ISSN 1119-3131

ILORIN JOURNAL OF ARTS AND SOCIAL SCIENCES (IJASS)

A PUBLICATION OF THE SCHOOL OF ARTS AND SOCIAL SCIENCES,
KWARA STATE COLLEGE OF EDUCATION,
ILORIN.

VOLUME 1, NUMBER 1 MARCH, 1998

Remote sensing is very expensive but it offers a tremendous way of knowing and understanding the environment intimately. Having seen the possibilities this technique offers, one cannot be satisfied with the current state of agricultural production in Nigeria. Remote sensing plays a major role in an information revolution that could alter man's relationship with his environment as strikingly as the present relationship different from that of stone age and man.

In the near future, remote sensing technique will have an increasing role to play in the execution of agricultural production based on these assumptions that:

i. any amount spend presently on data collection and dissemination programmes are worth the cost incurred;
ii. some of the limitations of the present programmes are particularly ammenable to improvement using remote sensing technique;
iii. many new remote sensing techniques showing promise in research and development stage will soon be operational; and
iv. improvement resulting from the remote sensing techniques will result in either direct or indirect naira benefit to the agricultural economy.

Conclusively, remote sensing has become a real modern tool for agricultural surveys and planning that the future of remote sensing in Nigeria is bright once government and voluntary groups can put a collective effort.

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PROFITABILITY OF UTILIZING CREDIT FOR ANIMAL TRACTION: A CASE STUDY OF NORTHERN NIGERIA

BY

K. M. BABA AND E. U. RIKIN

Abstract

Using data collected from 46 farmers participating in the Work-Oxen Credit Model of the National Livestock Projects Division in north-eastern Nigeria, the paper examines the profitability of using credit for animal traction. Four loan repayment scenarios were simulated based on length of repayment period, with or without annual variation in farm size. The first scenario assumed a three-year repayment period with constant farm size, while the second assumed a three-year repayment period with annual farm size increase of one hectare. A repayment period of five years with constant farm size and with annual farm increase of one hectare was assumed in the third and fourth scenarios, respectively. Cash flow projections show that only the fourth scenario guarantees availability of sufficient funds for reinvestment in animal traction by the farmer at the end of the project, the fact that the use of credit was profitable (as indicated by the fact that the net present value and benefit/cost ratio) in all the scenarios, notwithstanding. It was, therefore, concluded that the ability of the farmers to sustain animal traction could be enhanced if repayment period is extended beyond the three years adopted in the Model studied and if farmers are simultaneously encouraged to gradually increase their farm sizes.

Introduction

In Nigeria, as perhaps most of Africa, manual labour remains the most dominant source of farm power, contributing up to 90% of total power input in agriculture (Musa, 1990). This high dependence on manual labour has, however, been identified as a major constraint on agricultural production (Kaufman and Blench, 1990). It is argued that the drudgery associated with the use of manual labour does not only place a premium on the farm size a farmer and his family could effectively maintain, but it also hinders timely accomplishment of farm operations, resulting in low crop yields, low agricultural output, and low farm incomes.

In any case, the prospects of continued availability of manual labour for farm work are not very bright. Philip et al. (1988) have pointed out that the rural-urban migration phenomenon has continued to drain the rural areas, of able -bodied men, while the seclusion of muslim women, as practised in most parts of northern Nigeria, precludes the availability of married women for farm work. They further reported that the free and universal education policy in Nigeria has effectively removed children from the farm.

The apparent recognition of the shortcomings and problems of manual labour has encouraged the search for alternative farm power sources in Nigeria. For instance, animal traction (AT) was introduced to Nigeria as early as 1922. Widespread adoption of this source was, however, curtailed in the 1970s when policy interest shifted to motorized mechanization. Encouraged by the oil boom of that era, successive government in Nigeria embarked on massive importation of tractors to support the mechanization policy.

What was perceived as the immediate threat to the tractorization policy was the inability of small-scale farmers to afford tractors. To circumvent this problem, federal and state government in Nigeria designed and operated tractor hiring schemes through which the small-scale farmers were expected to benefit. This, however, turned out to be a serious miscalculation. Mismanagement as well as spare parts and maintenance problems put paid to whatever ambition the country might have had for agricultural development through tractor mechanization at this stage of its development. Consequently, in spite of the huge expenditures on tractor importation, tractor contributes less than 2% of power input in Nigeria's agriculture (Musa, 1990).

Probably as a result of the failure of the tractorization policy, as well as the dwindling revenue from oil, there appears to have been a rethinking of farm power policy. Focus now appears to be shifting towards achieving widespread adoption of AT. This farm power source is considered to have great potentials in the farming systems of a developing country such as Nigeria because: (1) it requires less foreign exchange than tractors, (2) it enables farmers formerly using manual labour to increase their farm sizes, (3) it is less expensive than tractors, (4) it enables the farmer to increase his revenue base through hiring out of the animals, (5) the animals could be slaughtered for meat or sold at the end of their useful life, and (6) the animals enrich the soil with farm yard manure while they feed on crop residue.

Despite these potentials, however, the inability of small-scale farmers to afford the animals and implements required for AT has been cited as a major constraint to its widespread adoption (Bolaji, 1990; Suleiman, 1990). It is, therefore, argued that to achieve the desired level of adoption, external financial assistance to farmers is required (Suleiman, 1990; Musa, 1990).

Animal Traction and Credit

Agriculture in northern Nigeria is Characterized by a preponderance of traditional small-scale farmers who accomplish farm operations manually using hoes and cutlasses. Due to their small farm sizes and low productivity, farm incomes are generally low. As a result of the low incomes, savings are also low, resulting in low availability of capital for investment, which, in turn, leads to low incomes. The farmers, therefore, operate in a vicious circle of poverty.

But AT, although less expensive than tractors, still requires some investment capital which the small-scale farmers may not be able to afford, given their low incomes and savings (Munzinger, 1982). To promote adoption of AT among these farmers, therefore, external financial assistance is needed in the form of credit. Another characteristic of AT which makes credit very significant is the relatively low returns to investment in the first few years, which is caused by the long learning periods associated with the adoption of the technology (Jeagers and Sanders, 1988). Credit is required to overcome the cash-flow difficulties that AT users may encounter in the early period of adoption.

Research Problem

It appears that while the significance of Credit in AT adoption has not been realised. Hence, most projects aimed at promoting AT since its first introduction in 1922, have included a Credit component. One of the most recent of such projects is the Work-Oxen model. The need for credit in AT adoption in the study area is perhaps incontrovertible, the unresolved issue is what repayment arrangement to adopt, to ensure profitability and sustainability. Inappropriate repayment condition could create short-run cash-flow problems that could endanger profitability and sustainability of the technology. It is, therefore, important to conduct cash-flow and profitability analysis for farmers using borrowed capital for AT.

Methodology

The Study Area

The study covered the erstwhile Bauchi, Borno and Gongola States (now Adamawa, Bauchi, Borno, Gombe, Taraba and Yobe States) . These cover an area of 271,699Km2, or 25% of the total land area of Nigeria (Udo, 1978; Abdullahi, 1985). The area lies within longitudes 8° - 15°E and latitude 6° - 14°N. It falls mainly within three savanna ecological zones, namely, Northern Guinea savanna, Sudan Savanna, and the Sahel. Annual rainfall varies from over 1000mm in the Northern Guinea Savanna, to below 500mm in the Sahel.

Major crops grown include maize, millet, sorghum, cowpea, groundnut, rice, cotton, yam and cassava. The crops are mostly grown in mixtures of various combinations. Norman (1974) identified up to 156 crop mixtures in the whole of northern Nigeria. The study area contributes significantly to livestock production, accounting for 45% of the total cattle population in the country(Abdullahi, 1985). Livestock raised in the area also include goats, sheep, poultry, camels and horses. While most of these stocks are in the hands of nomadic pastoralists, quite a few are owned by sedentary producers. Some of the latter include mixed farmers who use work animal for cultivation. The work animals used include oxen, camels and donkeys.

The Work-Oxen Model

With financial support from the World Bank, the Work-Oxen Model was implemented by the National Livestock Projects Division (NLPD) of the Federal Ministry of Agriculture, in collaboration with the Nigerian Agricultural and Cooperative Bank (NACB). Several versions of the model have been experimented over the past few years in northern Nigeria. In the Model reported here, forty-six farmers were selected from the then Bauchi, Gongola and Borno States and credit of N10,000 extended to each of them. The criteria for selection of participants were evidence of experience in raising of livestock and ownership of a farm of at least two hectares. The farmers were also required to present two

guarantors. The loan was granted in cash and kind. The farmers were granted money to purchase two bulls, a cow, an ox-cultivator, and an ox-drawn cart. They were also expected to purchase veterinary drugs. Supplementary feeds and mineral salt licks were provided to the farmers as part of the loan. The loan was to be used to cultivate two hectares of land. The interest on the loan was 17% per annum and the repayment period was three years, with one year grace period.

Data Collection and Analysis

Data for the study were collected from 46 farmers participating in the Work-Oxen Model through a field survey conducted during the 1987/88 farming season. The bulk of the information was obtained through structured questionnaires administered to the respondents and participatory appraisal by the researchers. Data were collected on cost of cattle purchased, cost of ox-cultivator and carts, cost of farm tools, quantity and cost of farm suppliers, cost of labour, cost of drugs and veterinary care, as well as value of principal and interest payments on the loan. Information was also obtained on value of crops harvested, milk and calf sales as well as revenue obtained from hiring out of oxen. Based on the one year data collected, four loan repayment scenarios were simulated. In each case, cash flow projections were made and two discounted measures of investment worth (net present value and benefit/cost ratio) were computed.

Results and Discussion

Table 2 present the cash flow analysis under the first repayment scenario. This scenario consists of the actual loan terms in the Model reported here. It includes a loan amount of N10,000 with 17% interest rate per annum, a three-years repayment period and a grace period of one year. The loan was to be used in procuring some of the items listed in Table 1 to enable farmers to cultivate two hectares of land. At the end of the three years farmers were expected to sell the three cattle in the open market.

The cash flow projections presented in Table 2 were based on the data collected during the field survey and an assumption that prices of inputs and output increased by the same proportion (after Gittinger, 1984). The rate chosen was 27.74% per annum which was about the average annual rate of increase in consumers' price index for Nigeria in the 1980s (FOS, 1989).

As presented in Table 2, the incremental net benefits for the average farmer were N330.29, N3,252.84, and N9,168.11, in the first, second and third years, respectively, giving a total of N12,751.24 for the three years. For the farmer to be able to reinvest in AT after the end of the project, he would require capital to cover not only the fixed investment in the fourth year, but also a reasonable proportion of the operating cost and family living expenses in that year. Projections made under the assumptions in the preceding paragraph revealed that N16,117.97 was required for fixed investment in the fourth year which exceeds the total incremental net benefit at the end of the third year. This is not to mention the operating cost of N3,868.63 and family living expenses of N2,401.30 that would be required in the following year. It is evident, therefore, that unaided, farmers in the Work-Oxen Model were unlikely to be able to sustain AT beyond the three-year life-span of the Model.

The loan terms simulated under the second scenario were similar to those of the first except that farmers were allowed an annual farm size increase of one hectare starting with two hectares in the first year. The argument is that as farmers become more experienced in the use of AT, the sizes of the farms they could effectively manage, would gradually increase. It has been observed that the learning process in AT usage takes up to four to seven years (Jeager and Sanders, 1988). During the learning process, the farmer increases his expertise and could increase his holding. This is, however, only up to a certain limit which would seem to be about six hectares for a farmer using a pair of oxen under the farming conditions in Northern Nigeria (Suleiman, 1990).

The results of the cash flow analysis for the second scenario are presented in Table 3, which shows incremental net benefit in the first, second, and third years, of N330.29, N4,769.11, and N13,042.18, respectively. The total incremental net benefit for the three years, therefore, was N18,141.58. This amount exceeds the initial investment requirement estimated at N16,117.97 in year four. What this implies is that at the end of the project, the farmer is likely to be in a position to acquire a new set of cattle and implements to continue AT farming. The farmer is, however, likely to experience serious cash constraints in meeting the operating and family living expenses (which add up to N12,072.92) in the fourth year. the surplus incremental net benefit of N2,023.61, after meeting the fixed expenses, could not cover any reasonable portion of the operating cost and family living expenses.

Table 4 presents the results of cash-flow analysis under the third scenario. The loan terms in scenario one were maintained except that the repayment period was extended to five years. A five-year repayment period would seem more realistic than the three years pursued under the Work-Oxen Credit Model. This is for various reasons. Firstly, farmers require at least four years to master the use of AT (Jeager and Sanders, 1988). Three years appear to be pre-mature for terminating the project since farmers could not have completed the learning process. Secondly, literature on AT in Northern Nigeria suggests that farmers use a pair of Work-Oxen for a period not less than five years before disposing of it (Otchere et al., 1988; Bolaji, 1990; Hamza, 1990). To obtain a comprehensive measure of profitability, therefore, it is necessary to examine AT over the entire useful life of a set of oxen, instead of terminating the project at the end of three years even when the animals are still very active.

The cash flow analysis presented in Table 4 shows an incremental net benefit of N330.29, N5,752.44, N849.74, N10,904.64, and N21,094.87 in the first, second, third, fourth and fifth years, respectively. This yields a total incremental net benefit of N37,232.50. Although, this amount covers the initial investment requirement as well as operating and family living costs in the sixth year, the negative value of incremental net benefit in the third year signals some danger. Unless farmers receive external assistance, they would be unlikely to move beyond the third year, under the assumptions of this scenario.

In the fourth scenario, the third scenario was slightly modified to allow one hectare annual increase in farm size. The cash-flow analysis for this scenario is presented in Table 5 which reveals net incremental benefits of N330.29, N7,269.11, N3,024.03, N18,327.15 and N33,736.92 in the first, second, third, fourth and fifth years, respectively. The total incremental net benefit, therefore, was N2,687.50. The projected fixed investment, operating cost, and family living expenses, in year six would be N26,300.51, N18,937.99 and N3,693.16, respectively, giving a total cost of N48,931.66. Obviously, the total incremental net benefit at the end of the fifth year exceeds the projected expenses in the sixth year. This suggests that the average work-oxen farmer would be able to reinvest in AT after repaying the loan.

The discounted cash flow analysis revealed positive net present value (NPV) for all the four circumstances. In fact, NPV of N8,382.84, N11,909.35, N19,394.92, N32,648.64, and benefit/cost ratios of 1.45, 1.68, 1.76 and 1.91, respectively, were found for the first, second, third and fourth scenarios. These findings suggest that it is generally profitable to utilize credit for AT. This notwithstanding, it would appear that because of initial cash-flow problems associated with the other scenarios, only scenario four (i. e. five year repayment period with annual farm-size increase of one hectare is likely to guarantee sustainable investment in AT.

Conclusion

The results of this study indicate that utilizing credit for AT is generally profitable. It was, however, found that because of cash flow problems, a five-year repayment period with annual farm-size increase of one hectare might be more beneficial to the farmers in terms of sustainability of the AT technology, than the three-year repayment period adopted in the Model. Furthermore, to circumvent the problem of labour bottle-necks shifting to other farm operations, it is suggested that a wider range of implements be provided for the farmers, so that planting, weeding, and harvesting could also be achieved through AT. Thereafter, the cost of these additional implements should be taken into consideration deciding loan amounts to be extended for the purpose of AT. Finally, an efficient animal health service should be considered as an integral component of any AT promotion strategy.

Table 1: Costs (naira) for the Average Darmer in the First Year of the Model

S/NO	ITEM OF COST	AMOUNT (N)	PERCENT OF TOTAL
1	Cattle purchase (two bulls and one cow)	5,066.67	40.98
2	Ox-plough and Cultivator	2,666.00	21.56
3	Operating cost	1,856.00	15.01
4	Interest on loan	1,700.00	13.75
5	Family living expenses	1,073.71	8.69
6	Total	12,362.38	100

* Farmer's contribution was N2,362.38.
Source: Field Survey, 1988

Table 2: Cash Flow Analysis (Naira) for a Three-Year Repayment Period with a Constant farm size of 2 Hectares

S/NO	ITEM	YEAR 1	YEAR 2	YEAR 3
1	Out flow Operating cost	1,856.00	2,370.00	3,028.52
2	Interest	1,700.00	1,700.00	850.00
3	Principal repayment	0.00	5,000.00	5,000.00
4	Family liv. Expenses	1,073.71	1,383.79	2,139.70
5	Total out flow	4,629.71	10,454.64	11,018.22
6	Inflow Sale of crops	4,230.00	5,403.00	6,902.30
7	Sale of calves	0.00	2,171.58	0.00
8	Sale of Milk	0.00	5,200.00	0.00
9	Transport & hiring	730.00	932.50	1,191.18
10	Salvage Value of Implements	0.00	0.00	666.00
11	Sale of Cattle	0.00	0.00	11,427.15
12	Total Inflow	4,960.00	13,707.48	20,186.33
13	Incremental Net Benefit	330.29	3,252.84	9,168.11

Total Incremental Net Benefit: N12,751.24
Source: Derived from field survey, 1988

Table 3: Cash Flow Analysis (Naira) for a Three-Year Repayment Period with One-hectare Annual Increase in Farm Size

S/NO	ITEM	YEAR 1	YEAR 2	YEAR 3
1	Outflow Operating cost	1,856.00	3,556.28	6,057.06
2	Interest	1,700.00	1,700.00	850.00
3	Principal	0.00	5,000.00	5,000.00
4	Family Liv. Expenses	1,073.71	1,383.79	2,139.70
5	Total Outflow	4,629.71	11,640.07	14,046.76
6	Inflow Sale of Crops	4,230.00	8,105.10	13,804.11
7	Sale of Calves	0.00	2,171.58	0.00
8	Sale of Milk	0.00	5,200.00	0.00
9	Transport & Hiring	730.00	932.50	1,191.18
10	Salvage Value of Implements	0.00	0.00	666.00
11	Sale of Cattle	0.00	0.00	11,427.15
12	Total Inflow	4,960.00	16,409.18	27,088.94
13	Incremental Net Benefit	330.29	4,769.11	13,042.18

Total Incremental Net Benefit: N18,141.58
Source: Derived from field survey, 1988.

Table 4: Cash Flow Analysis (Naira) for a Five-Year Repayment Period with Constant Farm Size

S/N	ITEM	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
1	Outflow					
	Operating Cost	1,856.00	2,370.85	3,028.52	3,868.63	4,941.79
2	Interest	1,700.00	1,700.00	1,275.00	850.00	425.00
3	Principal	0.00	2,500.00	2,500.00	2,500.00	2,500.00
4	Family Liv. Expenses	1,073.71	1,383.79	2,139.70	2,401.30	2,891.15
5	Total Outflow	4,629.71	7,954.64	8,943.22	9,619.93	10,757.94
6	Inflow Sale of crops	4,230.00	5,403.00	6,902.30	8,817.00	11,262.84
7	Sale of Calves	0.00	2,171.58	0.00	3,543.48	0.00
8	Sale of Milk	0.00	5,200.00	0.00	6,642.48	0.00
9	Transport /Hiring	730.00	932.00	1,191.18	1,521.61	1,943.74
10	Salvage Value of Implement	0.00	0.00	0.00	0.00	0.00
11	Sale of Cattle	0.00	0.00	0.00	0.00	18,646.26
12	Total Inflow	4,960.00	13,707.08	8,093.48	20,524.57	31,852.81
13	Incremental Net Benefit	330.29	5,752.44	849.74	10,904.74	21,094.87

Total Incremental Net Benefit: N37,232.50

Source: Derived from Field Survey, 1988.

Table 5: Cash Flow Analysis (Naira) for a Five-Year Repayment Period with One-Hectare Annual Increase in Farm Size

Item	Year 1	Year 2	Year 3	Year 4	Year 5
1. Oper-cost	1,856.00	3,556.28	6,057.06	9,671.62	14,825.42
2. Interest	1,700.00	1,700.00	1,275.00	850.00	425.00
3. Principal	0.00	2,500.00	2,500.00	2,500.00	2,500.00
4. Family Liv. Exp.	1,073.71	1,383.79	2,139.70	2,401.30	2,891.15
5. Total Out flow	4,629.71	9,140.07	11,971.76	15,422.92	20,641.57
Inflow					
6. Sale of crops	4,230.00	8,105.10	13,804.61	22,042.50	33,788.52
7. Sale of calves	0.00	2,171.58	0.00	3,543.48	0.00
8. Sale of Milk	0.00	5,200.00	0.00	6,642.48	0.00
9. Transp/Hiring	730.00	932.50	1,191.18	1,521.61	1,943.71
10. Salvage value of implement	0.00	0.00	0.00	0.00	0.00
11. Sale of Cattle	0.00	0.00	0.00	0.00	18,646.26
12. Total Inflow	4,960.00	16,409.18	14,995.79	33,750.07	54,378.49
13. Incr. Net Benefit	330.29	7,269.11	3,024.03	18,327.15	33,736.92

Total Incremental Net Benefit : N62,687.50

Source: Derived from Field Survey, 1988.

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FEEDING THE FAMILY: NUTRITIONAL PERSPECTIVE

BY

G.M. AKOGUN (MRS.)

Abstract

Food is one of the necessities of life. It is not enough to just eat but to eat food that is well balanced in order to be healthy.

Therefore, attempt will be made in this paper to highlight the food composition, nutritional needs of family members and meal management.

Introduction

Food can be regarded as the nutritive materials taken into the body to keep it alive and enable it to grow (Whitney & Hamitton 1981). For optimum nutrition adequate diet is necessary for individual. One obtains nutrients which undergo many transformation and arrangements in the body from food. Food is basic to existence because man must eat to live, and what he eats will affect his ability to live long. Robinson (1978) indicated that next to the air you breathe and water you drink, food has been basic to your existence.

Composition of Food

Whitney et al (1981) expressed that:

> Almost any food you eat is composed of dozen or even hundreds of different materials, tinier by far than the smallest things that can be seen with most powerful microscope, they are atoms and molecules" (p.4).

Foods are composed of six major nutrients namely -carbohydrates, proteins, fats, vitamins, minerals and water.

1. **Carbohydrates**

Peckham and Graves (1979) gave the literal definition of carbohydrates as hydrated carbon, that is carbon and water. This is so because the hydrogen and oxygen atoms in carbohydrates usually occur in the same proportion as they do in water.

The food we eat comprises of between 50 - 60% carbohydrates. They are referred to as sugars and starches. They are cheap and they store well. Carbohydrates provides energy to the body. The food sources include cereals and tubers.