PRODUCTIVITY OF AGRICULTURAL INPUTS: A CROSS SECTIONAL STUDY OF A LOCAL LEVEL ECONOMY OF WEST BENGAL

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Abstract: *The direction and magnitudes of productivity of the agricultural inputs occupy a paramount important position in the analysis of local level economic situation and hence local level planning. In a grass root economy, the proper utilisation of requisite combination of agricultural inputs is very important in raising the agricultural output and also the farm income. More importantly, however, there are many areas, and almost invariably the ones which are much away from the national or the state capital, which escape notice of the policy-makers and as a consequence are generally labelled as desertish or marginal areas. Plan for the development of these marginal areas remains as prolonged unfinished task yet after consuming of six and half decades of our national planning. Again, the development so far had been made at the initiation of the local level economies with their own effort and own resources is also needed to be flourished in front of the academic community of our country and abroad.*

Key Words: *Productivity, planning, policy makers, community.*

1. INTRODUCTION:

There is no denying that any kind of study on grass-root rural area economy of our Indian type requires a threat bear analysis on each and every aspect of its economic activities. If we try to expose specially the agricultural scenario of an area economy then it is necessary to give importance on the analysis of production function along with the analysis of simple input-output analysis. The direction and magnitudes of productivity of the agricultural inputs occupy a paramount important position in the analysis of local level economic situation and hence local level planning. In a grass root economy, the proper utilisation of requisite combination of agricultural inputs is very important in raising the agricultural output and also the farm income.

More importantly, however, there are many areas, and almost invariably the ones which at much away from the national or the state capital, which escape notice of the policy-makers and as a consequence are generally labelled as desertish or marginal areas. Plan for the development of these marginal areas remains as prolonged unfinished task yet after consuming of six and half decades of our national planning. Again, the development so far had been made at the initiation of the local level economies with their own effort and own resources is also needed to be flourished in front of the academic community of our country and abroad. In this paper we use mathematical production functions to see how agricultural inputs have been used to raise the level of agricultural production in total output and also the output of each crop in a specialised manner.

2. STUDY AREA:

For the purpose of this present study we have considered a local level economy which is made up with the villages around the village market town of ***Baneswar*** and the market town itself in ***Cooch Behar District*** of ***West Bengal***. The two villages we considered for special study are ***Ichhamari*** and ***Borokhata*** under the ***Baneswar Gram Panchayat***. We have considered these two villages due to their strong base in agricultural activities. The first village is nearer to the market town Baneswar and relatively more developed in all respects than the second village. Again, the second village has the facility of ***River Lift Irrigation Water*** arranged by the government. So, our choice of these two villages may also reveal the effect of cheap irrigational facility in agricultural activities of the economy. Elsewhere these two villages will be termed as village-1 and Village-2. In fact, the whole Baneswar Gram Panchayat area is synonymous with the local level rural economy being studied. The sale town or market town of Baneswar is the centre of interaction of the activities of the villages around.

3. METHODOLOGY:

There is no end of diversities of methodologies used in rural studies. The National Sample Survey has used a sample design that uses only sample households on a broad division of rural and urban areas. Such designs are not suitable for analysis of a very large number of variables. Some experts devised a method of studying modal farms for

input-output relations. The method might be useful for obtaining information about the productivity and use of inputs in different areas and serves as a basis for comparison of efficiency of agriculture in different local rural economies. This method can also be used as a basis for the planning of an extension service for farm management. Some Indian investigators have resorted to sample survey without a scientific design. They have used only elementary Census data to build a simple sample frame. In many cases about 100 households cover such a sample. The difficulty of such a sample is that since the sample is not stratified on the basis of size of farms, the sample is not good enough for study of variation of output and inputs according to size.

Thus, we are in need of selecting a methodology that will be more suitable for our type of object. For finding of agricultural inputs' efficiency in total output, we resort to a two-phase and one- stage stratified sample. In the first phase, out of total 693 farm households, we have surveyed each and every farm household of the sample villages Ichhamari and Borokhata with a specially prepared household schedule. In the second- phase, for the use of mathematical production functions, we have rather confined our study on 200 sample households taking 100 households from each sample village. Selection of these 200 sample households has been done for mathematical study on input used and output raised in this sample economy on the basis of stratified sampling taking farm size as strata. Out of these 200 households 121 are the farm households covering all the households. Again, out of these 121 farm households 58 belong to our Ichhamari village and the rest belong to Borokhata village. All the information used in the fitted production functions have been covered the agricultural year 2015-16 which is synonyms to our traditional agricultural year.

4. FITTED PRODUCTION FUNCTIONS:

In this present study we have used the mathematical production functions to see how the agricultural inputs have responded to raise the level of agricultural output in a specialised manner. To do this we have used both the Linear and Log Linear production functions of the following types:

$Y_i = A + bX_i$ as linear form, and

$\text{Log } Y = \text{Log } A + \alpha_1 \text{Log} X_1 + \alpha_2 \text{ Log } X_2 + ...$as Log linear form

Here, Y = Dependent variable showing the production total as well as individual

X_i = Inputs

α_i = Constants

We have used total output for combined crops as dependent variables. The independent variables, we have used in our production functions are of following types:

VATD= Value of Total Depreciation
VAHOL= Value of Home Labour-days
VAHIL=Value of Hired Labour-days
VAS=Value of Seeds
VAORM = Value of Organic Manures
VAINM= Value of Inorganic Manures
VINS= Value of Insecticides
VAIR= Value of Irrigation

All the variables are measured in value terms and also in per acre.

The estimation of the production functions reflect also the skill and knowledge of the farmers as well as the availability of infrastructural facilities including broad available services which have not been used as regressors. Given the quality of responses of the households, these factors are most important in considering the estimated production functions. The actual regression co-efficients which we obtain in the fitted production functions in no way point out to the absolute productivity of the respective inputs. We merely see how the villagers have reached to the type of setting in which they are placed. This setting includes their beings of underdeveloped state.

5. ANALYSIS OF THE FITTED PRODUCTION FUNCTIONS:

In this paper we try to produce the quantitative aspect of the production functions of both linear and log-linear form that we have used in this case. For unnecessary exaggeration, we have mentioned here only the pictures of the whole economy, village-1 and village-2 in table forms. Tables 1 & 1(a) to 3 & 3(a) exhibit the information of the input output responses of this grass-root rural area economy.

- Tables representing linear and log-linear production functions show that all the regression co-efficient are not significant. This is obvious. But in a very simple approach we might say, and as has been seen in various grass-root studies, that if one regression co-efficient is significant, the whole regression is significant. Though the fitting of the production functions (linear and log-linear) shown in tables 1 and 1(a) are not good enough, most regression co-efficients excepting VATD, VAHOL and VAS are positive. In all the fitted production functions the values of R^2 are significant and the values of R^2 are more than 0.9 in case of Boro paddy, Aus paddy and

cauliflower [not shown in this research paper]. This is true also for their respective Cobb-Douglas production functions.

- We can justify this good $\mathbf{R^2}$ values in this rural area economy just keeping into account of spreading up of infrastructural facilities and the wider use of irrigation facilities and that of the application of HYV seeds, chemical and organic fertilizers, pesticides and insecticides in a very significant manner. But this does not necessarily mean that there is no further scope for enhancing agricultural production in this area economy. The area economy still lacks infrastructural facilities such as storage and marketing networks. We can also say that not all the farmers are capable of using of conscious and calculated use of all the inputs. These will certainly hinder the prospect of the growth of the farm community and of the area economy in near future.
- The high negative co-efficient of seeds as revealed in table 1 and in table 1(a) is highly indicative of an absence of organised seed market for the farmers of the villages to take benefit from. At the same time, it is equally important to point out here is that the required type of extension in respect of better seeds is not being provided by official development agency in the grass- roots.

Table 1: LINEAR PRODUCTION FUNCTION FOR TOTAL OUTPUT (PER ACRE)

Variables	Regression Co-efficient	T with D. F.=120
Constant	18158.255	3.911
VATD	-0.530	-.483
VAHOL	-0.101	-.116
VAHIL	0.035	.054
VAS	-0.029	-.057
VAORM	1.725	2.682
VAINM	1.097	.883
VINS	2.389	2.025
VAIR	3.087	2.901

***Source**: Field Survey; 2015-16*

R^2= 0.74 D.W= 1.86

Table 1(a): PRODUCTION FUNCTION OF COBB-DOUGLAS TYPE FOR TOTAL OUTPUT (PER ACRE)

Variables	Marginal Productivity	Regression Co-efficient	T with D. F.=120
Constant	8.287	----	9.097
VATD	-.028	-.021	-.393
VAHOL	-.007	-.032	-.172
VAHIL	.014	.089	.368
VAS	-.007	-.013	-.142
VAORM	.126	.261	2.026
VAINM	.039	.103	1.069
VINS	.078	.265	2.035
VAIR	.050	.348	3.364

***Source**: Field Survey; 2015-16*

R^2=.723 D.W= 1.79

- The low regression co-efficient of the home labour may point to the indifference or lack of skill of farmers home labour as the proper setting for farmers' have not been laid down in the local level economy here. Another reason behind this low regression coefficient of the home labour in the grass-root area economy probably is that the farmers of this depressed agricultural area are still lagging behind the process of proper estimation of opportunity cost of use of labour power mainly due to seasonal fluctuation of use of the labour power. Frankly speaking, most of the family labourers use their labour power in their family farm in a very

less professional manner. The positive regression co-efficient in case of hired labour in the same periphery justifies that.

- On the other hand, consistently very good values of VINS for the total output as well as for the individual outputs permit us to say that insecticides have been used to deal with verities of hoppers that infested the total output and also for HYV paddy plants of the kharif season. Needless to say that they have contributed most in raising the level of total production of this area economy. Similarly, the most importantly productive inputs of organic manures and irrigation water have been found productive here also. The elasticities of production of these two inputs are also very impressive, as given in table 1(a).

Table 2: LINEAR PRODUCTION FUNCTION FOR TOTAL OUTPUT (PER ACRE): VILLAGE-1

Variables	Regression Co-efficient	T with D. F.=57
Constant	867.548	.126
VATD	-0.199	-.125
VAHOL	2.787	2.251
VAHIL	1.935	2.014
VAS	0.498	.475
VAORM	1.562	1.279
VAINM	1.958	1.048
VINS	3.363	2.126
VAIR	4.881	2.155

***Source**: Field Survey; 2015-16*

R^2= 0.77 D.W= 2.518

Table 2(a): PRODUCTION FUNCTION OF COBB-DOUGLAS TYPE FOR TOTAL OUTPUT (PER ACRE): VILLAGE-1

Variables	Marginal Productivity	Regression Co-efficient	T with D. F.=57
Constant	4.326	---	2.645
VATD	-.013	-.011	-.137
VAHOL	.158	.805	2.704
VAHIL	.140	.801	2.359
VAS	.139	.139	1.207
VAORM	.107	.214	1.070
VAINM	.053	.093	.936
VINS	.113	.415	2.228
VAIR	.084	.151	1.480

***Source**: Field Survey; 2015-16*

R^2= 0.77 D.W= 2.06

Table 3: LINEAR PRODUCTION FUNCTION FOR TOTAL OUTPUT (PER ACRE): VILLAGE-2

Variables	Regression Co-efficient	T with D. F.=62
Constant	36163.212	4.921
VATD	-1.428	-1.008
VAHOL	-2.836	-2.303
VAHIL	-1.221	-1.411

VAS	-0.807	-.880
VAORM	0.271	.252
VAINM	2.247	1.195
VINS	0.347	.191
VAIR	2.235	.934

***Source**: Field Survey; 2015-16*

R^2= 0.61 D.W= 2.068

Table 3(a): PRODUCTION FUNCTION OF COBB-DOUGLAS TYPE FOR TOTAL OUTPUT (PER ACRE): VILLAGE-2

Variables	Marginal Productivity	Regression Co-efficient	T with D. F.=62
Constant	13.881	---	7.945
VATD	-.061	-.058	-.684
VAHOL	-.291	-1.735	-3.341
VAHIL	-.093	-.830	-1.807
VAS	-.216	-.498	-2.105
VAORM	.046	.138	.541
VAINM	.092	.230	1.950
VINS	.025	.100	.467
VAIR	.043	.121	1.400

***Source**: Field Survey; 2015-16*

R^2= .64. D.W= 2.08

- But what is interesting is that, within the sample area economy, variation is being revealed in case of use of productive inputs among the sample villages. The low regression co-efficient of the home labour in sample village-2 further may point out to the indifference or lack of skills of farmers' home labour within the proper setting of agricultural activities in the local level economy. Again the low regression co-efficient of the hired labour permits us to draw the same conclusion just we have made in the preceding line. But what remains to say here, seeing the value of VAS, is that the farmers of our second village really suffer from the absence of organised seed market and at the same time from official assistance.

6. CONCLUSION:

We may conclude that any kind of grass-root economy, like ours, has been suffering a lot in performing smooth and uninterrupted agricultural activities throughout the year due to a number of acute problems. The most important problems are absence of qualitative input market, output market, proper training and education among the cultivators at the local level, storage facility, communication system, irrigation facility, scope of alternative employment opportunities, etc. at the grass-root economy. For this, agricultural activities are not always fruitful and beneficial to the cultivators of this type of economy. So, we strongly recommend an appropriate agricultural planning at the grass-root level which will be formulated and executed by the local planners in association with local and state level administrators. The planners must have to take proper initiative in extending and also in creating adequate infrastructures with the help of the administration for allowing interrupted agricultural activities throughout the year. The agricultural planning must incorporate the extension as well as creation of the facilities, like irrigation water at the cost of the government, storage, inputs and outputs markets from where all the farmers can purchase better quality inputs and the producers can dispose of their marketable surpluses at reasonable prices, proper training and education requiring for appropriate agricultural activities among the cultivators , communication system, easy and cheap crop loans during the agricultural seasons, etc.

The local level planners should also take initiatives to create new ventures like, agro-based industries, other small scale industries depending upon the availability of raw materials and cheap labour power and upgraded the local traditional handicrafts for more employment generation especially to stop migration of people to other states during the off agricultural season. This process will also increase the use intensities of both land and labour in a local economy like ours. Thus the formulation of an autonomous local level plan for both short and long ranges based on the existing as well as newly created resource-institutional-infrastructural set up of the economy will make the economy self

sufficient in all respects without over extraction of natural resources, and ultimately it will fulfil the goal of overall economic development of the local economy with sustainability.

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