


## Article

# Sustaining Performance of Wheat–Rice Farms in Pakistan: The Effects of Financial Literacy and Financial Inclusion

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**Abstract:** The unceasingly augmenting emission of greenhouse gases (GHG) has contributed substantially to the degradation of the key environmental parameters and the deterioration of performance of the agricultural sector globally. The food insecurity problem has been aggravated consequently. Due to a variety of economic and social issues, many farmers in developing economies use low-efficient and environmentally unfriendly agricultural practices. Adopting innovative technologies and practices linked with sustainable farming remains a complex issue across the developing world. In particular, financial exclusion and low financial literacy are commonly cited as the critical obstacles to achieving sustainable development. To contribute to resolving this development problem, the study attempts to investigate the effects of financial inclusion and literacy on establishing a sustainable performance of farms. A structured questionnaire was used to collect the data from 220 farmers within the Central Punjab region of Pakistan. Small-scale farms demonstrated a potential to sustain their performance by improving financial inclusion and financial literacy. Trust in extension services for agriculture plays a significant role in moderating the impact of eight independent variables (knowledge, skills, attitude, behavior, access, usage, quantity, welfare) on sustainable farm performance. The study implies that increased trust in financial services is essential for improving sustainable performance in the agricultural sector. The effect imposed by financial actors is crucial for establishing trust in financial services linked to sustainability within the agricultural industry.

**Keywords:** financial institutions; credit; extension services; financial inclusion; sustainable agriculture; financial literacy



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## 1. Introduction

The world population is growing at an alarming rate, while the dissipating effects of climate change are becoming more apparent [1]. This has significantly strained agricultural production, as many of the contemporary farming practices remain environmentally unfriendly and unsustainable, especially across developing and less developed countries [2]. Intensive farming aggravates the degradation of agricultural lands, depletes other environmental resources, and thus suppresses the productivity of the agricultural sector and endangers the global food security [3]. Those effects of unsustainable farming practices consequently threaten the social and economic wellbeing of people worldwide [4]. Soil fertility has declined globally over time. As the progressing climate change is transforming the longstanding agricultural production patterns, farmers are looking for more efficient practices that could allow them to sustain or even increase yields and reduce the environmental footprint of agricultural production at the same time. Several studies [5,6] recognize

sustainable agriculture practices among the primary tools for improving the performance of the agricultural sector globally while also protecting the environment and generating income for farmers.

Similar to most of the developing countries, Pakistan has a dual economic structure with a mix of urban and rural economies [7]. The gap between the two is most notable in the disparity in the quality of infrastructure and services [8]. Those living in more populated and developed urban areas usually have access to better roads, running water, and educational institutions, while rural dwellers often lack opportunities of similar quality [9,10]. This disbalance is especially apparent when incomes and consumption levels are compared between the two groups [11,12]. According to Zulfiqar and Thapa [13], the average rural household earns significantly less than the average urban one. In addition, rural households are more likely to consume less than their urban counterparts. This discrepancy highlights the need for more development and investment in rural areas of Pakistan. Otherwise, the country will continue suffering a divide between its urban and rural populations [14]. Pakistan's agricultural productivity has extensively relied on unsustainable and harmful practices, such as extensive use of inorganic fertilizers and pesticides, which have led to greenhouse gas (GHG) emissions [15–17]. The above tendency is particularly evident in the wheat and rice sectors, the two locomotives of Pakistan's agriculture [18–20]. The contribution of the agricultural sector to the country's GHG emissions has peaked at 44% (compared to the 24% contribution of the agricultural sector to the GDP) [21]. Meanwhile, the consideration given to the development of sustainable farming practices remains low. Therefore, there is an evident need for developing the solutions to address the rising demand for food and agricultural products while reducing GHG emissions [22].

Many scholars, including Ali et al. [4], Eton et al. [5], Ardic et al. [23], Lopez and Winkler [24], Wafula [25], Aro-Gordon [26], and Bongomin et al. [27], among others, have suggested that financial literacy and inclusion are consequential for sustainable business performance. However, the direct association between financial literacy, inclusion, and sustainable farming performance has remained under-investigated. Moreover, previous studies have also failed to incorporate the role of trust in extension services as a moderator between financial inclusion, literacy, and sustainable farming performance. Agricultural extension has been widely considered as a vehicle for encouraging the productivity and performance of farmers [28]. According to Feder et al. [29], the involvement in the extension practices allows farmers to reduce productivity differentials by increasing their knowledge and expertise and accelerating the technology transfer. Danso-Abbeam et al. [30] and Ogundari [31] reported positive economic gains across agricultural sectors from farmers' participation in the extension services programs. Economic, institutional, and farm-specific variables were estimated to significantly affect the farms' income. Until recently, extension has been financed mainly by the public sector [32]. However, due to a steady decrease in the farm population, substantial cuts have occurred in the public financing of agricultural extension services [28,33]. This process is particularly evident across developing countries, where the shift to self-supported extension services has highlighted the critical importance of access to credit [5,6], as well as the radical improvement of the financial literacy and financial inclusion among farmers as factors of rural poverty alleviation [34]. Still, there has remained an evident gap in the literature, which fails to relate financial access and literacy to sustainable agricultural performance development, particularly in the spheres of adaptation to climate change challenges [35], land quality issues [36], and the intensification of agricultural production and machinery [37]. The role played by financial actors in improving the financial inclusion of the rural population and businesses is essential for the economic and social development of Pakistan. This study seeks to reveal the association between the financial actors, farmers, sustainable development, and the performance of wheat–rice farms in Central Punjab.

The rest of the paper is organized as follows. Section 2 discusses the relevant literature; Section 3 explains the methodology used for data collection; and Section 4 reports the findings. In Section 5, the authors discuss the findings and point out the potential contributions

of the study to the literature. Section 6 concludes the study and summarizes future research directions and recommendations.

## 2. Background and Hypotheses

### 2.1. Financial Literacy and Sustainable Farm Performance

Financial literacy is an individual's ability to understand the concepts and tools associated with money and money management [23,25]. These tools often include the management of personal finances, investments, loans, budgeting, and capital management. The knowledge of managing finances significantly impacts the performance of businesses [38,39]. Bongomin et al. [27] examined the role of networks in moderating the relationship between financial literacy and financial inclusion among poor households in rural Uganda. The study found that personal and professional networks play a significant role in financial literacy and inclusion. Other studies have also suggested a growing need for people to become financially literate [23,38–40]. Increasing consumer debt, bankruptcy, and low savings have highlighted business people's lack of financial literacy. Empowering poor households with financial knowledge and skills could help them make informed financial decisions and strategic choices in a drive to scale up the scope of financial inclusion [27]. As suggested by Babajide et al. [38] and Usama and Yusoff [39], financial literacy among the poor can help improve their financial decision-making abilities by increasing their awareness of financial issues and choices and giving them the basic skills they need to navigate the financial world. Furthermore, Ali et al. [4] found that financial literacy can help reduce information asymmetry in the market by informing customers about different financial products and services they may not be aware of. This, in turn, can help encourage them to avoid non-standard financial services, which may not be in their best interests.

Usama and Yusoff [39] demonstrated that financial literacy could significantly improve the economic performance of businesses. A resource-based theory suggests that a company's resources can give it a competitive advantage if they are rare, difficult to imitate, and essential to the customer's experience. While financial literacy and sustainable farm performance have not been linked in recent literature, the concept of sustainable agriculture suggests that increased literacy of farmers would improve the performance of the farms. According to Gao et al. [41] and Sikandar et al. [42], sustainable agriculture is about more than just sustaining farmers, resources, and communities. It is about promoting farming practices and methods that are profitable, environmentally sound, and good for communities. Sustainable agriculture is a vital component of modern agriculture and complements traditional methods and techniques [6,43]. It can be defined as farming practices that are sustainable and that allow people to meet their current needs in terms of food, clothes, utilities, and other agriculture-related products without compromising the ability of future generations to meet their needs. Overall, achieving sustainable development in the agricultural complex is based on understanding the long-term sustainability of ecosystems [42,43]. Thus, the ability of farmers to make financially sound decisions would allow them to invest in sustainable practices, equipment, and technology and lead to improved farming performance.

**Hypothesis 1 (H1).** *Financial literacy of farmers has a positive and significant impact on sustainable farm performance.*

### 2.2. Financial Inclusion and Sustainable Farm Performance

Financial inclusion is a term used to describe the provision of affordable, timely, and appropriately regulated access to financial services and products to all categories of people to improve and promote the population's wellbeing. The usage, adequacy, convenience, product knowledge, affordability, and accessibility of financial services are some of the factors that affect financial inclusion. Financial inclusion emerged as a significant player in delivering financial services to the community and the disadvantaged poor at affordable terms and conditions. Financial inclusion has several benefits, including access to

credit, improved opportunities for savings, and improved financial literacy [26,44]. Financial inclusion also aids in poverty reduction and inequality and promotes economic growth [45]. Financial inclusion leads to the provision of increased access to financial services for individuals and communities that have been ignored in the past, leading to the creation of opportunities for poverty reduction. Providing access to formal banking services for communities such as farmers can allow them to save, invest, and have access to credit options, which improve their financial and economic situations and promote overall economic growth. The government and financial sectors need to create an enabling environment, which supports the capacity of financial service providers. This can be achieved by designing affordable products and services that identify and address market demands, which support financial inclusion [46]. For example, agricultural technology is improving in Pakistan, and innovative Fintech applications and services enable innovation and access to financial tools within the agricultural sector [3,13]. Lopez and Winkler [24] argued that financial inclusion could become difficult to sustain because formal financial institutions have difficulty staying afloat due to an unfavorable business environment and increasing transaction costs.

Moreover, De Olloqui et al. [47] suggested that most people who face financial exclusion are located in rural areas—these typically include low-income groups with lower levels of financial literacy. Several risks are associated with rural environments, such as lower rates of formal property ownership. This may reduce the range of collateral security options and affect the quality and coverage of the available infrastructure [24,48].

As demonstrated by Sikandar et al. [49], agricultural financing differs from other forms of financing, so it is important to understand this distinction. This knowledge is essential for borrowers looking to repay loans. The agricultural sector presents financial institutions with unique risks and challenges, which must be considered when providing access to financial services. These risks include lower yield, illness, injuries and accidents, and other product life-cycle risks. Timely and sustainable access to credit is essential for agricultural development. Still, financial institutions must be aware of the unique risks associated with the sector to provide adequate services. Moreover, access to credit is a significant feature of financial inclusion and plays a significant role in the development of sustainable agriculture. Gashu et al. [50] and Anshari et al. [51], among others, suggested that improved financial inclusion will improve agricultural performance and aid farming households in developing sustainable agricultural processes.

**Hypothesis 2 (H2).** *Financial inclusion of farmers has a positive and significant impact on sustainable farm performance.*

### 2.3. Moderation of Trust in Extension

Credibility is critical regarding whether people will trust new technology and decide to adopt or purchase it. In countries where agricultural extension services are developed, these agencies play a crucial role in providing farmers with the information they need to change their farming practices [52]. Because state-run agencies are considered credible information sources, farmers are more likely to trust and adopt the new technology [53,54]. Credit is critical for sustainable agriculture, and a functional financial system is key to achieving universal financial inclusion—a feature in the SDGs [3,43]. Thus, access to credit and inclusion by financial actors is essential for developing sustainable agriculture practices. According to Babajide et al. [38], Aracil et al. [55], and Akram et al. [56], agricultural production has been in decline due to several different factors, such as the pandemic, falling prices of the raw material, inadequate infrastructure, inefficient marketing, and lack of technology, which leads to stagnant growth and development of the sector and also impedes the progress toward sustainability. Yusuf et al. [48] suggested that the access to financial service providers and bank branches has been a problem for smallholder farmers and agriculturalists living in rural areas where banking services, financial assistance, and support from third party organizations are not readily available. Smallholder farmers

have often stuck to subsistence agriculture because it is less risky and, therefore, not as profitable, meaning they miss out on the potential benefits of commercializing their agricultural efforts [57,58]. In light of the reviewed literature, agricultural extension services are helpful in spreading financial and non-financial knowledge to farmers and facilitating knowledge transfer, accelerating the acceptance of new strategies, such as sustainable farming, making them better managers. Therefore, it can be predicted that the farmers' trust in the agricultural extension services can help in improving financial decision making and raise the percentage of adoption of better practices. The increased literacy and inclusion in financial services can lead to increased use of sustainable practices, which is furthered by having trust in extension services offered by financial and other state-run institutions.

**Hypothesis 3 (H3).** *Farmers' trust in extension services will moderate the association between financial literacy and sustainable farm performance.*

**Hypothesis 4 (H4).** *Farmers' trust in extension services will moderate the association between financial inclusion and sustainable farm performance.*

#### 2.4. Theoretical Framework and Model Development

The idea that institutions are essential for sustainable economic development has been proposed by Acemoglu et al. [59] and Rodrik et al. [60]. Institutions are identified as actors who govern market participation and dictate the human environment that influences it. They play a fundamental role in stimulating sustainable growth, reducing poverty, and improving the performance of agricultural and non-agricultural units [55]. Asadullah and Savoia [61] determined that institutional reforms are a primary cause of social advancement and poverty reduction. The institutional theory explains the financial institutions' role in providing the knowledge of their services. The theory of financial markets as frictionless was disapproved by Ford et al. [40], who argued that a world in which organizations, networks, norms, and rules construct the parameters of the partnership between service providers and consumers was more accurate. The theory emphasizes the financial institutions' role in providing the knowledge to improve behavior among consumers of financial services. Having financial knowledge is critical for making sound financial choices. According to findings by Wafula [25] and Bongomin et al. [27], a lack of financial knowledge is a barrier not only to food security but also to accessing financial services and products essential for economic growth and development in the country. Aracil et al. [55] argue that financial education should be part of the curriculum at the primary level, so that the rural community can acquire basic financial education, which can be employed in everyday practice. For the inclusion of the sustainability directive and ideology, financial literacy and inclusion are essential factors, which need to be addressed by the relevant institutions [6,38,62]. Thus, the rationale drawn from the theory is that financial actors and institutions should endorse equality and focus on the inclusion of various community members for growth and sustainability. The SDGs have appropriated sustainable agricultural development and financial inclusivity as imperial metrics. Therefore, the institutional actors should focus on implementing these goals for a harmonic, developed, and sustainable community. The increased presence of financial actors in the agricultural community would foster the farmers' trust in extension services and financial actors [51,63]. It would also lead to informed actions by the farmers, increase the inclusion and literacy rates, and therefore increase the adoption of sustainable practices. Thus, the institutional theory posits that financial and non-financial actors should perform their institutional role and make efforts to include farmers and the agricultural community, improve their financial literacy, and help them attain extension services, so that agricultural activities and output can become sustainable.



### 3. Materials and Methods

#### 3.1. Research Design, Sampling, and Data Collection

The study was developed in a quantitative framework, and the descriptive design was selected. The authors wanted to study the causal association between the farmers' financial literacy and the sustainable performance of farms, as well as to evaluate how trust in the extension services influences financial inclusion and literacy. The quantitative approach best suits the aim and scope of the study, as it allows the authors to analyze the causal behavior among the variables, a facet that is missing in the qualitative paradigm. The study used a cross-sectional research design, which is beneficial because it observes a representative subset of a selected population at one specific time. This allows for large amounts of data to be collected over a shorter period and minimizes problems arising from recurrent mistakes in data collection instruments.

The research population included rice and wheat farmers located in the Central Punjab province of Pakistan in 2022 between February and April. The area was selected because it accounts for about 76% of the national output of rice and wheat [3,13]. The agricultural lands in Central Punjab are among the most fertile plains with groundwater and irrigation, making rice farming a natural choice for farmers. Farmers in the area have seen an increase in rice yields thanks to new varieties, but the direct and indirect cost of production is still high due to water and labor costs and excess production of CO<sub>2</sub>. Irri and basmati are the two main types of rice grown in the study area [6]. Thus, based on these factors, Central Punjab can be considered a model region for tracking the effects of various economic, social, and institutional factors on farmers' performance.

A close-ended structured questionnaire was used for data collection. In earlier studies in the region, Asdullah and Yazdifar [64], Anjum and Ming [65], Pathan et al. [66], and Raza et al. [45] demonstrated that it was easier for respondents to comprehend and reply to close-ended questions compared to open-ended ones. As the population under study comprises farmers, who have lower literacy and knowledge, it is better to select the easier questionnaire style. The method was used because it included questions that were direct and only required a short time for completion. A vast proportion of the labor force in the area, i.e., the farmers, are uneducated. Therefore, the authors determined that the usage of this method would be beneficial in extracting related information. Different sections were created to increase the respondents' comprehension (see Appendix A, Table A1, for the questionnaire form and Appendix B for the informed consent signed by the respondents). As most of the respondents are undereducated, the questionnaire was prepared in Urdu, the national language of Pakistan. The instrument was initially designed in English and then translated to Urdu, according to the forward and back translation technique suggested by Maneesriwongul and Dixon [67]. A research assistant belonging to the area was hired to assist the authors in facilitating the data collection. Furthermore, a local agricultural landowner was asked to help the authors in collecting the data. Involving an assistant from the local population made local farmers more open to collaborating with the authors and participating in the survey. Additionally, once the initial scope and purpose of the study were explained to the farmers, they were asked to participate in a guidance bootcamp, where information relating to the questionnaire (the data collection method, the purpose and the meaning of the different concepts included in the study) was explained over the course of one week. The dissemination of that preliminary information allowed the researchers to collect the data, since the respondents understood the technicality of the terms included in the study. Additionally, the process allowed the scholars to improve the knowledge and understanding of the processes that the farmers implemented on a routine basis and increased their knowledge as well. Once the scope of the study was explained to the farmers by their peers (a research assistant and a local agricultural landowner), the respondents readily participated in the survey, as they thought the study might highlight the problems they faced. The data were collected only from the head of households/farms and not multiple members from the same household. This is one of the reasons for the small sample size. Some of the farmers declined to participate, and therefore, they were not

coerced, manipulated, or pressured into participation. The processing of the questionnaires collected was performed by the authors (A.R. and G.T.). The process was completed in two months.

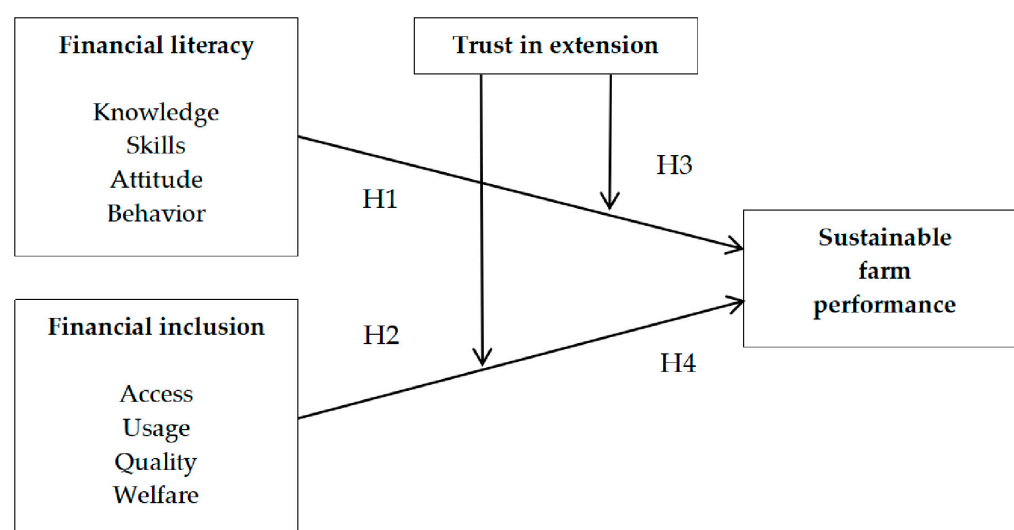
The authors addressed demographic parameters, such as age, gender, farming experience, and education. All constructs were measured on a five-point Likert scale, and the following is the specification of measure adaptation.

The study focused on identifying the financial literacy of farmers and financial actors and aimed to evaluate Pakistan farmers' perspectives. For this purpose, the authors visited rural areas within Central Punjab and contacted potential individuals for data collection. The households were selected randomly based on a random sampling approach. The strategy was applied to afford all farming households an equal chance of inclusion, since the study aimed to identify the financial literacy and inclusion of the farming households of Pakistan. Therefore, it was essential to understand their social and economic conditions. Three indicators were adopted to identify the farming households correctly: farming welfare, farming involvement, and the trust in the extension services available to the farming units. Once all households were identified, the authors allotted unique numbers as identifiers. Out of the 350 households, 260 agreed to participate in the study, and 220 correct responses were obtained. The unit of analysis was the head of the farming unit, irrespective of gender, age, and experience.

### 3.2. Measures

The study used previously developed scales for the measurement of the constructs. The rankings were adapted to the context of the study. Financial literacy was measured based on the ten construct items used by Bongomin et al. [27]. Similarly, financial inclusion was adopted using ten construct items from the same study. Sustainable farming was measured based on nine items developed by Tey et al. [62]. Trust in extension was measured based on the five items used by Ali et al. [3].

A direct association between farming literacy, farming inclusion, and sustainable farm performance was proposed, along with the moderation of trust in extension services (Figure 1).



**Figure 1.** Conceptual model. Source: authors' development.

The principal component analysis was conducted to ensure the variability in the factors, and it was used as a pre-test for the regression analysis. Once the significance of the variation of the different constructs was verified, they were then used to study the causal association through the stepwise regression analysis. SPSS was used for both preliminary testing and regression and moderation analysis to evaluate the moderation and direct association among the variables.

## 4. Results

### 4.1. Descriptive Statistics

The questionnaire responses included in the final dataset were complete with no missing answers (N value in Table 1). Moreover, the minimum and maximum values are recorded for each item. The minimum and maximum values lie between 1 and 5, which aligns with the 5-point Likert scale. The mean values of the variables lie between 3.12 and 3.99. The standard deviation values indicate that the value ranges are all within the threshold of normality.

**Table 1.** Summary of descriptive statistics.

Category	Subcategory	Index	Statement	Mean	SD
Financial literacy	Knowledge	FKW1	I am financially capable of making good use of financial products/services.	3.770	1.292
		FKW2	I understand what a personal budget is.	3.520	1.276
	Skills	FSK1	I can accurately determine the costs and benefits from financial dealings.	3.870	1.341
		FSK2	I can accurately determine the principal and interest amount owed to my creditors.	3.990	1.432
	Attitude	FATT1	I am interested in financial issues.	3.730	1.145
		FATT2	I compare prices before making choices on financial products/services.	3.520	1.276
	Behavior	FATT3	I feel very interested in dealing with banks.	3.120	0.987
		FBH1	I spend by sticking to my budget.	3.230	1.022
		FBH2	I save regularly.	3.540	1.214
		FBH3	I have been actively saving in the past years.	3.840	1.463
Financial inclusion	Access	FAC1	I believe that the financial services provided by the bank are safe for us.	3.650	1.268
		FAC2	I believe that the initial account opening fees charged by the bank are affordable.	3.240	1.123
		FAC3	I believe that the cost of making a trip to the bank is affordable.	3.430	1.254
	Usage	FUG1	I believe that the loan product provided by the bank suits my needs.	3.770	1.298
		FUG2	The terms and conditions on use of loans provided by the bank are favorable for me.	3.670	1.276
	Quantity	FQT1	The saving product provided by the bank is suitable for me.	3.520	1.265
		FQT2	The saving product offered by the bank is safe for me.	3.470	1.254
	Welfare	FWL1	The financial services offered by the bank have led to improvement in my and my family's nutrition.	3.540	1.268
		FWL2	The financial services offered by the bank have led to improved access to health services in my community.	3.870	1.827
		FWL3	The financial services offered by the bank have enabled me to pay school fees.	3.230	1.122
	Trust in extension	TOE1	I believe that agriculture extension services are essential sources of information.	3.570	1.235
		TOE2	I believe that extension services are a trustworthy source of information related to farming practices.	3.550	1.229
		TOE3	I believe that extension services are a secure system of information for farmers.	3.670	1.276
		TOE4	I believe that extension services are dependable.	3.490	1.245
		TOE5	According to me, users can easily access extension services.	3.540	1.255
Sustainable farm performance	Environmental performance	SEP1	Sustainable farm practices are needed for reduction in air emissions, wasted water, and solid wastes.	3.560	1.233
		SEP2	I believe that sustainable farm performance can decrease consumption of hazardous/harmful/toxic materials.	3.630	1.267
		SEP3	Using sustainable farm practices has decreased the frequency of environmental accidents.	3.450	1.254
		SEP4	Using sustainable farm practices has improved the overall environmental footprint of our sector.	3.420	1.231
		SFP1	I have increased my profit through selling scrap and used materials and equipment.	3.270	1.206
	Financial performance	SFP2	I have invested in sustainable practices, as it decreases the fee for waste treatment.	3.690	1.275
		SFP3	I have invested in sustainable practices at my farm, as it has led to improved capacity utilization.	3.340	1.244
		SFP4	I have invested in sustainable practices at my farm, as it has led to decreased penalty costs for an environmental accident.	3.890	1.395

Note: For all indices, N = 220, Min = 1, Max = 5. Source: authors' development.

### 4.2. Reliability and Validity Tests

The financial literacy variable was measured using four dimensions adopted from Bongomin et al. [27]: knowledge, skills, attitudes, and behavior (Table 2). The total variance explained is 63.409%. The reliability value for this variable is  $\alpha = 0.841$ . The exploratory factor analysis was carried out with the use of principal component analysis. The PCA used



Varimax and Kaiser normalization to test the financial literacy components. Four factors were revealed to have Eigen values above one of the reviewed factors.

**Table 2.** Factor analysis results for financial literacy.

Index	Subcategories			
	Behavior	Skills	Attitude	Knowledge
FKW1				0.643
FKW2				0.622
FSK1		0.754		
FSK2		0.689		
FATT1			0.764	
FATT2			0.676	
FATT3			0.743	
FBH1	0.722			
FBH2	0.677			
FBH3	0.643			
Eigen values	2.187	1.188	1.119	1.056
Percentage of variance	23.788	16.798	12.312	10.511
Cumulative percentage	23.788	40.599	52.877	63.409

Note: Extraction method: principal component analysis (KMO = 0.784). Source: authors' development.

The behavior items had significant loading values ranging between 0.643 and 0.722 and loaded on factor 1, contributing approximately 24% of the overall variance. The items for skill loaded on factor 2 fell in the range of 0.689–0.754, contributing approximately 17% of the variance. The items for attitude contributed approximately 12% of the variance, ranging from 0.676 to 0.764, and loaded on factor 3. Factor 4 loadings were recorded for knowledge, and the values ranged between 0.622 and 0.643, with a 10% contribution to the variance. Those factors had a 63.409% contribution to variance, with behavior being the most significant, followed by skills, attitude, and knowledge. The KMO test showed 78.4% sampling adequacy for the collected data sample.

The four factors studied in relation to financial inclusion are access, usage, quantity, and welfare (Table 3). The factors contributed to around 60% of the variance in financial inclusion, with welfare being the most significant, followed by quantity, usage, and access. The KMO for financial inclusion shows that the sample adequacy value is 80.5%.

**Table 3.** Factor analysis results for financial inclusion.

Index	Subcategories			
	Welfare	Quantity	Usage	Access
FAC1				0.788
FAC2				0.747
FAC3				0.785
FUG1			0.801	
FUG2			0.674	
FQT1		0.719		
FQT2		0.692		
FWL1	0.755			
FWL2	0.754			
FWL3	0.756			
Eigen values	2.221	1.523	1.159	1.122
Percentage of variance	22.101	15.272	11.722	11.222
Cumulative percentage	22.101	37.299	49.056	60.317

Note: Extraction method: principal component analysis (KMO = 0.805). Source: authors' development.

Only one factor was included for trust in extension. The factor contributed 61.212% of the variance in the variable. The rest of the factors had Eigen values below one (TOE1 = 0.762; TOE2 = 0.682; TOE3 = 0.801; TOE4 = 0.899; TOE5 = 0.767) and were hence discarded. The KMO for this variable shows 77.2% sampling adequacy. The factor loading values are significant between 0.682 and 0.899.

Three factors were tested for the dependent variable (sustainable farm performance), but only two were included to represent them (Table 4). The value of the loadings for environmental performance is significant within the 0.689–0.899 range, and the values of financial performance are significant between 0.678 and 0.915. Approximately 25% variance is contributed by environmental performance, and 32% is contributed by financial performance. The KMO value shows 82.45% sampling adequacy for SFP.

**Table 4.** Factor analysis results for sustainable farm performance.

Index	Subcategories	
	Financial Performance	Environmental Performance
SFP1	0.678	
SFP2	0.879	
SFP3	0.910	
SFP4	0.781	
SEP1		0.782
SEP2		0.689
SEP3		0.801
SEP4		0.899
Eigen values	1.781	1.567
Percentage of variance	25.321	31.762
Cumulative percentage	25.321	57.083

Note: Extraction method: principal component analysis (KMO = 0.824). Source: authors' development.

#### 4.3. Regression

Hierarchical regression analysis was carried out to test the interaction effects of the independent variables and the interaction term on the dependent variable (Equation (1)).

$$\text{SFP} = f(\beta_1 \text{FL} + \beta_2 \text{FI} + c) \quad (1)$$

where SFP = sustainable farm performance;  $\beta_{1-2}$  = beta coefficients; FL = financial literacy; FI = financial inclusion.

Model 1 was calculated with the independent and the moderating term, whereas in model 2, the calculation was carried out with independent terms. Model 3, which directly assessed the association between the interaction term, independent, and dependent variables, demonstrated the best results and was thus selected in the regression stages, including all the variables and interaction terms as well. Model 3 was recognized to be the best model based on the value of the coefficient of determination  $R^2$  (the highest among the models in the study) and also the representation of the significant associations with the dependent variable. Baron and Kenny [68], Namazi and Namazi [69], and Sikandar et al. [42,49] all indicated that the independent variable's effect on the dependent variable must vary as a function of change in terms of the moderator variable for an interaction to exist. Jose [70] also recommended tests to be conducted by centering the independent variable and generating the interaction terms used in hierarchical regression. The reason for selecting the hierarchical regression strategy lies in the fact that the predictive power of the independent variable on the dependent variable is strong in this strategy. Following Bongomin et al. [27,71] and Jose [70], the rule of interaction terms is applied to observe the interaction's significance through the beta coefficient of terms. Furthermore, moderation graphs were also presented to stipulate the moderation effect between the two direct effects graphically.

The correlation analysis reveals a positive and significant association between FL and FI, with  $r = 0.321$  and  $p \leq 0.01$  (Table 5). The association between FL and TOE is also positive and significant at 0.234. SFP and FL are connected through an association value of 0.456. There is also an indication of a positive and significant association of FI with TOE and SFP. The correlation between FI and TOE is 0.461, and between FI and SFP, it is 0.245.

**Table 5.** Relationships between financial literacy, financial inclusion, trust in extension, and sustainable farm performance.

Variables	Mean	SD	FL	FI	TOE	SFP
FL	3.770	0.576	-			
FI	3.700	0.578	0.321 **	-		
TOE	3.650	0.678	0.234 *	0.461 **	-	
SFP	3.660	0.878	0.456 **	0.245 **	0.212 **	-

Note: \* = correlation is significant at 0.05 level; \*\* = correlation is significant at 0.01 level; N = 220. Source: authors' development.

There was a correlation association detected between TOE and SFP. The results indicate that the correlation R-value is 0.212, which is positive and significant for a 0.01 significance value. There is no academic support for this correlation in the past literature. Therefore, the current study provides novel findings from this perspective.

After conducting the correlation analysis, an article regression test was carried out to understand the interaction effect and explanatory power between these variables. The results indicated a positive and significant relationship between financial literacy and sustainable farm performance ( $\beta = 0.299$ ,  $p < 0.05$ ). Similarly, there was a positive and significant relationship between financial inclusion and sustainable farm performance ( $\beta = 0.291$ ,  $p < 0.05$ ). These results can be depicted as follows.

$$SFP = f(\beta_1 FL + \beta_2 FI + \beta_3 TOE + c) \quad (2)$$

where SFP = sustainable farm performance;  $\beta_{1-3}$  = beta coefficients; FL = financial literacy; FI = financial inclusion; TOE = trust in extension.

Equation (2) and the above results provide the evidence for the acceptance of hypotheses H1 and H2, which predicted the direct effects of FL and FI on SFP. Furthermore, the results also indicated a positive and significant relationship between the TOE and SFP ( $\beta = 0.222$ ,  $p < 0.05$ ). The impact of TOE on SFP is depicted by Equation (3).

$$SFP = f(\beta_3 TOE + \beta_4 int + c) \quad (3)$$

where TOE = trust in extension; int = interaction terms.

The interaction impact between the independent and moderation variables is significant ( $\beta = 0.174$ ,  $p < 0.05$ ) (Table 6). This significance is also confirmed by the fact that the magnitude of the effect is increased from one level of the model to the next (previously shown by Lewis [72], Bien et al. [73], and Aiken et al. [74]). The findings reveal that the main effects are boosted by 4.9% by the moderation variable explaining the overall variance or change in SFP. The increase is shown as 22.1% without the moderation and 27.0% after including the interaction/moderation effects. These results therefore indicate that the interactive term (moderation and direct effects together) boosts the variance in sustainable farming performance of small-scale Pakistani farms.

**Table 6.** Interaction effect of financial literacy, financial inclusion, and trust in extension on sustainable farm performance.

Variables	Dependent Variable: Sustainable Farm Performance			
	Model 1	Model 2	Model 3	VIF
Constant	1.867	1.872	1.867	
FL (direct effect)	0.343 **	0.322 **	0.299 **	1.096
FI (direct effect)	0.399 **	0.345 **	0.291 **	1.085
TOE (moderator)		0.234 **	0.298 **	
Interaction terms			1.211 *	
$R^2$	0.082	0.221	0.270	N/A
$\Delta R^2$		0.146	0.049	N/A
$\Delta F$	19.199 **	41.624 **	0.303	N/A

Note: \* =  $p \leq 0.05$ ; \*\* =  $p \leq 0.01$ ; N = 220. Source: authors' development.

## 5. Discussion

As explained at the outset, the primary focus of this study was to explore how financial services, such as financial inclusion, literacy, and agricultural extension, can enhance or deteriorate the sustainable performance of small-scale Pakistani farms. Therefore, the researcher conducted a regression analysis based on four hypotheses, namely two direct impacts between financial inclusion and financial literacy on one side and sustainable farm performance on the other, and two moderation hypotheses studying the effect of trust in extension interactions. The results revealed that financial inclusion and literacy could increase the sustainable performance of small-scale Pakistani farms.

In particular, the authors found that financial literacy influenced financial inclusion, trust in extension services, and sustainable farm performance. The revealed relationship supports earlier findings published by Bongomin et al. [27], Sanistasya et al. [75], Noor et al. [76], Bire et al. [77], and Grohmann et al. [78], who all associated increasing financial literacy with improving financial inclusion practices. In addition, the authors' findings agree with Kodongo [79] and Mhlanga [80], who indicated a need to explore the impact of FL on TOE and agricultural extension services. Similarly, Ying et al. [81], Ssebunya et al. [82], and Tuffour et al. [83] indicated a positive effect of financial literacy on the performance of different firms and businesses. The findings take it further by implying a positive association between financial literacy and sustainable farm performance in small-scale Pakistani farms' financial and environmental performance.

A positive and significant association of financial inclusion with both trust in extension and sustainable farm performance shows that financial inclusion can also improve users' trust in extension services and technologies. Moreover, it also implies that financial inclusion can improve the overall sustainable performance of a business or small-scale farms in the current context. Similarly, Goel and Madan [84], Koomson and Ibrahim [85], and Adegbite and Machethe [86] suggested and proved a positive effect of financial inclusion on the sustainability of business performance in agriculture. Ampaw et al. [87], Bongomin and Ntayi [88], and David et al. [89] also found that financial inclusion can improve trust in extension and financial services. However, the current study is one of the first to test the impact of financial inclusion directly on sustainable farm performance.

The trust in extension services for agriculture was also proven to have a significant moderation role, as the interaction of this moderator caused an increase in the overall impact of the independent variables on the dependent variable. Therefore, it can be concluded that this study implies that increased trust in financial services is essential for improving sustainable performance in the agricultural sector.

Hypothesis 1 is confirmed; the financial literacy of farmers indeed exerts a positive and significant effect on sustainable farm performance. According to the results of the regression analysis, an increase in the financial literacy of farmers in rural Pakistani areas could have a 29.9% significant positive impact on improving the sustainable performance of farms. Similarly, the study confirmed Hypothesis 2. Improving the financial inclusion of farmers has a positive and significant impact on sustainable farm performance. There is a need to improve financial inclusion, as increasing the financial inclusion by only 1% can lead to enhancing sustainable farm performance by 29.1%. This means that both financial literacy and financial inclusion play a vital role in achieving sustainable performance in the agricultural sector. Sustainable farming and business models can reduce the harmful effects of the processes on social and environmental surroundings and assist in achieving a country's sustainability and economic goals. Hence, the knowledge and skills that farmers develop as a response to increased financial literacy can result in the enhanced sustainability performance of farms and improve the attitudes and behavior of the farming community regarding environmental outcomes. The policy implication in this finding is the need to increase the focus on primary education in rural areas, providing knowledge to the farming communities regarding the various financial services they can access and utilize and educating them on the benefits or demerits of each service. The government, financial institutions, and educational bodies in developing countries such as Pakistan can contribute

to the financial literacy of the farming community by becoming involved in educational drives, increasing dissemination of information through visiting the local farms and rural areas, providing lectures, seminars, pamphlets, and other educational material, which is tailored according to the education levels of the communities, so that the benefits can be maximized.

Farmers' trust in extension services moderates the association between financial literacy and sustainable farm performance (Hypothesis 3 confirmed). The moderation of TOE was found to be significant and positive. Finally, the results of the analysis allow the authors to accept Hypothesis 4—trust in the extension services moderates the association between financial inclusion and sustainable farm performance. The moderation of TOE between financial inclusion and SFP is significant. The findings for the moderation of trust in extension services are positive for both variables, financial literacy and financial inclusion.

However, while there is a uniform increase trajectory in the case of financial inclusion, financial literacy has a sharper growth with the increase in trust in extension. These findings imply the greater emphasis that needs to be focused on financial education and literacy. The study's findings therefore imply that education on money matters is crucial, as it enables a smoother functioning of the society and the economy. Citizens with greater access and control over their financial situations can benefit the nation and themselves. In the context of the current study, providing the farmers with education and financial literacy, giving them increased access to financial services, enhancing the quality as well as quantity of the financial assistance available to the farmer, etc., will not only allow the farming community to engage and become active users of financial services but will directly as well as indirectly enhance the business growth of the agricultural sector in the country. Therefore, the findings imply that, in addition to providing the opportunities for sustainable development and farm performance, financial literacy and access to financial services for the farming community of Pakistan will strengthen the ability of the country to achieve its national sustainability and economic goals as well. However, to maximize the positive outcomes, the government and financial institutions need to work on enhancing the trust of the farming community in the financial services available to them. This can only be achieved by ensuring transparency in the terms and conditions of the services and reduced interest rates on investments and loans.

The study is significant from several standpoints. On the one end, it extends the institutional theory by linking financial inclusion practices, financial literacy, and sustainable performance of farms as indications of the policy development role played by financial actors (banks, credit agencies, microfinance institutions). The study also introduces the moderation of trust in extension as a moderator between financial inclusion, literacy, and sustainable farm performance. The study is also significant from a policy development point of view. The findings of the study will aid economic and agricultural policymakers in developing new directives for the agricultural sector to attain the Sustainability Development Goals (SDGs) by 2030. Moreover, the findings are aligned with past research. For instance, Mhlanga and Dunga [90], Kodongo [79], and Kalunda [91], among others, shed light on the importance of the need for increased trust in financial institutions and the services they offer to improve sustainability performance, while Turvey and Xiong [92] and Afrin et al. [93] indicated the importance of financial literacy and inclusion for improving the overall financial and economic decision making. Therefore, the findings of the current research add to the already existing literature, as well as indicating the importance of trust in the case of farming practices.

## 6. Conclusions

From the results of the current study, several financial inclusion and literacy policy implications can be drawn. The results show the positive impact of financial inclusion and literacy on the performance of sustainable farming options in Pakistan. Therefore, financial inclusion policymakers, advocates, and managers working in financial institutions to provide finances to the agricultural sector within the country must focus on financial



literacy training for the farmers and agriculture workers to ensure that they can build efficient knowledge for interacting with the agricultural extension services that are provided within the country. Without this essential training and expertise, the impact of the extension programs will not be as significant as it can be with the farmers having adequate financial knowledge. This knowledge will also ensure an increased level of trust in the fintech services within the country for the agricultural sector. Moreover, financial literacy advocates and policymakers must also work toward intensifying the outreach of financial literacy programs to all the poor and rural regions within the country to maximize the impact. In addition to enabling community-based training for financial knowledge and skills, this will also improve the attitude and behavior of the rural region farmers toward technology-enabled financial services provided within the country.

In a practical way, the findings highlight the need for farmers to participate in educational and professional development programs, specifically those talking about access to credit and technologies, so that farmers can implement their learning and improve their production processes. Knowledge regarding sustainable farming must be disseminated within the rural region of the country, especially in Inner Punjab, Sindh areas, and Baluchistan. The reason for focusing on these areas within Pakistan is that the farmers in these regions are more illiterate than those in Upper Punjab. Some strategies that can be used include providing educational material, such as leaflets, brochures, notes, etc., and disseminating financial skills to rural dwellers. The financial institutions and banks within the country must also advocate these financial services. Loans and lending services must be provided across rural territories, so that the farmers can gain knowledge of the services available. The study implies that increased trust in financial services is essential for improving sustainable performance in the agricultural sector. Nurturing trust in extension services helps farmers increase the positive effect of financial inclusion on the sustainable performance of their farms. Improving the financial knowledge and inclusion of the farmers would help in increasing the sustainability of farms on a larger scale.

The current study had some design limitations. The first limitation is that the study did not incorporate additional input from respondents or researchers. The participants were interested in explaining the conditions they work in (not all), their experience with credit access, the availability of services, the involvement of policy actors, etc. However, the answers were excluded from the study, since the quantitative design was based purely on objectivism. Therefore, the data had to explain the associations and facts, not the insights gained by the authors. A mixed methods design could be applied in future studies to eliminate the above limitation. Establishing separate focus groups (one for policy makers, another for farmers) may deliver insights missed by preconceived measurement scales. The second limitation is the low response rate. The farmers were a bit distrusting, and the authors who conducted the surveys were able to gain the trust of only a few farmers, which was an obvious flaw in the process of the study. Using a longer data collection period could help future scholars improve the response rate and increase the sample size. Additionally, mobilizing a team of assistants who are familiar with or belong to the area could help in covering a larger area; the present study only used one assistant. Therefore, access to the farmers as potential respondents was restricted. Third, the study was mainly a cross-sectional design-based analysis. Therefore, the authors did not explore the critical implications that longitudinal research could reveal. Thus, in future research, there is a scope for longitudinal impact analysis of financial literacy and inclusion strategies on the sustainability of farming practices within the country. Furthermore, Pakistan's political and economic situation is unique compared to other agriculture-focused developing countries, such as Thailand, Uganda, etc. Therefore, future scholars can explore a similar research model within another agrarian country.

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## Appendix A

**Table A1.** Questionnaire form.

Category	Index	Statement	1	2	3	4	5
Financial literacy	FKW1	I am financially capable of making good use of financial products/services.	1	2	3	4	5
	FKW2	I understand what a personal budget is.	1	2	3	4	5
	FSK1	I can accurately determine the costs and benefits from financial dealings.	1	2	3	4	5
	FSK2	I can compute interest rates.	1	2	3	4	5
	FATT1	I am interested in financial issues.	1	2	3	4	5
	FATT2	I compare prices before making choices on financial products/services.	1	2	3	4	5
	FATT3	I feel very interested in dealing with banks.	1	2	3	4	5
	FBH1	I spend by sticking to my budget.	1	2	3	4	5
	FBH2	I save regularly.	1	2	3	4	5
	FBH3	I have been actively saving in the past years.	1	2	3	4	5
Financial inclusion	FAC1	I believe that the financial services provided by the bank are safe for us.	1	2	3	4	5
	FAC2	I believe that the initial account opening fees charged by the bank are affordable.	1	2	3	4	5
	FAC3	I believe that the cost of making a trip to the bank is affordable.	1	2	3	4	5
	FUG1	I believe that the loan product provided by the bank suits my needs.	1	2	3	4	5
	FUG2	The terms and conditions on use of loans provided by the bank are favorable for me.	1	2	3	4	5
	FQT1	The saving product provided by the bank is suitable for me.	1	2	3	4	5
	FQT2	The saving product offered by the bank is safe for me.	1	2	3	4	5
	FWL1	The financial services offered by the bank have led to improvement in my and my family's nutrition.	1	2	3	4	5
	FWL2	The financial services offered by the bank have led to improved access to health services in my community.	1	2	3	4	5
	FWL3	The financial services offered by the bank have enabled me to pay school fees.	1	2	3	4	5
Sustainable farm performance	TOE1	I believe that agriculture extension services are essential sources of information.	1	2	3	4	5
	TOE2	I believe that extension services are a trustworthy source of information related to farming practices.	1	2	3	4	5
	TOE3	I believe that extension services are a secure system of information for farmers.	1	2	3	4	5
	TOE4	I believe that extension services are dependable.	1	2	3	4	5
	TOE5	According to me, users can easily access extension services.	1	2	3	4	5
	SEP1	Sustainable farm practices are needed for reduction in air emissions, wasted water, and solid wastes.	1	2	3	4	5
	SEP2	I believe that sustainable farm performance can decrease consumption of hazardous/harmful/toxic materials.	1	2	3	4	5
	SEP3	Using sustainable farm practices has decreased the frequency of environmental accidents.	1	2	3	4	5
	SEP4	Using sustainable farm practices has improved the overall environmental footprint of our sector.	1	2	3	4	5
	SFP1	I have increased my profit through selling scrap and used materials and equipment.	1	2	3	4	5
	SFP2	I have invested in sustainable practices, as it decreases the fee for waste treatment.	1	2	3	4	5
	SFP3	I have invested in sustainable practices at my farm, as it has led to improved capacity utilization.	1	2	3	4	5
	SFP4	I have invested in sustainable practices at my farm, as it has led to decreased penalty costs of an environmental accident.	1	2	3	4	5

Source: authors' development.

## Appendix B

Informed Consent

Participant ID: \_\_\_\_\_

You are formally invited to become a part of the study titled "Studying the financial literacy of farmers in achieving sustainable farm performance: involving financial actors to identify the financial inclusion of the farming sector", which will primarily be performed within the rural region of Central Punjab, Pakistan. The study is focused on identifying the sustainable farm practices and focuses on the role played by financial actors in ensuring

the financial inclusion of the agricultural sector of Pakistan. Participation in the research is entirely voluntary, and the participants are recommended to read through the research instrument and clarify any and all ambiguities with the research team. Participants are requested to read through the survey comprehensively and discuss with their peers as well if they feel hesitant about participating. The following is some of the essential research that you will require to solidify your participation decision.

- Approximately 200–250 farmers from Central Punjab, Pakistan, will participate in the study.
- This study was designed to identify the role played by financial inclusion and literacy in sustainable farm performance.
- The data will be collected from Pakistani farmers within the Central Punjab region.
- A structured questionnaire will be used to collect data from respondents.
- If you do decide to take part in the study, your involvement will last approximately six–seven months.
- The study does not involve reporting of any factors that will result in risk for the respondent.
- The study holds theoretical and practical significance; however, there will be no monetary benefit for the participants.
- The data will be stored at the academic institutes of the corresponding and first author, i.e., University of Lahore, and Northeast Forestry University.
- This research received no external funding.
- Taking part in this research study is voluntary. If you choose to take part in this research, your major responsibilities will include completing the questionnaire and submitting it to the research team.
- The respondents can contact the author at their email address.

Signature and Consent/Permission to participate in the Research

Before making the decision regarding enrollment in this research, you should have:

- Discussed this study with an investigator,
- Reviewed the information in this form, and
- Had the opportunity to ask any questions you may have.

Your signature below means that you have received this information, have asked the questions you currently have about the research, and those questions have been answered. You will receive a copy of the signed and dated form to keep for future reference.

Participant: By signing this consent form, you indicate that you are voluntarily choosing to take part in this research.

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