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Economic Analysis and Production Efficiency of Dark Sun Cured Rustica Tobacco Production
A Case Study of Punjab, Pakistan

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ABSTRACT

Using a comprehensive primary dataset collected from 210 farmers of two (Dera Ghazi khan and Rajanpur) districts of Punjab Province in Pakistan. The objective of this study was to explore the technical, allocative and economic efficiencies and subsequently to estimate the determinants of inefficiency of tobacco farmers in Punjab, Pakistan. The technical, allocative and economic efficiencies were assessed by using data envelopment analysis (DEA) technique. The mean technical, allocative and economic efficiency scores for the tobacco farms were 0.90, 0.82 and 0.75 respectively. Results based on tobit regression analysis were highly significant for all three efficiencies. Thus, divulge that the age of household, education, agricultural credit access and contact with extension staff had a significant and negative effect on inefficiency score. The government should take steps for the improvement in the technical education of farmers, meetings with extension agents, insure the quality of inputs and provide a subsidy to small farmers in the purchase of inputs.
KEYWORDS: Tobacco, Efficiency, DEA Approach, Tobit Model

1. INTRODUCTION

Government of Pakistan endorsed new technologies for the enhancement in agriculture sector. Agriculture occupied a major (19.5%) share in the gross domestic product of Pakistan which involved 42.3% labor force [19]. Increase in the production as well as yield of agricultural crops is a need of time [16, 17].
Cash crops are considered as an essential part of agriculture because these are a source of livelihood and foreign exchange. Major problems faced by developing countries were unemployment and poverty. The sector of cash crops can tackle these problems in short period of time. Their short growing period was also helpful in the cultivation of many crops in a particular season [2].
Tobacco considers as an important cash crop occupied only 35251 hectares with the production of total 86.22 million kg tobacco and an average yield of 1900 kg per hectare [18]. Tobacco products included price earnings ratio of top fifteen companies in Pakistan. Tobacco in Pakistan was on growing value trend throughout the review period but declining trend in value term from past five years. Pakistan exported tobacco 1233.86 million rupees in 2016 which was less than half 2732.29 million rupees in 2012 [21] and posting negative growth of 2.6 percent in 2017 as compared to last year due to decrease in area [19]. Tobacco is a labor-intensive crop supporting 1.2 million persons [5].
Smokeless tobacco is popular with a name of Dark Sun Cured Rustica or black leaf, occupied an area of 7000 hectares with a production of 21 million kg [20]. Its product is consumed as snuffing and chewing. Snuff is fine-grain tobacco that often comes in teabag-like pouches that users "pinch" or "dip" between their lower lip and gum. Chewing tobacco comes in shredded, twisted, or "bricked" tobacco leaves that users put between their cheek and gum. [20].
Production of smoked and smokeless tobacco is nearly similar but the processing of smokeless tobacco is different than the smoked tobacco. Researchers who have explored economic analysis of smoked tobacco [22, 32, 36, 40], calculating all costs, output and profit. Production function, mathematical programming and frontier function techniques were used for the measurement of the technical efficiency of agricultural farms [7, 11, 28, 38]. They

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pointed out toward the improvement of efficiency and productivity by using different factors such as improvement in the land, seed quality, pesticide and fertilizer availability, labor skills, extensions services and credit Education. In the light of above studies, smokeless tobacco production is also said to be an important contributor to livelihood in terms of labor and revenue generation. But the literature was insufficient about smokeless tobacco is grown in Punjab, Pakistan. Therefore, a comprehensive study is required about the economic analysis and modeling of production efficiency of smokeless tobacco and checked the opportunity of input reduction keeping output level as constant or opportunity of obtaining more output keeping the input use level constant.

2. METHODOLOGY AND DATA SAMPLING

2.1 Study Area

Punjab province is located between 24-37ºN and 62-75ºE in the fertile land of five south flowing rivers [14]. The region is blessed with good climate, suitable for agricultural production [34]. The study was conducted in two smokeless tobacco growing districts of Punjab (Rajanpur and Dera Ghazi khan, based on their shares of total smokeless tobacco in the province following the statistics from [10]

2.2 Sampling

Multistage random sampling technique was applied to collect the data. In first stage Punjab province was selected. In second stage two district was selected. In third stage five villages from each district were selected. In fourth and last stage 20 to 22 tobacco farmers were selected. About 105 farmer's data was collected from each district, total 210 respondents were interviewed. Respondents were divided into three sub-groups such as small, medium and large farmers. Total operational land was less than 12.5 acres for small farmers; more than 25 acres for large farmers; and between 12.5 and 25 acres for medium farmers [23]. Small, medium and large farmers were 59.52%, 25.72% and 14.76%, respectively.

2.3 Analytical procedure

For the present study, software like Microsoft Excel, SPSS-15, DEAP-2.1 and Stata 13.0 were used for empirical analysis. For economic analysis, total revenue (TR) and total cost (TC) were estimated smokeless tobacco production. The total variable cost in the form of nursery cost, land preparation, seed, transplantation, fertilization, earthling up, hoeing, irrigation, pesticides, picking and marketing. The total fixed cost was the sum of land rent (six months) and administration charges [2]. Benefit-cost ratio, gross margin and net income were calculated with given formulas [6].

2.3.1 Data Envelopment Analysis

Efficiency means comparison between the existing and maximum productivity of a firm [15]. Production frontier was used to the determined Maximum productivity of a firm. Production frontier was developed by using two different techniques such as stochastic frontier analysis (SFA) and data envelopment analysis [24]. The technique of linear programming was used in DEA model. The increasing difference among actual data and frontier explored the presence of increasing inefficiency of a firm [9, 33] mentioned both output and input oriented nature of DEA model but a farmer has more control on inputs. Therefore, input oriented DEA model was used in this study. According to [12], constant returns to scale DEA model was only feasible when all firms were working at an optimal scale but it is not possible in agriculture in Pakistan due to many constraints such as financial constraints, imperfect competition etc. in order to accommodate this [8] incorporated convexity constraint in proposed variable returns to scale in DEA model. According to [33] , technical efficiency is the achievement of maximum output by utilizing given input resources on the basis of the production model. DEA model based on a variable return to scale was used for the estimation of technical efficiency.

The present study calculated technical allocative and economic efficiency by using DEA model based on a variable return to scale. Total farm income (Y) was considered as an output variable in the calculation of efficiency scores. Land (X1), tractor (X2), seed (X3), labor (X4) fertilizer (X5), irrigation (X6) and chemical (X7) were used as input variables in the analysis.

2.3.2 DEA Model for technical efficiency estimation

Input oriented variable return to scale DEA model was applied for technical efficiency estimation as mentioned by [33] like:

$$\min_{\theta,\lambda} \theta,$$

$$\text{subject to: } -yi + Y\lambda \geq 0,\ \theta xi - X\lambda \geq 0,\ \lambda \geq 0 \qquad (1)$$

Where:

Y represents the output matrix for N smokeless tobacco farmers.

θ represents the total technical efficiency.

λ represents Nx1 constants.

X represents input matrix for N smokeless tobacco farmers.
yi represents the total revenue (Rs.)
xi represents the vector of inputs $X_{1i,}\ X_{2i}\ldots\ldots\ X_{7i}$
X_{1i} represents the area under smokeless tobacco (acres)
X_{2i} represents the total tractor used (hours) in farm operations
X_{3i} represents the total quantity of seed (kg)
X_{4i} represents the total labor man days required for all farm operations
X_{5i} represents the weight of fertilizer (kg)
X_{6i} represents the total irrigation (hours)
X_{7i} represents the total chemical (liter)

2.3.3 Economic Efficiency Estimation

Cost minimization DEA model is considered as the first step for the estimation of economic efficiency and it is simply a ratio between minimum to observed cost as mentioned by [33]. Cost minimization DEA model was expressed as:

$\min_{\lambda,}\ xi^{E}\ wi\ xi^{E}$

subject to: $-yi + Y\lambda \geq 0,\ xi^{E} - X\lambda \geq 0,\ N1\lambda = 1,\ \lambda \geq 0$ (2)

Where:
wi represents input price vector $W_{1i}\ W_{2i,}\ldots\ldots,W_{7i}$
xi^{E} represents the vector of cost minimizing input quantities
N represents the total smokeless tobacco farmers
W_{1i} represents land rent in Rs.
W_{2i} represents total money spent on tractor use in Rs.
W_{3i} represents the total cost of seed in Rs.
W_{4i} represents the total cost of labor in Rs.
W_{5i} represents the total cost of fertilizer in Rs.
W_{6i} represents the total cost of irrigation in Rs.
W_{7i} represents the total cost of chemical in Rs.
Economic efficiency is simply a ratio between minimum cost and observed cost.
Economic Efficiency = minimum cost/observed cost

$EE = wi\ xi^{E}/\ wi\ xi$ (3)

2.3.4 Estimation of Allocative Efficiency

Allocative efficiency is obtained by dividing economic efficiency with technical efficiency. AE = EE/TE (4)

2.3.5 Tobit Regression Model

Efficiency improvement studies also explored the causes of efficiency variations between different farmers [26]. The score of inefficiency for each farmer was obtained by subtracting their efficiency score from 1. The technical, allocative, and economic inefficiency score were separately regressed on selected variables. The range of efficiency score by using DEA model was from 0 to 1. It shows that the dependent variable in the model was not normally distributed. Biasness in results becomes a hurdle for the use of ordinary least square technique [33]. So, the current study used Tobit regression model proposed by [39]. Socio-economic and farm related variables were age of farmer, education, land under tobacco, distance from output market, agriculture credit and contact with extension agents. Tobit regression model used by [33] for the determinants of inefficiency was expressed as:

$E_i = E_i^{*} = \beta_0 + \beta_1 Z_{1i} + \beta_2 Z_{2i} + \beta_3 Z_{3i} + \beta_4 Z_{4i} + \beta_5 Z_{5i} + \beta_6 Z_{6i} + \mu_i$ If $E^{*} > 0$ (5)

$E = 0$ if If $E^{*} \leq 0$

Where
i represents i^{th} farmer in the sample
E_i represents the technical, allocative, and economic inefficiency
Ei* represents the latent variable.
Z_{1i} represents the age (years)
Z_{2i} represents the education (years)
Z_{3i} represents the area under smokeless tobacco (acres)
Z_{4i} represents the distance from the market (Km)
Z_{5i} is a dummy variable having a value equal to one if a farmer has access to credit otherwise zero.
Z_{6i} is also a dummy variable having a value equal to one if a farmer has access to extension services otherwise zero.
ß's represents unknown parameters, μ_i represents the error term.

3. RESULTS AND DISCUSSION

Table 1 depicts the average variable cost incurred in per acre production for smokeless tobacco. On average, expenditures of small farmers were high in nursery growing cost (1428.12). Total cost was more for small farmer (Rs. 76499.81) followed by large (Rs. 74110.44) and medium farmer (Rs. 71824.32). The small farmer paid more uprooting and transportation cost (Rs. 1658.12), gap filling cost (Rs. 148.34), hoeing cost (Rs. 2560.68) and harvesting cost (Rs. 1046.15) as compared to the large farmer.

Table 1. Total production cost acre-1 (Rs.) for smokeless tobacco

Production Practices/Costs	Sub Groups			Standard Error of Mean
	Small	Medium	Large	
Total Nursery Cost	1428.12	711.84	484.13	49.69
Uprooting and transportation cost	1658.12	1626.79	1727.03	12.55
Gap filling cost	148.34	73.45	58.51	5.16
Manual ridge making cost	270.94	244.64	245.95	5.38
Fertilizer and FYM application Cost	1085.78	1007.85	1009.38	19.21
Pesticide insecticide application charges	241.20	313.39	263.51	7.80
Total Hoeing Charges	2560.68	2548.21	2448.65	33.53
Manual Topping and de-suckering Charges	3973.50	4137.50	4059.46	33.47
The labor cost of irrigation and water course cleaning	730.66	574.85	711.62	26.07
The labor cost of Harvesting	1046.15	1057.14	1024.32	11.01
Cost of picking tying and loading	1251.28	1296.43	1278.38	12.89
Stick replacement cost	3637.61	3805.36	3732.43	25.63
Total Labor Cost	**16604.27**	**16685.61**	**16559.24**	**126.54**
Total Land Preparation Charges	6395.34	4841.19	4446.24	113.37
Total Fertilizer and FYM Cost	24473.78	23724.95	25982.99	399.90
Total Pesticide insecticide cost	984.19	1030.36	1258.11	25.32
Total Irrigation Cost	7027.78	6962.50	7131.08	88.71
Total Curing Cost (Plastic)	526.50	564.29	518.92	13.82
Land rent	19059.83	17303.57	17729.73	150.81
Total Cost	**76499.81**	**71824.32**	**74110.44**	**968.18**

Table 2 describes that the small farmers get more leaf production (31.52 40kg/acre) and price (Rs.3955.98/40kg). The small farmers also get more stick production 7.88 40kg/acre. Total revenue was also more for small farmers (Rs.1276290.00 40kg/acre). GM (Rs.70189.02 40kg/acre) was more for medium and large farmer. BCR was high for medium farmers (1.22) followed by large (1.18) and small (1.07) farmer. It depicts that medium farmer received Rs.1.22 in return by investing rupee one in smokeless tobacco production.

Table 2. Economic Analysis of per acre smokeless tobacco Production

Indicator/Unit	Sub-Groups			Standard Error of Mean
	Small	Medium	Large	
Leaf Production (40 kg/acre)	31.52	31.21	30.92	0.33
Average Price (Rs. /40kg)	3955.98	3875.89	3945.95	28.44
Stick Production (40 kg/acre)	7.88	7.80	7.73	0.08
Stick Price (Rs. /40kg)	294.66	292.86	303.11	2.57
Total Cost (40 kg/acre)	76499.81	71824.32	74110.44	968.18
Total Revenue (Rs.)	127629.00	124680.80	124814.26	1822.58
Gross Margin (Rs.)	70189.02	70160.06	68433.55	1481.69
Net Income (Rs.)	51129.19	52856.49	50703.82	1475.85
BCR	1.07	1.22	1.18	

Table 3 also represents the descriptive statistics of the variables used in the DEA model. Findings show that usage of inputs fluctuates across farms as it depends on financial status of tobacco farmers. The average yield on tobacco farm is about 20086.67 kg. In monetary terms, the average revenue per tobacco farm is about Rs. 1619169.24. On average, a farmer pays Rs. 18357.14 in terms of land rent calculated for six months in tobacco production. Average farm machinery cost is Rs. 77893.38, the average cost of seed is Rs 5124.29, mean of irrigation cost is Rs. 91180.48, mean of fertilizer cost per farm is Rs. 325689.95, and the average chemical cost is Rs. 15900.00 per farm. Farming of tobacco crop is a labor-intensive activity and average labor cost is Rs. 215469.14 per farm

Table 3. Descriptive statistics of the variables used in the DEA

DEA variables	Units	Mean	SD	Min	Max
Tobacco Yield (Stick plus Leaf)	Kg	20086.67	15708.90	2600.00	81900.00
Land under Tobacco	Acre	13.05	10.46	1.50	63.00
Labor	man-days	861.93	686.60	102.00	3707.00
Farm Machinery	Number	98.25	77.87	16.00	445.00
Seed	Kg	17.08	16.25	2.00	100.00
Irrigation	Number	197.94	152.23	30.00	824.00
Fertilizer	Kg	7510.69	6697.73	6697.73	44280.00
Chemical	Liter	79.50	84.09	8.50	640.00
Input Cost and Output					
Overall revenue	PKR	1619169.24	1274689.06	196560.00	5876325.00
Opportunity value of Land	PKR	18357.14	2185.44	14000.00	24000.00
Labor Cost	PKR	215469.14	171649.80	25570.00	926750.00
Machinery Cost	PKR	77893.38	55796.85	14600.00	369450.00
Seed Cost	PKR	5124.29	4876.42	600.00	30000.00
Irrigation Cost	PKR	91180.48	74889.27	12750.00	327600.00
Fertilizer cost	PKR	325689.95	289316.55	30800.00	1745100.00
Chemical cost	PKR	15900.00	16817.95	1700.00	128000.00

Table 4 reveals that the mean total technical efficiency in the production of smokeless tobacco was 90.7% with minimum (62%) and maximum (100%). It depicts the possibility of 9.3% reduction in inputs for working at technical efficient level while output and technology remain unchanged. Results showed that 59.05% smokeless tobacco growers had more than 90% value of technical efficiency and 40.95% remaining falls between 60% and 90%. Average value of allocative efficiency was 82.8% with lowest (62.8%) and highest (100%). It depicts the possibility of 17.2% reduction in total cost for an allocative efficient farmer keeping the level of output and technology constant. A score of allocative efficiency was more than 70% for 89.05% farmers. Economic efficiency was 75% on average with minimum (49%) and maximum (100%).

Table 4. Frequency distribution of Technical, Allocative and Economic Efficiencies

Efficiency	Technical efficiency		Allocative efficiency		Economic efficiency	
Range	**N**	**%**	**N**	**%**	**N**	**%**
0.4<E≤0.5	-	-	-	-	2	0.95
0.5<E≤0.6	-	-	-	-	12	5.71
0.6<E≤0.7	4	1.90	23	10.95	60	28.57
0.7<E≤0.8	21	10.00	70	33.33	79	37.62
0.8<E≤0.9	61	29.05	55	26.19	28	13.33
0.9<E≤1.0	124	59.05	62	29.52	29	13.81
Total	210	100.00	210	100.00	210	100.00
Mean	0.90		0.82		0.75	
Minimum	0.62		0.62		0.49	
Maximum	1.00		1.00		1.00	
Sd.	0.08		0.09		0.11	

Note: E= Efficiency

Table 5 explores the impact of farm size efficiency scores. All production efficiency scores were found for small, medium and large smokeless tobacco farmers. The mean of total technical efficiency was 92.3% for large farmers followed by small (91.40%) and medium (88.3%) farmers. The average allocative efficiency was higher for medium farmers (86.5%) followed by large (84.7%) and small (80.7%) farmers. Economic efficiency was more for large farmers and it was 77.9% average while its value was 76.5% and 73.6% for medium and small farmers, respectively. Small farmers were more in Pakistan and their prosperity was also important for the uplift of Pakistani society [1].

Table 5. Estimation of production efficiency with respect to farm size

Efficiency	Farm size Category		
	Small	Medium	Large
Technical efficiency	0.914	0.883	0.923
Allocative efficiency	0.807	0.865	0.847
Economic efficiency	0.736	0.765	0.779

Table 6 reveals average age of smokeless tobacco growers was 41.44 years with minimum (22 years) and maximum (61 years). Mean value of education was 5.22 years. Average land allocated for tobacco 13.052 with minimum (1.5 acres) and maximum (63 acres). Extension services and agriculture credit access offered (44.3%) and (55.7%) respectively to smokeless tobacco growers in the study area.

Table 6. Descriptive statistics of the variable in Tobit regression

Variables	Unit	Mean	Maximum	Minimum	Standard Deviation
Age	Year	41.44	61	22	8.24
Education	Year	5.22	14	0	4.46
Land under tobacco	Acre	13.05	63	1.5	10.46
Distance from market	Km	15.41	36	2	8.17
Dummy Variables			Category	Frequency	Percent
Agri. Credit access			No	117	55.70
			Yes	93	44.30
Extension services			No	93	44.30
			Yes	117	55.70

Table No. 7 showed the results of the study indicated that old farmers were technically less inefficient than the young farmers in the study area. Education was included to test the hypothesis that a farmer with more schooling is more efficient in smokeless tobacco production. The results revealed a negative and significant education coefficient for technical and allocative inefficiency. Therefore, it confirmed from hypothesis to show a decrease in technical and economic inefficiency with an increase in education. The coefficient of smokeless tobacco area was positive and significant for allocative and economic inefficiency. It showed an increase in the value of inefficiency due to more area under control. Distance from the market was included to test the hypothesis that a distant farm had more value of inefficiency. The coefficient of distance from smokeless tobacco market was significant and positive for technical inefficiency. A distant farm bears more labor cost and transportation cost. Results of the study revealed that access to credit coefficient was negative and significant for technical and economic inefficiency. It is therefore recommended that farmers should be provided assistance in the form of soft loans to enable them to cope with ever increasing prices of inputs. Extension services are important for a new technique and it was included to test the hypothesis that there is a negative impact on production inefficiency in the presence of extension services. The coefficient of contacts with extension agents was significant and negative for technical and economic inefficiency. It showed that the value of inefficiency decreases when farmers increase the contact with extension staff.

Table 7. Factors affecting of Inefficiency

Variables	Unit	Technical inefficiency		Allocative inefficiency		Economic inefficiency	
		B	Std. Err.	β	Std. Err.	β	Std. Err.
Age	Year	-0.00461***	0.00072	-0.00088	0.00091	-0.00355***	0.00094
Education	Year	-0.00706***	0.00128	0.003888**	0.00160	-0.00047	0.00166
Land under tobacco	acre	0.000372	0.00051	-0.00303***	0.00066	-0.00258***	0.00068
Distance from market	km	0.002953***	0.00064	-0.00048	0.00083	0.000811	0.00086
Agri. Credit access	Yes/no	-0.03458**	0.01136	-0.012	0.01466	-0.03423**	0.01520
Extension services	Yes/no	-0.05331***	0.01142	-0.00742	0.01493	-0.05275***	0.01548

4. DISCUSSION

Tobacco is a profitable activity and the findings were in line with the results of [13, 22, 32, 37, 40] and [29]. Significant education coefficient was in line with previous studies [25, 30] and [29]. An educated farmer has the ability to understand new technology and learns about better production practices [4, 3, 31, 35]. The significant coefficient of extension services was in line with [30] and [29]. The mean value of technical efficiency was 77% and 87.4% as found by [7, 38] respectively, and Tobit results showed that the education, experience of crop cultivation, contacts with extension agents had a significant and negative effect on production inefficiency. The negative effect of education on inefficiency was also explored by [38]. The impact of extension service was in line with the findings of [11, 27, 28]. Result confirmed a significant potential for the improvement of technical, allocative and economic efficiency in smokeless tobacco production.

5. CONCLUSION

The findings of the study showed that the average technical, allocative and economic efficiencies of tobacco farmers were 0.90, 0.82 and 0.75 respectively. All the inputs were found to be contributing to tobacco productivity with labor and fertilizer making up most of the shares of total cost in small, medium and large farms. The reason behind that large farmers are more efficient in tobacco farming was due to better education, easy access to credit, more finance to purchase inputs like pesticide, fertilizer, irrigation, plant protection measures, etc. along with better managerial practices and extension facilities. Tobit regression analysis of the determinants of technical, allocative and economic inefficiencies was carried out which showed that the age of household, years of schooling, number of contacts with extension agents and access to credit had negative impact on technical, allocative and economic inefficiencies of tobacco farms in Punjab. Small farmers were technically less inefficient. Results of the study also indicated that those farmers which were located closer to the market were technically less inefficient than the farmer located away from the main markets. It was also found that farm to market distance variable had insignificant impact on the allocative and economic inefficiencies of tobacco farmers. Therefore, it is suggested that government should work on development of markets and road networks in the rural areas. Government should also strive to stabilize the prices of numerous inputs like fertilizers, hybrid seed, diesel, pesticides, and weedicides. The quality of inputs like seed, pesticide sprays and fertilizers should also be monitored. Government institutes like PTB (Pakistan tobacco board) should pay attention to this issue and produce low cost seed which is easily accessible to all farmers.

Conflict of interest

Authors would hereby like to declare that there is no conflict of interests that could possibly arise.

REFERENCES

1. Adil, S.A., H. Badar, and T. Sher, 2004. Factors Affecting Gross Income of Small Farmers in District Jhang-Pakistan. Pakistan Journal of Life and Social Sciences. **2**(2): p. 153-155.
2. Akhtar, S., et al., 2015. Economics and Dependence of Wheat Productivity on Farm Size in Southern Punjab. J. Environ. Agric. Sci. **2**(4).
3. Akhtar, S., Li, G., Nazir, A., Razzaq, A., Ullah, R., Faisal, M., Naseer, A.U.R., Raza, M.H., 2018. Maize Production under Risk: The Concurrent Adoption of Off-Farm Income Diversification and Agricultural Credit to Manage Risk. Journal of Integrative Agriculture.
4. Akhtar, S., Li, G., Ullah, R., Nazir, A., Iqbal, M.A., Raza, M.H., Iqbal, N., Faisal, M., 2017. Factors Influencing Hybrid Maize Farmers ' Risk Attitudes and Their Perceptions in Punjab Province , Pakistan. Journal of Integrative Agriculture.
5. Ali, N., et al., 2015. The Economic Analysis of Tobacco Industry: A Case Study of Tobacco Production in Pakistan.
6. Ali, Q., M. Ashfaq, and M.T.I. Khan, 2006. An Economic Analysis of Off-Season Capsicum/Bell Pepper Production in Punjab, Pakistan.
7. Ali, Q., M. Ashfaq, and M.T.I. Khan, 2016. Analysis of Off-Season Cucumber Production Efficiency in Punjab: A Dea Approach. JOURNAL OF EXPERIMENTAL BIOLOGY AND AGRICULTURAL SCIENCES. **4**(6): p. 653-661.
8. Banker, R.D., A. Charnes, and W.W. Cooper, 1984. Some Models for Estimating Technical and Scale Inefficiencies in Data Envelopment Analysis. Management science. **30**(9): p. 1078-1092.
9. Battese, G.E., D.P. Rao, and C.J. O'donnell, 2004. A Metafrontier Production Function for Estimation of Technical Efficiencies and Technology Gaps for Firms Operating under Different Technologies. Journal of Productivity Analysis. **21**(1): p. 91-103.
10. BOS, Punjab Development Statistics, B.o. statistics, Editor. 2016: Lahore, Pakistan,.

11. Bozoğlu, M. and V. Ceyhan, 2007. Measuring the Technical Efficiency and Exploring the Inefficiency Determinants of Vegetable Farms in Samsun Province, Turkey. Agricultural systems. **94**(3): p. 649-656.
12. Coelli, T., D.P. Rao, and G.E. Battese, 1998. An Introduction to Efficiency and Productivity. Analysis, Kluwer Academic Publishers, Boston.
13. Daundkar, K., S. Bairagi, and R. Kolambkar, 2015. Economics of Production of Rabi Potato in Pune District. International Research Journal of Agricultural Economics and Statistics. **6**(2).
14. Farooqi, A., H. Masuda, and N. Firdous, 2007. Toxic Fluoride and Arsenic Contaminated Groundwater in the Lahore and Kasur Districts, Punjab, Pakistan and Possible Contaminant Sources. Environmental Pollution. **145**(3): p. 839-849.
15. Farrell, M.J., 1957. The Measurement of Productive Efficiency. Journal of the Royal Statistical Society. Series A (General). **120**(3): p. 253-290.
16. GOP, 2015. Economic Survey of Pakistan. Ministry of Finance, Islamabad.
17. GOP, 2016. Economic Survey of Pakistan. Ministry of Finance, Islamabad.
18. GOP, 2016. Economic Survey of Pakistan, Islamabad. Economic Advisor's wing, Finance Division, Islamabad, Pakistan, 2016. .
19. GOP, 2017. Economic Survey of Pakistan. Ministry of Finance, Islamabad.
20. GOP, 2017. Government of Pakistan, Pakistan Tobacco Board.
21. GOP, Punjab Development Statisitics. 2017, Bureau of Statistics. Government of Punjab, Lahore.
22. Gumus, G., 2008. Economic Analysis of Oriental Tobacco in Turkey. Bulgarian journal of agricultural science. **14**(2008): p. 470-475.
23. Hassan, S., N. Tabasam, and J. Iqbal, 2005. An Economic Analysis of Wheat Farming in the Mixed Farming Zone of Punjab Province. Pakistan. Journal of Agriculture & Social Sciences. **1**(2): p. 167-171.
24. Hiebert, L.D., 1974. Risk, Learning, and the Adoption of Fertilizer Responsive Seed Varieties. American Journal of Agricultural Economics. **56**(4): p. 764-768.
25. Ibekwe, U. and O. Adesope, 2010. Analysis of Dry Season Vegetable Production in Owerri West Local Government Area of Imo State, Nigeria. Journal of Development and Agricultural Economics. **2**(6): p. 245-249.
26. Ibrahim, H., et al., 2013. Determinant of Technical Efficiency in Vegetable Production under Fadama in Northern Guinea Savannah, Nigeria. Journal of Agricultural Technology. **9**(6): p. 1367-1379.
27. Khan, H., 2012. Measurement of Technical, Allocative and Economic Efficiency of Tomato Farms in Northern Pakistan. Journal of Agricultural Science and Technology. B. **2**(10B): p. 1080.
28. Khan, H. and F. Ali, 2013. Measurement of Productive Efficiency of Tomato Growers in Peshawar, Pakistan. Agricultural Economics/Zemedelska Ekonomika. **59**(8).
29. Khan, M.T.I., et al., 2017. Economic Analysis of Open Field Chilli (Capsicum Annuum L.) Production in Punjab, Pakistan. Journal of Experimental Biology. **5**: p. 1.
30. Khan, R. and S. Ghafar, 2013. Technical Efficiency of Tomato Production: A Case Study of District Peshawar (Pakistan). World Applied Sciences Journal. **28**: p. 1389-1392.
31. Lalzaman, D., et al., 2016. The Impact of Training Provided by Malteser International through Community Based Disaster Risk Management Committees (Cbdrmc) to Local People in Chail Valley District Swat. J. Appl. Environ. Biol. Sci. **6**(11): p. 1-1.
32. Makoka, D., et al., 2017. Costs, Revenues and Profits: An Economic Analysis of Smallholder Tobacco Farmer Livelihoods in Malawi. Tobacco control. **26**(6): p. 634-640.
33. Mohammad, I.J., Efficiency Analysis of Cotton-Wheat and Rice-Wheat Systems in Punjab, Pakistan. 2009, University of Agriculture Faisalabad.
34. Muhammad, S., et al., 2015. An Impact Assessment of Tunnel Technology Transfer Project in Punjab, Pakistan. World Applied Sciences Journal. **33**(1): p. 33-37.
35. Naseem, K., 2018. Job Stress, Happiness and Life Satisfaction: The Moderating Role of Emotional Intelligence Empirical Study in Telecommunication Sector Pakistan. Journal of Social Sciences. **4**(1): p. 7-14.
36. Qamar, W., et al., 2006. Economics of Tobacco Production in District Swabi, Nwfp. J. Agric. Biol. Sci. **1**(3).
37. Sanusi, M. and I. Ayinde, 2013. Profitability of Pepper Production in Derived Savannah Zone of Ogun State, Nigeria. IJAFS. **4**(2): p. 401-410.
38. Shrestha, R.B., W.-C. Huang, and R. Ghimire, 2014. Production Efficiency of Smallholder Vegetable Farms in Ilam District, Eastern Hill, Nepal. American-Eurasian Journal of Agricultural and Environmental Sciences. **14**(2): p. 150-154.
39. Tobin, J., 1958. Estimation of Relationships for Limited Dependent Variables. Econometrica: journal of the Econometric Society: p. 24-36.
40. Ullah, S., et al., 2015. Economic Analysis of Tobacco Profitability in District Swabi. Economic Analysis. **10**.