Potential of Intermediate Means of Transport in Improving Rural Travel and Transport in Sub-Saharan Africa

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To discuss the current situation, develop new policy directions, and specify needed and ongoing studies for improving rural travel and transport in sub-Saharan Africa, three hypotheses are postulated: (a) poor rural roads, with inadequate and high cost of road transport services and lack of affordable means of transport, seriously constrain rural economic and social development; (b) significant time savings and productivity gains can be achieved by using intermediate means of transport (IMTs) ranging from wheelbarrows to motorcycles, with significant impact on women; and (c) returns on investments in IMTs and low-cost rural infrastructure will be so high that private people will respond, with the government's role being largely promotional. Current rural travel and transport are dominated by head loading and walking (largely by women) to satisfy the daily travel and goods movement needs of rural populations in sub-Saharan Africa. Although rural roads and off-road transport may interact synergistically, with each amplifying the economic and social impact of the other, this interaction has not been directly studied or quantified. IMTs would save large amounts of time and energy and reduce drudgery, particularly for women. When IMTs have been introduced and used in the transport system, private individuals have usually developed and reaped the benefits. The better understanding that is required of the nature of rural travel and transport and its impact on rural development is being addressed in current studies under the sub-Saharan Africa Transport Program by the World Bank and the Economic Commission of Africa with the support of bilateral donors.

The gravity of rural transport bottlenecks in sub-Saharan Africa (SSA), has recently been underscored by the World Bank's long-term perspective study (LTPS) (*1*). This report emphasizes that improving rural infrastructure is an essential requirement for the modernization and growth of agriculture. Further, it cautions that although better market incentives (especially related to prices and inputs) to farmers remain an important factor in agriculture, the effects of these would be blunted if the physical barriers and economic costs of transporting goods to and from local markets remain high. The alleviation of these economic constraints, and the equally important easing of the barriers to social intercourse and development would require improvement in access between villages and markets, schools, medical, economic, administrative, and social services, which affect the day-to-day lives of rural people.

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Like most developing areas, sub-Saharan Africa countries face two major rural transport gaps:

1. The rural and feeder roads connecting villages and farming areas to each other and to market centers are usually inadequate, poorly maintained, and costly to use; and
2. Poor and inadequate rural transport services, caused by the lack of intermediate means of transport (IMTs) and appropriate infrastructure for their use, has meant that the carrying of goods between and within villages and between fields, villages, roads, and markets is dependent almost entirely on walking and head- or shoulder-carrying.

By far, the majority of transport and travel activity in sub-Saharan African countries occurs in rural areas. The greater part of transport in rural areas—in terms both of distances and amounts carried—is usually off road. Almost all this transport, in turn, is nonmotorized—in fact, nonwheeled—and dominated by head-carrying by women and children of loads up to 30 kg.

Large efforts at rural transport improvement in SSA have, so far, concentrated on the design and construction of secondary and tertiary roads for motorized transportation. As a result, there are now approximately 700 000 km of recorded rural roads in SSA (Table 1). The condition of rural roads is poor, with about half the network requiring substantial rehabilitation. Even in the countries with the highest concentration of roads, the density of rural roads is low compared with the needs for full economic development. Completed World Bank projects have so far constructed or rehabilitated some 89 000 km and enhanced maintenance over a further 75 000 km of the network (Table 2). The World Bank has estimated that partial rehabilitation of existing rural roads would require an outlay of U.S. $3 billion (*2,3*), which compares with the U.S. $1.7 billion of World Bank–funded rural road rehabilitation over the past 25 years (Table 3). If rehabilitation were to be done over 5 years, the cost (U.S. $600 million per year, with a further U.S. $400 million for routine and emergency maintenance) would amount to about 0.7 percent of the region's GNP of U.S. $149 billion in 1987 (*3,4*).

The rural road networks have a skewed distribution in lengths between countries. For example, Nigeria, Cameroon, and Ivory Coast alone have more than half the rural roads in West Africa, whereas Zaire, Zimbabwe, Madagascar, and Tanzania

TABLE 1 LENGTHS (km) OF ROADS BY TYPE AND REGION (*3*)

Region	All Roads	Rural Roads	Density (m/km2)
Western Africa	430,937	286,425	32
Eastern and Southern Africa	589,943	398,972	36
Total	1,020,880	685,397	34

TABLE 2 RURAL ROAD PROJECT ACHIEVEMENTS IN SUB-SAHARAN AFRICA (*3*)

Period	Roads Constructed or Rehabilitated		Roads Maintained	
	Target Km	Actual %	Target Km	Actual %
Before 1980	49,999	81	28,978	42
After 1980	39,112	72	46,193	49
TOTAL	89,111	79	75,171	43

TABLE 3 RURAL ROAD PROJECT COSTS ($ MILLIONS, IN 1988 PRICES) IN SUB-SAHARAN AFRICA (*3*)

Period	No. of Projects	Loan or Credit Amount	Project Cost	Rural Road Component
Before 1980	79	2,860	6,068	887
After 1980	43	2,408	5,812	863
TOTAL	122	5,268	11,880	1,751

account for more than two-thirds of East African rural roads. Rural road density also varies widely within individual countries. Nigeria also has an average of about 83 m of rural road per square kilometer (individual states' values range from less than 30 to 490 m). Similar ranges were found in Kenya where high rural road densities were associated with provinces with high population and abundant natural resources (*3*).

A recent study (*5*) on food aid and development in the countries of the World Bank's research project "Managing Agricultural Development in Africa (MADIA)" has estimated that the present rural road network of SSA needs to be substantially increased if the full agricultural potential of the region, necessary to support the population, is to be realized. Even if only a part of the extra rural road network required to increase densities were to be built, the annual outlay could double to U.S. $2 billion a year, or about 1.4 percent of SSA gross national product (GNP). These figures are relevant given the 4 percent per annum target for agricultural growth in the region forecast in the LTPS, which translates to about a 1.5 percent increase in GNP. This target for extra agricultural production is unlikely to be achieved if there is no improvement in rural roads and other infrastructure. The needs are great, and although it may be possible to make a viable economic case for an improved and larger rural road network, the concept is not feasible unless specific financial and institutional arrangements for construction and maintenance can be put in place. The question is whether SSA countries can sustain the large network of roads that would result from massive improvements.

The problems caused by the lack of reliable, well-maintained rural road systems are exacerbated by the lack of motor vehicle capacity caused by relatively small vehicle fleets and the poor condition of the vehicles that exist in many countries. The vehicle fleets are small as a result of the generally low importation of vehicles. Data collected from Cameroon, Kenya, Malawi, Nigeria, Senegal, and Tanzania, the study countries of the World Bank's MADIA research project, confirm the low vehicle availability and importation levels. Even Nigeria with the largest share of vehicle imports in the region has shown declining trends. After exceeding U.S. $2.8 billion in 1981, total vehicle import values for Nigeria have decreased 90 percent, accounting for only U.S. $295 million in 1987. The other five countries only showed modest increases up to peak values ranging from a high of less than U.S. $50 million for Malawi and Senegal to U.S. $192,000 for Cameroon in 1987 (*6*).

In addition to these trends in reduced imports, which gradually reduce the size of vehicle fleets, the aging and deteriorating vehicle parks in many countries add to the continuing constraints. In many countries, vehicles have been maintained only by cannibalizing broken-down vehicles for scarce spare parts. Survival and continued use of many vehicles have depended on the ingenuity of good indigenous mechanics in modifying vehicles to the prevailing conditions including the spare parts available. Notwithstanding these remarkable achievements, vehicle capacity and availability remain inadequate. Even where motorable roads exist, transport services are unreliable and infrequent in most rural areas; where available, such services

are for-hire and the majority of rural inhabitants cannot afford them (*7*). This situation clearly highlights the need for alternative approaches to satisfying the rural transport market.

Beenhakker et al. (*8*) pointed out that an improved feeder road may only satisfy 5 percent of local farmers' transport needs, and then only after the surplus has been transported to the road side. This fact suggests that only an extremely small proportion of the total rural transport and personal mobility journeys would benefit from the extension of roads suitable for motor vehicles. Progress in these fields has been slow and expensive, and the transport and travel burden of the poorer rural inhabitants will not be significantly relieved for many decades to come. Without an alternative approach, transport services in rural areas will remain inadequate to sustain acceptable levels of social and economic activity and development.

The transport characteristics have been summarized in three hypotheses that form the basis for discussion of policy issues and options.

Inadequate on-road transport services coupled with the lack of off-road transport, which reduces the timeliness and amount of agricultural goods delivered to on-road transport, seriously constrains the growth of rural economies. Deficient off-road transport also restricts the flow of agricultural and other inputs from the road system to farming villages. Raising the capability of off-road transport could be reflected in much higher returns to rural road investments.

Significant productivity gains can be achieved by low-cost investments in improving off-road transport. These gains reflect both the ability to move more goods more quickly within rural communities and important reductions in the time and drudgery that afflicts transport tasks—particularly those undertaken by women. Reducing transport burdens could, thus, free significant human resources of energy and time for the economic and social development of rural Africa.

The returns on such investments (i.e., for appropriate low-cost infrastructure and IMTs ranging from wheelbarrows to motorcycles) to farm families themselves would be so high that they would be undertaken by private individuals, and the government's role could, therefore, be largely facilitative and promotional rather than requiring direct investment.

RURAL TRAVEL AND TRANSPORT TASK

The rural transport task in sub-Saharan Africa is of far greater complexity than is shown in most traffic surveys. Most surveys are conducted along roadways, and usually record only motorized traffic. They ignore the large numbers of informal means of transport such as pedestrians, bicycles, pack animals, and animal-drawn carts. Motorable roads comprise only a small portion of the rural transport and travel network. There exist vast but unmeasured networks of tracks, paths, and trails linking scattered villages with each other and the fields in which women, children, and men do the bulk of their work.

Predominance of Head-Loading

In many food-growing areas, food has to be carried many kilometers by head porterage either to the village market or roadside points from which vehicles transport it to major consuming centers. For many rural people, a trip on a bus, matatu, or bush taxi still entails a long access walk from the village (*9,10*). Head-loading is frequently performed in conjunction with other farming activities such as weeding and harvesting. Heidemann and Kaira (*11*) report that in Kirinyaga District of Kenya, 70 percent of all journeys made in the rural areas were on foot, with 7 percent by public transport and only 2 percent in private cars. Transport in these circumstances is limited to what can be back- or shoulder-carried or head-loaded to road sides and along rural roads. Riverson and Afele (*12*) also reported that in Ghana, on average, 38 percent of the weight of commodities carried on more than 200 rural roads were by head loads. The proportion carried by head load was up to 90 percent for roads carrying much less than 25 vehicles per day (vpd), but roads carrying 100 vpd and more also registered up to 25 percent of total goods movements by head-loading. The two major reasons given for head-loading along rural roads were (a) lack of alternative means of transport, and (b) lack of funds to pay for the for-hire services when they were available.

Time Used in Rural Transport Activities

Research studies in Ghana and Tanzania (*13,14*) have confirmed that activities involving transport consume inordinate amounts of household time and energy in rural areas. The average total time spent by village households on transport ranged between 1,875 hr per year (for about 80 ton-km in southwest Tanzania, with an average household size of 4.5) and 4,830 hr per year (for about 216 ton-km in study villages in Ashanti, Northern, and Volta regions of Ghana, with an average household size of 11.9).

The time and energy spent on transporting for agricultural and other household activities are major constraints to increased agricultural production or other productive economic ventures. Household transportation, especially for water and firewood, is in fact the major task that competes for household labor time and limits ability to do other things. Internal trips (for water and firewood collection, crop production, and marketing, to local market and grinding mill) represented 73 and 80 percent of total time and ton-kilometers spent on transport, respectively, in the Ghana and Tanzania studies. External trips were those to health facilities, external markets, and outside locations.

Extent and Distance of Head-Loading

In a study (*15,16*) of Ashanti Region, Ghana, it was found that for more than 90 percent of the households surveyed the principal means of carrying goods from the field was by head load. Fifty-six percent of the households used only household labor, whereas 44 percent used hired labor, or a combination of household and hired labor. Motorized transport was used to a significant degree only in one zone where tractors were reported as one of the principal means of transport. The average distance between field and village was 3.9 km, with nearly three-quarters of the distance taken up by footpaths. In only two of the eight zones studied did motorable tracks and feeder roads count for an appreciable component of journeys from

TABLE 4 TIME REQUIRED TO HEAD-LOAD CROPS FROM FARM TO VILLAGE OR ROAD (*9*)

Crop	Kg/ha	Person-days Needed to Headload 1 Acre from Farm to Village	Type of Labor Typically Used for Headloading
Cocoa	900	15	M,F,H,C [1]
Oil Palm	10,000	167	F,H,C
Cassava	10,000	167	F,C
Maize	1,900	32	F,C
Rice	1,500	25	F,C
Plantain	9,000	150	F,C
Cocoyams	7,000	117	F,C
Yams	8,000	133	F,C

1. M = Male, F = Female, H = Hired hand, C = Child

TABLE 5 CHARACTERISTICS OF SELECTED EXPORT AND FOOD CROPS IN GHANA (*9*)

Crop	Marketed Product	Storage Involved	Yield Kg/Ha	Storage Life	Keeping Quality
Cocoa	Dry Beans	Yes	900	6-12 mos.	Good
Oil Palm	Palm Oil	Yes	NA	6-12 mos.	Good
	Palm Kernel	Yes	NA	3- 6 mos.	Fair
	Fresh Fruits	No	10,000	1- 2 wks.	Poor
Maize	Grain Maize	No	1,900	6-12 mos.	Good
Rice	Milled Rice	Yes	1,500	6-12 mos.	Good
Plantain	Fingers	No	9,000	1- 2 wks.	Poor
Yams	Tubers	No	8,000	1- 6 wks.	Fair
Cocoyams	Corms	No	7,000	1- 3 wks.	Poor
Cassava	Roots	No	10,000	1- 2 wks.	Poor

farm to village, and in two other zones, a part of the journey from farm to village was along a main road. Cocoa loads have also been found to be carried an average distance of 5 km from the farm to village or buying centers (*9*).

Based on carrying, each day, two head loads of approximately 30 kg over an average distance of 5 km, it would require 15 person-days to move cocoa (900 kg/ha), and 167 person-days to move cassava and palm fruits (10,000 kg/ha) from a 1-hectare (1-ha) field to a nearby village or the roadside (see Table 4). In general, about 70 percent of agricultural activity involves transport with load consignments of 15 to 150 kg carried a distance of 1 to 13 km for on-farm trips, and load consignments of 15 to 150 kg carried a distance of 1 to 20 km for off-farm trips (*10,13,14*). Head loads of cassava, maize, cocoa beans, plantain, and palm fruits weigh typically 30 kg each (*9*), which is similar to other estimated head load weight range of 25 to 40 kg (*17*). Heidemann and Barth (*18*) present a comprehensive discussion and analysis that confirm these characteristics. If average load sizes and speed of these movements could be increased, rural families would gain great savings in time and energy expenditures for tasks from wood and water gathering to field-to-road transport of produce.

Impact of Transport Constraints on Food Production

Local food supplies from many rural areas do not usually respond quickly to changes in demand (*19*). Although many factors contribute to this effect, some transport-related ones are highlighted. Increases in production of smallholder farmers who dominate African agriculture depend on the assurance of good prices and market opportunities. Market opportunities, in particular, are constrained by poor rural travel and transport services that adversely affect accessibility and personal mobility. Although often unaccounted for, farmers' production activities and costs include costs of trekking between home and field often over long distances, quite apart from the transport requirements for marketing of harvested crops. The proportion of production costs represented by transport and travel costs usually increases rapidly with distance between village and fields. These constraints in off-road transport limit farmers' production to fields closer to the village. Dapaah (*9*) contends that the slow and expensive head-loading, as the only alternative to the limited capacity of unreliable vehicular transportation, as well as the poor keeping qualities of most staple food crops in West Africa (Table 5) are also major factors in the limiting of food production to levels considerably below the potential of rural areas. The extent to which this applies, however, is not quantified and calls for additional study and research on the subject.

INTERMEDIATE MEANS OF TRANSPORT

Indications for Use of IMTs

The time and energy burdens involved in off-road transport represent one of the major constraints to any efforts by smallholders to move from subsistence agriculture to produce more marketable surpluses. As described, agricultural production and consumption within rural areas rarely involve motor vehicles (*10,20*), rely heavily on household labor, and create a need for time- and energy-consuming movements of small loads over relatively short distances. Necessarily small load

sizes, on the other hand, mean that the return to labor—and the surplus it generates—is small, and the marginal cost of increasing production—in terms of time and energy expended—is high.

The trip ranges and load consignments typical of these transport tasks could suitably be undertaken using IMTs. IMTs have higher load capacities than head-loading and the potential for higher travel speeds than walking, and thus significantly reduce the amounts of time and energy spent walking and head-loading. For example, McCall (*17*) estimates that walking about 4 km to a plot reduces time available for fieldwork by about 25 percent, even assuming a generous 8-hr day. As a result, intensive cultivation of small-scale farming crops generally tends to drop off beyond 2 to 4 km (i.e., 1 hour's walk) from home villages. For female farmers, walking to distant farms significantly reduces the time and energy available for domestic household and other economic activities. These constraints to farmer productivity may be reduced greatly by affordable transport options that could facilitate local personal travel and load movements. The experience in other developing regions demonstrates that the introduction of low-cost IMTs, in conjunction with simple, usually community-based, infrastructure improvements, can provide a level of improvement in rural transport that will affect travel for social, educational, health, administrative and recreational, as well as directly economic purposes, that is rarely achieved through road improvements alone.

Potential of IMTs

IMTs are widely used in the developing world, both to improve the efficiency of directly productive tasks, and to serve as a bridge between rural fields and villages and nearby road networks or market towns. The list of IMTs used is impressive and has been widely documented (*7,8,21,22*). Nonmotorized transport ranges from bicycles with or without attachments to animal-drawn carts. The latter often make use of draft animals that are also used to aid cultivation. These human- and animal-powered vehicles provide low-cost and widely affordable means of transport, and their capacity and speed—though limited compared to motorized transport—is far beyond that of head- or back-loading. The design and manufacture of motorized low-cost IMTs have also been documented. However, the geographical coverage of their use is limited (*21*). As a result, some vehicles are used in some countries and not others, or in some regions and not others within the same country.

The design and application of existing IMTs tend to be specific to a country or region of a country. The extensive use of the motorcycle with sidecar, in the Philippines, for example, is one case where local needs appear to be adequately served through a locally developed and accepted solution. Animal-drawn carts have been adopted in some parts of Africa as a result of programs to promote the use of draft animals. Use of bicycles and mopeds is widespread in Burkina Faso, and bicycles are used in Northern Ghana, Uganda, and Rwanda. Kaira (*10*) reports some use of bicycles and animal carts in Kenya; Dixon-Fyle and Relf (*23*) report that in Malawi, the United Nations Food and Agriculture Organization is promoting the use of animal (draft) power for transport, which dates back to the Lilongwe Land Development Project in early 1970s. Reports on India describe extensive use of nonmotorized transport, particularly animal-drawn vehicles using bullocks, buffaloes, camels (in desert areas of Rajasthan),

TABLE 6 PERFORMANCE CHARACTERISTICS AND RELATIVE COST OF SOME IMTs (*27*)

Vehicle	Max. Load (kg)	Max. Speed (kph)	Max. Range (km)	Terrain/Route Requirements	Relative Cost
Wheelbarrow	100	5	10	Flat, narrow path	20
Bicycle	75	20	20	Flat, narrow path	50-90
Bicycle and trailer	200	10-15	15-20	Flat, wide track	90-150
Bicycle and sidecar	150	10-15	15-20	Flat, wide track	90-150
Pack Animal	100-250	5	15-20	Hilly, narrow path	Variable
Animal-drawn sledge (buffalo)	200-400	5	10	Unsuitable for steep terrain	10
Animal-drawn cart (oxen)	500-1500	5	15-20	Flat, wide track	100-180
Motor cycle	100	40-90	100	Motorable path	250-600
Motorcycle and sidecar:	250-500	30-60	60	Unsuitable for steep hills	350-800
Motorcycle and trailer	250	30-60	60	Unsuitable for steep hills	350-800
Single-axle tractor and trailer	1500	15-20	40	Unsuitable for steep hills	1500
Asian Utility Vehicle	1000	60	60	Motorable road or track	3000

Typical values are quoted with variations expected in specific locations. No currency is quoted or intended for the relative costs. The order of cost magnitude is in relation to other values in the Table.

horses, and mules (in urban areas). The type of transport used is closely associated with the nature and type of farming undertaken. Hence, where bullock ploughs are used, bullock carts are predominant, whereas tractors with trailers are associated with tractor-related farming. The performance characteristics of various IMTs are presented in Table 6. A great deal of IMT know-how is available; information needs to be widely disseminated within countries and between countries to ensure more widespread use. However, in each local situation, needs must be clearly identified so that suitable interventions can be made.

WOMEN AND RURAL TRANSPORT

Transport Burden of Women

Households constitute the unit of agricultural production in Africa, and household labor is a most important resource. Any measures to increase the time available to households for productive agriculture or to improve the movement of commodities will contribute to the long-term processes of socioeconomic development (*24*). Hence, reducing household transport time is essential, especially for women, because the most important productive activity in sub-Saharan Africa is small-scale agriculture for which the majority of labor is carried out by women. Head-loading of food crops is typically carried out by women and children. Thus, the transport burden is particularly onerous for women in rural Africa, who play predominant roles both in domestic and economic activities, including the production of food and cash crops (Tables 7 and 8). Women accounted for more than 70 percent of transport time and ton-kilometers carried in Tanzania (*13,14*). The large amount of female and child labor required to head-load food crops from farm to village or roadside have important implications for the attainment of food self-sufficiency in several African countries. McCall (*17*) also reports that women almost exclusively transport water and biomass fuel in addition to the movement of harvested crops from the fields.

Female labor availability in terms of quantity, seasonability, location, labor quality, and incentives, is therefore the key to agricultural improvement (*24*). As stated earlier, much time and energy are spent on transport-related activities associated with rural lifestyles.

Varying Roles of Women

The role played by women in the African transport industry varies from country to country. Hine et al. (*16*) recount that food marketing in southern Ghana is dominated by a large number of independent operators, most of whom are women. They collect produce from rural areas (rural assemblers), arrange for its transport to town (traveling wholesalers), transport the produce (transporters), wholesale the produce in urban areas (nontraveling urban wholesalers), and finally sell it to the urban population (retailers). Throughout West Africa,

TABLE 7 WOMEN'S PARTICIPATION IN LABOR ACTIVITIES: GENERAL AFRICAN SITUATION (*18*)

Production Activities	Percent of Work by Women
Cash Crop Production	30 - 70
Food Production	60 - 90
Food Processing	100
Animal Husbandry	30 - 50
Marketing	50 - 80
Brewing	90
Water Collection	90 - 100
Fuel Collection	80 - 100
Transport of Crops from Field	70 - 90
Household or Community Activities	
Rearing and Care of Children	100
Cooking	100
Cleaning, Washing, etc.	100
House Building and Repair	30 - 60
Communal Farming	50 - 80
Social - Dances, Funerals, Weddings, etc.	50
Litigation Activities	10 - 20
Political Meetings, etc.	10 - 25

TABLE 8 PARTICIPATION IN LABOR ACTIVITIES BY GENDER: A CASE FROM BUKOBA DISTRICT, TANZANIA (*18*)

Average Hours Spent per Adult Household Member in 14-hour Day		
Type of Activity	Male Input	Female Input
Total On-Farm Work	3.10	4.37
Domestic (food preparation, wood, water, child care, etc.)	1.16	3.37
Total Work - including paid employment	6.44	7.90
"Leisure"	4.83	3.41

women are actively engaged in selling food crops and prepared foods and other products in traditional rural and urban markets. Urban market women sometimes prefinance the purchase and transport of food from rural farmers. Within rural areas, the constraints on the rural transport and travel task for women can have two main effects: (a) they have a relatively high workload in other economic sectors (both market and household oriented), which is cut into by transport constraints; and (b) the heavy burden of head loading can cut into agricultural productivity, which also depends on a large input by women.

Potential for Relieving Women's Transport Burden

The extent to which the transport burden on women can be ameliorated will depend on the policies affecting rural development and the role of women in the planning of transport and social services. It will also depend on the willingness of men and women to learn new skills such as bicycle riding for the performance of their duties. In all cases, the transition must be gradual, and will depend on the education, experience, and attitudes of husbands and their female partners. In general, IMTs introduce new roles for husbands that will ultimately reduce the burden on rural women. Experience shows that, usually when improved means of goods transport in the form of pack animals such as donkeys, ox sleds, or tractors have been introduced, men increase their share of transport because of the skills required. However, the issues and the resultant problems must be understood by both genders who must participate equally in the process.

INDICATIONS OF THE NEED FOR CHANGE

IMTs such as bicycles with or without trailers, and animal-drawn carts have proven their worth as labor- and time-saving and productivity-increasing devices in many areas of the developing world. More widespread introduction, in Africa, of proven relatively low-cost IMTs, with appropriate infrastructure aimed at improving access, would provide a valuable complement to road improvements. Improving off-road transport and relieving its onerous burden on rural farm families—especially women—can be expected to increase production and speed transport to rural roads, thus increasing the volume of goods on roads and improving the economic impact of the roads themselves. IMTs, properly developed locally, would complement rather than replace existing motorized transport systems where these exist. They would, therefore, provide an intermediate transitional improvement to satisfy transport and travel needs until improved motor roads and vehicular transport systems become more widespread. The introduction of IMTs is, therefore, thought of as an important first step in upgrading rural transport technology to induce increased economic activity. In effect, the aim is to provide a south-to-south transfer of appropriate technology because these IMTs are in significant use both in Asia and Latin America. In this regard, it is essential to understand the pattern of adoption and development of IMTs and to identify the helping factors and the barriers.

Extensive use of IMTs will also necessitate the construction of suitable paths. Beenhakker et al. (*8*) present specifications for the development of suitable infrastructure for IMTs. These infrastructure design considerations will, however, have to be taken into account in any policies aimed at promoting the use of IMTs. For example, a >2-m-wide unpaved path or trail for pedestrians, wheelbarrows, and bicycles would cost less than 10 percent of the cost of a 6-m-wide all-weather rural road for motorized transport. Such access infrastructure would also be more amenable to locally mobilized labor-based construction and maintenance.

Ongoing Applications in Africa

The potential of IMTs has been shown in some recent donor-assisted investment projects designed to improve personal mobility through the introduction of intermediate transport facilities. These have included bicycles with trailers introduced in Ghana with World Bank assistance, and wooden wheelbarrows and donkey panniers by the International Labor Organization (ILO) in Makete district, Tanzania, with assistance from the Swiss Development Corporation (see Box 1). Reaction of rural populations to these initiatives will do much to determine the interest that rural families show in the potential of IMTs to save time and energy and to raise productivity. It will also highlight their willingness to undertake the investments needed to acquire such devices, and to provide and maintain the usually rudimentary infrastructure needed to operate them efficiently.

Government Roles

These recent projects, also, will help to demonstrate the roles governments could play in promoting IMTs. Actions may range from providing information on such devices to making credit available to purchase them, and could also involve education, technical assistance, or community organization to ensure that appropriate infrastructure is built and maintained. Governments may also have a role on the supply side in promoting the production of IMTs. Evaluation of the extent of IMT use would also form a basis for quantifying the impact of improving rural transport and mobility in general.

Reasons for Slow Development of IMTs in Africa

Africa has lagged behind other developing regions in its adoption of IMTs to increase rural productivity. Kaira (*10*) cites two important reasons for the slow uptake of IMT: attitude and custom (or lifestyle). The attitudinal problems start with a bias against governmental, institutional, and commercial bodies that favor road construction and motor vehicle use as the unique solution to rural transport problems. This bias will only be overcome with a clear understanding of the benefits that can be achieved through relatively low-cost investments in IMTs and rural transport infrastructure. Studies have been proposed as part of the Rural Travel and Transport Project of the World Bank and the Economic Commission of Africa's sub-Saharan Africa Transport Program that will attempt to isolate and quantify these benefits.

Developing IMT in Ghana and Tanzania

In Northern Ghana, field studies have demonstrated that taking into account both speed and payload, a bicycle trailer can increase a person's capacity by at least five times. A bicycle trailer enables the rider to carry up to 440 pounds, and specially designed small handcarts, as much as 330 pounds. These intermediate forms of transport can greatly reduce the amount of time and human energy wasted through back and head loading. Based on these findings the Bank is monitoring performance and productivity.

With International Development Association financing, Ghana's Technology Consultancy Center is promoting the production and use of two forms of intermediate transport—bicycles with trailers and hand-propelled farm vehicles. Vehicle designs have been adapted to local conditions, and demonstration lots are being produced for promotion through local organizations. The third phase of the project establishes credit lines and provides technical assistance to start-up firms to manufacture, assemble and maintain the vehicles. The nurturing of local institutional capacity will provide a sound basis for a longer term strategy to promote intermediate transport in Ghana.

These efforts by the Bank are complementary to similar efforts being undertaken by the ILO in Makete, Tanzania with the support of Swiss Development Corporation. In Makete, local carpenters have been trained to make specially designed wooden wheelbarrows and donkey panniers for use in the hilly areas of Makete district. Demonstration projects have been used to assist marketing, and with the cooperation of the district council, project staff have provided technical advice and supervised local communities in labor-based rehabilitation of earth and gravel roads on a self-help basis. A survey of paths has been undertaken to assess the improvements required for use by wheelbarrows and donkeys.

BOX 1

Technological Degradation or Upgrading

A major obstacle to be overcome is the notion held by many African policy makers that the use of IMTs amounts to technological degradation. However, this perspective can only be justified if IMTs are viewed in the context of motor transport as the only feasible alternative. They cannot be justified when viewed in the context of preponderance of head- and back-loading as exist at present, and with the realization that motor roads and road transport are still decades away from universal availability and use. In addition, the educational curricula for professional engineers and planners have usually been geared to the design and development of high technology. In most countries, not much is done to promote design practices that make the best use of available local resources. It is easily forgotten that transport development in industrialized countries began with draft animals and carts, and other forms of IMTs, and that changes came as economic development increased and incomes rose. On custom and lifestyle, Kaira (*10*) argues that failure of the animal-drawn cart, for example, may be caused by lack of experience in feeding, training, and caring for animals. In some places, climate and existence of pests such as the tse-tse fly may also have contributed to unsuccessful adoption. Local taboos may also have prevented certain segments of the society—such as women—from riding bicycles and tricycles. However, in other parts of the world experience has shown that, with increased levels of education and the appreciation of the potential benefits, this situation may change.

Rural Transport Institutional and Planning Gaps

National transport planning systems in sub-Saharan Africa have often neglected the secondary and tertiary roads that serve rural areas—and largely ignored the off-road transport and travel that make up the bulk of the rural journeys. Possible—in fact, quite likely—synergistic interaction between these two modes of transport has received almost no attention.

A further problem is that the major rural transport and travel tasks, such as the extensive use of nonmotorized transport, including walking with back- or head-loading, is not recognized or taken into account by most planning approaches. The planning approaches focus on roads and their requirements assuming that someone, usually the private sector, will provide the vehicles and services needed for the roads to be used at an economic level. They also assume that rural people can afford the potential motor trips and transport activities predicted. These assumptions are not valid in many rural areas in which the opportunity costs of time and labor for getting to roads are the dominant factors governing, and often limiting, their use.

In addition, the methods and tools applied by many donor and national agencies, sometimes with minor modifications, are dependent on extensive data bases that are not available in most developing countries, and even less so in their rural areas. This paucity of data is a deficiency that continues to create doubts on the applicability of these methodologies for transport investment decisions. Most African planners would rather take their decisions on the basis of local knowledge to satisfy locally defined needs and assume that roads will create the required impact on rural development. The lack of data affects projections into the future for rural roads that generally serve areas with relatively low levels of development.

Invisible and Uncounted Traffic

Rural transport development is based largely on planning and decision-making processes that do not take into account the need for farm families to get more quickly and efficiently between their homes and fields and the rural roads to which they must bring their produce if it is to reach market. Head-loading, though an important cost of production, has usually been excluded from most rural transport evaluations. Part of the gap in data is caused by the fact that even on motorable roads, nonmotorized transport and travel are not recorded or counted. The impact of this would be evident when one examines traffic statistics on rural roads for which all movements

are recorded. For example, recent counts on rural roads in southwest Uganda, where bicycle use is widespread (*25*), indicated that the pedestrian and bicycle counts far outweighed the traffic distribution of motor vehicles on 55 rural road count locations (see Box 2).

Bicycles—The Work Horse of Rural Uganda

The bicycle has become one of the lynch-pins of Uganda's path to rural economic recovery. Although official figures are not available for the total number of bicycles in the country, their existence and intensive use in many rural areas are providing an obvious and visible value to the producers, suppliers and marketers of the country's staple food—matoke (green bananas). They are also used extensively for transport of other commodities and cash crops in most rural areas. The official figures that are available obviously understate the level of bicycle imports. However, the evidence of their widespread and intensive use can be seen from recent traffic counts taken from 55 counting stations on rural roads in southwest Uganda. Total traffic counts at those stations averaged 715 movements per day, with 538 pedestrians (75%), 164 bicycles (22%) and only 15 motor vehicles (2%). The motor vehicle traffic of 15 ADT included 4 trucks, 1 tractor, 2 cars and 8 pick-ups/4-wheel drive vehicles. Minibuses and buses were observed at only 9 of the 55 counting stations.

A separate survey and study of the costs of owning and operating a bicycle used in the transport of matoke revealed that all those surveyed were operating on bad roads and tracks. The bicycles were used for an average of 4.3 days per week during which they made 6.3 trips that averaged 13.2 km, one way. Each bicycle moved a total of 260 ton-km per year at an average revenue income of 1050 Ugandan Shillings (UGSh 375 = US$1.00) per ton-km and an average bicycle operating cost of 336 UGSh per ton-km, leaving the owner with a profit of UGSh 715.0 gross per ton-km. This results in a net return to the operator of UGSh 92.0 per hour for 1,420 hours per year. This excludes the farm-gate value of the matoke which would accrue to the farmer if he were the transporter. The average revenue income includes an unstated amount of profit based on the buying and selling prices of the matoke.

BOX 2

Understanding Rural Transport

A better understanding of rural transport and travel needs and the high returns available from low-cost improvements could lead to the development and definition of policies, planning approaches, and other responses that focus on improving farm-to-field-to-road mobility as a necessary complement to roads investment programs. It could also lead to the adoption of policies that would affect the approaches to infrastructure design, construction, and maintenance and give emphasis to the provision of access, rather than to predefined engineered standards.

This situation calls for a review of the level of understanding of the true nature of rural transport needs, priorities, and planning approaches to adequately consider the true nature of rural transport and travel. Cook (*26*), from a review of research on personal mobility in rural areas, concluded that current rural road evaluation methodologies focus on expected changes in agricultural production, but that the real socio-economic impact of rural road improvements comes about largely through changes in the patterns of personal mobility. Various authors (*8,18,22*) have presented some general guidelines on this subject. There is a great need to synthesize the various experiences and to develop a conceptual approach for planning that incorporates the lessons learned from an improved understanding of the rural transport and travel task and needs that would result from an increased use of IMTs.

NEW APPROACHES TO PLANNING FOR RURAL TRANSPORT

Past planning for rural transport has not given adequate attention to transport services in rural areas. Heidemann and Barth (*18*) point out that there has been too much preoccupation with low-frequency, large-volume, long-distance, high-speed transport operations. The result is a neglect of the real transport problems of the majority of rural population, which is founded in their inability to reduce the everyday burden of moving small volumes of cargo over short distances at low speeds and, preferably, at no extra cash expense. Hine (*20*) also emphasizes that roads cannot be considered in isolation from either the vehicles that are to use them or the factors that determine transport demand. Rather, they must be viewed as a component of a much larger distribution system in which changes in one aspect can cause repercussions on all others. For example, improved storage could lead to a reduced need for all-weather access, while better handling and packaging of easily bruised and damaged crops may reduce the need for a good riding surface.

Two-Part Strategy

The nature of the rural transport problem suggests adoption of a two-part strategy for the provision of transport services in rural areas made up of two complementary systems: (a) conventional motor vehicles along the national road network (essentially all-weather) for moving people, consumer goods and services to an area, and farm products and people out of the area; and (b) traditional and intermediate technology modes on the rural access infrastructure joining villages to distribution, buying and collection centers, depots, and markets. In most cases, however, the national system has been the focus of most attention. Little attention had been paid to the important needs of the upstream second part (*10*).

The planning of rural roads and transport must fit the context of national goals and objectives. Beenhakker et al. (*8*) suggest a comprehensive list of national objectives for rural transport development. These objectives cover social, economic, and political aspects and stress the importance of defining clearly the level of access affordable for rural roads and transport to serve different locations and economic and social func-

tions. He notes that there has been a tendency to overdesign, and that the attractiveness of all-weather roads often leads to their construction in areas in which they are not economically justified and may not even be affordable.

Clear objectives must be followed by formulating strategies for implementation of the planned program. These strategies may cover (a) infrastructure design, construction, and maintenance; (b) resource utilization; (c) technology; (d) institutional arrangements; (e) alternative transport; and (f) potential for an integrated approach. The strategy adopted should suit the financial and technical capability and capacity within the country. Ultimately, the goal is to implement a program that can be sustained within the country. Hence, even with technical and financial assistance from donors, the necessary local inputs—institutions and other resources—must be forthcoming to ensure sustainability in the long term.

Solutions adopted under more realistic approaches would take account of all alternative means of transport (including intermediate means of transport) suitable for the identified rural travel and transport situation peculiar to each country. India has some good lessons to offer in this regard. The needs of villagers and rural farmers and people must be adequately catered for. This could only be achieved by using a bottom-up planning approach that begins with the local transport system and needs as the basis for a continuous planning process. This process must actively involve people at the local level, and the level of sophistication should be increased gradually to suit changing knowledge and understanding of local situations and trends. Technical assistance will often need to be provided to assist at the local level.

Institutional Aspects

Many of the problems and policy issues that have been highlighted in this review can be addressed through a review of government transport policies and planning mechanisms in SSA countries. The pertinent institutional issues relate to integrating transport into rural and agricultural development, enhancing the role of women in development through transport improvements, improving rural transport services, and development and promotion of IMTs and appropriate infrastructure for their use. The broader issues concern the appropriate organizational setup for implementing programs to improve rural accessibility, mobility, and transport, including the involvement of local or village organizations and institutions and nongovernmental organizations (NGOs), and mobilization and use of local resources, including the skills and know-how of local people.

Government commitment and cooperation will be necessary for IMTs to be developed locally and effectively marketed. Suitable standards will need to be set for the required infrastructure, with the necessary legislation, regulations, and institutional arrangements. The improvements in personal mobility and transport will have greater impact on agriculture if they are properly coordinated with the provision of agricultural extension, crops storage and suitable rural markets, and inputs for rural development. In India, this combination of marketing, storage, and transport has been effectively achieved through the operations of a farmers' cooperative union (see Box 3).

India's "Mundi" Grain Regulatory Market

India presents an interesting case where rural market infrastructure is privately provided and coordinated with rural transport services. In Gujarat State, there are regulated rural markets owned by farmer cooperatives that are set up by law and run by a management committee (The Mundi Committee). All traders wishing to operate in the market must register with the committee. No sales are allowed in the immediate vicinity of the Mundi market area. Market facilities provided include sheds, storage, carts for transport, and other basic social infrastructure and services. Farmers without transport can use carts made available at the market to transport their produce. Farmers' produce is brought to the market and sold by auction. The buyer is then required by law to purchase the farmer's produce at the auction price. The farmer has the right to reject the auction price by refusing to sell. The farmer can then store his produce for up to a month in facilities available at the market. With these facilities, the major market and transport constraints to the rural farmer are minimized, and the farmer dictates his own prices.

BOX 3

Implications for Rural Transport Development

Government road and transport agencies are likely to be using almost all available human and financial resources, particularly foreign exchange, in the development, maintenance, and operation of the formal systems of transport—main highways and railways. The evidence is that essential institutional arrangements for rural roads cannot depend on central road organizations because most are underfunded and already overburdened by main road responsibilities, and often far removed from the areas served by rural roads. Accordingly, improving transport and travel systems in rural areas must hinge on distinct institutional and funding arrangements for rural roads, including decentralizing some existing institutions, mobilizing local resources including community and self-help interventions, and using local contractors and technicians. However, guidance and technical assistance from in-country and external sources will still be required to assist and train local people for these tasks. Local communities are presently ill-equipped to maintain roads, and will have to be strengthened to improve their capability for rural roads maintenance. However, until motor roads reach them, maintenance needs would be mainly for infrastructure used for walking and any IMTs introduced and used.

CONCLUSIONS

Evidence of the deficiencies in both the rural road network and the motorized transport services in Africa has been presented. The importance of off-road transport in rural areas and the inadequate understanding of, and lack of attention

to, this essential factor of production and rural day-to-day survival has been confirmed. With the predominance of head-loading and walking as the means of personal and goods movements in rural areas, rural travel and transport, accessibility to and from rural areas, and personal mobility of rural people are gravely restricted.

Although there may be a synergy between rural roads and off-road transport, with each amplifying the economic and social impact of the other, as contended in the first hypothesis, this interaction has not been directly studied or quantified. The relationship between rural motor-road use and off-road feeder networks has important policy implications; if a lack of upstream investment—whether private, public, or combined—is preventing rural roads from reaching their full potential, this should be included in the economic analysis and planning of rural road systems. Governments may also wish to investigate whether relatively minor investments in off-road transport and infrastructure could be reflected in significantly greater use of rural roads.

IMT use would also save large amounts of time and energy and reduce drudgery, particularly for women, as stated in the second hypothesis. A major contribution can be made by planning agencies when they count all IMTs and pedestrians in their traffic planning and monitoring studies. This would fully account for the contribution of IMTs to improving rural accessibility and personal mobility improvement. There has been little study of the production and mobility responses that could be expected with the introduction of affordable IMTs. The basic information gap seems to involve the nature and extent of off-road transportation tasks themselves. Although there is considerable data on amount of labor and time expended on the drudgery of head- and back-loading, there has been little analysis of its effect on production or social pattern in rural Africa.

Another question that has not been adequately analyzed is why IMT usage in rural Africa has lagged so far behind that in other developing regions. Has the major constraint been a generally low level of economic activity, poor communications that have stifled awareness of such devices, market failures, macroeconomic policies that have discouraged such investments, or local and cultural barriers?

A better understanding of the potential economic and social value of IMTs and the low-cost infrastructure needed to make them effective to rural residents—and their stimulative effect on production and road transport—is clearly needed to test the assumptions made in the first two hypotheses. Thereafter, transport planners will address the question of how best to stimulate investment in productive intermediate transport devices at minimum cost—in both financial and manpower terms—to national economies. Some promotional and infrastructural work will obviously be needed, but governments will find a path that is stimulative and facilitative without requiring significant allocations of scarce resources. When IMTs have been introduced in the past and used in the transport system, private individuals have usually taken up the initiative to develop them further, and to reap the benefits therefrom as suggested by the third hypothesis.

The development of institutions for the improvement of rural accessibility and personal mobility including the introduction of IMTs would require different approaches to suit particular country situations. But, for all countries, the primary requirement for the success of new initiatives is a clear understanding, by government and local officials, of the policy issues involved and a commitment to pursue solutions applicable to local situations. Once the relevant issues are accepted and the required commitment is attained, it will be necessary to identify suitable existing institutions, parastatals, nongovernmental organizations (NGOs), or private entrepreneurs for the development and promotion of new IMTs. Successful promotion will also depend on the government's creating the enabling environment for the participation of the private sector. In most countries, this process will require understandings from, and policy review and initiatives of, ministries or agencies responsible for agriculture, rural development, planning, roads or public works, local government, transport, and industries.

These concerns are currently being addressed in the Rural Travel and Transport Project (RTTP) of the World Bank and ECA's sub-Saharan Africa Transport Program. The objectives of the RTTP are (a) to develop and disseminate improved policies to plan, finance, build, and maintain rural roads; (b) to recommend approaches to the improvement of rural transport services, and to the adoption of intermediate technologies to increase personal mobility and agricultural production. The specific recommendations are being developed through village level travel and transport surveys and country case studies that focus on (a) analysis of rural transport and travel patterns by gender in a variety of agricultural, social, economic, or transport environments over a given time frame; (b) assessment of past experiences in, and prospects and means of, introducing and developing intermediate (low-cost) means of transport (IMTs), including a determination of the institutional requirements and functions and the external constraints to IMT use; and (c) assessment of the impact on the role of women in improving accessibility by introducing IMTs.

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