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Factor Analysis in Smallscale Banana Production in the Rain Forest Zone of Delta State, Nigeria

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Abstract

Efficient combination of factors of production by farmers will bring improvement in banana output. This study investigates factor analysis in smallscale banana production in the rain forest zone of Nigeria. Primary data collected from 130 banana farmers with structured questionnaire, were analysed using descrptive and inferential statistics. Multiple regression model was used to fit the production function.The test of hypothesis reveals a significant joint relationship between the selected variables and smallscale banana output in the area. The results of the study further show that linear regression function best describes factor combination in banana production in the rain forest zone of Nigeria. Labour, fertilizers, price and educational status of farmers significantly determined banana output. Other factors such as land, credit facilities and frequency of extension contact also influence banana output but not significantly. Factor analysis reveals that fertilizer is the most significant factor of banana production. More quantity of labour,fertilizer and more extension training should be combined with available land to bring about more output in smallscale banana production in the rain forest zone of Nigeria. It was recommended amongst others that fertilizers should be made available to banana farmers coupled with credit facilities and periodic workshops on improved production methods**.**

Keywords: Smallscale,Banana,Factor analysis,Production function,Rain forest**.**

1. Introduction

Banana (Musa spp) is an important food crops in the rain forest and mid- altitude zones of sub-saharan Africa. They provide more than 25% of the carbohydrates and 10% of the calorie intake for approximately 70% million people in the producing regions. Banana has become a key source of revenue as they are not only traded within countries but also exported. The statues change from food to food/cash crop enhances its importance (Ortiz and Vuylsteke, 1996). Banana production is found mainly in the Southern states of Nigeria especially in Cross River and Rivers States (Arene, 1996; Ogazi 1996). A large concentration of banana production also exist in parts of Benue and Plateau State, while isolated production area are found in the Bida area of Niger State (Udensi, 1988). Banana has the potential to contribute to strengthening nation food security and decreasing rural poverty. It is important in the diet of Nigerians and in most West African countries. It is believed that Central and West Africa produces and consumes more
than 60% of the world's banana production (Fademi and Baiyere, 1993). One of the major problems limiting the expansion of its production in West and Central Africa include high post harvest losses.

In Nigeria, up to 40% of the harvested crop can be lost during distribution (Olorunda, 1996). Organized research activities on banana were initiated by the International Institute of Tropical Agriculture (IITA) in Nigeria as far back 1973 and focused mainly on production systems in the low land humid forest zone of West Africa. In subsequent years, the scope of research gradually increased, initially to cover germplasm collection and the characterization and conservation of banana cultivars (Brader, 1996). The first aim of the production function is to address efficiency in the use of factor inputs in production and the resulting distribution of income to those factors. Under certain assumptions, the production function can be used to derive a marginal productivity for each factor, which implies an ideal distribution of the income generated from output among the various inputs / factors of production (Cobb and Douglas, 1928).

Banana production is an important means of livelihood among the people of Delta state, Nigeria. Banana enterprise is dominated by smallholder farmers. Yet there is information gap on significant factors that underpin smallscale banana production in this area in before now. Hence the need to ascertain the socio-economic factors of banana production, is warranted.

Due to the importance of Banana production to the Nigeria people, there is the need to accentuate the role of efficient combination of inputs in Banana production. Estimating the production function of Banana will reveal some technical weaknesses that need to address among Banana producers. The main objective in analysing banana production is to increase the yield at minimum cost. To that extent, efficient combination of inputs is important in profitable Banana production. Input use plan is the numerical comparison of the relationship between input and output of an enterprise (Gezer et al, 2003). Banana production on a sustainable basis at minimum cost is vital to improve farmer's welfare (De, et al, 2001) and income status. This study was designed to provide valuable information that can improve Banana production and enhance the welfare of Banana farmers. Banana is a primary food staple as well as essential cash crop for smallholder farmers in Nigeria. From 1990 Nigeria has being experiencing low productivity of bananas. Since banana production is key to poverty reduction and food security, there is need for concerted efforts to improve banana production. The result of the study is expected to provide useful information for government plans and programmes for the development of banana sub-sector in Nigeria.

Although many experts have worked on input use in agriculture, to the best of our knowledge, no studies have been done to analyse the productivity of inputs in Banana production in hte rain forest zone of Delta State, Nigeria. For instance Rafiee et al (2011) studied input use in Apple production in Tehsan province. Mohammadi et al (2010) investigated input and crop yield relationship for Kiwi fruit production in Mazandaran province in Iran. Banacian and Zangeneh (2011) examined the production walnut in Iran.

The broad objective of this study is to conduct factor analysis in Banana production function among small-scale producers in the rain forest zone of Nigeria. These specific objectives of the study were to:

i. estimate and select an appropriate production function for Banana production in the study area.

ii. analyse the effect of various factors on banana output.

H0: Selected factors do not have joint significant effect on banana output in the rain forest zone of Nigeria.

2. Theoretical Framework.

A production function is that which specifies the output of a farm, an industry, or an entire economy for all combinations of inputs. This function is an assumed technological relationship, based on current state of engineering knowledge. It does not represent result of economic choices, but rather is an extremely given entity that influences economic decision making. Almost all economic theories presuppose a production function, either on the firm level or the aggregate level (Daly, 1997; Cohen and Harcourt, 2003).

A meta-production function compares the practice of the existing entities converting inputs into output to determine the most efficient practice production function of the existing entries, whether the most efficient feasible practice production or the most efficient actual practice production. In either case, the maximum output of a technologically determined production process is a mathematical function of one or more inputs. Put in another way, given the set of all technically feasible combinations encompassing a maximum output for a specified set of inputs would constitute the production function. Alternatively, a production function can be defined as the specification of the minimum input requirements needed to produce designated quantities of output, given available technology.

According to Schultz (1965), observed that economic growth means simply increase in gross national product and income. He further hypothesized that there are comparatively few inefficiencies in the allocation of factors of production in traditional agriculture. Labour is the primary instrument for increasing output within the framework of traditional agriculture. The analysis done by Mellor (1974) concluded that families with small farms (a small resource base) will maximise utility by providing greater labour input per acre and achieving higher yield per acre than families with larger farms (a large resource base). For instance, in Asia, land has been the major factor limiting the increase in output. while in the new continents; a relatively inelastic supply of labour has represented the most significant on growth of output.

Clayton (1964) noted that it is important to know the problem facing peasant agriculture if they are related to raising agricultural productivity. Schultz (1965) says that the technological possibilities have become increasingly more favourable but the economic opportunities that are required for farmers in the low-income countries to realize their potential are far from favourable. The pressure of population on the existing land resource may have driven the marginal productivity of labor and other inputs to a level, which favors expanding cultivation outside the extensive margin to successively poorer quality land. The total supply of rural labor is too high (US Census Bureau, population Division 2005). As states Mellor(ibid) that there is little relation to the level of factor returns until the population becomes so large that the average product of labour drops close to subsistence level.

According to Hayami and Vernon (1971) divide the sources of productivity growth into three broad categories (i) Resource endowments which include not only the original land resource endowments but also internal capital

accumulation in the form of land reclamation and development, livestock, inventories, and so forth. (ii) Technical inputs which include the mechanical devices and the
biological and chemical materials purchased from the industrial sector. (iii) Human capital which is broadly conceived to include the education, skill, knowledge, and capacity embodied in country's population.

Several studies have been done on agricultural production using the production function model to estimate the impact of various factors on output changes. The combination of both allows estimating total impacts of institutional reforms, price realignments and technological factors on agricultural production. Macours and Swinnen (1997), in their paper they quantify the relative importance of the different causal factors of the changes in agricultural production in Central and Eastern Europe since 1989 using a production function and supply response approach. The analysis shows that the deterioration of the agricultural terms of trade explains a considerable part of the production change.

The different causal factors can influence production by inducing changes in input use, or by causing changes in productivity. With the production function model, the factors that significantly influence productivity can be identified. The supply response function model allows indication all causal factors the ones that have an impact on productivity as well as the ones that influence the use of production factors. This idea is supported by Mbithi (2000) who asserted that the supply response has an impact on economics as well as on agricultural development, poverty, equity and the environment at large. So policy makers need supply response information on both individual activities and on the sector aggregates. The amount of output generated with a certain amount of inputs depends on the intensity and quality of input use.

3. Materials and Methods

3.1 Study Area, Sampling procedure and Data collection techniques

The study was carried out in the rain forest zone of Delta state, Nigeria.
The tropical climate, characterized by wet and dry season is suitable for banana production. The area is characterised by evergreen forest. The research inquiry was targeted at the population of all banana farmers in Delta State, Nigeria. Multi stage sampling procedures was used to select sample for the study. The first stage, involved the selection of communities. Boji Boji- Owa (Agbor), Agbor- Obi (Agbor), Oyoko (Abavo). Second stage involved the selection of respondents. About 130 respondents were selected on the criterion that they are banana farmers but 120 copies of the questionnaire were used for data analysis. Primary data were obtained using a combination of structured questionnaire.

3.2 Data Analytical Framework.

Data collected will be subjected to descriptive and inferential statistics. Descriptive statistics including mean, percentage, tables and average will be use to summaries the data so as to achieve objective (i). Regression model was used to estimate production function. The economic model commonly used to determine the relationship between the various factors and the output in agriculture is production function model. The production function of any farmer is determined by resource availability of the farmer. In agriculture, the production inputs consist of Land and Capital as the basic factors of production. The expected relationship between output and land is that as more land is brought under production, output is increased (Malassis 1975). The simplified form of production function is given by:

$$Q = F_{(}Ld, K, L_{)} \qquad \text{.......... (1)}$$

Where Q is the production output, which is function of the land (Ld); the capital (K) and the labor force (L) used for the production of the same output. A production may be defined as a mathematical equation showing the maximum amount if output that can be realized form of the Cobb-Douglas production function is given by

$$Q = AL^{a} K^{\beta} \qquad \text{.......... (2)}$$

Where Q is the output; A is the technology used in the production of output; Labor (L); Capital (K); α and β are elasticity. Alternatively, a production function can show the minimum amount of inputs that can be utilized to achieve a given level of output (Malassis 1975). To find out the impact of these factors on farm level production of bananas on small-scale farmers in Ika-South Local Government Area, the functional relationship is specified.

$$Q = F_{(}N, Kp\, L, F, P, Ed_{)} \qquad \text{.......... (3)}$$

Where,
α = Constant

Q = Total output of banana produced, (in bunches)

$N =$ Acreage in terms of hectares under banana crop,

$Kp =$ Physical capital in terms of Ika-South spent on equipment,

$L =$ Labor in terms of man-hours spent on the farm,

$F =$ Fertilizer use in terms of Ika-South spent on fertilizer,

P= Price of bananas,

ED = Level of education attained by respondent (dummy of 1= educated, 0, otherwise)

$U =$ Error term.

The econometric model is specified as follows

$$Ln\,Q = Lna_0 + a_1 lnN + a_2 lnKp + a_3 lnL + a_4 Fert + a_5 lnP + a_6 Ed + U \quad (4)$$

Using OLS technique, the coefficients of the above variables were estimated. For the study to estimate with OLS, the Cobb-Douglas production function has to be a transformed model, to satisfy the Classical Linear Regression Model (CLRM), so that to come up with the usual assumption of Best Linear Unbiased Estimator (BLUE).

4. Results and Discussion

4.1 Appropriate Production Function for smallscale Banana Production

Data analysis shows that the appropriate function for banana production in the study area was evaluated by using different forms of production functions as presented in the table 2. The overall significant of the model was evaluated by the R^2 value. The linear regression model was chosen as the lead model based on the value of the R^2 (62%) appropriate and the number of significant variable in the model. The R^2 value of 62% is the degree of variation in Banana output as explained by the joint effect of the independent variables that were captured in the model. The significant value of F- statistics ($P < 0.05$) indicates overall significance of the model.

4.2 Effect of Multivariate Factors on Banana Production.

Land: From the findings output from banana production is negative and not significant related to land as shown by the coefficient of -0.285. This implies that although land is important in banana production, the size of land cultivated by farmers is too compared to other available factors of production. As a result, overall output will decline. This confirms the earlier finding of Mellor (1974), that smallscale farms will maximize output, provided they can effectively combine available resources.

Labour: From the result, labour is positive and has significant effect on output from banana as indicated by the coefficient 0.003. This implies that as household increase hired labour by 1%, the output increase by 0.003%. In this study, majority of households surveyed hired labourers in different activities of banana production.

Fertilizer: Output from banana production is positively related to fertilizer as shown from the findings where the coefficient is positive 0.336 and significant ($P < 0.05$). This implies that a 1% increase in fertilizer will result in a 0.336% increase in banana output.

Price: The output of banana production responds positively and significantly to the changes in market price of banana as shown by the coefficient of 0.023. This means that a 1% increase in price of banana; the output is expected to increase by 0.023%.

Educational Status: From the results, education as a dummy variable shows a positive and significant relationship with the output of smallscale banana farmers as indicated by the coefficient of 0.030. This study demonstrates that continuous education of smallscale banana farmers on improve practices, will enhance their capacity to produce more banana.

Characteristic Stages of Production Surface

From the result, it is clear that with respect to Labour and Fertilizer, banana production is in stage I of the production surface. This implies that the level of utilization of these two factors of production should be increased since banana output is increasing. On the other hand, changes in Land use has negative relationship with banana output in the study area. This shows that with respect to land, banana farmers are in stage III of the production surface. For small-scale banana farmers to be more efficient, the size of land should be reduced to the size that available resources can effectively cover.

Other factors that Relate to Banana Production include:

Credit Facilities: In this study, only 12 households out of the 120 surveyed have acknowledged having had credit from the local bank or from financial institutions. This credit was enabling the purchase chemical or organic fertilizer. Majority were facing the problem of collaterals, while others said that they couldn't afford the payments due to the high rates of interest.

Extension Services: The availability of extension service to farmer was measured by the number of times a households was visited by extension officers during the period. Since the study was focused only on banana production, what was interesting to farmer was extension information in terms of developing banana production in study area. But the information given by respondent- farmers was that extension officers have not visited them. This is the reason that the extension services as a variable in the model was removed, because no data has been recorded.

5. **Conclusions**

In the light of the findings of the study the following major conclusion were drawn. Educational status made them knowledgeable about the type and kind of practice to be put in place in order to have bountiful harvest of the banana production. The implication of all these is that banana producers, in the study area if encouraged by appropriate price policy, will be able to boost banana production. This study has demonstrated that any development plan for banana production should emphasize the significant factors in the smallscale banana production function.

Based on the findings the following recommendations are suggested. The Government should make sure that micro-finance banks grant loans to banana farmers with little interest in order to expand banana production scale since more capital are needed for expansion. The Banana producers should have frequent contact with extension officers for improved production practices. There should be standardization measuresto standardize and stabilize banana price.

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Table1: Expected signs of explanatory variables in the model

Dependable variables	Explanatory variables	Expected signs	Explanations of relationship
Output (Q)	Acreage (N)	+	Output is positively related to acreage. As more land is brought under banana production, output will increase.
	Physical Capital (Kp)	+	Output is positively to physical capital. The more households invest in banana production, the more the output.
	Labor (L)	+	Output is positively related to labor, the more they increase output.
	Fertilizer (Fertz)	+	Output is positively related to fertilizer. The more households use fertilizer, the more they increase the output.
	Price (P)	+	Expected high price of bananas will make its output to increase. When the households expect an increase in price of bananas, they will be motivated to increase the output.
	Education level (ED)	+	Output is related to education. This means that the more households are educated, the more output they will produce.

Table 2.0; Production Function Selection for Banana Production

Linear Function			Semi - Log		Double – Log	
Variables	**Coefficient**	**t-stat**	**Coefficient**	**t-stat**	**Coefficient**	**t-stat**
Constant	-3.001	-0.197	-52.459	-0.471	1.074	1.625
Land	0.285	0.744	1.544	0.090	0.028	0.275
Labour	0.003	2.056	-	-	-	-
Fertilizer	0.336	4.430	32.480	1.910	0.006	0.058
Price	0.023	1.98	10.995	0.5611	0.144	12.356
Educational status	0.302	3.203	-3.330	-0.106	0.138	0.737
R^2	62%	-	26%	-	59%	-
R^2	60%	-	23%	-	58%	-
F. Statistic	36.83	-	9.98	-	41.251	-

(Source: 2012 Survey Data).