The Potential and Development in Animal Transport Devices

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Abstract

This paper examines the status and potential of animal power in the development of rural transport. Data on travel in rural communities show that the trips most frequently undertaken are for farming and domestic needs. Of the trips, 82% of the trips are between 0 and 5 km, 10% are between 6 and 20 km and 8% of the trips are above 50 km. The variety of animal-drawn equipment including transport devices is limited and has design deficiencies which limit efficient usage. Widespread ownership of animals and transport devices will be more attractive when animals are also engaged in other activities.

Introduction

Available data on public expenditure show that governments in developing countries have always accorded transport high priority but major emphasis has been on conventional highways and their associated motorised vehicles. However, it is becoming obvious that the simpler transport systems will continue to serve as supplementary devices. One of these is the animal-powered transport system, intermediate between human power and the motorised power transport systems.

In Nigeria, as in other developing countries where the majority of the population live in rural areas and on subsistence farming, animal power is cost-effective and has a unique position. However, the animal is only one part of the animal transport system. The other basic component is the machine. Very often the role of the machine is grossly underestimated.

This paper therefore examines the potential of the animal as a source of power for transportation and the current status of transport devices.

Household Travel Characteristics with Focus on the Rural Community

In developing countries, the bulk of the population live in the rural areas, often in widely scattered communities with poor transport systems. Studies by Barwell (1979), Idachaba (1980), and Howe (1983) have indicated that the distance of health and educational (etc) facilities in the rural areas is aggravated by poor communications. Transport is therefore more important in the rural community than in the urban where activities and services are more accessible. The major transport needs of the rural population may be categorised as follows (Adeoti et al. 1989):

1. Trips to farm–70%
2. Trips to market –11%
3. Trips for domestic needs other than farm and market- fetching water, firewood, local building materials etc – 6%
4. Trips for social, religious or recreational activities – 9%
5. Trips to school (teachers and pupils), hospital (patients and staff), administration (village head), etc. – 4%

In terms of trip length, on average the frequency of all trips undertaken for short (0-5km), medium (6-20km) and long (above 20km) distance trips were 82, 10 and 8% respectively with over 80% of the trips being shorter than 3km (Adeoti et al. 1989).

Results from other developing countries indicate similar trends (Barwell 1979; Howe 1983). In Kenya and Mexico, most of the trips were within the area of the village, with 75-80% less than 7km in length. In India trips to and from the farm dominated (80%) with those for domestic needs 15% and to market 5%. Long-distance trips in Kenya and Tanzania were described as being 'compulsory' visits to facilities not available in the village such as hospitals, or for social functions.

It is obvious that there cannot be a vehicle which meets all a community's travel needs, so a choice of transport must be provided. Within the existing transport infrastructure, the devices include the

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manual, animal, and mechanical systems. The alternative transport systems are given in Table 1.

Potential of Animal Power for Transportation

Animal power is the next stage after manpower in the progression to basic vehicles. The animals used for transport purposes include the horse, mule, donkey, ox, buffalo and camel.

Draught power varies with type, size, care (feeding, environment) and animal, type of harness and period during which animals are used (Hussain 1980). In all cases,the available power is much greater than that which can be generated by human beings (up to 0.1 kW). The unique advantage of animals in rural transportation especially for haulage of loads over short distances is the ability to travel over a wide range of terrain (Table 1).

A disadvantage of animal haulage is its low speed, but speed is not a crucial factor in rural areas. Even in cities where time is not a constraint, animal haulage over short distances is economical. In India, for example, the bullock-cart is still the main means of handling and transporting agricultural products.

Development in Animal Drawn Transport Devices

The use of animal traction for transport is either in 'packing' or 'carting' form. 'Packing' is carrying loads on the back, and is of major importance in steep, rocky or sandy terrain, or on paths too narrow for wheeled transport.

Carrying loads on the back limits the maximum quantity of the load an animal can convey in comparison to what it can pull. Donkeys can carry about 70-120kg load per trip, but they can pull up to 5 times this load (Musa 1978).

The only equipment required is a carrying container or saddle. generally consisting of cord lashing, though often bags or wicker baskets are used. These containers are usually made of local materials.

Animal Carts

There are 2 types of basic design:

Chassis above wheels. This has small diameter wheels in order to have a low centre of gravity for stability. It has the advantage of a shorter wheel to wheel distance and the ability to operate on narrow paths.

Table 1. Characteristics of Alternative Transport Systems for Rural Areas (Howe 1983; Adeoti 1988).

	Transport Systems/ Vehicles	Characteristics			
		Load Capacity (Kg)	Speed (Km/h)	Distance (Km)	Effective Width of track
A.	Maual system				
	Human Porterage	40–50	4–6	5	unlimited
	Wheelbarrow	100–120	3–4	3–5	wide/limited
	Hand cart	400–700	3–4	3–5	wide/limited
	Bicycle with carrier	60–100	10–15	40	unlimited
	Bicycle with trailer	100–120	8–12	40	limited
B.	Animal system				
	Packanimal	80–150	3–5	20	unlimited
	Animal (cart)	400–2000	3–5	20	limited
C.	Motorised system				
	Motorcycle	150–200	30–80	100	unlimited
	Motorcycle with trailer	100–250	30–50	100	limited
	Cars	100–200	40–100	100	limited
	Pick-ups	1000	40–80	100	limited
	Tractor-trailer	2000–3000	25–40	50–100	limited

Chassis sitting directly on the axle. These carts are generally wider and can only be used on wider paths. but the stability and manoeuvrability are better. This is the more widely used form.

In Asian countries, the traditional cart's salient features include two large diameter (1-1.75m) wooden spoked wheels, each enclosed in a forged iron axle with very loose-fitting steel bushes. The axle is contained in a wooden block on to which is fitted a wooden platform. This is drawn with a simple yoke to which a pair of bullocks or buffaloes is harnessed. These carts generally operate on muddy tracks but cause damage to surfaced roads because of high contact pressure at the rim. To avoid/reduce this damage, an alternative design has been introduced : the pneumatic tyre-type with ball bearing. The whole assembly is fitted to a specially fabricated steel wheel. It has been estimated that such carts can carry loads up to 2.5 tonnes (Barwell 1979).

The use of animal carts is less widespread in Africa even in areas where animals are used for cultivation. Recently, there has been renewed interest in animal transport, especially in efforts to develop improved animal carts, notably in India and on a limited scale in Malawi, Nigeria and Senegal.

The Indian Institute of Management (IIM), has developed an improved ox-cart, the Yaatra ox-cart (Deshpande 1988). The cart is for passenger transport and incorporates some modern design features such as:

1. Coil spring shock absorber unit which protects the animal's neck and hump from shock load to avoid injuries.
2. Helical coil spring-mounted cushion unit, slowing-down device.
3. Tarpaulin-hood to protect passenger from sun and rain.

The cart has a maximum payload of 550kg or 10 adult passengers on a tarred road, while it carries 412 kg on off-the-road terrain and 150 kg on loose field terrain.

In Nigeria, the Institute for Agricultural Research, Samaru, developed an ox-cart (Schneider 1967) which can be adapted by using different yokes to hand-pushed, ox-drawn or tractor- trailer. An indigenous established manufacturer, John Holt Agricultural Engineers, Zaria, has been manufacturing and marketing these ox-carts with yoke, along with other animal-drawn equipment.

Also, the Intermediate Technology Development Group (ITDG), U.K., under its Transport Programme, has made tremendous contributions recently in the development of low cost transport technologies (Barwell 1980).

Criteria for Successful Expansion of Animal-Drawn Transport

Devices

Despite the potential of animal power, studies (Howe 1983; Adeoti 1988) have indicated that only a few people own animals, especially in West Africa. Reasons for this may include:

1. Devastating animal diseases such as trypanosomiasis once endemic throughout tropical Africa, and the more recent cattle-killer rinderpest.
2. Lack of experience in training and caring for animals.
3. The limited use of animals for other activities such as weeding, harvesting etc due to shortage of appropriate implements and information.
4. The difficulty in maintaining the animal during the dry season due to feed shortages.

The use of animal power for transport, then, can be successfully expanded in the following ways:

Improved Animals

It is desirable to breed traits which influence draught power, resistance to animal diseases, and other environmental factors. There is need for research on health and nutrition, especially in view of the acute shortage of food during the dry season.

Improved Animal Power Utilisation

Animal power can be used for ploughing, harrowing, planting, transportation etc. and to drive stationary machines such as threshers, water-lifting devices, etc. The existing tools are yet to be proven for local appropriateness. Therefore, one of the first steps for improving animal power utilisation involves adaptive research on the existing tools and development of other tools.

Availability of Appropriate Transport Devices/Attachments

The pack bags/lashings, made of local materials, for local use, are virtually unknown elsewhere. The techniques and designs should be studied to see if they are capable of more general application. The major deficiencies of the existing animal carts have earlier been discussed. Some of the improvements that can be made to the basic components of carts are the provision of smooth bearings on axles,

improved yokes and collars, and the addition of brakes.

Improved Manufacturing and Repair Facilities

The relevant manufacturing industries include medium-sized urban industries and cottage manufacturers, i.e. the blacksmiths. The former undertake the production of the more complex parts; the latter look after the simpler components and repair and maintenance of the devices.

Improved Credit Facilities

The government should assist by providing credit facilities to rural people. The credit need not be in cash but in the form of an animal and its associated implements. This type of credit has been successfully practised in some parts of Nigeria.

Improved Extension Facilities

The training of animal owners/users, staff of cottage industries etc. forms part of the needed extension service. The impact of the extension service has not been felt in the rural areas hitherto,probably due to inadequate funding, staffing and training.

Conclusion

Animals can provide a good source of power for transportation as rural transportation is characterised by low-load requirement, short trip distance, and is mostly on non-motorable roads. However, ownership of animals is limited as is the range of their equipment, given the described design deficiencies.

The ownership and potential of animal power for rural transportation would be enhanced if animals were engaged in other productive activities.

Résumé

Cette communication fait le point sur l'état et les possibilités de l'utilisation de l'énergie animale dans le développement du transport en milieu rural. Il ressort des données sur les trajets effectués en zone rurale que les déplacements les plus fréquents s'effectuent pour des raisons d'ordre agricole et domestique. 82% des trajets couvrent une longueur de 0 à 5 km; 10% de 6 à 20 km et 8% plus de 50 km. Le matériel de trait, matériel de transport compris, est peu diversifié. Il n'est pas utilisé de manière absolument efficace à cause des défauts qu'il comporte au niveau de sa conception. Il faudra que l'utilisation des animaux s'étende à d'autres activités pour qu'il apparaisse intéressant de posséder des animaux et du matériel de transport.

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