

# Study of indigenous fertilizer Marketing system and its impact on farmers' livelihood in Sindh Province of Pakistan

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**Abstract:** In many countries, achieving food security is a primary concern in agriculture. Sustainable Intensification of agriculture production and higher fertilizer prices including prevention of inputs material in balance quantity are the key issues in agriculture crop producing countries, mainly in south Asian countries. Agriculture sector play an important role in the movement of economy's wheel of Pakistan. Balance use of fertilizer can improve the crop yields by integrating the economic and environmental needs of the country to be in sustainable level, but the demand of fertilizer as per crop yield and rising fertilizer prices in the markets depressing the small-households in rural areas to increase their cost of production for required fertilizer nutrients of their crops. In this order, a field survey has been conducted to evaluate the indigenous fertilizer markets supply system and impacts of fertilizer prices on yield, how prices are varying in spatial transportation in remote areas, how subsidy and regulated policies are benefitted to agriculture growth in the country. This research paper has analyzed those factors which is influencing the farmers purchasing decisions on fertilizer and its application by considering the market challenges faced by farmers. The overall analysis is comprised on a survey samples of 220 farmers from Sindh province of Pkistan, mainly the major crop producing belts has been targeted in this study to make it more accurate by collecting data. By designing a standard questionnaire paper to enhance the each independent variables effects on dependent variables as defined in framework. It revealed that current marketing system and its effects are highly significant over crop production and farmers life.

**Key words:** Marketing, Subsidized, Farmers, Fertilizer, Agriculture, Transportation, Remote areas

## 1. Introduction

Pakistan as an agriculture country facing economic burden due to lack of technology and low production and rising inflation rate which is directly impacted to the country's GDP growth rate i.e. about 4.7% from its set target of 5.7 for the year 2015/16 (2015-16) [*ESoP, Chapter\_16/2 Agriculture*]<sup>1</sup>. However, the yearly budget-review 2016/17 has mentioned that low agriculture production in the country is the major causes in declining the GDP growth by recording 19% of negative growth rate in which approximately 6.25% declined has recorded in crop production i.e. significantly-worst in two and half decades of Pakistan agriculture history.

In national economy, agriculture supposed to be the backbone of the country by providing 42.3% employment out of total labour force, from farming to input material supply then to the food markets. However, for the last several years crop yield, specifically major crops has recorded

lower than the average of crop yield among the developing countries. The factors responsible for stagnant yield is high inputs cost, particularly fertilizers and pesticides prices are the major components in crop production of the country while the local farmers are getting low crop prices in the market (**T. Brunelle a\***, 2015), (**Moti Jaletaa**, 2016) and (**Hedley**, 2015)<sup>3</sup>, which has discouraged the farmers to spend more for crop cultivation that causes in declining their profitability .

Approximately 30% - 50% contribution in crop yield performance is based on fertilizer nutrients as per the economic survey of Pakistan 2015/16 (2015-16) [*ESoP, Chapter\_16/2 Agriculture*]. In Pakistan, crop belts have recorded nutrient deficiency due to climatic changes and low availability of crop development resources i.e. essential for plant growths majorly nitrogen, phosphorous and potash are the required elements in terms of high yielding crop varieties.

However, history proven the importance of fertilizer in agriculture production has amply demonstrated the direct impact on the economic growth of Pakistan by its balanced utilization and increased crop productivity and production. Despite the increasing demand of the fertilizers in last two decades, country has recorded continues declining in fertilizer consumption during the last 5 years i.e. approximately (-) 21.4% from 3861K-tons in 2011-12 to 3035K-tons in 2015-16, mainly due to the rising trend in fertilizer prices(2011-12) [*ESoP, Chapter\_12/02-Agriculture*]<sup>2</sup>. Consequently, government intervened as major stakeholder in fertilizer price control by providing subsidies to increase fertilizer consumption and expand. Therefore, by keeping in view the importance of Zn this study was conducted to study the ill-effects of zinc on crop plants, to find out part of the plant body which absorbs more Zn, to evaluate the concentration of Zn in both root and shoot of rice and to initiate the development of zinc biofortified rice variety to control the hidden hunger among human population of the zinc deficient areas of the world.

## 2. Materials and method

In this study, research methodology relies on secondary and primary data statistical analysis as per framework to derive input demand and output supply equations that would largely impact the existing fertilizer market trend and rural development. The gross profit analysis function approach to analyze the impacts on livelihoods of farmers due to the variable costs of production associated with market price of the commodities (**Chuan Liao**, 2015), (**Megan Sheahan**, 2016)<sup>3</sup>. Secondary resources are taken into account for analyzing the possible variations.

The major contribution of this research would be to collect the updated and accurate data by addressing the problem and derive the appropriate results on basis of field survey. The lack of availability of updated data and information is also one of the reasons that causes for the assessment of declining in household incomes and its impacts on country's economy. Literature review comprises on international journals about fertilizer market prices, demand and consumption by nutrient value and its impacts on crop yield, while the study was also carried-out for the analysis of fertilizer subsidies influences on cost function.

## Data and descriptive analyses

During the survey in Feb-Mar, 2017, about 7 districts of Sindh was randomly selected according to the crop area and production capacity. Mainly Badin, Hyderabad, Mirpurkhas, Nausheroferoze, Nawabshah, Sanghar and Sukkur districts have been considered to collect the farmer's data in order to get the required information as per the standard questionnaire designed in respect of the research objective and hypothesis analysis. By applying a proportionate multi-stages sampling structure as already explained in methodology section, about 220 farmers' samples have been randomly selected in 7 districts of Sindh which is accounted as major crop producing belts in Sindh province.

District-wise Distribution under Study		
District	Province	Count of District
Badin	Sindh	37
Hyderabad	Sindh	31
Mirpurkhas	Sindh	35
N.Shehro Feroz	Sindh	32

Nawabshah	Sindh	35
Sanghar	Sindh	22
Sukkur	Sindh	28

## 2.1 Research Questions

The questionnaire paper has developed as per the problem statement and objectives of this research study. Following are the four questions of many questions enquired from the farmers and fertilizer industry/distribution channels during survey:

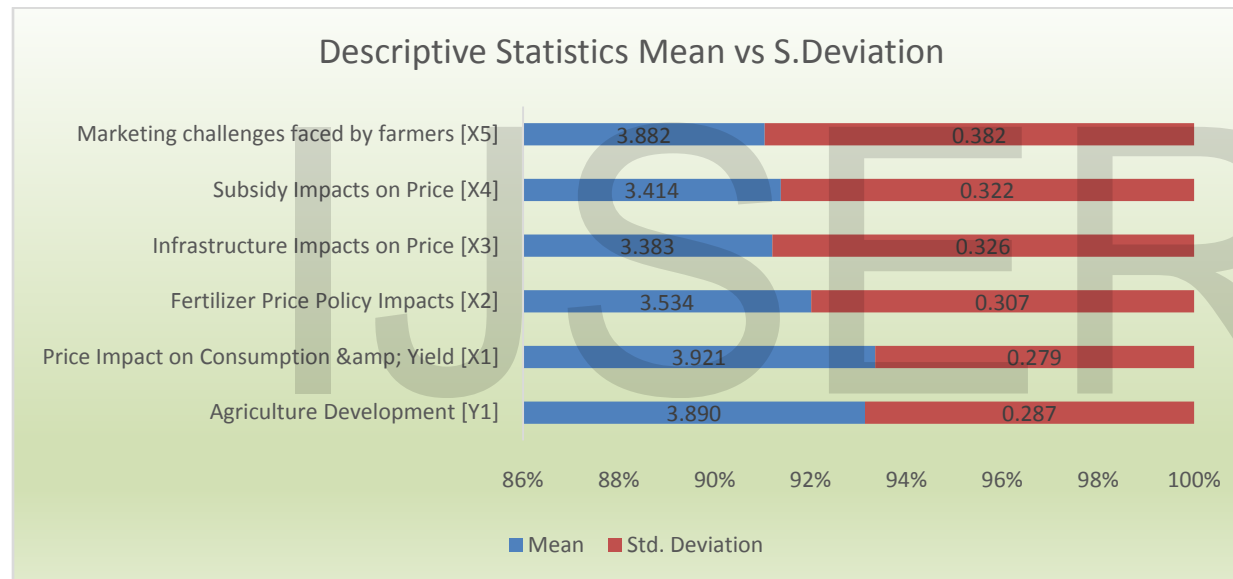
- 1- How the rising fertilizer price impact on farmers cost of cultivation and fertilizer consumption?
- 2- How to improve the current status of fertilizer offtake/consumption in local market and narrow-down the year-on-year crop acreage and yield gap?
- 3- What factors affecting the sustainability of crop production, identification of factors responsible for crop yield declining in Pakistan?
- 4- How the farmer cooperative market reforms would improve livelihood of small farmers?

## 3. Results

### 3.1 Descriptive Statistical Model

In descriptive statistics table the mean and standard deviation shows the X variables impact on Y Variable. The mean is varying from 3.38 – 3.92, the highest mean was recorded for X1 which is indicating about the price impact on fertilizer consumption and yield. Tabulation shows the standard deviation of independent and dependent variables by calculating the 220 farmers' feedback against the questionnaire. This tabulation shows the projection sensitivity for dependent variable.

Descriptive Statistics			
	Mean	Std. Deviation	N
Agriculture Development [Y1]	3.890	0.287	220
Price Impact on Consumption & Yield [X1]	3.921	0.279	220
Fertilizer Price Policy Impacts [X2]	3.534	0.307	220
Infrastructure Impacts on Price [X3]	3.383	0.326	220
Subsidy Impacts on Price [X4]	3.414	0.322	220
Marketing challenges faced by farmers [X5]	3.882	0.382	220



The next step involved to elaborate correlation of X variables and Y variables [e.g. independent and dependent variables correlation] by applying the analytical techniques and models to retrieve the correlation data of higher fertilizer price impact on sub variables. Also the descriptive command shows a correlation statistical matrix in which at the top of the table the Pearson (correlation) shows the relation b/w the variables.

Correlations							
		Agriculture Development [Y1]	Price Impact on Consumption & Yield [X1]	Fertilizer Price Policy Impacts [X2]	Infrastructure Impacts on Price [X3]	Subsidy Impacts on Price [X4]	Marketing challenges faced by farmers [X5]
Pearson Correlation	Agriculture Development [Y1]	1.000	.471	.253	.147	.097	.473
	Price Impact on Consumption & Yield [X1]	.471	1.000	.075	-.040	-.093	.359
	Fertilizer Price Policy Impacts [X2]	.253	.075	1.000	.122	-.005	.289
	Infrastructure Impacts on Price [X3]	.147	-.040	.122	1.000	-.009	.190
	Subsidy Impacts on Price [X4]	.097	-.093	-.005	-.009	1.000	-.029
	Marketing challenges faced by farmers [X5]	.473	.359	.289	.190	-.029	1.000
Sig. (1-tailed)	Agriculture Development [Y1]		.000	.000	.014	.076	.000
	Price Impact on Consumption & Yield [X1]	.000		.135	.278	.084	.000
	Fertilizer Price Policy Impacts [X2]	.000	.135		.036	.470	.000
	Infrastructure Impacts on Price [X3]	.014	.278	.036		.449	.002
	Subsidy Impacts on Price [X4]	.076	.084	.470	.449		.334
	Marketing challenges faced by farmers [X5]	.000	.000	.000	.002	.334	

N	Agriculture Development [Y1]	220	220	220	220	220	220
	Price Impact on Consumption & Yield [X1]	220	220	220	220	220	220
	Fertilizer Price Policy Impacts [X2]	220	220	220	220	220	220
	Infrastructure Impacts on Price [X3]	220	220	220	220	220	220
	Subsidy Impacts on Price [X4]	220	220	220	220	220	220
	Marketing challenges faced by farmers [X5]	220	220	220	220	220	220

### 3.3- ANOVA – Statistical Model

The Model Summary and **ANOVA** are in relation to predict the impact of independent variables of X on dependent variable. First the table ANOVA is giving the analytical analysis that the model is significant model. What it means that model to be significant, the prediction of significant model is related with the tolerance prediction of the analytical model. In other words, either the rejection sensitivity predict the depressive symptoms or not on outcomes variable. The significant of this model is (0.000<sup>b</sup>), this is less than the alpha (0.05), which is indicating that the model is significant. [e.g. if Sig. (p-value) is less than alpha (.05), we say the model is significant).

In this Model the equation would be:

$$F(5, 214) = 25.436, p = .000$$

Meanwhile derived the adjusted R Square, in this model the adjusted R square is (.358) which is multiply with 100, the value shows that the percentage of dependent variable (DV) or outcome variable explained by the independent variable or predictor variable, in this model the 35.8% of the variance in depressive symptoms can be explained by one level of rejection sensitivity. Therefore, the adjusted

R square have been derived by excluding it with 1-0.358 to get the outcome i.e. 0.642, means the tolerance statistics comparatively higher than the outcomes of adjusted R square value.

$$DV = 0.358 \times 100 = 35.8$$

$$\text{Tolerance Level} = 0.358 - 1 = 0.642$$

Tolerance Level				
Model	Sig.	Statistics		
		Tolerance	Adjusted R Square	Tolerance Level
(Constant)	.009			
1 Price Impact on Consumption & Yield [X1]	.000	.851	0.358	0.642
Fertilizer Price Policy Impacts [X2]	.021	.911	0.358	0.642
Infrastructure Impacts on Price [X3]	.096	.946	0.358	0.642
Subsidy Impacts on Price [X4]	.010	.991	0.358	0.642
Marketing challenges faced by farmers [X5]	.000	.772	0.358	0.642

### Model Summary & ANOVA Table

The model summary table indicated that the change percentage of variability accounted in dependent variable against the selected independent variables collectively that is called multiple "R" square. While the description under this table shows the variables which is performed to develop the equation to get the statistical result.

Model Summary <sup>(b)</sup>										
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.611 <sup>a</sup>	.373	.358	.2297494	.373	25.436	5	214	.000	1.585



a. Predictors: (Constant), Marketing challenges faced by farmers [X5], Subsidy Impacts on Price [X4], Infrastructure Impacts on Price [X3], Fertilizer Price Policy Impacts [X2], Price Impact on Consumption & Yield [X1]

b. Dependent Variable: Agriculture Development [Y1]

**\*\*ANOVA tables is highlighted the (F)-test to conclude that the statistical model is appropriately suitable for the given dataset in which it is considered to determine the p-value for computing it.**

ANOVA <sup>(a)</sup>						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	6.713	5	1.343	25.436	.000 <sup>b</sup>
	Residual	11.296	214	.053		
	Total	18.009	219			

a. Dependent Variable: Agriculture Development [Y1]

b. Predictors: (Constant), Marketing challenges faced by farmers [X5], Subsidy Impacts on Price [X4], Infrastructure Impacts on Price [X3], Fertilizer Price Policy Impacts [X2], Price Impact on Consumption & Yield [X1]

### 3.4- Coefficient Table

**Finally, the Beta coefficients shows the predictor for each by including the zero Beta constant under the unstandardized coefficients. To considering the data on this table the regression line equation is:**

$$y = .830 + .385(X1) + .123(X2) + .082(X3) + .001(X4) + .215(X5)$$

Coefficient model shows that impact of X variables on Y variable, in which the significant weights are indicating the depressive symptoms or hypothesis acceptance and rejection. In this model out of 5 X variables about 4 independent variables are significantly impacting the Y variable that is Agriculture development. The weights shows that the rising price of fertilizer can significantly impact the agriculture development in which the balance use of fertilizer nutrients

and environmental factors can be affected due to high fertilizer price and demand of chemical fertilizer for crop yield.

As per the coefficient model the hypothesis analysis have been computed accordingly.

Coefficients <sup>(a)</sup>												
Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B		Correlations			Collinearity Statistics	
	B	Std. Error	Beta			Lower Bound	Upper Bound	Zero-order	Partial	Part	Tolerance	VIF
1 (Constant)	.830	.312		2.656	.009	.214	1.446					
Price Impact on Consumption & Yield [X1]	.385	.060	.375	6.388	.000	.266	.503	.471	.400	.346	.851	1.174
Fertilizer Price Policy Impacts [X2]	.123	.053	.132	2.322	.021	.019	.228	.253	.157	.126	.911	1.097
Infrastructure Impacts on Price [X3]	.082	.049	.093	1.670	.096	-.015	.178	.147	.113	.090	.946	1.057
Subsidy Impacts on Price [X4]	.001	.000	.142	2.608	.010	.000	.002	.097	.175	.141	.991	1.009
Marketing challenges faced by farmers [X5]	.215	.046	.287	4.652	.000	.124	.306	.473	.303	.252	.772	1.296

a. Dependent Variable: Agriculture Development [Y1]

#### 4. Conclusion and Recommendations

Because of the high energy crises and oil market's price instability, policies under climatic impacts, transaction costs are the major key influences to evaluate the agriculture growth in the coming future due to the rising prices of inputs supply in the market, in which the prices of the fertilizer is estimated to be increased in next decades because of the highlighted issues around the world. The research study under the subject matter has been covered within the timeline by discovering the survey based results in which the targeted audiences have shared their issues and opinion about the variables which is set to be asked during the survey. Results indicated that the selected variables to determine the impact of higher fertilizer price on rural development and livelihoods of the farmers are having strong relationship, while it is also observed that the agriculture growth/crop yield is declining due to the low consumption of fertilizer nutrients on time and the reason behind the case is high market prices and low income because of the lack of marketing system in rural areas for selling their produce in the market to cover the cost of production.

However, farmers' skills about the new technology adoption and managing the crop pattern according to the soil fertility of their land is not as much competitive as it should be. While during survey it has been recorded by farmers' statement that lack of availability of certified inputs material is one of the big issue for farmers to recognize the accuracy of brand features as per the requirement. Field demonstration program is so far working under the official farm land rather than to enhance the skills of smallholder farmers by demonstrating on his farm to give him a real time support.

Therefore, the international organizations like Foods and Agriculture Organization [FAO], World Bank and many other research programs under the world's recognized institutions have clearly mentioned that globally rising population is the case to understand the importance of food security in near future. Pakistan as an agriculture country is also facing severe issues under agriculture growth program, in which the main concern is low crop yield and demand of foods. Farmers are the key source to produce agriculture crops but still malnutrition ratios are increasing in rural areas due to the low consumption of foods and poverty. Farmers are not at the stage to face the financial burden in wide range to increase the cost of cultivation for producing large numbers of crop under their field. While they are unable to get the benefits of subsidy on inputs supply.

The authorized departments and institution can reform the agriculture sector to be more efficient by providing the farmers and industrial market support program under the regulated policy. By this the high cost supply system would be harmonized where supply and demand curves will be at upward level to fulfill the market and customer requirements at the equilibrium point by implementing the right plan at the right place on the right time to save the agriculture sector for the long term.

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