

HUMAN POWERED GARDEN CARTS: Appropriate Farm Transportation.

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Transportation is a crucial factor in crop production. African farm transport has traditionally meant carrying loads on heads, shoulders, backs and arms. The few load carrying innovations 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. This is the typical unsatisfactory state of African farm transport today.

Although development efforts have created extensive road networks, wheeled transport remains unavailable to most farmers. Motor vehicles and ox carts are beyond the reach of subsistence farmers, who are often unable to afford even a bicycle; a vehicle which in any event is not suited to the demands of crop production, despite efforts to perch bulky loads on or within its frame. It is a fact that most road traffic in Africa is pedestrian traffic, and the vast majority of farm transport is carried by the farmers themselves. (See attached table for person to vehicle ratios in Africa and elsewhere.) The inability to transport their crops to market prevents many farmers from entering the market economy.

A farmer's efficiency is greatly diminished by a lack of wheeled transport. African farmers are eager to utilize wheels, but they are seldom available. The wheelbarrow has come into limited use in some areas, but although affordable to some, it has not been widely accepted because it is suited only for short hauls. Although widely used on construction sites, its single wheel, placed at one end of its frame, requires the operator to lift half the combined weight of both barrow and load. This makes it impossible to wheel heavy loads over any appreciable distance without exhausting the operator.

Most 'development' has been, and is presently based upon, 'European' models. Development experts are either themselves European, or are the products of European education and tradition. There is no European tradition of long haul human transport. European practice long ago rejected the long distance human carriage of goods; at first in favour of pack animals, then by animal-drawn wheeled vehicles. Mechanical power has now virtually supplanted muscle power.

In contrast, Asia has a centuries old tradition of using human powered wheeled vehicles for long distance transport. The success of human powered vehicles is attributable to their light weight, and to the balancing of the load over the wheel or wheels. Human powered carts are in wide use in Asia today. Their inherent utility has been proven and refined upon 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 attached illustrations show a type of 'garden cart' widely sold in the United States, which is similar in its essentials to the contemporary Chinese model, also illustrated. The carrying capacity of such a cart is about 180 kg on firm level ground using a single operator. The utility of the garden cart derives from its basic mechanical elements, two wheels connected by an axle. The load is carried by the axle, and the operator merely propels the cart, but does no lifting. The wheels have wide hubs with (replaceable) ball bearings. Thick spokes, wide rims and pneumatic tyres allow for good flotation on soft ground, yet minimize rolling friction. A light but stiff tempered steel axle connects the two wheels, and forms the structural 'backbone' for any platform or box body laid on it.

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, lightweight and 'handy,' configurable to suit local conditions, and can be maintained and repaired by unskilled labour.

I suggest that until such wheels are manufactured locally, that they be imported. Complete wheel-axle assemblies have been quoted delivered, in small quantities, to East African ports for \$37.00 (U.S.). This cost would be greatly reduced by the expedient of shipping the wheels 'knocked-down' (rims, spokes, hubs, tubes and tyres) and assembling them with local labour.

In July of 1992 I took a sample wheel-axle set to Malawi, and employed a village carpenter to construct a garden cart. I asked various people to use it for a variety of applications, including the haulage of bricks, firewood, sand, furniture, grass, coffee and fertilizer. The demonstration was a resounding success. There can be no doubt as to the utility of the garden cart for crop production and allied applications. The users were uniformly enthusiastic as to the utility of the cart. In fact a number of persons hired the cart for short periods.

I realize that there are several draught animal advocates who will read this paper. With all apologies to them, I do not think that animal drawn farm carts are a practical proposition for most smallholder farmers in Malawi, and by extrapolation to most smallholder farmers in Africa. Both oxen and donkeys are expensive, and both compete with humans for increasingly scarce land and vegetation. The simple fact is that few farmers presently possess the requisite draught animals, nor is there any likelihood of their acquiring them in significant numbers in the foreseeable future. Draught animals need to be trained, fed, watered, pastured and harnessed in order to be of use. On the other hand, the garden cart need merely be picked up and loaded.

Ox carts are useful for hauling very heavy loads, but are clumsy and slow. I am certain that even the most cursory comparative analysis between the oxcart and garden cart use on smallholder farms, would indicate the greater utilization factor, economy,

ease of use and 'handiness' of a garden cart. The garden cart is applicable to many more tasks than its cumbersome counterpart. Other factors aside, the capital investment in an oxcart and oxen is many times that needed for a garden cart, a difference which alone makes the ox cart impractical for most farmers. The garden cart has the potential of being produced and distributed at a cost sufficiently low so as to be affordable by virtually all families. The same can not be said of the ox or donkey cart.

Agricultural development policy must incorporate the goal of taking burdens off peoples backs and placing them on wheels. The widespread introduction of the garden cart is the only realistic manner in which this goal can be met. The widespread adoption of such carts would greatly reduce the burden of rural life, especially for women, who are the primary hewers of wood and drawers of water. The availability of domestic water would be greatly increased, and it would become feasible to maintain irrigated gardens in the dry season.

As the objective of this Workshop is to "identify future research and development needs to make more effective use of muscle power," I can think of no more urgent priority than introducing the wheel (in the form of the garden cart) to the masses of farmers who are presently suffering for want of that essential technological element.

Selected references who have evaluated the garden cart in Malawi.

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Note: I apologize for my inability to present this paper in person, having learned of the Workshop too late to allow me to attend. I've deposited numerous background documents, photographs and a videotape (PAL format) of the construction and use of a garden cart in Malawi, with Mr. D.H. O'Neill of Silsoe Research Institute. This material should be available for your inspection during the Workshop. Please contact me for clarification, questions, comments or suggestions.

January 10, 1993

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attachments:

Tables: ratio of to motor vehicles to population (Africa & selected nations)

Illustrations: Garden cart brochure (U.S.A)
Garden cart carrying firewood (Malawi)
Cart hauling straw (China)

AFRICAN NATIONS: RATIO OF MOTOR VEHICLES TO POPULATION

(Source: The World Almanac & Book of Facts 1993 NY)

<u>Country</u>	<u>Population</u>	<u>Pass. Vehicles</u>	<u>Comm. Vehicles</u>	<u>Total Vehicles</u>
Algeria	26,022,000	712,000	471,000	1,183,000
Angola	8,668,000	122,000	44,000	166,000
Benin	4,831,000	-----	-----	-----
Botswana	1,300,000	26,000	47,000	73,000
Burkina Faso	9,359,000	21,000	6,600	27,600
Burundi	5,831,000	11,000	10,000	21,000
Cameroon	11,390,000	78,000	43,000	121,000
C. Afr. Rep.	2,952,000	10,000	8,000	18,000
Chad	5,122,000	8,000	6,000	14,000
Congo	2,411,000	26,000	20,000	46,000
Cote d'Ivoire	12,977,000	168,000	90,000	258,000
Djibouti	541,000	13,000	13,000	26,000
Egypt	54,451,000	826,000	550,000	1,376,000
Eq. Guinea	360,000	-----	-----	-----
Ethiopia	53,131,000	43,000	21,000	64,000
Gabon	1,079,000	19,000	15,000	34,000
The Gambia	874,000	5,200	1,000	6,200
Ghana	15,616,000	26,000	28,000	54,000
Guinea	7,455,000	13,000	13,000	26,000
Guinea-Bissau	1,023,000	-----	-----	-----
Kenya	25,241,000	133,000	149,000	282,000
Lesotho	1,801,000	6,000	15,000	21,000
Liberia	2,730,000	7,000	4,000	11,000
Libya	4,350,000	448,000	322,000	770,000
Madagascar	12,185,000	27,000	20,000	47,000
Malawi	9,438,000	15,000	15,000	30,000
Mali	8,338,000	29,000	7,500	36,500
Mauritania	1,995,000	8,000	5,000	13,000
Morocco	26,181,000	554,000	255,000	809,000
Mozambique	15,113,000	84,000	24,000	108,000
Namibia	1,520,000	-----	-----	-----
Niger	8,154,000	27,000	25,000	52,000
Nigeria	88,500,000	773,000	606,000	1,379,000
Rwanda	7,902,000	8,000	10,000	18,000
Senegal	7,952,000	90,000	36,000	126,000
Sierra Leone	4,274,000	29,000	10,000	39,000
Somalia	6,709,000	19,000	11,000	30,000
South Africa	40,600,000	3,300,000	1,200,000	4,500,000
Sudan	27,220,000	99,000	17,000	116,000
Swaziland	859,000	25,000	28,000	53,000
Tanzania	26,000,000	44,000	52,000	96,000
Togo	3,810,000	47,000	22,000	69,000
Tunisia	8,276,000	321,000	208,000	529,000
Uganda	18,690,000	35,000	6,000	41,000
Zaire	37,832,000	24,000	60,000	84,000
Zambia	8,445,000	105,000	97,000	202,000
Zimbabwe	10,720,000	173,000	80,000	253,000