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Sustainable Agriculture and Rural Poverty Eradication in Pakistan: The Role of Foreign Aid and Government Policies

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Abstract: For decades, agriculture has been central to economic growth and development in Pakistan. However, endemic rural poverty hinders the performance of agricultural production, and thus deteriorates the sustainable development perspectives of the agricultural sector and the entire country. The need for agricultural reform emphasizes raising farmers' incomes as a cornerstone of the sustainable development of rural areas, and this study attempts to reveal the effects of foreign aid and government policies on the level of rural poverty in Pakistan. In total, 384 farmers from major agricultural areas of Pakistan completed the survey-based questionnaire. The partial least square structural equation modelling technique tested the results. They, using sustainable agriculture practices, improved agricultural production positively and significantly. Agriculture production positively and significantly reduces or mitigates poverty. This study aimed to reveal the role of foreign aid in sustaining agricultural production and eradicating rural poverty. Foreign aid positively moderated the association between sustainable agriculture practices and agricultural production. In addition, government policies negatively, yet insignificantly, moderate the association between agriculture production and poverty reduction. Furthermore, the findings indicate that agriculture production positively and significantly mediates the association between sustainable agriculture practices and poverty reduction. The study contributes to the literature by improving the understanding of linkages within the poverty-policies-aid-sustainability framework.

Keywords: sustainable agriculture practices; agriculture production; poverty reduction; foreign aid; government policies

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1. Introduction

The 17 Sustainable Development Goals (SDGs) outlined by the economic and social affairs department of the United Nations were considered the areas to be dealt with urgently, and are known as the "2030 agenda" for sustainable development. The first three SDGs are (1) no poverty, (2) zero hunger, and (3) good health and well-being. These three SDGs goals are directly associated with the quality of sustainable agricultural production. Government departments, financial and non-financial sectors, and non-profit organizations in developing or under-developing economies need extra financial support or aid to achieve these SDGs. However, due to budgetary issues or funds, governments in developing countries cannot provide policy guidelines to relevant sectors. For instance, Pakistan's government has not changed the policies and strategies for the agriculture sector in the last decade. Hence, the agriculture sector fails to produce the required level of output. In such conditions, attracting foreign aid and allocating it to the most vulnerable sectors through

efficient government policies are the critical factors in eradicating poverty and ensuring sustainable development of agricultural production in developing countries.

The linkage of higher agricultural production levels reduces poverty. Poverty begins with a lack of economic resources, resulting in low income and savings, which leads to an inability to develop further economic resources (poor investments), thus increasing these individuals' economic and financial vulnerability (having hardships in life) [1,2]. Developing and least-developed countries, where the rural poverty problem is exacerbated by market imperfections, capital shortage, economic backwardness, infrastructure deficiencies, and low productivity [3–5]. Developing countries with agricultural land fail to meet the domestic market needs or demands, resulting issues of hunger, health, and well-being. In order to deal with these issues and challenges, developing countries such as Pakistan need to adopt sustainable agriculture practices to achieve the required level of agriculture production that will result in a reduction in the poverty level.

In Pakistan, rural poverty has remained one of the key obstacles to achieving sustainable rural development. In Pakistan, only 28% of the country's total area is involved in agriculture [6]. Furthermore, fragmentation and sub-division of land holdings, particularly in rural areas, is impossible to apply to modern technology [7]. Therefore, the underlying factors influencing agriculture growth are storage facilities, roads, transport, education, electricity, health facilities, and sanitation [8]. The agriculture sector of Pakistan accounted for around 21.4%, 20.9%, and 19.53% of GDP, and involved 45%, 43.5%, and 42% of the total workforce in 2015, 2016, and 2017, respectively [9–11].

Almost 63% of the total population of Pakistan living in villages was directly or indirectly associated with such an industry for their livings [12]. The agricultural industry has a strong association with the remaining economy which was unconsidered in the census [13–16]. The agriculture sector recorded a growth of 3.46% in FY 2017 compared to the growth of 0.27% last year, while the industrial sector's growth was 5.26% [11]. Over three years, the government of Pakistan indicated a decreasing trend in the agricultural sector's contribution to GDP. This growth occurred due to the low contribution of agricultural export to GDP. Domestic agricultural producers lost competition in the global market because of the low-quality agricultural products they supplied abroad and the uncompetitive high prices. The government attempted to boost agricultural exports by reducing tariffs and removing non-tariff trade barriers. However, these measures have had a modest contribution to the increase in the portion of the agricultural sector in GDP [17]. This study aims to evaluate the role of sustainable agriculture approaches, foreign aid, and government policies toward the improvement of agricultural production and reduction in poverty.

2. Materials and Methods

2.1. Selection of Variables

The dependent variable in this study is poverty reduction, which is defined as the economic growth which permanently lifts as many people as possible out of poverty (above the poverty line) in the short run (Figure 1) [18]. Poverty reduction is measured based on the scale adapted from Okibo and Makanga [19].

Independent variables include sustainable agriculture, agricultural production, government policies, and foreign aid as moderating factors. Sustainable agriculture is defined as production to meet the demand of the present without compromising the needs of future generations [20–23]. It cannot be achieved without the cooperation of private and public sectors based on sustainable standards [24]. Following Allahyari et al. [25], sustainable agriculture is measured as a multidimensional construct based on social responsibility, environmental sustainability, economic viability, and production efficiency. Agricultural production means achieving sustainable outcomes through different state, market, and civil society interventions [26]. This study measures it based on the scale adapted from Trojan [27]. The measures taken by the government include providing incentives to producers, introducing more stringent standards, and facilitating the development of downstream

capabilities in order to achieve the targeted outputs [28] measured based on the scale derived from Deng et al. [29].

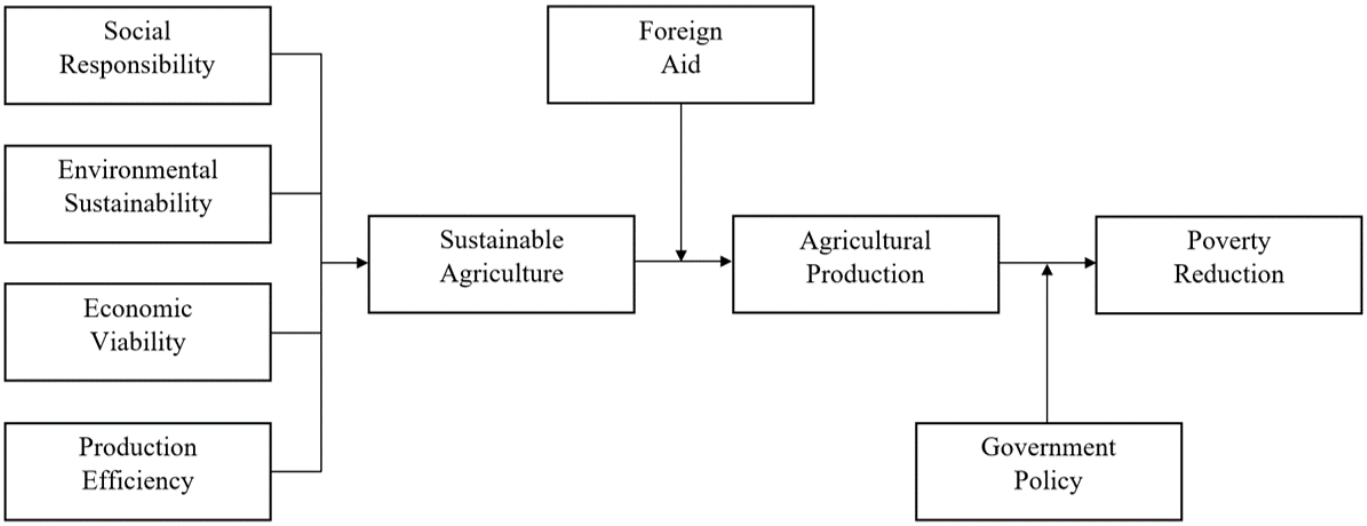

Figure 1. Conceptual framework. Source: authors' development.

2.2. Research Approach

According to the United Nations Development Programme (UNDP), 54.6% of people in the rural area of Pakistan face poverty, which significantly influences their education, living standards, and leisure activities [30,31]. The province of Punjab in Pakistan is the second largest province in terms of rural population and the first in agriculture production. Therefore, it is considered one of the most affected territories by multidimensional poverty [30]. The irrigation system of Punjab is extensive, and is located in the semi-arid plains zone [32]. With 56.2% arable land, Punjab contributes 53% of the total agricultural contribution to the GDP, and 74% of cereal output [33]. Despite this magnificent infrastructure, the contribution towards the agriculture employment generation is not considered at all; thus, 31% of the rural people of Punjab live below the poverty line [34]. The total population of Punjab is 110 million, while that of Southern Punjab is about 34.74 million, with an average of five household members [35]. Southern Punjab is one of the country's leading territories in agriculture output, and despite that fact, most of the population lives below the poverty line. Hence, the present study selects Southern Punjab as the population for evaluation of the factors influencing poverty. The recent report published by the Government of Punjab indicates that Dera Ghazi Khan, Faisalabad, Gujranwala, Multan, Sahiwal, and Sargodha are the primary divisions in terms of maize, rice, wheat, cotton, and sugarcane production. The present study considered these divisions and associated tehsils as the population reported in Appendix A Table A6.

The present study used the nonprobability sampling technique in this research to collect data. It is considered to be convenient and suitable for this research. This technique gives accurate results. A close-ended structured questionnaire with a 5-point Likert scale was used for primary data collection (Appendix A, Tables A1–A5). English/Urdu was used as a questionnaire medium, as most farmers cannot read and write the English language. The literature documented the three well-acknowledged methods for the calculation of sample size. The first is the rule of thumb which claims that ten observations are sufficient for each predictor; hence, a total sample of 50 was sufficient as the five predictors in the present study. The G*power calculator was another method used to calculate the minimum sample size in order to validate the findings. The results of the G*power calculator affirmed that a sample size of 166 was sufficient to validate the findings. The third method of sample size calculation was based on the sampling technique. In the case of the probability sampling (simple random sampling) technique, the sample of 384 was sufficient to validate

and generalize the findings despite the sample size; hence, the present study considered the sample size of 384 to be sufficient validate and generalizability of findings.

2.3. Structural Equation Modelling

Structural Equation Modelling (SME) was employed in order to explain the relationship among multiple variables [36]. It allows one to reveal the structural relationship among the equations (see the conceptual framework in Figure 1). SEM is capable of addressing and assessing the errors in the measurement model. SEM also provides a tool to access the measurement errors which may occur [37]. This approach facilitates multiple regression analysis [38] and multivariable analysis, as it allows one to compute moderating effects and calculate the direct and indirect effects, or even in the case of compounding measurement error when computing interaction terms [39]. PLS-SEM is a type of variance-based structural equation modelling that has been most popular recently [40]. PLS-SEM is a second-generation technique for multivariate data analysis, and is also powered by the features of the first-generation (linear regression, principal components). Furthermore, PLS-SEM is a modelling technique that facilitates the research by measuring the relationship between multiple independent or more dependent variables.

The present study used the PLS-SEM technique to assess the association between latent and measured constructs. The PLS-SEM uses two steps to evaluate the relationship between latent and measured variables. The first step is assessing the measurement model (outer model), and the second is the structural model assessment (inner model). The measurement model assessment, also known as the outer model assessment, specifies the correspondence rules between latent and measured variables [41]. This technique allows the researcher to use as many as several variables for one or multiple numbers of dependent variables. The assessment of the measurement model is based on two key criteria; reliability and validity of items/constructs [42]. The present study assesses the reliability of validity using convergent and discriminant validity. The underpinning objective of reliability assessment is to ensure the stability or consistency of items/constructs. At the same time, validity is used to assess the accuracy of items/constructs for measuring any latent variables [43].

2.4. Reliability and Validity

The reliability and validity of constructs/items is a matter of concern which ensured the use of the assessment of the measurement model to proceed with the structural model assessment. Impairment of reliability and validity of constructs/items can mislead the findings and association among the variables. The evaluation of the measurement model is used to assess the reliability and validity of the constructs/items taken under consideration. Reliability refers to the chances/degree of producing similar findings if items are used repetitively to measure the same construct or variables under the same criteria. Validity refers to the degree or chance of measurement of the construct, which intends to be measured by the relevant items [44]. Ensuring the validity of items to measure the required variable is possible if the items measured the same construct, and we could say that the scale is valid. Three tests are frequently used to ensure the validity of the questionnaire in the literature: face/content, construct, and criterion validity.

Face validity is required for the newly developed items; however, if the items are adopted from the previous studies, then there is no need for face validity, as those items were previously used to measure the required constructs [43]. Moreover, content validity ensures that the questions/items used in a questionnaire are adequate to measure the relevant construct. The content validity questionnaire should be duly reviewed by the experts from the academic research. The criterion validity of the questionnaire will be ensured using factor analysis, and factor analysis will provide the relevance of each item being used in the measurement of the relevant construct. The present study used three criteria for assessing the reliability and validity of items/constructs: items loading, composite reliability, and average variance extracted. The threshold values for the factor loadings were 0.50, composite reliability was 0.70, and AVE was 0.50.

The study measured sustainable agriculture with four dimensions (environment sustainability, economic viability, production efficiency, and social responsibility) (Table 1). The loadings of four items for environmental sustainability were less than 0.50, the remaining four items meet the threshold criteria and composite reliability, and AVE meets the minimum threshold of 0.70 and 0.50, respectively.

Table 1. Reliability and validity.

Variables		Items	Loadings	CR	AVE
Sustainable Agriculture	Environmental Sustainability	ENV_1	0.816	0.913	0.724
		ENV_2	0.867		
		ENV_3	0.817		
		ENV_4	0.900		
	Economic Viability	Econ_1	0.832	0.950	0.733
		Econ_2	0.840		
		Econ_3	0.890		
		Econ_4	0.858		
		Econ_5	0.901		
		Econ_6	0.874		
		Econ_7	0.795		
	Production Efficiency	Prod_1	0.893	0.949	0.824
		Prod_2	0.923		
		Prod_3	0.919		
		Prod_4	0.897		
	Social Responsibility	SR_1	0.877	0.925	0.712
		SR_2	0.828		
		SR_3	0.813		
		SR_4	0.832		
		SR_5	0.868		
	Foreign Aid	FA_1	0.870	0.957	0.737
		FA_2	0.871		
		FA_3	0.823		
		FA_4	0.927		
		FA_5	0.795		
		FA_6	0.840		
		FA_7	0.882		
		FA_8	0.852		
	Agriculture Production	AP_1	0.699	0.949	0.608
		AP_2	0.704		
		AP_3	0.791		
		AP_4	0.778		
		AP_5	0.768		
		AP_6	0.811		
		AP_7	0.849		
		AP_8	0.813		
		AP_9	0.847		
		AP_10	0.751		
		AP_12	0.810		
		AP_14	0.721		
	Government Policies	GP_1	0.593	0.630	0.422
		GP_2	0.627		
		GP_3	0.998		
	Poverty Reduction	PRE_1	0.897	0.929	0.724
		PRE_3	0.931		
		PRE_4	0.863		
		PRE_5	0.827		
		PRE_6	0.721		

Source: authors' development.

The agriculture production was measured with 15 items, out of which one item failed to meet the threshold value of 0.50, while the remaining items were more than 0.50. As

a result, the values of CR and AVE were more than 0.70 and 0.50. Therefore, the present study measures the government policies with the three items and meets the threshold of 0.50, while the values of CR and AVE were approximately near the threshold values of 0.70 and 0.50 (Figure 2).

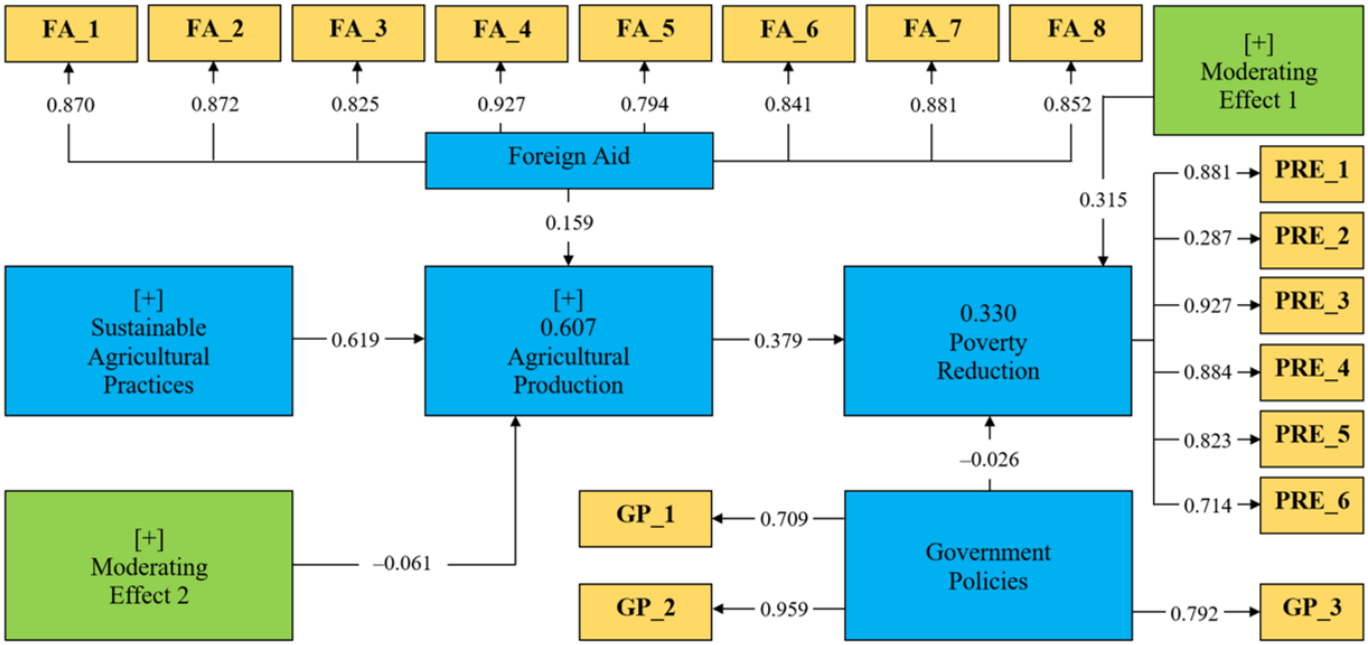

Figure 2. Assessment of measurement model. Source: authors' development.

Convergent validity was used to assess the items/construct positively correlations with the same and alternative construct simultaneously. Determination of the convergent validity of the PLS-SEM technique used the average variance extracted (AVE) criteria and outer loadings of items [45]. The average variance extracted was the average variance shared between indicators and latent constructs. In other words, we can say that it was the grand mean value of all the squared loadings of indicators being used to measure a particular construct [45]. The acceptable range of average variance extracted based on the average variance shared by the measured construct must be higher than the variance shared with other constructs in the same model [46].

Discriminant validity is used to assess the uniqueness of a latent construct. Simply put, we can say that a phenomenon captured by an individual construct must be unique and not be captured by the other constructs in the same model [45]. There are various techniques for discriminant validity assessment: cross-loadings among latent constructs, Fornell–Larcker, and Heterotrait–Monotrait criteria. In the initial stage, we assessed that the cross-loading of constructs must be higher at a particular construct than other constructs in the same model [47]. The findings revealed that the diagonal values of the Fornell–Larcker Criterion indicate that all of the values were within the threshold value (Table 2).

The discriminant validity was assessed by using the loadings and cross-loadings techniques. First, all of the loadings indicate the highest loadings on the relevant constructs. Then, the discriminant validity was rechecked using the Heterotrait–Monotrait Ratio (HTMT). The results reveal that all the values are less than the threshold value of 0.90 (Table 3).

Table 2. Fornell–Larcker Criterion.

	1	2	3	4	5	6	7	8	9
AP	0.780								
EV	−0.423	0.856							
EN	0.730	−0.412	0.851						
FA	0.591	−0.312	0.583	0.858					
FDI	−0.442	0.814	−0.385	−0.263	0.618				
GP	0.156	−0.084	0.208	0.070	−0.289	0.649			
Pre	0.527	−0.223	0.449	0.595	−0.135	0.080	0.851		
Pro	0.367	−0.185	0.283	0.575	−0.172	0.055	0.403	0.908	
SR	0.682	−0.372	0.752	0.524	−0.320	0.131	0.463	0.311	0.844

Note: AP = Agriculture Production, EV = Economic Viability, EN = Environment, FA = Foreign Aid, FDI = Foreign Direct Investment, GP = Government Policies, Pre = Poverty Reduction, Pro = Production, SR = Social Responsibility. Source: authors' development.

Table 3. Heterotrait–Monotrait Ratio (HTMT).

	AP	EV	EN	FA	FDI	GP	Pre	Pro	SR
AP									
EV	0.447								
EN	0.807	0.438							
FA	0.608	0.329	0.649						
FDI	0.377	0.710	0.370	0.278					
GP	0.168	0.114	0.207	0.208	0.533				
Pre	0.548	0.242	0.500	0.622	0.158	0.161			
Pro	0.382	0.202	0.303	0.599	0.166	0.215	0.437		
SR	0.739	0.396	0.861	0.574	0.307	0.194	0.502	0.334	

Note: AP = Agriculture Production, EV = Economic Viability, EN = Environment, FA = Foreign Aid, FDI = Foreign Direct Investment, GP = Government Policies, Pre = Poverty Reduction, Pro = Production, SR = Social Responsibility. Source: authors' development.

3. Results and Discussion

3.1. Structural Model Assessment

The independent variables and dependent variables were linked directly. The results were given using the bootstrapping at 5000-sample re-sample criterion and the coefficient beta, standard deviation, *t*-values, *p*-values, and *f*-square [42].

3.2. Findings

Sustainable agriculture practices indicate a positive and significant association with agriculture production (Figure 3), at a 5% significance level ($\beta = 0.619$, $t = 4.858$, $p = 0.000$) (Table 4). Furthermore, agriculture production is positively and significantly linked with poverty reduction ($\beta = 0.379$, $t = 2.014$, $p = 0.044$). The current study reveals that foreign aid is positively and insignificantly linked with agricultural production ($\beta = 0.159$, $t = 1.366$, $p = 0.172$), and that government policies have a negative yet insignificant association with poverty reduction ($\beta = -0.026$, $t = 0.167$, $p = 0.875$). The empirical findings indicate that foreign aid positively yet insignificantly moderates the association between sustainable agriculture practices and agriculture production ($\beta = 0.315$, $t = 0.935$, $p = 0.350$). Similarly, government policies negatively yet insignificantly moderate the association between agriculture production and poverty reduction at a 5% significance level ($\beta = (-0.061)$, $t = 0.693$, $p = 0.488$). Furthermore, agricultural production positively and significantly mediates the association between sustainable agriculture practices and poverty reduction at a 5% significance level ($\beta = (-0.234)$, $t = 1.969$, $p = 0.049$).

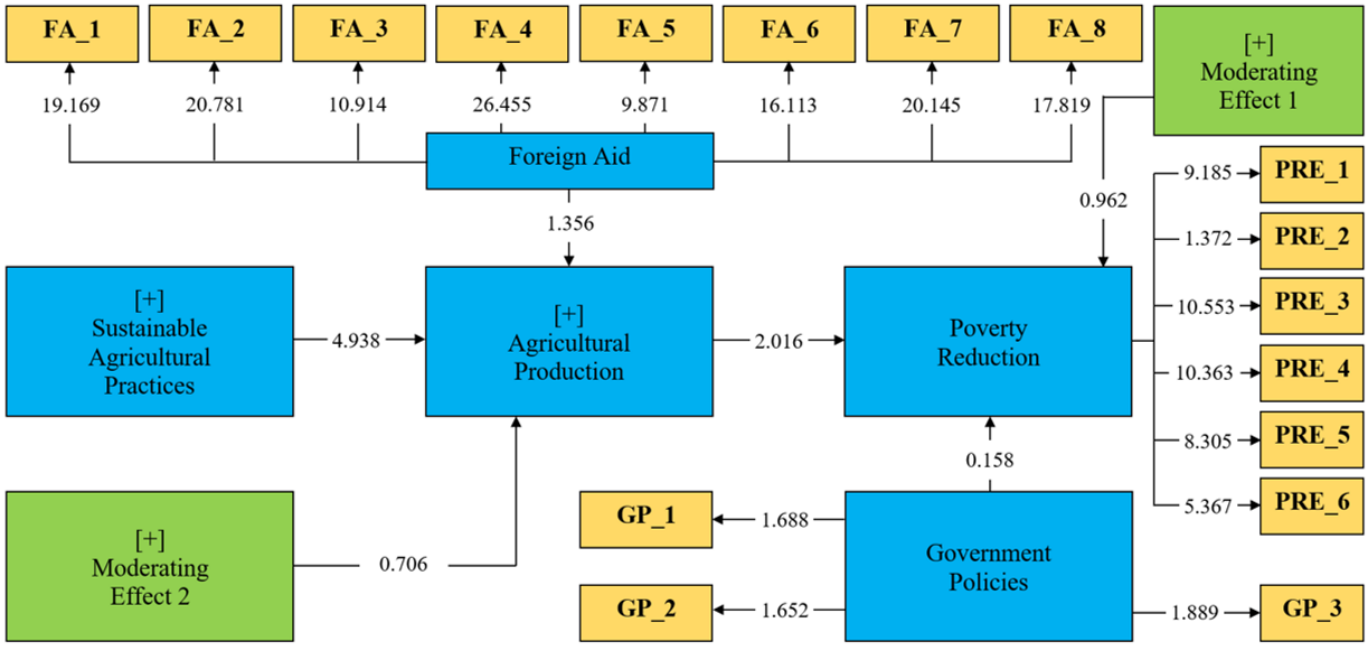

Figure 3. Assessment of the structural model. Source: authors' development.

Table 4. Testing of the hypothesis.

	Coeff.	SD.	*t*-Values	*p*-Values
SAP ≥ AP	0.619	0.127	4.858	0.000
AP ≥ PR	0.379	0.188	2.014	0.044
FA ≥ AP	0.159	0.116	1.366	0.172
GP ≥ PR	−0.026	0.167	0.157	0.875
Moderating Effect 1 ≥ PR	0.315	0.338	0.935	0.350
Moderating Effect 2 ≥ AP	−0.061	0.088	0.693	0.488
SAP ≥ AP ≥ PR	0.234	0.119	1.969	0.049

Note: AP = Agriculture Production, PR = Poverty Reduction, FA = Foreign Aid, AP = Agriculture Production, GP = Government Policies, SAP = Sustainable Agriculture Practices. Source: authors' development.

3.3. Discussion

The first underlying objective of the present study was to evaluate the association between sustainable agriculture practice and agriculture production. The current study revealed that sustainable agriculture practices are positively and significantly linked with agricultural production. Some of the prior literature has acknowledged that adopting sustainable agriculture practices significantly improves agriculture production [48,49]. The current study's findings aligned well with the existing literature, as developing countries usually cultivate crops using traditional tools and techniques, resulting in lower level of production; thus, adopting sustainable agriculture practices significantly improves agricultural production.

The SDG's goals are to deal with poverty, zero hunger, health, and well-being if the country can produce the required level of agricultural production. The present study's findings aligned well with the existing literature which states that agricultural production positively and significantly influences the reduction in poverty level [50,51]. However, there was a continued argument on topics from the application of foreign assistance to receiving the country's professional assistance. It was debated that the help received complements the restricted local funds for escalation and progress in underdeveloped regions. In contrast, the anti-assistive opine that where external resources flowed, those that were impeded rose, as the resources were majorly transformed into other things, mainly by individual use [52–54]. The underlying reason for these findings could be that local farmers considered foreign aid as a tool of restrictions for them.

The findings indicate that government policies negatively yet insignificantly influence poverty reduction. This could be because respondents believe that government policies related to the agriculture sector are not supportive, particularly for small-scale farmers, or because the government does not have any policies related to improving agriculture production or reducing poverty. However, the prior literature affirms that government policies are significantly and positively linked with poverty reduction.

By the courage of global partnerships for progress, donors must continue to assist in stimulating local farmers to enhance their agricultural units and farms for optimal productivity. Donors and world organizations must lift the inflow effect of foreign aid in agriculture. Consequently, the donors and government must ensure that foreign assistance is efficiently and effectively consumed for agricultural-related operations in order to escalate regional crop productivity [55]. Such findings could be because the local farmers considered that foreign aid might bring some restrictions along with it.

Government policies negatively yet insignificantly moderate the association between agriculture production and poverty reduction. The findings could be why the respondents believe government policies are against the agriculture sector. Furthermore, agricultural production positively and significantly mediates the association between sustainable agriculture practices and poverty reduction at a 5% significance level. The existing recent literature supports the findings of Sarkar et al. [56] and Sikandar et al. [57].

4. Conclusions

The contribution of the current study is multifaceted; theoretical, empirical, methodological, and contextual contributions have been made by the current study to the existing body of literature. The underpinning theory claims that a person or a country is poor because they are poor. This means that there is a cyclical relationship between poverty and the poor. The findings significantly contribute to the underpinning theory of the vicious cycle of poverty by considering the underlying variables that can break this circle, including sustainable agriculture practices and agricultural production, towards poverty reduction. Furthermore, the present study considered the role of foreign aid and government policies to be moderating variables. The underlying theory claims that a lack of resources leads to an inability to develop more resources, and this cycle continues indefinitely. The findings contribute to the existing literature and the underpinning theory by explaining the role of sustainable agriculture practices in poverty reduction. Only limited research has been documented so far from the developing countries, which collected the data using survey-based questionnaires from the farmers on the five Likert scales and used the structural equation modelling technique to test the hypothesis.

The study will help the farmers, landlords, policymakers, and regulatory authorities of Pakistan to understand the role of sustainable agriculture practices in improving agricultural production to reduce the poverty level in Pakistan. Furthermore, the findings also help the policymakers and regulatory authorities to understand how farmers perceive foreign aid as well as how they perceive the fact that government policies are not supporting the farmers in Pakistan. This study helps the policymakers and regulatory authorities to understand the significance of government policies, as current farmers consider that current government policies negatively influence the country's agricultural production. The present study's findings help the regulatory authorities, farmers, foreign agencies, and academicians to empirically test the association among the latent constructs. Future studies must also consider other regions or South Asian regions to validate the current study's findings. In addition, future studies need to consider other factors, including the lack of access to finance, market imperfection, storage capacity, infrastructure deficiencies, economic backwardness, and other factors that negatively influence productivity.

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Conflicts of Interest: The authors declare no conflict of interest.

Appendix A

Table A1. Foreign aid.

#	Question	SD	D	SDA	A	SA
1	Do you feel foreign aid has helped Pakistan to achieve SDG 1 (eradicate extreme poverty for all people)?	1	2	3	4	5
2	Do you feel foreign aid has improved the agricultural sector?	1	2	3	4	5
3	Has foreign aid helped Pakistan to achieve universal basic goals?	1	2	3	4	5
4	Do you feel foreign aid has improved information and communication technology in Pakistan?	1	2	3	4	5
5	Do you feel foreign aid has led to improvement in the outcome of agriculture at primary?	1	2	3	4	5
6	Do you feel foreign aid has negative effects on the agricultural sector in Pakistan?	1	2	3	4	5
7	Do you feel foreign aid has improved science and technology through research innovations in the agricultural sector of Pakistan?	1	2	3	4	5
8	Do you think foreign aid has led to the improvement of the agricultural sector outcome at the national level?	1	2	3	4	5
9	Do you feel foreign aid has improved agriculture production in Pakistan?	1	2	3	4	5
10	Do you feel Pakistan relies on foreign aid intervention in the area of agriculture development?	1	2	3	4	5

Note: SD = strongly disagree; D = disagree; SDA = slightly disagree; A = agree; SA = strongly agree. Source: authors' development.

Table A2. Sustainable agriculture.

#	Question	SD	D	SDA	A	SA
	Production efficiency					
1	Technology should be used as best as possible to increase the efficiency of agricultural production	1	2	3	4	5
2	Meeting food needs with fewer farmers is a positive outcome of technological progress	1	2	3	4	5
3	Production, processing, and marketing of agricultural products are best carried out at the national and regional level	1	2	3	4	5
4	Technology should be used to make farm labour more rewarding and enjoyable, but not to replace it	1	2	3	4	5
	Economic viability					
5	Farming is first and foremost a business, like any other business	1	2	3	4	5
6	The primary goal of farmers should be to maximize the productivity, efficiency, and profitability of their farms	1	2	3	4	5
7	The successful farmer is one who earns enough from farming to enjoy a good standard of living	1	2	3	4	5
8	Farmers should purchase most of the goods and services they use on their farm	1	2	3	4	5

Table A2. *Cont*.

#	Question	SD	D	SDA	A	SA
9	Large scale farmers can best serve agriculture needs	1	2	3	4	5
10	Farmers should farm only as much land as they can personally care for	1	2	3	4	5
11	The amount of farmland owned by an individual/corporation should be limited in order to encourage land ownership by as many people as possible	1	2	3	4	5
	Environmental sustainability					
12	Soil and water are the sources of all life and should, therefore, be strictly conserved	1	2	3	4	5
13	Farms should be specialized in one or at most a few crops	1	2	3	4	5
14	The key to agriculture's future success lies in learning to imitate natural ecosystems and farm in harmony with nature	1	2	3	4	5
15	Farmers should use primarily natural fertilizers/production methods such as manure, crop rotations, compost, and biological pest control	1	2	3	4	5
16	Agricultural scientists and policymakers should expand efforts to develop biotechnologies and other innovations in order to increase food supplies	1	2	3	4	5
17	Modern agriculture is a major cause of ecological problems and must be greatly modified to become ecologically sound	1	2	3	4	5
18	Most farms should integrate agronomy and animal husbandry	1	2	3	4	5
19	Sustainability should be considered only at the farm level	1	2	3	4	5
	Social responsibility					
20	Agricultural education programs should teach students about the interrelationships between the environment, agriculture, and people	1	2	3	4	5
21	An important responsibility of agricultural education programs is to develop future leaders for the agricultural industry and rural communities in Iran	1	2	3	4	5
22	Farm traditions and culture are outdated and of little use in modern agriculture	1	2	3	4	5
23	Most people should live in cities, and they should entrust farming to somebody who can do it in the best manner	1	2	3	4	5
24	Sustainability is the outcome of the collective decision-making that arises from interaction among stakeholders	1	2	3	4	5

Note: SD = strongly disagree; D = disagree; SDA = slightly disagree; A = agree; SA = strongly agree. Source: authors' development.

Table A3. Agricultural production.

#	Question	SD	D	SDA	A	SA
1	Changes in agricultural pattern	1	2	3	4	5
2	Pests infestation of crops	1	2	3	4	5
3	Choking of crops by weeds	1	2	3	4	5
4	Crop failure and poor harvest	1	2	3	4	5
5	Farmers incur more costs on agricultural activities	1	2	3	4	5
6	Drying up and rotting of farm produce	1	2	3	4	5
7	Delays planting dates which affect yields	1	2	3	4	5
8	Animal growth, reproduction, and milk production are negatively affected	1	2	3	4	5
9	Pasture, forage, and other animal feeds are negatively affected	1	2	3	4	5
10	Diseases and parasites spread quickly	1	2	3	4	5
11	Reduces animal rate of eating and grazing	1	2	3	4	5
12	Increases animal mortality	1	2	3	4	5
13	Reduction in livestock quality and quantity	1	2	3	4	5
14	Reduction in fish harvest	1	2	3	4	5
15	Displacement of farmers	1	2	3	4	5

Note: SD = strongly disagree; D = disagree; SDA = slightly disagree; A = agree; SA = strongly agree. Source: authors' development.

Table A4. Government policy.

#	Question	SD	D	SDA	A	SA
1	Government offers advisory services and consultancy to improve the agricultural output	1	2	3	4	5
2	Receiving R&D from the government	1	2	3	4	5
3	Collaboration with government institutions	1	2	3	4	5

Note: SD = strongly disagree; D = disagree; SDA = slightly disagree; A = agree; SA = strongly agree. Source: authors' development.

Table A5. Poverty reduction.

#	Question	SD	D	SDA	A	SA
1	Ability to save and invest	1	2	3	4	5
2	Ability to meet basic needs of shelter, food, and clothing	1	2	3	4	5
3	Ability to access recreational services/facilities	1	2	3	4	5
4	Ability to enjoy luxury goods and services	1	2	3	4	5
5	Increase health and education level	1	2	3	4	5
6	Increase wealth for household members	1	2	3	4	5
7	Increase employment levels and skills	1	2	3	4	5

Note: SD = strongly disagree; D = disagree; SDA = slightly disagree; A = agree; SA = strongly agree. Source: authors' development.

Table A6. The population of the current study.

Division	District	Tehsil	Union Councils
Dera Ghazi Khan	Dera Ghazi Khan	Rajanpur, Dera Ghazi Khan, Muzaffargarh District, Layyah District	98
	Layyah	Chaubara, Karor Lal Esan, Layyah	48
	Muzaffargarh	Alipur, Jatoi, Kot Addu, Muzaffargarh	111
	Rajanpur	De-Excluded Area Rajanpur, Jampur, Rajanpur, Rohan	69
Faisalabad	Chiniot	Bhawana, Chiniot, Lalian	39
	Faisalabad	Chak Jhumra, Faisalabad City, Faisalabad Sadar, Jaranwala, Sammundri, Tandlianwala	189
	Jhang	18-Hazari, Ahmadpur Sial, Jhang, Shorkot	91
	Toba Tek Singh	Gojra, Kamalia, Pirmahal, Toba Tek Singh	85
Gujranwala	Gujranwala	Gujranwala City, Gujranwala Saddar, Kamoke, Nowshera Virkan Tehsil, Wazirabad	93
	Gujrat	Gujrat, Kharian, Sarai Alamgir	117
	Hafizabad	Hafizabad, Pindi Bhattian	46
	Mandi Bahauddin	Malakwal, Mandi Bahauddin, Phalia	80
	Narowal	Narowal, Shakargarh, Zafarwal	98
Lahore	Sialkot	Daska, Pasrur, Sambrial, Sialkot	124
	Kasur	Chunian, Kasur, Kot Radha Kishan, Pattoki	125
	Lahore	Lahore Cantt, Lahore City, Model Town, Raiwind, Shalimar	274
	Nankana Sahib	Nankana Sahib, Sangla Hill, Shah Kot	65
	Sheikhupura	Firozewala, Muridke, Safdarabad, Sharak Pur, Sheikhupura	99
Multan	Khanewal	Jahanian, Kabirwala, Khanewal, Mian Channu	135
	Lodhran	Dunyapur, Kahror Pacca, Lodhran	70
	Multan	Jalalpur Pirwala, Multan City, Multan Saddar, Shujabad	117
	Vehari	Burewala, Mailsi, Vehari	105
Sahiwal	Okara	Depalpur, Okara, Renala Khurd	140
	Pakpattan	Arifwala, Pakpattan	33
	Sahiwal	Chichawatni, Sahiwal	88
Sargodha	Bhakkar	Bhakkar, Darya Khan, Kalur Kot, Mankera	64
	Khushab	Khushab, Nurpur Thal, Quaidabad	48
	Mianwali	Isa Khel, Mianwali, Piplan	51
	Sargodha	Bhalwal, Bhera, Kot Momin, Sahiwal, Sargodha, Shahpur, Sillanwali	164
Bahawalpur	Bahawalnagar	Bahawalnagar, Chishtian, Fort Abbas, Haroonabad, Minchinabad	135
	Bahawalpur	Ahmadpur East, Bahawalpur City, Bahawalpur Saddar, Hasilpur, Khairpur Tamiwali, Yazman	88
	Rahim Yar Khan	Khanpur, Liaquatpur, Rahim Yar Khan, Sadiqabad	139

Source: authors' development.

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