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Farmer's Income and its Influencing Factor using Standardized Regression Coefficients

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ABSTRACT

The agriculture system is affected by several biotic and abiotic factors which directly or indirectly influence the farming community. Around half of the workforce is employed in the agriculture sector which contributes only 17.5 per cent inGDP. Only 47.6 per cent of the cropped area in the country is irrigated and remaining area depends on monsoon rainfall which is erratic in nature.Also, in recent decades, the occurrence of flood and drought in many parts of the country has affected the agricultural production system. The socio-economic condition of a farmer is affected by so many biotic and abiotic factors and thus it is multi-dimensional in nature.In the present study, an attempt has been made to find out the relationship of farmer's income with other influencing factors likeagricultural workers, average holding size, storage capacity, cropping intensity etc. For this purpose, the state-wise data on the above variables were obtained from secondary sources for all the states of the country and the stepwise regression was used to find out the linear relationship. Also, the most influencing factors were identified using standardized regression coefficients.The linear relationship of farmer's income with agricultural workers and storage capacity of the states was found significant. The farmer's income was highly influenced by storage capacity followed by agricultural worker on the basis of standardized regression coefficients that was found to be 0.83 and -0.29 respectively.

***Keywords*:** Farmer's income, stepwise regression, standardized regression coefficients.

INTRODUCTION

Around half of the workforce employs in the agriculture sector in India. While, the share of agriculture sector in GDP is only 17.5per cent (Deshpande, 2017). The agriculture is a complex system and the income of the farmers is affected by many biotic and abiotic factors like rainfall.The irrigated area in the country is only 66 million hectare (47.6 %) whereas the estimated irrigation potential of the country is about 140 million hectare (Anonymous, 2016). Thus,agriculture in India depends heavily on the monsoon rainfall, which is erratic in nature.

The status of farming community has been studied by many authors. Chanana (2016) studied the economic condition of farmers in India. They found that after green revolution, the economic condition of farmers improved to some extent but the same economic did not sustain. Also the agricultural productivity started falling as well as their income gradually gone down. In addition to this, the farmers are still dependent on the rain.They also quoted that the most of the farmers hadthe burden of loans from Banks and private money lenders. Dev (2012) examined the role and challenges of small land holdings in achieving agriculture growth, food security and livelihoods in India. They show that the market-oriented reforms are not enough and intervention from government and other support are required for small land holdings to achieve the above goals.

Lack of storage facilities led to a significant loss of grains and perishable agricultural product and thus affects the income of the farmer. Kannan (2014) assessed the pre and post-harvest losses of the important crops in India. He found that there is a lack of adequate scientific storage facilities at the village level and suggested construction of common godown among local farmers with active support from various agencies. Chaturvedi (2014) reported that in the financial year 2013, the total food grains production reached an all-time high of 263.3 million tonnes (MT). The food corporation of India (FCI) did not have the sufficient number of grain silos (modern storage facilities) and covered godowns with adequate storage capacities. Due to this, tonnes of food grains go waste because of insufficient storage and infrastructure facilities. Hence, food logistic chain in India needs a huge investment in providing proper storage facilities for food grains.

Keeping in view the different factors that affect the socio-economic condition of a farmer, in the present study an attempt has been made to find out the relationship of farmer's income with other influencing factors.In finding the relationship, the state-wise data on factors under study was collected from secondary sources.The secondary data for the 29 states of the country was obtained and multiple linear regression technique was used to find out the linear relationship. The most influencing factors were identified using standardized regression coefficients. The study shows that there was a significant linear relationship of farmer's income with the influencing factors like storage capacity and agricultural workers.

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MATERIALS AND METHODS

In the present study, the relationship of farmer's income with other factors and identification of most influencing factors had been studied using secondary data. For this purpose, secondary data on following variables were collected from secondary sources as Anonymous (2016a), Anonymous (2016b).

The list of variables under study is given below

Dependent variable:

1. Average monthly income of agricultural household (INCOME) (in Rs)

Independent variables:

1. Number of agricultural workers per thousand ha of net sown area (WORKER)
2. Fertiliser consumption (FERT) (in tonne/ha)
3. Average holding size (AHS) (in ha)
4. Cropping Intensity (CI)
5. Percentage of gross irrigated area to total cropped area (GIA)
6. Storage capacity (STORAGE) (MT/1000ha)

The descriptive statistics with 95 per cent confidence interval of the dependent and independent variables were calculated using equation 1.

$$\bar{x} = \frac{1}{n}\sum_{i=1}^{n} x_i \; ; \qquad \text{Confidence interval} = \bar{x} \pm t_{n-1,\, 1-\alpha/2} \times \frac{\sigma}{\sqrt{n}} \qquad \ldots(1)$$

where,

x_i:i^{th} observation, n: Total number of observation , $\bar{x}$: Sample mean, σ : Sample standard deviation, t: Value of t-distribution having n-1 degree of freedom and á: Probability of type 1 error. The relationship of farmer's income with other independent variables have been analysed using multiple linear regression method.

The important or most influencing independent variables/factors in a model can be judgedusing standardized regression coefficients. The independent variable having largest standardized regression coefficient may be considered as the most important variable and the independent variable with the second largest standardized regression coefficient as the second important variable, and so on. The standardized regression coefficient (SRC)have been obtained as follow

$$\text{SRC of } b_j = \frac{b_j \times \sqrt{x_{jj}}}{\sigma} \qquad \ldots (2)$$

Where, b_j isj^{th}regression co-efficient,x_{jj} is j^{th} diagonal element of the matrix $\mathbf{X^1X}$.

The normality test of residuals was also performed to check whether the residuals were following the normal distribution or not to fulfil the assumption of multiple linear regression analysis. The test of normality was performed using many tests like Shapiro-Wilk test, Kolmogorov-Smirnov test, Cramer-von Mises test and Anderson-Darling test. The statistical analysis was done using SAS-9.3. The MEANS procedure was used to find descriptive statistics of the variable under study. The REG procedure available in SAS-9.3 was used to find out the linear relationship of farmer's income with other independent variables. The UNIVARIATE procedure was used to test the normality of residuals.

RESULTS AND DISCUSSION

All the statistical analysis was performed using SAS-9.3. The descriptive statistics of the variables under study along with 95 per cent confidence interval were evaluated and is presented in table 1. The monthly average farmer's income for the states of the country was found to be Rs. 7738.72 with confidence interval (Rs. 6342.01-9135.44).The means of the other variables can also be seen in table 1 with their 95 per cent confidence interval.

The ANOVA table for the multiple linear regression analysis is given in table 2. The linear relationship of farmer's income with other independent variables was found highly significant as p-value is 0.0002. Also, the value of R^2 and adjusted R^2 were found satisfactory. The significance of individual independent variables is also given in table 2. Out of 6 independent variables, only one independent variable *i.e*. storage capacity was found significant

and the variable WORKER was significant at p value 0.07. Thus, these two variables along with intercept were taken in to model given in equation 3. The values of standardized regression coefficients (SRC) were also presented in table 2. The value of SRC was found largest for the variable storage capacity followed by the worker. Thus, it was concluded that the farmer's income was highly influenced by the availability of storage capacity of the states. The fitted regression model can be given as

$$Y=9407.402 - -1.055X_1 + 2.327X_2 \quad \ldots(3)$$

Where,Y: Farmer's income

X_1: Number of agricultural workers per thousand ha of net sown area

X_2: Storage capacity

The normality test of residuals was also performed and is given in table 3. The null hypothesis for all the tests was that the residuals follow the normal distribution. It can be seen that in all the tests, there were no evidence found to reject the null hypothesis as p-value for all the tests were more than 0.05. Thus, it may be assumed that the residuals follow the normal distribution. This test checked the adequacy of the fitted model.

Table 1: Descriptive statistics of the variables under study

S. No	Variables	Mean	95 % confidence interval	
1	INCOME	7738.72	6342.01	9135.44
2	WORKER	971.078	616.6433	1325.51
3	FERT	15.2731	10.66959	19.87671
4	AHS	1.53207	1.071292	1.992846
5	CI	135.309	121.2295	149.3891
6	GIA	36.7661	27.93467	45.59761
7	STORAGE	578.483	118.1555	1038.81

Table 2: ANOVA, parameter estimates and SRC of multiple linear regressions

Source	DF	Sum of Squares	Mean Square	p Value
Model	6	210411905	35068651	0.0002
Error	22	105079366	4776335	
Corrected Total	28	315491271		
R-Square	0.6669			
Adj R- Square	0.5761			
Variable	**Parameter estimate**		**p Value**	**SRC**
Intercept	9407.402		<.0001	0
WORKER	-1.055		0.073	-0.293
FERT	-102.626		0.280	-0.370
AHS	49.395		0.907	0.017
CI	-2.749		0.820	-0.030
GIA	4.094		0.920	0.028
STORAGE	2.327		0.0008	0.838

Table 3: Normality test of residuals

Tests	p value
Shapiro-Wilk	0.1739
Kolmogorov-Smirnov	>0.1500
Cramer-von Mises	>0.2500
Anderson-Darling	>0.2500

CONCLUSION

In the present study, the linear relationship of farmer's income with other variable under study was found highly significant as the p-value for the fitted model was 0.0063. Out of 6 independent variables under study, the estimate of storage capacity was found highly significant. On the basis of standardized regression coefficients, it was also concluded that the availability of the storage capacity of the states highly influencing the farmer's income. Thus, the storage infrastructure facilities for cereals, fruit and vegetables will enhance the income level of the farmers. The adequacy of the fitted model was checked by many normality tests of residuals. In all the tests, it was found that the residuals were following the normal distribution which fulfils the one assumptions of linear regression analysis.

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