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TECHNOLOGICAL AND ECONOMIC CONSTRAINTS TO ANIMAL TRACTION IN NIGERIA.

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ABSTRACT

In spite of the efforts being made to popularises animal traction in Nigeria, the desired widespread adoption of the technology by farmers has not been achieved. This paper examines some of the technological and economic constraints to widespread adoption of animal traction by farmers. Some of the technological problems identified include non-availability of a wide range of implements for farm operations other than land preparation, lack of diversification in the use of animals, poor knowledge of animal husbandry practices and poor animal health services. The economic problems discussed include the relatively high initial investment cost, deferred earnings and the lack of significant increases in crop yield over manual farming. A number of solutions are proffered for alleviating these problems.

1.0 INTRODUCTION

Power at the farm level is one of the most limiting factors to crop production in most of the developing world. In Africa, the available farm power is estimated at 0.08 Kw/ha which falls far short of the estimated requirement of 0.37 Kw/ha (Giles, 1975). In Nigeria, 90% of the farm power input is manual, while drought animal and tractor power contribute 8% and 2%, respectly (Musa, 1990).

This high dependence on manual labor has, however, been identified as a major constraint on agricultural production (Kaufman and blench, 1990). It is argued that drudgery and slow speed associated with the use of manual labor places a premium on the farm size a farmer and his family could effectively maintain. Furthermore, labour bottleneck during critical farm operations has been identified as one of the causes of low crop yield under traditional farming in northern Nigeria (Norman, 1972; Phillip et al., 1986)

Apparently recognising the shortcomings of manual labour, alternative sources of farm power have been explored by various governments in Nigeria. Animal traction was introduced to Nigeria as early as 1920s (Musa, 1990; Badawi, 1990; Mijindadi, 1990). Widespread adoption of this source was however curtailed in the 1970s when policy interest shifted to motorized mechanization (Badawi, 1990; Suleman, 1990). Encouraged by the oil boom of that era, agricultural development planners in Nigeria embarked on massive importation of tractors to support the mechanization policy.

In order to make tractors available to farmers, tractor hiring schemes were established in various states. Most of the schemes failed for various reasons (Phillip et al., 1988). In spite of the huge sums of money spent on the tractorization

strategy, only about 2% of the farm power input in Nigeria is obtained from tractors (Musa, 1990; Alhassan, 1990). Probably as a result of the failure of the tractorization policy, as well as the dwindling revenue from oil, focus in recent times appears to be shifting back to animal traction (Alhassan, 1990). Available evidence suggests that animal traction has high potentials in the farming systems of a developing country such as Nigeria (Phillip et al., 1988; Bolaji, 1990; Suleiman, 1990; Kaufmann and Blench, 1990).

Nevertheless, the expected widespread adoption of the animal traction technology has not been achieved (Phillip et al., 1988); the fairly long history of introduction and the renewed interest in it notwithstanding. The principal aim of this paper is to discuss the constraints to animal traction adoption in Nigeria from economic and technological perspectives. Also examined are the potentials of animal traction in the Nigerian farming systems, and recommendations are made for promoting widespread utilization of the technology.

2.0 POTENTIALS OF ANIMAL TRACTION

Since animal traction is largely based on locally available resources, it appears to have great potentials for sustainable increase in agricultural production in a developing country, such as Nigeria. Another significant advantage of animal traction is that it allows farmers, originally using hand hoes, to increase farm sizes. It has been noted that under the farming systems in northern Nigeria, a man and his family with a pair of bulls can handle four to five times the area of a hand-cultivated farm (Phillip et al., 1988; Mijindadi, 1990). It is also argued that since animal traction permits more timely accomplishment of farm operations and better soil tilth, it gives higher yields when compared to manual farming with hoe and cutlass. There is, however, a lack of consensus in the literature on this argument. For instance, Francis (1988), Spencer (1988), Panin and de Haen (1989), and Seifert (1993) have all maintained that the yield increasing effects of animal traction are not clear. In a study in Mali, Jolly and Gadbois (1996) found that animal traction increased the yield of cotton but decreased the yields of cereal crops. Also, a study conducted in West Africa by Jaeger and Matlon found no significant difference in yields of Sorghum, Millet, Maize, Peanut and cotton between manual tillage and animal traction, in the Sahelian Zone. However, significant differences were observed in the yields of sorghum, maize and peanuts in the Sudanian Zone. They found that only cotton and sorghum showed significant yield differences in the Guinean Zone.

The integration of animal traction with arable farming could be regarded as a "work-manure-meat" phenomenon (Suleiman, 1990). There appears to be a symbiotic link between the keeping of work on the one hand, and the growing of crops, on the other. Animal traction enhances crop production through the accomplishment of farm operations and by adding manure to the soil. Crops, in turn, provide feed for the animals in the form of greens, grains or residue. Furthermore, when eventually the animals are considered unsuitable for further farm work, they could be slaughtered for meat or sold to earn additional income,. It is significant to note that work animals appreciate with use and a farmer selling at the end of "useful" life of the animals should obtain higher prices than the original cost price. For instance, Gefu et al., (1988) have reported that farmers in northern Nigeria obtained salvage values of between N600 and N2700 on a pair of work-oxen

which were more than sufficient to acquire a pair of young bulls as replacement.

Animal traction also enhances the income of the farmer especially when work animals are hired out to other farmers for farm operations. The farmer could also use the animals for threshing grains, turning water wheels, and pulling loaded arts, or hire them out for similar purposes and earn extra income. Gefu et al., (1988), found that farmers earned between ₦295 and N1400 which they considered quite modest for a rural household.

When compared with tractor, animal traction is cheaper and more compatible with small-holder farming systems such as obtain in northern Nigeria. In addition, work animals and their implements could be obtained locally as opposed to the tractor which has to be imported. Animal traction, if widely adopted, could therefore save scarce foreign exchange in terms of reduced expenditure on importing tractors and accessories.

3.0 TECHNOLOGICAL AND ECONOMIC CONSTRAINTS

Despite the apparently good potentials of animal traction and its success elsewhere, it has not been widely adopted in Nigeria (Phillip et al., 1988). The question is : why?

3.1 Technological constraints

3.1.1 Narrow Range of Implements

One of the reasons often adduced for low adoption rate of animal traction is the narrow range of implements available to animal traction users. In Nigeria, the implements available are limited only to the ridger, ox-drawn carts, and sometimes ploughs made by local blacksmiths (Starkey, 1988s; Mijindadi, 1990; Medupin, 1990). Implements for planting, weeding and harvesting have not been widely adopted. According to Starkey (1988a), efforts by projects to promote the use of multipurpose toolbars have been generally disappointing. Consequently, rather than being a labour saving device, it is contended that animal traction is actually a labour shifting technology (Mijindadi, 1990); while it frees labour during the land preparation, it creates labour bottle-necks during other operations since the farmer now has to cope with planting, weeding and harvesting large plots of land manually.

A number of reasons could be adduced for the non-adoption of multipurpose toolbars. One of these is that the implements were manufactured in Britain and were not compatible with the environment and farming systems in Nigeria (Bansal et al., 1988).

In a linear programming analysis of animal traction in northern Nigeria, Philli et al., (1988) indicated that because of labour bottlenecks during the period of weeding and harvesting, the average farmer could not handle more than 2.91 ha with a pair of oxen if he expects maximum returns. This is in sharp contrast with the 8 to 10 ha a farmer could effectively cultivate if implements for weeding and other operations were available (Mijindadi, 1990). In addition, restricting the use of work animals mainly to primary cultivation implies that the animals are not fully engaged throughout the year. It therefore seems that the use of single purpose (primary cultivation) implements alone hinders the realization of the full potentials

of animals traction in Nigeria. The challenge to agricultural engineers in Nigeria therefore, is to design and develop a range of animal-drawn implements which are adapted to the farming systems and affordable to the small-scale farmers.

3.1.2 Tractorization

The oil boom experienced in Nigeria in the 1970s also contributed to the low level of adoption of animal traction. Prior to the oil boom phenomenon, animal traction was gaining popularity since its introduction to the country in 1922. With huge revenue in foreign exchange from oil, attempt was made to jump the technological gap directly from traditional hoe farming to tractor mechanization as animal traction was considered primitive and a symbol of backwardness (Kaul, 1990). The tractor mechanization policy led to massive importation of tractors into the country and to the establishment of various tractor-hiring schemes. This diverted attention away from animal traction. But by the mid-eighties, the euphoria about tractor mechanization began to fizzle out following the failure of the ambitious tractorization schemes, coupled with the decline in the international prices of crude oil. It is in the light of these problems that the animal traction programme is seriously being reconsidered.

3.1.3 Lack of Diversification in the use of animals

The animal category most commonly used for AT in Nigeria is cattle. In a survey if animal traction utilization in Kaduna State, Otchere et al., (1988) found that all the respondents utilized Bunaji (white Fulani) bread of cattle for both cultivation and transportation. In a few areas, donkeys are also being used for cultivation in addition to their traditional roles as pack animals (Starkey,1988a). But this is on a limited scale; the major type of draft animal remains the oxen which are mostly used in pairs. The use of oxen alone is a constraint to the adoption of animal traction since they are more costly than other animals. For the realisation of the full potentials of animal traction, it is necessary to actively involve such other animals as the camel, donkey, and horses. In addition the use of single animals such as an ox, instead of a pair of oxen needs to be seriously considered to enhance affordability. Alhassan (1990) and Starkey (1988b) have even suggested the use of female animals for tractive purposes.

A possible threat to the various proposals on diversification of animals might be non-availability of matching implements. Fabrication of appropriate implements, hardness, and yoke for different classes of livestock, therefore, should be seriously considered.

3.1.4 Poor knowledge of Animal Husbandry Practices

Another constraint to animal traction adoption in Nigeria is inadequate knowledge of animal husbandry practices. Although there is a tradition of livestock ownership in northern Nigeria, most of the livestock used for animal traction (cattle, camels and donkeys) are owned and controlled by nomadic pastoralists with limited interest in arable farming. Majority of arable farmers do not keep livestock and introduction of work animals into their farming systems is a new phenomenon. Training and extension is thus very crucial to any strategy aimed at promoting widespread animal traction.

3.1.5 Poor Animal Health Services

Veterinary services in Nigeria, which are generally provided by government have all but collapsed (Kela, 1991). Relating ICRISAT's experience in promoting animal traction in the semi-arid Tropics, particularly India and West Africa, Reddy (1988) reported that due to poor animal health services, high mortality rates (as high as 40%) of work animals caused many farmers to revert to manual tillage practices after experimenting with animal traction. In Nigeria, unless veterinary services are improved, widespread adoption may be difficult to attain because of the prevailing high livestock mortality rates.

3.2 Economic Constraints

3.1.6 High Initial Investment Cost

High initial investment cost has been cited as one of the most serious constraints to animal traction adoption (Reddy, 1988; Reynolds, 1988; Suleiman, 1990). A recent survey in Sokoto State reveals that a farmer will require about N50,000 to acquire a pair of oxen, ridger and accessories. Most small-scale farmers cannot afford this amount, given their low income and savings (Munzinger, 1982). To promote adoption of animal traction among these farmers, therefore, external financial assistance is needed in the form of credit.

3.2.2 Deferred Earnings

According to Reddy (1988), realisation of the full benefits to new adopters of animal traction is often deferred for many years because of the associated long learning periods. He maintained that as long as eight years may elapse before investment in animal breaks even. This is further corroborated by the findings of Jaeger and Matlon (1990) who used regression technic to estimate the learning curves associated with animal traction adoption in West Africa. The curves are reproduced in Figure 1 which shows that land area cultivated continued to increase as farmers became more accustomed to the technology for up to eight years in the case of land scarce Sahel.

Baba and Rikin (1996) have also investigated the structure of returns to animal traction among farmers participating in the 'Work-Oxen credit Model' of the National Livestock Projects Division (NLPD) in north-eastern Nigeria. They made cash flow projections over three and five years repayment scenarios. Some of their findings are presented in Tables 1 and 2 which show that returns (incremental net benefits) were low in the first few years but increased over time. Obviously, the benefits of animal traction increased as the farmers became more accustomed to the technology.

The implications of long learning periods and low returns in the first few years is that farmers may experience short-term cash flow problems which may deter them from further use of animal traction. This further underscores the need for credit in animal traction promotion strategies. In fact the NLPD appears to have recognised the significance of credit and has integrated credit into its animal traction strategy. However, a repayment period of three years as stipulated in the model examined in the above-mentioned study, appears to be too short since farmers will still be in the learning period. As earlier indicated, learning periods may continue for up to eight years. Credit strategy for animal traction should not

carry a repayment period term of less than five years. In fact, eight years or more appears to be more ideal.

3.2.3 No Significant Difference in Yield

It is generally accepted that the adoption of animal traction increases farm size thereby enabling higher output levels. However, empirical findings have not demonstrated significant differences in crop yield between animal traction and manual hand hoe farming (Spencer, 1988; Reddy; Jaeger and Malton, 1990). A major determinant of technology adoption is the expected yield or returns per unit area associated with the technology. If animal traction shows no significant increase in crop yield over manual hoe farming, it would be difficult to persuade farmers to adopt it.

A possible explanation for the low yields may be the non-diversification in implement usage which prevents the achievement of the full potentials of animal traction. This further underscores the urgent need for fabrication of a full range of implements to enable the accomplishment of most farming operations with animal traction.

4.0 RECOMMENDATIONS AND CONCLUSION

The study has identified a number of technological and economic constraints to animal traction utilization in traditional farming. These include non-diversification in animal traction implements, non-diversification in animal usage, absence of effective animal health services, poor knowledge of farmers in animals husbandry, high initial costs, deferred returns and low crop yields. Concerted engineering research is therefore needed for local fabrication of a full range of implements for different farm operations and different types of tractive animals. In addition, introduction of animal traction should be accompanied by effective extension, not only to train farmers on animal traction utilization, but also on animal husbandry practices. The agencies responsible for populating animal traction may need to provide adequately trained specialists to undertake this job and should not unduly rely on the Unified Extension System whose extension personnel appear to be overwhelmed by simultaneously trying. to provide solutions to all farming problems of the farmer. The introduction of animal traction should also be backed-up with efficient animal health services. Finally, credit with realistic repayment terms should be treated as an integral part of the animal traction strategy.

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Table 1: Cash flow analysis (Naira) for a three-year repayment period with one-hectare annual increase in farm size.

	Items	Year 1	Year 2	Year 3
	Outflow			
1.	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**
Inflow				
6.	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**

Source: Baba and Rikin (1996).