al., 2021; Li et al., 2019; Singh et al., 2020). Prayitno et al. (2021) discovered that sustainable practices, which place a high priority on social justice, economic viability, and environmental stewardship, deeply connect people to the agriculture industry. Li et al. (2019) found that farm-

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ers who embraced sustainable agricultural methods—like crop rotation and organic farming reported feeling a closer emotional connection to their land and means of subsistence. Ahmed et al. (2021); Singh et al. (2020) highlighted how sustainable agriculture practices strengthen farmers' relationships to both the natural environment and their communities. Furthermore, studies have repeatedly demonstrated how sustainable agriculture practices affect farmers' perceptions of agricultural output. According to Dessart et al. (2019); Prayitno et al. (2021), farmers who adopted sustainable agricultural practices showed increased satisfaction with their approaches. They saw the move towards sustainability as a way to improve their communities' general well-being and agricultural productivity. Chen et al. (2018) found that farmers' views changed significantly as a result of adopting sustainable agriculture methods, perceiving agricultural output as a means of preserving natural resources and advancing a sustainable future.

H3: The sustainable agriculture method has a significant impact on agriculture attachment.

H4: Sustainable agriculture method has a significant impact on farmer's attitudes toward agriculture production.

Mediating role of agriculture knowledge

Agricultural knowledge is "a fluid mix of structured expertise, numbers, historical context, and knowledge from experts which offers a basis for assessing and integrating fresh knowledge and data about agriculture," according to Fielke et al. (2020). It comes from and is used in knowers' thoughts. Thus, knowledge and information are regarded as commodities that meet basic human needs. However, these resources are "volatile," different from conventional things (they can be misplaced or distorted, for instance) (Nguyen et al., 2019; Stone, 2016). Simultaneously, information and knowledge possess additional unique and valuable qualities. These include such as the ability to multiply knowledge, which is not depleted during production. The transmission of knowledge does not result in its loss; rather, the person transmitting it retains it and the relative ease with which knowledge can be acquired (provided adequate motivation and conditions) and then placed at the exclusive disposal of the individual who has acquired it (Janc et al., 2019). Similar to other economies, farming relies heavily on information to sustain and even improve effectiveness (Fielke et al., 2020; Stone, 2016). From the outset, research on modernizing agriculture showed that increasing farm economic development required farmers to become knowledgeable about existing production technology. Then, among the factors explaining variations in farm productivity and the geographic division of this occurrence, knowledge, and education levels began to be mentioned. While some models considered knowledge and technology to be external aspects One of the fundamental theories of economics (the model of induced development in farming, introduced by Janc et al. (2019) was Similar to other economies, farming relies heavily on information to sustain and even improve effectiveness (Adnan et al., 2019). From the outset, research on modernizing agriculture showed that increasing farm economic development required farmers to become knowledgeable about existing production technology (Caffaro et al., 2020). Then, among the factors explaining variations in farm productivity and the geographic division of this occurrence, knowledge, and education levels began to be mentioned. While some models considered knowledge and technology to be external aspects. One of the fundamental theories of economics (the model of induced development in farming, was introduced by Fielke et al. (2020); Janc et al. (2019).

Moreover, the function of agricultural knowledge as a moderating element encompasses its influence on the correlation between sustainable farming practices and a farmer's perspective on crop yield (Caffaro et al., 2020). Approaches to sustainable agriculture that put an emphasis on economically and environmentally sound practices are crucial for tackling the problems associated with contemporary agriculture. Studies show that farmers are more likely to embrace and implement sustainable practices in their production operations if they have a strong foundation in these areas (Fielke et al., 2020). Farmers are more likely to have positive attitudes as a result of this knowledge-mediated interaction because they understand the long-term advantages of sustainable agriculture, which include higher yields, less damage to the environment, and improved economic stability. Therefore, this review of the literature emphasizes how knowledge about agriculture plays a complex role in mediating the interactions between views, sustainable practices, and agricultural attachment, highlighting its importance in determining the direction of agriculture (Hansson et al., 2020). A better understanding of agricultural principles tends to make farmers more optimistic about the industry, viewing it as a means of subsistence, sustainability, and communal cohesiveness. Kaler and Ruston (2019), agriculture knowledge serves as a link that strengthens people's bonds with the agricultural sector. This one is often understood to refer to the ability and aptitude to foster collaboration among members of a group or organization in order to further shared interests. Thus, attention is made to the fundamentals of social interactions

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and how they help to understand conduct, in this case, decisions about knowledge sources chosen (as inter alia affected by peers) (Alam et al., 2019). Attachment and close relationships with family, friends, and neighbors, Nguyen et al. (2019), are different from weaker ones in that they facilitate easier access to information required for the operation and coordination of systems of sharing information and knowledge appropriation, as well as easier decision-making (Sok et al., 2021). In particular, the Internet facilitates information sharing and exchange Sulewski et al. (2020), including the state of agricultural markets, farmer-related weather, and government and local government initiatives. It also makes it possible to avoid intermediaries when new production technologies and solutions are being explored (Purwanto et al., 2021).

H5: Agriculture knowledge has a mediating impact between attitude toward agriculture and agriculture attachment.

H6: Agriculture knowledge has a mediating impact between attitude toward agriculture and farmer's attitude toward agriculture production.

H7: Agriculture knowledge has a mediating impact between sustainable agriculture methods and agriculture attachment.

H8: Agriculture knowledge has mediating impact between sustainable agriculture methods and farmer's attitudes toward agriculture production.

Moderating Role of Technology Adoption Behavior

Prior research on the adoption of agricultural technology in Indonesia mostly examined top-down promotion strategies, with comparatively less attention paid to farmer adoption behaviors (Sulewski et al., 2020; Tata, 2019). Moreover, studies explicitly focusing on tree crops are uncommon; most research on agriculture technology adoption habits globally has been on grain crops. For example, it takes several years to reach harvesting maturity for tree crops. Tree crops also typically have a higher, albeit more variable, market price (Pu & Zhong, 2020). Indonesia in the modern era offers fascinating insights into farmer technology adoption patterns. First off, like in other developing nations, some farming households in Indonesia depend on agriculture for a living. Growth in agriculture can be directly connected to a decrease in poverty for these households. However, they cannot take on the risks associated with experimenting with new technologies (Tama et al., 2021). Furthermore, the majority of younger generations in certain farming homes, like in other affluent nations, increasingly work in cities, leaving older family members to tend to the land. These elderly farmers may be incapable of learning and using new methods (Sulewski et al., 2020). The Farmers, on the other hand, are young individuals who have taken the initiative to engage in agriculture after receiving a solid education Valizadeh et al. (2020), and one of their traits is their enthusiasm to embrace new technologies. Finally, high-quality edible agricultural goods are starting to receive more and more attention from Indonesian farmers and the government.

Technology adoption behavior assumes that farmers are rational agents who seek to maximize their own interests while deciding whether to implement new agricultural techniques. Simon, however, proposed the notion of bounded rationality, which brings decision-making closer to reality (Sulewski et al., 2020; Zaremohzzabieh et al., 2022). Technology adoption behavior is predicated on the notion that people are searching for a "good enough" decision which Simon referred to as a satisfying decision because they lack full information and have cognitive limitations (Pu & Zhong, 2020; Singh et al., 2020). Information acquired, a farmer's cognitive capacity, and his or her attitude toward technology all play a role in the decision to adopt new technology. A farmer adopts a new technology in five steps, according to Rogers' innovation diffusion theory: the farmer learns about the technology, develops an attitude towards it, makes a decision, puts it into practice, and confirms it (Prayitno et al., 2021). There is a lot of informal (like from neighbors) as well as formal (like via training) information available about agricultural technology. The amount of knowledge a farmer may obtain depends on a number of factors, including social capital (Tama et al., 2021). A farmer's familial and personal traits influence their cognitive level. Adoption behavior is also influenced by a variety of circumstances and is a result of both the dynamic proliferation of technology and the psychological process that goes from cognition to decision-making. According to Valizadeh et al. (2020), adoption is defined as the choice to fully utilize an innovation, which is a phrase used interchangeably with new technology, as the best available course of action. This usually involves going through a number of steps before adoption. According to Fielke et al. (2020), individual adoption decisions are influenced by a variety of factors, including the traits of potential adopters and the perceptions that follow regarding innovation attributes, their adoption behaviors, and the learning and communications that take place throughout the various stages of the innovation decision-making process. These findings are supported by sociological research. More specifically, according to Li et al. (2021), the chance of adopting agricultural technology depends on the character-

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istics of the farmer, the characteristics of the new technology, and the environment.

H9: Technology adoption behavior has a moderating impact on agriculture knowledge and agriculture attachment.

H10: Technology adoption behavior has a moderating impact on agriculture knowledge and farmers' attitudes toward agriculture production.

Agriculture attachment

Researchers have characterized agriculture attachment in a variety of ways, but most agree that it is a complex structure (Valizadeh et al., 2020). Prayitno et al. (2021); Valizadeh et al. (2020), the identity of the place, the effects of the location, the reliance or dependence on the site, and Prayitno et al. (2021), as well as the social connections in the region, are some examples of this. Scientifically and conceptually speaking, there is a growing body of work in a variety of domains, such as tourism, the administration of natural resources, and ecological behavioral science (Cavanagh, 2015; Prayitno et al., 2021; Valizadeh et al., 2020). The research on how we perceive the environment and psychology serves as the foundation for both the definition and the traits of position attachment. A strong attachment to a place can also be attributed to environmental pleasure and affection for the area, as these factors make it more difficult to relocate (Cavanagh, 2015; Prayitno et al., 2021; Valizadeh et al., 2020). These included relationships to identity Adnan et al. (2019), location reliance Ahmed et al. (2021), community (friends and family ties) Alam et al. (2019), and climate (nature) Alexander et al. (2020); Dessart et al. (2019). Changes in land use are caused by social, economic, and governmental policies aimed at regulating the sector or national growth (Dessart et al., 2019). Two categories of causes are responsible for changes in land use: internal and external (Caffaro et al., 2020; Gao et al., 2020). Reduced soil fertility and economic pressures are closely tied to both internal and external variables. According to Dong et al. (2022), there was an annual shift in agricultural land use of 187,720 ha. The majority of the converted property was put to use as building lots and for the construction of homes. In addition, 48.96% of the land converted was used for housing development, with 36.50% and 14.55% going to industrial and office development, respectively (Fielke et al., 2020). Agricultural farmland has a low value in comparison to other (non-agricultural) land uses, which leads to ongoing conversions into non-agriculture (Hansson et al., 2020; Kaler & Ruston, 2019). Agricultural land, especially rice fields, provides ecological functions as well as economic ones, such as controlling water management and absorbing carbon from the atmosphere (Janc et al., 2019). The benefits of agricultural land should be maintained rather than disregarded, since farmland conversion frequently upsets farmers' socioeconomic lives Kaler and Ruston (2019), and because perceived socioeconomic changes seem to be bad for the farming community (Alam et al., 2019).

H11: Technology adoption behavior has a significant impact on agriculture attachment.

Farmer's attitude toward agriculture production

Previous research has yielded significant insights into the deep influence that farmers' adoption behavior of technology has on their attitudes and methods for agricultural output in general (Pu & Zhong, 2020). Stone (2016), studies conducted in the area of innovation diffusion theory showed how farmers' attitudes and perceptions of new agricultural technologies were greatly impacted by their acceptance. Furthermore, Hansson et al. (2020) made clear that farmers who were successful in implementing contemporary agricultural technologies also tended to have more positive attitudes towards innovation and were more likely to expand their adoption practices, which raised output and improved well-being all around. Furthermore, (Pu & Zhong, 2020) research showed that farmers' views improved as they adopted new technology, especially when it came to lower labor intensity and higher income. All of these studies highlight how important it is for farmers' attitudes towards agricultural production to be shaped by their behavior when adopting new technologies since successful adoption of these tools can boost productivity while also encouraging more creative and positive attitudes in farmers (Stone, 2016; Zaremohzzabieh et al., 2022). In order to promote sustainable and productive agricultural practices and enable the widespread use of cutting-edge agricultural technologies, it is imperative to comprehend this dynamic interaction. It implies that social structures, communication channels, innovativeness of persons, perceived innovations, and adopter readiness for change all have an impact on technology adoption.

Additionally, Pu and Zhong (2020) carried out a groundbreaking study on the adoption of contemporary farming technologies in the agricultural setting, highlighting the influence of socioeconomic conditions, information availability, and loan availability on farmers' technology adoption behavior. Similarly, Pan et al. (2021) showed how social networks and extension services can affect farmers' decisions to adopt new technologies by highlighting their significance in influencing farmers' adoption of agricultural innovations. Taken as a whole, these studies highlight how mul-

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tifaceted technology adoption behavior is and how several aspects affect its outcome. Furthermore, the focus of more recent studies has been on comprehending the dynamics of technology adoption in relation to precision and digital agriculture. Research conducted by Hansson et al. (2020); Janc et al. (2019) has investigated the ways in which data-driven decision-making, sensor technologies, and artificial intelligence are influencing farmers' technology adoption practices. The focus has been on how these technologies can improve productivity and sustainability.

H12: Technology adoption behavior has a significant impact on farmer's attitudes toward agriculture production.

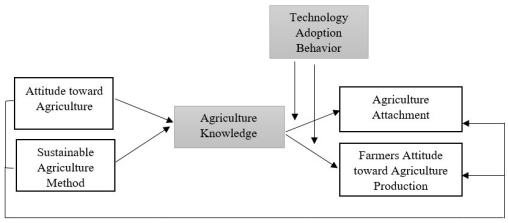

FIGURE 1. Conceptual framework

METHODOLOGY

This study reflects the agriculture attachment and farmers' attitude toward agriculture production in the presence of attitude toward agriculture and sustainable agriculture method, as predictor variables. Agriculture knowledge is the mediating variable and technology adoption behavior is the moderating variable in this conceptual framework. Based on the mentioned phenomena this research was quantitative and descriptive in nature, where the explanatory approach was used to investigate the role of sustainable agriculture practices and knowledge in shaping farmer attitudes and attachment to agriculture. To test the hypotheses, data was collected and it was primary data by using the cross-sectional time horizon. Respondents were approached just for one time to collect the data by using the adapted questionnaire as an instrument. A survey method was used in this research where questionnaires were distributed among the targeted population. The respondents were farmers belonging to the South Kalimantan Province of Indonesia. To gather the data, 400 questionnaires were distributed and out of those 373 were received as filled properly. The population was unknown as it was difficult to approach all the farmers and access the record which is why a non-probability sampling technique was used. The sampling method in this study to collect the data from the respondents was convenience sampling. After gathering the data, all statistical tests were performed by using the SMART PLS as a tool.

After defining the context of the study adapted questionnaire was used, because the survey approach was used to test the defined research assumptions. Face to face method was used for gathering the data from the respondents as the farmers were not that educated and they needed to define the clear purpose of the study and what was required from them as a respondent. To assemble the items from different sources by using the adapted method of designing the questionnaire, the instrument was formatted into three parts, one was the information regarding the aim and direction of the research and why the data is collected. It was indicated as well that the provided data will be kept secret and usage will be limited to this research only. The second part of the instrument contains the demographical information, close-ended options were mentioned so that the respondent can easily chose the range of the following questions, like; gender, age, farm size, education and experience. The final part of the instrument was consist of the variables items with reference to the context of the study. For attitude toward agriculture as an independent variable, total 4 items were adapted from Sulewski et al. (2020) and the other predictor variable sustainable agriculture method was measured by using the 5 items scale developed by Syuaib (2016). Agriculture knowledge was measured as a mediating variable and 4 items were adapted from Norgaard (1984). The moderating variable technology adoption behavior was measured by using the scale of Kaler and Ruston (2019), where 6 items were adapted. The outcome variable of agriculture attachment was measured by adapting the 6 items from the scale of Cavanagh (2015) and the other outcome variable of the study, farmers attitude toward agriculture production was measured by using the 8 items scale of (Stone, 2016).

Demographics

Table 1 displays the demographic information and descriptive statistics of the sample (N=373) used in this investigation. Planned behavior theory is included, as is the impact of sustainable agriculture methods and attitudes towards agriculture production and attachment. Mediating and moderating the role of technology adoption behavior are agriculture knowledge and planned behavior. The primary features of a dataset are listed and described using descriptive statistics. These statistics give a general summary of the data in terms of central tendency, variability, and other pertinent information. In addition to summarizing, highlighting, and condensing the salient features of a dataset used in a specific inquiry, it offers a summary that highlights the large dataset and its measurements. According to data collection, 373 farmers are from Indonesia's South Kalimantan Province.

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TABLE 1. Demographic profile

Demography	Description	No. of Responses	%
Gender	Male	269	72
	Female	104	28
Age	Less than 20 Years	93	25
	21-30	101	27
	31-40	90	24
	Above 40 Years	89	24
Farm size	Below 7 acres	121	33
	7–9 acres	98	26
	10 acres and above	154	41
Education	Primary schooling	121	33
	Secondary schooling	112	30
	Collage	90	24
	others	50	13
Experience	1-3 years	102	27
	5-7 years	152	41
	More than 7 year	119	32

RESULTS

The present study determines that attitude toward agriculture, sustainable agriculture method impact on farmer's attitude toward agriculture production and agriculture attachment and mediating role of agriculture knowledge and moderating role of technology adoption behavior, as well as planned behavior theory involved. Using SmartPLS3, the structural and measurement models were evaluated (Sarstedt & Cheah, 2019).

Structural model

Reliability and validity test

Before assessing convergent validity, the researcher looked at the item loadings and cross-loadings for each study variable as a prerequisite for the measurement model. During the model evaluation process, the measurement model's validity and reliability were assessed. Notably, all of the items used in this investigation were adapted from another study, and the only software utilized for confirmatory component analysis was SmartPLS 3.0 Ramayah et al. (2018), which includes a built-in CFA capability. Internal consistency reliability, according to Sarstedt and Cheah (2019), quantifies the degree to which every item on a certain subscale measures the same underlying concept. A measurement model, also known as a confirmatory factor analysis (CFA) model, is a statistical technique used in quantitative research to assess an observational variable or indicator set's suitability for measurement. It is frequently used in disciplines like psychology, the social sciences, and market research to validate the measurement techniques used in a study. The measurement model examines the relationships between the latent constructs to support the observable variables. When evaluating the consistency or reliability of a set of observed variables on a measuring scale, two methods of "internal consistency reliability, Composite Reliability (CR) and Cronbach's Alpha" are commonly utilized. They are frequently employed in the field of psychometrics to assess the accuracy of scales and questionnaires. Even though the goals are similar, there are differences in how they are computed and understood. According to Sarstedt and Cheah (2019), composite reliability should ideally achieve a minimum requirement of 0.70 and the Average Variance Extracted (AVE) should be at least 0.50. With AVE values over the 0.50 cutoff point, Table 2, which is displayed below, demonstrates strong reliability for all of the constructions and demonstrates the measurement model's dependability. In this study, Cronbach's Alpha was also computed to evaluate the internal consistency of the data. Additionally, Sarstedt and Cheah (2019), offer the following guidelines for interpreting alpha values: Good is defined as $\alpha < 0.8$, acceptable as $\alpha < 0.7$, and excellent as $\alpha > 0.9$. The AVE, composite reliability, and Cronbach's Alpha values for each construct are shown in the accompanying Table 2. The average variance, composite reliability, and Cronbach alpha of the variables used in this study are shown in Table 2.

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TABLE 2. Composite reliability, cronbach's alpha and AVE values

Constructs/Items	CA	Rho-A	CR	AVE
Agriculture Attachment	0.856	0.861	0.893	0.584
Agriculture Knowledge	0.868	0.868	0.911	0.720
Attitude toward Agriculture	0.838	0.841	0.892	0.676
Farmer's Attitude toward Agriculture Production	0.888	0.895	0.911	0.564
Sustainable Agriculture Method	0.854	0.859	0.895	0.632
Technology Adoption Behavior	0.897	0.899	0.921	0.661

Note: CR=composite reliability; AVE=average variance extracted; CA= Cronbach's Alpha

Discriminant validity

The ability of a measuring instrument to consistently detect a range of variables or elements that are hypothesized to be distinct from one another is referred to as "discriminant validity" in statistical approaches (Purwanto et al., 2021). The Average Variance Extracted (AVE) method proposed by Sarstedt and Cheah (2019), was applied to assess discriminant validity within the context of this study. Discriminant validity was ascertained by comparing the correlations between latent variables with the square root of each of their individual AVE values, in accordance with the instructions given by Sarstedt and Cheah (2019). As per their suggestions, the demonstration of discriminant validity necessitates that the square root of the AVE for a particular latent variable surpasses the correlation values among other latent variables. The significant degree of outside loading is compared to cross-loading in the discriminant validity assessment. A construct deviates significantly from other similar structures when its outside load surpasses its cross-loading significance (Ramayah et al., 2018; Sarstedt & Cheah, 2019). The built-outside loadings (bold) are higher than the cross-loading, as Table 3 demonstrates. It implies that every construct assesses a distinct idea. This covers surveys and questionnaires. Research on structural route analysis was conducted once it was shown that all requirements for the variables' validity and reliability had been met. The HTMT values of less than one further highlighted the discriminant validity. The HTMT values are shown in Table 3.

TABLE 3. Discriminant validity

	ALS	DLS	EIL	PS	PT	TLS
Agriculture Attachment	0.764					
Agriculture Knowledge	0.730	0.848				
Attitude toward Agriculture	0.709	0.650	0.822			
Farmers Attitude toward Agriculture Production	0.916	0.788	0.721	0.751		
Sustainable Agriculture Method	0.690	0.639	0.577	0.704	0.795	
Technology Adoption Behavior	-0.674	-0.763	-0.605	-0.688	-0.538	0.813

Assessment of R square

The R-square in a regression model shows how well the independent variables account for the variance in the dependent variable. The route coefficients are required in order for the study to be deemed vital, even though the R square value may differ significantly depending on the study region. Sarstedt and Cheah (2019), state that in order for the study to be considered essential, the path coefficients must be present. The suggested values of 0.19, 0.33, and 0.67 are regarded as substantial, moderate, and low. In a regression model, the R-square indicates the extent to which the independent variables can account for the variance in the dependent variable.

TABLE 4. Assessment of R square

	R^2
Agriculture Attachment	0.685
Agriculture Knowledge	0.527
Farmers Attitude toward Agriculture Production	0.738

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Measurement model

Three models of structures in this work, three structural models are used: the direct relationship structural model, the mediation structural model, and the structural model with moderating variables. The structural model route coefficients that supported the postulated relationships were statistically determined using the PLS-SEM bootstrapping approach. The structural equation model (SEM) is an example of a statistical model that shows the relationships between a set of latent variables and their observable indicators or variables. A useful and flexible statistical method for evaluating complex theoretical models and hypotheses is the structural equation model. By utilizing factor analysis, regression analysis, and path analysis, structural equation modeling generates a comprehensive model that can account for both the direct and indirect interactions between variables. The variables inside the model are categorized as either latent variables, which are unobserved components believed to underlie the observed variables, or observable variables, which are the variables that are assessed (Ramayah et al., 2018).

Direct and indirect analysis

Using the PLS-SEM bootstrapping method, the structural model route coefficients supporting the hypothesized associations were statistically determined. A statistical modeling method called structural equation modeling (SEM) is used to look into intricate interactions between latent, or unseen, and apparent variables. Combining elements from route assessment, regression evaluation, and component evaluation yields a useful method that simultaneously analyses measurement models and structural models (Ramayah et al., 2018; Sarstedt & Cheah, 2019). The average fit quality indicators of the proposed structural model are shown. The standardized coefficients and pertinent t- and p-values are shown in Table 5. The outcomes of the hypothesis testing are displayed in Figure 2 and Table 5. The influence or impact of a third variable, the moderator, on the relationship between two other variables, the independent variable, and the dependent variable, is known as a moderating effect in statistical analysis and research. In essence, a moderating effect is a helpful tool for determining which circumstances or participants have a greater, weaker, or even skewed relationship between two variables. Sarstedt and Cheah (2019), assert that it matters when the link between the independent and dependent variables is irregular or tepid. Sarstedt and Cheah (2019), state that following the assessment of measurement model direct relationships, the structural model handles the relationship's dependency in the study's hypothesized model. The structural model provides an internal modeling examination of the direct link between the path coefficients and t-values of the study's constructs PLS. The regression analysis's path coefficient is comparable to the standardised beta coefficient, according to Sarstedt and Cheah (2019). Where the significance is ascertained by analysing the t-values and the beta values of the regression's coefficient. The main objectives of this study are to test the model by first examining direct ties and then utilising a structural model to evaluate the hypothesised links between the constructs.

According to Sarstedt and Cheah (2019), the main goal of the mediation test was to identify the mediating variable that enhanced the impact of the independent variable on the dependent variable. As a result, from the standpoint of the current study, the researchers used the bootstrapping, or resampling, mediation strategy to examine the indirect effect of each prospective variable. In a similar vein, the majority of researchers discovered that future researchers were growing increasingly intrigued by bootstrapping a non-parametric resampling strategy since it is one of the most complete and successful ways to ascertain whether the mediation effect is there. According to Sarstedt and Cheah (2019), PLS-SEM is the best option for bootstrapping for mediation analysis, while it can be utilized with smaller sample sizes as well. When evaluating the mediation effects, researchers should bootstrap the sampling distribution of the indirect effects that work for simple and complex models, according to Sarstedt and Cheah (2019). Sarstedt and Cheah (2019) employ an approach that entails determining the route coefficients using the PLS algorithm first, then obtaining the t-values by bootstrapping and determining whether there are direct relationships between the independent and dependent variables before evaluating the mediation impact. A test of moderation was carried out, according to Sarstedt and Cheah (2019), to ascertain which moderator variable affects the direction or intensity of the relationship between the independent and dependent variables. According to Sarstedt and Cheah (2019), moderator factors are frequently included in studies where there is a weak or inconsistent relationship between the independent and dependent variables. There are further techniques, such as the three-step hierarchical regression procedure, for analyzing the moderating effects. The drawback of this approach is that it necessitates the manual computing of interaction terms via the use of compute, transforms, functions, and taking the product of each pair. Another way is to employ the moderating variable as an additional construct by using the cross-products of the moderator and the indicator of the independent variable (Ramayah et al., 2018; Sarstedt & Cheah, 2019).

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TABLE 5. Direct and indirect relationship

	Relationships	Original Sample	*T* Statistics	*p* Values	Decision
H1	Attitude toward Agriculture -> Agriculture Attachment	0.295	6.821	0.000	Supported
H2	Attitude toward Agriculture -> Farmers Attitude toward Agriculture Production	0.270	7.422	0.000	Supported
H3	Sustainable Agriculture Method -> Agriculture Attachment	0.295	5.550	0.000	Supported
H4	Sustainable Agriculture Method -> Farmers Attitude toward Agriculture Production	0.265	5.512	0.000	Supported
H5	Attitude toward Agriculture -> Agriculture Knowledge -> Agriculture Attachment	0.124	3.618	0.000	Supported
H6	Attitude toward Agriculture -> Agriculture Knowledge -> Farmers Attitude toward Agriculture Production	0.178	4.142	0.000	Supported
H7	Sustainable Agriculture Method -> Agriculture Knowledge -> Agriculture Attachment	0.116	3.313	0.001	Supported
H8	Sustainable Agriculture Method -> Agriculture Knowledge -> Farmers Attitude toward Agriculture Production	0.166	4.875	0.000	Supported
H9	Moderating Effect 1 -> Agriculture Attachment	0.158	3.215	0.001	Supported
H10	Moderating Effect 2 -> Farmers Attitude toward Agriculture Production	0.123	3.334	0.001	Supported
H11	Technology Adoption Behavior -> Agriculture Attachment	-0.239	3.623	0.000	Supported
H12	Technology Adoption Behavior -> Farmers Attitude toward Agriculture Production	-0.158	2.786	0.006	Supported

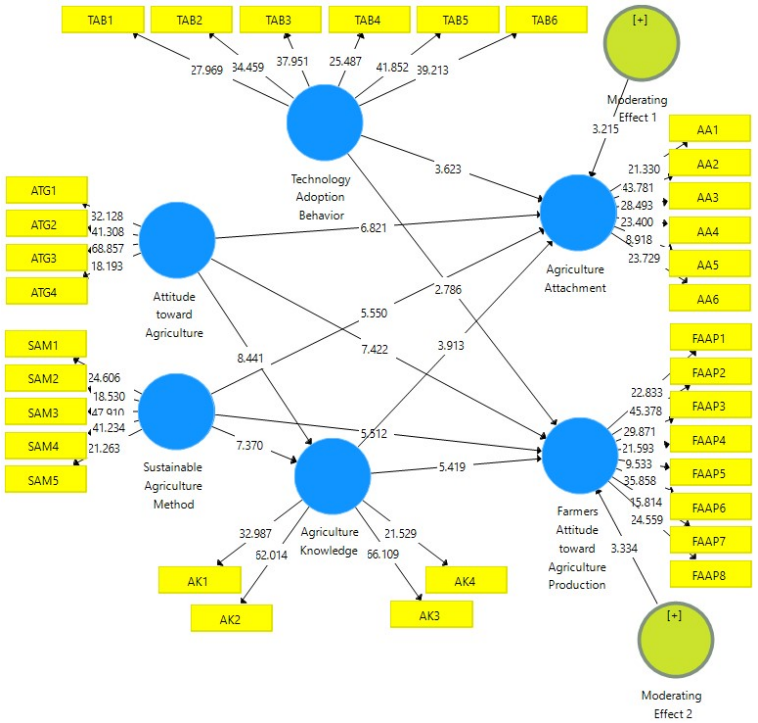

FIGURE 2. Measurement model

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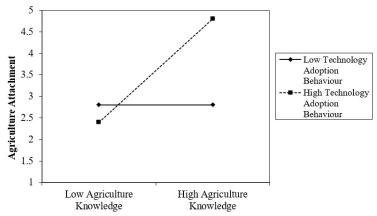

FIGURE 3. Moderating effect 1

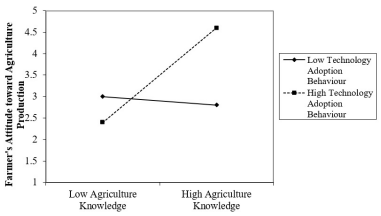

FIGURE 4. Moderating effect 2

DISCUSSION AND CONCLUSION

The goal of the current study is to ascertain how farmers' attitudes towards agriculture, sustainable farming practices, and planned behavior theory are related to their attitudes towards agriculture production, attachment, and mediating and moderating roles, respectively, of agriculture knowledge and technology adoption behavior. All hypotheses were accepted. Our study has shown that farmers' views are very important in determining how they approach agricultural output and how emotionally attached they are to the industry. Furthermore, the mediating and moderating functions of technology adoption behavior and agriculture knowledge have been discovered, highlighting their importance in shaping the overall dynamics within the agricultural sector. Policymakers, agricultural organizations, and educators who want to encourage sustainable farming practices and improve the overall performance of the agricultural sector will find great value in these findings. In order to guarantee a sustainable and profitable future for agriculture, greater study in this field may contribute to the development of more focused tactics for encouraging positive attitudes among farmers and hastening the adoption of cutting-edge technologies.

The results show that attitude toward agriculture has a significant impact on agriculture attachment. The results show that attitude toward agriculture has a significant impact on farmer's attitude toward agriculture production. First, the understanding that attitudes regarding agriculture have a major impact on agriculture attachment highlights the psychological and emotional bond that farmers have with their work. Farmers are more likely to form a deep bond with their farming methods, their land, and the agricultural community when they have good attitudes towards agriculture (Hansson et al., 2020; Li et al., 2019). Significant effects on things like job satisfaction, staying in the agricultural industry, and farmers' general well-being may result from this attachment. It implies that initiatives meant to enhance farmers' perceptions of agriculture may also serve to subtly encourage a stronger sense of dedication and attachment to their labor. Secondly, our research emphasizes the significant influence that farmers' perspectives on agriculture have on their perspectives regarding agricultural output. A farmer's approach to production practices may be motivated by a favorable attitude towards agriculture. Positive attitudes among farmers increase the likelihood that they will use creative and sustainable agricultural methods, which can have significant positive effects on output, resource conservation, and environmental sustainability. This research emphasizes how crucial it is to support more sustainable and fruitful farming practices by not just dispensing technical knowledge but also encouraging positive attitudes within the farming community (Prayitno et al., 2021; Sok et al., 2021). The results show that the sustainable agriculture method has a significant impact on agriculture attachment. The results show that the sustainable agriculture method has a significant impact on farmer's attitude toward agriculture production. According to research, agriculture attachment is significantly positively impacted by sustainable agricultural practices. This implies that farmers form a closer emotional and psychological bond with their work, their land, and the larger agricultural community when they implement sustainable farming practices. Such a connection can be a potent incentive, boosting job satisfaction and retention rates in the agriculture industry.

The results show that agriculture knowledge has a mediating impact between attitude toward agriculture and agriculture attachment. The results show that agriculture knowledge has a mediating impact between attitude toward agriculture and farmer's attitude toward agriculture production. The results show that agriculture knowledge has a mediating impact between sustainable agriculture methods and agriculture attachment. The results show that agriculture knowledge has a mediating impact between sustainable agriculture methods and farmers' attitudes toward agriculture production. This suggests that an individual's emotional attachment to the agricultural realm is mostly shaped by their degree of agricultural knowledge (Sulewski et al., 2020). This is a crucial realization because it emphasizes the value of public education programs and awareness efforts that try to increase people's knowledge of agriculture and, ultimately, strengthen their loyalty to it. Tama et al. (2021) demonstrate the relationship that exists between people's affinity for agriculture and ecologically conscious

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practices. It implies that raising awareness of sustainable farming methods and spreading information about them may improve people's attachment to the agricultural industry. This research supports the global trend toward sustainable agriculture and emphasizes the value of teaching farmers and the general public about the advantages of these methods. Furthermore, Tata (2019) shows that farmers' attitudes towards agriculture production are influenced by their understanding of the field, both in terms of their general attitudes and their adoption of sustainable practices. This implies that, whether they are thinking about using traditional or sustainable methods, farmers who possess a greater degree of agricultural expertise are more likely to have favorable views about agricultural output. This may have real-world effects on agricultural policy and extension services, which may concentrate on increasing farmers' knowledge to encourage positive attitudes and more environmentally friendly practices in the industry.

The results show that technology adoption behavior has a moderating impact on agriculture knowledge and agriculture attachment. The results show that technology adoption behavior has a moderating impact on agriculture knowledge and farmer's attitude toward agriculture production. This finding is noteworthy because it emphasizes how technology is always changing the way people farm and how they feel about the industry. Zaremohzzabieh et al. (2022) suggest that by making knowledge and resources more accessible, technology might serve as a catalyst for improving attachment. Farmers' attitudes about agricultural knowledge can be influenced by the degree of technology adoption, indicating that the incorporation of technology can have a substantial impact on how they view production methods. The results show that technology adoption behavior has a significant impact on agriculture attachment. The results show that technology adoption behavior has a significant impact on farmer's attitudes toward agriculture production. With the globe becoming more digitally connected, technology can be a very effective instrument to increase interest in agriculture. It gives users access to data-driven decision-making, creative solutions, and real-time information. These things can help people who are interested in agriculture whether as professionals or hobbyists feel more connected to one another. Growing technology has the potential to make farming practices more productive, sustainable, and efficient. Farmers who accept and use these technical advancements are probably going to be more optimistic about their farming practices, seeing them as chances for development and advancement (Pu & Zhong, 2020; Tama et al., 2021). This conclusion highlights the significance of encouraging and supporting farmers' adoption of technology as a way to improve their general attitudes and contentment with agriculture output, which has significant implications for policymakers and agricultural extension services.

The findings underscore the critical function that agricultural knowledge plays in mediating and moderating these associations. As a result, it emphasizes the significance of educational initiatives meant to raise farmers' level of agricultural expertise. To improve their comprehension of sustainable practices and technology breakthroughs, extension services, workshops, and educational programs can be created, which will ultimately lead to more informed decision-making. Hansson et al. (2020) explain the mediating and regulating functions that technology adoption behavior and agricultural knowledge play. This improves our comprehension of the ways in which these variables interact with attitudes and behaviors, implying that technology and knowledge play a crucial role in influencing farmers' attitudes and behaviors. Nguyen et al. (2019) emphasize how diverse perspectives are in the context of agriculture. It shows that a variety of elements, including knowledge, adoption of sustainable practices, and technology, have an impact on attitudes towards agriculture production and connection. It is important to take this complexity into account when creating comprehensive agriculture policies and strategies.

It is imperative to acknowledge the limitations of the study, which must be taken into account while interpreting and implementing the implications. The study emphasizes the need for better agricultural education and training programs because of its focus on the role that agriculture knowledge plays in mediating and moderating interactions. Enhancing farmers' awareness of sustainable and technologically sophisticated farming methods in addition to conventional farming practices can be a focus for policymakers and agricultural organizations. Workshops, internet resources, and regional agricultural extension agencies could all help achieve this. The study emphasizes how important farmers' attitudes are shaped by their technology adoption behavior. There are many advantages to pushing farmers to use and adjust to new agricultural technologies. To help farmers incorporate new technologies into their operations, doable strategies including training initiatives, financial aid, and easily accessible technology should be taken into account. Given that farmers' attitudes are impacted by sustainable farming practices, the agricultural sector needs to support and lobby for sustainable agriculture. Farming practices that are resource-efficient and environmentally

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friendly could be promoted through policy initiatives and incentives. By expanding the theory's application to the agricultural sector, this study adds to the body of knowledge on planned behavior theory. The results imply that this theoretical framework can explain farmers' attitudes and behaviors effectively, expanding the range of situations in which it can be applied.

The study emphasizes the functions that technology adoption patterns and agricultural knowledge play as moderators and mediators. This shows the intricacy of the interactions between attitudes, behaviors, and outside circumstances and broadens our understanding of how these variables interact within the agricultural setting. This study's cross-sectional design makes it more difficult to identify causal links. Longitudinal studies that monitor changes in attitudes, knowledge, and behavior across time may be beneficial for future research. This would offer a more thorough comprehension of the dynamics at play. The study's dependence on a tiny convenience sample may make it more difficult to extrapolate the results to a larger group of farmers. To improve the external validity of the findings, larger and more varied sample sizes should be the goal of future research.

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