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RESEARCH PAPER

Resource use and Allocative Efficiency of Brick Production at Traditional Brick Kilns (Brick Manufacturing Units) of North Sindh, Pakistan

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ABSTRACT

This article on resource use and allocative efficiency of brick production in North Sindh has objective of finding kiln's ability to effectively use resources and to maximize profits at available technology and fixed factor level. It is about kiln sector's economic efficiency. Sector's returns to scale (ROS) tells elasticity of production at a kiln i.e. to check if any one kiln produces higher level of output from same level of inputs as compared to other kilns. Sample of 90 kilns is taken randomly. Survey and face to face interviews were taken. A kiln is allocative efficient (or price efficient) if it maximizes profits by equating MVP of each variable input to its price. MVP is additional or marginal revenue generated by adding one unit of resource or input. R represents Allocative efficiency which is MVP/MFC. MFC is Px (Input price of one unit). R value can be greater or less than 1. If R is equal to 1 it means that input is economically utilized. If R is less than 1 it means that input is over utilized. North Sindh Kilns are going through IRS (Increasing returns to scale) as elasticity of production (sum of all nine coefficients of production function) is greater than 1 i.e. 1.09. These kilns are technically efficient. Labour clay and water are underutilized while all other inputs are over utilized for an average North Sindh kiln. For small kiln clay, fuel and water are underutilized and rests are over utilized. For medium kiln clay, labour and water are underutilized and rests are over utilized. For large kiln clay, labour, maintenance and water are underutilized and rests are over utilized. Clay and water are underutilized throughout all kilns. Labour is over utilized only at small kilns. Land is underutilized only at large kilns. Fuel is over utilized only at small kilns. Transport, capital, FOH/Inventory are over utilized at all kiln types. Maintenance is underutilized only at large kilns. In regression utilization model if all the R values (representing allocative efficiency of kiln inputs) are zeroes, than there will be a loss of 1175473 bricks to owner of kiln. Only labor R, capital R and FOH (Factory Overhead) R are significant in the model. The best beta (coefficient) is that of FOH. Only land R is negatively (but insignificant in model) related to total production. It is recommended that those factors which are underutilized or overutilized at small, medium or large kilns have to be used optimum.

KEYWORDS Allocative Efficiency, North Sindh, Red Brick, Kiln, MPC, MVP, MFC, FOH

Introduction

Resource use and allocative efficiency of brick production in North Sindh is about kiln's ability to effectively use resources to maximize profits at available technology and fixed factor level. (Amjad Ali 2018). Total Physical Product (TPP) is brick output(Y) that is produced by employing inputs(X1-X9). Average Physical Product APP is obtained by dividing total physical product with total input resource units utilized annually. Input Coefficient is elasticity of each input and found by regression through CDPF. Marginal Physical Product (MPP) is change in output by change in variable input. It is found separately for each input by multiplying APP with respective input coefficient. Py is price of one brick. Px is price of one input unit. Px is also called MFC (Marginal Factor Cost). MVP (Marginal Value Product) or MRP (Marginal Revenue Product) is additional or marginal revenue generated by adding one unit of resource or input. Allocative Efficiency (R) reflects the ability of the kiln to produce at minimum cost input ratio. If R is equal to 1 it means that input is economically utilized. If R is less than 1 it means that input is over utilized.

Literature Review

Rural kilns are usually clamp kilns with energy usage of 1.5-3.0 MJ/kg usually in form of coal) (Rizwan Khan et al., 2007). Kilns don't work during monsoon time i.e. June to September. (Sushmita Dey et al., 2015

Fuel used mostly is coal and bricks are used within 25 km radius of the area. high use of fuel causes fire and flames to affect surrounding fertile lands. According to them fuel cost is the largest cost of brick making i.e. around 30-35%. (Palash Patra et al., 2015)

Pakistan kilns are less energy efficient and use cheap fuel to make bricks thus there is problem of pollution. Kaleemullah sheikh et al., Sindh 2020)

Red brick is main product and usually cow dung or fire wood is burnt to produce it. Only 2% of the bricks are manufactured by using fossil fuel. This causes urban GHG (Greenhouse gases) problem as low combustion efficiency of used fuels. (Abdalla et al, 2012)

Dung was dried and then burnt to find ratio of carbon dioxide and other nitrogenous gases released. (Abdalla et al, 2012)

Mostly labour is male dominant, young (60%) temporary, seasonal and nomadic. (Palash Patra et al., 2015) In both Rangia and Hajo 37% labour is female. (Mayuree Das et al, Assam, India, 2018)

Amjad Ali, 2018 has conducted research to find Allocative efficiency of sugarcane inputs in D. I Khan , Pakistan.

Material and Methods

It is about kiln's ability to effectively use resources to maximize profits at available technology and fixed factor level. (AmjadAli , 2018) Economic efficiency consists of technical efficiency and allocative efficiency. Economic efficiency tells about profit maximization and cost minimization.

A kiln is technical efficient if it produces higher level of output from same level of inputs as compared to other kilns. It tells about returns to scale and measured by EP (Elasticity of production). If EP is greater than 1 kiln is operating under increasing returns to scale (IRS). It can be explained in other words. If sum of all coefficients of

CDPF equation is greater than 1 it means kiln is experiencing IRS. if EP equals to 1 than kiln is under constant returns to scale (CRS). DRS is when EP is less than 1.

EP=MPP/APP (: MPP=Marginal physical product, APP= Average Physical product)

A kiln is allocatively efficient (or price efficient) if it maximizes profits by equating MVP of each variable input to its price. (AmjadAli , 2018)

Calculation of factor's unit

Labour: annual hours worked = annual days worked * average hours daily work

Fuel : annual fuel demand (maunds) is sumof special andnormalfueldemand at kiln

Clay: Annual clay maunds = annual clay trolleys* weigtht of a trolley

Land: jaraibs = acre*2

Capital: monthly capital required = short term loans or AR/12

Maintenance= totalmaintenance hours = total working days * 10

FOH = chokidaar hours = (chokidaars*Months*30)*10

Water: Generator hours = annual moulding days* average hours generator work

Transport: Transport Trolleys= clay trolleys+ fuel trolleys

TPP: (Total Physical Product). It is output (Y) that is produced by employing inputs (X1,…)

APP: (Average Physical Product). It tells about output quantity (of bricks) produced per unit of a specific input keeping rest of the inputs constant. It is calculated separately for each input resource. It is obtained by dividing total physical product with total input resource units utilized annually. In the literature AmjadAli , 2018 has conducted similar research to find Allocative efficiency of sugarcane inputs in D. I Khan , Pakistan. Following table is to be generated to find APP for each input.

Table 1
Allocative Efficiency Factors

Variable	Unit	unit quantity	MFC (Px)
Labour	annual labour hours	1990.7185	average labour wage
Fuel	annual fuel demand (maunds)	20269.222	average fuel maund cost
Clay	annual clay demand (maunds)	279124.7	average clay maund cost
Land (rent)	Jaraibs(Land Units)	7.744444	average annual Jaraib land rent
Capital	monthly capital need	68222.22	Average monthly capital interest
Maintenance	total maintenance hours	2286.062	Average maintenance cost per hour
FOH/Inventory	Chokidaar hours	3016.667	Average chokidaar wage
Water	Generator total hours	135.7884	Average one hour generator cost
Transport	Total transport trolleys	1331.775	average trolley transport

Formula used to find APP is

APPx=TPP/X quantity of units of an input

Input Coefficient:It is elasticity of each input and found by regression through CDPF

MPP: (Marginal Physical Product). It is change in output by change in variable input. It is change in output divided by change in input. It will be calculated as

MPPx= APPx*i

Here i is coefficient. And it is separate for each input cost. It is found by CDPF regression.

Py: Per unit price of output. It is price per unit i.e. one brick price.

MVP (Marginal Value Product): or MRP (Marginal Revenue Product): It is additional or marginal revenue generated by adding one unit of resource or input. It is calculated by multiplying MPP with marginal revenue per unit of that resource.It is calculated as

MVP= MPPx*Py

Px (Price per unit of Input): It is price per unit of resource or input used. For labour it is daily or one hour s wage .It is also called MFC (Marginal Factor Cost) as it is increment to total costs of that input type by purchasing one additional unit.

Allocative Efficiency r : It reflects the ability of the kiln to produce at minimum cost input ratio. If r is equal to 1 it means that input is economically utilized. If r is less than 1 it means that input is over utilized. r value tells about input utilization. It is calculated as, r = MVP/MFC.

It is calculated for first two kilns as

Table 2
Sample R Of First Two Kilns (labour)

Annual days worked	Average hours worked daily	APP	Coefficient	MPP	MVP	(MFC) Average Labour wage	r value	Utilization
156	10	1250	0.45	563	3877	967.972028	4.0053	Underutilization
112.5	11	101.8	0.45	45.8	309.9	1318.333333	0.2351	Overutilized

Average value of 90 kilns is taken for each head except for coefficient that is taken from Cobb Douglas Production Function.

Table 3
Variables used at CDPF

Total labour cost	Capital cost	Land cost	Maintenance cost	Clay cost	Total fuel cost	Transport cost	Water cost	FOH
x1	x2	x3	x4	x5	x6	x7	x8	x9

Kiln resource utilization and allocation model:

This simple multiple linear regression model tells about impact of kiln factor utilization on the total production at kiln. Y variable is total kiln production (after subtracting Ending inventory) and X variables are r values for all kiln inputs. R means allocative efficiency. Results achieved are as

Results and Discussion

It is about kiln's ability to effectively use resources to maximize profits at available technology and fixed factor level. Economic efficiency consists of technical efficiency and Allocative efficiency. Economic efficiency tells about profit maximization and cost minimization.

A kiln is technical efficient if it produces higher level of output from same level of inputs as compared to other kilns. It tells about returns to scale and measured by EP (Elasticity of production). If EP is greater than 1 kiln is operating under Increasing returns to scale (IRS), if it equals to 1 than kiln is under constant returns to scale (CRS). DRS is when EP is less than 1.

Kiln Technical Efficiency: Overall North Sindh kilns experience IRS (increasing returns to scale) with elasticity of production 1.09. It is sum of coefficients of all factors (costs) of production.

Kiln factor allocative efficiency: A kiln is allocatively efficient (or price efficient) if it maximizes profits by equating MVP of each variable input to its price.

TPP: (Total Physical Product). It is output (Y) that is produced by employing inputs (X1,…)

APP: (Average Physical Product). It tells about output quantity (of bricks) produced per unit of a specific input keeping rest of the inputs constant. It is calculated separately for each input resource. It is obtained by dividing total physical product with total input resource units utilized annually. In the literature (AmjadAli , 2018) has conducted similar research to find Allocative efficiency of sugarcane inputs in D. I Khan , Pakistan. Following table is generated to find APP for each input.

Formula used to find APP is

APPx=TPP/X quantity of units of an input

Table 4
Allocative efficiency table (for all kilns) (Unit determination)

Variable	Unit	unit quantity	MFC (Px)
Labour	annual labour hours	1990.7185	average labour wage
Fuel	annual fuel demand (maunds)	20269.222	average fuel maund cost
Clay	annual clay demand (maunds)	279124.7	average clay maund cost
Land (rent)	Jaraibs(Land Units)	7.744444	average annual Jaraib land rent
Capital	monthly capital need	68222.22	Average monthly capital interest
Maintenance	total maintenance hours	2286.062	Average maintenance cost per hour
FOH/Inventory	Chokidaar hours	3016.667	Average chokidaar wage
Water	Generator total hours	135.7884	Average one hour generator cost
Transport	Total transport trolleys	1331.775	average trolley transport

Justification of unit selection Labour unit is taken from literature (AmjadAli , 2018). Fuel/clay unit is easy to find APP so selected. For land cost quantity of jaraibs is selected to affect totalproduction APP and MPP of land factor. Monthly capital need has an impact on the production factor of capital. Hours is the unit used for maintenance, FOH and water. Hours of use can have impact on the input factors' APP and MPP. For transport factor trolleys are used as unit to calculate further transport APP and MPP. These rest of the units used are not in literature.

Largest unit is that of land cost. Smallest unit is that of clay cost. There is opposite relation of unit quantity of factor and APP of factor. When unit quatity is the smallest the APP is the largest.

Table 5
Unit quantity for three kiln types

	large	medium	Small	Average
Labour	2909.945	1348.715	191.6031	1990.7185
Fuel	38327.35	12098.93	924.6429	20269.222
Clay	511654.4	178256	17016.07	279124.7
Land (rent)	10.85294	7.142857	2	7.744444
Capital	108333.3	52976.19	16547.62	68222.22
Maintenance	2764.688	2179.552	1443.214	2286.062
FOH/Inventory	3388.235	3042.857	2035.714	3016.667
Water	51.00978	229.1979	61.45064	135.7884
Transport	2369.629	898.5667	110.8957	1331.775

APP analysis:when total production of bricks (after subtracting ending inventory) at a kiln is divided by annual hours (of labour) the result is unit quantity which is further used to find MPP of labourfactor.Similiarly when total production of bricks (after subtracting ending inventory) at a kiln is divided by annual fuelmaunds demand the result is unit quantity which is further used to find MPP of fuel factor.

Largest APP is that of clay cost.Out of clay input total units made of final product is the smallest. It is APP. Largest APP is that of land cost (Rent). It is largest because unit is the smallest.

Table 6
APP Results for kilns

Factor	Unit	Small	medium	large	Average
Labour	annual labour hours	191.603	1348.72	2909.95	1758.518
Clay	annual clay demand (maunds)	13.3476	13.8089	13.9689	13.7976
Land (rent)	Jaraibs (Land Units)	129476	466004	926499	587620.1
Fuel	annual fuel demand (maunds)	240.057	241.213	218.869	232.592
Transport	Total transport trolleys	2009.67	2790.14	3078.87	2777.81
Capital	monthly capital need	18.4357	100.97	218.69	132.6031
FOH Inventory	Chokidaar hours	109.968	813.502	2069.27	1178.466
Water	Generator total hours	4341.19	25094.3	252687	107845.5
Maintenance	total maint hours	154.806	1148.47	2533.43	1517.105

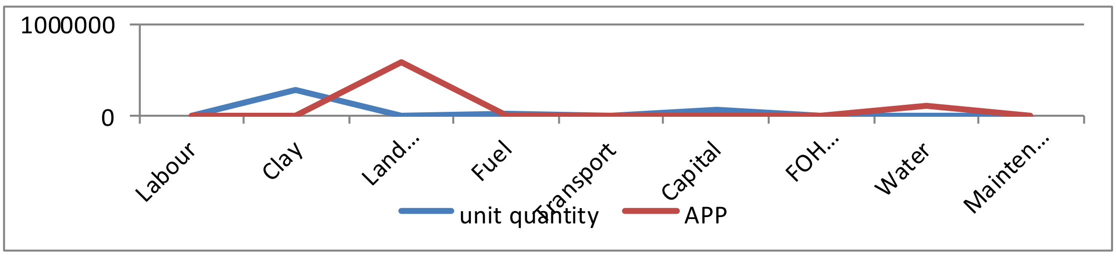

Figure 1: Relationship between APP and factor Quantity unit

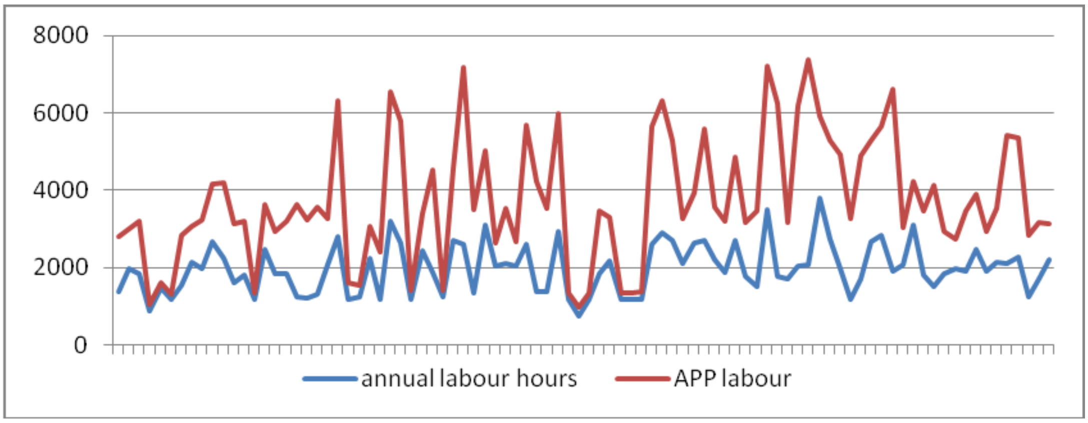

Figure 2: relationship between APP and Quantity unit .labor only

Input Coefficient: It is elasticity of each input and found by regression through CDPF. It is acquired from CDPF equation. For this see regression model 22 sector 1.It tells about individual factor price elasticity. Some are negative variables and some are positive variables in CDPF equation.

MPP: (Marginal Physical Product). It is change in output by change in variable input. It is change in output divided by change in input. It will be calculated as (MPPx= APPx*i). Here i is a coefficient got from CDPF equation.

Table 7
Factor MPP and coefficient results for kilns

Factor	coefficient	MPP kilns			
	Coefficient	Average	Small	Medium	Large
Labour	0.861	1514.084	164.97	1161.24	2505.46
Fuel	0.032	7.442944	7.68182	7.71882	7.0038
Clay	0.098	1.352164	1.30806	1.35327	1.36896
Land (rent)	0.004	2350.481	517.905	1864.02	3706
Capital	0.039	5.171522	0.71899	3.93783	8.52889
Maintenance	0.006	9.102631	0.92884	6.8908	15.2006
FactoryOverhead	0.019	22.39085	2.0894	15.4565	39.3162
Water	0.028	3019.674	121.553	702.641	7075.24
Transport	0.004	11.11124	8.03866	11.1606	12.3155

When water unit is additionaly used it affects brick production mostly as compared to other kiln production factors. Water MPP is highest for all types of kiln. Least MPP is that of clay factor of production on average for kilns but it is capital factor for small kilns. Capital factor increases brick production least in small kilns.

Py: Per unit price of output.It is price per unit i.e. one brick price. It is 6.96, 6.97 7.12 and 7.03 for small,medium ,large and average (for all kilns) kilns respectively. MVP (Marginal Value Product): or MRP (Marginal Revenue Product): It is additional or marginal revenue generated by adding one unit of resource or input. It is calculated by multiplying MPP with marginal revenue per unit of that resource.It is calculated as (MVP= MPPx*Py)

Table 8
Kiln factor MVP Results for kilns

Factor	Average	Small	medium	Large
Labour	10638.43	1130.57	8011.3	17798.7

Fuel	52.38272	52.9697	54.2866	49.7892
Clay	9.496282	9.09619	9.43107	9.74158
Land	16553.23	3559.51	13046	26236.1
Capital	36.78999	5.00474	27.8063	60.9756
Maintenance	64.11269	6.37396	47.7139	108.145
FOH/Inventory	157.7771	14.3103	107.07	279.49
Water	21363.4	836.391	4899.08	50154
Transport	78.08332	55.6054	77.7159	87.7929

Land adds largest value to brickproduction per unit for all kilns. Least value adding factor is capital, clay and clay for small,medium and large kilns.

Px (Price per unit of Input): It is price per unit of resource or input used. For labour it is daily or one hour s wage .It is also called MFC (Marginal Factor Cost) as it is increment to total costs of that input type by purchasing one additional unit.

Table 9
MFC Table for kiln factors

Variable	MFC details	MFC value (Px)			
		average	**small**	**medium**	**Large**
Labour	average labour wage	1087.54	1189.94	1089.86	1042.51
Fuel	average fuel maund cost	279.5	41.0714	313.333	335.882
Clay	average clay maund cost	1.615787	1.92224	1.66831	1.42472
Land (rent)	average annual Jaraib land rent	19672.22	16857.1	20535.7	19764.7
Capital	Average monthly capital interest	25389.54	3986.31	18337.3	42914.2
Maint	Average maintenance cost per hour	71.6477	23.1369	65.9028	98.7194
FOH Inventory	Average chokidaar wage	430.3704	385.714	429.365	450
Water	Average one hour generator cost	2043.917	246.548	1086.13	3967.16
Transport	average trolley transport	4198.889	1352.38	5022.22	4353.92

Largest price per unit of input goes to capital factor for small and large kilns, but it is land (rent) factor for medium kilns. Least costly input price is that of clay for all kiln types.

Allocative Efficiency r: It reflects the ability of the kiln to produce at minimum cost input ratio of r is equal to 1 it means that input is economically utilized. If r is less than 1 it means that input is over utilized. r value tells about input utilization. It is calculated as (r = MVP/MFC)

Table 10
Factor utilization at kilns

Factor	**average**		**small**		**medium**		**large**	
	r value	Utilization	r value					
Labour	10.13035	Under	0.95948	over	7.43584	under	17.2351	Under
Fuel	0.414974	Over	1.5857	under	0.20622	over	0.19078	Over
Clay	6.413452	Under	5.08542	under	6.24745	under	7.16535	Under
Land (rent)	0.899179	Over	0.21805	over	0.70279	over	1.42224	Under
Capital	0.006625	Over	0.00266	over	0.00562	over	0.00951	Over
Maint	0.817949	Over	0.28672	over	0.74516	over	1.12661	Under
FOH Inventory	0.363088	Over	0.03837	over	0.25652	over	0.62844	Over
Water	7.768592	Under	3.4921	under	5.31182	under	12.5643	Under
Transport	0.03439	Over	0.04142	over	0.03332	over	0.03282	Over

R value analysis: Labour clay and water are underutilized while all other inputs are over utilized for an average North Sindh kiln. For small kiln clay, fuel and water are underutilized and rest are over utilized. For medium kiln clay, labour and water are underutilized and rest are over utilized. For large kiln clay, labour, maintenance and water are underutilized and rest are over utilized. Clay and water are underutilized throughout all kilns.

Labour is over utilized only at small kilns. Land is underutilized onl at large kilns. Fuel is overutilized only at small kilns. Transport, capital, FOH/Inventory are overutilized at all kiln types. Maintenance is underutilized only at large kilns.

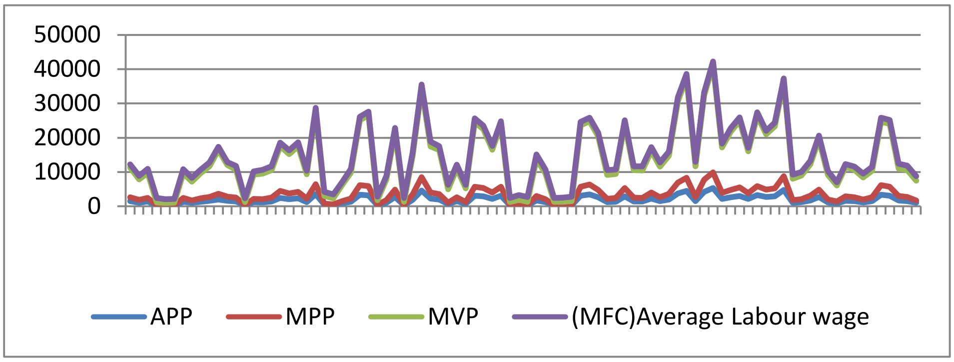

Figure 3: Relation of APP,MPP, MVP and MFC (Labour only)

Following are the specific results for small, medium and large kiln categories.

Table 11
Allocative Efficiency for small, medium and large kiln categories

	APP	Coefficient	MPP	MVP	(MFC)Px	r value
Small Kiln Allocative efficiency						
Labour	191.60314	0.861	164.9703	1130.574	1189.94	0.959484
Clay	13.347561	0.098	1.3080609	9.096191	1.922244	5.085417
Land	129476.19	0.004	517.90476	3559.506	16857.14	0.218054
Fuel	240.05683	0.032	7.6818187	52.96969	41.07143	1.585698
Transport	2009.6657	0.004	8.0386627	55.60539	1352.381	0.041422
Capital	18.435714	0.039	0.7189929	5.004744	3986.31	0.00266
FOH/Inventory	109.96825	0.019	2.0893968	14.31028	385.7143	0.038369
Water	4341.1855	0.028	121.55319	836.3905	246.5476	3.492097
Maintenance	154.80632	0.006	0.9288379	6.373957	23.13685	0.286719
Medium kiln Allocative Efficiency						
Labour	1348.7151	0.861	1161.2437	8011.302	1089.863	7.435836
Clay	13.808898	0.098	1.353272	9.431069	1.668306	6.24745
Land	466004.16	0.004	1864.0166	13045.98	20535.71	0.702791
Fuel	241.21309	0.032	7.7188188	54.28657	313.3333	0.20622
Transport	2790.1427	0.004	11.160571	77.71585	5022.222	0.033318
Capital	100.96993	0.039	3.9378273	27.80628	18337.3	0.005615
FOH/Inventory	813.50198	0.019	15.456538	107.07	429.3651	0.25652
Water	25094.318	0.028	702.6409	4899.079	1086.134	5.311816
Maintenance	1148.467	0.006	6.8908021	47.7139	65.90283	0.745158
Large kiln Allocative Efficiency						
Labour	2909.9452	0.861	2505.4629	17798.7	1042.505	17.23511
Clay	13.968941	0.098	1.3689563	9.741583	1.424722	7.165351
Land	926499.16	0.004	3705.9966	26236.06	19764.71	1.42224
Fuel	218.86868	0.032	7.0037979	49.78921	335.8824	0.190782
Transport	3078.8704	0.004	12.315482	87.79287	4353.922	0.032819
Capital	218.68956	0.039	8.528893	60.97556	42914.22	0.009505
FOH/Inventory	2069.2729	0.019	39.316185	279.4899	450	0.628438
Water	252687.01	0.028	7075.2363	50153.99	3967.156	12.56434
Maintenance	2533.4282	0.006	15.200569	108.1448	98.71937	1.126611

Kiln resource utilization and allocation model

This model tells about impact of kiln factor utilization on the total production at kiln. Y variable is total kiln production (after subtracting Ending inventory) and X variables are r values for all kiln inputs. R means allocative efficiency. Results achieved are as

Table 12
Kiln resource utilization and allocation model SPSS Model summary, ANOVA and coefficients

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.964[a]	.929	.921	877052.46782
a. Predictors: (Constant), maintR, TransportR, CapitalR, ClayR, waterR, FuelR, LandR, labR, FOHRRR				

ANOVA[a]						
Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	802316929595076.000	9	89146325510564.000	115.892	.000[b]
	Residual	61537682504924.400	80	769221031311.555		
	Total	863854612100000.000	89			
a. Dependent Variable: totTrod						
b. Predictors: (Constant), maintR, TransportR, CapitalR, ClayR, waterR, FuelR, LandR, labR, FOHRRR						

Coefficients[a]						
		Unstandardized Coefficients		Standardized Coefficients		
Model		B	Std. Error	Beta	t	Sig.
1	(Constant)	-1175473.823	448175.481		-2.623	.010
	labR	80219.072	38083.424	.184	2.106	.038
	ClayR	27424.972	57161.193	.016	.480	.633
	LandR	-124550.466	176301.987	-.033	-.706	.482
	FuelR	92551.318	206473.245	.017	.448	.655
	TransportR	8919333.916	4284965.371	.069	2.082	.041
	CapitalR	1019286.875	7992390.620	.004	.128	.899
	FOHRRR	8927662.071	1106945.413	.744	8.065	.000
	water	24719.293	28395.938	.043	.871	.387
	maintR	440986.069	485431.017	.056	.908	.366
a. Dependent Variable: totTrod						

Equation generated is

Totproduction= -1175473+0.184Lab+0.016Clay-0.033Land +0.017F +0.069Tr +0.004Cap +0.744FOH +0.043W+0.056M±877052

If all the R values (allocative efficiency) of kiln inputs are zeroes, than there will be a loss of 1175473 bricks to owner of kiln. Only labor R, capital R and FOH R are significant in the model. The best beta is that of FOH. Only land R is negatively (but insignificant in model) related to total production.

Conclusion

Resource use and Allocative efficiency of brick production in North Sindh is about kilns ability to effectively use resources to maximize profits at available technology and fixed factor level. Returns to scale tells elasticity of production at a kiln i.e. if it produces higher level of output from same level of inputs as compared to other kilns. Kilns are going through IRS (Increasing returns to scale) as elasticity of production (sum of all nine coefficients of production function) is greater than 1 i.e. 1.09. kilns are technically efficient. A kiln is allocatively efficient (or price efficient) if it maximizes profits by equating MVP of each variable input to its price. MVP is additional or marginal revenue generated by adding one unit of resource or input. R represents Allocative efficiency which is MVP/MFC. MFC is Px (Input price of one unit). R value can be greater or less than 1. If R is equal to 1 it means that input is economically utilized. If R is less than 1 it means that input is over utilized. Labour clay and water are underutilized while all other inputs are over utilized for an average North Sindh kiln. For small kiln clay, fuel and water are underutilized and rest are over utilized. For medium kiln clay, labour and water are underutilized and rest are over utilized. For large kiln clay, labour, maintenance and water are underutilized and rest are over utilized. Clay and water are underutilized throughout all kilns. Labour is over utilized only at small kilns. Land is underutilized only at large kilns. Fuel is over utilized only at small kilns. Transport, capital, FOH/Inventory are over utilized at all kiln types. Maintenance is underutilized only at large kilns. In regression utilization model if all the R values (representing allocative efficiency of kiln inputs) are zeroes, than there will be a loss of 1175473 bricks to owner of kiln. Only labor R, capital R and FOH (Factory Overhead) R are significant in the model. The best beta (coefficient) is that of FOH. Only land R is negatively (but insignificant in model) related to total production.

Recommendations

- Kilns are run without professionalism as all the inputs are either underutilized or overutilized. There is *Seth* culture at kilns.
- The presence of women labour at 26 kilns has increased net profit by 4 percent. Kilns should employ more and more women labour.
- Labour factor at all of kilns is underutilized except for small kilns where it is overutilized. !
- Fuel is over utilized only at small kilns. Fuel is very important input for kilns but very important for small kilns. Locally acquired fuel is easy to access and so less expensive and thus overutilized.
- Maintenance is underutilized only at large kilns because of *Seth* culture. Government must enforce laws of labour upon large kilns.
- Land is underutilized only at large kilns. Land is not allocatively efficient at large kilns.

It is recommended that those factors which are underutilized or overutilized at small, medium or large kilns have to be used optimum.

References

Azam, M., & Khan, M. (2010). Significance of the sugarcane crops with special and ference to NWFP. *Sarhad J. agric, 26(2),* 289-295.

Chen, K., &Irarrazabal, A. (2015). The role of allocative efficiency in a decade of recovery. *Review of Economic Dynamics*, *18(3),* 523-550.

Ghoshal, P., &Goswami, B. (2017). Cobb-douglas production function for measuring efficiency in indian agriculture: a region-wise analysis. *Economic Affairs*, *62(4)*, 573-579.

Kumar, A. (2014). Climate change and sugarcane productivity in India: An econometric analysis. *Journal of Social and Development Sciences, 5(2),* 111-122.

Msuya, E., &Ashimogo, G. (2005). Estimation of technical efficiency in Tanzanian sugarcane production: A case study of Mtibwa sugar Estate outgrowers scheme

Nadeem, N., Mushtaq, K., &Javed, M. I. (2011). Impact of social and physical infrastructure on agricultural productivity in Punjab, Pakistan-A production function approach. *Pakistan Journal of life and social sciences*, *9(2),* 153-158.