Integrated Farming System and its Effect on Farm Cash Income in Awka South Agricultural Zone of Anambra State, Nigeria


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Abstract: This study reviewed types of integrated farming system (IFS), profitability of IFS and its impact on farm cash income in Awka agricultural zone of Anambra State, Nigeria. Structured questionnaires were used to obtain information from 84 respondents selected by random sampling technique. Data obtained were analyzed by means of gross margin and net farm income, profit function and multiple regression methods. The highest net farm income of N1,156,730.00 or $7,462.77 was recorded by crop-livestock-fish partial integration which is closest to the full integration of crop-livestock-fish-processing-biogas. Output price parameter accounted for more of the maximum variable profit in profit function analysis. Farm cash income was significantly influenced by level of farmer’s education, years of experience, type of integration and cost of farm inputs. Farm cash income could be increased through the provision of subsides for inputs to reduce cost of production and enlightenment campaigns to improve farmer’s knowledge and technical skills.

Key words: Agricultural system, Profitability, Farm cash income, Econometrics

INTRODUCTION

Farming and agriculture are respectively defined as the practice of cultivating the land or raising stock and the production of agricultural goods through the growing of plants and the raising of domesticated animals [1]. In the developing countries (Nigeria inclusive) frantic efforts have been made through research and enlightenment campaigns to encourage farming and thus ensure significant increases in agricultural production in order to feed and sustain the population that is increasing at geometric proportion. However, the increases recorded have often fluctuated considerably due to improper coordination of measures that support increased productivity [2, 3].

The sustenance of increased productivity must emphasize on the development of strategies aimed at maintaining improved yields without depleting natural resources or destabilizing the environment. Such strategies abound in IFS. Integrated farming (or integrated agriculture) is a commonly and broadly used word to explain a more integrated approach to farming as compared to existing monoculture approaches. It refers to agricultural systems that integrated livestock and crop production. Integrated farming system has revolutionized conventional farming of livestock, aquaculture, horticulture, agro-industry and allied activities [4]. It could be crop-fish integration, livestock-fish integration, crop-fish-livestock integration or combinations of crop, livestock, fish and other enterprises [2, 4-6].

The benefits of IFS over those of Traditional farming system, [7], cannot be over emphasized. Though agricultural systems are better practised on large expanse of land, subsistence farmers notable for their small holdings can equally engage in them, especially those involving homestead fish ponds [8]. This is because IFS has been confirmed to reduce cost of production and thus increase farmer’s productivity, income, nutrition and overall welfare [5]. If properly adopted with investment in agriculture, IFS improves the personal savings and health of farmers [9]. Othman,[3], summarized the multifaceted benefits of IFS to include economic benefits in terms of increased food production; social function in terms of provision of employment opportunities for excess labour force displaced from other sectors in the urban areas.
Integrated farming system can be complete integration encompassing crops, livestock, fisheries, processing and biogas units [4, 10] or partial integration involving different combinations of the later units [10, 11]. Which ever is the case, IFS can remove all the farming constraints (such as shortage and high cost of inputs and environmental pollution) by not only solving most of the existing economic and even ecological problems, but also provide the needed means of production such as fuel, fertilizer and feed, besides increasing productivity many-fold. It can turn all the existing disastrous farming systems, especially in the world’s poor countries into economically viable and ecologically balanced systems that will not only alleviate poverty, but can even eradicate it completely [4].

There is dearth of information on the types, extent of adoption and benefits of IFS in Awka agricultural zone of Anambra State. This is evidenced by the observed subsistence nature of farming and poor levels of cash income realized by farmers in the area [7]. This study sets out to specifically identify types of IFS, determine the profitability of IFS and examine the impact of IFS on farm cash income in the study area. It is therefore justified because information generated there from will not only enrich literature on IFS but will inform policy on programmes that will encourage speedy adoption of full IFS in order to drastically reduce poverty and increase the standard of living of the farmers.

**MATERIALS AND METHODS**

**The Study Area:** Awka agricultural zone is one of the four agricultural zones operational in Anambra state. It comprises of five Local government areas (L.G.As) namely: Awka north, Awka south, Anaocha, Njikoka and Dunukofia L.G.As. The agricultural zone is within the derived savanna vegetative zone. The topography is hilly and in many parts flood erosion is a major problem. The soil is classified as deep porous ferralthic which is easy to till but subject to excessive leaching because it is formed from sandstone [12].

**Farming Is the Predominant Occupation:** It is carried out at the family level and it is mainly for subsistence. The little surplus production that may be generated is sold for money used to purchase non-farm commodities. Planting of food crops like maize, yam, cassava and others is largely determined by weather conditions. Animals such as goats, sheep, poultry and in limited cases cattle are kept, while homestead fish farming (especially catfish farming) is gaining grounds [8].

The agricultural zone was chosen because of the prevalence of various types of IFS and the location of Awka city, the capital of Anambra state, with its fast growing population and commercial activities. The Capital city serves as a viable market for farm products produced in the zone.

**Sampling Procedure:** The five L.G.As in the agricultural zone constitute the sample space. A total of 42 communities are found in the zone. Farmers operating various types of IFS were identified via the technical assistance provided by officers of Anambra state agricultural development programme (ASADEP) in charge of the zone. Random sampling technique was then used to select a total of 84 respondents (two from each community) for the study.

**Data Collection:** Data for the study were collected through primary sources. Primary sources of data, which were cross-sectional, comprise of the use of structured questionnaire items administered to the farmers. On the other hand, secondary data were obtained from relevant publications. The questionnaires were administered with the assistance of trained enumerators. Primary data collected include types of IFS, quantities of farm inputs and outputs and their prices and some socio-economic and demographic characteristics of the farmers.

**Data Analysis:** Whole farm budget, profit function and multiple regression techniques were used to analyze the data and achieve the objectives. To determine the profitability of IFS, gross margin and net farm income analysis were employed in the whole farm budget. Whole farm budget is a projection of the total production, income and expenses of a farm business for a whole farm plan [13]. It involves the establishment of revenue and cost items of the enterprises that constituted a particular farm. This is subsequently followed by the determination of farm gross margin and net farm income [14].

The mathematical expression for the gross margin analysis is presented below:

\[
GM = P_i Y_i - r_i c_i \quad (i = 1, 2, ..., n)
\]

Where:
- \(GM\) = Gross margin
- \(P_i\) = Farm gate price of the ith product
- \(Y_i\) = Output of the ith enterprise producing ith product
- \(r_i\) = Market price of variable cost
- \(c_i\) = Variable cost
- \(n\) = Number of the ith enterprise
The net farm income was calculated by deducting fixed cost from gross margin in each case as:

\[ \text{Net farm income} = \text{gross margin} - \text{fixed cost}. \]

To obtain the worth of each of the fixed cost items, the straight line method of depreciation was used and it was assumed that the salvage value of the fixed cost items used in production is zero. The straight line depreciation method used thus becomes:

\[ \text{Depreciation} = \frac{\text{Purchase price}}{\text{No. of years of useful life of the asset}}. \]

Profit function analysis was employed to estimate the profitability levels of individual resource inputs on crop, livestock or catfish enterprises. These inputs include variable and fixed capital items deployed by the enterprises in producing the various products. The profit function was used because of its importance in diagnostic analysis reflecting marginal resource profitability at mean levels of input price [15]. The profit function model is specified as follows:

\[ \Pi^* = \Pi^* (P_1, P_2, P_3, P_4, P_5, P_6, Z_1, Z_2, Z_3) \]

Where:

- \( \Pi^* \): Amount of maximum variable profit (N)
- \( P_1 \): Price of output (N)
- \( P_2 \): Per unit price of planting materials (N)
- \( P_3 \): Per unit price of livestock feed (N)
- \( P_4 \): Per unit price of fish feed (N)
- \( P_5 \): Per unit price of labour (N)
- \( Z_1 \): Value of farm land (N)
- \( Z_2 \): Value of matchet, wheel barrow, basin, etc. (N)
- \( Z_3 \): Value of fish pond, livestock pen (N)

**Note:** \( Z_1, Z_2 \) and \( Z_3 \) are fixed cost items. They are not included in the analysis since the analysis is based on the short-run effect of input prices.

Multiple regression analysis following Koutsoyiannis, [16] was used to determine the effect of IFS on farm cash income. The multiple regression model is specified explicitly as follows:

\[ Y = B_0 + B_1 X_1 + B_2 X_2 + B_3 X_3 + B_4 X_4 + B_5 X_5 + B_6 X_6 + B_7 X_7 + B_8 X_8 + B_9 X_9 + e \]

Where:

- \( Y \): Farm cash income (dependent variable) \( X_1, X_2, \ldots, X_9 \) (independent variables) and \( X_9 \): age of farmer (years)
- \( X_1 \): Household size
- \( X_2 \): Level of farmer’s education
- \( X_3 \): Years of experience
- \( X_4 \): Type of IFS (Dummy: partial integration = 1, full-integration = 0)
- \( X_5 \): Cost of farm inputs (especially cost of poultry and fish feeds)
- \( X_6 \): Gender (Dummy: male = 1, female = 0)

\( B_0 \) – \( B_9 \) are regression coefficients

**RESULTS AND DISCUSSION**

**Types of Integrated Farming System (IFS):** Integrated farming system in the study area involves such agricultural systems as shown in Table 1 below. None of the farmers engaged in full integration of crop-livestock-fish-processing-biogas production. Rather, all the farmers practised one form of partial integration, with majority (47.6%) engaging in crop-livestock integration.

About 29.76% of the farmers had incorporated catfish farming into their agricultural systems and are thus practising crop-fish-livestock integration. Other types of partial integration patronized by the remaining farmers include: Livestock-fish integration (11.90%); crop-fish integration (9.52%) and crop-livestock-agro-
Table 1: Types of integrated farming system

<table>
<thead>
<tr>
<th>Type of IFS</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crop-livestock</td>
<td>47.62</td>
</tr>
<tr>
<td>Crop-fish (catfish)</td>
<td>9.52</td>
</tr>
<tr>
<td>Crop-fish-livestock</td>
<td>29.76</td>
</tr>
<tr>
<td>Livestock-fish</td>
<td>11.90</td>
</tr>
<tr>
<td>Crop-livestock-agro processing</td>
<td>1.19</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100.00</strong></td>
</tr>
</tbody>
</table>

Source: Field survey, 2008

Note: Livestock includes sheep, goat and broiler poultry while agro-processing mill refers to cassava tuber processing mill

Processing (1.19%). The common feature of most integrated agricultural systems is that livestock and fisheries wastes are used as fertilizer for livestock and fish production; and livestock waste is also used to fertilize the growth of various natural planktons in the ponds as fish feed.

**Profitability of Integrated Farming System:** Gross margin and net farm income: Gross margin and net farm income techniques employed in whole farm budget analysis were used as a measure of profitability of the various types of IFS in the study area. Results of the analysis are presented in Table 2. The results show that IFS is a viable system in the area. This is exemplified in the net farm incomes (NFIs) realized by the different types of partial IFS in the study area viz: livestock-fish integration (N719,580.00 or $4,642.45), crop-livestock integration (N785,830.00 or $5,066.65), crop-fish integration (N808,050.00 or $5,210.00), an crop-livestock-fish integration (N1,156,730.00 or $7,462.77). The highest NFI was recorded by the IFS with the highest number of enterprises. This suggests that the highest the number of viable enterprises integrated into an agricultural system the highest the expected profit. Results of this analysis

Table 2: Gross margin and net farm income estimates in whole farm budgets

<table>
<thead>
<tr>
<th>Item</th>
<th>Qty/ha/enterprise</th>
<th>Price/unity (N)</th>
<th>Livestock-fish</th>
<th>Crop-livestock</th>
<th>Crop-fish</th>
<th>Crop-livestock-fish</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Revenue</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yam</td>
<td>1,200</td>
<td>80</td>
<td>96,000</td>
<td>96,000</td>
<td>96,000</td>
<td>96,000</td>
</tr>
<tr>
<td>Maize</td>
<td>120</td>
<td>_</td>
<td>3,750</td>
<td>3,750</td>
<td>3,750</td>
<td>3,750</td>
</tr>
<tr>
<td>Cassava</td>
<td>200</td>
<td>200</td>
<td>60,000</td>
<td>50,000</td>
<td>50,000</td>
<td>50,000</td>
</tr>
<tr>
<td>Labour (crops)</td>
<td>13 bags</td>
<td>1,700</td>
<td>22,100</td>
<td>22,100</td>
<td>22,100</td>
<td>22,100</td>
</tr>
<tr>
<td>Fertilizer (crops)</td>
<td>10</td>
<td>500</td>
<td>5,000</td>
<td>5,000</td>
<td>5,000</td>
<td>5,000</td>
</tr>
<tr>
<td>Sheep (lamps)</td>
<td>10</td>
<td>800</td>
<td>8,000</td>
<td>8,000</td>
<td>8,000</td>
<td>8,000</td>
</tr>
<tr>
<td>Poultry (chicks)</td>
<td>210</td>
<td>100</td>
<td>21,000</td>
<td>21,000</td>
<td>21,000</td>
<td>21,000</td>
</tr>
<tr>
<td>Feeds (goat, sheep and poultry)</td>
<td>400 bags</td>
<td>2,100</td>
<td>84,000</td>
<td>84,000</td>
<td>84,000</td>
<td>84,000</td>
</tr>
<tr>
<td>Medication/vet. Ser.</td>
<td></td>
<td></td>
<td>2,120</td>
<td>2,120</td>
<td>2,120</td>
<td>2,120</td>
</tr>
<tr>
<td>Miscellaneous (water, wood shaving electricity etc)</td>
<td>-</td>
<td>-</td>
<td>4,000</td>
<td>4,000</td>
<td>4,000</td>
<td>4,000</td>
</tr>
<tr>
<td>Labour (livestock)</td>
<td></td>
<td></td>
<td>3,800</td>
<td>3,800</td>
<td>3,800</td>
<td>3,800</td>
</tr>
<tr>
<td>First (Fingerlings)</td>
<td>5,200</td>
<td>10</td>
<td>52,000</td>
<td>52,000</td>
<td>52,000</td>
<td>52,000</td>
</tr>
<tr>
<td>Feeds (fish)</td>
<td>7,000 kg</td>
<td>150</td>
<td>1,050,000</td>
<td>1,050,000</td>
<td>1,050,000</td>
<td>1,050,000</td>
</tr>
<tr>
<td>Labour (fish)</td>
<td></td>
<td></td>
<td>15,000</td>
<td>15,000</td>
<td>15,000</td>
<td>15,000</td>
</tr>
<tr>
<td>Miscellaneous (water, electricity, etc)</td>
<td>-</td>
<td>-</td>
<td>10,000</td>
<td>10,000</td>
<td>10,000</td>
<td>10,000</td>
</tr>
<tr>
<td><strong>Total variable cost (TVC)</strong></td>
<td></td>
<td></td>
<td>1,254,920</td>
<td>305,770</td>
<td>1,304,850</td>
<td>1,432,770</td>
</tr>
<tr>
<td><strong>Fixed cost (FC)</strong></td>
<td></td>
<td></td>
<td>1,254,920</td>
<td>305,770</td>
<td>1,304,850</td>
<td>1,432,770</td>
</tr>
<tr>
<td>(livestock and fish)</td>
<td></td>
<td></td>
<td>5,500</td>
<td>3,400</td>
<td>2,100</td>
<td>5,500</td>
</tr>
<tr>
<td>Gross margin [GM] =TR –TVC</td>
<td></td>
<td></td>
<td>725,080</td>
<td>789,230</td>
<td>810,150</td>
<td>1,162,230</td>
</tr>
<tr>
<td>Net farm income [NFI] = GM – FC</td>
<td></td>
<td></td>
<td>719,580</td>
<td>785,830</td>
<td>808,050</td>
<td>1,156,730</td>
</tr>
</tbody>
</table>

Source: Field survey, 2008

Note: One US Dollar ($) – N155.00
Table 3: Profit function estimation

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Coefficient</th>
<th>Standard error</th>
<th>t-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Price of output</td>
<td>3.142</td>
<td>0.170</td>
<td>17.751**</td>
</tr>
<tr>
<td>Price of labour</td>
<td>-8.230</td>
<td>0.047</td>
<td>0.029</td>
</tr>
<tr>
<td>Price of feeds</td>
<td>-16.671</td>
<td>0.095</td>
<td>5.632**</td>
</tr>
<tr>
<td>Price of planting materials</td>
<td>11.530</td>
<td>0.041</td>
<td>0.004</td>
</tr>
<tr>
<td>Price of livestock/Catfish seeds</td>
<td>-4.715</td>
<td>0.048</td>
<td>0.015</td>
</tr>
<tr>
<td>Intercept</td>
<td>-3.492</td>
<td>0.519</td>
<td>0.00041</td>
</tr>
<tr>
<td>R²</td>
<td></td>
<td></td>
<td>0.812</td>
</tr>
<tr>
<td>F-statistics</td>
<td></td>
<td></td>
<td>47.630*</td>
</tr>
</tbody>
</table>

Source: Field survey, 2008

*Significant at 10% **Significant at 5%

Impact of IFS on Farm Cash Income: It is hypothesized that farm cash income of the survey farmers was influenced by certain variables including age of farmer; household size; level of farmer’s education; years of experience; type of IFS; cost of farm inputs; and gender of farmer. These variables were analyzed using the multiple regression method to find their effects on farm cash income. The result is shown in Table 4.

The coefficients of level of farmer’s education, years of experience and type of IFS are positively signed as expected. This implies that farmers who are educated, have more years of experience and can combine many viable enterprises tend to be more efficient in production and consequently will realize more income. This agrees with respective findings of Adeoti,[17] and Chan, [4], that years of experience and type of IFS reduce farmer’s inefficiency and thus increase productivity and income.

The coefficient of household size is negative and statistically insignificant. This means that the agricultural systems depend more on hired labour. Most family labour are more likely to be engaged in non-farm activities.

CONCLUSION

The study highlighted the impact of IFS on farm cash income. Majority of the farmers in the study area practised partial integration. Results revealed that all types of IFS are on the average profitable. Net farm income realized by farmers who maintained crop-livestock-fish integration
was the highest. Implying that farmers who want to achieve full integration and thus earn more income and escape from poverty will target the combination of more enterprises including crops, livestock, fisheries, processing and even biogas.

Farm cash income was positively influenced by farmer’s age, level of education, years of experience and type of integration. It was, however, negatively influenced by household size, cost of farm inputs and gender of farmer. Farm cash income can be improved by directing policy towards measures that will reduce cost of inputs and increase farmers knowledge and technical skills. Such measures may include subsidization of inputs and enlightenment campaigns in form of trainings, workshops and seminars.

REFERENCES