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EVALUATION OF FARMING SYSTEMS AND INFORMAL INSURANCE MEASURES FOR OPTIMUM INCOME OF RURAL FARMERS IN THE RAIN FOREST ZONE OF NIGERIA

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ABSTRACT

Maintaining an increasing flow of income to rural farmers is a challenge to success of poverty alleviation programmes in developing economies, due to risks and uncertainties that characterize agricultural activities. The study thus, evaluated farming systems and other informal insurance measures used by farmers for optimum farm income in rain forest zone of Nigeria. Fifty farmers were randomly selected from Anambra East Local Government Area of Anambra State, Nigeria. Data collected through structured questionnaires and interview schedules were analysed using net farm income analysis, Pearson correlation, and two way ANOVA techniques. Results showed a positive correlation between number of sources of risks and uncertainties perceived by farmers and strategies employed to prevent their effects. The two way ANOVA showed that farmers who cultivated plantation crops, food crops, reared poultry and small ruminants have more income than those who do not. It also showed that adoption of risk management techniques, marketing strategies, souring of micro-credit and improving information sources simultaneously, ensured higher income. Recommendations include encouraging farmers to adopt the most profitable farming systems and informal insurance measures as well as provision of more micro-finance facilities to rural people.

Key words: *Agriculture; Risks and Uncertainties; Informal Insurance; Income. Nigeria*

BACKGROUND INFORMATION

Population pressure of South Eastern Nigeria which occupies most of the rain forest ecological zone of the country is about the highest in West Africa (Arene, 1996). As a result of this, ninety percent of rural farmers in this rain forest zone possess less than three hectares of land, which is fragmented, and exist as individual plots. On the average, their farm size is usually about a hectare (Achike, 1997). These small-scale farmers are faced with risks and uncertainties, which have been distinctive features of agrarian activities in developing economies. In order to mitigate these risks and uncertainties the Federal Government of Nigeria has instituted the Nigerian Agricultural Insurance Company. But due to remoteness of the company from farmers, poverty and illiteracy as well as bureaucratic processes of corporate organizations, majority of the farmers are yet to take advantage of the formal insurance services.

However, the management of risks and uncertainties is as old as mankind recognized themselves as the most rational creatures and have developed informal measures to handle risks and uncertainties associated with their livelihood.

Agriculture as the first occupation of human was not left out in this regard. Measures have been developed to deal with its unique risks and uncertainties. Some of these measures are associated with farming systems, marketing strategies, source of information and finance as well as social ties. Farming systems technologies encompasses all technologies to deal with on-farm risks. It includes cropping and mixed farming technologies (Mkpado and Arene 2003).

THE PROBLEM AND VALUE OF THE STUDY

Fluctuations in farmers' income due to yield variations, the cobweb theorem of agricultural prices as well as the threat of total loss due to natural disasters, weather fluctuations, out break of pests and diseases may present difficult welfare problems to rural farmers (Holzmann and Jorgensen 2000, World Bank 2004). Farmers have used different formal and informal strategies to cope with these problems. Many of these strategies and their effects on farm income and farmers' well being in Southeastern Nigeria are yet to be empirically underpinned. Increasing the flow of households out of poverty and extenuating circumstances can serve as a basis for social protection strategy (Baulch and Hoddinott 2000). This shows the need to empirically investigate measures through which rural farmers protect their livelihood and ensure increasing steady flow of income. In an attempt to determine effects of poverty and risk attitude of farmers on their investment, Nzenwa (2005) examined the case of rice farmers in Benue State, which is a typical derived Savannah in Nigeria. Her results may not explain exactly the experiences of farmers in rain forest zone especially those who cultivate different crops and rear animals, but it showed that farmers are risk averse and take different measures to cope with foreseen and unforeseen adverse occurrence in their farm operations.

The primary aim of rural farmers is to meet their household food consumption needs, but in order to get out of poverty they need to have enough income to meet also their non-food consumption needs such as good shelter, medical services, clothing, schooling, transportation, electricity and communication services. This could serve as a measure of degree of liberation from poverty. This premise presupposes that studies which, centered on meeting only the food consumption needs of rural farmers have not adequately addressed most factors that will influence their liberation from poverty as will studies that aim at synchronizing production, marketing and social strategies for increasing the income flow to rural farmers. For example Harrower et al. (2002) focused on consumption insurance by

emphasizing food consumption as a basis for measuring vulnerability to poverty with little emphasis on non-food consumption. It has been argued that rural households can get out of poverty by increasing their magnitude of savings (Paxson 1992, Wright 1999). This prospect may be far-fetched if risk management strategies that increase the flow of income are not documented and implemented to increase the income such that substantial saving can be made. It was also reported that rural formers could increase their income by engaging in non-agricultural activities (Kochar 1988, Morduch 1995). But many non-agricultural activities may require specialized skills, which may be difficult for these farmers who are advancing in age to learn. Besides, there is the risk of loosing these limited labour in agriculture to non-agricultural activities if the gradual shift by integrating non-agricultural activities are encouraged; so, farmers should be encouraged to engage in more than one farming enterprise.

A number of agricultural technologies including vertical and horizontal integration, marketing strategies and informal social securities have been recommended. This is to manage agricultural risks and uncertainties as well as provide gainful enterprises that will absorb agricultural labour during limited crop farming activities due to seasonal nature of food crop production activities occasioned by rain-fed nature of agriculture practice in rain forest zone of Nigeria. For instance, a distinct feature of production technologies is the farming system, which includes cropping systems and mixed farming systems. Cropping system comprises mixed cropping involving legumes, crop rotation, taungya farming and agro-forestry technologies. Mixed farming technologies deal with integration of crop(s) and animal(s) production. These technologies have strategies for managing farm risks and diversification of farm operations. For example adjustment on the time of planting can help to prevent certain pests and diseases, allow for planting more than one type of crop (mixed cropping) as well as offer advantages with respect to time of marketing and price setting. There is need for consistent objective support of the above statement.

It is expected that with a hand full of agricultural enterprises, farmers should be able to adjust to the ones that best satisfy their objectives. Researchers are yet to document effects of these strategies on farmers' income in South Eastern Nigeria. This can help to address the reason why there is low adoption of certain recommended technologies and to determine the capacity at which rural farmers can adopt vertical and horizontal integration strategies aimed at reducing effects of risks and uncertainties characterizing agrarian activities. This will be very useful because while commercial farmers can increase their scale of operation and specialty in a particular farming enterprise, rural farmers are mainly at the fringes of these enterprises. The small-scale status of these enterprises exposes entrepreneurs to more risks, that a change in production and market factors associated with their enterprises can easily

cause a lot of economic loss (World Bank 2004). Since at such hard times, commercial farmers can take advantage of formal insurance service; there is need to understand fully the strategies adopted by rural farmers to safeguard their livelihood. This is to enable policy makers and extension officers to effectively carry-out the job and handle the challenges of sustainable poverty reduction programmes which must include up-grading the livelihood and social ties of rural communities. The study thus aimed at evaluating farming systems and other informal insurance measures used by rural farmers to safeguard their livelihood and manage poverty as well as determine the relationship between informal insurance measures and management of perceived risks.

METHODOLOGY

The Study Area: The study was carried out in Anambra East Local Government Area of Anambra State of Nigeria. Major crops grown in the area include yams, cassava, maize, rice, vegetables, legumes and oil palm. The state has an annual rainfall of about 1600 to 2000 mm, which lasts from April to October (Inyang 1975). The soil type is typical of sandy loamy soil. The choice of the area is due to high population density of Anambra State which has placed farmers under land use pressure (Arene 1996)

Sampling Procedure: Purposive and multi-stage random sampling techniques were used. First stage is the purposive selection of Anambra East Local Government Area because of the relative suitability of its soil and weather for crop and animal productions. Second stage is the random selection of five communities from seven communities of Anambra East Local Government Area namely; Igbariam, Nsugbe, Nnadi, Abata and Umuleri. Third stage is the random selection of ten farmers from each of the five communities. This gives a total of fifty (50) respondents.

Data Collection and Analyses: Primary and secondary data were collected for the study. Primary data collection involved the use of structured questionnaires, oral interview and observation of field activities. Data collected include types of crop cultivated, types of animal reared, farming systems, marketing strategies, prices, expenditure, expenses, types of risk experienced and type of social securities used. Secondary data were collected from publications and reports of relevant ministries. Data were analysed using descriptive statistics, two-way Analysis of variance, scheffe multiple comparison test, net farm income, and correlation analysis.

Model Specification

Net farm income is implicitly expressed as follows

$$\text{NFI} = \sum_{i=1}^{n} Ri \quad - \sum_{i=1}^{n} \text{ei}$$

Where NFI = Net farm income of a farmer per annum

Ri = Revenue of an enterprise
ei = sum of expenses and expenditure
n = number of farming enterprises engaged in respectively by a farmer.
$\sum$ = summation symbol.

The Pearson correlation coefficient 'r' is expressed as follows:

$$r = \frac{n\sum Xi\ Yi - \sum Xi \sum Yi}{\sqrt{\{ (n \sum X^2 - (\sum X)^2 . (n \sum Y^2 - (\sum Y)^2 \}}}$$

Where Xi = number of informal insurance used by a farmer respondent
Yi = number of risk perceived by the farmer respondent
n = number of farmer respondents

RESULTS AND DISCUSSION

Risks Perceived by Respondents and Measures Adopted

Major risks perceived by the farmers can be grouped as production risks, marketing risks and financial risks (see table 1). Production risks are often related to variation in soil fertility and weather leading to poor yield. Weather variations can be associated with extreme temperatures, insufficient rainfall in duration and intensity. Others can include field pests and diseases as well as 'losses' in viability of seeds. Marketing risks can be as a result of price fluctuations and damaged produce or poor yield. These risks (production and market risks) can reflect in financial risks. Institutional risks were not mentioned. This could be as a result of low scale of operation, poor marketing structures and strategies.

The multiple responses in tables 1 and 2 imply that no farmer perceived only one or used just one informal insurance measure. The least informal insurance measure practiced is contract farming, which only about 6% of the respondent used. This could be because farmers are cautious and even averse to the problems of futuristic marketing; or it may be due to the small-sale nature of their operations and the existing poor marketing structures; hence they prefer the buffering stock strategy. Diversification of farming enterprises obtained a higher frequency than the souring of micro- credit. This could be as a result of limited sources of credit available to the farmers. Correlation Result of Perceived Source of Risk and Adopted Management Strategy have a coefficient of correlation (r) of 0.83. The result showed a positive correlation between informal insurance measures and perceived risks. It means that an increase in number of risks perceived by farmers, will result in increase number of informal risk management strategies used

Net Farm Income

The result indicates that farming system 'D' offers the highest annual income (see table 3). It is possible that taungya farming involving cultivation of a plantation crop and food crops offers maximum land use system; integrating small scale livestock production with it provides opportunity for economic use of abundant forage crops and generation of organic manure to ensure higher crop yield (see table 4)

The two - way ANOVA is significant at one percent probability level with R^2 of 97%. It is important to note that the interaction between farming systems and other informal insurance measures is significant just like the main effects (farming system and other informal insurance measures) at one percent probability level (see table 5)

As a compliment to the ANOVA, the Scheffe multiple comparison test ranks the mean differences of farming system involving a plantation crop, 3 food crops, 5 poultry birds and 2-5 small ruminants first. Small ruminants here refer to sheep and goats.

Scheffe test was used to show the mean differences due to the effect of adopting different informal insurance measures. The Scheffe test showed that farmers who employed on-farm risk management techniques, sourced micro-credit, adopted marketing strategies and improved their information sources earned more income than those who employed only two of the strategies (see table 6). Since the interaction between farming system and other insurance measures is significant, it implies that choice of most uncreative farming system and the outlined informal insurance measures will ensure an increased and steady flow of income. It also indicates that farmers who employ other risk management strategies will earn more income than their counter parts who adopt the same farming system only.

SUMMARY AND RECOMMENDATION

The study has shown that farmers are aware of the risks and uncertainties characterizing agriculture and are using informal insurance measures to cope with their effects. This is because there is a positive correlation between risk perceived and informal insurance measures adopted. The two-way ANOVA illustrated that the most profitable farming system in the rain forest zone included plantation crop, food crops, rearing of poultry and small-ruminants. It also showed that joint adoption of on farm risk management techniques, marketing strategies, souring of micro-credit and improving souring of information ensures higher annual income.

Consequently, the following recommendations are made (1) Farmers should diversify their operations by adopting mixed farming systems that allow for integrating plantation crop with food crops as well as rearing of poultry and small ruminants. (2) Farmers should be dynamic in souring of information and micro-credits as well as adopting marketing strategies and on

farm risks management strategies in order to maintain high income. (3) Government and non-governmental organizations should increase their financial assistance to rural farmers through provision of more micro-credit facilities. And (4) Agricultural extension activities should be encouraged since they serve as major source of information to rural farmers.

REFERENCES

Achike, A I (1997). Women and Rights to Agricultural Lands in Nigeria: Socio-Cultural Determinants, Inhibitions and Implications for Sustainable Development. *13th Annual Conference Proceedings of Farm Management Association of Nigeria. PP. 106-116*

Arene, C.J. 1996 "Population Pressure, Agricultural Intensification and the Sustainability of Cropping System in Anambra state of Nigeria*" Rivista de Agricultoura Subtropicale e tropicale,* Vol. 90, No. I, PP 75 – 84.

Baulch, B. and J. Hoddinott (2000) "Economic Mobility and Poverty Dynamics in Developing Countries" *Journal of Economic Perspectives Studies* Vol. 4(1) pp 9-11.

Mkpado, M. and C.J. Arene (2003) "Effects of Cropping System and Selected Socio-Economic Factors on Sustainability of Arable Crop Production: The case of Cassava in Okigwe, Imo State of Nigeria" *Journal of Agro-Technology and Extension* Vol 3, No. 1 & 2 pp 14 – 17.

Morduch, J. (1995) "Income Smoothing and Consumption Smothing". *Journal of Economic Perspectives.* Vol. 9 (Summer) pp 103 – 114.

Kochar, A. (1998) "Smoothing Consumption: Hours of Work Responses to Idiosyncratic Agricultural Shocks in Rural India". *The* Review of Economics and Statistics Vol. 81(1) pp 50-61.

Nzenwa G. (2005) "Effect of Poverty on Risk Attitudes of Rice Farmers in Benue State, Nigeria" *Unpublished M.Sc. Dissertation in Department of Agricultural Economic University of Nigeria Nsukka.*

Paxson, C. (1992) "Using Weather Variability to Estimate the Responses of Savings to Transitory Income in Thailand". *American Economic Review* Vol. 82.

Holzmann, R. and Jorgenson, S. (2002) "Social Risk Management: A New Conceptual Framework for Social Protection and Beyond", *Social Protection Discussion Paper No. 0006, World Bank*

Harrower, S., and J. Hoddinott (2002) "Consumption Smoothing and Vulnerability in zone Lancaster, Mali, Draft" International Food Policy Research Institute (IFPRI) Washington D.C.

World Bank (2004) Managing Agricultural Risk, Vulnerability and Disaster. Agricultural Investment source Book http://www.worldbank.org/duf

Wright, A. N.G. (1999) Necessity as the Mother of Intervention: How Poor People Protect dissolves Against Risks. Mimeo prepared for Micro-Save Africa.

Inyang, P.E.B. (1975) Climatic Regions in G.E.K. Ofomata (ed). Nigeria in Maps, Eastern States. Ethiopia Publ. House, Benin City, Nigeria.

Table 1: List of Risks Perceived by Farmers

Risks	Frequency*	Percentages
Yield variations	40	80
Weather variations	48	96
Damages by pests and diseases	35	70
Physiological damages /decay of stored produce	40	80
Loss in viability of seeds	25	50
Price fluctuations	42	84
Financial risks	30	60
Personal risk (death/injury)	18	36
Assets risk (theft/fire)	10	20
Maximum responding unit	50	

*Multiple responses recorded
Source: Computed from field data.

Table 2: Informal Measures Used to Manage Perceived Risks

Informal Measures	Frequency*	Percent
Diversification of farm enterprises	40	80
Contract farming	3	6
Buffer stock	30	60
Flexibility/Timeliness of operations	42	84
Soil fertility management practices	50	100
Improving information systems	30	60
Vertical and horizontal integration	45	90
Savings	38	76
Souring micro-credit	28	56
Safety precautions	45	90
Keeping next of kin arrangement	48	96
Maximum responding unit	50	

*Multiple responses recorded
Source: Competed from field data

Table 3: Net Farm Income Analysis Result

Farming Systems /Diversification	Number of Farmers	Annual Average Cost	Annual Average Revenue	Annual Average net Farm Income.
A	3	13583.33	55335.33	41752.00
B	27	16456	69625.93	53175.93
C	20	18356.67	86066.04	67709.37
D	4	26850	100350	73500.00

Source: Computed from field data

Key: A = Farming system involving 3 food crops and 5-poultry birds
B = Farming system involving 3 food crops, 5-poultry birds and 2-5 small ruminants.
C = Farming system involving a plantation crop, 3 food crops, 5-poultry birds and 2-5 small ruminants.
D = Farming system involving a plantation crop, 3 food crops, 8-10 poultry birds and 2-5 small ruminants.

Table 4: Two -Way Analysis of Variance Result of Effects of Farming Systems and other Informal Insurance Measures on Farmers' Income

Source	Type III Sum of squares	Degree of Freedom	Mean square	F-ratio
Corrected model	4545058331	17	267356372.43	60.152**
Intercept	76665404897	1	76665404997	17284.682**
Farming	334167594.9	6	55694599.142	12.531**
system*OIM	1793757434	3	597919144.77	134.524**
Farming system	182958184.6	8	22869773.670	5.145**
OIM	142230750.0	33	4444710.937	
Errow				
Total	1.7737E+11	50		
Corrected Total	4687289081	49		

R^2 =.970, R- adjusted = .954,

** =Significant at 1 percent probability level; R^2 = R – squared,

OIM = other informal insurance measures farming systems * OIM = Interaction between farming systems and other informal insurance measures.

Source: Computed from field data

Table 5: Multiple Comparison of Annual Mean Income Based on Farming Systems Using Scheffe Test

Farming Systems	Annual Mean Income	Rank*
D	73500.00	1st
C	67709.37	2nd
B	53175.93	3rd
A	41752.00	4th

* = Significant at 5 percent probability level.
A = Farming system involving 3 food crops and 5-poultry birds
B = Farming system involving 3 food crops, 5-poultry birds and 2-5 small ruminants.
C = Farming system involving a plantation crop, 3 food crops, 5-poultry birds and 2-5 small ruminants.
D = Farming system involving a plantation crop, 3 food crops, 8-10 poultry birds and 2-5 small ruminants.
Source: Computed from field data.

Table 6: Multiple Comparison of Annual Mean Income Based on other Informal Insurance Measures

Insurance Measures	**Annual Mean Income**	**Rank***
N/M	66969.09/65630.00	1st
L	58974.44	2nd
J/I	54583.33/53916.67	3rd
H/K/Q	52337.50/51916.67/50337.50	4th
F	47076.50	5th

Key: Other informal insurance measures
On farm risk management = 1
Souring micro – credit = 2
Marketing strategies/savings = 3
Improving information sources = 4
F = 1+2, Q = 1+3, H = 1+4, I = 2+3, J = 2+4,
K = 3+4, L = 1+2+3, M = 1+2+4, N = 1+2+3+4.
* = Significant at 5 percent probability level.
Source: Computed from field data