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Household Market Participation, Access, and Farm Productivity in AJK: Evidence from Farm Household Data

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The goal of the study is to get insight into agriculture production and market constraints in the AJK region. To achieve the objectives of the study, in the first stage, production function is estimated to obtain technical efficiency scores that are explicitly dependent on the farm and farm-specific variables. For this, single-step stochastic production estimation was applied. Tobit regression was employed in the second phase, with the market participation index as the dependent variable and market accessibility factors and efficiency as explanatory variables. The findings show that all inputs contributed favourably and considerably to farm production, with a mean technical efficiency of 58 percent, indicating that sample farmers might achieve the maximum production frontier by raising their efficiency to 42 percentage points.

Among the determinants of technical efficiency farm size, land fragmentation and traction power negatively contributed to efficiency. Market participation was low as approximately 47 percent of the sampled farmers had less than 50 percent market participation and 20 percent did not participate in the market. The remaining 33 percent had market participation greater than 50 percent. The major factors that affect market participation were production efficiency, distance from roads and the market, credit facility, training, experiences, and internet and refrigerator facilities. All these variables were positive and significantly contributed to market participation.

JEL Classifications: D24,Q12,Q13
Keywords: Market Participation, Stochastic Production Estimation, Technical Efficiency Scores, Farm Productivity

1. INTRODUCTION

Understanding barriers to market access and factors affecting production efficiency are key to overcoming market failures. Most of the small farmers in Azad Kashmir, whose access to the market is limited and the only farmers who have access to the market, participate in the agricultural market. Due to this market failure in this particular area, there is a dire need for government programmes in this area to invest in improving market access, infrastructure, and agricultural production. Improving

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productivity can help improve market participation as long as incentives and information for working capital are improved. Higher yields may increase market participation because higher yields may have additional crops to be sold.

AJ&K has abundant rich terrain and seasons that are ideal for various crops and fruits. Due to its climate-friendly nature, the traditional farming system has a distinct advantage. All of AJ&K's districts, which are located in distinct agro-climatic zones, provide ideal circumstances for growing multiple crops at the same time. However, agriculture's potential is not being completely realised since the AJ&K agricultural sector is beset by challenges. The development of the agricultural industry in Azad Kashmir is hampered by a lack of financial resources as well as agriculture-related enterprises, packing and value addition, storage facilities, and advanced research and development facilities.

According to Anwar (2020), the agricultural sector employed 8 percent of the active labour force. Around 72 percent of the households owned agricultural land. The average size of the farm was assessed to be 1.1 acres. Bhimber had the highest percentage of agricultural proprietors at 76 percent, with around 87 percent growing crops. Only 10 percent of households sold and contributed to market participation indicating that 90 percent of the households were subsistence farmers who grew crops for their consumption. Only 31 percent of subsistence farmers could meet their household consumption demands. The average income per harvest of commercial farmers was Rs. 81,086, which is low. In AJ&K, 77.2 percent of the sampled farmers cultivated maize. Wheat was grown by 59.4 percent of farmers, while pulses and rice were grown by 3.2 percent . The growers of vegetables and fruits accounted for 18.4 percent and 12.8 percent, respectively (SDG, 2021).

Weak marketing strategies have contributed to the peasant community's lack of interest. Standard seed production is also difficult. On a commercial scale, small farms holding have an impact on agricultural production. The overall farmland area in Azad Kashmir was around 47 percent of the total land area. Approximately 31 percent of the entire farmland was under cultivation. AJ&K's irrigation area was 6.2 percent of the total agricultural area (P&DD, 2020).

The wheat-maize-wheat cropping pattern is "mountain agriculture" as opposed to agriculture in the lowland plains. Crop and marketing promotion plans have not been devised. Due to a lack of infrastructure and financial assistance, the area is characterised by low productivity and limited market access. Market involvement is contingent on having access to the market. Smallholders sell from their farms or manually lug the produce to the closest local markets. An increasing body of evidence suggests that improving infrastructure, such as road conditions, and market information, has a positive impact on farmers' access to markets (Sigei, et al. 2014; Fraser, et al. 2014). However, there is no actual data on the magnitude and scope of inefficiency. Our hypothesis is that farmers participate in the market with a high level of efficiency and have better market access. To overcome the problem of market failure in this specific sector, this must be investigated.

Although many other factors contribute to agricultural productivity, such as technological advancement, regulatory framework, and optimal use of material inputs, these elements may not have an impact on agricultural performance unless better marketing conditions prevail (Cabas, et al. 2010). Landowners in Azad Kashmir, who are often peasants, have limited financial and technical resources. Hence, policy intervention in this area is critical. To our knowledge, there is no systematic research on agricultural productivity and market participation in the Azad Jammu Kashmir (AJK) region. There are issues with the region's data availability and veracity. To compensate for these statistical flaws, it might be beneficial to limit international studies to a local environment.

Purpose and Scope

The idea of the study is to evaluate farm productivity given resources and technology, and household market participation given market access conditions to establish a linkage between these in the agriculture market of the Azad Jammu Kashmir. Particularly, this study focuses on:

- Measuring the impact of farm variables on farm production and technical efficiency.
- Estimating the linkage between market participation and market access conditions in addition to farm-level efficiencies.
- Recommending policy options based on the outcomes of this study.

Apart from quantitative, the study traces the policy interventions that have been adopted by relevant departments to reduce farm inefficiency and support the farmers to link with the market and the challenges they face to implement their policy agenda.

The study aims to answer the following key questions related to the development strategy in this specific area.

- What are the reasons that cause production inefficiency at the farm level?
- Do farmers produce the optimum level of output to market it?
- What are the area-specific barriers to market access?
- Do improvements in farm productivity increase market participation, having better market access?
- Do new roads and improved accessibility to the market increase commercialisation leading to continuous production?

2. REVIEW OF LITERATURE

Many studies have been conducted to assess the technical efficiency of crops in underdeveloped nations. In Sudan, Adam, et al. (2005) calculated the technical efficiency of sorghum yield, whereas Alemu, et al. (2007) estimated it for agricultural output in Ethiopia. Similarly, Binam, et al. (2004) did a study on Cameroon to measure the technical efficiency of maize and sorghum production. There is no shortage of research on assessing technological efficiency in Sub-Saharan African countries (Fakayode, 2009; Kariuki, et al. 2008; Kibara, 2005). Rios & Shively (2005) calculated the technical efficiency of Vietnam's coffee yield. The measurement of technical efficiency for farmers has also been done using evidence from South Asian countries. Thiruchelvam (2005) conducted a study on Sri Lanka that estimated the technical efficiency of chilli and onion growers.

Similarly, for different crops, a large body of literature has studied farm efficiency in other South Asian countries. Hassan & Ahmad (2005) estimated farm efficiency in Pakistan (Punjab). Thus, creative literature exists in Pakistan that has measured farm efficiencies for various crops such as wheat, rice, vegetables, and citrus (Zahid & Ahmed; 2018; Javed, et al. 2009; Hussain, et al. 2012; Sohail, et al. 2012; Khan & Ghafar, 2013). The majority of these are focused on a particular crop and do not link farm productivity to market participation which limits their scope. Therefore, the focus of this research is on agricultural productivity and market participation. Surprisingly little research has been done on how these variables interact. Previous studies have investigated the relationship between market involvement and productivity (Govereh, Jane, & Nyoro, 1999; Strasberg, et al. 1999; Govereh & Jayne, 1999).

Few studies related to the current work that focused on a single crop in developing countries such as Africa, Latin America, and South Asia are Deaton (1989); Benjamin & Deaton (1993); Barrett & Dorosh (1996); Jayne, et al. (2001); Makhura, Kirsten, & Delgado (2001); Vakis, Sadoulet, & de Janvry (2003); Renkow, Hallstrom; Karanja (2004); Edmeades (2006); Boughton, et al. (2007).

A strand of research has also investigated crop market involvement. In West Africa, Strauss (1984) studied cereals, whereas Budd (1993) looked at food crops, and Strasberg, et al. (1999) and Heltberg & Tarp (2001) looked at total crop production in East Africa. In Pakistan, recent studies on the technical performance of agriculture in Pakistan do not provide a clear picture of farmers' productive performance. The current study adds to this analysis. All crops should be combined with all measurable inputs and outputs and link them with the market. By summarising the preceding debate, the present study contributes to the literature on the AJK agriculture market's agro-climatic structure. It evaluates local farmers' farm inefficiencies and tracks their market involvement. The findings of the study would add to the literature on agriculture specifically related to farm efficiency and farmers' market involvement because the topography, cropping patterns, and adoption of technology differ from one region to another.

3. METHODOLOGY

The study primarily focused on the use of mixed approaches to assess the defined objectives. This method is often used to combine the results of quantitative and qualitative instruments to provide a comprehensive picture of the study problem (Aramo-Immonen, 2011, 2013). The project followed a quantitative approach in which primary data was obtained from farmers in AJK using a detailed questionnaire. In addition to primary data, secondary data was used to establish facts and figures about the structure of the agriculture sector in the sampled areas. Secondary data was collected by conducting a desk review of secondary sources, such as government-published reports on the agriculture sector in the AJK.

Furthermore, the qualitative method was used to conduct key informant interviews (KIIs) to obtain expert opinions on policy activities related to the study's objectives. Questions about their views, subjective norms, perceived behaviour, future expectations, and attitude toward new technology adaptation, government backing, and input availability made up qualitative data. The following is a detailed discussion of qualitative and quantitative approaches.

3.1. Quantitative Methods

The quantitative methods involved the use of primary data gathered from 1,200 farmers in all 10 districts of the AJK via a detailed questionnaire. All socioeconomic characteristics of farmers, farm features, and specific information on agricultural activities and market accessibility factors were included in the questionnaire.

In the first step, the study area was divided into two regions[1] based on topography and climate to give due coverage to all types of heterogeneity in units of farm households in the AJK. In the second step, since all ten districts are located at different climatic zone, two tehsils were selected from each sampled district based on farm population for the household survey taking the total sampled tehsils to 20 (10*2). In the third step, two union councils (villages) were taken from each tehsil. Thus, there were 40 (20*2) UCs (villages) in 20 tehsils from which sampled respondents were taken. In the final step, 30 farmers were selected from each union council, giving us a sample of 1,200 farmers. Based on potential villages, a sample of farm households was randomly chosen from each union council. The geographical, agricultural, demographic, and socioeconomic characteristics can provide important understandings for our research questions. We concentrated on a diverse sample because these traits are almost similar within a certain place. Secondly, given time and money constraints, the sample size of 30 farmers from each UC was considered adequate to achieve our goals. We focused on Rabi (winter) and Kharif (summer) crops for the agriculture year 2020-21 for simplification because these crops are grown at a specific time of the year.

Two principal crop seasons were covered in our data set, i.e., Rabi, which stretches from October-December 2020 to April-May 202 and "Kharif," with sowing beginning in April-June 2021 and harvesting taking place in October-December 2021. Agriculture is a process that involves multiple crops and inputs. The production of several crops on each farm was merged into a single product to apply the production function technique. Farm products included all outputs of the farm including crops, livestock, fruits, and vegetables. We did not consider livestock and livestock products in our analysis for which representative data are hard to come by and need a couple of years to collect. Statistical data included information about household demographics, farm-specific characteristics, farm-level inputs, technical practices, and variables related to output production, geography, infrastructure, and market access. We employed field assistants and agriculture graduates from different tehsils to collect the data. Subsequent training was given to the selected enumerators. Trained enumerators conducted face-to-face interviews. Quantitative data were collected during November and December 2021 because the harvesting of summer crops starts in November. The primary data was then compiled, cleaned, and estimated to analyse the research questions.

Empirical Model

After quantitative data collection, statistical analysis was carried out. Since the computation of farm inefficiency is purely econometric based, we used an empirical model to evaluate the objectives of the study.

[1]The Northern districts which are generally mountainous include Muzaffarabad, Jhelum Valley, Neelum valley, Bagh, Haveli, Poonch, and Sudhnoti while Southern are comparatively plain districts such as Kotli, Mirpur, and Bhimber.

The stochastic production frontier approach was preferred instead of using a simple production approach because it fitted the data the best, i.e., large units of cross-sectional data, separate form, biological, the inclusion of social features, non-observable characteristics of the farmer, and technological neglect (Kumbhakar & Lovell, 2000; Salvo, et al. 2013). The stochastic approach was also found to be suitable for our objectives.

The study covered three aspects of the farm household. First, we evaluated farm-level technical performance scores using the stochastic production frontier. If there is a technical inefficiency, it means that the farmers are not producing at the maximum level of the production frontier curve but below and, therefore, the technical performance is less than one. Second, we gained access to the specific constraints and conditions of the region for market access to the sampled households. This test assumes that production efficiency increases market participation due to higher sales in the presence of improved market access conditions. Third, we analysed the relevance of production efficiency and market participation in terms of market accessibility, such as infrastructure, distance to roads, sources of market information, distance from markets, marketing experience, and other market-related variables. The Tobit model was used to determine the relationships. For market participation, the sales index was used as a fraction of the total sales. Farm-specific inputs (land, labour, capital, and materials) served as explanatory variables to determine their impact on farm production (gross value of vegetables, fruits, grains, and other food crops). The study considered the effects of different farmers' characteristics, such as experience, education, and farm size on farmer performance such as the 'technical ineffectiveness model' depending on the specific features of the farm as done by Battese & Coelli (1995).

Specification of Empirical Model

When analysing unit-level information like the household farm survey, the production frontier using the stochastic frontier approach is a better way to quantify production efficiencies (Hughes, et al. 2011). We can also use the stochastic frontier model to deal with specific random shocks (Thiam and Bravo-Ureta, 2001). Traditional deterministic methods ignore the noise, which can lead to an overestimation of technical inefficiency. A 'composite error term' with two components is used in the stochastic frontier technique. The first is technical inefficiency, which is defined as "farm departures from the production frontier," and the second is statistical noise, which captures the influence of random shocks on each producer as defined by his or her operating environment (Coelli, 1995). This method also enables the statistical testing of assumptions about the production structure and degree of inefficiency.

Various functional forms have been used in the literature to assess farm performance. Cobb-Douglas and translog functions are the most employed functional forms by academics to measure efficiency in the agriculture sector. The translog function has a more flexible functional form and is most represented in logarithm form such as:

$$ln(Y_i) = \alpha_o + \sum_k \beta_k lnX_{ki} + \sum_j \beta_j ln\, X_{ji} + \frac{1}{2}\sum_j \sum_k \beta_{jk} lnX_{ji} lnX_{ki} \qquad \ldots \quad (1)$$

This function is viewed in three ways by Boisvert (1982). It is viewed, first as an exact production function, second, as a second-order Taylor series approximation to a general, but unknown production function, and, third, as a second-order approximation to a CES production function. Boisvert (1982) defined the exact production function in Cobb-Douglas functional form as

$$ln(Y_i) = \alpha_o + \sum_k \beta_k lnX_{ki} + \sum_j \beta_j lnX_{ji} \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (2)$$

We chose Cobb Douglas functional form because this study employed several exogenous variables and a large number of parameters to evaluate. Assuming that the number of production factors is n, the number of parameters to be estimated is n (n+3)/2, which increases the risk of severe multicollinearity, which could result in contradicting interpretation of parameters (Pavelescu, 2011). Based on applied economic literature, the Cobb-Douglas function form is favoured because of its simplicity and ability to avoid collinearity among the independent variables. The linear form of the Cobb-Douglas production frontier function is as follows:

$$\ln(Y_i) = \alpha_o + \sum_k \gamma_k \, lnX_{ki} + \sum_j \beta_j lnX_{ji} + v_i - u_i \ldots \mathrm{i} = 1, 2, 3, \ldots, \mathrm{N} \quad \ldots \quad (3)$$

In Equation 3, ln denotes the natural logarithm to the base e, Y_i is the ith farm output (gross value from all crops), X_{ki} is the vector of k inputs, and X_{ji} is the vector of *j* inputs (land, labour, capital and material) of the ith farm. Technical inefficiency affects u_i derived in the preceding equation is specified as:

$$u_i = d_{\circ} + d_1 Z_i + e_i \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (4)$$

where Z_i are the vectors of farmer and farm-specific characteristics of the *ith* household, and e_i is the error term. $u_i = Z_i d' + e_i$ where d' denotes the vector of parameters, *d* is the constant term with d_0 omitted, assumed that it is included in the expression $Z_i d'$

$$TE_i = \exp(-u_i) \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (5)$$

This demonstrates that the lesser the nonnegative inefficiency component u, the more efficient the *ith* farm. By construction, technical efficiency indices range from zero to one, and higher technical efficiency indices denote higher levels of efficiency. Households having a technical efficiency index of one are considered technically efficient. A single-step estimating technique was used to estimate the model (Battese & Coelli, 1995). The maximum likelihood technique (MLE) was proposed by Battese and Coelli (1995) for the simultaneous estimation of parameters of the stochastic production frontier and the inefficiency model. The MLE technique employs the following variance parameters: δ^2 is total error variation, $\delta^2 = \delta^2{}_v + \delta^2{}_u$, and $\gamma = \frac{\delta_\mu^2}{\delta^2}$, which represents the technical inefficiency contribution to total error variation.

The two-step modelling approach has been questioned by Battese and Coelli (1995) and Battese, et al. (1996) because it violates one of the most crucial assumptions of the stochastic frontier model, i.e., identically independently distributed technical inefficiency effects. Various statistical tests can be used to determine the model's validity. The null hypothesis, H_0=γ=0, i.e., the technical inefficiency effects are not present in the model and are not random, is of particular importance. Furthermore, $H_0 =$

$d' = 0$, expressed the null hypothesis that the household-specific attributes do not affect the technical inefficiency level. The generalized likelihood-ratio statistic λ is defined as $\lambda =$ -2 ln $[L.(H_0)/L.(H_1)]$, where H_0 and H_1 are the null and alternative hypotheses, respectively. If, H_0 is true, then is asymptotically distributed as a chi-square random variable (see Coelli, 1995 and 1996).

Market Participation

Market participation was measured by sales as a fraction of the overall output of the household's entire agricultural crop production. This "sales index" would be zero for a household that sells nothing, more than zero for a household that sells their crops, and greater than unity for households that add value to their crop production through additional processing (Govereh & Jayne, 1999). It is defined as:

$$sale\ index_i = \left[\frac{\sum_{j=1}^{J} Crop\ marketed_{iy}}{\sum_{j=1}^{J} Crop\ harvested_{iy}}\right] \begin{Bmatrix} Non\ seller & = 0 \\ seller & > 0 \end{Bmatrix} \quad \ldots \quad \ldots \quad (5)$$

where a different jth crop is grown on an ith farm. The sale of crops involves transactions with people and organisations outside of the farm household. Y_m is the amount marketed, Y_h is amount harvested but it does not contain the portion used for household consumption, Y_C, the gift portion, Y_G, or stored as seeds, Y_S, for the next season.

$$Y_m = Y_h - Y_C - Y_S + Y_G$$

where $Y_h > 0$ if $Y_C, Y_S, Y_G > 0$, Y_m/Y_h=1 if the farmer sells all the crop harvested or, $0 < \frac{Y_m}{Y_h} < 1$ if the farmer distributes his crop and sells a portion of it in some market. Therefore, the value of the dependent variable is between 0 and 1.

The next analytical step involved identifying factors that influence market participation using regression analysis. The determinants of market participation are those that affect productivity and, hence, domestic market access conditions.

The general model can be written as

$$(MP)_i = f\{(u)_{i,}, (MA)_i, (D)_i\} \ldots i = 1 \ldots\ldots N \quad \ldots \quad \ldots \quad \ldots \quad (6)$$

where MA is the vector of variables that determine market access conditions, u is the technical efficiency scores generated from the above model, *D* shows demographic conditions, and MP is market participation. We used the Tobit model to estimate this because of the truncation of market participation variables (Barrett, et al. 2001).

$$\text{Tobit}(\text{M}P_i) = \ln\left[\frac{Y_m}{Y_h}\right] = \beta_1 + \beta_2(\text{MA})_i + \beta_3(D)_i + \beta_4(u)_i + \varepsilon_i \quad \ldots \quad (7)$$

3.2. Qualitative Methods

The study implemented qualitative methods to accomplish the objectives related to the policy interventions by stakeholders. The study implemented the qualitative method to get information from the key informant interviews (KIIs), which contained the information about agriculture sector in the AJK. The objective was to ask them about the sort of support they provided to the farmers to reduce farm inefficiencies. Moreover, KIIs maintained focus on the problem faced during the provision of assistance to farmers, and how the relevant institutions provided help to farmers to participate in the market. Qualitative information was collected from different interlinked departments such as the agriculture department officials, Planning and Development Department (P&DD), Irrigation and Small Dams Department, Extension Service Management Academy (ESMA), Agriculture Tourism Development Corporation, and Crop Reporting Services (CRS).

Focused Interviews

The qualitative data were collected following Yin (2003) to ensure the reliability of individual case study interviews, and personal observations using the focus group discussions (FGD) methods. Some crucial questions about agriculture productivity and marketing of the relevant sectors were included in the surveys. They were also given some specific questions about the reasons for agricultural inefficiencies and marketing faults, as well as their suggestions, roles, challenges, and expected policy recommendations.

To collect data, 40 key informant interviews (KIIs) and direct observations at various institutions at all levels were conducted. This group was made up of people from ten interconnected departments. Interviews were conducted with 36 field specialists and four members of a privately owned farm. Each interview lasted approximately one hour. Twenty percent of the key informants (KIs) were female, and eighty percent were male. Of those working on private farms, 68 percent had M.Sc. (Hons) or higher education, 22 percent had B.Sc. (Hons), and 10 percent had intermediate education. Experts represented all agriculture sector departments from all districts. Fifty percent had more than 14 years of experience in the agricultural sector. Four focus group discussions (FGD) with eight to ten participants were also held.

The overall goal of these interviews was to gather the most relevant information, opinions, experiences, and other issues. Additionally, we utilised these as a foundation for identifying issues, difficulties, future expectations, convictions, and driving forces associated with this particular sector.

4. RESULTS AND DISCUSSION

4.1. Technical Inefficiency Score

The mean value of efficiency derived from the above model that was estimated in Table 1. These efficiency score are presented in Table 2, was 58 percent , with a range of 7.5 percent to 86 percent . It indicates that farmers might achieve the maximum output frontier by raising their efficiency by 42 percent . This could be accomplished through the use of current technology and other measures. This suggests that by utilising agricultural resources more efficiently, the gross value from crops might increase by 42 percent . While 53 percent of the sampled farmers were under 60 percent efficient, there is still space for the average farmer to increase farm production by 40 percent with the same level of inputs and technology by strengthening the farming community’s managerial capacity.

Table 1

The Maximum Likelihood Estimates for Cobb-Douglas Production Frontier including Determinants for Technical Inefficiency

	Estimate	Std. Error	z value	Pr(>|z|)	Significance
(Intercept)	9.56	0.22	43.53	< 2.2e-16	***
Weedicide/insect (dummy variable)	0.10	0.03	3.26	0.00	**
FYM(trolleys)	0.11	0.02	5.17	0.00	***
NPK (nitrogen and phosphorous nutrients, kg)	0.16	0.02	8.35	< 2.2e-16	***
Irrigation (numbers)	0.16	0.03	6.22	0.00	***
Cultivated area (kanal)	0.48	0.04	12.96	< 2.2e-16	***
Seed (kg)	0.01	0.03	0.49	0.63	.
Man days (for hired labour one man-day=8 hours)	0.17	0.04	4.68	0.00	***
Tractor (dummy)	0.47	0.10	4.66	0.00	***
District south (dummy)	0.42	0.08	5.08	0.00	***
Intercept	-0.23	0.81	-0.29	0.78	
Farm size	-0.02	0.01	-1.94	0.05	.
Farming experience	0.01	0.01	1.83	0.07	.
Education	0.09	0.04	2.54	0.01	*
Farming area	0.66	0.26	2.50	0.01	*
Irrigation sources	0.10	0.05	1.90	0.06	.
Land fragmentation	-0.61	0.27	-2.31	0.02	*
Traction power	-0.55	0.24	-2.29	0.02	*
Sigma sq.	1.73	0.51	3.37	0.00	***
Gamma	0.72	0.08	8.51	< 2.2e-16	***
Log-likelihood	-1549.364				

Source: Author own estimations.

Significance: 0***, 0.001 **, 0.01*, 0.05 '.' 0.1 ' ' 1.

Table 2

Efficiency Estimates Distribution Using CD -SFA Model

TE Range	Percent of Farms
<50	21
50-60	32
60-70	30
70-80	15
80-90	2
90-100	0
Total	100

Source: Author own estimations.

4.2. Market Participation Index

Market participation is calculated by the sum of all crops marketed divided by the sum of all crops harvested $\left[\frac{\sum_{j=1}^{J} \text{Crop marketed}_{iy}}{\sum_{j=1}^{J} \text{Crop harvested}_{iy}}\right]$. Its value ranged between 0 and 0.9 with a mean of 0.36. Zero means they marketed nothing, whereas a value close to 1 means that the share of the crop marketed in total production increased, which implies more market participation. 1 means that they sold the whole crop produced. On average, the farm output produced was 4,215 kg and the amount marketed was 2,319 kg. Forty-seven percent of the farmers had less than 50 percent market participation, while 20 percent did not participate in the market at all. The remaining 33 percent had market participation greater than 50 percent . The distribution is shown in Table 3.

Table 3

Market Participation Distribution

MP Range	Percent of Farms
0	20
0.01-0.10	5
0.10-0.20	13
0.20-0.30	12
0.30-0.50	17
0.50-0.70	17
0.70-1	16
Total	100

Source: Author own estimations.

Factors Affecting Market Participation

We used the technical efficiency level generated from the above model along with other market accessibility factors and household characteristics, which include credit facility, agriculture, and a market training dummy variable as the determinants of market participation. For the distance dummy variable, the farm that was within 5 km from the road was taken as the base category. The other determinants of market participation included the processing or value addition dummy variable, the distance from the market between 15-30 km dummy variable, marketing experience in years, having a refrigerator for storage dummy variable, having the internet as a source of information dummy variable, and family size in numbers. The model fit was good as the sigma coefficient was highly significant and the log-likelihood value was also large (404) with df 12. The results are presented in Table 4. All the variables, except the family size and processing, were positive and significantly contributed to market participation. An increase in credit facilities along with training and an increase in technical efficiency at a farm increase

Table 4

Analysis of Market Participation Determinants (Tobit Model)

	Estimate	Std. error	t value	Pr(> t)	Significance
Intercept	-0.69	0.06	-11.32	< 2e-16	***
Credit (dummy)	0.04	0.02	1.85	0.06	.
Training (dummy)	0.12	0.02	5.65	0.00	***
Technical efficiency index	1.39	0.08	16.80	< 2e-16	***
Distance from the road (within 5 km)	0.08	0.02	4.29	0.00	***
Processing	-0.05	0.02	-2.34	0.02	*
Distance from the market (within 15-30km)	0.11	0.02	4.77	0.00	***
Marketing experience (years)	0.01	0.00	6.18	0.00	***
Refrigerator (dummy)	0.06	0.02	2.91	0.00	**
Internet (dummy)	0.04	0.02	1.90	0.06	.
Family size(number)	-0.01	0.00	-3.17	0.00	**
Log sigma	-1.21	0.02	-51.16	< 2e-16	***
Log-likelihood	-405.00				

Source: Author own estimations.

Significance: 0***, 0.001 **, 0.01*, 0.05 '.' 0.1 ' ' 1.

market participation. Chandio, et al. (2018); Ali, et al. (2014); Mukasa, et al. (2017) also found evidence to prove that credit increases agricultural gross domestic product in Pakistan. Marketing experience also positively contributed as experienced farmers have established customer bases who usually buy from them (Harriet, et al. 2018).

The coefficient of efficiency was 1.39 indicating that one point increase in efficiency score increased market participation by 1.39 percent. Rios, Shively, & Masters (2009); Abu, Issahaku, & Nkegbe (2016); Mekonnen (2017) & Alhassan, et al. (2020) observed that farm households who are more productive have higher market participation rates.

Similarly, closer distance from the roads and market also significantly increased market participation. Makhura, et al. (2001) found that more distance to the market negatively influences both the decision to participate in markets and the proportion of output sold. Acheampong, et al. (2018) reported that access to improved roads encourages the use of modern farm inputs giving higher yields. The positive effect of the market on the community supports the argument that physical infrastructure reduces transaction costs associated with marketing and information, which increases the quantities sold (Abu & Issahaku, 2017). Since the internet is a source of information, having the internet also positively contributed. Other studies have also found a positive effect of market information on market participation (see, for example, Abu, et al. 2016 & 2014; Siziba, et al. 2011).

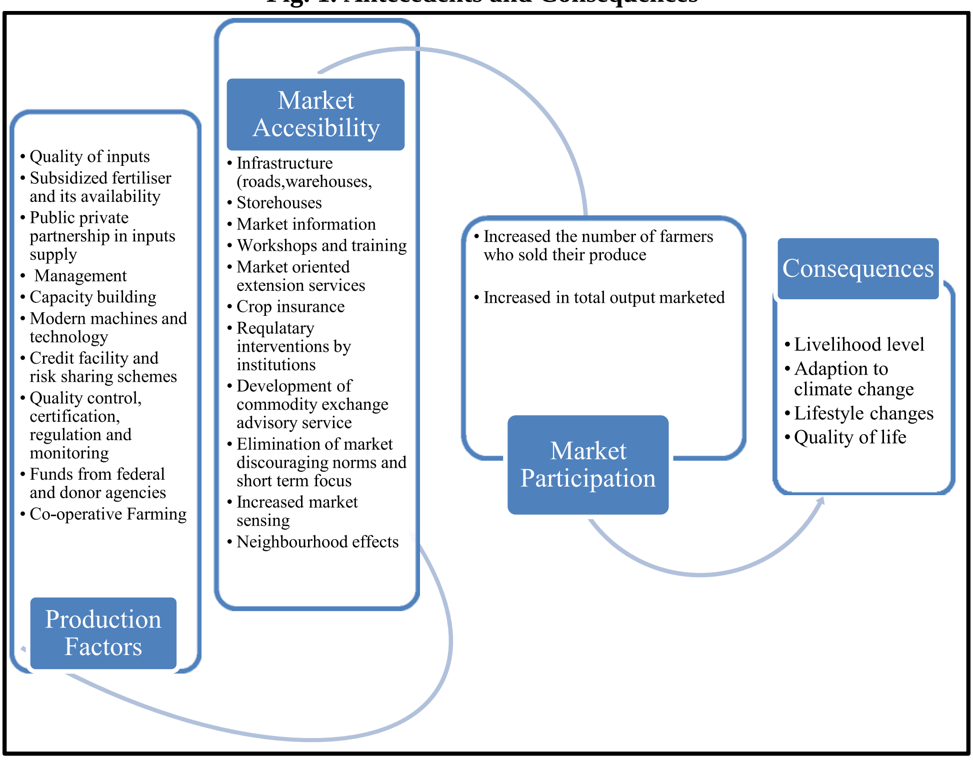
The family size and processing negatively contributed to participation because larger families mostly process products for their immediate consumption at home, such as spices, maize, and wheat flour. Therefore, an increase in family size increases household consumption and results in a decrease in the amount marketed. The result is consistent with Olwande & Mathenge (2012).

4.4. Response Generated from KIIs

Two sections make up the qualitative questionnaire. We posed questions about farm efficiency in Section A and market involvement in Section B. The results are summarised here in percentage terms. One of the questions was, "*How are you contributing/assisting the farmers to improve farm productivity?"* Twenty percent said that they provided instant information. Another 20 percent said that by introducing efficient farm practices. Similarly, 25 percent said that they assisted by educating, training, and demonstrating. Seven percent helped with irrigation, while 27 percent assisted with other measures such as enhancing soil fertility. Another question was "*Your organisation is demonstrating/working on which impact-based policy type?* Thirty-five percent responded that they provided input support, 5 percent output support, 50 percent technical support, and 10 percent financial assistance. In response to the question "*Is your department playing a role in the timely provision of pesticides, fertilisers, and other inputs to farmers?"* 42 percent answered yes, while 58 percent said no. Another question was "*In the face of climatic shocks/disasters, what has been your role to assist the farmers?"* Thirty percent that they assisted with adaptation, 25 percent with financial assistance, 45 percent with climate change perceptions, and 22 percent said they assisted with other measures. In response to the question "*Does your department have any collaboration with some other department to assist the farmers?"* 82 percent said yes, while 18 percent responded with no. The question "*Is your department engaged in finding new research-based ways to increase the productivity of the farmers?*" yes answers accounted for 55 percent of the total, while no answers accounted for 45 percent.

The question "Which extension teaching method, in your opinion, is most persuasive for farmers in terms of an innovation's adaptability?" was also asked. The responses show that individual interaction was preferred by 32 percent , group contact by 55 percent , and mass contact by 12 percent . In response to the question "*Is the district administration working with you to help farmers raise their output?*" 37 percent said yes, while 62 percent said no. *Similarly, to the question "Are you training farmers on how to gain market access?"* 25 percent responded with yes, while 75 percent responded with no. There was also a question that asked "*Is your department encouraging farmers to go into commercial farming and switch from traditional to high-yield crops?*" Eighty percent responded with no, while 20 percent with yes. Finally, a question asked, "*Are you having difficulty carrying out your plan to enhance farmer market participation?*" In response, 65 percent said yes and 35 percent said no. The overall discussion and response are summarized in given Figure 1.

Fig. 1. Antecedents and Consequences



6. CONCLUSION AND POLICY RECOMMENDATIONS

The positive coefficients of inputs on output, as previously mentioned, may indicate that measures to enhance input availability would be beneficial, or the fact that higher traction power increases efficiency may indicate the need for private-public partnerships to boost power availability. Similarly, the positive role of training in increasing market participation may imply that some training programmes are beneficial. Improvement of infrastructure by constructing local markets, roads and storage houses may also positively contribute to market participation.

The study's main goal was to establish a relationship between farm production, technical efficiency, and market participation. The research question was whether increasing agricultural production leads to increased market participation, having better market access conditions. To this purpose, the study demonstrates that farm-level variables and market accessibility factors have a significant impact on agricultural productivity and market participation. The findings also revealed that, in addition to market accessibility factors, production and technical efficiencies play a substantial impact in influencing market participation levels, with a positive coefficient of 1.39. There is room to increase the efficiency level by 42 percent. Therefore, there is a need to take the following steps:

- To control the effects of farm inputs on production; the inputs should be available to every farmer timely and in good quality and quantity.
- Socioeconomic factors influence farm performance. Education and agriculture skills along with training should create awareness and interest so that more educated people are involved in agriculture.
- Innovative machines should improve the management capabilities of the agricultural community, which enhance technical efficiency and market participation by designing and promoting infrastructure support, i.e., roads, markets, storage and warehouses, and transport facilities.
- Poor monitoring mechanisms were noted. To evaluate the impact of development schemes, advisory support systems, monitoring and evaluation mechanisms can assist in reorganising schemes to achieve the desired goals.
- Credit and short-term loans have a significant impact on market participation. The loans are used to convert traditional agriculture to modern commercial farming, which increases market participation.
- Strategies need to be devised to equip farmers with marketing skills and opportunities so that their products can reach the market at a lower cost and in a shorter time. .
- The agricultural extension should be market-oriented. Reorganise the agricultural extension system to meet the challenges of the market because extension agents are the ones who are in close contact with the community. Therefore, they should be well equipped with updated information about marketing. The farmers should be provided training to improve their management skills in the changing environment.
- The study's findings also show that increasing production efficiencies increase market participation. As a result, greater infrastructure and farmer-friendly policies are required to remove input and output market inefficiencies, lowering production costs, and making the sector more competitive.

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