

ARNOLD P. WEINROTH, PH.D.
MALAWI HANDCART PROJECT
544 EIGHTH STREET
BROOKLYN, NEW YORK 11215
USA

HUMAN AND DRAUGHT ANIMAL POWER IN CROP PRODUCTION

**EXPERIENCES, PRESENT STATUS
AND RESEARCH PRIORITIES**

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Paper 3.11

Human and Animal Powered Transport in Rural Communities in sub-Saharan Africa

Author: R.A. Dennis; Full paper: 9 pages

Introduction

Transport for domestic and agricultural purposes in rural communities in sub-Saharan Africa (SSA) require as much as 280-900 hours/year/adult. This occupies up to 3 hours per day and the loads transported are equivalent to 100 kg-km per day. At least 65% of this transport burden is carried by women and the domestic transport demand is 4 - 6 times that for agriculture.

The paper gives a brief description of the different types, uses and characteristics of both human and animal-powered modes of transport found in SSA. These are discussed mainly from a technical point of view. Non-technical issues such as affordability, acceptability and availability of credit may often be more difficult to overcome than the technical problems.

Role of transport

I.T. Transport has prepared a study for the World Bank on the role of transport for domestic and agricultural purposes in a number of sub-Saharan African countries. Table 3.5 gives some of the typical data provided by this study.

Most transport activities involve only short trips around the village and take place on earth roads, tracks and paths.

The most important tasks are:

- Collection of water, taking 30 - 35% of the active time spent on transport and the collection of fire wood, taking 30 - 35% of the total. Both these activities are mainly carried out by women (using headloading), who typically use about 20% of their active time on transport.
- Agricultural transport takes up only 12 - 25% of the total and includes transport of seeds, fertilisers, manure, surplus products to markets etc.

Table 3.5: Transport characteristics in SSA countries.

TYPE OF TRANSPORT	TIME SPENT IN TRANSPORT HOURS/YEAR	TRANSPORT EFFORT TONNE-KM/YEAR
Domestic - mainly water and firewood collection	600 - 1500	20 - 60
Agricultural transport	200 - 450	6 - 10
Social purposes - health, visits	180 - 600	-
Total per year per household	1200 - 1500	30 - 65
Total per year per adult	280 - 900	7.5 - 25

Modes of transport

The different transport modes described in the paper are summarized below and table 3.6 gives the main characteristics.

Human carrying methods such as head-loading are the most common in SSA. Back loading and use of shoulder poles and some of the other techniques found in Asian countries are not so common in SSA, possibly due to different cultural attitudes. People often carry more than the recommended maximum load of about 40% of bodyweight, which can lead to injuries and ill health.

Wheel barrows and hand carts can be much more efficient than carrying in their use of human energy as compared to carrying but this depends on the ground surface and the quality of the axle/wheel assemblies.

Bicycles are widely used in Africa for personal transport and for just carrying loads. The bicycle is the most efficient means of human powered transport and is particularly suited on narrow but firm tracks and paths. Its higher speed can also reduce travelling times and extend travelling ranges. There is considerable potential for modified bicycles with increased carrying capacities. Cycle trailers are being used on a limited scale only in SSA.

Animal powered transport relieves the human burden and releases human energy for other tasks. As it is usually controlled by the male members of the household it can relieve women of part of their transport duties. However, introduction of this type of transport into areas where animals are not already kept by communities involves considerable difficulties. The most common types of animal powered transport are summarized below:

- * Pack-donkeys are widely used in northern Africa. They can carry loads up to 20% of their body weight and can work in hilly terrains where wheeled vehicles cannot operate.
- * Ox-drawn sledges, often a forked branch of a tree, are attached to the yoke by a chain. They have a low carrying capacity and their use is discouraged in some countries as they can cause erosion of tracks and paths.
- * Donkey or ox-drawn carts are the most effective because of their higher load capacities reducing the number of trips needed. Performance of carts is greatly influenced by wheel-axle assemblies.

Table 3.6: Characteristics of modes of human and animal powered transport.

MODE OF TRANSPORT	TYPICAL LOAD	AVERAGE SPEED (km/hr)	FEASIBLE DAILY RANGE (km)
Human Carrying: Head Back Shoulder-pole	In practice up to 80 Recommended maximum 30 to 40	4 to 5	15 to 20
Wheelbarrow	80	3 to 4	5 to 6
Handcart	200 to 250	3 to 4	10 to 12
1 person	400 to 500	3 to 4	10 to 12
2 person			
Cycle with carrier	30 to 40	12	40
Cycle trailer	200 to 250	10	30
Donkey	50 to 70	4 to 5	20
Pack			
Cart (single donkey)	300	4 to 5	20
Ox-drawn sledge (2 oxen)	200 to 300	2 to 3	15
Ox-cart (2 oxen)	800 to 1,000	3 to 4	20

Paper 3.32

Human Powered Garden Carts; Appropriate Farm Transportation
Author: A.P. Wendroff; Full paper: 5 pages

Appropriate Farm Transportation

Transportation is a crucial factor in crop production and, in Africa, farm transport has traditionally meant carrying loads on heads, shoulders, backs and arms. The few load carrying innovations to date include head-rings and pads to cushion hard loads, slings, nets and cordage to bundle loads, and pots and baskets to carry loose solids and liquids.

Although development efforts have created extensive road networks, wheeled transport remains unavailable to most farmers, motor vehicles and ox-carts being beyond their reach. The inability to transport their crops to markets prevents many farmers from entering the market economy.

A farmer's efficiency is greatly diminished by a lack of wheeled transport. Most of the 'development' that has been done is based on European models, where there is no great tradition of long-haul human transport but where in previous times, pack animals and animal-drawn vehicles have been used. The wheel-barrow has come into limited use in some areas, but although affordable, it has not been widely accepted because it is suited only for short hauls. Its single wheel, placed at one end of its frame, requires the operator to lift approximately half the combined weight of both barrow and load, making it impossible to wheel heavy loads over any appreciable distances.

In contrast, Asia has a long tradition of human-powered vehicles for long distance transport. The success of these vehicles is attributable to their light weight and to balancing the load over the wheel(s). Their inherent utility has been proven and refined for over a thousand years, and is an example of a mature technology. Yet the transfer of this eminently appropriate form of transportation technology to Africa has yet to be effected.

The 'garden cart' widely sold in the USA, is similar in its essentials to the Chinese model. The carrying capacity is about 180 kg on firm level ground, using a single operator. The load is carried by the axle/two wheels and the operator merely propels the cart, with no need for lifting. These garden carts are suitable for smallholder farmers because they allow one person to easily move heavy and bulky loads over distances of many kilometres. In addition they are affordable, light weight and 'handy', configurable to suit local conditions, and can be maintained and repaired by unskilled labour.

The author took a sample set of wheels and axle to Malawi in July 1992 and employed a village carpenter to construct a garden cart. Various people were asked to use the cart for a variety of applications, including haulage of bricks, firewood, sand, furniture, grass, coffee and fertilizer. The demonstration was a resounding success and there is no doubt as to the utility of this cart for crop production and allied applications.

Animal drawn farm carts are not a practical proposition for most smallholder farmers in Malawi, and, by extrapolation, to most smallholder farmers in Africa. Donkeys and oxen are expensive, and compete with humans for increasingly scarce land and vegetation. Draught animals have to be trained, fed, watered, pastured and harnessed in order to be of use. On the other hand, the garden cart need merely to be picked up and loaded.

Furthermore, the capital investment in an ox-cart and oxen is many times that needed for a garden cart.

As the objective of the Workshop is to "identify future research and development needs to make more efficient use of muscle power", the introduction of the wheel (in the form of the garden cart) to the masses of the farmers, should be its first priority.