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Predicting the Future Income and Profit Levels of Kogi Agricultural Development Project Contact Farmers in Kogi State, Nigeria

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Abstract

The model of Markov chain analysis was employed to predict the future impact of Kogi Agricultural Development Project (KADP) on farm income and profit levels of contact farmers in kogi state of Nigeria. A structured questionnaire was designed to capture the farm income and expenses for the 2008/2009 and 2009/2010 farming seasons. In all 200 contact farmers were involved in the analysis. This comprised of one contact farmer in each of the 200 extension circles in the state. The result showed that the current income as well as the profit levels were found to be very low. A five year projections into the future income shows that the future income of the farmers is low if nothing is done to address this low income, about 77.50 percent of the farmers will earn less than ₦100,000 per annum in 2015. The future profit derivable by these farmers were also found to be almost insignificant to move the farmers from subsistence level to commercial level. It was then recommended that in addition to the extension services provided by Kogi Agricultural Development Project, the project should also establish commercial ventures to provide essential farm inputs to farmers at affordable rate.

Keyword: Agricultural Development Project, Contact farmers, Impact, Income, Profit, Markov chain.

Introduction

Agriculture in Nigeria is like those of most other developing countries where small farm producers predominate. Nigeria still manifests the typical symptoms of a peasant agriculture. The farms are dominated by small scale farmers who are responsible for

about 90 percent of total food production (Emerole and Osuala, 2010) Ekumankama and Izuogu (2008) opined that the livestock is in the hands of nomadic herdsmen and poultry is still essentially the backyard type with few commercial units. The result of this attitude toward agriculture is low productivity in virtually all the subsectors.

In a move to redress the food crisis situation in Nigeria, the federal government through the federal ministry of Agriculture invited a World Bank Agricultural Mission to Nigeria in 1971. According to Agbamu and Okagbare (2005), the World Bank invitation was as a result of the fact that agricultural production had stagnated after the civil war and the sahellian droughts which was later compounded by the discovery of crude oil. The food import bills were rising fast and agriculture had lost its position as the leading sector of the Nigeria economy. The standard of living of the rural dwellers had also fallen due to poor income and low agriculture production.

Before the World Bank was invited to Nigeria, various options were tried by the government to effect positive changes and improvement on the Nigerian agricultural sector to make the country self-sufficient in food production. However, most of these policies did not quite succeed as a result of inadequate fund and lack of commitment on the part of government (Idachaba, 2006). Some of these policies include: National Accelerated Food Production Programme (NAFPP) established in 1974, Operation Feed the Nation (OFN) launched in 1977, Green Revolution (GR) of 1983, River Basin Development Authorities (RBDA) established in1976 and Directorate for Food, Road and Rural Infrastructure (DFRRI) established in 1986. These policies according to Ojetunji (2003) were designed to address the following problems: the subsistence nature of Nigeria agricultural system, rapid population expansion and the need to feed the growing number of people, poor standard of living of the rural populace, rapid growth in the number of processing industries and large number of unemployed school leavers and urban dwellers.

The recommendations of the World Bank for the establishment of Integrated Agricultural Development Project was accepted by the Federal Government of Nigeria. The funding of the projects was by the federal and state governments and loan from the World Bank. In 1975, it started as an Integrated Sgricultural Development Project (IADP), an enclave project that covered small geographical areas of one or more Local Government Areas. According to Agbamu and Okagbare (2005), the pilot projects were established in Funtua in Katsina State, Gusau in Zamfara State and Gombe in Gombe State. In 1985, six additional enclave IADP were established in some northern and western states of the country. These are in Lafia, Anyigba, Bida, Ilorin, Oyo-north and Ekiti-Akoko. As a result of remarkable achievements recorded by these enclave IADPs, today, every state in Nigeria has Agricultural Development Project (ADP) covering all the Local Government Areas in the country.

Agricultural Development Projects (ADP) is an integrated approach to agriculture and rural development. It is a multipurpose development programmes involving agriculture, education and training, health and nutrition, rural electrification and cooperatives. The focus of agricultural sector according to Ojetunji (2003) is on the development of high yielding technology, high yielding varieties and provision of fertilizer. This is to be supported by the development of infrastructures such as feeder

roads and dams. This modern farming is expected to benefit peasant farmers in the form of high income, access to water and road and general improvement in the quality of life.

Kogi Agricultural Development Project (KADP) was established in 1991 as a result of the creation of the state from the then Kwara and Benue States. KADP came into being under the edict no. 12 of 16th December, 1991 by the Kogi state government. The overall objectives of the project as stated by KADP (2003) is to contribute to and also facilitate the attainment of self-sufficient in food production in Kogi State and Nigeria, with the aim of raising the income and standard of living of small scale famers in the rural communities.

The need for the Study

Agriculture is the most predominant source of income and employment for a majority of the population in Nigeria. The recent declining performance of the sector and the rising population have been a concern to the various arms of government, (CBN, 2004). In response to this problem of low agricultural productivity, the Federal Government of Nigeria introduced the Agricultural Development Project concept as a development strategy designed to raise agricultural productivity.

The average annual growth rates attributed to Agricultural Development Project (ADP) intervention in Nigeria was about 5 percent (FGN, 2007). In 2005 a team of experts conducted a survey on the impact of KADP on agricultural productivity in the state. The survey revealed that the project over the period of ten years of its existence, made significant impact on agricultural productivity (KADP, 2006). This research work is conducted as a follow up to the earlier ones, to find out the future effects of this impact on income and profit levels of farmers in the state.

Materials and Methods

The Administrative Area of the Project

The study area is Kogi State of Nigeria, Kogi State Agricultural Development Project was designed to cover all the 21 Local Government Areas (LGA) of the state with a total population of about 3.3 million people (NPC, 2004). KADP use the training and visit method of extension delivery system to serve their clientele that is spread all over the state. KADP operate a headquarter, zonal and block level of administrative structure. A project manager serves as the overall administrative head and supported by the directors of the various sub-programmes. At the zonal levels, we have zonal managers, zonal extension officers and subject matter specialists. At the block levels we have extension supervisors overseeing the activities of the extension agents.

KADP is divided into Four operational zones: The four Zones Include

- Zone A: The zonal headquarter is at Aiyetoro-Gbede. The zone covers five LGA of the state. The LGA include :- Ijumu, Kabba-Bunu, Mapamuro, Yagba-East and yagba-West.
- Zone B: The headquarter is located at Anyigba. The zone covers four LGA which include Bassa, Dekina, Ankpa and Omala.

- Zone C: The headquarter of zone c is located at koton-Karfi and it covers seven LGA of the state. The LGA include:- Kogi, Lokoja, Adavi, Okene, Okehi, Ajaokuta and Ogori-Mangongo.
- Zone D: The headquarter of zone D is at Alloma. There are five LGA under the operations of the zone. These LGA include Idah, Ibaji, Ofu, Olamaboro and Igalamela-Odolu.

The state has about 2 million hectares of cultivable land with only about 0.5 million hectares currently under cultivation (KOSEEDS, 2004). The major food crops grown in the state are cassava, yam, coco-yam, sweet potato, maize, sorghum, rice, millet, cowpea, pigeon pea, ground nut, bambara nut, melon, meni seed, banana and plantain. Fruits and leafy vegetables such as okra, peper, fluted pumpkin and spinach are highly cultivated in the area. Tree crops grown in the state are cocoa, coffee, cashew, oil palm, citrus and kolanut. Cattle, sheep, goats and poultry are the major animal reared. Fish farming is common along the riverine areas.

Sample and Sample Size

Kogi state is divided into four agricultural zones under the KADP. Each block is also divided into ten Village Extension Circle (VEC). In all there are 200 extension circles. In each circle ten contact farmers are appointed to work with the Extension Agent in the area. From each of the extension circle, one contact farmer was randomly selected from the list of the ten contact farmers. In all, a total of 200 contact farmers were involved in the survey.

Contact farmers (CF) are selected by the extension agents with possible assistance from the village elders from among the farmers in the circle. The contact farmers are the channel through whom recommended practices will spread to other farmers. Contact farmers are the models for other farmers. They are usually the most progressive practicing farmers in the village. Their standard of living are usually above other farmers in the area. Contact farmers are usually the first beneficiaries of KADP packages. Therefore the impact of KADP on the income of farmers are supposed to be felt most by the contact farmers.

Instrument

The study was carried out in 2010 in Kogi state of Nigeria. Both primary and secondary data were used for the study. Secondary data for the study were collected from the headquarter of KADP at Lokoja. The primary data on the other hand were collected through field survey with the use of structured questionnaire. The questionnaire were administered to the selected contact farmers by the researcher with the assistance of the extension agents attached to the areas.

The questionnaire sought information on the revenue accrued from farm operations during 2008/2009 and 2009/2010 farming seasons. The information obtained was used to calculate farm income and expenses for the year 2009 and 2010. Some of the expenses include costs of land clearing, land cultivation, agro-chemicals, planting, weeding, harvesting and processing. Others include costs of other farm inputs and other miscellaneous expenses. All the total costs for each year was

computed and subtracted from the total revenue to obtain the farm profit for each of the two years.

Prior to the administration of the questionnaire, the instrument were validated. Test and re-test reliability were carried out. Cronbatch Alpha test of the instrument reliability gave reliability coefficients (rs) of 0.840 and 0.891 respectively. Face and content validity of the instrument was established by a team of research experts. Restructuring and revisions of the instruments were incorporated into the finally produced questionnaire.

Data Collection Technique

The distribution and collection of completed questionnaire was done by the researched with the assistance of the extension agents and enumerators of KADP. All the instruments were successfully completed, recovered and analyzed by the researcher.

Method of Data Analysis

Markov chain analysis was applied to analyze the problem. Since the main focus of this study was to predict the movement of extension contact farmers between and within farm income and profit levels. Therefore, for the purpose of forecasting how many extension contact farmers will move from lower income level to higher income level, Markov chain analysis is considered most appropriate for this study. Thierauf and Klekamp (1975) described Markov analysis as a way of analyzing the current movement of some variabes in an effort to forecast the future movement of that same variable. The Markovian process assume that the conditional distribution of random variables in the future given their values now is the same as their conditional distribution now and at all times.

The Model Specification

Markov chain are used to model a variety of different phenomena both in finance and economics. Frank and Garcia (2006) opined that the first financial model to use markov chain was from prafad et al in 1974, since then markov chain analysis have been applied in other fields including agriculture and health.

Mubea et al (2010) employed markov chain Stochastic modeling technique in analyzing and projecting land use changes in nyeri municipality in Kenya. The results indicates that there has been a notable and uneven urban growth and substantial loss in forest land and that the land use change process has not stabilized. The projected land use for 2030 shows substantial increase in urban and agricultural land use.

Other applications of markov chain in agricultural analysis also exist. Zimmemann (2006) in his study of the structural change in the European agricultural sector adopted the use of markov chain analysis, the approach used the development of farm numbers in certain typologies in the past to derive a transition pattern which is then used to predict future farm numbers in these typologies. Transition probabilities which represent the likelihood for a farm to move to another farm type within a given time period are calculated for each farm type and region. Frank and Garcia (2006) also calculated the liquidity cost in agricultural future market using markov chain

approach. Similarly, Ardine et al (1998) used markov chain model to predict cost effectiveness and cost utility of dialysis and transplantation over the period of 5 years (1997-2001).

Why other models like dynamic programming can only show which of the income and profit level will dominate others at a particular time, markov chain analysis is designed to show on yearly basis, the changes that will occur between and within the different income and profit groups.

The Basic Assumption in Markov Analysis are as follows

- The matrix of transition probability remains constant from period to period.
- The farmers population remains essentially the same for the period for which the forecast was made as in the period which forms the basis for deriving the transition probability matrix (Thierauf and Klekamp, 1975).

The first assumption implied that the sampled farmers cannot be changed throughout the period of prediction, while the second condition assumed that, there will be no increase or decrease in the number of sampled farmers. These conditions may not pose any serious problem to the utilization of this tool because the authority of Kogi Agricultural Development Project does not change their contact farmers.

The income obtained by farmers is used as the model variable. Assume there are X^m farmer in the state with varying amounts of income at a given period 'M'. they may belong to the ith income groups containing:- x1, x2, x3 xi such that x1 + x2 + x3 +……+ xi = x^m.

For another time period 'n' when incomes were obtained again by the same set of farmers x^m during the time lapse between the two periods 'm' and 'n', the x1 farmers who received certain amount of income might have received higher amount hence moved to higher income group or received lower income hence moved to lower group or received the same or almost the same amount as in the previous group. This new group is represented by the ith column such that the sum of the ith column i.e. x1 + x2 + x3 +……+ xi = x^m.

Calculation of the Transition Probability Matrix

In general, the probability that a farmer belonging to the ith income group during the initial period 'm' move to the ith income group during 'n' is given by:

$$Bij = \frac{Xij}{Xi}$$

Where I, j = 1,2,3….N

These probabilities are known as the transition probability matrix. The matrix is called Transition Probability Matrix because the Bij summation is equal to one.

Mathematically written as

$$\sum_{J=i}^{N} B_{ij} = 1$$

Calculation of the Future Projections

In order to project the future distribution of farmers into different income groups, there are two possible alternatives –either to square the matrix of transition probabilities for the desired number of periods and then multiplying the resultant matrix by the original income or to multiply the original matrix of transition probabilities by the vector of the proceeding year. The latter method is adopted for this study because of its obvious advantage that changes which occur from period to period can be observed.

The vector of initial income distribution are x1, x2, x3, xj and the transition probability matrix Bij, gives the probability associated with all possible levels of movement.

Limitations of this Model

As a result of the risk and uncertainties associated with agricultural production, the use of Markov analysis in predicting the growth rate of farmers depends largely on the external forces like seasonality of production, disease outbreak and vagaries of weather conditions among others.

Markov analysis does not incorporate any structural changes like population over the years in which the prediction is made that is, the model assumes that the transition probability matrix is constant over the years. There is also the difficulty of obtaining the standard error associated with the estimates. Despite these shortcomings it is believe that the analysis will provide a useful basis for planning purposes.

Result and Discussions

The model of markov analysis is employed to forecast the future income and profitability of contact farmers under the Kogi Agricultural Development Project given the prevailing conditions. The income and profit data used in this study are for the 2008/2009 and 2009/2010 farming seasons.

Table 1: Estimated annual income analysis of farmers in ₦'000

Income Group	2010 Income Group			Total 2009
	<50	50-100	>100	
2009 Income Group				
<50	94	9	0	103
50-100	6	48	9	63
>100	0	6	28	34
Total (2010)	100	63	37	200

Source: Field survey, 2010

Table I shows that out of 200 respondents, 103 were in less than ₦50,000 income group in 2009 as against 100 in 2010. Out of the 103 respondents in 2009 nine of them moved to higher income group of between ₦50,000 and ₦ 100,000. In 2009 and 2010 there were 63 respondents in the income group of ₦50,000-₦ 100,000. Out of the 63 respondents in 2009, 48 of them remained in the group in 2010, nine moved to higher income group of above ₦ 100,000. While six others dropped to less than ₦50,000. In 2009, 34 respondents were in high income group of above ₦100,000 as against 37 in 2010. Out of the 34 in 2009, 28 remained in 2010, while six of them dropped to ₦50,000 – ₦100,000 income group.
Based on the above information, the transition probability matrix of the income of farmers was prepared as shown in table II.

Table 2: Transition Probability Matrix of the income of farmers in ₦'000

Income Group	2010 Income Group			Total
	<50	50-100	>100	Probability
2009 Income Group				
<50	0.91	0.09	0.00	1
50-100	0.10	0.76	0.14	1
>100	0.00	0.82	0.82	1

Source: Field Survey, 2010

The predicted vectors of the income of farmers are calculated by multiplying the transition probability matrix by the vector of the preceeding year.

Table 3: Predicted vectors of the income of farmers in ₦'000.

Year	<₦50	No. of farmers	₦ 50- 100	No. of farmers	>₦ 100	No. of farmers
2009	0.515	103	0.315	63	0.170	34
2010	0.500	100	0.315	63	0.185	37
2011	0.487	97	0.317	64	0.196	38
2012	0.475	95	0.320	64	0.205	41
2013	0.464	93	0.323	64	0.213	43
2014	0.454	91	0.326	65	0.220	44
2015	0.446	89	0.328	66	0.226	45

Source: Field Survey, 2010 *Actual figure computed from Table I

The Detail analysis above shows that most of the farmers are very poor considering their level of income. The actual result indicates that about half of the farmers, 103 and 100 in 2009 and 2010 respectively had an estimated annual income of less than ₦50,000, while 63 of them in both 2009 and 2010 had an estimated annual income of between ₦50.000-100,000. Finally, farmers who earned above ₦100,000 in 2009 and 2010 were just 34 and 39 respectively. This is a true reflection of the vicious poverty circle among our small scale farmers most of whom reside in the rural area. In as much as there may be an under estimation of the responses from these farmers, it

cannot at all be far from the truth. This is why the present economic recession tends to tell much more on them.

A five year projection into the income of the farmers shows that about 45% of them will fall below the ₦50,000 annual income level, while over 77% will fall below ₦100,000. This shows that in addition to the provision of rural infrastructures in the rural area, more urgent attention is needed in order to salvage our agricultural production from total collapse in the future.

Profit Analysis of Farmers

The profit analysis of farmers for 2008/2009 and 2009/2010 farming seasons is shown in Table IV.

Table 4: Net cash surplus of farmers in ₦'000

Level of profit	2010 Profit Group			Total (2009)
	<10	10-50	>50	
2009 Profit Group				
<10	80	37	0	117
10-50	11	55	3	69
>50	0	3	11	14
Total (2010)	91	95	14	200

Source: Field Survey, 2010

The result of the study shows that in 2009, 117 were in less than ₦10,000 profit level out of which 80 of them remain in 2010 and 37 moved to ₦10,000-50,000 profit level. Out of 69 farmers that are in ₦10,000-50,000 profit level in 2009, 55 remain, 11 drop back and 3 move to higher profit level. Out of 14 respondents in above ₦50,000 level, 3 droped to ₦10,000 – ₦50,000 and 11 of them remained. Thus bringing the total farmers in less than ₦10,000 profit level to 91 in 2010 as against 117 in 2009, as in ₦10,000 -50,000 level in 2010 as against 69 in 2009 and 14 respondents in above ₦50,000 profit level in both 2009 and 2010.

Table 5: Transition Probability matrix of the profit of farmers in ₦'000

Profit Level	2010 Profit Group			Total
	<10	10-50	>50	Probability
2009 Profit Group				
<10	0.69	0.31	0.00	1
10-50	0.16	0.80	0.04	1
>50	0.00	0.21	0.79	1

Source: Field Survey, 2010

The predicted vectors of the profit of farmers is calculated by multiplying the transition probability matrix of the profit by the vector of the preceding year.

Table 6: Predicted vectors of probability of the profit level of farmers in ₦'000.

Year	Less than ₦10	No. of farmers	₦ 10-50	No. of farmers	Above ₦50	No. of farmers
2009	0.585	117	0.345	69	0.070	14
2010	0.455	91	0.475	95	0.070	14
2011	0.390	78	0.536	107	0.074	15
2012	0.355	71	0.565	113	0.080	16
2013	0.355	67	0.579	116	0.086	17
2014	0.324	65	0.685	117	0.91	18
2015	0.317	63	0.588	118	0.095	19

Source: Field Survey, 2010 *Actual figure computed from table IV

All things being equal, it is expected that over half of the farmers (118) will probably be having between ₦10,000 and ₦50,000 as profit by the year 2015, while 90.5% of them are expected to earn not more than an annual profit of ₦50,000 by the year 2015, given the present level of agricultural production in the area. With the low level of income coupled with small scope of farm operations there is no doubt that saving of surplus after consumption will be small.

The levels of income and profits accruing to these farmers are so low that no meaningful impact could be made on the transformation of the traditional practice of our agricultural production to the expected technological level without additional concrete and effective agricultural incentives to farmers.

Conclusion and Recommendations

The evidence obtained in this investigation showed that only about 10% of the farmers will belong to high profit group by the year 2015. It is very clear that it is only what is saved that is invested and in this case low level of saving automatically will lead to low investment and the poverty cycle continues. All these point to the fact that the provision of rural infrastructure alone is not enough to substantially increase the profit level of farmers, other agricultural incentives are needed to back it up.

It is therefore recommended that KADP should establish commercial ventures that sell high quality goods and services at affordable rate to farmers. The goods should include Agrochemicals, farm equipment and implements, improved variety of planting materials and other farm inputs. They can also embark on tractor hiring services to help farmers increase their farmland. The project should also engage in consultancy services where farmers can come for technical advice on how to improve and increase their farm output and profit levels.

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