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Findings from African Village-Level Travel and Transport Surveys and Related Studies

Ian Barwell

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FOREWORD

Over the last ten years there has been a growing awareness that rural transport concerns more than just roads. In this report, the rural transport concept, which is still relatively new, is extended to include concerns of household access to domestic, economic and social facilities. To enhance existing knowledge of local transport in rural Africa, village-level travel and transport surveys and related case studies have been carried out under the Rural Travel and Transport Project (RTTP). The findings are synthesized here together with the assessed implications for policy formulation, institutional arrangements and planning for rural transport.

The RTTP is a component of the Sub-Saharan Africa Transport Policy Program (SSATP) which is a collaborative effort between many bilateral and multilateral organizations aiming to assist governments to formulate and implement improved transport policies. It is supported by the Governments of Denmark, Norway, Sweden and Switzerland, and this paper results from a collaborative effort with the International Labour Organisation. The RTTP combines research with dissemination through country policy and strategy development, and lends support to pilot projects. Previous papers of the RTTP include technical papers on *Rural Roads in Sub-Saharan Africa* and *Intermediate Means of Transport in Sub-Saharan Africa.* Future papers will cover issues such as the use of intermediate technology means of transport, institutional framework for rural transport infrastructure, rural transport planning, and the use of labor-based work methods in rural roads construction and maintenance.

The overall image which emerges from the surveys related to the present study is one of rural isolation and unproductive use of limited resources. The African farmer largely inhabits a walking world. Access to rural transport services are poor. Only rarely do rural people visit the world outside their most immediate locality. Women are the principal transporters with the typical female's carrying effort in the survey areas being equivalent to carrying a 20 kilogram load over a distance of 1 to 5 kilometers daily. The average time rural adults spend daily on transport--between 1 and 2.5 hours--is, however, not more than many people in industrial countries devote to traveling to and from paid employment. The main differences are that (a) transport efficiency in Africa is very low with the time and effort invested achieving little more than meeting the household's needs for survival, and (b) transport is a drain on labor which is the principal factor of production of most rural households.

It is clear that the extremely poor state of the off-road transport system in Africa acts as a powerful brake on agricultural productivity and growth. Improved accessibility will reduce the economic costs of moving goods from local markets and ease the barriers to social facilities. This will contribute to economic growth and enhanced social well-being. The challenges are many and considerable. National governments should provide a policy

environment conducive to the development of local-level infrastructure. Communities and local governments need to assert themselves to assume management responsibilities. Donors should identify ways in which they can effectively support the build-up of capacity at the local levels and design instruments through which they can respond to demand-driven requests for improvements in locally-managed infrastructure.

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ABSTRACT

In the past, efforts to improve rural transport principally focused on building and maintaining roads. Limited attention was devoted to the whole complex of rural access, mobility and household transport. Village-level transport is important in this and is an indispensable element for meeting the basic subsistence needs of rural households. This paper, prepared under the Rural Travel and Transport Project (RTTP) of the Sub-Saharan Africa Transport Policy Program (SSATP), focuses on local-level transport in rural Africa. Household surveys and case studies on intermediate means of transport (IMT) and the role of transport in women's lives were carried out to enhance the understanding of the circumstances under which local-level transport imposes a constraint, of the nature of that constraint, and of the appropriate measures to alleviate the constraint.

The paper examines the multi-sectoral implication of rural transport and the related issues in policy formualtion, institutional structures and planning. It defines a range of policy measures which would facilitate an effective response to rural transport needs. It also advocates a more integrated approach to rural transport planning at the local level, and recommends that accessibility be considered in the design of many types of development projects and programs. This report presents a synthesis of the key findings from the research, and an agenda for governments, donor agencies and NGOs aiming to improve rural mobility and access in SSA.

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Particular thanks are due to Geoff Edmonds (ILO) and Jean Doyen for their management advice and support, and to John Riverson and Snorri Hallgrimsson who supervised the study. Many World Bank staff provided valuable comments and suggestions for the report as did representatives of NORAD, SDC, and SIDA. Steve Carapetis, Christina Malmberg Calvo, Moctar Thiam, Elisabeth Stock and Snorri Hallgrímsson, contributed to the editing of the study.

EXECUTIVE SUMMARY

As part of the Rural Travel and Transport Project (RTTP) of the Sub-Saharan Africa Transport Policy Program (SSATP), the World Bank commissioned a research study on the potential for improvements in the level of access of rural populations in Sub-Saharan Africa (SSA) to economic and social services. The research has led to recommendations for approaches to improve rural transport services, and for adopting intermediate technologies to increase personal mobility and agricultural production.

This report synthesizes the key findings and recommendations from research comprising five village-level surveys of household travel and transport demands, carried out in three countries—Burkina Faso, Uganda and Zambia. It identifies the circumstances under, and the means by which, sustainable improvements can be made in the level of access to rural economic and social services; and examines the institutional, policy and planning implications for governments in SSA as well as for donor agencies.

HOUSEHOLD TRAVEL AND TRANSPORT PATTERNS

The surveys attempted to develop an understanding of the time and effort spent on transport in the context of overall household labor allocation and of the outputs achieved from the inputs to transports. They also sought to analyze local-level rural transport as a factor and constraint in agricultural development and in the utilization of essential services. These surveys were complemented by case studies to investigate the issues related to transport in women's daily lives and the role of Intermediate Means of Transport (IMT) in improving mobility and addressing local-level transport constraints. The five study areas and the villages within each area were selected so as to offer different characteristics of mobility and accessibility. Thus, the five areas contain examples of dispersed settlements and low population densities as well as nucleated settlements with relatively high population densities. Within the villages, the households surveyed had widely varying household sizes and compositions.

Across the five study areas the average time spent on travel (personal movement) and transport (the carrying of good and commodities) ranged from 1,125 to 2,700 hours per rural household per annum, or 0.8 to 2.5 hours per adult per day. In the households studied, the economic activities are mainly agriculture, predominantly subsistence agriculture as evidenced by the fact that between 23 percent and 60 percent do not sell any of their main crop and between 56 percent and 87 percent do not sell any of their secondary crop. Only in two areas, does travel and transport associated with productive household activities constitute the second most important component in terms of time spent. This reflects the emphasis in these two areas on agriculture as the income-generating strategy, and the adoption of modern, input-intensive, surplus-producting farming systems. In two of the other areas, agriculture is essentially a subsistence activity since the physical environment or political/economic conditions limit productive potential, and in the last the peri-urban location offers more attractive income-earning options to many households.

Eighty-seven percent of household travel and transport takes place on foot. While IMT are available, their use for domestic transport is limited. Consequently, the physical burden of transporting loads is considerable, ranging from 28-64 ton-km per household per annum. The overall impression from the village studies is one of rural isolation. Some people use IMT for agricultural transport tasks and for personal travel, but travel using the 'rural road and motor vehicle' system is limited.

WOMEN AND RURAL TRANSPORT

Being responsible for domestic activities and contributing to agricultural tasks, it is women who bear the greater part of the transport burden. Throughout SSA, women contribute at least 65 percent of the household time spent on travel and transport, and more than 65 percent of the effort. Across the five study areas, the average adult female spends 1.0 - 2.7 hours per day on transport (the higher figure representing 23 percent of active time), the effort being equivalent to carrying a load of 20kg over a distance of 1.4 - 5.3 km every day. Given their other demanding responsibilities, the burden of these essential transport tasks imposes a particular constraint on the allocation of the female household labor resource to other more productive or socially beneficial activities.

The distance to sources of water and firewood is a critical factor in determining the scale of transport tasks for women and consumption of water tends to decrease when the source is more than 1 km away. Also, the greater the number of female adults in a household, the less the time and effort spent by each woman on transport. Daughters contribute to domestic transport work, particularly at times of peak labor demand, and this can constrain their attendance at school.

There are strong cultural constraints to the use of IMT by women in SSA. The studies found a few examples of women using bicycles and donkey-carts, but on the whole, use of IMT by women to alleviate their transport burden is rare. In specific circumstances, men, using IMT, will take over responsibility for tasks which are traditionally performed by women. However, no examples were found of men using IMT to collect water for domestic consumption, although the use of IMT for transport of water for construction purposes is quite common. When sources of firewood are very distant, there is some evidence of men using IMT to collect the fuel. This only occurs when the opportunity cost of the time spent by women on this task becomes high, or if the distance is so great that it is physically difficult for women to carry out the work.

THE ROLE AND ECONOMICS OF INTERMEDIATE MEANS OF TRANSPORT

Ownership of IMT by rural households in SSA is significant, the most common in the study areas being bicycles and donkey/ox-drawn carts, along with some small motorcycles and wheelbarrows. Other IMT found in rural SSA include pack donkeys, ox-drawn sledges and bicycle trailers. Bicycles and motorcycles are used for personal travel, predominantly by men, to facilities outside the village, to a workplace, and for social reasons. Bicycles are also used, and are economically effective, for small enterprise activities such as trading in crops, beer and other goods, and in one area of Uganda, to provide passenger-carrying services.

Where crop marketing involves the local sale of small quantities of crops, these may be carried to market by bicycle. The economics of the bicycle-based matoke and beer trade in Uganda are clearly advantageous as shown in Chapter 4.

Ox- and donkey-carts perform two main functions—movement of agricultural inputs (particularly fertilizer) from a depot to the fields, and transport of harvested crops back to the store and to a local point of sale such as a buying point. Carts may also be used for firewood collection in specific circumstances, and for the transport of building materials. Carts typically generate a high return on investment for the owners as shown in the economic analysis of the owning and operating of ox-drawn carts in Chapter 4. Transport becomes a constraint to increased crop production and marketing when the time and effort needed for agricultural transport tasks exceeds the household labor resource available at periods of peak activity. The use of IMT is one response to this constraint as it may be seen as releasing latent factors of production, particularly land (by allowing a larger area to be cultivated) and labor (by generating a substantial increase in labor productivity at periods of peak activity). The use of IMT has the additional advantage of reducing crop losses at harvest-time. In one area, which lacks the IMT that would improve access to land, farmers have adopted a dispersed settlement pattern in order to live within walking distance of their land. However, this results in poor access to social facilities within the community and to marketing channels.

THE ROLE OF RURAL ROADS AND TRANSPORT SERVICES

Since very few rural households in SSA own conventional, four-wheeled motor vehicles, it is through the use of transport services provided by motor vehicle that they benefit from the rural road network. Access to 'for hire' passenger transport services for rural people is poor. Bus services mainly operate on main roads remote from most villages, capacity is limited, and the services tend to fill up at the start of the journey. Arguably, in many parts of Africa, informal, and often illegal, passenger services are more easily available than formal, licensed services. Typically, except for those living within the ambit of large urban centers, rural people use passenger transport services only rarely. A small minority of rural people—e.g. local businessmen and government officials—make more frequent use of these services. Use of 'for-hire' cargo transport services is also limited. There are examples of their use to take crops in bulk to market, or in certain circumstances to carry bulk harvested crops from the field. However, investing in the hire of a truck for marketing involves a degree of risk, and it is often necessary to travel to a distant urban center to hire the vehicle because the service is not available locally.

The village-level studies show that proximity to an active local urban center and to a main road, complemented by good rural road access, has a positive influence on the level of household income. However, in any given area, only a small minority of communities can be in this fortunate position. More generally, for two of the areas producing large quantities of low unit-value surplus crops, the highest agricultural incomes were concentrated, to a statistically significant degree, in the villages with the best road access. The agricultural function of these access roads is to allow passage by motor vehicle at critical times in the agricultural cycle. This does not necessarily mean all-weather access.

RURAL TRANSPORT AND ACCESS TO SERVICES IN SSA

A variety of interventions exist for improving physical accessibility in rural SSA. One can intervene to increase the level of mobility of rural people to reach a particular facility (a market, health clinic, etc.) or one can intervene to bring the facility closer to the community, i.e. site facilities closer to rural communities. Mobility can be enhanced by improving transport infrastructure and/or access to means of transport. Good physical accessibility to basic, daily needed facilities such as potable water, medicines etc. can best be provided in nucleated villages. This can, however, be in conflict with the need for good access to land. In one study area this issue has been resolved by well-served nucleated settlements where people make extensive use of IMT for agricultural tasks. Provision of facilities such as improved sources of water and firewood closer to rural communities have the advantage over IMT promotion of potentially benefiting all members of the community and not just those who can aford to buy or rent IMT.

The surveys have identified the five principal rural transport problems in SSA. The first one is the problem of water and firewood collection which can be most effectively addressed by the location and maintenance of sources of water and firewood close to the household, the use of fuel-efficient stoves, the improvement of footpaths and the use of IMT.

The second and third problems are the transport constraints to increased crop production and marketing. These are most effectively alleviated by increased use of IMT, first for load-carrying at peak periods (e.g. animal-drawn carts) and then for personal travel to more distant fields (e.g. bicycles). Footpath improvements, and delivery of farm inputs by motor vehicle along rural roads, are complementary measures. The benefits of alleviating this transport constraint are increased agricultural production and incomes.

The fourth problem concerns access to social facilities, and can be effectively adressed through providing additional facilities closer to communities and through the upgrading of existing services. However, considerations of economic efficiency, financial viability and operational effectiveness all influence the degree of spatial distribution of rural services that can be achieved. Spatial distribution is likely to be the poorest in areas of low population density. In planning the location of facilities, there is a need to adopt a spatial planning approach that aims to maximize the improvement in accessibility.

The last problem relates to the role of rural transport in non-agricultural income generation. The use of IMT increases the efficiency of personal travel, allows the transport of accompanying goods, and facilitates local-level income-generating activities in the form of travel to and from paid employment and trading and operation of small businesses.

TOWARD A RURAL TRANSPORT STRATEGY

Rural transport is relevant to a number of key rural development issues, and there are a wide range of institutional stakeholders in the sector. It is recommended that SSA governments and donor agencies develop explicit rural transport strategies and that governments clearly define the responsibilities of different agencies. The definition of rural transport strategies will provide the framework to develop institutional capability. But before strategies can be defined, policies must be developed.

A wide range of policy issues have been defined to facilitate an effective response to rural transport needs including measures in the fiscal and regulatory fields; measures to encourage involvement by the private sector, NGOs and community-based organizations; reforms to increase the effectiveness of extension and community development services; measures to increase the availability of rural credit; and the adoption of more effective procedures for the planning of social and economic facilities.

Policy reform, deregulation and financing measures will all reduce constraints to the operation of rural transport services. There is a need to support innovative approaches to the provision of local-level rural transport services. The findings indicate that, because transport impacts on so many aspects of rural development, accessibility concerns should be considered in the preparation of any sectoral or multi-sectoral project.

The employment of local labor for road improvement should be encouraged, but an important issue is to define the conditions necessary for the emergence of viable local contracting industries that use labor-based work methods because they are competitive with equipment-based ones. Further investigation is also required of the key considerations in the design of the institutional framework, and of a planning system, for rural transport which encompasses the different levels of government as well as stakeholder participation.

1. INTRODUCTION

The Sub-Saharan Africa Transport Policy Program (SSATP)

The inefficiency of the transport sector in Sub-Saharan Africa (SSA) is an impediment to economic growth. The aims of the Sub-Saharan Africa Transport Policy Program (SSATP), which is structured into a series of discrete components examining different aspects of the transport sector, are to promote and assist African governments in improving transport efficiency and sustainability through policy reform and institutional improvements, and identify measures to improve the planning, design and appraisal of transport investments.

The Rural Travel and Transport Program (RTTP)

The Rural Travel and Transport Program (RTTP) of the SSATP is concerned with transport at the local level where it has the most direct influence on economic, particularly agricultural, and social development in SSA. The specific objectives of the RTTP are to:

(i) Develop and disseminate improved policies to plan, finance, build and maintain rural roads; and

(ii) Recommend approaches to the improvement of rural transport services, and to the adoption of intermediate technologies to increase personal mobility and agricultural production.

This report, which focuses on rural mobility, accessibility and transport services, addresses the second objective which is concerned with the local-level transport demands of rural households. The purpose of the report is to recommend approaches to the improvement of rural transport services, and to the adoption of intermediate technologies, to increase personal mobility and agricultural production.

Village-Level Travel and Transport Surveys (VLTTS) and Related Case Studies

Earlier work had indicated that rural households in SSA devote significant time and effort to rural transport, much of it in and around the village, on foot, and to meet domestic and subsistence needs. The work suggested that this time and effort spent on transport was a constraint to the optimal exploitation of agricultural and social opportunities. It also suggested that a major part of the transport burden falls on women and that the development and use of intermediate means of transport (IMT) (see Box 1) was much less in SSA than in other parts of the developing world, particularly Asia, where motorized as well as non-motorized IMT have evolved (see Box 2). The work had, however, been too limited to provide a sufficient understanding of the circumstances under which local-level transport imposes a constraint, of the nature of that constraint, and of the appropriate measures to alleviate that constraint. A series of Village-Level Travel and Transport Surveys and Related Case Studies have therefore been carried out to help increase that understanding.

The work program comprised five Village-Level Travel and Transport Surveys (VLTTS) carried out in three countries—Burkina Faso, Uganda and Zambia—complemented by a series of case studies to investigate key aspects of local-level rural transport in SSA. The aim of the investigations was to:

(i) Develop an understanding of the time and effort spent on transport in the context of overall household labor allocation, and of the outputs achieved from the inputs to transport.

(ii) Analyze local-level transport, and the time spent, as a factor and constraint in agricultural development and in the utilization of essential services.

(iii) Understand the role of transport in women's daily lives and the impact upon women of improvements in mobility and accessibility, given that a major part of the transport burden falls to women.

(iv) Assess the role of IMT in improving mobility and addressing local-level transport constraints as well as the policy, institutional and implementation requirements for developing the use of IMT.

A series of reports have been prepared on the results and findings from the Village-Level Travel and Transport Surveys and the Related Case Studies (see Box 3). This report presents a synthesis of the key findings from the research, and an agenda for governments, donor agencies and NGOs aiming to improve rural mobility and access in SSA.

Structure of the Report

The report is structured in two parts. Part 1 presents the findings of the research. Four chapters (Chapters 2-5) summarize the key findings on:

- Household Travel and Transport Patterns
- Women and Rural Transport
- The Role and Economics of Intermediate Means of Transport
- The Role of Rural Roads and Transport Services

Part 2 presents the conclusions and implications of these findings in respect of improving access to economic and social services in rural SSA. Chapter 6 presents a framework for improving rural access to economic and social services. This framework identifies the elements of accessibility, and the five areas for intervention, as: (a) rural roads; (b) footpaths and tracks; (c) intermediate means of transport; (d) motorized transport services; and (e) siting of facilities. The chapter then prioritizes these elements for addressing access to the following activities: (a) water and firewood collection; (b) crop production; (c) crop marketing; (d) access to economic and social services; and (e) non-agricultural income generation. Chapter 7 examines some institutional and policy implications of these findings.

Box 1: Intermediate Means of Transport (IMT)

Intermediate Means of Transport (IMT) are those means of transport which are intermediate between the traditional mode of walking (with loads carried on the head, shoulder or back) and modern, conventional motor vehicles such as cars, pick-ups, trucks and buses, in terms of:

- Investment cost;
- Transport capacity—speed, payload and range of travel;
- Infrastructure requirements;
- Complexity of maintenance; and
- Skills, facilities, materials and investment required for manufacture.

A range of types of non-motorized, intermediate means of transport are found in different parts of SSA:

The *wheelbarrow* is a single-wheeled load-carrier which allows a person to move a heavier load than is possible by head-loading. Wheelbarrows are efficient in flat terrain, but are not suitable for use in hilly areas. The technologies available range from very simple, all-wooden wheelbarrows made by carpenters to factory-made all-metal wheelbarrows with pneumatic-tired wheels. They are used for building and road construction activities, and are often found in market centers as a means of short-distance load transport.

The *hand-cart* is a two- or four-wheeled load carrier which allows a person to move a greater load than is possible with a wheelbarrow. The payload can be further increased if several persons push and pull the cart. Hand-carts are efficient in flat terrain but require a smooth riding surface—they are difficult to control on a bumpy track. Hand-carts can be of wooden or steel construction and are usually made in small workshops, often using scrap motor vehicle parts. They are most commonly found in urban areas in Africa, operating on a for-hire basis to carry loads.

Pack donkeys are widely used in certain parts of Africa, for example in Ethiopia and Lesotho, to carry loads, and by itinerant pastoralists such as the Maasai. Users have evolved a range of ingenious ways of carrying different types of load such as water, firewood and crops, on the backs of donkeys. Pack donkeys are particularly suitable for use in hilly terrain where it is difficult to operate wheeled vehicles. Donkeys are easy to care for and, because less status attaches to them than to cattle or oxen, they are more often used by women.

Ox-drawn sledges are the simplest and cheapest way of carrying loads using oxen, which will not accept a load on their backs. They are found in a number of African countries, and are usually constructed by the ox-owner using suitably-shaped branches of trees. Typically, the only cash investment is for a length of chain to attach the sledge to the ox-yoke. They are most commonly used for agricultural activities, e.g. to carry a plough or a sack of fertilizer, and can carry a similar weight to a pack donkey. They are disliked by road engineers because where the sledge routes follow, or cross, a road they can cause erosion. In Zimbabwe, sledges are banned for this reason.

Animal-drawn carts, hauled by oxen or donkeys, are common in some African countries. They have the highest load capacity—in terms of the weight that can be carried, of any African IMT. They are also the most expensive type of non-motorized IMT in Africa. The carts can be made from wood or steel in factories or in small workshops. A common problem is to obtain suitable, efficient wheel/axle assemblies at a reasonable price. Carts are used primarily for agricultural transport purposes. The use of ox-carts is directly associated with the use of the work animals for ploughing, and the cart is normally drawn by a pair of oxen. It is also feasible for a cart to be drawn by a single donkey. A donkey-drawn cart is a cheaper investment than an ox-cart, and the travel speed is somewhat higher, although the payload is lower.

The *bicycle* is the most common IMT in Africa. In many countries, considerable status attaches to the ownership of a bicycle. Full manufacture of bicycles is capital-intensive and in many African countries they are locally assembled from imported parts. The key characteristic of bicycles is that, compared with walking, they allow significantly higher travel speed, with a small accompanying load. They are used for personal travel, in conjunction with small business activities, and for some agricultural tasks. As discussed in the main text they are operated to provide transport services in eastern Uganda. The successful use of bicycles is dependent on a ready supply of spare parts, particularly such items as tires, inner tubes, spokes and bearings.

The bicycle trailer is a means to increase the load-carrying capacity of a bicycle. Essentially, it is a two-wheeled cart which hitches to the back of the bicycle and can be unhitched when not needed. The trailer allows heavier, and more voluminous, loads to be moved by bicycle in flat terrain. It is less suitable for use in hilly terrain. Bicycle trailers can be produced in small, metal-working workshops. Trailers are found in some Francophone African countries, and initiatives are now being made to introduce them in other parts of the continent.

Source: Case Study 2 (see Box 3)

Box 2: Local-Level Rural Transport Services in Asia

Motor Tricycles in the Philippines

Throughout rural areas of the Philippines, 125cc motor cycles, fitted with sidecars, operate to provide local-level transport services. The vehicles evolved initially to provide urban transport services in Manila, but subsequently spread to rural areas. Fitted with reinforced frames and wheels, and strengthened suspension, these motor tricycles are able to carry loads of up to 500kg, or 7-8 passengers or, more commonly, a combination of the two. The motor tricycles are often purchased using credit provided by the motor cycle dealers.

Motor tricycles provide flexible, "for hire" transport services connecting rural villages to local centers and to the main road network where long-distance passenger services operate. They facilitate access to economic and social services, they take people to market together with quantities of crops for sale, and are used by farmers to purchase fertilizer and seeds.

Motor tricycles are able to operate throughout the year on earth tracks and gravel roads, except when road conditions are at their worst. They must be licensed, and operations are regulated by local operators' associations. Some owners operate their own vehicles, others employ drivers. In the latter case, the owner receives a fixed daily amount from the driver, who retains the balance of the fares received after buying fuel. Fares are low, typically about US$ 0.30-0.40 for a trip of several kilometers.

The Itaen of Thailand

The Itaen may be most simply described as a very basic pick-up truck. It has evolved in Thailand as a consequence of the use of power tillers for rice cultivation. It has a simple, fabricated steel frame, suspension and drive-train components taken from scrap motor vehicles, and a single-cylinder, air-cooled diesel engine. It has a simple load-carrying body and an open cab. It can carry a 2-tonne payload, travel at up to 40-50 km/h and operate on earth tracks. The purchase cost of an Itaen is less than half that of a conventional 1 tonne Japanese pick-up.

Itaen are owned by farmers and are used to transport fertilizer and harvested and marketed crops. They are also hired out to other users in a similar way to the hire of ox and donkey carts in Africa. In addition, Itaen carry passengers and their accompanying goods on trips from the village to local centers. Itaen are operated by the owners.

Motorized Three-Wheelers in Gujarat, India

Motorized three-wheelers were introduced in one region of Gujarat state in 1980. There are now over 25,000 of these vehicles in the region, with an annual manufacturing capacity of 1,500 units. The vehicles are fitted with single-cylinder diesel engines have to be registered, and have a nominal payload capacity of 600kg, although in practice they carry loads of up to 1,000kg or 15 people. The motorized three-wheelers complement bus services. They operate more frequently, and link villages to rural centers, typical trip distances being up to 25km. The major constraint on their use is that operation on the fine-particled sandy soils found in some areas is difficult. Depending on the depreciation rate assumed, the operating cost of the vehicle is US$ 0.05—0.10 per km. Operation is viable at low fare rates up to about US$ 0.20 for a 20 km trip. Additional fares are charged for small quantities of accompanying goods.

In addition to providing services which allow rural people to travel with their goods between the village and local centers, the motorized three-wheelers are purchased by small and medium industrial enterprises to meet their goods movement needs. They are also widely used by agricultural traders for crop purchasing.

The motorized three-wheeler costs about US$ 2,750, and purchasers generally have medium income levels. The vehicle manufacturers assist purchasers to obtain credit (30 percent down payment) from agricultural cooperative banks. The owners employ drivers to operate the vehicles.

Source: Case Studies 5 and 6 (see Box 3)

Box 3: Reports Produced on Village-Level Travel and Transport Surveys and Related Case Studies

Village Surveys:

1) Rural Household Travel and Transport Patterns, by Tony Airey, Ian Barwell and Tom Strandberg, June 1993.

2) Transport as a Factor and Constraint in Agricultural Production and Marketing, by Tony Airey, June 1993.

3) Accessibility and the Siting of Facilities and Services, by Geoff Edmonds and Ian Barwell, June 1993.

Case Studies:

1) Women and Rural Transport: an Assessment of their Role in Sub-Saharan Africa, by Irene Urasa, September 1990.

2) Review of Literature Relating to the Use of Intermediate Means of Transport in Sub-Saharan Africa, by David de Leyser, March 1992.

3) Case Study on the Role of Women in Rural Transport: Access of Women to Domestic Facilities, SSATP Working Paper No. 11, by Christina Malmberg Calvo, February 1994.

4) Case Study on Intermediate Means of Transport: Bicycles and Rural Women in Uganda, SSATP Working Paper No. 12, Christina Malmberg Calvo, February 1994.

5) Study of the Rural Transport Services provided by Motorized Three Wheelers in Gujarat State, India, by Sheladia Associates, September 1992.

6) Study of "Itaen" Rural Transport Services in Northern Thailand, by Lamduan Srisakda and Sompong Chivasant, October 1992.

7) Improving Animal-Based Transport in Eastern and Southern Africa, by Mary Anderson and Ron Dennis, January 1992.

PART 1: RESEARCH FINDINGS

2. HOUSEHOLD TRAVEL AND TRANSPORT PATTERNS: THE STUDY AREAS

The village-level surveys were carried out in a total of five study areas in Burkina Faso, Uganda and Zambia. The five areas cover a range of physical and climatic environments that are typical of less-developed areas of SSA, from the Sahel to the Savanna and Montane ecosystems. Although the areas are quite representative, a sample of five study areas is too small to give a complete picture of the full variety of conditions in SSA; for instance the Rain Forest zone was not covered by the surveys. Within each study area, four sample villages were selected to represent different levels of access to the road network and were surveyed in detail. The households that participated in the study—42 per village, 168 per study area, a total of 840—were found to have different degrees of interaction with the economies of their respective states and are characterized by different levels of access to urban centers and to the transport system.

In Burkina Faso and Zambia, where surveys were carried out in two areas in each country, one survey was located in a rural area with 'poor' access (Kaya area in Burkina Faso and Kasama area in Zambia) and the other in a rural area with relatively good access (Dedougou area in Burkina Faso and Lusaka Rural in Zambia). In northern Zambia, the people in the Kasama study area (Zambia I) do not have easy access to facilities as it is some 100 km from the nearest town, has poor road infrastructure and few vehicles and transport services (though the Tazara railway runs through the area), and a low population density. Indeed, some successful farmers in Kasama used the opportunity offered by the Tazara railway to market some produce in Kasama town (100 km away) and in other provinces. Because Kasama lacks an infrastructure of local markets, marketing options are concentrated in villages close to the railway station. For more remote villages the efficacy of the railway is constrained by the need to walk for several hours to the station, which limits the amount of crop that can be marketed per trip and increases the scale of the journey involved. The other area, Lusaka Rural (Zambia II) falls under the sphere of Lusaka city. The roads are in better condition, and transport services are much more widely available. In Burkina Faso, the Kaya area (Burkina Faso I) is Sahelian, has poor road infrastructure and few transport services, though there is significant ownership of IMT. The study area in Dedougou (Burkina Faso II) has better road infrastructure and more easily accessible transport services. There is also a very high level of ownership of IMT. Mbale, the study area in eastern Uganda, is in the equatorial Montane zone of Mount Elgon between 13 km and 23 km from Mbale town.

The villages studied had different settlement patterns. In the Kasama villages, the population tended to be scattered with people's houses close to their cultivated fields. This pattern appeared to be influenced by their desire to reduce the time taken to travel to and from their fields. Such a scattered settlement pattern also means that other facilities provided for the village tend to be relatively far from the village households. At the other extreme are the villages in Dedougou where the people are more mobile due to their relatively high levels of IMT ownership and use. Accordingly, their villages are more nucleated. This development pattern results in the other facilities that are located within nucleated villages being relatively close to all households.

Demographically, the study areas are characterized by a wide range of population densities—from less than 10 to more than 250 persons per sq km—and of household sizes and compositions. Table 2.1 presents information on household composition in the study areas. It shows average household sizes varying between 4.6 and 9.9 and similar variations in the number of adults per household between 2.5 and 4.5. Within these figures there are also varying numbers of female adults per household, with Kasama showing the lowest at 1.2 and Dedougou the highest at 2.4. For purposes of later analysis, the table also presents the percentage of female-headed households ranging from 4.5 percent in Dedougou to 27 percent in Kaya. The sizes of the households in Burkina Faso are significantly higher than those in the other countries due to the effect of polygamous households in Burkina Faso. Apart from the larger overall household sizes they also have higher numbers of adult females, and significantly, in the case of Dedougou, relatively fewer female-headed households.

Table 2.1: Demographic Characteristics of Survey Areas

	Zambia I	*Zambia II*	*Uganda*	*Burkina Faso I*	*Burkina Faso II*
Average Household Size	4.6	6.1	5.7	8.0	9.9
Average Number of Adults per Household	2.5	3.1	2.6	3.8	4.5
Average Number of Female Adults Per Households	1.2	1.5	1.4	2.1	2.4
Percent of Female-Headed Household	16.0	25.6	15. 0	27.0	4.3

Source: Village Survey 1 (see Box 3)

In three of the study areas, there is significant surplus production and marketing of cash crops (fertilizer-dependent production of hybrid maize in Kasama and Lusaka Rural, and irrigated cultivation of cotton in Dedougou). In two of these areas, agricultural production is the major source of income, and household income levels are relatively high (US$387 per annum in Kasama and US$844 in Dedougou). Incomes are also relatively high in Lusaka Rural (US$684 per household per annum) but only 29 percent of this is derived from agriculture. In this area, the opportunities of a large, nearby urban market have been exploited for employment and business activities by people in the more accessible villages. Surplus agricultural production tends to be concentrated in the less accessible villages in the study area, which do not have such good access to employment and business opportunities. Agriculture in the other two areas is characterized by low levels of activity and is geared, for the most part, to household subsistence goals with only limited marketing of small amounts of surplus crops. In Burkina Faso, the location of Kaya in the fragile environment of the Sahel limits its potential for significant production of agricultural surpluses. In Mbale (eastern Uganda) recent political instability, exacerbated by the fall in world coffee prices, has undermined the opportunities for, and returns to, agriculture and people have retreated into subsistence, growing coffee only on a minimum-input, minimum-risk strategy.

The level of participation in agriculture and other income-generating activities varies between different members of the household. Women make a substantial input to agricultural production and harvesting activities, though there are cultural variations which determine the gender division of responsibilities. For example, it is common for men to take the prime responsibility for heavy land clearing and cultivating cash crops, and women for weeding and cultivating food crops for domestic consumption. Some men earn income from employment or trading while many women engage in beer brewing and handicraft production.

Household Transport Time and Effort

Through the terms travel and transport can be used interchangeably, they imply different types of mobility. In this report, travel is seen as personal movement, the interaction between household members and the wider socio-economic environment in terms of access to services and for social purposes. Much of this travel is not burdened by a load. Transport implies a narrower focus on the carrying of goods and commodities associated with the basic domestic needs for food, water and fuel, and the production needs of agriculture. The village-level surveys examined the travel and transport patterns of rural households, i.e. the movement by rural people of themselves and their goods to meet their subsistence, economic and social needs. Many of these relate to the movement of rural people, and their goods, within and around, and to local places outside, their community. This travel and transport takes places along footpaths and tracks as well as on the road network (and, in Kasama, the rail network). The means of transport include walking, with loads carried on the head or the back, as well as IMT and motor vehicles (and the train).

The time and effort spent by the average household on travel and transport in each study area is detailed in Table 2.2[1]. In this table, household travel and transport is divided into three categories:

- *Domestic Transport*: comprises collection of water and firewood, and trips to the grinding mill to produce ground flour for domestic consumption.
- *Agricultural Travel and Transport:* comprises trips to the fields for different cultivation activities, movement of farm inputs, collection of the harvested crop, and crop marketing.
- *Travel to Services and for Social Purposes:* includes trips to the dispensary and the hospital, travel to markets, travel within and outside the village associated with visits to family and friends or to meet social obligations, and travel by children to secondary school.

[1] The data presented here are for the transport component of activities only. Thus, the time spent on water collection, for example, is only the time to travel to and from the water source, not the time spent there.

Table 2.2 shows that the time spent by the average household on travel and transport ranges from 1,125 hours per annum in Kaya to over 2,700 hours per annum in Lusaka Rural[2]. These values take on greater meaning if they are converted to the average time spent per day by an adult on travel and transport. The figures range from 0.8 hours per adult per day for the two Burkina Faso study areas to 2.5 hours per day in Mbale[3].

Domestic travel is by far the most time-consuming task in all areas, except in Lusaka Rural where travel outside the village for access to services and for social purposes is most important in terms of time spent. This reflects its peri-urban location (including the opportunity for children to attend secondary school while living at home). In the other four, more typically rural, areas it is transport to meet the daily needs of the household that requires the greatest time and effort. The time spent on domestic transport, much of which involves load-carrying, ranges from 625 hours per household per annum in Dedougou to 1,500 hours in Mbale. Domestic transport tasks are almost exclusively performed by women. Domestic transport is dominated, in time and effort terms, by water and firewood collection. Only in two study areas, Kasama and Dedougou, does agricultural travel and transport, associated with the productive activities of the household, constitute the second most important travel component in terms of time spent. This reflects the adoption by most households in these two areas of modern, input-intensive agricultural systems which generate significant surpluses. These are more transport-demanding than the more 'traditional' agricultural systems practiced in Mbale and Kaya.

While some use is made of IMT, and there is limited travel by motor vehicle, rural Africans, to a very considerable extent, inhabit a walking world, with loads carried on the head and the back. Although IMT are owned in all areas, their use for domestic transport, which accounts for the major part of transport time and effort, is limited. Consequently, the transport effort of moving goods and commodities is physically demanding. It ranges from 28-64 tonne-km per household per annum, equivalent on average to each adult carrying a load of 20kg over a distance of 1-3.5 km every day. Much of this effort is devoted to the movement of water and firewood. The agricultural transport effort is highest in Dedougou at 10 tonne-km per household per annum. However, in this area there is substantial use of IMT for agricultural transport which reduces the human physical effort involved.

Characteristics of Travel and Transport Patterns

The travel and transport patterns of rural households in SSA comprise the following components:

(i) Frequent trips (several per day) following a regular pattern, within the village and to local places outside the village, primarily concerned with domestic tasks

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2 Data were not collected on travel by children to primary schools within, or in a nearby, village. Only in Lusaka Rural is daily travel to secondary school by children living at home of any significance. In the other areas, children who attend secondary school must leave home and board at the school.

3 For Lusaka Rural, the figure for hours per adult per day excludes time spent by children traveling daily to and from secondary school.

such as water and firewood collection and use of the grinding mill, but also including local travel for leisure reasons and by children to primary school.

(ii) Frequent trips following the agricultural cycle, associated with agricultural production and marketing, within the village and to local places outside the village. This includes, at different times of the year, trips to the fields for different cultivation activities and for harvesting, and trips to obtain farm inputs and to market surplus crops. The need for, and pattern of farm input and marketing trips is determined by the agricultural characteristics of the area. However, in the study areas, crops are predominantly marketed locally—crops are sold in bulk to the cooperative and in smaller quantities to private traders or in local markets.

(iii) Regular travel outside the village to local markets (for a variety of purposes in addition to sale of crops) and, for some people, to paid employment in the area. People travel frequently where there is a network of local markets sufficiently accessible that people can reach them, conduct their business and return home the same day. Where there are no local markets (as in the sparsely populated Kasama area), people only use the market a few times a year.

(iv) Infrequent and irregular trips outside the village to health facilities.

(v) Infrequent, long-distance trips, often for social reasons.

Determinants of Travel and Transport Patterns

Given the considerable degree of dependence on travel by foot, carrying loads on the head or the back, it is distance to facilities that is the prime determinant of trip time and effort. That in time influences trip frequency and total time and effort devoted to transport. A range of internal and external factors influence the distance to facilities and overall travel and transport patterns:

- *Spatial structure of settlements:* nucleated villages tend to have good access to facilities such as water supplies, health facilities, primary schools etc., but poor access to land. For scattered settlements the situation is the opposite.

- *Cultural variations in demand for goods and services:* for example, food staple preferences influence travel patterns for harvesting and crop processing (e.g. need for use of a grinding mill). Attitudes toward western medicine affect frequency of use of health services.

- *Natural resource endowments:* these determine, for example, access to land and distance to sources of firewood and natural water supplies.

- *Demographic characteristics:* distances to social and economic facilities tend to be greater in areas of low population density. In large, polygamous households, the transport burden per adult tends to decrease because it can be shared among a larger group of people.

- *Government rural development policy:* this influences provision of improved water supplies and other social facilities, distance to sources of farm inputs and distance to crop marketing facilities, and opportunities for agricultural production.

- *Availability and affordability of means of transport:* this determines the extent to which rural people rely on travel on foot.

- *Type and quality of transport infrastructure:* the condition of the rural road network and of the paths and tracks in and around the village (on which much of the movement of people and their goods take place) influences the means of transport used for different purposes.

Box 4 compares the characteristics of two of the study areas to illustrate the influence of different factors on household travel and transport. In this comparison, Dedougou can be regarded as representing 'good access' and Kasama 'poor access'.

The Significance of Time and Effort Spent on Transport

The village-level surveys confirm and expand the findings from earlier studies in Tanzania and Ghana. Specifically, they confirm that significant time and effort is spent by rural people in SSA on transport, that much of it is to meet essential domestic and subsistence needs, and that much of it takes place in and around the village. Lusaka Rural, which is clearly within the area of influence of the nation's capital city, is the one notable exception to the overall impression of rural isolation. Households in Lusaka Rural spend an average of 10 hours per week (excluding travel to secondary school) on travel outside the village, equivalent to about 25 percent of total adult travel time, and make several such trips per week—in the other areas this external travel is much less significant. In the more typical rural areas, people lack mobility (because they depend primarily on travel on foot) and have poor accessibility (because the facilities that they need to use are remote). Their walking world is largely restricted to the village, its environs, and local places outside the village—long-distance travel is rare.

The average rural African adult, based on averaging the data from the five study areas, spends $1\,^{1}/_{4}$ hours per day on "essential" travel and transport—for domestic (75 percent of time), agricultural (18 percent), health (<1 percent) and market (6 percent) purposes—and expends a carrying effort equivalent to moving a load of 20kg just over 2 km each day. These averages, of course, conceal substantial variations both between and within study areas, and for many households the burden is substantially higher—the average adult in Mbale spends almost 2 hours per day on essential transport and moves a load of 20kg over a distance of nearly 3.5 km every day.

Box 4: Household Travel and Transport in Two Rural Areas

Kasama (Zambia I)—area with poor access

The study area is some 100 km from Kasama town in northern Zambia, in the watershed of a major river and is sparsely populated—less than 10 persons per sq km. People live in scattered settlements, with good access to natural water sources. Hybrid maize is grown on permanent fields close to the house, and farmers depend on the cooperative to deliver inputs and evacuate the crop. Staple foods are grown on chitemene 'slash and burn' fields remote from the house.

The area is about 60 km from a main road. A graveled district road runs through the area, but is in poor condition and carries less than 10 vehicles per day. The nearest bus service operates on the main road. The access roads to some of the villages are passable only with great difficulty by motor vehicles. The Tazara railway runs through the area, and the four study villages are 30 minutes to 6 hours walk from the station. One train per week in each direction stops at the station and links the area to Kasama town.

In the four study villages only one household, the most successful farmer in the area, owned an ox-cart. 21 percent of households own a working bicycle, but spare parts are expensive and difficult to obtain—another 7 percent of households have a bicycle that is not working. Consequently, bicycles are husbanded carefully and not used for trips where there is a risk of damage. A few households have a wheelbarrow.

Households in the area have good access to water, and in theory to agricultural services, though in practice the performance of the cooperative is poor. In other respects, access is poor. Because of varying soil quality, some of the fields are distant, and firewood resources are severely degraded. Because of low population density, health facilities are remote, and there are no local markets. The limited availability and utility of IMT, and the lack of transport services, mean that mobility is poor and people must meet their movement needs predominantly on foot, even over long distances. Household sizes are small. Consequently, people spend a lot of time (695 hours per adult per annum) on transport, and devote considerable physical effort to these tasks, yet achieve very little as a result—transport is essentially devoted to meeting daily subsistence needs and producing some surplus crops. Use of health services and markets is limited to a few times per year, and travel outside the isolated area for any purpose is very rare.

Dedougou (Burkina Faso II)—area with good access

The study villages are located 15-35 km from Dedougou town, a provincial center. People live in nucleated settlements, and farm fairly distant irrigated land in the Black Volta river basin to produce cotton. They depend on the efficient cooperative system to deliver farm inputs and evacuate the cotton.

Two good roads link the area to Dedougou town, though the direct road access to three of the study villages is not in good condition. Passenger transport services to Dedougou town are quite frequent. Ownership of IMT is extensive 87 percent of households own a bicycle, 47 percent a donkey-cart and 31 percent a mobylette.

Households have very good access to water supplies in the nucleated settlements, to reliable agricultural support services, to regular markets in the villages, and to dispensaries and grinding mills. Physical access to land and to sources of firewood is poor, but the high level of mobility provided by IMT is used to reduce the time and effort spent on travel and transport to and from these facilities. The relatively good access to facilities, the extensive use of IMT, and the large household size mean that the time spent per adult on transport is much lower than in Kasama—279 hours per annum. Yet much more is achieved from the input to transport—the value of crop surpluses produced is high, there is much more frequent use of health and market facilities, and social travel outside the community is more common. Thus, the efficiency of household travel and transport in Dedougou is much higher than in Kasama. Although IMT are widely available and there are good transport services, people do not travel to Dedougou town as often as might be expected. This is largely because good facilities are available in the village—including efficient crop marketing services and active village markets. However, the high level of mobility does offer people options—for example, some people travel choose not to use dispensaries in the village and instead travel by mobylette or bicycle to more distant facilities.

Source: Village Survey 1 (see Box 3)

This average time spent on transport is no more than that devoted by many people in industrial countries to traveling to and from paid work. It can be argued that the time and

effort spent on transport simply constitutes part of the normal working life of rural Africans. However, there are three points which are of fundamental importance:

(i) The efficiency of transport in rural Africa is very low. The time and effort invested only meets the transport needs of subsistence (providing sufficient food and water for the family), of limited participation in the productive economy (generating only low incomes), and of limited utilization of social services (use of health services, for example, is low).

(ii) Transport is, of itself, an 'unproductive' activity. It is a 'derived' need which is carried out only to meet other, more important and direct needs. It is a drain on the household labor resource, which is one of the key factors of rural production in Africa, and this has two implications:

- reduction in the time devoted to 'unproductive' transport would free this household labor resource for other, more productive and beneficial activities; and

- rural life is essentially labor-intensive. The absence of energy-saving devices means that most rural activities involve physical work. Rural people have only a limited daily resource of human energy to devote to physical work, particularly given that their diet is often nutritionaly poor. The human energy that is currently devoted to carrying loads could be better allocated to more productive purposes.

(iii) Most important, the burden of rural transport tasks falls disproportionately on women in SSA, and constitutes a significant component of their very heavy workload. This issue is analyzed in detail in the next chapter.

Transport as a Factor and Constraint in Agriculture

The constraints imposed on rural households by their lack of mobility has a number of repercussions on their daily lives including on their performance in agriculture. In two of the five study areas, transport is at most a second-order constraint to agricultural development. However, transport as a factor and constraint in agriculture can be examined even in these areas by studying the more agriculturally successful[4] farmers. These farmers have responded most positively to the given agricultural circumstances and opportunities of their locality, and have had to face the issues of transport in the production and marketing process, even in the least productive areas. The studies highlight how measures have been adopted by the more successful farmers to increase both on-farm and off-farm transport efficiency and hence alleviate constraints to increased agricultural production.

The survey shows that for most agricultural activities the members of the farming households walk to and from the fields and carry agricultural goods on the head or back. In

[4] The term "agriculturally successful farmers" is used to define to those with the highest incomes from farm production; other generated incomes are not considered.

areas where the agricultural income-generation strategy is based on input-dependent production of relatively large quantities of bulky, low unit-value cash crops, there is a strong correlation between agricultural income and the volume of crops produced, the area of land cultivated, and the amount of fertilizer used. In these agricultural systems, as production increases, the on-farm agricultural travel and transport demands (i.e. those associated with trips to fields for cultivation activities, supply of inputs to the fields and crop harvesting) increase in three ways: (a) more frequent trips to a larger area of, often more distant, fields; (b) larger amounts of inputs, particularly fertilizer, to transport from local depots to the fields; and (c) larger amount of harvested crops to be transported from (more distant) fields. The transport activities then become a constraint to increased crop production when the time and effort involved in meeting any one of these transport demands exceed the available household labor supply at periods of peak activy. The measures adopted by successful farmers to address this constraint are to hire outside labor, to use IMT to increase the transport efficiency of household labor, and in certain circumstances to hire trucks to carry harvested crops from the fields.

Off-farm agricultural transport which is concerned with the distribution of farm inputs and the marketing of produce, is of particular importance for input-intensive farming systems producing bulky, low unit-value cash crops. These farming systems, practiced in Kasama, Lusaka Rural and Dedougou, are crucially dependent on motor vehicle access. Fertilizer and high-yielding variety (HYV) seeds must be delivered in bulk to local depots from which they can be collected by farmers, and crops must be evacuated from the local area in large quantities by motor vehicle. In Kasama, the fertilizer needs of the area are brought in by rail and distributed by truck. In the other two areas, inputs are delivered to depots by truck. In Kasama, surpluses are collected from the village stores by truck. In Dedougou, crops are purchased at cooperative buying points in the village and evacuated by truck. In both Kasama and Dedougou, cooperatives take full transport responsibility from the buying point and their efficiency is largely determined by road accessibility and the quality of management of the cooperative. The same situation applies in Lusaka Rural, although its proximity to a major city, the relatively good condition of the road network, and the easy availability of transport services offers farmers a second option for marketing their cash crops. As a result, some farmers choose to hire motor vehicles to take their crop outside the area for sale, rather than selling it to the local cooperative.

In Dedougou, the concentrated settlement pattern means that while the household has a long harvest distance from the fields to the house, this is compensated by the short distance to the point of sale. In the Zambian areas, the more dispersed settlement pattern minimizes the harvest distance but exacerbates the marketing problem. In Lusaka Rural, this is resolved by a combination of use of ox, carts and hire of motor vehicles. In Kasama, these options are more constrained, though they are used by some of the more successful farmers. Others hire labor to carry crops to the cooperative store. The use of informal marketing channels is widespread in the other two study areas. Here, the agricultural systems involve the more limited use of inputs and the marketing of relatively small quantities of low weight, high-value crops or of crops which are harvested continuously and can be sold progressively in small quantities. These systems are less "road and motor vehicle" dependent. Crops are sold in small quantities to traders in the villages or in local markets.

Head-loading is the most common transport mode used for marketing. IMT have a role to play in widening the choice of market outlets, and in allowing greater amounts to be marketed per trip. Thus, there is a significant use of bicycles to market crops in Kaya. Bicycles tend to be more appropriate than animal-drawn carts for this local marketing since travel speeds are higher, and the relatively small volumes of crops marketed each trip can be transported on the rear carrier of the bicycle. Many households in the Mbale area sell matoke to middlemen traders who transport the crop on bicycles to the markets in town. Local marketing seems to be preferred for reasons of convenience and risk-aversion—specifically the risk that, after investing in the fare to travel to a distant town, the crop may not be sold. Thus, for the marketing of smaller quantities of higher-value crops, or for the progressive marketing of small quantities of crops, there is evidence of a preference for local, informal marketing channels. In this situation, the important transport and access factors that facilitate marketing are: (a) a network of local market facilities; (b) availability of IMT, particularly bicycles; (c) adequate road access to encourage visits to villages by private traders; and (d) availability of local-level transport services.

3. Women and Rural Transport

The Transport Role of Women

All the evidence from the village-level surveys, from the case studies, and from earlier work argues that the major part of the household transport burden in SSA falls on women, who receive some assistance from children. Table 3.1 shows the comparison of the average tonne-kms moved by women compared with that moved by men in the surveyed households.

Table 3.1: Comparison of Female—Male Transport Burdens
(Tonne-Kms per person per year)

	Kasama (Zambia I)	*Lusaka Rural (Zambia II)*	*Mbale (Uganda)*	*Kaya (Burkina Faso I)*	*Dedougou (Burkina Faso II)*
Adult Females	35.7	30.3	39.0	10.3	15.5
Adult Males	7.1	9.8	8.6	3.6	4.4

Source: Village Survey 1 (see Box 3)

The differences are quite dramatic with women carrying about three to five times as much as men in a year. Women take full responsibility for domestic travel and transport (which as noted earlier accounts for the major part of the total transport task). The domestic transport task is to a considerable degree inflexible, influenced primarily by changes in family size over the years. Also, with progressive de-forestation, the burden of the domestic transport task, and hence women's transport burden, will increase over time unless strategies are adopted to address the problem. Women make a significant contribution to the agricultural efforts of the household, including frequent trips to the field for cultivation activities, and involvement in harvesting. In contrast to domestic transport, inputs by women to agriculture are seasonal. The Village-level Travel and Tranport-Surveys' (VLTTS) findings support the data from earlier studies which show that women contribute at least 65 percent of the total transport effort. This division appears to apply across East and West Africa, across Anglophone and Francophone Africa, and across Muslim, Christian and animist societies.

The Transport Burden on Rural Women

The domestic and agricultural transport activities of rural women, plus those trips associated with health care and use of markets, are essential to the reproductive and productive well-being of the household. In Kasama and Mbale (Table 3.2), the typical adult female spends nearly 1,000 hours per year on this essential transport, equivalent to 2.7 hours per day. If the active day for rural Africans is defined as the 12 daylight hours, this equates to 22-23 percent of female active time being spent on transport. In Lusaka Rural, the time spent per adult female is somewhat less, 750 hours per annum or just over two hours per day,

equivalent to 17 percent of active time. In Burkina Faso, the typical adult female spends substantially less time on transport, 1-1.25 hours per day or 8-10 percent of active time. In each case, the major part of the female input to transport is devoted to water and firewood collection. The analysis in one of the case studies[5] of data from other African sources is consistent with these findings. It shows adult females spending 0.9 to 2.2 hours per day simply on domestic transport (water and firewood collection and travel to and from the grinding mill).

Transport of goods by women is predominantly by head-loading. The effort involved is therefore most effectively expressed as the distance over which a head-load is carried every day. For the five study areas, the effort equates to the adult female carrying a 20kg load over a distanc e of 1.4-5.3 km every day. Other surveys in Africa have identified load-carrying burdens as being as high as moving a load of 20kg over a distance of 6.8 km every day. Females transport a large proportion of harvested crops from the fields to the home. The surveys indicate, however, that it is men who take primary responsibility for crop marketing, although it is known that in some societies, particularly in West Africa, women are very much involved in marketing.

Determinants of the Transport Burden

A range of factors determine the extent of the transport burden for women:

(i) The time and effort spent by each woman on transport decreases as the number of female adults in the household increases. Burkina Faso, where polygamy is prevalent, provides evidence of this.

(ii) The transport burden increases with increasing distance to sources of water and firewood. In Burkina Faso, the nucleated villages, each provided with several wells, mean that travel times for water collection are low. Similarly, in Kasama, the scattered settlements, located in the watershed of a major river, have good access to natural streams as sources of water. On the other hand in Uganda, where water sources are distant, travel time is high. There is, however, evidence that, when distances to water and firewood are very large, the transport burden is alleviated by reducing consumption.

(iii) Children, and particularly daughters, contribute to alleviating the transport burden on women. Children are most likely to be involved in carrying water, because distances are relatively short compared with firewood collection, and water can conveniently be carried in small containers. Children are least likely to be involved in travel to the grinding mill because distances are long and the task involves a cash transaction and hence increased responsibility[6]. The surveys also indicated that, at times of maximum demand on household labor

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5 Christina Malmberg Calvo, *Case Study on the Role of Women in Rural Transport: Access of Women to Domestic Facilities*, SSATP Working Paper No-11, 1994.

6 Christina Malmberg Calvo, *Case Study on the Role of Women in Rural Transport: Access of Women to Domestic Facilities*, SSATP Working Paper No. 11, 1994.

(e.g. at harvest time) children make a greater contribution to domestic tasks. Discussions in the survey areas and evidence from elsewhere indicate that the need for daughters to contribute to household tasks may constrain their attendance at school.

(iv) Food staple preferences also influence the transport burden. When the staple food crop is harvested as a concentrated activity, all household members tend to contribute. However, in Uganda, the staple crop, matoke, is harvested continuously as required, and this task tends to fall predominantly on women. The need to convert the staple food into flour, as is the case with maize and millet but not matoke, creates the additional task of travel to and from the grinding mill. However, by using a grinding mill, women eliminate the arduous task of hand-pounding the crop into flour.

(v) As discussed subsequently, the availability and use for domestic tasks of IMT can reduce the transport burden for women under certain circumstances.

The Situation of Female-Headed Households

In four of the five study areas, a significant proportion of the households were headed by females—ranging from 15 percent in Mbale to 27 percent in Kaya. The main reasons for a household being headed by a female are: because the woman is separated or divorced; because the male partner has migrated out of the area in search of work (sometimes defined as a female-managed household); or because the male has died. Female-headed households are smaller than their male-headed counterparts, have fewer adults, work a smaller area of land, and have lower total incomes and incomes from agriculture.Typically, in a female-headed household, the absence of a male partner, the lack of access to IMT, and the only option to cultivate more distant fields, all contribute to increasing the scale of the transport burden faced by women. They must fulfill this burden as well as take responsibility for agricultural tasks that would normally be undertaken by men. Consequently , female-headed households are preoccupied with meeting subsistence and domestic needs to ensure their survival, and have limited opportunity to engage in income-generating activity.

The Impact of IMT on Women

There are two ways in which IMT can reduce the transport burden on women: (a) when use of an IMT results in males assuming responsibility for a transport task that would normally be undertaken by women; and (b) when women themselves use an IMT to reduce the time and effort involved in a particular transport task. Although there are strong cultural constraints on use of IMT by women in SSA, these are neither absolute nor unchangeable. For example, in parts of eastern Uganda, it is acceptable for women to ride bicycles; in Dedougou, women ride bicycles and use donkey-carts.

Clearly, the main benefit to women would be if IMT were used to collect water and firewood since these are their most demanding transport tasks. The surveys identified two examples of this modal change occurring. In Lusaka Rural, households owning ox-carts use

them to collect firewood, and in most cases men or boys take responsibility for the task[7] In Dedougou, just over 50 percent of households owning donkey-carts use them to collect firewood, but this is accompanied by only a limited transfer of responsibility from women to men. For women who use the donkey-carts the time spent on firewood collection is reduced because fewer trips are required—cart-users collect firewood about once every 11 days compared with once every 3 days on foot, and there is a time saving of about 5 hours per week. Further, the human physical effort is largely eliminated because the task is transferred to the donkey.

The surveys indicate, however, that, in general, there is a reluctance by men (who tend to control the IMT) to allow the IMT to be used for 'women's work'. Specifically:

(i) There is no evidence of use of IMT, or of assumption of responsibility by men, for domestic travel activities other than firewood collection. In particular, there is no significant evidence of use of IMT to collect water, even when the distance to a source of water is long; nor is there evidence of use of bicycles to travel to the grinding mill, although they are well-suited to this task.

(ii) It would appear that the willingness of men to assume responsibility for firewood collection, using IMT, only starts to occur when the distance that women have to travel to becomes so great that:

- the opportunity cost of the time they spend becomes high; or
- it becomes difficult for them to find time to cope with the task traveling on foot, as well as fulfilling their many other responsibilities.

Where IMT are used to move harvested crops, the burden of this transport task on women is alleviated. In this situation, however, women are likely to make a greater input into the actual work of harvesting.

Potential Time Savings

With the majority of travel and transport in most areas dedicated to domestic activities, particularly water and fuelwood collection, these would be the most obvious areas for attention to derive savings in travel time. The potential for such savings can be estimated by assuming realistic targets for reduced access time to the sources of these needs. The Tanzanian government has set a national target that all households should be within 400m, i.e. 6 minutes walk of a potable water source. Applying this target, the potential average annual time savings per household would be 182 hours for Lusaka Rural, 125 hours for Kaya and 664 hours for Mbale. Kasama and Dedougou are already within this target. The household in the worst-case village would save 942 hours per year. One effective means of reducing time spent on firewood collection is to establish woodlots. If a target of 30 minutes average walk to a woodlot is accepted as realistic, the potential annual savings per household are 610 hours for Kasama, 208 hours for Lusaka Rural, 241 hours for Mbale, 119 hours for

[7] Concern was expressed that this would accelerate the process of deforestation. As one village headman expressed it, "Women collect branches, men fell trees".

Kaya and 248 hours for Dedougou. Households in the worst-case village would save 984 hours, which is equivalent to half a year's work for a person working 8 hours per day 5 days per week.

However, the provision of sources of water and firewood closer to the house will not necessarily generate these time savings for the household, nor will the full time saving necessarily accrue to the female adults. Relevant factors include:

(i) The improved, closer source of water must be reliable, have adequate capacity, and supply water of acceptable taste.

(ii) Better access to a water source may generate an increase in consumption, and hence more trips—this is beneficial, and represents an increase in the productivity of time spent on water collection, but will reduce the absolute time saving.

(iii) A reduction in the scale of the task may mean that the contribution of young daughters to the work is reduced to a greater degree than that of the adult females. Again, this may be regarded as beneficial, particularly if it results in a higher level of school attendance by young females, which is known to have long-term economic benefits.

Reallocation of Travel Time Savings

There is evidence that the labor resource released by reducing the transport burden of women would be reallocated to beneficial reproductive or productive activities[8]. A complex interplay of a range of factors will determine whether the benefits would be social or economic. The analysis of the case studies shows that while women tend to use their physical and financial resources to maximize the welfare of their families, at times even they find it difficult to accurately predict their own future actions. For example, in a study in Singida, Tanzania, women predicted that they would devote the time saved from improved access to water primarily to leisure—resting and visiting neighbors. However in practice, after the water situation was improved, the time saved was allocated to agriculture and to domestic activities. This illustrates the fact that, while African women may desire additional leisure, the welfare of the family takes precedence. Other studies in Lesotho and Tanzania showed that women make assessments of the priorities of the family, or of their responsibilities that are most neglected, in deciding where to reallocate time savings.

Several factors affect the decision on whether to reallocate time to additional agricultural production. Of the total time allocated to agricultural travel and transport, female adults contribute 32 percent in Mbale, 33 percent in Lusaka Rural, and 37 percent in Kasama. However, in Dedougou, they contribute 54 percent and in Kaya 95 percent—both much higher proportions than in the other areas. The conclusion that emerges is that the reduced

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8 See various examples cited in Christina Malmberg Calvo, *Case Study on the Role of Women in Rural Transport: Access of Women to Domestic Facilities*, SSATP Workshop Papers, No. 11, 1994.

travel and transport for domestic purposes in these areas leaves women with a choice of how they might use the additional time and they choose to make higher contributions to agriculture.

4. THE ROLE AND ECONOMICS OF INTERMEDIATE MEANS OF TRANSPORT

IMT in the Study Areas

Ownership by rural households of conventional, four-wheeled motor vehicles in SSA is rare—only three owners of such motor vehicles were found in the total survey sample, all in Lusaka Rural. However, ownership of IMT is significant, and the travel and transport patterns of rural households in the study areas are influenced by the types and availability of IMT which are used to meet short/medium-distance movement needs. The IMT owned in the study areas comprise bicycles (41 percent of households own a bicycle in working order), donkey - and ox-drawn carts (owned by 16 percent of households), mopeds/mobylettes (owned by 10 percent of households), and small numbers of wheelbarrows (owned by 2 percent of households). The study areas encompass a wide range of levels of ownership of IMT in SSA:

- In Burkina Faso, and in particular the Dedougou study area, almost all households own a bicycle, nearly 50 percent own a donkey cart, and about 33 percent own a moped. Some households own all three modes.

- In Kasama and Mbale on the other hand, IMT ownership is limited to a small minority of households owning bicycles (21 percent and 13 percent), the occasional wheelbarrow, and, in the case of Kasama, one ox-cart owned by the richest household in the survey. In most rural areas of Africa, except in mountainous terrain, one would expect to find at least some households owning bicycles.

The study areas are, however, not fully representative of the range of IMT modes found in SSA (see Box 2). The modal characteristics of IMT are such that they can be used both for personal travel and for goods movement.

IMT increase the efficiency of short/medium - distance personal travel and goods movement. Specifically, they:

- Reduce the time and effort devoted to movement of large quantities of agricultural inputs and outputs.
- Facilitate access to local crop marketing points of sale.
- Facilitate small enterprise activities.
- Facilitate access, particularly for men, to social services.
- Facilitate social travel, by men, outside the village.
- Reduce the burden of firewood collection in certain circumstances.
- Enable fast and easy travel to local, paid employment.IMT for Personal Travel.

Table 4.1: Ownership and Use of Bicycles and Mobylettes

	% of *households owing IMT in working order*	*% of households using the vehicle for:*						
		Travel to fields	*Transp. of farms inputs*	*Crop marketing*	*Travel to dispensary*	*Travel to hospital*	*Travel to market*	*Social travel outside village*
Bicycle								
Kasama	21	—	13	3	—	—	—	3
Lusaka								
Rural	15	—	2	1	—	—	1	—
Mbale	13	—	2	6	3	1	4	3
Kaya	67	—	10	23	64	65	45	31
Dedougou	87	33	23	—	31	54	22	56
Mobylette								
Kaya	15	—	—	—	14	18	5	5
Dedougou	31	—	—	—	5	33	3	15

Source: Village Survey 1 (see Box 3)

Table 4.2: Ownership and Use of Animal Carts

	% of households owning		*% of households using animal-drawn cart for:*			
	Donkey cart	*Ox cart*	*Firewood Collection*	*Transp. of farm inputs*	*Crop harvesting*	*Crop Marketing*
Kasama	—	1	—	4	2	7
Lusaka Rural	—	11	12	44	44	24
Mbale	—	—	—	—	—	—
Kaya	20	—	2	22	19	3
Dedougou	47	—	27	45	76	—

Source: Village Survey 1 (see Box 3)

The bicycle and mobylette are used for personal travel, predominantly by men, and sometimes with small accompanying loads (Table 4.1). Much of this travel is outside the village and along tracks and roads with a good riding surface: (a) in Dedougou, nearly 40 percent of bicycle owners use bicycles to travel to and from their fields for different crop cultivation activities. Bicycles were not used for this purpose in the other study areas; (b) bicycles and mobylettes are used for travel to dispensaries, to hospital, to local markets, and for short/medium-distance social trips outside the village; and (c) in Lusaka Rural, where there are employment opportunities outside the village, bicycles and motorcycles are used to travel to and from work.

IMT for Goods Movement

The use of a bicycle extends the range over which local marketing can be carried out, compared with travel on foot. However, bicycles are not used for trips to the grinding mill, although technically they would be well-suited to this task. One reason for this may be that the transport of crops to the mill is considered women's work. Bicycles are also used in small enterprise activities such as marketing of charcoal, beer and other local brews, and handicrafts. In eastern Uganda, trading in matoke using bicycles is common. Another phenomenon in eastern Uganda is the use of bicycles to provide transport services. Known as 'boda-boda' bicycles, they are available for hire, to carry passengers and accompanying goods in small towns and market centers.

Ox - and donkey-drawn carts are the main form of load-carrying IMT in the survey areas. Their primary use is to address agricultural transport needs (Table 4.2); bringing agricultural inputs from a source of supply in the village (or a local depot outside the village) to the fields; and ferrying harvested crops from the fields to the house. The use of animal-drawn carts addresses a classic transport bottleneck—the need to move a relatively large volume of goods in a short space of time.

The evidence on use of carts for crop marketing is more complex. Farmers in Dedougou and Kasama, and to a lesser extent in Lusaka Rural, rely on the cooperative to collect large quantities of bulky, cash crops from the village by truck. In Kasama and Lusaka Rural, with the scattered settlement pattern, carts are used to move the crops in bulk to the cooperative store. In other circumstances in SSA where crops cannot be sold in the village, animal-drawn carts may be used to transport bulk quantities of marketed crops to local points of sale. In addition, there are examples from the surveys of ox - and donkey-carts being used to collect firewood. The level of usage of carts often significantly exceeds the level of ownership (Table 4.2). This indicates a significant degree of loan and hire of carts (sometimes paid for in-kind rather than in cash) at these periods of peak agricultural transport demand.

A few households in the survey sample owned wheelbarrows. These are used to some extent for moving sacks of fertilizer, but rarely for domestic transport activities. Their main use appears to be for transportation of materials for brick-making (including water) and house construction.

IMT for Water and Firewood Collection

A frequently-raised issue in relation to water and firewood collection is the feasibility, and economics, of using IMT for the tasks, as an alternative or complement to the provision of an improved water supply system or woodlot to serve a community. In theory, the use of IMT would generate a significant reduction in time and effort. For example, the use of a wheelbarrow with a payload of 50kg, compared with head-loading 20kg, would reduce the time spent on water transport by 60 percent. The Dedougou data show a saving of about 250 hours per annum from the collection of firewood using a donkey-cart.

However, the survey findings indicate that there are substantial limitations on the use of IMT for these tasks. This is particularly the case for water collection, where virtually no evidence was found of the use of IMT, even in areas where they are widely owned. There are several contributory reasons for this:

(i) There is an extremely strong cultural tradition in Africa that water collection is the responsibility of women and girls.

(ii) The terrain, and the footpath infrastructure that connects the house to the source of water, is often unsuitable for use of IMT.

(iii) In many circumstances, IMT are technically inappropriate for water collection.

(iv) To exploit the benefits of using IMT a household must also own some means of storing a substantial quantity of water at the house.Thus, even if major efforts were made to encourage ownership and use of IMT by women, technical factors would greatly restrict the scope for use for water collection in many areas.

The situation in respect of firewood collection is less clear-cut than for water collection. The most effective IMT for firewood collection is the animal-drawn cart. Physical access by cart to firewood sources will not be a major problem, and there are no problems associated with storage of the firewood. Further, the economics of the use of carts to collect firewood can be attractive. Farmers normally buy animal-drawn carts for agricultural tasks, and the evidence suggests that the return on the investment is high and more than covers the cost. Further, except for limited periods of the year, the utilization of the carts is not high. Thus, the marginal cost of a farmer allowing his wife to use the cart to collect firewood would be negligible, yet could save her hundreds of hours of work every year. Thus, while the economic of purchasing a cart solely to collect firewood is not attractive, the 'marginal' use of carts for this task, by the family of the owner, generates a very high return. The fact that there is only a limited use of carts in this way suggests that it is the cultural barrier to use by women, and the reluctance of men to assume responsibility for the task except in extreme circumstances, that are the real constraints.

A further consideration that would limit the impact of IMT on water and firewood collection is that these are universal needs (all households must have water and fuel). However, it is unrealistic to expect to achieve universal ownership of IMT for water or firewood collection in a community—only those households which owned suitable IMT, and

others who were able to borrow or hire the IMT, would benefit. But the provision of improved sources of supply would benefit all households in a community.

The Agriculture Roles of IMT

In agricultural terms, the role of IMT is four-fold. First, they shorten the travel time involved in journeys to and from the fields — a bicycle traveling at 10 km/hr decreases the time spent, compared with walking to the field at 4 km/hr, by 60 percent. Second, they increase the efficiency with which loads are carried. Transferring harvested crops by donkey-cart, which can carry a load of 250kg, rather than by head-loading in 20kg units, reduces the number of trips required by 92 percent. Third, they reduce the effort and drudgery involved in the human portage of inputs to, and produce from, the fields. Lastly, they reduce pest damage and spoilage — crops can be evacuated from the fields quickly before they are attacked by pests, and harvested crops can be loaded directly into the cart cutting down handling losses.

In economic terms, these benefits of IMT can be considered as releasing latent factors of production, principally land and labor. In land terms, the evidence from Dedougou suggests that the use of IMT have enabled farmers to extend the distance over which agriculture is practiced. In labor terms, IMT increases the efficiency with which the household labor endowment is utilized. Dedougou, where most households use donkey-carts for harvesting, has one of the heaviest and bulkiest harvests studied yet the time spent on transport is one of the smallest. The separation of the task of harvesting from transport enables the harvesters to work longer and more effectively. This minimizes the time that the crop is exposed in the fields. An indirect way in which IMT releases household labor for agricultural activities is through their use, by some households in Dedougou, to collect fuelwood.

Ownership of IMT

Income level is clearly one factor that influences the level of ownership of IMT. As might be expected, in each of the study areas, IMT owners tend to have higher income levels than non-owners. There are, however, other important factors apart from income level which influence the level of ownership of IMT including:

(i) The local availability of IMT and spare parts.

(ii) Familiarity of people with IMT.

(iii) Terrain condition.

(iv) Cultural acceptance.

(v) Availability, and terms, of credit for the purchase of IMT.

(vi) Income-generation potential of the IMT.

(vii) Attitudes towards communal ownership.

Economics of IMT

The economics of each type of use are examined through examples from Sub-Saharan Africa.

Commercial Operation of IMT to Provide a Transport Service

In Mbale district of eastern Uganda, there are bicycle operators whose main occupation is to trade in goods such as matoke (the local staple food, a form of green banana), beer, and charcoal[9]. The matoke traders buy from the more inaccessible villages and transport the crop into Mbale town where they sell the entire load to a retailer. They typically carry 4 to 8 bunches of matoke (70-160kg), and make only a single trip per day. They typically only work 3-4 days per week, 10 hours per day. They buy the matoke at Ush.700-850[*] (US$) per bunch and sell it in the market at about USh.1,400 per bunch. The beer traders travel to the surrounding areas to buy beer. They bring the beer back to local places where there is a good market. The typical load is 40-80 liters, and the gross income about USh.1,600 per day. Beer traders usually work five days per week.

Some of these traders own their own bicycles, while others (about one-third) rent them on a regular basis from an owner at a standard rate of USh.500 per day. Because of the intensive use of the bicycles, often on tracks and roads that are in poor condition, maintenance and repair costs are high. Table 4.3 summarizes the economics of ownership of a bicycle which is rented out to a matoke or beer trader. The analysis assumes purchase of a new bicycle and a life of four years - in practice, annual depreciation costs are probably lower than estimated because the bicycles are often older and may last for more than four years. The table shows that ownership of a bicycle and its rental to a trader is a profitable activity. It also shows that (a) rental to beer traders is more profitable because they work more days per week than matoke traders; (b) the payback period for the original investment ranges from 6-13.5 months; (c) the annual return on the investment ranges from 88-200 percent; and (d) ownership of one or two bicycles, and their rental to traders, is sufficient to generate the average annual income of about Ush.124,000 in Mbale district.

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9 Christina Malmberg Calvo, *Case Study on Intermediate Means of Transport: Bicycles and Rural Women in Uganda*, SSATP Working Paper 12, 1994.

* At the time of the study, 1 US$ was about Ush 895.

Table 4.3: Economics of Ownership of a Bicycle Rented Out to a Trader

1. Investment Cost	
Purchase of Bicycle	USh.68,750
Life	4 years
Annual Depreciation	USh.17,188 per annum
2. Operating Cost	
All maintenance and repair costs borne by renter of bicycle	0
3. Annual Gross Income	
USh.500 per day, 3-6 days per week, 12 months of the year	USh.78,000-156,000
4. Annual Net Income	Ush.60,812-138,812

Source: Case Study 4 (see Box 3)

Table 4.4 summarizes the economics of trading by a bicycle-owner. The same assumptions on investment cost are used as in Table 4.3. Table 4.4 shows that a typical matoke trader earns about USh.550,000 per annum (US$3 per working day), more than four times the average annual household income, and a beer trader about USh.320,000, more than twice the average annual household income. The table also illustrates that annual operating costs are very high, exceeding the purchase price of a new bicycle.

Table 4.4: Economics of Trading Operation by Bicycle Owner

1. Investment Cost		
Purchase of Bicycle	USh.68,750	
Life	4 years	
Annual Depreciation	USh.17,188 per annum	
2. Annual Operating Cost		
General Maintenance	USh.30,000	
Tyres and Tubes	USh.50,400	
Total	USh.80,400	
3. Annual Gross Revenue	USh.655,000	USh. 416,000
4. Annual Net Income	USh.557,612	USh.318,412

Source: Case Study 4 (see Box 3)

Table 4.5 summarizes the economics of operating as a trader using a rented bicycle. As would be expected, the income is lower than if the rider owns the bicycle, but it still substantially exceeds the average annual household income in the area - a typical matoke trader earns over USh.480,000 per annum and a beer trader over USh.200,000 per annum. The higher income resulting from owning rather than renting the bicycle raises the question of credit availability.

Table 4.5: Economics of Trading by Rider Who Rents Bicycle

	Matoke Trader	*Beer Trader*
1. Annual Operating Cost		
Rent to Owner	USh. 91,000	USh. 130,000
General Maintenance	USh. 30,000	USh. 30,000
Tyres and Tubes	USh. 50,400	USh. 50,400
Total	**USh. 171,400**	**USh. 210,400**
2. Annual Gross Revenue	USh.655,000	USh.416,000
3. Annual Net Income	USh.483,600	USh.205,600

Source: Case Study 4 (see Box 3)

The typical trader studied carried six bunches of matoke per trip, at a combined weight of 100kg, over a distance of 23km, and sold each bunch for USh.600 more than he paid for it. This equates to a transport charge of USh.1,565 per tonne per kilometer, or US$1.75 per tonne per kilometer. This is substantially higher than the cost of transport by truck on a good road. However, matoke traders concentrate on areas that have poor road access, and are buying in small quantities. For the farmer, an alternative to selling matoke to a bicycle trader is to head-load it to the market in Mbale. Assuming a farmer could head-load two bunches of matoke, walking at 4km per hour, the return to the farmer from the higher price the crop will fetch in Mbale equates to USh.100 per hour. Data from the Mbale area show wage rates for hired labour ranging from USh.75-125 per hour. Thus, the return to the marketing trip on foot is comparable to that from working as a hired laborer. However, the marketing trip involves a 12-hour return journey and the risk of not selling the crop. The other option for the farmer is to catch a bus to Mbale, but this involves a long walk to the bus route, the risk of not being able to catch a bus, and a return fare of at least USh.2,000—i.e. the farmer must sell a minimum of four bunches of matoke simply to recover the bus fare. Thus, for farmers marketing small quantities of matoke from inaccessible areas, to sell to a bicycle matoke trader is a reasonable economic choice to make.

Operation of IMT to Meet Transport Needs of Owner, and for Hire to Other Users

A case study in Rukwa Region of Tanzania provides detailed data on the economics of ox-cart ownership. In this area, ownership of ox-carts is concentrated among the "larger"farmers cultivating at least 2 hectares of land, but the carts are hired out to smaller farmers. Carts are purchased by farmers who already own work oxen and use them for ploughing. Table 4.6 details the annualized cost, to a farmer who already has oxen, of owning and operating an ox-cart. It presents two scenarios: (a) outright purchase for cash at TSh.72,000*; and (b) purchase on credit (which is available to larger farmers), based on 25 percent down-payment and repayment of the loan over 2 years at 30 percent interest.

* At the time of the study, 1 US$ was about TSh 300.

Table 4.6: Cost of Ownership of Ox-Cart, Rukwa Region of Tanzania

	Outright Purchase	*Purchase on credit*
1. Costs over Six Years		
Initial Investment	TSh.72,000	TSh.18,000
Loan Repayment	--	TSh.54,000
Interest	--	TSh.16,200
Maintenance	TSh.64,800	TSh.64,800
2. Total Cost over Six Years	TSh.136,800	TSh.153,000
3. Annual Cost of Ownership	TSh.22,800	TSh.25,500

Source: Case Study 7 (see Box 3)

The life of the cart is assumed to be six years, and annual maintenance cost to be 15 percent of purchase price. The table shows that the annual cost of ownership ranges from TSh.22,800-25,500. Thus, the use of credit for purchase only increases cost of ownership by about 10 percent. However, credit makes an ox-cart much more affordable to an owner of oxen—the capital required is reduced by 75 percent, from TSh.72,000 to TSh.18,000, if the cart is bought on credit. The significance of this investment can be examined by considering that a typical maize farmer in the area harvests about 35 bags per hectare, value TSh.70,000-TSh.87,500, and that production costs per hectare are TSh.6,250 for hired ox-ploughing and TSh.12,500 for five bags of fertilizer, i.e. the gross margin per hectare is TSh.51,250-68,750. The cash price of an ox-cart is equivalent to the gross margin value of 1.0-1.4 hectares of maize. However, the deposit required to buy a cart on credit equates to the gross margin value of 0.26-0.35 hectares of maize. Thus, by growing an additional one-third of a hectare of maize for one season, a farmer could generate the down-payment to buy a cart.

The cash income to the owner from hire of the cart is estimated based on the typical pattern of use as follows: (a) hire of cart to five other farmers, each cultivating 1.2 hectares of maize, producing 42 bags of maize and using 6 bags of fertilizer, at hire rates of TSh.50 per bag of fertilizer and TSh.100 per bag of maize; and (b) hire to three households for firewood collection, each household using the cart once every two months, and paying Tsh.700 per collection trip. This gives an annual cash income from hire of the cart of Tsh.35,100 (TSh. 1,500 for Fertilizer; TSh.21,000 for Harvesting and TSh.12,600 for Firewood). Thus, hire to five farmers for fertilizer transport and harvesting is sufficient to cover all costs of the cart, and if it is also hired for firewood collection the owner makes a cash profit.

The agricultural economic benefits to the owner from own-use of the cart can be assessed on the basis of savings in hire of labour to transport fertilizer and harvested crop, and reduction in crop losses. In this context it should be noted that labour is, in any event, in short supply at the concentrated maize harvesting period. A farmer may have difficulty in finding hired labor, and the consequent delay in harvesting the maize can result in significant crop losses. A cart-owner farming 2 hectares of maize has 70 bags of crop to be harvested, plus 10 bags of fertilizer to be moved. A hired laborer can transport about 1.5 bags per day of maize, and 2 bags per day of fertilizer, at a cost of about TSh.250-300 per day, i.e. a cost of at least TSh.165 per bag of maize, and TSh.125 per bag of fertilizer. The saving to the owner from use of his own cart to transport the crop is TSh.12,600. The gross value of 2 hectares of

maize is about TSh.150,000. A 5 percent reduction in crop losses through rapid evacuation of the crop by ox-cart (2 hectares of maize can be evacuated in 2 days) would yield an additional saving of Tsh.7,500. This analysis shows that, even with the minimum land-holding that would be expected for a cart-owner in the area, the return from ownership is estimated at about TSh.54,000 per annum, more than twice the cost of ownership. With a larger land-holding the return would be higher.

More fundamentally, in a typical African maize cultivation system where there is sufficient land available to expand production, the labour constraint at the concentrated harvesting period is a key production bottleneck. In this context, the use of carts to alleviate the bottleneck (a cart has 12-30 times the transport capacity of human labour) could stimulate a significant increase in production, if accompanied by an efficient input supply and crop marketing system - relying on the use of carts for the first stage in the marketing process, delivery to a local bulking point. Further, a 16 percent level of cart ownership would be sufficient to serve the whole farming community.

Operation of IMT to Meet Transport Needs of Owner

Ox-Drawn Sledge

In some parts of Africa, farmers who use oxen for ploughing regard the ownership of a sledge as being very important. The sledge is made by the farmer from a suitably-shaped tree branch and the total investment in a length of chain will not exceed a few dollars plus a few hours of work by the farmer. For a very minimal investment, he conveniently transfers the burden of moving certain types of load from himself to his oxen. However, sledges are also regarded as a cause of damage to rural roads, and hence increase road maintenance costs, particularly at places where sledge routes cross the road.

Bicycle

Except for commercial operations such as those found in Mbale district of Uganda, it is rare for bicycles to be hired out by their owners to other users. A decision by an African man to buy a bicycle will be not be based solely on the economic benefits, but also on the status that attaches to owning a bicycle. Detailed below is an analysis of the annual cost of personal ownership of a bicycle in Mbale district. It assumes the purchase of a new bicycle with a life of 8 years — longer than for commercial operations because of the much lower intensity of use. Annual operating costs are also much lower for the same reason, equating to replacement of one set of tyres per annum plus minor repairs. The costs are based on 2,500km travel by bicycle per annum, i.e. about 7 km per day. This, with a total cost per annum of USh.21,600 (Ush.8,600 for Annual Depreciation Cost, USh.8,000 for Tyres and Ush.5,000 for General Maintenance), equates to USh.8.65 per km (US$0.01).

For *crop marketing*, based on travel to a market 10 km away, the savings in time from use of a bicycle equates to just over 2 hours per bunch of matoke. The value of this time, based on the wage rate for hired labour, is about USh.220. Thus, to cover the cost of ownership of a bicycle for this task, the farmer would have to market 100 bunches of matoke per annum, and allocate all the time saved to productive activity. Since few farmers in the area market more than 100 bunches of matoke per annum, this is unlikely to be the case. Ownership of the bicycle is more likely to be justified if the marketing of matoke is complemented by the sale of other crops, and if a higher price is received through sale in a

more distant market. In respect of the latter, based on the data for matoke traders, transport by the farmer of his matoke for sale in Mbale town using a bicycle would generate an additional value of about USh.450 per bunch after taking account of the value of the time involved. The sale of about 50 bunches of matoke per annum, a level achieved by many farmers in the area, would cover the cost of ownership of the bicycle.

For *travel to and from place of employment*, the economic benefits from the use of a bicycle will derive from either savings in time compared with walking, or from the savings in cash compared with travel by bus. A 10 km daily journey to work would take about 2 hours each way on foot. Assuming travel at 10 km per hour by bicycle, the time saving would be two hours per day or 500 hours per annum. Based on the hired labour wage rate of USh.100 per hour, allocation of about 40 percent of the time saved to productive activity would cover the cost of use of the bicycle to travel to and from work. Bus fares in the Mbale area equate to about USh.40 per km. On this basis, for journeys to and from work beyond about 1km and within the range of a bicycle, savings on bus fares would justify investment in a bicycle as an alternative to travel by bus - though in practice people would of course travel short distances to work on foot rather than by bus.

The economics of the use of a bicycle for *business activities* can be examined by considering the case of an owner of a small shop in Mbale district. The shop-owner had to travel regularly to purchase supplies, and used a bicycle for this purpose. All supplies, up to 80kg per trip, could be carried on the bicycle and all sources of supply were within cycling range. By using his bicycle rather than traveling by bus, he saved USh.40,800 per annum in fares - amply justifying the cost of using the bicycle.

5. THE ROLE OF RURAL ROADS AND TRANSPORT SERVICES

Types of Transport Service

Roads and transport services are considered together because they constitute the two mutually necessary elements of the rural motor transport system. Rural roads are the lowest level of the road network, providing the physical link from particular villages to the higher levels of the road network and hence to the regional and national economy. Since very few rural Africans own motor vehicles, it is *transport services*, provided by a range of passenger and cargo-carrying motor vehicles operating on the these roads, that are the mechanism by which rural households are linked to the wider economy. In certain circumstances, including the Kasama study area, these road transport services are supplemented by the railway. Transport services can be divided into two categories:

(i) Transport services which operate for hire on the rural roads and are available to rural people to transport themselves and their goods. In SSA, these can be categorized as follows:

- bus services, using large buses, which carry passengers and accompanying goods, operate on fixed routes and to fixed timetables (though timetables are not necessarily adhered to), and are typically overloaded;

- services using pick-ups and mini-buses which typically operate from main centers and carry passengers and accompanying goods. The major differences between these and bus services are that, while the former also tend to operate on fixed routes, they have flexible stopping points and do not operate to a fixed timetable—they tend to depart only when they are full or close to full;

- trucks available for hire—the standard practice is to hire the whole truck for a specific task, e.g. to carry marketed crops;

- informal transport services—it is common for rural people to hitch a lift on a passing vehicle, often paying a fare to the driver. In Malawi for example this system, known as 'matola', is extensive though illegal; and

- rail services.

(ii) Services which are brought to rural communities by motor vehicles operated by government and parastatal organizations, NGOs and the private sector. These services include:

- delivery, for example by cooperative systems, of farm inputs to local depots from where the inputs can be collected by farmers;

- crop purchasing services provided by cooperatives, marketing boards or private traders at the village level;
- delivery of consumer goods such as soft drinks and beer to local shops;
- agricultural extension and community development services;
- delivery of services and supplies to rural health and educational facilities, including mobile health clinics and emergency evacuation of sick people.

Use of "For Hire" Passenger Transport Services

The evidence from the study areas, complemented by that from other sources, is that typical rural people make only limited use of 'for hire' transport services offered by buses and pick-ups for personal travel. In the Dedougou, Kaya, and Mbale study areas, the use of passenger transport services is primarily for travel to hospital (6-89 percent of households) and for longer distance social trips outside the village (8-52 percent of households), with a few households also using them to travel to the dispensary or to the market. However, trips to the hospital, and social travel beyond the local center, are infrequent. In Zambia, the situation is somewhat different. In Lusaka Rural, which can be regarded as peri-urban, there is frequent travel beyond the local center and frequent use of transport services for travel to school, to work and for social purposes. The Kasama study area is about 60 km from the nearest road passenger transport services, but people do use the Tazara railway which passes through the area. It is the dominant means of travel to the dispensary, to the hospital and to the market. However: (a) all these facilities are very distant and trips are infrequent. For example, households only travel 5-6 times per year to the market, which is over 100 km away; (b) rural people have a long journey on foot to reach the railway station—for the most remote village it is a six-hour walk.

The overall picture that emerges is that:

- Passenger transport services are limited and typical rural people living outside the influence of major urban centers utilize them only rarely, and then for some special, usually social, purpose that involves making a long journey.
- A small minority of 'untypical' rural people, such as local government officials, local businessmen, and people with paid employment outside the locality, are the main users of passenger transport services and use them quite frequently.

Use of "For Hire" Cargo Transport Services

In the three study areas producing substantial crop surpluses, the use of hired trucks to transport marketed crops was quite limited. In Kasama and Dedougou, bulk quantities of crops were sold to the cooperative. However, in Lusaka Rural, some farmers preferred to hire a vehicle to transport large quantities of crops to Lusaka city for sale. This preference implies the expectation of receiving a higher price for the crop, and also confidence that the crop will be sold successfully to justify the investment in the hire of the vehicle. An individual farmer

must produce a substantial surplus to justify hiring a 7-tonne truck to market the crop. It is noteworthy that one village in Kasama, and some farmers in Dedougou, hired trucks to bring their harvested crops back from the fields. In both cases, the fields are relatively distant, and in Kasama, the village benefits from its location on the main district road.

Services Delivered by Motor Vehicle

In market terms, it is the services which are brought by motor vehicle to the rural communities which are most important to the functioning of the cash economy. In Kasama, Lusaka Rural and Dedougou, input-intensive, modern agricultural systems have been adopted which depend on road access to the villages to allow cooperative trucks to deliver fertilizer inputs and to evacuate the marketed surplus. It is road access, and the operation of an efficient cooperative transport service, that are critical to the cash crop production of these areas. In Dedougou, the system operates successfully. In Lusaka Rural, there is evidence of farmers preferring to market their crops themselves rather than relying on the cooperative. In Kasama, the cooperative system was breaking down at the time of the study, resulting in the late delivery of inputs, and non-collection of crops. The requirements of adequate road access at critical times of the year and of efficient and timely truck transport services apply equally when the distribution of inputs and evacuation of outputs is in the hands of the private sector. However, whereas cooperative decisions about where to provide these services are guided by considerations of equity, for the private sector they are based on maximizing profit, and hence the services are less likely to be provided to communities which are remote, or have poor road access.

The Lack of Local-Level Transport Services

The lack of local-level rural transport services in SSA has already been noted. Apart from exceptional cases such as the "boda-boda" bicycles in eastern Uganda, transport services in Africa are provided by conventional, usually large, motor vehicles. However, in Asia, there are a variety of motorized IMT used in different countries, the common characteristic of which is that they are operated to provide local-level "for-hire" rural transport services. Such motorized IMT, and the services that they provide, are not found in SSA (see Box 2).

The Role of Rural Roads

The main agricultural function of access roads is to allow passage by motor vehicles at critical periods in the agricultural cycle to deliver farm inputs, and in particular fertilizer, which is the most transport-intensive input; and to evacuate large quantities of bulky, low-unit value crops after harvesting. For agricultural systems which are less transport-intensive, the quality of road access to the villages is less critical. In such systems, marketed crops can be transported outside the village to a bulking point within the area, on foot or using IMT. Given the lack of local-level transport services, the primary social function of access roads is to facilitate the delivery of social services to villages. Finally, it should be noted that access roads are also used by IMT, particularly bicycles and animal-carts, for trips outside the village.

The function of roads is to facilitate the operation of transport services, and thereby to increase the mobility of rural people and to improve their access to facilities and services. In all of the study areas there was a positive relationship between the overall access-level of a community and household income. However, this does not imply that the provision of good roads (and of reliable transport services) to rural communities is sufficient to provide them with 'good' access and hence generate increased incomes. For this analysis, access was defined in a fairly broad way, and good access was determined to a significant extent by the physical proximity of the community to an active local center, and to a *main* road (rather than a road in good condition). The realities of spatial distribution of communities dictate that only a minority will be in this fortunate situation.

In two of the study areas, the households that had the highest agricultural incomes were concentrated, to a degree that was statistically significant, in the villages that had the best road access. This reflects the agricultural systems in the two areas—Dedougou, and Kasama—which are dependent upon the supply of farm inputs, and the evacuation of large quantities of low-unit value crops, by motor vehicle. In Lusaka Rural, the situation was the opposite—agricultural production was concentrated in the villages with the worst road access—the good access in the other villages allowed them to exploit more attractive economic opportunities in paid employment and business activities. Thus, the analysis confirms that good road access broadens the economic opportunities available to rural people.

PART 2: IMPROVING RURAL ACCESS IN SUB-SAHARAN AFRICA

6. RURAL TRANSPORT AND ACCESS TO SERVICES

Rural access to economic and social services is determined within a framework of **elements of accessibility** on one hand, and **transport tasks** on the other. This framework will first identify the elements of accessibility: rural roads, paths and tracks, the means of transport (IMT or motorized), and the siting and quality of facilities. These elements will then be linked to the five principal tasks of rural transport in SSA: water and firewood collection; crop production; crop marketing; access to economic and social services; and non-agriculture income generation. The reader may refer to Table 6.1 to visualize the relation of the elements of accessibility to the principal tasks of rural transport.

Framework for Improving Access to Economic and Social Services

Physical *accessibility* is the ease or difficulty of reaching a particular service. The level of physical accessibility is dependent on two factors: (a) the level of *mobility*; and (b) the *siting and quality of facilities*[10]. Mobility is the ease or difficulty with which rural people can move themselves and their goods. The siting and quality of facilities affects the distances and routes between the places of production or residence, and the facilities which people choose to use. There is often an overlap between these two factors, and Dedougou provides an example of this. There the provision of access roads and cooperative transport services has resulted in a reduction in the distance that farmers have to travel to the crop marketing point—the cooperative trucks come to the village to collect the crops. However, there is an important difference between the two factors:

- Measures to improve the transport system can increase mobility (and accessibility) for a variety of different trip purposes—e.g. the introduction of IMT can improve mobility for harvesting, movement of farm inputs, crop marketing, etc., but only for those whose mobility is improved.

- Measures to improve the location and/or quality of facilities increase the accessibility of a particular service, e.g. the installation of an improved water supply improves accessibility for water collection for everybody in the community.

Elements of Accessibility

Rural Roads, Paths and Tracks

Rural roads link rural communities to the higher levels of the road network and make it possible for motor vehicles to operate down to the village-level. It is, however, not the mere existence of a road, but its condition, which determines whether it is possible for motor vehicles to operate down to the village-level.

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[10] The full results from the analysis of the survey data in respect of this issue are presented in G. Edmonds and I. Barwell "Accessibility and Siting of Facilities and Services," June 1993.

Given that so much rural travel is on foot or using IMT remote from the road network, the improvement of the condition of footpaths and tracks can have a significant impact on the efficiency of rural travel and transport. Improvements can take the form of: (a) increasing the safety of footbridges or other water-crossings so that people do not have to make long detours to avoid dangerous river crossings; (b) straightening paths so that they are not unnecessarily long and indirect; (c) reducing the length of those sections of the route that are steep and/or slippery, cause falls, loss of time, and injury; and (d) making a route which is passable only on foot passable also by an IMT such as a bicycle or an animal-drawn cart.

Means of Transport

Ownership by rural people of motor vehicles (apart from small motorcycles) is extremely rare in most parts of rural SSA. Therefore, it is mostly through the operation of Motorized Transport Services that rural people can benefit from the provision of rural road access. These services are, although only to a modest extent, complemented through the use of IMT.

The IMT most commonly used for cargo transport in SSA are ox- and donkey-drawn carts, ox-drawn sledges, and pack donkeys. Wheelbarrows and hand-carts are also used to some extent, though more commonly in urban than in rural areas. None of these IMT offer any increase in the speed of travel compared with walking, but they do allow substantially greater loads to be moved per trip. In the case of the animal-powered IMT, the physical effort of moving the load is transferred from the human to the animal. In the case of the wheelbarrow and hand-cart, the efficiency of use of human energy for moving loads is increased. Bicycles and small motorcycles are most relevant for personal travel — bicycles are much more widely owned in rural Africa than motorcycles — though donkeys can also be used for personal travel as well as load-carrying. The bicycle trailer provides a means of increasing the load-carrying capacity, while at the same time maintaining the speed advantage of travel by bicycle.

Siting and Quality of Facilities

One of the determinants of the rural transport problem in SSA is the long distances that many people have to travel, in most cases on foot, to reach facilities that they need to use. Further, the poor quality of service offered by the facility closest at hand may provoke travel to a more distant facility which offers a better quality of service. The siting of high-quality facilities and services closer to rural people can make a significant impact on transport efficiency, on the time and effort spent on transport, and on the frequency of utilization of the services offered.

Means of Addressing Specific Tasks of Rural Transport

Having identified the principal transport problems for typical rural people in SSA as: (a) water and firewood collection; (b) crop production; (c) crop marketing; (d) access to economic and social services; and (e) non-agricultural income generation, table 6.1 summarizes the means to address each problem. Although each of the principal tasks identified is treated separately, the transport problems of crop production and crop marketing are related since farmers will not increase their output unless they are reasonably assured that

they can market the additional surplus. An increase in the level of production of a particular crop generates a much greater increase in the marketing transport demand. As a simple example, a farming household operating at near-subsistence may be producing a surplus of 10 percent above its consumption needs of a particular crop. A 10 percent increase in the production of that crop by the household would double its demand for transport to market the surplus output.

Table 6.1: Access Problems and Means to Address Them

Transport Task	*Elements of Accessibility*				
	Mobility				Siting and Quality of Facilities
	Rural Transport Infrastructure		Means of Transport		
	Rural Roads	Footpaths & Tracks	IMT	Motorized Transp. Serv.	
Water and Firewood Collection		*	*		**
Crop Production	*	*	**	*	*
Crop Marketing	**		*	**	*
Access to Economic and Social Services	*	*	*	*	**
Non-agriculture Income Generation	*		**	*	

** most important means of addressing an access problem.
* complementary means of addressing an access problem.

Source: Village Survey 3 (see Box 3)

Water and Firewood Collection

The findings from the surveys and the case studies indicate that water and firewood collection are very time-consuming and burdensome tasks for rural women of all ages. They involve frequent trips (several times per day to collect water, and several times per week to collect firewood) and it is common for women to spend an hour or more every day on the transport component of each of the tasks. With the progressive degradation of fuelwood sources in Africa, the distance to firewood, and hence the transport burden, is likely to increase.

A common theme which underlies many of the projects which have had only a limited impact is the lack of involvement of women in their design and implementation. This argues that, if such projects are to be effective in addressing the access problem of water and firewood collection, their design must be based on an understanding of the local situation of women; must incorporate the expertise and perceptions of women on the water and firewood

collection, and cooking tasks; and must substantially involve women in their implementation, including maintenance.

Water Collection

The main determinant of the access problem for water collection is the distance to the existing source. The surveys show that levels of water consumption are low—in all areas the daily consumption was less than 20 liters per capita. The evidence from the study areas and the case studies is that, for a particular society, per capita consumption of water remains relatively constant up to trip distances of 15-20 minutes. For higher trip distances, there is a tendency for the number of trips, and hence consumption, to decrease to compensate for the difficulty of the collection task. Thus, the most effective means of addressing the access problem of water collection, to the benefit of the whole community, is better siting of facilities, specifically, the installation of an improved community water supply system which is closer to the households than the existing, natural source and the introduction of procedures for the financing, operation and maintenance of the system to ensure its sustainability. Complementary means of addressing this problem include: the provision of suitable IMT and containers to carry and store the water, and the improvement of footpath routes linking the houses to the water sources.

Although IMT are unlikely to have a major impact on the transport burden of water collection, a carefully-designed pilot project could reveal more about their use. Such a pilot project would need to pay attention to such issues as control over use of IMT by women; provision of suitable IMT and containers to carry and store the water; and condition of the footpath routes connecting the houses to the water sources. A second complementary means of addressing access to water is improving footpaths and tracks. However, such interventions are unlikely to achieve the same level of impact as better siting of facilities.

Firewood Collection

Similar to water collection, there are also a range of options for addressing the access problem of firewood collection, including:

(i) Development of community woodlots closer to the household. This would reduce the trip time for, and hence the time and effort devoted to, firewood collection. The development of community woodlots is a long-term intervention since it takes several years for the trees to mature and produce firewood. However, it offers a sustainable means of addressing the environmental degradation that is occurring in SSA as a result of deforestation.

(ii) Introduction of fuel-efficient wood-burning. This focuses on the use of more efficient stoves.

(iii) Substitution of more efficient, alternative fuels to firewood, e.g. charcoal. This is most likely to take place first amongst the richer members of a community and to result from increased incomes generated by agricultural development.

(iv) Use of IMT. This option, however, also could increase the rate of degradation of fuelwood reserves, and would therefore need to be assessed carefully.

(v) Improving paths and tracks. As with access to water, the paths that provide access to sources of firewood may be difficult, particularly in hilly or mountainous terrain.

Crop Production

Different agricultural systems have varying levels of transport-intensity. For example, the cultivation of permanent crops producing low-bulk, high-unit value outputs, e.g. spices or coffee, requires only limited transport inputs. However where agricultural production is based on land-extensive cultivation of large quantities of seasonal, bulky, low unit-value crops:

(i) The production system is inherently transport-intensive.

(ii) Increased output will result from an increase in the area of land worked and the greater use of inputs, particularly fertilizer. This increased output generates a greater than proportional increase in the on-farm agricultural transport demand.

The best means of reducing the transport constraints for production are:

(i) Introducing IMT to facilitate increased mobility. Indeed, IMT that increase the efficiency of personal travel with accompanying loads, most notably the bicycle but also the bicycle with trailer, will facilitate the marketing of crops.

(ii) Siting local storage facilities for farm inputs (i.e. fertilizer) close to the community.

(iii) Improving footpaths or tracks.

(iv) Developing and improving rural roads and rural transport services so that farmers can hire and bring in trucks to move bulk harvests.

Crop Marketing

A farmer's decision about whether and how to market his crop depends upon his mobility, the siting of markets, the price he expects to be paid, when he will receive payment and the degree of marketing risk involved. There is a range of options for addressing the access problem of crop marketing including the following: (a) the improvement of rural transport services; (b) the development of rural roads; (c) the introduction of IMT; and (d) the siting of local markets closer to rural communities.

The introduction of rural transport services can have the greatest impact on crop marketing. However, for the motor transport service to be provided:

(i) There must be the necessary level and quality of road access to allow motor vehicles to come to, or close to, the village level at crop marketing time. The marketing time depends on the crop, but typically, crops will be marketed at the start of the dry season.

(ii) Truck services, operated by cooperatives or by the private sector (traders, or trucks available for hire), must be available at marketing time.

(iii) In some situations, a storage facility must be provided to allow bulking of crops delivered by individual farmers prior to transference to the truck.

IMT are complementary means of addressing the crop marketing problem. Whether the point at which bulk crops are transferred to motor vehicles should be in the village, or at a local center outside the village, depends on the availability of IMT in the community, the volume of surplus crops produced by the community, and the settlement pattern. For the marketing of low-bulk, high value crops, or for the continuous marketing of bulky crops in small quantities, the use of IMT can extend the range over which they are marketed and increase the quantities sold per trip. IMT that increase the efficiency of *personal travel with accompanying loads*, most notably the bicycle but also the bicycle and trailer, will facilitate the marketing of crops in this way. The concentrated marketing of seasonal, bulky, low-value crops is dependent on the transference of the crop to a motor vehicle relatively close to the point of production. In such agricultural systems the role of *load-carrying IMT*, particularly animal-drawn carts is in the initial movement of the crop to a bulking point for transfer to the motor vehicle.

The final option for addressing the access problem of crop marketing is the siting of the markets themselves. Typically, there is a hierarchy of markets: (a) local markets provide an opportunity for households to sell small quantities of crops to traders or to meet local demand; to sell other products; to buy food, household and consumer items; and to meet for social interaction; (b) main markets that serve large areas, provide an opportunity to sell crops to meet a wider demand, offer a wider range of consumer items, and are usually in main centers where people can also deal with business and administrative matters and meet socially. People tend to make regular, frequent use of the services provided by local markets when it is convenient to travel there, do business and return home within daylight hours. Travel to the main markets is less frequent.

Access to Economic and Social Services

Improving access can be achieved through the following measures: (a) developing additional facilities closer to rural communities or improving the quality of the facilities that already exist by increasing their reliability and/or the level of service offered; (b) introducing IMT; (c) developing and improving rural transport services; and (d) improving footpaths or tracks.

Siting facilities close to communities can have the greatest impact of any of the measures listed above. Travel to these social facilities is essentially on foot, so that it is the distance to the facility that determines the level of access. In most of SSA, the physical access to facilities tends to depend upon: (a) government policy for the provision of social services; (b) the population size and density of an area (people in areas with lower population density will tend to have poorer access); and (c) whether a village is nucleated or has broadly distributed housing (facilities can be provided close to people cheaply and more efficiently if the villages are nucleated).

In Sub-Saharan African societies where the staple food must be converted into flour, there is a strong preference for using motorized grinding mills both to avoid the arduous and time-consuming task of hand-pounding and to produce a more flavorsome product. The siting of mills within convenient walking distance of rural communities will minimize the transport time and effort devoted to the task. For example, where there is good access (within 20-30 minutes walk), use of the mill is more frequent, but a smaller load is carried on each trip. However, while for the users a grinding mill is a social facility, for the owners it is a commercial operation. The degree of spatial distribution of grinding mills that is achievable is determined by the need for them to be financially viable—decisions on siting of new mills should therefore ultimately be based on commercial considerations.

Personal mobility can be increased through the development of passenger-carrying rural transport services. Such services will improve access to health centers and to rural markets. However, given the present state of passenger services in rural Africa, it is highly unlikely that those provided by conventional motor vehicles will reach in a reliable manner down to, or close to, most rural villages. A more innovative approach would be the development of local-level services provided by motorized IMT.

Non-Agricultural Income Generation

The role of rural transport in non-agricultural income generation was only investigated to a limited extent in the studies. However, certain conclusions can be derived. The use of IMT which increase the efficiency of personal travel, and allow the transport of accompanying goods, facilitate local-level income-generating activities as follows:

(i) For regular travel to and from paid employment, if the place of work is within cycling distance and beyond convenient (about 30 minutes) walking distance, and if the terrain and route conditions are suitable, then:

- travel by bicycle is likely to be cheaper than travel by passenger transport service;
- the time savings from travel by bicycle rather than on foot is likely to justify the cost of using a bicycle if the time saved can be put to some productive use.

(ii) For trading and operation of small businesses involving movements of relatively small quantities of goods over distances that are within cycling range, use of a bicycle is economically effective, even in quite difficult terrain conditions.

(iii) The use of trailers to increase the carrying capacity of the bicycle can, where the terrain is reasonably flat, increase the effectiveness of the use of this means of transport for local trading and for delivery of supplies. A pilot project in Tanzania has successfully demonstrated the use of bicycles and trailers for the collection and delivery of scrap steel for local blacksmiths.

For longer-distance travel in relation to income-generating activities, the role of motor vehicle transport services, and of suitable roads on which to operate, becomes important. However, for many rural people, income-generating activities tend to take place on a small scale, and within the local area. It is likely to be the minority of more successful businessmen in an area who will have a greater demand for long-distance, motor vehicle transport services.

7. Toward a Rural Transport Strategy

The village-level surveys component of the research investigated household travel and transport demands and problems in five areas of sub-Saharan Africa, whereas the case studies concentrated on the use of IMT and the role of women in rural travel and transport. The findings from the research therefore bring to the discussion on rural transport strategies the perspective from the village, with a special emphasis on the use and potential role of IMT. However, the perspectives of central and local government on such matters as institutional structure, resource mobilization, and regulation of credit and transport services must also be brought to bear on the design of a viable, national rural transport strategy.

The Dimensions of Rural Transport

Local-level rural transport is relevant to a number of key issues and themes of current development thinking in Sub-Saharan Africa:

(i) It is of central significance to gender issues, poverty alleviation and food security.

(ii) It has a significant impact on environmental degradation.

(iii) It can be an important avenue for developing the private sector.

(iv) It can both promote and benefit from increased community participation.

(v) The maintenance of its infrastructure and the operation of its services both need a much greater degree of sustainability than at present.

The relevance of rural transport to these key development issues means that a wide range of institutional "actors" have a stake in rural transport - different government departments; units in donor agencies;[11] community-based organizations; NGOs; and private sector companies and organisations. It also means that consideration of these issues and institutional interests needs to be incorporated into the planning and design of project initiatives concerned with rural transport, and that accessibility concerns should be considered in the preparation of any sectoral or multi-sectoral rural development project.

At the central government level in SSA, responsibilities for different aspects of rural transport policy, planning and implementation are usually distributed between departments concerned with public works, transport, agriculture and forestry, trade and industry, water supply, health and education. For the typical local government structure, there is a similar spread of responsibilities across different departments. In most of the donor agencies infrastructure, agriculture and forestry, small enterprise, rural and social development etc. are also dealt with through separate administrative units. *Responsibilities as dispersed as these*

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[11] The term "donor agency" is used here in a broad sense to include development banks, UN agencies, regional agencies, bilateral donors and international development NGOs.

can only be discharged effectively if they are directed within a framework of an overall, and widely accepted, strategy.

Rural Transport Strategy

The key elements of a fully-developed, national rural transport strategy are:

(i) A statement, in national terms, of the role of local-level transport in rural economic and social development.

(ii) A definition of the national priorities for addressing rural access problems.

(iii) The allocation of responsibilities for rural transport policy, planning and implementation between Ministries and between central and local government, and a definition of the roles of the public sector, the private sector, NGOs and community-based organizations.

(iv) A definition of approaches, and operational guidelines, for addressing rural access problems including procedures for effective community participation.

(v) A definition of the guidelines for financing of rural transport infrastructure, including identification of specific sources for both maintenance and development.

(vi) A definition of training and human resource development needs, and of mechanisms for providing training.

A well-defined and publicized strategy containing the above statements, decisions and guidelines will permit those "actors" involved in the sector to themselves become active participants in the development of the rural transport system. However, before the strategy can be finalized and publicized, a number of policy issues must be addressed and resolved.

Policy Issues

Specific policy considerations and decisions, discussed below, are required by governments in respect of interventions to improve rural mobility and accessibility. There is also an important role here for donor agencies, through their institutional and project work, to support governments in the adoption of appropriate policy measures.

Rural Roads

The research findings indicate certain policy measures which governments should consider for more effective development of rural road networks.

(i) When the economic function of rural roads serving villages is to support the production and marketing of seasonal crops, 'economic road access' is required only at specific times of the year - planting and harvesting - and may be

achieved through a policy of 'spot improvement and rehabilitation' to eliminate barriers to access by motor vehicle at these critical times.

(ii) When road improvements are motivated by the objective of providing social access down to village-level, the standard of road improvement adopted should relate to the frequency, seasonal timing, and type of services that will operate.

(iii) Economic decisions to invest in rural road improvements should be made only after confirmation that existing transport services are available to operate on the roads, or that other measures will be adopted to develop such services.

(iv) The employment of local labour for road rehabilitation, improvement and maintenance should be developed through a policy that makes labour-intensive execution of works commercially attractive to contractors. This employment will provide additional income for rural people. The policy may include offering IMT as a means of payment, and an incentive, for employment on road works - this approach combines the provision of transport infrastructure with development of the use of IMT.

Paths and Tracks

The case has been made in Chapter 6 for official recognition of, and attention to, paths and tracks as a component of the rural transport infrastructure system. Simple policy measures to achieve this would include:

(i) Promotion of self-help improvement of paths and tracks through the community development system.

(ii) Allocation of official funds for path and track improvement as a contribution to support village self-help efforts.

(iii) Defining the provision of technical support for community initiatives as one of the responsibilities of the local government engineering department.

Intermediate Means of Transport

There are three policy actors in the supply side of developing the use of IMT: government, development assistance agencies, and NGOs. The example of the Dedougou study area shows how a range of government policy measures can be combined to generate extensive use of IMT. Government policy measures should provide the enabling environment for increased use of IMT. They should encourage a competitive market for the import and distribution of the components for IMT, and for imported IMT. Government may also choose to provide credit for investment by local industries in manufacturing equipment and materials. Governments, and other agencies, should discourage actions which artificially decrease the competitiveness of local manufacturing and distribution industries.

There is also a need for husbandry and veterinary services to support the use of work animals, particularly donkeys. Generally, government livestock extension services in Africa are oriented towards cattle and oxen and staff lack skill in the care of donkeys. Yet, in areas

where donkeys are not traditionally used, owners are likely to need training in basic husbandry skills.

Specific policy assessments and measures which governments should consider to promote the use of IMT are:

(i) Measures to reduce the price, and increase the supply, of bicycles. In many African countries, bicycles are imported from India and China, but their retail price is more than double the price in the country of origin, even though international freight costs are low. Prices can be reduced through:

- review of tax and duty structure;
- elimination of constraints on availability of foreign exchange for import; and
- elimination of any price-fixing or business licensing constraints to the operation of a competitive market in the supply and distribution of bicycles and spare parts.

(ii) To assess whether locally-produced bicycles could compete with cheap imports from Asia, including investigation of the feasibility of local manufacture of components and spare parts. The production by the informal sector in Ghana of motor vehicle spare parts provides one model for the development of bicycle component manufacturing industries.

(iii) Where a private sector distribution system is lacking, to use government, parastatal, cooperative or NGO (e.g. farmers' associations) systems to market bicycles, IMT spare parts and materials for the local production of IMT, to rural areas. This should not constrain private sector activity, but rather be a means to demonstrate the commercial potential of such distribution operations.

(iv) To develop ox training and extension services in areas where conditions are appropriate for ox cultivation, accompanied by measures to ensure the ready supply of oxen. Also, through extension services, to promote the use of oxen for transport as well as for on-field tasks.

(v) To promote the use of donkeys - both as haulers of carts and as pack animals - in areas where they are not prone to serious endemic diseases through measures to increase supply and through provision of training and extension services.

(vi) To address, through livestock services, constraints imposed by diseases on the use of work animals.

(vii) Where appropriate, to use IMT for official travel by government personnel in rural areas — this would increase the mobility and effectiveness of many officials, and have a demonstration effect.

(viii) To promote the use of IMT by women through mass media communications, demonstration and community development initiatives, working closely with women's organizations.

Donor-assisted projects, government agencies, and NGOs can all be used as mechanisms to promote the use of IMT that people are not familiar with, and to adapt the IMT to local conditions. Where this process is required, three factors are critical to success:

(i) It is important to take a long-term perspective to the introduction of IMT new to an area.

(ii) The intervention, and the demonstration, should be on a sufficient scale to make a significant impact.

(iii) It may be necessary to adapt IMT designs to suit use by women.

Rural Transport Services

Policy measures to be considered by national and local government to promote the operation of transport services provided by motor vehicles include:

(i) To remove unnecessary regulatory constraints to the provision and development of transport services by the private sector. Regulation should focus on safety and insurance measures and should not inhibit:

- the types of vehicle used (including, for example, the use of tractors and trailers to provide transport services);
- the routes on which they operate;
- the type of service they offer - passenger, goods or both; fixed route or flexible route; and
- the fare rates that they charge — controlled rates can be counter-productive by reducing the extent of transport services. Sustainable low fare rates are more likely to result from a competitive market, efficient operation, and pressure from users on local service operators.

(ii) To facilitate the supply of motor vehicles by eliminating unnecessary constraints on the import of vehicles and, most important, spare parts, and by developing capability for vehicle maintenance and repair.

(iii) To support and promote innovative schemes for operation of services targeted at local-level needs, including services provided by 'non-commercial' operators such as local development associations. This support might involve:

- measures to encourage the financing of the services, but only if there is clear evidence that the transport operation is financially viable;
- provision of training in transport management; and

- the adoption of a regulatory and licensing framework that facilitates innovative services, for example, using motorized IMT.

Credit

Lack of affordability, in terms of lack of sufficient cash, is a constraint to the purchase of IMT for many rural farmers who could earn a viable financial return from them, and in SSA, it is generally difficult to obtain credit to buy IMT. There is a need to establish rural credit systems for IMT which are more widely distributed, impose less rigorous conditions, and have more appropriate administrative procedures than those which typically exist at present, and accept the IMT as the security for the loan. The adoption of policy measures to increase the availability of credit is therefore important, and there is a need to develop guidelines on credit for projects aiming to introduce or popularize IMT use. However, the effective delivery of rural credit is a complex matter, and in developing credit policy measures certain key institutional issues should be addressed:

(i) The policy measures should include provision for, and encourage, access to credit by rural women, including groups of women, for the purchase of IMT.

(ii) The policy measures should encourage savings and the role of NGOs and the private sector in the provision of credit.

(iii) The policy measures should not encourage subsidized interest rates, which can damage the chances of establishing safe, responsible, private credit. However, in the demonstration and promotion of a new IMT, a grant element can be incorporated, which will be received when the buyer makes timely repayments of the loan.

Other Policy Measures

The research findings indicate that other policy measures are also required.

(i) To establish achievable national targets, based on level of accessibility, for provision of water supplies, rural health centers and educational facilities, and to prioritize location of new facilities and upgrading of existing facilities on the basis of the degree of improvement in access that would result.

(ii) To place priority on reforestation, and include the establishment of sustainable and accessible sources of firewood as part of this policy.

(iii) To ensure that commercial practices do not inadvertently cause transport and distribution problems. For example, fertilizer is marketed in 50kg bags and bags for marketing bulk crops are frequently only available with a 90-100kg capacity. Bags of these weights can be loaded and unloaded manually, but are too heavy to carry on foot except over very short distances. Yet, the last stage of a fertilizer journey, and the first stage of a crop marketing journey, is often on foot. There is a case for the government to mandate the use of smaller bags.

CONCLUSION

There is no single solution to the improvement of rural transport in Sub-Saharan Africa — a range of measures are required. Further, each area or region has its own characteristics and problems, which must be understood for improvements to be attainable in the local context. The village-level surveys and case studies were undertaken to contribute to this understanding. Obviously, the findings from this RTTP research do not cover the entire spectrum of issues that need to be assessed in order to design a comprehensive and workable strategy for the improvement of transport in rural areas in any given African setting. Attention is already being given to issues relating to the sustainable maintenance of rural transport infrastructure. Specific issues which are priorities for further investigations are:

- The conditions necessary for the emergence of viable local contracting industries that use labor-based work methods for construction and maintenance of infrastructure because they are competitive with equipment-based ones.

- Considerations in the design of the institutional framework, and of a planning system, for rural transport encompassing the local, intermediary and central government levels as well as the participation of stakeholders in the decision-making process.

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