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EAST AFRICAN REGIONAL WORKSHOP ON RURAL TRANSPORT AND DEVELOPMENT

KEYNOTE PAPER

ON

GENDER ISSUES IN RURAL AGRICULTURE TRANSPORT AND DEVELOPMENT

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GENDER ISSUES IN RURAL AGRICULTURE TRANSPORT AND DEVELOPMENT

Abstract

Tanzania has agricultural sector as its backbone of the national economy. A majority of agricultural activities are conducted in rural areas which are characterised by poor infrastructure and facilities as well as technological disadvantages. Rural women have a substantial contribution in agricultural (particularly food) production and transportation. Hence, in order to boost and sustain agricultural growth, a special emphasis needs to be given to develop the rural agricultural potential areas. To create a balanced and sustainable development in rural areas, a gender balanced participation approach is prerequisite. Todate, women participation in decision making and planning for development activities in rural areas has been minimum.

This paper aims at looking on the gender distribution of rural agriculture transport burden. It highlights on some prominent influencing factors on the higher agricultural transport burden on rural women, i.e. in addition to their usual core responsibilities of the family households.

The paper has also attempted to pinpoint some key issues to be considered in the design and planning of an Agricultural Rural Transport Research Project with a gender perspective. In conclusion, the authors have suggested recommendations for further research areas in relation to the theme in discussion.

A larger part of the material content of this paper has been cited on the lessons and experiences of Tanzania. Based on the authors' broad knowledge of the social-cultural and economic situations of the other East African countries, it is assumed that such experience will bear significant similarities among these countries. In anticipation, the paper shall form a good basis for a common platform of action on gender incorporation in the design of the East African Regional Agricultural Rural Transport Research Project.

1.0 BACKGROUND

Agriculture contributes substantially to the economy of Tanzania and accounts for 50% of the GDP at factor cost and 75% of foreign exchange earning. Agricultural activities are mainly conducted by smallholder farmers in rural areas where more than 80% of the country's population live.[11] About 70% of Tanzania's crop area is cultivated by handhoe, 20% by oxplough and 10% by tractor.[10] The share of labour force employment in agricultural sector is 54.9% of which 56% are women. The share of women labour force in non-agricultural economic and social sectors, including unemployed labour is 44%. Women self employment is 53% and unpaid female family workers account for 62% of total female productive group.[12] In general, the occupational pattern of male and female differ remarkably. Male are predorminant in most occupations which are considered of higher status, while clerical jobs and traditional agriculture are female dominated.

Communities in most rural areas are settled in dispersed clusters with farms located away from households. Major markets and sub-market centres, as well as distribution points for farm implements and agricultural inputs are either located at considerable distances from households, or further in urban areas. On the average, 4.0 million tonnage of food crops are transported from farming areas annually. Whereas agricultural transport plays a crucial role in the country's economic development, transportation system in rural areas has remained unreliable and cumbersome to be able to maintain and sustain farmers initiatives to increase agricultural production. Walking and head loading are thus predominant modes of agricultural transport in rural areas, with significant share of burden borne by women. Whereas rural households spend 47% of their total travel time on subsistence activities, agricultural activities account for 22% of the total travel time [15 & 16]

2.0 FACTS ON GENDER DISTRIBUTION OF BURDEN IN RURAL AGRICULTURE AND TRANSPORT

So far, the available researched data on gender in rural agriculture and transport is not aggregated. Researches and studies already conducted have been specific to either gender and transport, or gender and agriculture. Accordingly, planning and development initiatives in the two sectors are conducted independently, while (if at all) gender issues receive only superficial consideration.

Given that the rural economies are characterised by two dominant resources, i.e. land and labour, it is important to assess the labour force distribution in rural agriculture according to gender. Thus, to be able to comprehend a gender distribution of burden in a rural context of the two sectors, a broad analysis has to be done on the state of rural women and transport, rural women and agriculture, and thereafter assess the combined effects on a gender dimension.

It is estimated that the ratio of male to female in the agricultural sector is 1:1.5. Women in Tanzania produce about 70% of the food crops.[10] In addition, they bear a substantial responsibility on many aspects pertaining to export crops and livestock production. In rural areas, women are responsible for about 67% of the total travel and transport time, while men and children are responsible for about 21% and 12% respectively. Women are also responsible for about 85% of total load carried, inclusive of agricultural products.[9&15] Women's time and effort spent on rural transport activities related to domestic needs is 65%, while the time and effort spent on agricultural production and harvesting is 25%. Other economic activities, trading and marketing account for only 10% of the total transport time. Taking a vertical comparison, men spend 60% of their time in agricultural production and harvesting activities, 28% is spent on domestic needs and the rest i.e. 12% is spent on other economic activities. *(NB: For the two vertical comparisons, we may have to ask ourselves in this case; "what is the realistic total productive time for a man and a woman?").* The division of responsibilities between men and women in a household in Makete District reveals that women's time spent for transport in agricultural production was 50% while for men was 37.5%. Likewise, women share 61% of all transport in economic activities of marketing and trading, while men contribute 23% only.[13]

The above data show that women shoulder a bigger burden than men in terms of transport as well as labour input in agriculture. Hence, an improvement of the rural transport situation will have a direct effect of reducing their agricultural transport burden. Improved transport situation may also result in increased labour time available for agriculture and other economic activities, with subsequent improvement of social services. But, this phenomenon may not automatically result into an improved situation on burden sharing between men and women, as this will also be determined by other factors within or outside the scope of agriculture and transport sectors, as will be explained in the next chapters.

3.0 FACTORS INFLUENCING GENDER DISTRIBUTION OF BURDEN IN RURAL AGRICULTURE AND TRANSPORT

Factors discussed below are characterised by Government and market weaknesses to address adequately the rural agricultural transport situation, sociocultural and traditional barriers, topographic and ecological constraints on gender. The issues discussed in this section are in no way exhaustive, but will shed some light into the core of the subject in discussion. However, it is expected that the discussion of this paper will trigger out some other important issues on gender in rural transport and agriculture which are not yet researched or addressed in practical terms.

3.1 Government Weaknesses and Constraints

3.1.1 Intersectorial Coordination

Despite the crucial interdependence between agriculture and transport sector development activities, there has so far not been a clearly integrated agricultural - transport planning. The outputs derived from development initiatives of these two sectors reflect very much on complementarity of activities deployed between the two. As a matter of fact, the visions and objectives of the two responsible

institutions do not match enough to create the desired interlinkage. In such a situation, it is rather difficult to have gender aspects accorded the deserved place in respective development endeavours.

3.1.2 Policy Constraints

a) Agricultural and Transport Policies

The agricultural sector policy for Tanzania has just been recently revised. However, the revised version does not accord the necessary importance on gender issues. Gender is rather addressed in one short paragraph without a clear direction for followup. The transport sector policy is still in draft form. Thus, "gender" as a new phenomenon, could not have featured any where in the past sectoral plans. However, planning of the recent pilot initiatives in rural transport, has taken gender issues into account.

Consequent to the absence/or adequate policies, there has been distortions in allocation and utilisation of available rural (labour and land) resources, resulting into low productivity of both. From the Government's contribution side, the meagre resources available (e.g. for extension services, farm impliments and inputs, and road maintenance fund) are so thinly and haphazardly distributed that the impact to be created ends up being minimal. Since women's share of rural labour in agriculture and transport is bigger than that of men, they and the children are mostly affected by the mentioned distortions.

b) Land Policy

Women's access to productive resources (e.g. land) and supporting services (i.e. marketing services, credit and labour serving technologies, etc.) is severely limited by sociocultural and traditional factors. The land tenure system is guided by traditional ownership and heritage which negatively discriminate women against the right of land ownership. The land policy in development (i.e. for Tanzania) has not fully recognised the contribution of women to the societies' well being in a way that would clearly give them full rights of land ownership.[17] Women may have access, but not full control over the land. As a result of these constraints, women's commitment of labour in rural agriculture is more directed to non-environmental friendly and unsustainable farming systems, i.e short term yielding crops which may have no sustainable and longterm effects to improve land, transport situation and their ultimate livelihoods.

c) Labour Policy

The absence of labour policy in Tanzania has more detrimental effects on rural population. A majority of urban employment is covered under the draft employment policy which hardly recognises a gender division of roles as an issue. In addition, it has not fully recognised the role of agriculture in producing food for wage earners, and in sustaining high levels of employment generation in the country, as it has not provided clear strategic policies for the improvement of rural employment conditions. E.g. In various occasions, the Government has allowed (i.e. without an in-between regulatory mechanism) large scale producers to compete with local smallholder producers in the labour market of agricultural food products. The situation has not only aggravated rural - urban migration, but also a high unemployment rate of 30.5% of total labour force. Despite of women being the main producers in agriculture, their unemployment rate is recorded at 55% compared to 45% of men.[12] It is of the authors opinion that, the higher rate of unemployment featuring on women is due to lack of properly accounted data on self-help and voluntary labour predominant among rural women. The higher rate of unemployment on women may also be due to low education and technology diffusion rate.

Rural labour is not well organised (i.e. collective bargaining not easy) to determine its minimum level of income as would be with the urban employment which is safeguarded by certain legislations. Citing an example of Tanzania's villagesation in 1974, the rural labour was unwillingly displaced from potentially productive land and placed in better accessible areas with the intention to ease provision of common basic services and facilities by the government. This displacement created unnecessary inconveniences on farmers who had to spend excessive time walking back to cultivate their original farms. A majority of these hassles were of course borne by women, as they are basically the main food producers.

3.1.3 Investment Programmes

Rural agriculture and transport investment programmes have been more geared to boost export crops production, (i.e. coffee. cotton, tobacco. etc) rather than securing sustainable food production. Though women have a substantial input in labour for traditional as well as non-traditional export crops. they do not have a strong part in the overall economic export systems. A relevant example here is the Core Rural Roads Programme conceived in 1990 and implemented in 11 core regions of Tanzania which have a high potential for cash crops. The programme initiatives were targeted to medium and large scale farmers without consideration of the smallholder (mainly women) food farming, and the intricacies involved in the transport system of the farms - households - markets. As a result, the expected increased outputs in agricultural production with contribution to the national Economic Recovery Programme (ERP), is still far from being achieved.[11] There has also been an outcry among women from developing countries regarding the effects of Structural Adjustment Programmes (SAP), e.g. removal of subsidies on agricultural inputs while the pricing mechanism remains almost uncontrolled. The programmes have had negative effects, particularly on rural women's context.

The rural transport interventions of the past were more in favour of conventional type of modern technologies and infrastructure. The infrastructure part has been difficult and expensive to maintain. Also, the development of modern and intermediate technologies, their applicability and use. has not considered gender as an issue. Moreover. both intermediate and modern technologies are unaffordable to most rural people.[8] Women stand a lesser chance of acquisition of such technological instruments, since due to cultural factors and multiple responsibilities. their financial base is comparably less than that of men of the same class.[7]

Other sectors like water, energy and health have not adequately addressed the rural needs. leading to poor utilisation of human labour that is mainly diverted from production to subsistence transport activities. In this respect. women have to spend much more time and effort to fetch water. collect fuel wood. etc.

3.1.4 Development and Implementation Approaches

Being in a transition from public to market intervention development approach, the Government is yet to comprehend the process with responsive policy measures to address rural agriculture and transport development. There has also sometimes been lack of political will and patience to address pertinent issues in a pragmatic way. Development planning in Tanzania has neither been participatory. no stimulated a sense of purpose among the target groups. Few attempts of participatory nature have not taken roots due to lack of supportive policies. Thus. the best opportunities for gender balanced participation and mainstreaming are yet to be exploited. In many occasions rural communities' initiatives have been suppressed or blurred by ideologies and philosophies (both from in-house and imported) which are not adaptable to the rural situations and have neither long term benefits nor future sustainability. The use of indigenous knowledge has been suppressed in favour of modern solutions and unaffordable technologies. (e.g. whereas a footpath could ease the problem of transportation. a standardised rural road is preferred with of course a lot of waiting time between planning and construction. and huge future maintenance input requirements).

3.1.5 Institutional and Regulatory Issues

a) Extension Services

There is lack of coherence in the institutional setting for rural agriculture. E.g. Whereas the control of extension services is centralised. the farming activities are decentralised. The extension services are quite fragmented, uncoordinated in nature and poorly utilised. In addition. they are supply driven and without any inbuilt strategies to reach women farmers. Due to cultural and traditional barriers. women in rural setting are not strong in bargaining for such services. thereby remaining in use of poor farming methodologies and technologies.[4&5]

b) Pricing Policy Interventions and Effects

Regulatory mechanism to safeguard the pricing of rural agricultural products is not in place. E.g. While women's first concern is food security, the adhoc food products pricing mechanism by the Government or market is more favourable to middlemen, large scale food importers and urban dwellers. The handling of the current food shortage crisis in Tanzania is a good case in hand, where import duties have been waived on main importers to give them an advantage of selling their products at competitive prices that suppresses local producer prices. To react on this, rural dwellers have to lower their prices, and sometimes below production cost in order for them to become competitive. In this case, farmers are demotivated to boost agricultural production in the subsequent seasons, hence a perpetuation of national food shortages. In addition, their financial base is further eroded and prospects for them to purchase credits for farm inputs, or pay for improvement and maintenance of rural infrastructure are curtailed.[1]

One of the consequences of the above situation is a paralysis of local markets, reallocation of labour to non-agricultural activities ending in rural - urban migration of productive age men, and sometimes girls. Obviously, adult women are left behind to take care of the children and households. In order for them to make their ends meet, they have to diversify to some other income earning activities as well as diversifying the use of agricultural food products (e.g. grains for local brewing). This situation adversely affect the social welfare of rural women and children.[2]

c) Transport Infrastructure

The transport infrastructure to most rural market sub-centres is often in very poor state. Due to lack of enforcement of weight limit regulations in rural areas, the urban transporters have many times taken liberty to drive overweight (sometimes army type) vehicles to remote rural areas with an excuse of easing the process of agricultural products evacuation. Whilst they do this without any consideration of the damage they may cause on the minimum infrastructure in place, they also influence, and sometimes dictate the market prices, knowing that rural producers are unorganised, and that there are no clear systems or regulations safeguarding the pricing mechanism between the rural producers and an incoming buyer. This phenomenon leads to the distortion of the whole rural economy which is mainly dependent on agriculture.[1] Women being the main players in rural agricultural production and transport, are more adversely affected by the mentioned snags.

3.1.6 Information and Research

a) Information System

There is a general lack of prerequisite information flow to/and within rural areas (e.g. on policy and development strategies, pricing issues, etc.). This has limited the range of a two-way information exchange as well as effective interaction among rural dwellers in areas where they could advance methodologically in both agriculture and rural transport. Due to lack of prior information, the rural communities are also denied opportunities for effective participation in planning and decision making for their own development.

The existing traditional information channels in rural areas neither provide effective links nor equal opportunity for interaction between men and women. These are mostly male dominated as men have a comparative advantage of more leisure time and exposure outside the rural circles.

b) Research and Utilisation of Findings

Researches so far conducted in rural agriculture and transport have provided interesting findings which could be instrumental in development aspects. However, information has been inadequate to stimulate effective translation into policy or practical solutions. One reason is that, there has not been a good linkage of researches between the sectors of agriculture and transport. As a matter of fact, there are no synthesised results of the two sectors combined. Also, researches have not been well coordinated within individual sectors and institutions.[5] The forum for networking and exchange of information on research facts and modalities is not formally established. Consequently, there has not been a concerted effort for follow-up of application and transfer. Many researches already conducted

have been more of supply as well as donor driven types. On the other hand, demand driven researches have not been able to fully integrate the values of the intended users.

There has not been enough drive to put gender messages clearly on the agenda of most researches. Gender issues are still tackled as "need arises" and sometimes they are only realised as worth considering during the process of implementation of other findings. E.g. though the baseline survey data of Makete Integrated Rural Transport Project (MIRTP) was gender disagregated, the design of the project components was done in consideration of the transport situation of a household and not directly targeted with a gender perspective. A study found out later during the last phase of the project that some interventions had constraints on their use by women. Effective mainstreaming of changes/or modifications at this stage was not easy.

Many parts of remote rural areas are inaccessible by motorable transport. Eventually, most researches have been limited to the areas which are accessible by motorable transport, i.e. avoiding excessive walking. This may be partly due to time constraints, but also due to the ill perception of research work as a white collar job. For example, the two remote wards of Morogoro Rural District had not been reached by traditional researchers due to their remoteness and inaccessibility by motorised transport. On reaching them (i.e. by a determined researcher), it was found out that they had quite a different agricultural and transport pattern, and gender characteristics other than those usually presented in the representative research findings of the district. This phenomenon leads to limited access and opportunities for development of the most disadvantaged groups of the society.

3.2 Market Weaknesses and Constraints

Market works on competitive forces of individuals' preferences of goods and services based on demand and supply of the same and regulated by prices. So, why do we say that market has failed to address with adequate interventions, an improvement of the conditions of rural transport and rural agriculture in favour of gender? In addition, the share of labour on subsistence activities is higher than on agricultural productive activities. Why has the market not been able to address this issue?

The two factors outlined below are not exhaustive to address the questions raised above, but they will help us to understand the essence of the matter in discussion.

3.2.1 Information and Research

a) Information

One of the underlying principles for marketing system to function well, is the timely access to information by the individual competitors of goods and services. E.g. They must be up to date with the information on prices, technologies, etc. This is obviously not the case with rural population. The market is also not informed of the demand pattern of rural population, mainly because market research has been more inclined to capitalise on the needs of the urban sector. E.g. The rural communities in Morogoro were ready to purchase hand grinding mills (i.e. a feasible non-transport intervention) but did not know the source. At the same time, a potential manufacturer within the same district premises was not aware of the high prospect of manufacturing and marketing of the item in the area.

Market in nature is driven by individual consumer interests. Hence, it is not gender sensitive, unless if the goods and services to be provided and the benefits to be accrued thereafter depend on participation of a specific gender. Rarely it will happen that market is particularly attracted by rural women in terms of service requirements or goods/technology to be provided, as what is most appropriate for rural setting will be construed by outsiders as old fashioned.

b) Market Research Limitations

Failure of researches to address clearly the most relevant rural agriculture and transport issues in this direction, has created constraints in the proper functioning of the markets between the rural dwellers and the private sector. Research is expensive for the private sector operators to finance from own

sources. Hence, the investment and pricing mechanism, inputs supply, etc. is done on assumption basis and mainly to the disadvantage of rural communities.

3.2.2 Resource Utilisation

Market forces have so far not been able to influence the full utilisation of labour and land resources for agricultural production in Tanzania. Credit purchase system for rural agricultural produce has been a burden to farmers. Credit facilities are in many rural areas not available, and where available, they have to a large extent been inadequate to sustain a sound level of income to farmers. On the other hand, rural communities have inherent problems to organise themselves in cooperatives or social groups which would enhance collective bargaining power, which to them is a prerequisite instrument towards the challenges of an open market environment. Grouping in this case is even more important to women who due to social-cultural constraints are weaker in individual bargaining.[3] The problems in agriculture as stifled by transport constraints and lack of effective intervention measures, have severely curtailed the ability of farmers (women being a driving force in food farming) to maintain an adequate level of production.

Market forces are obviously not attracted to merit goods (e.g. water supply, rural roads and paths infrastructure, etc.) which are basic to human and economic needs. As a result, they have not been able to offer any counter balancing measures for the much more time and effort spent by rural communities on subsistence rather than productive activities. A good balance if created would empower rural communities to become competitive partners and eventually contribute to the improvement of rural and national economies.

3.3 Sociocultural and Traditional Barriers

Sociocultural and traditional barriers are a serious bottleneck to the implementation of most initiatives designed to address the situation of rural women in developing countries. Traditionally, rural women are in weaker position in decision making, even on their own personal matters of concern. In Tanzania, constitution provides an institutional opportunity (quarter system) for women to participate in the country's decision making process starting from village councils up to the parliamentary level. Whilst the criterion used to set the "quarter system" is not clearly understood, it is rather difficult to contemplate that the same women who are the main contributors in agriculture (i.e. the backbone of the country's economy) are only allotted about a half of the seats they deserve. The "quarter seats" are also labelled in Swahili, "viti vya upendeleo".(i.e. a direct translation to the "seats not deserved, but favoured "), thus undermining the whole reasoning around the system. Most women including the elite group seem to have acknowledged a wide use of this terminology. Nevertheless, at top levels the opportunity has been to some extent utilised and provided room for policy influence, e.g. in education for girls. At grassroots level, the "quarter" representation is entangled in sociocultural constraints and rendered ineffective (e.g.participation without strengths for decision making). The situation in rural areas is aggravated by leadership manipulation of power structures to cover ideological and political interests. This has a negative influence on women in leadership positions whose struggle to fight for common interests in unison is undermined.

It is factual that if you empower (i.e. socially and economically) a woman you will have empowered and improved the livelihood of the whole household. This to male rural society means an interference with the value system and order of the society, as it is an attempt to counter their right of superiority. The traditional "role model" status which is particularly maintained in rural areas, draws clear distinctive lines with unfair distribution of roles and responsibilities between men and women. This unequal distribution has had suppressive effects on women's ability to advance. Most societies seem to have accepted and inculcated in their attitudes the gender discriminative role modelling in a way that has sustained them for generations.[4]

Conventional development approaches have been top-down, non-participatory and providing little room for gender sensitivity.[5&4] Since the spokespersons of households (i.e. for male headed households) are men, it follows that most of the information sought by outside collaborators (particularly when they are men) with regard to development issues, will be directed and biased on

male opinion. As a result, choice of technologies, implementation methodologies, etc. have been gender biased. Whereas women are not a strong part in decision making process and information sourcing, they still abide to the very decisions taken and fully participate in the process of their implementation. Thus, the past development initiatives did in fact help to perpetuate the undesirable gender discriminative situation in Tanzania.

In order to accord gender issues a deserved place in rural development endeavours, factors contributing to sociocultural and traditional barriers have to be fully recognised in advance of any development plans.[8] It is worth noting that any changes to be brought in to alleviate the situation with a gender dimension is bound to bounce against long inherited negative attitudes. Hence, an appropriate entry point has to be designed with long-term perspective measures in order to have most, if not only some, of these barriers eliminated.

3.4 Topographical and Ecological Constraints

The nature of land and vegetation determines the type of crops suitable for the area. Accordingly, different types of crops demand different levels of labour intensity to be put in. In Morogoro Tanzania, women contributed 59% and 67% of total weeding labour input for beans and rice respectively.[5] In Makete Tanzania, women usually intercrop wheat and peas together. Whereas wheat does not need any more labour until the time of harvesting i.e. in five to six months later, peas require intermediate labour before harvesting. Thus some women prefer to grow wheat alone without intercropping with peas whose supplementary nutrition value is compromised because of the added labour input. Since women are responsible for family food security, they are compelled to cope with these varying intensities and frequencies of crop seasoning.

The cropping pattern and farming system in hilly terrains requires more labour input (e.g. terracing). In addition, transportation of agricultural produce which is more dependent on women's time and effort becomes more difficult in hilly than in flat terrain. The quality of rural infrastructure in an area is significantly influenced by topographical factors. Intense labour is required for the improvement and maintenance of infrastructure in hilly areas. In addition, the use of a wide range of intermediate means of transport (IMTs) is limited. In this situation, the appropriate IMTs may be too costly for women to afford, yet they have to shoulder transportation requirements of the households.

4.0 STRATEGIC GENDER BALANCED INTEGRATION

Tanzania has made preliminary steps towards a gender balanced rural agricultural transport situation. The steps made are mainly based on the experiences of the Makete Integrated Rural Transport Project (MIRTP, 1985 - 1993). The project was implemented by the International Labour Organisation (ILO) in collaboration with Makete District Council, and financed by the Swiss Agency for Development and Cooperation (SDC). Hence, the Government in collaboration with ILO and SDC have produced the guidelines on "Integrated Rural Accessibility Planning" which incorporate gender.[9] In these guidelines, agricultural transport issue is addressed in broad terms within a matrix framework of planning, selection and prioritisation of interventions. Since the guidelines are yet to be applied, it would be premature at this stage to assess their usefulness and effectiveness within the existing institutional frameworks. However, there is a need to complement this effort with more focused and specific researches/studies on rural "agricultural transport". Researches and further studies should among other issues, take into consideration the issues outlined below.

4.1 Key Issues on Policies, Institutions, Resources and Technologies

The Government and market institutions have not adequately recognised rural women labour as a major factor of production and transportation in agricultural economies. As a matter of fact, rural women labour is a driving force towards poverty eradication in Tanzania. Transport constraints in rural agriculture have led into low productivity of both land and labour resources. Eventually, there has been seasonal underemployment or overemployment (i.e. mainly on women) as well as the gradually increasing unemployment.

In an attempt to improve the rural agricultural transport situation, the following issues of importance will have to be addressed, i.e. for a successful gender balanced integration:-

4.1.1 Adequate policies should be in place for a gender balanced participation and development in rural agricultural transport. The most relevant and complementary sectoral policies in this respect are agriculture, transport, land and labour. NB:- Research findings should very much aim at influencing policy formulation and reform.

4.1.2 In case there are no policies in place, strategies should be set with a gender perspective for intermediate measures leading towards policy formulation, or revision (i.e. incase the existing policies are not appropriate/or adequate).

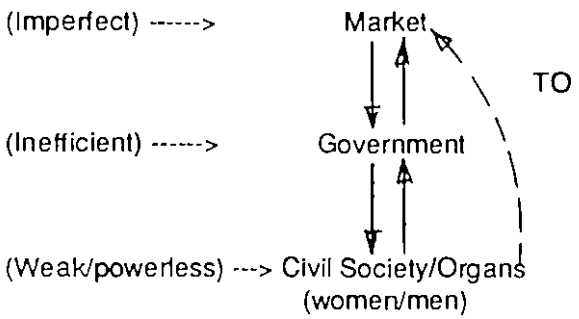
4.1.3 There should be a mechanism to ensure gender balanced resource mobilisation, management and coordination in rural infrastructure and agriculture.

4.1.4 There is a need for serious gender consideration in designs for agricultural rural transport technologies focusing on intermediate rural development alternative strategies, from the communities perspective.

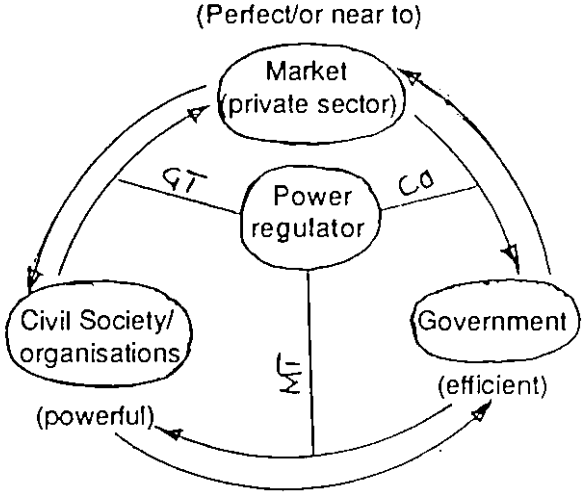
4.1.5 There is a need for gender balanced self-help initiatives in rural transport and agricultural improvement. This should not only justify for Government assistance, but also act as a catalyst for participation and attraction of a gender sensitive mind of a rural investor, entrepreneur, creditor and a rural dweller.

4.1.6 There is a need for gender balanced institutional links and regulatory mechanisms among the Government, market and civil society/organisations (e.g. strong cooperatives, women groups, etc.) interventions in rural agricultural transport improvement and development. I.e. Tripartite links focusing on partnership action and not command action relationship of top-down or bottom-up. See proposed link below:-

a) Existing Command (1997)



b) Proposed Partnership (--> 21st century)



Note:

CO - Civil Organisations
GT - Government
MT - Market

The aim of the proposed structure is to empower rural women and men to intervene on imperfect market conditions and inefficient Government organs for their service demand in the two sectors.

4.1.7 A well thought out entry point should be designed to address the social - cultural attitudes and barriers which are a stumbling block to the advancement of rural women socially and economically.

4.2 Emerging Research Issues

As a first step, the existing relevant researched information/data in relation to gender in rural transport and gender in rural agriculture should as much as possible be synthesized in a comprehensive form. In this way, answers can already be drawn on some research issues outlined below. However, following the presentation above, it is important to outline below some important issues which need further researching:-

4.2.1 If in the long-term the rural transport situation is improved, can (and how?) the Government and market intervene effectively in reallocating productively the women's labour saving from unjustified rural agricultural transport activities?

4.2.2 To what extent can rural women be involved in self-help rural infrastructure improvement activities without adding on them extra burden of time and effort in excess of what they have?

4.2.3 To what extent can improvement in rural agricultural transport influence farming system in favour of gender balanced labour allocation?

4.2.4 To what extent have the Government's macro - import policies affected gender distribution of labour in rural agricultural transport?

4.2.5 What are the major constraints with the functioning of existing credit systems in rural agriculture and transport? What would be the requirements for an appropriate gender responsive credit system/or facility?

4.2.6 What are the basic requirements and appropriate entry point to put in place a tripartite (i.e. market - Government - civil organisations) gender balanced power institution to support rural agricultural transport?

4.2.7 What opportunities are there for an improved rural agricultural transport situation to create a leverage for a broader context rural development? What are prerequisite necessities in this case, for attraction of gender sensitive investors, entrepreneurs and creditors?

5.0 CONCLUSION

The constraints already explained on the Government and market sides are a basic cause of sustained women's burden in rural agriculture and transport. There is thus a need of concerted gender focused strategies for counter measures. Such strategies can only be effectively implemented if the policies and institutional frameworks are appropriate. In view of the inadequacies observed in the existing policies and institutional frameworks, it is more appropriate now, to direct our efforts in the real empowerment of rural communities, (particularly rural women as main agricultural producers) in all aspects enabling them to participate effectively in rural agricultural transport improvement. Empowerment will enable rural communities to build within themselves a "sense of purpose", "self confidence" and "powers" to intervene on the Government and market constraints on "partnership" basis. Hence, through a long-term appropriate power regulatory machinery, (i.e. comprising of market (private), Government and gender balanced civil organisations) the rural agricultural transport situation can be improved.

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Glossary

GoK	Government of Kenya
KENATCO	Kenya National Transport Company
MPW&H	Ministry of Public Works and Housing
GDP	Gross Domestic Product
NIC	Newly Indistrialized Country
KRC	Kenya Railways Corporation
NMT	Non-Motorized Transport
IMT	Intermediate Modes of Transport
ITs	Intermediate Technologies
RARP	Rural Access Roads Programme
RAR	Rural Access Roads
MPR	Minor Roads Programme
ILO	International Labour Organization
KTC	Kisii Training Centre
RTT	Rural Travel and Transport
NGO	Non-Governmental Organization
IT-RTP	Intermediate Technology Rural Transport Programme
IT-K	Intermediate Technology Kenya
ITDG	International Technology Development Group
KERUWOSA	Kandara Rural Water and Sanitation Group
KWAHO	Kenya Water and Health Organization
UNEP	United Nations Environment Programme
EIA	Environmental Impact Assessment
NEAP	National Environment Action Plan

1 An Overview of the Transport Sector in Kenya

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1.1 Introduction

Since attainment of political independence in 1963, the Government of Kenya (GoK) has accorded the development of road transport a high priority in recognition of its crucial importance to the development of all sectors and to the achievement of most development policies. It accounts for over 80% of both freight and passenger transport in Kenya in terms of traffic earnings generated from both rail and road transport, the two leading modes of internal transport.

The transport sector along with other economic sectors in which Government participation was predominant has therefore undergone a number of policy changes. The first two decades of Kenya's independence (1964 to early 1980's) were characterized by emphasis on the need for expansion of existing facilities and to increase the supply of transport facilities such as roads in order to meet the growing demand due to rapid increase in production in the economy. It is during this period therefore that most road developments were undertaken in Kenya. There was a phenomenal development of road transport (and communications) facilities in Kenya during the first two decades (between 1964 and 1982) due to the Government policy to increase its participation in the economy and to expand productive capacity in all sectors. By early 1980's, however, the Government's capacity to expand its activities and indeed to manage the transport facilities was constrained by resource limitations. Funding for road maintenance, for instance, has been declining as a proportion of total government expenditure on road development due to decreased exchequer allocations.

From mid 1980's to the present date emphasis in the transport sector has been to increase efficiency in the management of existing facilities instead of building additional new ones, introducing cost-sharing and promoting private sector participation in the sector through user-charges, privatization and cost sharing. Examples of this policy include the liberalization of rail tariffs, privatization of some of its services and the introduction user charges such as the Road Maintenance Fuel Levy Fund, road tolls and other measures aimed at ensuring increased accountability in the utilization of the Fund. The Government has also diversted from transport parastatals such as the Kenya National Transport Company Ltd. (KENATCO) and the Nyayo Bus Services Corporation although it is still responsible for the maintenance of "classified" roads through the Ministry of Public Works and Housing (MPWH). Parastatal enterprises such as Kenya Railways, Kenya Ports Authority, Kenya Pipeline Co. Ltd. and Kenya Airways through restructuring, privatization and divestiture are further examples of Government policies in this area. The implementation of these policies however, has not been very successful due to institutional, financial and other constraints.

1.2 Development policies and strategies

Despite efforts made so far by the Government and indeed despite having some of the most impressive transport sectors in Sub-Saharan Africa, Kenya is still ranked among the poor countries. In an effort to eradicate poverty and unemployment and to improve the standards of the Government has stated its commitment to accelerate the growth rate of the economy and improve per capita incomes of the majority of the population.

Strategies for achieving these development objectives include;

- Improved macro-economic management of the country;
- Implementation of structural adjustment policies in key sectors; including liberalization of markets, prices and economic activities through privatization, divestiture and improved efficiency in the management of the economy;
- Improving efficiency in the production and marketing of agricultural and industrial products and strengthening linkages between the manufacturing and agricultural sectors on a sustainable basis;
- promoting the development and participation of the private sector as the key player in productive commercial economic activities.
- Encouragement of competition in all sectors of the economy;
- Promoting the development of rural areas where 80% of the population lives.
- Promotion of export-oriented industrial production and an outward-looking business orientation.

In order to facilitate the success of these policies the Government expects the Gross Domestic Product to grow at an average of 5.9% per annum during the period 1997-2001, i.e. during the current 5 year Development Plan period. In Sessional paper no. 1 of 1994 on Recovery and Sustainable Development to the Year 2010, it was intended to strengthen the impact of economic reforms, e.g. liberalization of imports, removal of foreign exchange controls, price de-control and liberalization of interest rates undertaken in 1993. Up to the year 2010, GDP growth rate is expected to be maintained at 8.2% p.a. More recently, however, the Government through Sessional Paper No. 2 of 1996 on Industrial Transformation to the year 2020 declared its intention to transform Kenya from an agrarian economy into a Newly Industrialized Country (NIC) such as the South-East Asian NICs like Korea, Taiwan, Singapore and Malaysia. This industrialization process is intended to spring from increased agricultural productivity and the strengthening of linkages between the two sectors and with others. Thus, increased output in the production of food, cash crops, livestock on a sustainable basis are expected to lead to the development of increased capacities in the manufacturing sector and to stimulate their growth and generate employment in both sectors.

1.3 Current status of the transport sector

The ambitious nature of the above policy goals and the urgency with which they must be achieved places a considerable importance to the crucial need to focus attention on the development and management of the transport sector as a whole. The supply of an efficient and adequate system of transport in all transport modes is a necessary condition for the success in the achievement of the policies of transforming Kenya into an NIC by the year 2020. The following is the current status of the rail, road and inland water and air transport. It will require strengthening as shown in each the respective sectors.

1.3.1 Rail Transport

Rail transport has been suffering from many problems partly due to competition from road transport and partly due to management constraints. Because of these constraints Kenya Railways Corporation (KR) has been experiencing stead decline in freight and passenger traffic(e.g. from 3.3 million tonnes of freight in 1991 to only 1.8 million tonnes in 1996 and from 563 million passenger-km in 1992 to 371 passenger-km in 1996). The parastatal has been characterized by low availability of locomotives which has declined from about 70% (in 1981) to only 47% (1994), leading to huge operational losses.

For purposes of rural transport development, the efficiency of rail transport will facilitate the essential connection with markets in the urban areas and with the international markets especially for bulky commodities and farm inputs. The implementation of restructuring programmes aimed at improving the performance of KR should be intensified in order to assist the agricultural and industrial sectors.

1.3.2 Road Transport

Kenya's current road network consists of 150,600km. This includes 63,700km of "classified" roads that are under the responsibility of the Ministry of Public Works and Housing and 86,900 km of "unclassified" roads that are under the operational responsibility of various Government agencies, including local government authorities.

It is important to note that the bulk of small-holder agricultural production of crops and livestock takes place in areas that are not even covered by the "unclassified" roads. Due to financial and other management constraints in both the MPW&H and in local authorities, both classified and unclassified roads have been experiencing poor maintenance. Even the Road Maintenance Fuel Levy Fund introduced since 1994 as a road user charge is inadequate for the maintenance of all roads. The Government is currently supplementing it with subventions from the Exchequer.

These roads do not, however, cater for the farmers due to low level of motorization and due to the high cost of motor vehicles. Rural level transport has not been a policy issue although it is now recognized in the current, 1997-2001, Development Plan. As of today there is no Government financial allocation for it. The main conclusion is that there is a strong need for Kenya to identify specific rural transport interventions that would be more relevant to small-holder farmers' problems, based on affordable and readily available technology.

As in the case of rail transport, both "classified" and "unclassified" roads constitute important outlets to farmers. However, presently poor condition and the lack of appropriate rural transport infrastructure including Non-motorized modes of Transport (NMTs), constitute a considerable hindrance to increased agricultural productivity.

1.3.3 Other Modes of Transport

In view of the strong links between various modes of transport, it is important that all other modes operate efficiently in order to enhance their complimentarily to the advantage of the small-holder farmers. In this regard it is important to ensure that the restructuring processes that are to be undertaken in the Mombasa Port by the Kenya Ports Authority, the restructuring and privatization of Kenya Airways that has already been undertaken, and the commercialization of operations of the Kenya Pipeline Co. Ltd should lead to increased efficiency in the transport sector because all these processes affect the farmers. Delay as a result of port congestion or lack of air transport (for perishable agricultural export commodities) can have a considerable impact on the farmers productivity.

1.3.4 Non-motorized transport (NMTs)

Apart from the recognition in the current Development Plan, the Government has not previously addressed the question of non motorized transport. They do not appear in Government Statistics nor the institutions/organizations that produce and maintain them. It is now necessary through the National Forum Group on Rural Transport Development, to ensure that mechanisms are formulated for the Central Bureau of Statistics and other agencies to officially establish a data base on NMTs.

1.4 Conclusion

The success of Government policies in enabling small holder agricultural producers to actively participate in achieving the ambitious development goals lies in the extent to which rural transport can be rapidly improved as part and parcel of Government Policy. This has to be done from the point of view of and in accordance with the capacity of the small holder farmers.

The road infrastructural facilities and the Intermediate Technologies introduced to improve productivity in this area, must be affordable to the farmers. For this to be achieved, the Government will have to incorporate NMTs and rural transport modes in its policy framework and ensure that the policies are strictly implemented. Similarly, there is a need for the Government to ensure the success of macro-economic and other development policies in raising the incomes of the rural poor to enable them to afford IMTs on a sustainable basis.

Finally, the Government can also team up with the private sector and NGOs through the National Forum Group to find effective ways of promoting commercialization of IMTs.

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2 Infrastructure for Rural Transport – The Experience of Kenya

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2.1 Introduction

Appropriate infrastructure is essential in providing transport for the rural poor. No matter what means of transport is used (car, "matatu", bicycle, animal-cart, hand cart or walking), some basic infrastructure is needed. This may be tarred roads, murram roads, tracks, or bicycle lanes. In some cases, infrastructure may be constructed close to people to lessen their transport needs. For example; a school can be build near a village instead of children having to travel to a school 10 km away. Making a decision on how to solve rural transport needs is called Integrated Rural Accessibility Planning.

In Kenya, infrastructure for transport has concentrated on the construction and maintenance of roads. While this definitely contributes to solving transport needs of the rural poor, it has been realized that building roads is not enough. Most of the rural transport actually takes place on foot, while in Western Kenya bicycle transport is increasingly popular. In rural road construction and maintenance, Kenya adopted labour-based technologies. Thus, not only infrastructure was constructed, but local employment was created as well.

2.2 Historical Background of Labour Based Road Works

Labour-based rural roadworks started in Kenya in 1974 in four selected districts. The districts were selected to provide site representation of all regions being considered for inclusion in a larger programme.They represented varioustopographic, climatic and socio-economic factors.These districts were:

- Nyeri for highland, wet, regions
- Kwale for coastal regions
- West Pokot for semi-arid regions

During the periods 1974 to 1976 the "Pilot Projects" in these districts worked independently. There was a lot of expatriate inputs and Kenyan engineers were very few. Labour based work was seen as second class form of engineering, still having an aura of relief work. This left the way for various donor employed expatriate engineers to run pilot units with a free hand. The controlling Roads Department or the ministry realized that work methods, techniques and procedures in various districts needed to be standardized, if the programme was to be put into effect on a national scale. The results so far had been very encouraging and a national programme of labour based road construction and improvement was foreseen. This national programme became known as the **Rural Access Roads Programme (RARP).**

The objective of standardizing the works led to the formation of a training site in one of the initial districts. The district chosen was Nyeri. Standard methods and procedures were agreed upon and put into practice on the Nyeri sites. These sites were used for demonstration of standard methods. Out of these beginnings, the Labour Based Training unit was born. It was quickly realized that one essential feature for national success of this type of programme was to involve the national engineers in its research and implementation. As the programme grew, all new engineers were attached to training units before appointment to implementing units in other districts.

As the programme expanded, the training unit was moved to Kisii district. A small temporary facility was constructed at Suneka- Kisii, with the support of Swiss funding. This resulted in a more formalized training for the programme with the objective of maximizing efficiency and standardizing working methods and procedures.

The RARP was so successful both in terms of its own objectives and national political enthusiasm that labour based methods were brought into the classified road network in 1985 with the creation of the **Minor Roads Programme (MRP)**. A more permanent training centre was built at Kisii town to cope with the increased training for the MRP. This complex is the present day Kisii Training Centre (KTC) where all labour based roads training for Kenya is carried out. In addition, the ILO/ASIST project in collaboration with KTC conducts International Labour-Based Roadwork courses for engineers, technicians and trainers. A module on Rural Transport and Travel (RTT) Strategy was introduced as part of the courses in October 1997 with the aim of sensitizing participants on the importance of these strategies.

Programme Achievements

In the span of twelve years, both the RARP and MRP have achieved wide success and fame in Kenya. Some of the achievements include:

- A total of 12000 Km of access and feeder roads have been constructed in the agricultural productive regions of the country. This created man years of employment per year for the rural population. Land use patterns in these areas also changed from subsistence to cash crops resulting in increased economic activity.
- The programme has developed a cadre of experienced engineers, technicians, and overseers in labour based road works.
- Labour based road work methods have been transfered to the local communities who have constructed access roads on self help basis using the same technology.
- There has been increased political awareness among the country's leaders of the potentials of labour based road works not only as a provider of jobs and access to the villagers but also as a strategic political tool.
- Local communities have benefitted from easy access to markets, schools and health facilities.

2.3 Future Strategy of Roadworks in Kenya

The Ministry of Public Works and Housing has adopted a policy to expand the use of Labour Based RoadWorks technology in the roads' sector.The Roads 2000 strategy has been introduced with the aim of applying Labour Based Road Maintenance methodology into the whole network of classified roads in Kenya. The labour Based methods will be backed by appropriate equipment for carriage- way work on heavily trafficked roads and in areas of low population.

2.4 Conclusion

It is clear that the RARP and the MRP have largely achieved the goals for which they were set. Nevertheless, a lot still needs to be done. For example, several surveys conducted in different parts of the country indicate that there is a huge demand for appropriate rural transport in the country. As these surveys were not directly concerned with rural transport, their findings have not resulted in independent rural transport policy. The expectation that investment in access roads would result in increased agricultural productivity and accessibility to basic economic and social amenities has not been fully realized.

While the basic rural access roads (RAR) may largely be in place, there is poor linkage between them and the interior villages because the RAR did not take into account the need for paths and tracks that connect the villagers to the roads. There is therefore need for the formulation of a Rural Travel and Transport policy. The policy would give direction and coordination in utilization of Kenya's rich potentialities in labour based road technology, which include the following:

- experienced technical staff, engineers, technicians, overseers,
- a knowledgeable rural community in labour based road works, many of whom have been involved in the construction of rural roads,
- available training institutions for labour based Road works could be still used for training on relevant aspects of construction of RTT like paths and tracks, small bridges etc.

With the current resources, coupled with an enabling rural transport policy, Kenya stands a great chance of successfully implementing the RTT Programme due to her experience in labour based road technology and a very positive community attitude to development issues affecting them. In addition to creating sustainable transport system, such a programme would generate employment opportunities for many people in the rural areas.

3 Socio economic issues affecting agricultural transport and its development

By Jeff Maganya,
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3.1 Background

Conventional public road transport planning and development in Kenya have tended to focus on highways and road infrastructure. These facilities have failed to satisfy the major transport needs of rural small holder farming communities located away from them. Moreover, this kind of development has tended to cater mainly for farmers producing cash crops and other higher-value economic goods, leaving out the majority of subsistence farmers. The reality therefore, is that headloading is still by far the most common transport mode in the rural villages where the transport burden still contributes the biggest share of all rural activities. Intermediate modes of Transport (IMTs) are scarce and even where they are available their ownership is confined to the relatively richer members of the village community.

From the perspective of rural communities, rural transport itself is a larger component of the problem of access: access to markets, information and technical support, labour opportunities and household consumption items, all of which directly affect the social and economic development. Lack of access contributes to poverty. Both colonial and post-independence socio-economic development encouraged the growth of towns and markets along railway lines and highways. These areas were established as government administrative headquarters and centers for educational and economic activities attracting, a lot of social and economic amenities. Access to the hinterlands beyond these centers has therefore remained problematic to the present date.

Besides transport burdens associated with getting water and firewood, a considerable amount of transport drudgery is related to small scale subsistence agriculture, the mainstay of many rural communities. This paper reviews access issues relating to small holder agricultural communities.

3.2 Rural Transport and Travel Patterns

In most of East Africa, rural agricultural small holder farmers expend a lot of time and energy in transportation activities related to basic subsistence and social needs. These include trips to procure farm inputs, agricultural production and marketing of farm products. Since these trips are made on foot away from the highway and road system, they reduce opportunities for

income generation in agriculture and increase in food security. Mainly because of lack of government support, access to IMTs is limited and options are few even in areas where they would have potential. In addition, East African countries also have problems in expanding or maintaining their current road networks, while the cost of owning or using motor vehicles is prohibitive to the majority of the poor rural people.

The table below shows goods and key rural transport modes in western Kenya.

Table 3.1: Goods and related Modes of Transport in Western Kenya

Main goods transported	Main mode of transport
water	Headloading wheelbarrows Bicycles donkeys
Firewood (For domestic use)	Headloading
Firewood (for sale)	Headloading Handcart Bicycles Donkeys
Agricultural produce from the fields	Headloading Wheelbarrows Donkeys
Agricultural product (local market)	Headloading Matatu[1] Wheelbarrows Donkeys Bicycles
Agricultural produce for processing (Posho mill, etc.)	Headloading bicycles donkeys

Source: Needs assessment for non motorized transport in west Kenya and field from reports from IT-Kenya's Rural Transport Programme

There is presently a growing recognition of the transport burdens of the rural communities in meeting their basic needs, and the degree to which these limit their social and economic development. There is also parallel recognition that conventional approaches to rural transport

[1]Any motorized vehicle that has been adapted to carry passengers and goods.

and access that focus on roads and motor vehicles do not adequately address the transport needs of rural people.

3.3 Agricultural Transport

Small holder farmers have critical demands for the realization of a good harvest. This is because most small holder farmers depend on the timing of the rain for their crop.

Accordingly, agricultural transport demands vary with activities at different periods.

- Tilling the land requires transport for equipment, *Jembes*, animal drawn ploughs, etc.
- Re-tilling and planting requires seeds and organic manure.
- Weeding needs access to the right weeding hoes.
- Protection of farms against domestic/wild animal, birds and other pests.
- Harvesting involves a drudgery of repeated transport between the farm and home and has to be done in time so that thieves, pests and rain do not affect the harvest.
- Marketing of subsistence crops is done by headload or on bicycles to reach the market.
- Water for domestic animals like calves, chicken, etc. is required in the homes and is transported by headloading or use of donkeys.
- Access to information on agriculture is obtained in market places, barazas, and meetings.
- Some small holder farmers usually irrigate their farm land that are in the homestead or near a water point.

Table 3.2 shows the access demands for a small holder farmer.

Table 3.2. Access Demands for Small Holder Farmer

Item	Source	mode of transport	cost of mode	comments
Seeds	Market	Walking Formal or informal village level transport service	pay in cash	most village level transport service is bicycles. they could be bicycle taxis or hiring a neighbors bicycle
Seeds	Home (kept from last Harvest)			
Seeds	From relatives	walking informal village level transport service	pay in cash	most informal service arrangements mean that one self rides themselves
Manure	compost pit, animal pens etc.	headloading animal/human pulled sledges, wheelbarrows,	Mode belongs to self or could be borrowed	
Fencing of land using twigs and shrubs	woodland around	dragging by hand		
Tilling of land	Drag ox/donkey plough to farm	on wooden sledge	made from cutting a stem of a tree	
Water for young calves	watering points	headloading donkeys		
irrigating the farm	water point	headloading ADP wheelbarrows	Home owned device	
Transport to stores	farm	headloading ADP wheelbarrows	home owned devices	
marketing	market	Informal of formal village level transport service bicycles	pay in cash use own bicycle	
Agricultural equipment (Ox drawn ploughs etc.)	Market, neighbors	Sledges Walking and headloading	home made	
inorganic/organic pesticides, insecticides and herbicides e.g. ash for storage	woodland, from home	headloading		
extension service from (NGOs/ Government)	Market, Baraza, meeting	Walking Informal and formal village level transport service	cash	

Source: field report from IT-Kenya's Rural Transport Programme

Transport for agriculture is still under-developed and depends mainly on headloading. These are often supplemented with crude home made NMTs e.g. the animal drawn sledge, wooden wheelbarrows and handcarts. Most of the IMTs used for agricultural transport purposes are purchased for other functions e.g. wheelbarrows for construction. Even in the remotest of the rural areas there is still some form of IMTs in existence however simple. The quality or efficiency of these IMTs is never a concern as they can be replaced easily and by local materials. The more advanced IMTs for agricultural use require manufacturing skills and relatively complex technology especially in hub and wheel making. The cost of these discourages wide ownership. There are also cultural factors e.g. in certain places donkeys are perceived as dangerous. Gender and labor allocation may also affect access to IMTs, for example, a man may not avail his bicycle to be used for a traditionally female task or by a female for dangers of breakage.

3.4 Intermediate Modes of Transport

The successful introduction of IMTs has various social and economic effects. The main advantage are that they match closely the use and management abilities of owners; are more efficient than headloading; their manufacture can be easily decentralized thus tailored to users needs are within reach of rural populations and link market centers with remote areas. Based on IT-RTP experience in Intermediate Modes of Transport and improvement of Non Motorized Transport (NMT) in rural East Africa, the following are some of the benefits that to rural communities from these IMTs:

- Reduction in time and effort that goes to subsistence activities:
- improved and more timely transport of produce and inputs to/from the farm;
- employment creation through provision of local transport services;
- reduction in travel time to markets, main roads
- improved linkages within rural areas.

The process of introduction of IMTs in many rural areas is complicated by the physical terrain, the economic ability of people in the area and the social beliefs and attitudes of people in relation to the IMT.

In order to make IMTs more affordable, there is a need to improve the current stock. This may however necessitate the introduction of new IMTs encouraging users to participate in the production process. Other parallel activities include increasing the capacity of local people to deal with on-going related problems, and the demonstration of other potentially beneficial IMTs from other areas.

In western Kenya, IT working with rural communities in introducing improved IMTs identified that the most important considerations for investing in a transport vehicle are;

- Price of vehicle;
- availability of IMT and access to local repair and maintenance or vet care in case of animals
- versatility of use (Vehicles that could be used for agricultural work, water fetching and other transport tasks in the homestead);
- durability of vehicle;
- ease of propulsion;
- loading capacity of vehicle.

It is necessary that the research on IMTs should address these issues.

3.5 Improving Rural Transport Infrastructure and Equipment

Conventional transport infrastructure investment has mainly focused on motorized transport. In view of the growing use and recognition of IMTs, public policy should provide for appropriate infrastructure for rural transport including the many paths that traverse rural areas so that they are able to accomodate IMTs. There should also be public investment in footbridges and other unclassified roads.

There is also need for the government to make provision for the use of NMTs on classified roads and change traffic laws to accommodate them.

In the 1990s there has been a spontaneous needs-led development of the bicycle taxi phenomenon. Initially called "border-border" these taxis operated between the Kenya-Uganda border but these taxis are now in use in rural areas and have spread to many parts of Uganda and western Kenya. An example of such operation is the bicycle taxi in Kenya's third largest town, Kisumu, along a distance of about 17km. This operation that has close contacts with IT-Kenya's Rural Transport Programme employs about 300 bicycle taxi operators, and 130 bicycle owners who lease their bicycles to be used in the trade. The operation transports 4600 people many with their goods, and generates to the transport service providers KSh 3.3 million (US$55,000) a year.

3.6 Methods of Improving Access in Rural Small Holder Agricultural Communities

Some of the options available for improving transport access for small holder rural farming communities include:

- improving and/or introducing Intermediate modes of transport;
- improving village level infrastructure including access roads, footpaths and foot bridges;
- improving and introducing village level transport services;
- locating non-farm facilities closer to communities.

3.8 Conclusions

There is potential demand for in IMTs East Africa, but translating this to effective demand is problematic as IT-Kenya learnt in their work of increasing and improving available options of non motorized transport in an area. Transport in the rural areas is given less priority particularly since women perform most transport activities and the opportunity cost of their time is perceived as low, partly because they perform duties that do not offer immediate cash rewards. Another reason may be due to the instinctive risk aversion of farmers in the area.

Some of the areas that need further action by development agencies include the following:

- studies on the effects of transport on time/activities of rural people and how investment in improved agricultural transport can release time for people to undertake other activities;
- a study on rural transport infrastructure and methods of their classification;

- there is need for an engineering or economic definition of roads, paths, tracks and trails used by NMTs.
- Programmes to improve rural transport infrastructure; village level transport services and; adapting and producing IMTs by use of participatory technology development.
- Influencing governments in the region to support rural transport initiatives and adopt policies that support rural transport;
- encouraging credit institutions to provide credit to agricultural rural transport.
- adaptation and improvement of existing IMTs to meet the requirements of users

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4 Gender Issues in Rural Agriculture Transport and Development

By Cecilia Kinuthia-Njenga

4.1 The Context of Women in rural transport

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-bing of households. In rural Kenya, the typical adult female spends about 3 hours per day on this activity. If the active day of a rural women is defined as 14-16 hours, this equates to approximately 19% to 21% of female active time spent on transport. (The time spent on travel could be more in the arid zones, sometimes averaging 6 hours during severe drought). It is important to note, however, that the major part of the female input to transport is devoted to water and firewood collection. Transport of goods by women is predominantly by head loading with loads of over 20 kilograms. Women and girls also transport a large proportion of harvested crops from the farm to the home while men often transport farm produce to the markets.

Children and particularly the girl-child, contribute to alleviate the transport burden of women. Children are most likely to be involved in carrying water and firewood, but are least likely to in travel to the posho mill because distances are relatively long and the task requires cash transactions and hence increased responsibility.

The division of labour structure in most rural households, puts more transport burden on women and the girl-child. Thus the time and effort spent by each woman in transport decreases as the number of female adults in the household increases and they are able to share the tasks and responsibilities assigned to them.

4.2 Rural transport and environmental constraints

With increasing environmental degradation (drought and desertification) coupled with rapid population growth and poverty, the transport burden of women has increased. Environmental degradation has meant increased distance to source of water and firewood. In Makueni District, for example during the dry season, a woman may travel over 20 kilometres (to and from) in search of water. This means that she might only be able to fetch 20 gallons of water a day, forcing the family to cut-down on their daily water consumption. During the wet season, travel to water sources may be reduced where water harvesting technology has been introduced.

Increased deforestation has adversely affected women's access to fuelwood. In Maralel, Samburu District, women spend at least one hour every day travelling to look for firewood. Previously they travelled to a nearby forest, a kilometre away from their village; spending less time. The forest has now been depleted (mainly by timber factories), forcing them to walk longer distances.

In the arid and semi-arid zones, markets tend to be located very far from the villages. In most cases, it is men who take the primary responsibility for crop marketing, travelling, sometimes, for two days to get to markets. Access to farm inputs in also greatly constrained by the long distance to outlets and again, it is mainly the responsibility of men to purchase the farm inputs.

4.3 The Impact of IMT on Women

It is widely believed that the introduction of IMTs greatly reduces the transport burden of women. Use of IMT may result to males assuming responsibility for a transport task that would normally be undertaken by women and at the same time reduce the time and effort involved in a particular transport task. The impact of IMT in reducing the transport burden of women has been more evident in the latter case. For women who use the donkey carts and bicycles to transport water and fuelwood, the time spent is reduced as fewer trips are required. The time saved is reallocated to other productive tasks.

In high agricultural productive areas - where the opportunity cost is greater- there is a reluctance by men to allow the IMT to be used for "women's work". This is evident in some parts of central province, where a donkey cart may be used for productive and income generating activities and the females continue with their transport related tasks unaided by the IMT. In lower agricultural productive areas such as Kathekani, the introduction of IMTs (bicycle trailers and handcarts) has slowly enabled the responsibility of fetching water to be transferred to the men. Where IMTs are used to move harvested crops to the home and market, the burden may be alleviated but in this case, women will lose access to some minimal cash income.

With IMTs, it is also important to understand the social, economic and cultural factors that influnce women's ability to acquire new technology and use them. In Nyanza Province, it might be culturally alright to introduce the bicycle to women farmers but not in Central Province.

Introduction of carts to subsistence farming communities and the introduction of donkeys to women's groups by ITDG, has made a positive impact in alleviating the transport burden of women. These innovations have been supported by innovative credit arrangements and participatory technology development and planning.

4.4 Rural Infrastructure

The condition of rural infrastructure in Kenya affects women's transport related activities. Recognizing the importance of rural infrastructure, particularly the paths, tracks and footbridges, in their daily operations women groups have made them part of their community work. In Kandara district, for instance, the Kandara Rural Water and Sanitation Group (KERUWOSA), a local NGO, has mobilized women groups in the area to maintain the footpaths on a self-help basis. The conditions of the transport routes used by rural women and men determine the amount of time and effort that they spend on transport activities. For women who most often walk and carry loads on their head or back, poor condition of roads and paths, particularly during the rainy season requires women to spend more time and efforts.

In spite of these realizations, a recent study on women's participation in rural road construction and maintenance, indicates low participation, constituting only 16.7 percent of the labour force. Even when they did participate there was a tendency to restrict the scope of their participation by confining them to task categorized as less arduous. Restrictions on women's participation emanates from the belief that they are physically weak and cannot cope with roadwork. The study points out that this belief contradicts women's reality, because they have from traditional times been responsible for construction and maintenance work. In Makueni District, where women's participation is high accounting for about 35%, there are very few women in senior and supervisory positions.

4.5 Conclusion

Throughout Kenya, rural women bear a greater transport burden than men, but their access to transport resources remains limited. Most transport planners fail to recognize these differences or to prioritize them. The different roles and responsibilities assigned to men, women-children implies that they all have different transport needs. Trips to collect firewood and water are predominantly done by women and the children (particularly the girl-child). Farming and marketing task have specific gender characteristics women growing subsistence food crops for the family, while men are responsible for the marketing of cash crops. The travel requirements of these responsibilities may differ.

Increased environmental degradation, changing demographic and land-use patterns have made the distances to farms, water and fuelwood sources greater thus increasing travel time to these sources. Increased use of modern health facilities (away form herbal medicine) and educational facilities and women's engagement in income generating activities and wage labour, have also increased women's transport needs. Thus any intervention made in agricultural rural transport should take into consideration the different roles and responsibilities of both women and men.

Gender-sensitive interventions include:

direct intervention such as credit and loan schemes for poor women to buy IMTs or road construction and maintenance, improving access to markets and creating new opportunities.

Non-transport interventions that reduce the need for travel could also be introduced. They include:

a) water supply schemes that bring water closer to the people (KWAHO)
b) introducing fuel-saving jikos (Maendeleo ya Wanawake, ITDG)
c) woodlots and greenbelts and agroforestry (green-belt movement)

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5 Environmental Issues in Rural Agricultural Transport and Development

By Paul Kirai, Environment Management Services.

5.1 Rural transport and the environment

Rural transport systems form an intrinsic part of rural development strategies, serving as mechanisms and catalyst for development of a rural area, reinforcing development efforts or improving return on existing developments. *(UNEP - environmental Guidelines for Rural Roads).* The current National development plan 1997-2001 also recognizes the importance of rural transport: *"Inadequate rural infrastructure, including poor roads and transport systems is one of the major constraints to agricultural development".*

Although agricultural development may be the primary driving force behind a road project, many roads serve a variety of purposes. This may include access to agricultural lands, mining grounds, forests or simply connecting two regions. Roads may also serve to access remote areas, encourage settlement development or provide opportunities for marketing and entrepreneurs.

Environment plays a major role in shaping rural transport and in turn, transportation systems have a significant influence on the environment.
Kenya cuts across different climatic zones and geographic features. Sustainable agricultural transport development must therefore recognize environmental constraints and opportunities. It is important therefore that environmental considerations are given priority in the development of rural transport systems.

Environmental issues in rural transportation relate primarily to the infrastructure networks and secondly to the modes of transport. Apart from the physical and primary environmental impacts of putting up transport infrastructure, there are secondary environmental impacts caused by rural roads, when they open up new land to agricultural and human settlements activity. Extensive rural road networks encourages intensive farming practices, and greater subdivision of farmland to proportions that could lead to loss of productivity, and increased soil erosion. This is evident in many of the areas sorrounding major urban centres, where agricultural activities have beome so intense, and water meant for the towns has been diverted into irrigation when the rains fall, a lot of the top soil is washed into the rivers. Transport planning should therefore take into account the overall development plan of the area, as well as environmental impacts of the proposed infrastructure.

Other concerns of increased access to transportation is the introduction of negative social impacts. Hitherto closed communities have become exposed to disruptive social habits through greater interaction with outsiders. Often, after the construction of a major road through a particular region, there have been increased incidents of disrupted homes and illegitimate children. The impacts for various social groups, including women, should be taken into account.

Recently, under the National Environment Action Plan, the Kenya government has recognized the importance of environmental concerns related to transportation and has formulated environmental impact assesment (EIA) guidelines for transportation projects. This is an area where little work has been done and even less has been written. It is important to reecognize some of the critical

environmental issues in rural transportation development related to the following aspects:

- Design and flexibility,
- respect for local conditions,
- minimization of soil and vegetation disturbance,
- introduction of heavy machinery and vehicles,
- clearing of vegetation,
- introduction of work crews,
- raw materials.

5.2 Environmental Considerations

The effects of increasing transport infrastructure, or of upgrading existing access networks are more far reaching than suggested by immediate objectives. A complex interaction of factors lead to a variety of direct and tangential side effects which have to be accounted for in one way or another. Not only are local environments affected, but the quality and types of infrastructure developed is in turn determined by the local environment. These effects need to be recognized and accounted for throughout the stages of development: project identification, planning and implementation.

Well planned rural transport systems should contribute to environmental conservation through rational use of natural resources and a recognition of population and the land's bearing capacity.

5.2.1 Project identification and conceptualization

It is important for rural transport studies to consider environmental effects in the absence of transportation systems, as well as how transport infrastructure fits into local development projections for the short and long terms. Creating and improving access to a given area leads to the introduction of forces and pressures hitherto unknown or rarely perceived by local inhabitants or local environments. Some of these environmental or social/culture considerations only become apparent during project implementation, and can lead to costly failures. Appropriate studies would include examination of local socio-cultural perceptions and attitudes and their absorptive capabilities as well as land-capacity and land-use planning surveys, in terms of projected agricultural and other activities.

During project identification, attention should be given to identify what steps can be undertaken to limit environmental degradation which could occur through unplanned growth and development in the area. What measures can be used to reduce or contain potential for future air, water, soil and noise pollution?

These questions can be answered through environmental impact assessments to determine the environmental consequences of a transport project and if possible propose several alternatives. Discussions should be held with local populations not only on their transport needs and projections, but also on their perceptions of local climates and general environmental peculiarities (torrent beds, acute flooding problems and so on). This information should be combined with available climate and topography data to help enhance choices available.

5.2.2 *Respect for local limitations*

Rural Transportation systems should maximize use of local materials and minimize introduction of imported raw materials. At the same time, it is necessary to respect limitations imposed by local raw material availability and conflict of use. Agricultural lands for example need to be respected as do forest reserves and areas susceptible to erosion damage. Therefore both excavation and dumping efforts will need to be carefully managed.

In planning transport infrastructure, natural limits such as rock outcrops, river beds, torrent channels, steep hillsides must be recognized. The Rural Access Roads (RAR) Programme of Kenya has in a way succeded in the use of simplified locally absorbable technologies, but their appropriateness to local environments and capacities have not always been considered. Advantage has not been taken of local environmental opportunities and avoiding such areas as might be environmentally unsuitable (due to factors of erosion, vegetation etc) although preferred from a purely access point of view.

Improvement of rural transport leads to increased use of motorized transport which introduces a variety of environmental impacts. The most significant is air and land pollution from the fuel and dust. Areas adjuscent to busy roads exhibit higher amounts of lead (from leaded petrol) in the soils; the lead eventually finds its way into the food chain. Lead is toxic to many animals as well as human beings. Diesel engines pollute the atmosphere with organic smoke which can be seen on roofs and plant leaves along a busy road. In addition to the dust raised by the vehicles, noise pollution is of great importance especially in areas with physical features that reflect sound.

5.2.3 *Local Raw materials and Vegetation cover and Soil loss*

In addition to use of local materials for infrastructure, there should be an emphasis on conservation of resources. Quarrying exercises have not been carried out in an orderly and contained manner, to ensure minimum disruption and waste. Many road programmes have left behind huge craters in the ground where murram and rock has been excavated, creating risks of drowning or exposure to disease through vectors that breed in the stagnant water. Care has also not been taken to keep loss of vegetation cover to a minimum.

Erosion is one of the major problems in road and transport infrastructure construction, especially in steep grounds. Cutting of land for road construction accentuates problems of erosion through changing the profile of the mountain and removing natural protective vegetation cover, and may trigger off landslides. Soil and rock slipping due to erosion can become a problem leading to siltation of waterways and deterioration of the mountain environment. Unless preventative measures are taken early, it is also possible that the road or track may be rendered unusable because of landslide damage.

Many parts of the country suffer from soil erosion initiated or made worse by road contruction on steep ground with unstable soils. Muranga, Kisii and Meru in Kenya, are examples of regions where the negative effects of erosion, landslide or siltation from the building of roads on steep grounds have been experienced. The problem is exacerbated by heavy, torrential rainfall characteristic of these areas.

It is important to maintain flexibility in the location of the infrastructure and determine through on site-exploration whether other locations may pose greater opportunities and less constraints.

5.3 Future directions

Rural access and the expansion of access networks forms an important part of both national and local rural development. Rural transport systems not only have an impact on local environments and socio-cultural issues, but their existence and continued use is equally determined by the local environmental conditions and constraints. The following considerations should be made in future rural transport development.

Planning:
Rural transport must be planned in the context of development strategies integrated with all factors on which it could impact or be affect by. Careful planning, coherent design and flexibility can help ensure that the benefits brought by increased transportation are maximized and that wastage of resource, whether monetary or natural is limited.

Maximize benefits:
In this context, it is important to examine schedules of proposed user, types of vehicles, volumes of traffic as well as opportunities for development presented by the physical existence of the transport system but not formally planned for. Transport systems should be located in such a way so as to be suitable for a multiplicity of users and uses. Efforts should be geared towards ensuring that the minimum of road and path networks possible are built at each level for each area.

Social awareness:
Rural transport planning should include an awareness of local areas and customs so as to be able to include proposals to help the region absorb changes that increased transportation may bring. The many benefits to the indigenous populations need to be introduced and managed so as not to become burdens or disruptive forces.

Syncronized development:
An important issue is the timing of new developemts. Changes should be spaced timewise to enhance absorbability and local acceptability. There has been jokes about expansive tarmack roads in some parts of the country which are used by farmers to dry their crops, and rest their animals, as there is no traffic. Though slightly exaggerated, this example serves to illustrate the importance of synchronizing transport development with the overall developement of a region. For instance, a road should not be built in a void, long before the necessary infrastructure for its use has been established. Careful planning at this level will also help reduce occasion for environmental stress.

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6 General Conclusions and Recommendations

6.1 Infrastructure

Though the government initiated RARP and the MRP largely achieved the goals for which they were set, the expected economic returns are yet to realized. There is still a huge demand for appropriate rural transport in the country to increase agricultural productivity and accessibility to basic economic and social amenities. Much remains to be done.

The path and track network to the interior villages remains poor though the basic rural access roads (RAR) may largely be in place. Many of these paths can benefit from labour based technology.

There is therefore need for the formulation of a Rural Travel and Transport policy to direct and coordinate utilization of the country's rich potential in labour based road technology, which includes:

- experienced technical staff, engineers, technicians, overseers,
- a knowledgeable rural community in labour based road works, many of whom have been involved in the construction of rural roads,
- available training institutions for labour based Road works could be still used for training on relevant aspects of construction of RTT like paths and tracks, small bridges etc.

In addition to creating sustainable transport system, such a programme would generate employment opportunities for many people in the rural areas.

6.2 Social economic issues:

Studies show that transport in the rural areas is given less priority particularly since women perform most transport activities. The opportunity cost of their time is considered low partly because they perform duties that do not offer immediate cash rewards.

This perception can be challenged through the increased dissemination of IMTs as in some ITDG projects where even the transport burden has been shared among the men.

Some of the areas that need further action by development agencies include the following:

- studies on the effects of transport on time/activities of rural people and how improved agricultural transport can release time for people to undertake other activities;
- More studies on rural transport infrastructure and methods of their classification; including an engineering or economic definition of roads, paths, tracks and trails used by NMTs.
- Programmes to improve village level transport services and facilitate adaption and production of IMTs using participatory technology development.

- Influencing governments in the region to support rural transport initiatives and adopt policies that support rural transport;

- encouraging credit institutions to provide credit to agricultural rural transport:

- adaptation and improvement of existing IMTs to meet the requirements of users

6.3 Gender considerations

As has been shown, rural women bear a greater transport burden than men, but their access to transport resources remains limited. Most transport planners fail to recognize these differences or to prioritize them.

Environmental degradation, changing demographic and land-use patterns increase the travel burden of women by increasing distances that have to be travelled.

Thus any intervention made in agricultural rural transport should take into consideration the different roles and responsibilities of both women and men. Transport focused gender-sensitive interventions include:

- direct intervention such as credit and loan schemes for poor women to buy IMTs, and
- road construction and maintenance to improving access to markets and creating new opportunities.

Other non-transport interventions that reduce the need for travel could be introduced. They include:

- water supply schemes that bring water closer to the people (KWAHO)
- introducing fuel-saving jikos (Maendeleo ya Wanawake, ITDG)
- woodlots and greenbelts and agro-forestry (green-belt movement)

6.4 Environmental Issues

Rural transport systems not only have an impact on local environments and socio-cultural issues, but their existence and continued use is equally determined by the local environmental conditions and constraints. The following considerations should be made in future rural transport development to enhance environmental conservation.

- Careful planning, coherent design and flexibility to help ensure that the benefits brought by increased transportation are maximized and that wastage of resource and environmental degradation is limited.

- Recognition of limits placed by environmental factors, such soil erosion, rock outcrops or flood zones, and preparing mitigation plans.

- Studies should be carried out to determine unacceptable impacts on the environment caused by infrastructural development or introduction of motorized traffic, and propose alternatives. The social impacts of increased mobility should also be taken into account in transport planning.

- Road and inland transport systems in such a way so as to be suitable for a multiplicity of needs and uses. Efforts should be geared towards ensuring that the minimum of road and path networks possible are built at each level for each area.

- Synchronization and spacing new developments to enhance absorbability and local acceptability. For instance, a road should not be built in a void, long before the necessary infrastructure for its use has been established.

6.5 Government policy

For small holder agricultural producers to actively participate in national development, rural transport should be rapidly improved as part and parcel of Government Policy. This has to be done from the point of view of and in accordance with the capacity of the small holder farmers.

Such policies and strategies should take into account environmental and cultural considerations and include proposals to help the region absorb changes that increased transportation may bring. The many benefits to the indigenous populations need to be managed so as not to become burdens or disruptive forces.

Infrastructural facilities and the intermediate technologies introduced to improve productivity in rural areas, remain unaffordable to many farmers. Transport improvement programmes should therefore go hand in hand with macro-economic and other development policies geared towards raising the incomes of the rural poor to enable them to afford IMTs on a sustainable basis.

There is need for the government to incorporate NMTs and rural transport modes in its transport policy framework and ensure that the policies are strictly implemented.

The National Forum Group should facilitate the Government to team up with the private sector and NGOs to find effective ways of promoting commercialization of IMTs.

AGRICULTURAL RURAL TRANSPORT AND DEVELOPMENT - UGANDA

1 Introduction

Agriculture is, and will for a long time continue to be the leading sector in Uganda's economy (Mukasa, 1997). It contributes nearly 49% to GDP and 85% the value of exports, and provides 80% of employment and most of the raw materials to the agro-based industry. Over 80 % of the 20.4 million population live in rural areas and derive their livelihood from agriculture. Although there was a decline in cash crop production in the 70's and early 80's, there are now clear signs of its recovery as evidenced by annual average growth of 8% since 1987/88. All this means more production capacity by and marketing opportunities as well as more cash flows for the subsistence farmers. At the same time the large agriculture potential remain untapped because of the inadequate rural transport and travel which limits the market potential. In addition, the rural population is not yet sufficiently catered for in terms of rural transport which is still at the level of limited use of bicycles, pickups, ox-carts, and animal pack (donkeys). Head loading is by far the commonest form of rural transportation.

2 Status of Rural Travel and Transport

2.1 Infrastructure

Regarding rural travel and transport, road is by far the most dominant transport mode. It plays a pivotal role in supporting economic and development programs. In general it carries over 90% of the country's passenger and freight transport. The road network in Uganda comprises of 9003 km of classified roads; 22,300 km, feeder roads; and a lesser grade of roads known as community roads, locally called *bulungi bwansi* estimated at 30,000 km. The contribution of the latter two categories to rural travel and transport are the most significant. The rural feeder roads are the principal means of vehicular access to rural areas, and are therefore crucial to the economic development of the country especially with regard to agriculture.

Rural transport is predominantly by walking and head-loading on tracks or foot paths-not subjected to any form of formal engineering design and/or maintenance. These community tracks/paths are constructed and maintained by communities on a voluntary basis and are normally 1-2 meters wide. They make up the transport infrastructure on which animal-cart and motorized transport are possible. Where the terrain, and track/path conditions permit, *bodaboda* transport, a hire service in form of bicycles and motorcycles, is often used. The paths leading to agricultural fields, water and firewood sources are of a lesser width. Here donkey use in form of pack animal is the only option to walking and head loading.

2.2 Needs and Services

In the rural context, Travel and Transport needs and services are manifested at four levels:

- Domestic
- Farming
- Marketing
- Services and social purposes

Domestic

Domestic level transport comprises collection of water and fire wood, and trips to the grinding mills to process grains or cassava. According to studies made in Mbale (Barwell, 1996) domestic transport made up 75% of household transport demand. It was by far the most energy and time-consuming task taking up to 1,500 hours per household size of 5.7. Domestic transport was dominated, in time and effort, by water and firewood and these tasks were almost exclusively performed by women using head-loading. An average health adult carried about 20 kg to 35 kg of load at any given time.

Farming

As per studies indicated above, travel and transport for agricultural activities made up 18% of household transport demand. It involved trips to the fields for cultivation, movement of farm inputs, and collection of the harvested crop. It was mainly by head loading (93%) carried out almost exclusively by women and children. At the national level, although IMTs are owned in almost all areas, their use in agriculture is minimal. The exception is in marketing. The reasons for these include:

- most transport is to/from the fields using paths/tracks
- The terrain may also be a limiting factor

Use of donkeys represents about 5% limited to pack animal. Donkeys may be made to carry up to 100 kg for distances of about 5 km. Transportation by carts is limited by lack of technical know-how on local fabrication of carts. The problem of narrow paths from farms to homesteads can be solved by using pack donkeys, while transportation from homestead to markets can be done using carts along tracks and feeder/community roads. The districts which traditionally use donkeys are Kapchorwa, Kotido, and Moroto. Recently, donkey use has been introduced in the districts of Mpigi (50), Masaka (45), Jinja (35), Bushenyi (35), and Iganga (30). The use of farm tractors and trucks for transportation from field to homesteads contributes only 2%, mainly on large farms/estates in the country.

Marketing

Transport of farm produce to markets made up 6% of transport demand in the Mbale survey. At the national level, transporting commodities to markets is done by head-loading mainly by women handling about 70% of the produce sold at local markets. Bicycles ridden almost exclusively by men handle 20% while the remaining 10 % is handled by donkeys (2%) and motorized transport mainly pick-ups (8%). Use of motorized transport is normally expensive due to poor transport infrastructure in rural areas. However, the majority of farmers sell their produce at farm-gate, sometimes at give away prices due to high costs of transport means or the shear burden of transporting the produce to markets, in some cases with a high risk of not being able to sell.

Social Services

Travel to social services include trips to the health centres, travel to markets (other than selling farm produce), travel outside the village associated with visits to family members and friends or to meet social obligations, and travel by children to schools. Walking is quite predominant for short distances up to 5 km while bicycle use is the favorite personal transport for those who can afford. Bicycle ownership and use for hire *(bodaboda)* is common especially in Eastern Uganda. Where road conditions are good, pick-up transport is available especially on market days.

2.3 Rural Transport Technology

Transportation

Transport of goods is mainly by head or back-loading. The following intermediate means of transport are also available, though not utilized to the maximum extent possible:

- **Wooden wheelbarrows:** those in the rural areas use wooden wheels locally made while those in urban areas use factory-made hardened rubber tires.
- **Metallic wheelbarrows:** mainly used for road/building construction
- **Animal-drawn sledges:** simple and cheap way of transporting load using cattle power
- **Donkey Carts:** their use is almost insignificant. This is because of lack of technical know how on their fabrication at the local level
- **Pack animals (donkeys):** main form of utilization in areas where donkeys are found
- **Ox-carts:** not widely used perhaps due to lack of technical know-how on their fabrication, high initial cost and paucity of traction animals. Currently, a limited number of ox-cart is manufactured in Soroti and supplied to farmers on a hire-purchase basis by NGOs. There is not only a need to reduce the cost but also make

them lighter, more robust with minimal maintenance requirements, and to train local artisans to fabricate them.

- **Bicycles**: large numbers imported and also manufactured at one plant in Kampala
- **Motor cycles**: a rather recent adoption on rural roads for transport hire services
- **Personal Travel** from village to urban centers is predominantly by bicycle and motorized transport - mainly the motor-cycle following its adoption in the last two years especially in areas near major towns of Kampala, Jinja and Entebbe. Furthermore, three-wheelers (Vespa) are used in Jinja mainly for special drops within the town environs.

3 Efforts made towards Rural Transport and Development

Government made concerted efforts in the late 80's and early 90's to reverse the economic decline of the previous years to the path of sustained economic growth. The following initiatives were undertaken.

3.1 Development Projects

Southwestern Uganda Agricultural Rehabilitation Program (SWARP)

The objectives were to increase food production, incomes and living standards in the southwest of Uganda.

One of the main components was rehabilitation of rural access roads. With feeder road rehabilitated, substantial increases in number of vehicles, motorcycles and bicycles using the roads have been registered, and several lorry loads of produce leave the project area to outside markets. Farm gate prices have also generally gone up thereby increasing the farmers' incomes.

The project also facilitated provision of plant, equipment, and other logistics for maintenance of feeder roads network for access, and in-service training for staff engaged in the works.

Feeder Roads Rehabilitation and Maintenance programs

Over the last eight years, Government undertook the initiative through a number of feeder road projects to rehabilitate and maintain feeder roads in the country. The main objective was for improving selected feeder roads to all weather road surface standard; priority given to those roads which could first unlock areas with potentially high agricultural surplus. To date, some US$ 75 million has been used to improve on the feeder roads and an estimated 9,000 km of feeder roads has been rehabilitated.

3.2 Decentralization of Functions to Districts

Under the decentralization policy, government has transferred substantial powers, functions and responsibilities to the Local Governments. The provision in the Local Government Act of 1997 is that the role of central government is limited to policy formulation, monitoring, guidance and support supervision, while the bulk of planning and implementation of activities is the responsibility of Local Governments.

The main objective is to increase management efficiency, increased democratic and popular participation, and improved financial performance through increased revenue generation and rational expenditure decisions. The strategy has been a comprehensive policy encompassing political, administrative and financial decentralization.

It is believed that the current decentralization process will lead to much needed massive improvements of public services production and allocation while at the same time strengthening local democracy. There is evidence that improvement has already been registered in several districts. However, it is also clear that serious management problems exist at all levels during the inception stage.

4. Constraints and Issues of Concerns

4.1 Agricultural Production

There exist structural and institutional problems in Uganda's agriculture, namely;

- **Backward technology**: About 90% of farmers carry out production activities using the hand-hoe; animal power contribute 8% and tractor power only 2%. Predominant use of the hand-hoe leads to low productivity of land and labour, and low farm incomes.

- **Inadequate extension services** on improved production technologies

- **Low utilization of land**: Out of 17 million hectares of land which is classified as arable land, only 4.6 million hectares (27%) are currently under cultivation. The low utilization of land is due to inadequate and inefficient utilization of available farm inputs and mechanization options.

- **Degradation of the environment**: The current agricultural practices present some serious environmental problems, partly because the arable land is located away from major population centers. The main environmental problems in agriculture include land fragmentation, soil erosion, inappropriate farming systems, soil compaction, shifting cultivation and its effects, overgrazing, deforestation, siltation of water bodies and bush fires. As a result of shortage of woodfuel in some areas, agricultural residues which would have been ploughed back into the soil to conserve soil fertility is used as a source of domestic energy.

- **Inefficient means of transportation of agricultural produce**: Head loading contributes 70% of transport means of agricultural produce sold in local markets

and 93% of transport means from farms to homesteads. It is done mainly by women.

- **Lack of technical know-how by local artisans in cart making**: Use of carts in transportation is insignificant due to lack of technical know-how by local artisans in cart making. Ox-carts manufactured in local industry are too expensive for ordinary farmers. Donkey carts are not found on the open market. There is also lack of donkey-drawn implements and inadequate secondary tillage implements.

- **Shortage of donkeys**: Donkey availability is limited and its distribution poor. Kapchorwa district in Eastern Uganda is the main source.

- **Poor roads and market infrastructure** in rural areas

- **Reliance on the unpredictable weather**, especially rain-fed agriculture

4.2 Socio-Economic

Head-loading which is the predominant means is very inefficient in terms of load carried and is characterized by small loads over short distances and wastage of time and energy (drudgery). In cases of heavy harvest, head-loading used as the only transport mode leads to losses due to delays in harvesting.

There is lack of low-cost vehicles or IMTs as well as relatively high cost of owning and operating the available means of transport. This has been compounded by the fact that Government has divested itself from the provision of transport services. The private sector involved in providing transport services is after profit maximization and service routes with high returns mainly along roads in good condition. Means of transport which are widely available elsewhere are not known to the Uganda populace. The diffused patterns of human settlement and economic activity, also make it difficult to provide infrastructure in certain areas.

In some parts of the country, as a result of deforestation and the lack of nearby water sources, more time is spent by women and children walking long distances to fetch wood for fuel and drinking water. It therefore follows that less time is given to productive activities which is mainly agricultural production.

4.3 Technological

The following IMTs are not available in Uganda:

- **Bicycle trailers**
- **Mopeds**
- **Motor-cycle adaptations** such as sidecars and detachable trailers

Animal Traction Transport: These would be the ideal means of transport especially for the agricultural sector during the cultivation, harvesting and post-harvest

processing and marketing. Presently, the use of animal traction technology for transportation is limited to pulling sledges with oxen, to back packing with donkeys, and to insignificant use of carts. Animal traction would be a simple and affordable substitute for head-loading.

5. Recent Initiatives in Planning and Support to Rural Development by Government

Further concerted efforts has been made by the Government in re-dressing the problems of agricultural rural transport and development. The recent key initiatives are described below.

5.1 Poverty Eradication Action Plan

Government recognizes that poverty eradication among the masses is a high priority in its current economic policy reform. To this end, the Poverty Eradication Action Plan (PEAP) was launched in 1996 and developed in 1997.

The PEAP is in two volumes, the first volume establishes the policy framework for the eradication of poverty for the next two decades. The plan identifies the existing constraints in strategic policy areas and specifies policy objectives and activities which are to be implemented in order to realize the goals of the plan. The strategy is two-pronged, consisting of:

- **Measures to improve incomes** focus on roads, land, agriculture, rural markets, employment and labour productivity, rural credit and financial services, and micro and small scale enterprises.
- **Measures to improve the quality of life of the poor** target the provision of basic services - primary health care, primary education, water and the environment as well as disaster management which enhances the welfare and quality of life of the affected people.

Government believes that, if successfully implemented, this strategy will enable Uganda to eradicate mass poverty from its society within the United Nations' Poverty Eradication Decade of 1996-2007 but in any case, not later than the year 2017. Government further believes that the set of policy strategies contained in the plan are the correct ones and represent a national consensus, given the extent and range of consultation carried out in preparing the policy document.

The second volume, which is currently being worked on, will give a review of the main features of the public expenditure programme for the plan period focusing on poverty eradication initiatives. All on-going and new public investment programmes/projects are being reviewed with the view of addressing the policy objectives. The following recent initiatives are being reviewed and developed a long the poverty concerns.

5.1.1 Modernization of Agriculture Plan

Government has put together the Modernization of Agriculture Plan as one of the most effect strategies for attaining the national goal of increased agricultural production. The main thrust is to exploit to the full the potentials offered by agriculture, rich soil and generally good weather which make it possible to grow a wide range of crops.

The main objectives of modernizing agriculture include:

- Ensuring food security and adequate nutrition levels
- Increasing and diversifying the production of agricultural export commodities
- Provision of adequate agricultural raw materials for development of domestic agro-based industries
- Creation of sufficient employment opportunities in the agricultural sector and thereby improving the socio-economic welfare of rural areas

The strategies planned covers improvement of the coverage and efficiency of research and extension services; improvement of the rural infrastructure (rural feeder roads, markets and storage systems); improved standard of marketing of the agricultural products; introduction of rural credit schemes through introduction of micro financial institutions; and provision of friendly fiscal policies.

5.1.2 Mechanization of Agricultural Production and Transportation

Draft animal power (oxen and donkeys) complement both hand labour and mechanical power and provide small-holder farmers with vital power for:

- Crop cultivation, planting, ridging, weeding and harvesting
- Rural transport for fetching water, firewood, and moving people from farm to markets.
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The drudgery involved in all the above operations once alleviated will lead to food security, high farm incomes and better living standards. The objective is to enable farmers utilize affordable intermediate technologies for agricultural production, and transportation.

Key Strategies

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- Train artisans and blacksmiths on cart fabrication and repair, and fabrication of spares.

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- To mobilize and guarantee adequate and timely resources by Central Government and Local Authorities (LAs) for implementing programs
- To evolve an effective and efficient institutional framework for the rehabilitation and maintenance of RFRs
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NEAP was formulated in 1995. NEAP gives a policy framework which provides a comprehensive, integrated and coordinated plan for environment management at national and district levels. However, the NEAP recognized the following constraints: inadequacies of the existing policies, legislation on the environment which is fragmented; lack of inter-sectoral coordination in environment management; low levels of environment awareness; and lack of information.

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- Intensification of public awareness campaign on the evils of natural resource degradation.
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- District plans to reflect national priorities

- Sustainable development - focusing on natural resource management and protection of the environment

- Financially sound and feasible development taking into consideration financial resource constraints

- Maximum use of political agents in mobilization to a high degree of local commitment and a sense of ownership

- Encourage self help activities - use of available labour and local resources

- Efficiency and accountability in governance and service delivery

- Application of multi-sector development approach

- Increased private sector participation in development

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Future development projects in Agricultural Rural Transport and Development should be line with the recent Government initiatives. The projects will be in the areas of:

- Capacity Building
- Infrastructure development and maintenance
- Wood-lots and other energy sources
- Water sources (protected springs, swallow wells, water harvesting and valley dams)
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Future research efforts should address the areas covered in **Section 4** covering the following:

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AGRICULTURAL RURAL TRANSPORT RESEARCH PROJECT

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2nd to 8th November, 1997

Country Paper

AGRICULTURAL RURAL TRANPORT AND DEVELOPMENT - UGANDA

By

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AGRICULTURAL RURAL TRANSPORT AND DEVELOPMENT - UGANDA

1 Introduction

Agriculture is, and will for a long time continue to be the leading sector in Uganda's economy (Mukasa, 1997). It contributes nearly 49% to GDP and 85% the value of exports, and provides 80% of employment and most of the raw materials to the agro-based industry. Over 80 % of the 20.4 million population live in rural areas and derive their livelihood from agriculture. Although there was a decline in cash crop production in the 70's and early 80's, there are now clear signs of its recovery as evidenced by annual average growth of 8% since 1987/88. All this means more production capacity by and marketing opportunities as well as more cash flows for the subsistence farmers. At the same time the large agriculture potential remain untapped because of the inadequate rural transport and travel which limits the market potential. In addition, the rural population is not yet sufficiently catered for in terms of rural transport which is still at the level of limited use of bicycles, pickups, ox-carts, and animal pack (donkeys). Head loading is by far the commonest form of rural transportation.

2 Status of Rural Travel and Transport

2.1 Infrastructure

Regarding rural travel and transport, road is by far the most dominant transport mode. It plays a pivotal role in supporting economic and development programs. In general it carries over 90% of the country's passenger and freight transport. The road network in Uganda comprises of 9003 km of classified roads; 22,300 km, feeder roads; and a lesser grade of roads known as community roads, locally called *bulungi bwansi* estimated at 30,000 km. The contribution of the latter two categories to rural travel and transport are the most significant. The rural feeder roads are the principal means of vehicular access to rural areas, and are therefore crucial to the economic development of the country especially with regard to agriculture.

Rural transport is predominantly by walking and head-loading on tracks or foot paths-not subjected to any form of formal engineering design and/or maintenance. These community tracks/paths are constructed and maintained by communities on a voluntary basis and are normally 1-2 meters wide. They make up the transport infrastructure on which animal-cart and motorized transport are possible. Where the terrain, and track/path conditions permit, *bodaboda* transport, a hire service in form of bicycles and motorcycles, is often used. The paths leading to agricultural fields, water and firewood sources are of a lesser width. Here donkey use in form of pack animal is the only option to walking and head loading.

2.2 Needs and Services

In the rural context, Travel and Transport needs and services are manifested at four levels:

- Domestic
- Farming
- Marketing
- Services and social purposes

Domestic

Domestic level transport comprises collection of water and fire wood, and trips to the grinding mills to process grains or cassava. According to studies made in Mbale (Barwell, 1996) domestic transport made up 75% of household transport demand. It was by far the most energy and time-consuming task taking up to 1,500 hours per household size of 5.7. Domestic transport was dominated, in time and effort, by water and firewood and these tasks were almost exclusively performed by women using head-loading. An average health adult carried about 20 kg to 35 kg of load at any given time

Farming

As per studies indicated above, travel and transport for agricultural activities made up 18% of household transport demand. It involved trips to the fields for cultivation, movement of farm inputs, and collection of the harvested crop. It was mainly by head loading (93%) carried out almost exclusively by women and children. At the national level, although IMTs are owned in almost all areas, their use in agriculture is minimal. The exception is in marketing. The reasons for these include:

- most transport is to/from the fields using paths/tracks
- The terrain may also be a limiting factor

Use of donkeys represents about 5% limited to pack animal. Donkeys may be made to carry up to 100 kg for distances of about 5 km. Transportation by carts is limited by lack of technical know-how on local fabrication of carts. The problem of narrow paths from farms to homesteads can be solved by using pack donkeys, while transportation from homestead to markets can be done using carts along tracks and feeder/community roads. The districts which traditionally use donkeys are Kapchorwa, Kotido, and Moroto. Recently, donkey use has been introduced in the districts of Mpigi (50), Masaka (45), Jinja (35), Bushenyi (35), and Iganga (30). The use of farm tractors and trucks for transportation from field to homesteads contributes only 2%, mainly on large farms/estates in the country.

Marketing

Transport of farm produce to markets made up 6% of transport demand in the Mbale survey. At the national level, transporting commodities to markets is done by head-loading mainly by women handling about 70% of the produce sold at local markets. Bicycles ridden almost exclusively by men handle 20% while the remaining 10 % is handled by donkeys (2%) and motorized transport mainly pick-ups (8%). Use of motorized transport is normally expensive due to poor transport infrastructure in rural areas. However, the majority of farmers sell their produce at farm-gate, sometimes at give away prices due to high costs of transport means or the shear burden of transporting the produce to markets, in some cases with a high risk of not being able to sell.

Social Services

Travel to social services include trips to the health centres, travel to markets (other than selling farm produce), travel outside the village associated with visits to family members and friends or to meet social obligations, and travel by children to schools. Walking is quite predominant for short distances up to 5 km while bicycle use is the favorite personal transport for those who can afford. Bicycle ownership and use for hire *(bodaboda)* is common especially in Eastern Uganda. Where road conditions are good, pick-up transport is available especially on market days.

2.3 Rural Transport Technology

Transportation

Transport of goods is mainly by head or back-loading. The following intermediate means of transport are also available, though not utilized to the maximum extent possible:

- **Wooden wheelbarrows:** those in the rural areas use wooden wheels locally made while those in urban areas use factory-made hardened rubber tires.
- **Metallic wheelbarrows:** mainly used for road/building construction
- **Animal-drawn sledges:** simple and cheap way of transporting load using cattle power
- **Donkey Carts:** their use is almost insignificant. This is because of lack of technical know how on their fabrication at the local level
- **Pack animals (donkeys):** main form of utilization in areas where donkeys are found
- **Ox-carts:** not widely used perhaps due to lack of technical know-how on their fabrication, high initial cost and paucity of traction animals. Currently, a limited number of ox-cart is manufactured in Soroti and supplied to farmers on a hire-purchase basis by NGOs. There is not only a need to reduce the cost but also make

them lighter, more robust with minimal maintenance requirements, and to train local artisans to fabricate them.

- Bicycles: large numbers imported and also manufactured at one plant in Kampala
- Motor cycles: a rather recent adoption on rural roads for transport hire services
- Personal Travel from village to urban centers is predominantly by bicycle and motorized transport - mainly the motor-cycle following its adoption in the last two years especially in areas near major towns of Kampala, Jinja and Entebbe. Furthermore, three-wheelers (Vespa) are used in Jinja mainly for special drops within the town environs.

3 Efforts made towards Rural Transport and Development

Government made concerted efforts in the late 80's and early 90's to reverse the economic decline of the previous years to the path of sustained economic growth. The following initiatives were undertaken.

3.1 Development Projects

Southwestern Uganda Agricultural Rehabilitation Program (SWARP)

The objectives were to increase food production, incomes and living standards in the southwest of Uganda.

One of the main components was rehabilitation of rural access roads. With feeder road rehabilitated, substantial increases in number of vehicles, motorcycles and bicycles using the roads have been registered, and several lorry loads of produce leave the project area to outside markets. Farm gate prices have also generally gone up thereby increasing the farmers' incomes.

The project also facilitated provision of plant, equipment, and other logistics for maintenance of feeder roads network for access, and in-service training for staff engaged in the works.

Feeder Roads Rehabilitation and Maintenance programs

Over the last eight years, Government undertook the initiative through a number of feeder road projects to rehabilitate and maintain feeder roads in the country. The main objective was for improving selected feeder roads to all weather road surface standard, priority given to those roads which could first unlock areas with potentially high agricultural surplus. To date, some US$ 75 million has been used to improve on the feeder roads and an estimated 9,000 km of feeder roads has been rehabilitated.

3.2 Decentralization of Functions to Districts

Under the decentralization policy, government has transferred substantial powers, functions and responsibilities to the Local Governments. The provision in the Local Government Act of 1997 is that the role of central government is limited to policy formulation, monitoring, guidance and support supervision, while the bulk of planning and implementation of activities is the responsibility of Local Governments.

The main objective is to increase management efficiency, increased democratic and popular participation, and improved financial performance through increased revenue generation and rational expenditure decisions. The strategy has been a comprehensive policy encompassing political, administrative and financial decentralization.

It is believed that the current decentralization process will lead to much needed massive improvements of public services production and allocation while at the same time strengthening local democracy. There is evidence that improvement has already been registered in several districts. However, it is also clear that serious management problems exist at all levels during the inception stage.

4. Constraints and Issues of Concerns

4.1 Agricultural Production

There exist structural and institutional problems in Uganda's agriculture, namely;

- **Backward technology**: About 90% of farmers carry out production activities using the hand-hoe; animal power contribute 8% and tractor power only 2%. Predominant use of the hand-hoe leads to low productivity of land and labour, and low farm incomes.

- **Inadequate extension services** on improved production technologies

- **Low utilization of land**: Out of 17 million hectares of land which is classified as arable land, only 4.6 million hectares (27%) are currently under cultivation. The low utilization of land is due to inadequate and inefficient utilization of available farm inputs and mechanization options.

- **Degradation of the environment**: The current agricultural practices present some serious environmental problems, partly because the arable land is located away from major population centers. The main environmental problems in agriculture include land fragmentation, soil erosion, inappropriate farming systems, soil compaction, shifting cultivation and its effects, overgrazing, deforestation, siltation of water bodies and bush fires. As a result of shortage of woodfuel in some areas, agricultural residues which would have been ploughed back into the soil to conserve soil fertility is used as a source of domestic energy.

- **Inefficient means of transportation of agricultural produce**: Head loading contributes 70% of transport means of agricultural produce sold in local markets

and 93% of transport means from farms to homesteads. It is done mainly by women.

- Lack of technical know-how by local artisans in cart making: Use of carts in transportation is insignificant due to lack of technical know-how by local artisans in cart making. Ox-carts manufactured in local industry are too expensive for ordinary farmers. Donkey carts are not found on the open market. There is also lack of donkey-drawn implements and inadequate secondary tillage implements.

- Shortage of donkeys: Donkey availability is limited and its distribution poor. Kapchorwa district in Eastern Uganda is the main source

- Poor roads and market infrastructure in rural areas

- Reliance on the unpredictable weather, especially rain-fed agriculture

4.2 Socio-Economic

Head-loading which is the predominant means is very inefficient in terms of load carried and is characterized by small loads over short distances and wastage of time and energy (drudgery). In cases of heavy harvest, head-loading used as the only transport mode leads to losses due to delays in harvesting

There is lack of low-cost vehicles or IMTs as well as relatively high cost of owning and operating the available means of transport. This has been compounded by the fact that Government has divested itself from the provision of transport services. The private sector involved in providing transport services is after profit maximization and service routes with high returns mainly along roads in good condition. Means of transport which are widely available elsewhere are not known to the Uganda populace The diffused patterns of human settlement and economic activity, also make it difficult to provide infrastructure in certain areas

In some parts of the country, as a result of deforestation and the lack of nearby water sources, more time is spent by women and children walking long distances to fetch wood for fuel and drinking water It therefore follows that less time is given to productive activities which is mainly agricultural production.

4.3 Technological

The following IMTs are not available in Uganda:

- Bicycle trailers
- Mopeds
- Motor-cycle adaptations such as sidecars and detachable trailers

Animal Traction Transport: These would be the ideal means of transport especially for the agricultural sector during the cultivation, harvesting and post-harvest

processing and marketing. Presently, the use of animal traction technology for transportation is limited to pulling sledges with oxen, to back packing with donkeys, and to insignificant use of carts. Animal traction would be a simple and affordable substitute for head-loading.

5. Recent Initiatives in Planning and Support to Rural Development by Government

Further concerted efforts has been made by the Government in re-dressing the problems of agricultural rural transport and development. The recent key initiatives are described below.

5.1 Poverty Eradication Action Plan

Government recognizes that poverty eradication among the masses is a high priority in its current economic policy reform. To this end, the Poverty Eradication Action Plan (PEAP) was launched in 1996 and developed in 1997.

The PEAP is in two volumes, the first volume establishes the policy framework for the eradication of poverty for the next two decades. The plan identifies the existing constraints in strategic policy areas and specifies policy objectives and activities which are to be implemented in order to realize the goals of the plan. The strategy is two-pronged, consisting of:

- **Measures to improve incomes** focus on roads, land, agriculture, rural markets, employment and labour productivity, rural credit and financial services, and micro and small scale enterprises.
- **Measures to improve the quality of life of the poor** target the provision of basic services - primary health care, primary education, water and the environment as well as disaster management which enhances the welfare and quality of life of the affected people.

Government believes that, if successfully implemented, this strategy will enable Uganda to eradicate mass poverty from its society within the United Nations' Poverty Eradication Decade of 1996-2007 but in any case, not later than the year 2017. Government further believes that the set of policy strategies contained in the plan are the correct ones and represent a national consensus, given the extent and range of consultation carried out in preparing the policy document.

The second volume, which is currently being worked on, will give a review of the main features of the public expenditure programme for the plan period focusing on poverty eradication initiatives. All on-going and new public investment programmes/projects are being reviewed with the view of addressing the policy objectives. The following recent initiatives are being reviewed and developed a long the poverty concerns.

5.1.1 Modernization of Agriculture Plan

Government has put together the Modernization of Agriculture Plan as one of the most effect strategies for attaining the national goal of increased agricultural production. The main thrust is to exploit to the full the potentials offered by agriculture, rich soil and generally good weather which make it possible to grow a wide range of crops.

The main objectives of modernizing agriculture include:

- Ensuring food security and adequate nutrition levels
- Increasing and diversifying the production of agricultural export commodities
- Provision of adequate agricultural raw materials for development of domestic agro-based industries
- Creation of sufficient employment opportunities in the agricultural sector and thereby improving the socio-economic welfare of rural areas

The strategies planned covers improvement of the coverage and efficiency of research and extension services; improvement of the rural infrastructure (rural feeder roads, markets and storage systems); improved standard of marketing of the agricultural products; introduction of rural credit schemes through introduction of micro financial institutions; and provision of friendly fiscal policies.

5.1.2 Mechanization of Agricultural Production and Transportation

Draft animal power (oxen and donkeys) complement both hand labour and mechanical power and provide small-holder farmers with vital power for:

- Crop cultivation, planting, ridging, weeding and harvesting
- Rural transport for fetching water, firewood, and moving people from farm to markets.
- Land leveling in rice production
- Construction of rural roads and small fish ponds
- Logging in forestry operations
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RURAL TRAVEL AND TRANSPORT IN TANZANIA

by

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ABSTRACT

Investments made in the Tanzania's transport sector have been largely concentrated on roads and vehicles. Investments have also been made to develop air and water transport. Distribution of advantages emanating from such investments have been skewed, benefiting more the urban communities compared to their rural counterparts. The situation is more unfavourable to rural women and children who are responsible for more than 80% of the transport burden but have limited access to transport aids. The attempts which the rural communities make to overcome the travel and transport burdens are often lacking national and international support.

This paper attempts to throw some light on: (i) the travel and transport situation in the rural areas of Tanzania; (ii) the efforts being made to address and redress the situation; and (iii) the benefits expected from carrying out rural travel and transport interventions. The paper is concluded with an appeal to private and public institutions to support the efforts of government and the rural communities to alleviate the travel and transport burden in rural areas and, hence, contribute to poverty alleviation and improvement of welfare of the rural communities.

1.0 INTRODUCTION

Travel and transport are necessary in carrying out subsistence and economic activities as well as accessing social services and cultural obligations. Effectiveness and efficiency in meeting the travel and transport needs are influenced by both the transport infrastructure and the means of transport used. Significant differences have been noted among the rural and urban communities regarding the time and effort they spend on effecting the travel and transport needs. This paper attempts to show that to date the travel and transport situation is favourable for urban than rural communities. The paper is divided into five main sections: (i) general comparison of the travel and transport situations in the rural and urban areas; (ii) detailed description of the travel and transport situation in the rural areas of Tanzania; (iii) initiatives being made to address and redress the situation; (iv) benefits expected from the rural travel and transport interventions; and (v) appeal for supporting the efforts being made to improve the travel and transport situation.

2.0 THE RURAL AND URBAN TRAVEL AND TRANSPORT SITUATIONS COMPARED

Four fundamental differences are evident when looking at the travel and transport situations in rural and urban areas: (i) needs for and pattern of travel and transport; (ii) the transport infrastructure; (iii) the means of transport, and (iv) gender/age distribution of the transport burden.

2.1 Needs For And Patterns of Travel And Transport

Generally, the needs for rural travel and transport include: (i) carrying out household activities, and (ii) accessing social services and cultural obligations. The information available for rural communities is summarized hereunder.

Research has shown that more than 80% of total time and 95% of total weight of goods transported in rural areas take place within and around the village, rarely on roads and using vehicles; the remaining proportions account for time travelled and load transported outside the village. A good part of the travelling time and loads carried within and around the village is dedicated to meeting household activities which can be subdivided into economic or productive activities (those carried out to generate income and capital) and reproductive activities (those carried out to maintain the household e.g. fetching water, collection of firewood, and taking grains to milling machines). In particular, rural households spend 26%, 15% and 6% of their total travelling time on fetching water, firewood collection and accessing grain milling machines respectively. The respective loads transported are 36%, 35% and 18% of the total load measured in tonne-km. Agricultural activities account for about 22% of the total travel time and 9% of total tonne-km per annum on transport activities[1].

The trips made in fetching water, collecting firewood and transporting grains to milling machines are often short and frequent. In some cases, however, the distance travelled can be long up to 8 km for fetching water, 15 km for collecting firewood and 15 km to access the nearest milling machine. Other longest distances travelled are up to 5 km to crop fields, 25 km to access a medical facility and 80 km to reach a nearby bus station. In most cases the loads transported are small, weighing 20-30 kg per trip per person[1,2,3].

Although comparative data and information on travel and transport for the urban sector are not available, assessment from the general observation suggests a relatively better situation for the urban sector since utilities such as water supply, electricity, grinding mills and food outlets have been located within proximity of households. Contrary to the rural areas where basically the need for travel and transport is on household activities, in urban areas the major need for travelling remain to be conducting economic activities.

2.2 Transport Infrastructure

Roads, classified and unclassified, form the dominant transport infrastructure in Tanzania; other infrastructure include the railways, harbours and ports as well as airports and aerodromes. Data available on the classified road network is summarised in Table 1.

Table 1: The Classified National Road Network by Type and Linkage (km)

Responsible Institution	Classification by Linkage	Length by Surface Type (Km)		
		Paved	Unpaved	Total
Ministry of Works (Including REs)	Trunk Roads	4,006	6,201	10,207
	Rural Roads	144	18,959	19,103
	Sub Total	4,150	25,160	29,310
Local Authorities	District Roads	0	30,000	30,000
	Feeder Roads	0	30,000	30,000
	Sub Total	0	60,000	60,000
TOTAL		4,150	85,160	89,310

Source: Various Regional Socio-Economic Profiles (1994-1997) and MoW Reports.

With a total national road-network of 89,310 km, shown in Table 1, and the area of Tanzania being at about 945,000 sq. km, an average national road density is estimated at 0.09 km/km^2. This figure is too far below the road density for urban areas. For example, the road densities are 49.6, 18.9, and 4.9 km/km^2 for Tabora (urban), Shinyanga (urban) and Dodoma (urban) respectively[4]. Although this comparison is too general, it reveals the skewness on distribution of the classified roads, the density being higher for urban than rural areas.

Footpaths, trails and tracks form the major proportion of the unclassified transport infrastructure and dominate in the rural areas of Tanzania. Despite their importance, data and information on lengths and locations of paths and tracks has not been collected. This lack of data and information, in part, reflect the fact that the government (and probably the donor community) has not appropriated technical and financial resources to such infrastructure. Consequently, development and maintenance responsibilities have been left entirely to villagers. Most of the roads in Tanzania are in a poor state although some have now been rehabilitated under the Integrated Roads Project (IRP). It should, however, be noted that IRP is mainly concerned with the trunk and regional roads as well as the selected districts and feeder roads, the latter totalling to only about 5,000 km. This implies that the infrastructure which is important to the rural communities has received, if any, only limited support from the government and donors.

2.3 Social Services and Infrastructure

There is no uniform pattern concerning the distribution of social services and infrastructure in the rural areas of Tanzania. While in some areas the services are within proximity of the communities, in other places people have to travel over long distances in search of the services. There are two relevant examples:

i) Only about one third of the villages in Tanzania presently have access to clean water within their villages. Consequently, some people have to travel over long distances in search for clean water. The national water policy stipulates that by the year 2002 there shall be clean water supply for every 200-250 people within distances which shall not exceed 400m.[5] The objectives are still far from being realised.

ii) Todate many villages have no medical facilities including dispensaries and health centres, a situation which compel people to search for the services from distant places. As an indication of commitment to alleviate the situation, the national health policy has set a target to have a dispensary for about every 10,000 persons or 5-6 villages. Since in most cases villages are located very far apart from one another, the fact remains that even if the target is achieved some people will still have to travel over long distances to access a dispensary.

2.4 Means of Transport

Motorised transport, for both the passengers and goods, is more pronounced in the urban than in the rural sectors. In contrast to the urban sector, walking and head loading (or back-loading) are predominant in the rural areas. It should be noted that non motorized means of transport such as bicycles and carts are also in use in both the rural and urban areas but they are, generally, used more extensively in urban than in rural areas. Among other reasons, the low use of Intermediate Means of Transport (IMTs) in the rural areas can be attributed to low incomes, limited availability, difficult terrain characteristics and socio-cultural factors. In the attempt to overcome limitations of purchasing power, some rural communities have resorted to using wooden bicycles and sledges[1].

In most cases the means of transport are owned, controlled and used by men. It is rare to find a woman owning such means of transport, especially for the men headed households. In some cases a vehicle can be available in a household but women do not have access to it due to cultural and social reasons[6].

2.5 The gender/age distribution of the transport burden

Data is not available on the distribution of the transport responsibilities by gender and age for the urban population. Nevertheless, it can be generally concluded that, irrespective of gender, adults assume the largest share of the transportation responsibilities. But, in view of the urban peoples' access to better means of transport and the location of amenities and services within proximity of households, it is easy to carry out the transport activities in the urban areas.

Research has generated interesting results on the gender/age distribution of the travel and transport burden in the rural areas: on average, women are responsible for nearly 67% of the travelling time while men and children are responsible for 21% and 12% of time respectively. Women are also responsible for 85% of the total load carried. Since women have limited or no access to means of transport, they do more than 90% of the travel and transport by walking and head-loading[1,3].

3.0 THE TRAVEL AND TRANSPORT SITUATION IN THE RURAL AREAS OF TANZANIA

3.1 Distribution of Responsibilities for the Transport Infrastructure and the Dominant Means of Transport

The transport infrastructure which serves rural communities in Tanzania include: (i) paths, tracks and trails; (ii) feeder roads; (iii) district roads; (iv) regional roads, (v) trunk roads and (vi) landing ports, especially the traditional ones. The paths, tracks and trails cater for about 80% of the travel and transport requirements of the rural communities mainly through walking and head-loading. Depending on their width, the soil characteristics and terrain, the infrastructure is also plied by bicycles, donkeys and animal carts where these

means are being used. Paths, trails and tracks, as well as most of the traditional landing ports on rivers and lakes, are developed and maintained by villagers from the villages they serve.

The surface of feeder and district roads is normally earth. The major mode of transport on these roads is again walking and porterage. However, tractor-trailers, pick-ups and land-rovers ply these roads especially during the market days. Furthermore, some district roads are served with some kind of scheduled bus service. Ward godowns for produce are usually located along these roads for easy access by the lorries. Feeder and district roads are usually constructed and maintained by District Councils through a budgetary allocation from both the District Council and the Central Government. However, due to financial limitations, some feeder roads are constructed and maintained by communities on self-help basis.

Regional roads are mostly of gravel surface while trunk roads are gravel or bitumen, and both are all weather. The roads are under the responsibility of the Regional Engineers Office (REO) which receives maintenance funds from the Central Government. The trunk and regional roads are usually served with scheduled bus services throughout the year and provide inter-district and inter-regional movements of passengers and goods. Since the roads serve long distance traffic they have no major significance to the local population.

3.2 Access of Rural Communities to Transport Services

Some villages in Tanzania are completely not accessible by motorized vehicles due to absence of appropriate infrastructure. With a few exceptions where access is only by waterways, most of such villages are accessible by walking and bicycles where terrain permits.

Most of the villages are accessible by tracks and feeder roads. About 50% of the villages, however, are not accessible by these roads during the rainy season due to: (i) lack of drainage structures at stream/river crossings, and (ii) prevalence of the naturally occurring black cotton and red coffee soils which render roads slippery when wet. When the roads are passable, in most cases villagers, access to motorised transport is by chance when government officials, extension workers, missionaries or NGO workers pass through the villages on their way to some destination. Alternatively, some villages get access to motorized transport only on market days when 4WD vehicles and trucks go to buy produce from markets in those villages. Such vehicles are neither safe nor suitable for passenger transport especially in consideration of the goods they transport and the prevailing poor road conditions.

Scheduled bus services are mainly available on the regional and trunk roads and rarely on district roads. In most of the districts scheduled bus services meet less than 50% of the demand for passenger transport for inter-district trips[6].

3.3 Factors Accounting for the Poor Rural Travel and Transport

3.3.1 Transport Policy

To date no Transport Policy exists in Tanzania apart from the final draft of the National Transport Policy completed in 1987. Despite the recognition that more than 75% of the country's population live in rural areas, only a limited mention of the rural sector is included in the draft policy document. This shortfall leaves the problems of travel and transport in the rural areas un-addressed. This can be attributed to the fact that although most things in life involve travelling and transport, the transport element is often not recognized an important feature in people's lives.

3.3.2 Rural Transport Planning

In Tanzania transport planning in rural areas has been largely confined to the process of evaluating socio-economic costs and benefits of individual road links or classes of links in a network as a means of putting together a programme of work. This approach has neither allowed for optimal allocation and utilization of resources for development of transport in the rural areas nor eased the transport burden for households in the rural areas. What is essentially lacking is the procedure to analyze transport demand at the household level and include it in the planning process[6].

Furthermore, there has been lack of coordination among sectors which have concern on travel and transport.

For example, the ministries responsible for water and health have targets of reducing the travel time to water sources and medical facilities by relocating the services closer to communities. However, this creation of facilities has not been complemented by measures to improve mobility. Since rural accessibility is a concern that cuts across many sectors, planning for rural access should not be left to individual government departments/ministries but such agencies should rather work more closely with each other.

3.3.3 Classification of Transport Infrastructure

To date classification of the transport infrastructure ends at the feeder roads level, leaving out the tracks, trails and paths on which most of the rural travel and transport takes place. The exclusion of this important network from classification is, in part, responsible for failure to allocate public funds for its development and maintenance. This area need to be rectified in order to give the network the recognition it deserves and, subsequently, allocation of resources from the public sector.

3.3.4 Legal Ownership

The institutions which have been given mandate to develop, maintain and control the various transport infrastructure can be considered to be the legal owners of such infrastructure. As regards some feeder roads and all infrastructure below that level the ownership is not clear. For example, although feeder roads are generally conferred to District Councils, in some cases it is claimed that it is a responsibility of communities to take care of the feeder roads. Also, as said earlier on, the communities are responsible for the development and maintenance of paths, tracks and trails. For this reason, the rural communities should be the legal owners of these infrastructure but, unfortunately, the communities have no legal control over the use of the infrastructure. It is expected that if communities are granted legal ownership of the transport infrastructure, including control over their use, the communities will be motivated to mobilize resources required to develop, maintain and manage the infrastructure.

4. SOME OF THE INITIATIVES IMPLEMENTED TO ADDRESS AND REDRESS THE RURAL TRAVEL AND TRANSPORT SITUATION

4.1 Individuals and Rural Communities

Rural communities have been dedicating part of their resources, in terms of time, labour, locally available materials as well as tools and sometimes cash, to implement interventions focused at alleviating the travel and transport problems they face. Below are few examples:

4.1.1 Transport Infrastructure

Development and maintenance of footpaths, trails and tracks have been entirely dealt by the rural communities on self-help, unassisted and at their own initiative. In the same spirit, in some areas, the rural communities have done commendable work in developing, rehabilitating and maintaining feeder roads. In other instances, the same communities have supplied free labour and materials, and sometimes cash contributions to district and regional roads. Such efforts, especially as regards the unclassified transport infrastructure, are sometimes frustrated by poor workmanship due to lack of appropriate skills among the community members and limited finance to acquire and install necessary drainage and river/stream crossing structures.

4.1.2 Intermediate Means of Transport (IMTs)

Some individual households and groups of villagers purchase IMTs and motorized transport for personal travel and transportation of various goods. However, other households with interest to acquire such vehicles fail to do so due to limited incomes and distant location of retail outlets for the vehicles. In the villages some entrepreneurs establish small workshops for production and maintenance of IMTs but they sometimes face shortages of spare parts, working tools, limited market and appropriate skills. Within the constrained environment, some households resort to making wooden bicycles and using sledges, especially where trees are not limiting. Such means are better than porterage but are inefficient compared to other means of transport. Wooden bicycles and sledges, in addition to being inefficient, have detrimental effects on the environment.

4.1.3 Non Transport Interventions

Attempts have been made by individuals or groups of individuals to locate services such as water facilities, milling machines, schools, dispensaries and social centres close to the communities concerned. Similar efforts have gone into establishing wood lots. As in other cases, the developments have sometimes not been sustainable due to shortages of spare parts, working tools, limited market and appropriate skills.

4.2 The Makete Integrated Rural Transport Project (MIRTP)

The Makete Integrated Rural Transport Project (MIRTP) was executed by the International Organization ILO and implemented by the Makete District Council with funding from the Swiss Agency for Development and Cooperation (SDC) ffom 1987. The objective of MIRTP was to improve the transport system in the district by establishing a capacity within the district council and at community level to plan, organize and implement rural transport interventions for the benefit of rural communities. The MIRTP interventions included maintenance and rehabilitation of the transport infrastructure (roads/paths), rehabilitation and promoting the use of low cost means of transport (wheel-barrows, donkeys and carts) as well as rehabilitation and maintenance of grinding mills.

Positive MIRTP results include: (i) making information available on transport characteristics for a typical rural household in Tanzania; (ii) giving highlights on existence of potential to reduce the rural travel and transport burden; (iii) highlighting the fact that the development of the rural roads network alone is not enough to solve the rural travel and transport problems; (iv) eased walking and increased capacity to head-load on improved footpaths; (v) increased use of IMTs especially the donkeys; (vi) reduction in the time and effort spent on grinding grains; and (vii) some capacity created at the village and district level to plan and carry out road works (sustainability). These successes are attributed to factors such as: (a) the holistic approach to improving the rural travel and transport situation; and (b) the active participation of all the stake-holders, especially the target communities, from the early stages of the project.

It should be noted that MIRTP did not meet some expectations. For example: (i) some types of IMTs and other types of donkey panniers were not adopted as expected, and (ii) the project did not reduce the womens' transport burden as expected.

4.3 Transport Planning Workshop in Morogoro Region

In 1991, the Ministry of Works, in collaboration with the Swiss Agency for Development and Cooperation (SDC), organised a joint workshop on Transport Planning in Morogoro Region. Among others, the workshop reached a conclusion that *a village based project, with pronounced bottom up approach, which could include a variety of transport improvements comprising both paths/tracks and intermediate means of transport, was needed to stimulate agricultural production in Morogoro region*. The workshop participants felt that improvements to rural travel and transport were probably needed very badly but can not be introduced on a broad scale as neither the organisational approach nor the technical solutions could be validly planned during the workshop.

The workshop suggested that a pilot project on ward/village level be formulated and carried out to try the bottom-up approach where initiatives as well as considerable labour force contributions would come from the villagers. Before the proposal from the workshop could be developed into an implementable project, the rural travel and transport constraints acquired a national recognition hence taking aboard the initiatives of SDC to carry out improvement programmes in Morogoro.

4.4 The First National Seminar on Rural Travel and Transport

The first national seminar on rural travel and transport was held in Arusha between the 11th and 13th May, 1992. The seminar attracted a total of 60 participants including Principal Secretaries of various Ministries, representatives of some donor agencies (e.g. the World Bank, International Labour Organization, Germany Agency for Technical Cooperation, the Swiss Agency for Development and Cooperation, Norwegian Agency for Development Cooperation, and Italian Aid Fund), some Regional Development Directors as well as a number of government officials. The major objective of the seminar was to deliberate on the rural travel and transport situation in Tanzania and, subsequently, to formulate a strategy to alleviate the situation. Among other

things, the seminar concluded that pilot projects on rural travel and transport be conducted in selected districts to yield lessons which would be used in extending coverage to the rest of the country. The districts proposed by the seminar as candidates for inclusion in the pilot project were: Masasi, Mbinga, Mbozi, Sumbawanga, Kasulu, Meatu, Iramba, Mbulu, Muheza and Morogoro (Rural).

4.5 The Prioritization Study

Subsequent to the national seminar, the National Steering Committee of the Road Maintenance Initiative/Rural Travel and Transport Programme (NSC-RMI/RTTP) commissioned an inter-ministerial team to carry out the prioritization study on the ten districts proposed by the seminar to: (a) prioritize the districts as possible candidates for implementation of the pilot projects on rural travel and transport; and (b) recommend suitable interventions for implementation in the pilot project of rural travel and transport. Interventions recommended by the prioritization study include: (i) improvement of paths, roads and drainage structures; (ii) promoting the use of appropriate intermediate means of transport; and (iii) improving access to selected services mainly water, milling machines and fuel-wood. The study, also, recommended that efforts should be made to: (i) empower women to own and get access to IMTs, and (ii) develop strategies which may facilitate the transfer of some travel and transport responsibilities from women to men.

4.6 The Village Travel and Transport Programme (VTTP)

4.6.1 Formulation

The pilot project of the Village Travel and Transport Programme (VTTP) was formulated following the prioritization study and incorporated in the second phase of the Integrated Roads Project (IRP II). The coordination unit of the pilot project was established in the Ministry of Works from July, 1995. Firm donor funding for VTTP has been secured for eight (8) pilot districts including: Morogoro Rural (Swiss Agency for Development and Cooperation, (SDC); Iramba (World Bank/International Development Association, (WB/IDA) Mbozi and Muheza (Norwegian Agency for Development Cooperation, (NORAD) Mbinga (Department For International Development, DFID) Kilosa (Irish Aid) Rufiji (Danish Agency for International Development, (DANIDA) and Masasi (Finnish International Development Agency, (FINNIDA).

4.6.2 Objectives of the Village Travel and Transport Programme

The overall development objective of VTTP is "to improve the livelihood of people in rural Tanzania through making sustainable improvements in the rural travel and transport situation". Immediate objectives of VTTP are:

i) to empower communities to build capacity in: (a) development and maintenance of transport infrastructure; (b) promoting the use and maintenance of appropriate intermediate means of transport; and (c) establishment, maintenance and rehabilitation of some non-transport interventions; and

ii) to develop an effective approach and method for VTTP design and implementation which can be applied in other areas of Tanzania.

4.6.3 The Institutional Framework (Organization) for VTTP

At the National level, VTTP is being coordinated by the Ministry of Works in close collaboration with the Prime Minister's Office (PMO). The stake-holders in each district are determining the VTTP implementing agency based on three institutional models which have been proposed in this respect:

i) partial or full implementation of the programme may be contracted to an NGO where a strong NGO is present.

ii) VTTP may be incorporated in on-going but related donor funded programmes in a district.

iii) In a district where there is no strong presence of either an NGO or appropriate donor funded programmes, the District Council will implement the programme, being able to contract some

work to the private sector.

In all the districts, however, the District Executive Director (DED) features as the overall overseer of VTTP.

4.6.4 Status of Implementation in the Pilot Districts

The VTTP pilot districts are at various planning stages as shown in Table 3.

Table 3: Status of Implementation of VTTP in the Pilot Districts

PILOT DISTRICT	ACTIVITIES DONE
Iramba	Local Project Manager (LPM), a coordinator at the district level, has been appointed and pilot divisions, wards as well as villages selected.
Muheza	LPM appointed; pilot divisions selected.
Mbozi	LPM appointed.
Morogoro Rural	Pilot divisions selected. LPM identified. Project document for the district is being finalised by SDC.
Kilosa	Implementation of some interventions started long time ago through the Irish Aid assistance to the district. Ways are being sought on how to introduce in the on-going programme other interventions proposed under VTTP.
Mbinga	Draft programme document finalised. Pilot divisions, wards and villages selected.
Rufiji	Project document is being prepared. Pilot divisions, wards and villages have been selected.
Masasi	A draft document for Roads Rehabilitation in Mtwara and Lindi Regions, which incorporates VTTP in Masasi, has been produced. Pilot divisions and wards selected.

5.0 OUTPUTS AND BENEFITS EXPECTED FROM THE VILLAGE TRAVEL AND TRANSPORT INTERVENTIONS

5.1 Outputs

(i) A local organization

VTTP is expected to be implemented through self-help on a bottom up approach with the beneficiaries participating in planning and contributing locally available resources. The project, therefore, will attempt to put in place a local organization which will oversee the travel and transport situation in the villages and respond to the stipulated participation.

(ii) Local technical and social capacity

Training will be provided to both the district staff and communities to ensure short term effectiveness and long term sustainability of the VTTP interventions. Villagers, with assistance from the districts, will be able to develop appropriate village action plans.

(iii) **Local capacity to mobilize resources on sustainable basis**

Rural communities will have capacity to mobilize resources required for implementation of the travel and transport interventions. Villagers will also be able to identify appropriate actors to be consulted in case external assistance is required. It is expected that districts will include a budget line for the village travel and transport interventions in their annual budgets to ensure sustainability.

(iv) **Village/community paths and roads improved**

From the village action plans, communities will put in place a sustainable system for maintenance and improvement of their transport infrastructure including footpaths and tracks. The district staff will provide technical advice.

(v) **Use of IMTs promoted**

There is little use of intermediate means of transport in the rural areas. Reasons behind this situation will be established and addressed appropriately in order to either introduce or increase the use of IMTs sustainably.

(vi) **Key services located closer to villagers**

Since a lot of time and effort of the rural communities is spent on accessing services such as water supply, grinding mills and fuel wood, it is expected that appropriate interventions will be considered in preparing the village action plans and, therefore, implemented accordingly.

(vii) **National VTTP approach and method designed**

Experience from the pilot districts will be used to develop the national methodology for VTTP.

5.2 Benefits from VTTP

The main benefit from implementing VTTP is the reduction of time and effort which the rural communities spend on carrying out their travel and transport needs. Time and effort saved is expected to be used on: (i) economic activities which will earn rural households more income, (ii) resting and caring better for the household members. Both of these are expected to contribute towards the welfare of the rural communities and the national economy.

Other benefits expected from the implementation of VTTP include the following:

- increased safety on stream and river crossings.
- increased skills in the maintenance of the transport infrastructure. This, in turn, is expected to facilitate maintenance of the various categories of roads by villagers through contracts with (Regional Engineer's Office (REOs) and District Engineer's Office (DEOs). Contract works will increase revenue to villages and peoples incomes. Employment opportunities will further be created for blacksmith and artisans who will be involved in the production and maintenance of both IMTs and NTIs.
- improved standard of living through increased access to safe water for domestic use.
- low maintenance and running costs, as well as increases in the economic life of vehicles.
- establishment of wood-lots, reduced use of inappropriate IMTs (such as sledges) as well as adoption of appropriate methods of road works will result in positive environmental impact.

VTTP is basically focused at the village level. However, in order to generate greater impact, complementary activities should be implemented along VTTP. For example: (i) the villages have to be accessible to realise positive spill-overs in travel and transportation; and (ii) people's attitudes towards such issues as use of labour based technology, discrimination of women in certain areas and other cultural inhibitions must changed. Such attitudes can be changed much faster with complementary programmes to VTTP.

Support is also required in financing implementation of the interventions and making better skills accessible by rural communities. As mentioned earlier, to-date donor financing for implementation of VTTP have been confirmed for only eight (8) districts but it is expected that soon the programme will go national and, therefore, the new districts will require financing.

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Economics of Appropriate Agricultural Transport

A broader approach towards on-farm and market transport

by Niklas Sieber, IFRTD

The conventional transport approach focuses on roads and motorised vehicles. Undoubtedly both are essential for the agricultural production and marketing of smallholders in East Africa. They give the producers access to inputs and enable them to sell their products on distant markets. But what happens within and around the village? Farmers have to transport inputs to the field, crops from the field to storage facilities and to collection points or local markets. This can not be done by motorised vehicles, because (i) it is far too expensive, (ii) motorised vehicles are often not available and (iii) many fields do not have road access. Therefore most agricultural transports are undertaken on foot, which implies diseconomies:

- transports are time consuming and thus expensive
- high losses occur due to lower carrying capacities
- opportunities for production of more profitable crops can often not be taken
- walking is consuming energy which could be otherwise productively used on the fields

Therefore Barwell and Dawson (1993) argue that "roads are not enough". Following the authors' arguments this paper tries to draw a broader approach towards transport for production and marketing. It includes not only roads, but as well paths and tracks; not only trucks but as well Intermediate Means of Transport (IMT) such as donkeys, bicycles and animal carts. The main purpose is to show the economic potentials and limits of IMT in agricultural transport and define research needs to improve their actual performance.

This paper will first of all will give an overview of the performance indicators of IMT and compare them with conventional vehicles. Transport for agricultural purposes can be split into (i) on-farm transport to and from the fields and (ii) transport to markets or collection points. Sections 2 and 3 draw up the potentials which IMT have in order to fulfil these two tasks and increase production and marketing. Section 4 gives a short overview of the research done on the economic effects of IMT in agriculture and section 5 describes the economic constraints concerning IMT. In the last section gives a conclusive overview on the research needs.

1. Performance indicators of Intermediate Means of Transport

IMT "are defined as those means of transport which are intermediate in terms of initial cost and transport characteristics ... between the traditional methods of walking and headloading and conventional motor vehicles... (and) ... intermediate in time, i.e. they are a stage in the process of developing a traditional to a modern transport system." (HOWE 1994, p. 5). A number of studies concerning IMT[1] have been carried out in many Developing Countries. They emphasise the economic role which IMT can play in the development process. IMT are more appropriate for local transport, because they

- are relatively cheap to purchase,
- have a low level of maintenance,
- can operate on paths, tracks and trails, which are inexpensive to construct and maintain,
- are designed for small and medium loads,
- can often be produced locally and thus
- need less foreign currency.

Tab. 1 gives an overview of the available means of transport in Developing Countries. While motorised transport can carry bigger loads over longer distances, the IMT are appropriate if many trips with shorter distances have to be undertaken. Wheelbarrows and handcarts are suitable if loads have to be moved on a flat terrain and on short trips around the farm stead. Bicycles are able to transport medium loads up to 40 km with a reasonable speed of 10 km/h. Sidecars or trailers can augment the load on flat terrains up to 150 kg, and animal drawn carts up to several tons. Pack animals are more appropriate where the morphology is accentuated or the tracks are not suitable to be passed by the above mentioned vehicles. Also motor cycles can be appropriate because they are able to pass on narrow footpaths and are comparatively cheap. Animal drawn cart can transport big loads over short to medium distances, while pickups or trucks are unbeatable on long distances. Single axle power tillers have proved to be operating very efficiently in Asia. ELLIS (1996, p. 35) emphasises the multi-purpose use for pumping, ploughing and transport. The transport performance is comparable to animal traction.

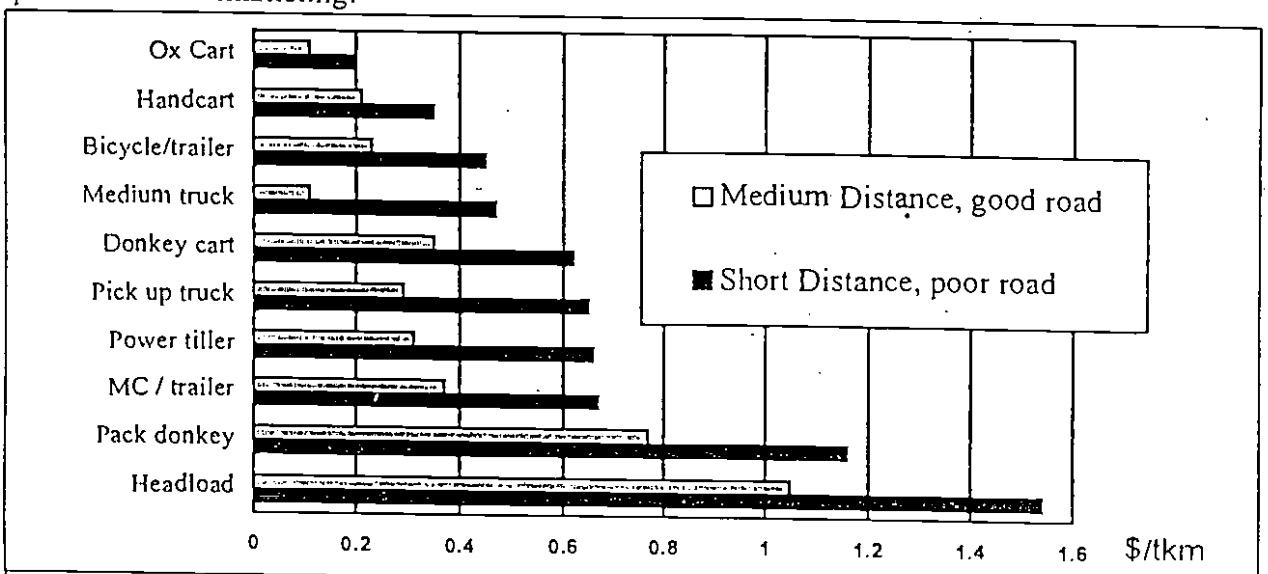
Vehicle	Load [kg]	Speed [km/h]	Range [km]	Terrain
Carrying Pole	35	3-5	10	Unlimited
Improved Chee-ke	70	4-5	10	Unlimited
Western Wheelbarrow	120	3-5	1	Reasonably flat, smooth surface
Chinese Wheelbarrow	180	3-5	3-5	Reasonably flat, tolerates rough surface
Handcart	180	3-5	3-5	Reasonably flat, smooth surface
Bicycle	80	10-15	40	Reasonably flat, paths
Bicycle and trailer or sidecar	150	10-15	40	Reasonably flat; wide paths
Tricycle	150-200	10-15	40	Reasonably flat; wide paths
Pack Animal	70-150	3-5	20	Unlimited
Animal drawn cart (oxen)	1000-3000	3-5	50	Reasonably flat; wide track
Luggage on bus	15	30-60	>100	Wide track
Motorised bicycle	100-150	20-30	50	Reasonably flat
Motorcycle: 125cc	150-200	30-60	100	Moderate hills
Motorcycle 125cc & trailer or sidecar	250-400	30-60	100	Moderate hills; wide path
Motor tricycle: 125cc	200-300	30-60	100	Moderate hills; wide track
Single-axle tractor and trailer	1200	10-15	50	Moderate hills; wide track
Tractor	10 000	10-15	50	Moderate hills, wide track
Pickup	1000	30-60	>100	Wide track
Truck	10 000	30-60	>100	Wide track

Source: SIEBER, 1996, p. 30

Tab. 1: Performance characteristics of basic vehicles

A salient criterion for the choice of the transport mode are the transport costs, which are plotted in Fig.1. The transport costs differ according to the road conditions, the utilisation of the loading capacity and the length of the trip. The graph shows two typical costs per tonne kilometre of medium distance transport (50km) on good roads (grey pattern) and short distance transport (5km) on poor roads. Heavy trucks are cheapest if they operate on good roads over long distances and have a high capacity utilisation. Due to the small transport vol-

umes, short transport distances and the bad road conditions many rural areas are only served by pickups, which are more expensive than ox carts, handcarts or bicycles with trailers. Restrictions for the latter vehicles are not the transport costs, but the lower speed and the smaller range. Transport around the farm stead has to be undertaken by the expensive headload on paths and tracks. Intermediate means of transport can reduce the transport costs significantly if paths are widened, small bridges built and the surfaces smoothened. The shift from headload to donkey cart can reduce the transport costs by 60%, the shift to an oxcart by nearly 90%. The reduction in transport costs might have a strong impact on agricultural production and marketing.



Source: Own graph, data: Crossley, Ellis 1997

Fig 1: Transport costs for different vehicles in Developing Countries

2. Potentials of IMT for agricultural production

Agricultural production involves a considerable amount of transport activities in and around the village. Usually fields are reached by walking and the produce is transported by headload. A research in Zambia, Uganda and Burkina Faso (BARWELL 1993) revealed big variations for production related transports. A rural household spends 75-460 hours annually to reach its fields and the annual transport burden amounts to 5.4-10.2 tkm. The expansion of agricultural production can be hampered because the increasing production entails augmenting transport volumes, which cannot be met by headloading. IMT can be an appropriate solution to this problem.

Transport costs are from the economic point of view the most important criterion for the modal choice. Tab 2 lists the costs for different means of transport from the field to storage or collection points[2]. Transporting the yield of one hectare of cacao, rice or maize is much cheaper than yams, plantains or palm oil. In the latter case the use of IMT can considerably reduce transport costs. If the farmer uses a donkey cart instead of headload to transport his plantains from the fields he saves 41$ for every hectare he cultivates. If he uses an oxcart his income will increase by $60/ha.

	Yield	Transport	Transport Cost $/ha				
	Kg/ha	tkm	Headload	Doneky cart	Cycle trailer	Handcart	Ox cart
Cocoa	900	4.50	6.93	2.79	2.03	1.58	0.90
Rice	1500	7.50	11.55	4.65	3.38	2.63	1.50
Maize	1900	9.50	14.63	5.89	4.28	3.33	1.90
Cocyam	7000	35.00	53.90	21.70	15.75	12.25	7.00
Yams	8000	40.00	61.60	24.80	18.00	14.00	8.00
Plantain	9000	45.00	69.30	27.90	20.25	15.75	9.00
Oil Palm	10000	50.00	77.00	31.00	22.50	17.50	10.00
Cassava	10000	50.00	77.00	31.00	22.50	17.50	10.00
Assumption: Distance field to collection point = 5 km							
Source: Riverson/Carapetis (1991), Crossley/Ellis (1996), own calculations							

Tab 2: Transport costs for the evacuation of the annual yield of one hectare

Transport costs are as well influencing cultivation patterns. Heavy crops are only cultivated around farmstead and collection points, whereas it is still profitable to cultivate high value crops like cocoa further away from the road network. New fields are not taken under cultivation if the distance for the evacuation of crops is long and transport costs too high. The production limit is reached when the costs for inputs and transport are higher than the revenues from marketing. Tab 2 indicates as well that the radius of cultivation can be extended if the farmers use IMT to transport their produce. MÜLLER (1986, p116) observed that ox carts in Zambia can extend the agricultural area available to a radius of 20km around markets and depots.

Thus high transport costs hamper the expansion of agricultural production. During peak labour periods the transport to and from the fields can restrict the labour input for production. Especially in harvesting times, when time is a scarce resource, the evacuation of crops by headload means be a severe transport bottleneck, which can be overcome by the use of IMT.

The potential effects of IMT on production can be summarised as follows:

- transport costs for the transport of crops from the fields are lower,
- a bigger area can be cultivated,
- more fertile, but remote soils can be used,
- lower transport costs increase the use of fertiliser and manure,
- pest damage and spoilage at crop harvest time is reduced
- less time is required for trips to the fields,
- the effort and drudgery involved in human porterage is reduced
- spill over effects might occur if animals are used for ploughing and transport

These effects and their synergies have an impact on agricultural production, which could not yet be quantified. It is of special interest to assess the benefits under different agro-ecological conditions for different modes of transport. Once potential benefits have been quantified they can be used for rural transport investment appraisals.

A comprehensive approach takes as well the cost for transport infrastructure into account. Which investments are necessary to give IMT access to the fields? Only an overall estimation of costs and benefits will enable the planner to make economically sound decisions.

Conclusion:
IMT have a strong potential to increase the efficiency of on-farm agricultural transports and thus extend agricultural production.

3. Potentials of IMT for marketing purposes

Because rural households in SSAfrica farm mainly for subsistence, often the bigger share of the products will be consumed by the household and only a smaller quantity sold on regional, national or international markets. How the products are transported to the market is dependent on many factors:

- Transport costs
- Availability of motorised transport services or IMT
- Difference in producer prices offered on markets and by traders (at collection points)
- Weight and quantity to be transported
- Distance to markets (walking or use of IMT possible?)
- Road conditions at harvesting period

If markets are within walking distance headloading can play a considerable role in marketing of agricultural produce. SIEBER (1996) observed in Makete, Tanzania, that more people were using a footpath to travel to local market than persons were transported on a comparable road. Some villages preferred to transport a considerable share of their products by headload instead of selling it to traders with trucks, because they would pay them lower producer prices. SIEBER (p. 80pp) shows as well that the improvement of a footpath can cut transport costs by reducing travel times, increasing transport loads and reducing accidents. The improvement caused a stronger market integration and reduced rural isolation.

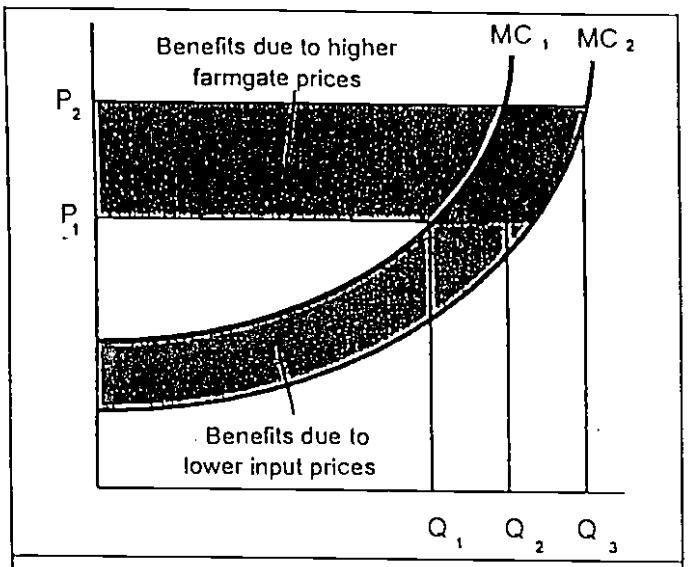
Transport by headload is restricted if larger weights have to be carried or the distance to the market is more than half a days walk. Both imply that more time has to be used for transport, which could be alternatively used for direct productive activities. IMT can overcome these constraints by increasing the carrying capacity and the speed. In economic terms this means a reduction of transport costs.

The economic consequences can be manifold. For example farmers could grow more or heavier crops (in terms of $/ton) or they could decide to transport produce to further distant markets, where producer prices are higher. These new economic opportunities are benefits, which can be clearly attributed to IMT.

The choice of the transport mode depends on the performance indicators given in section 1 of this article. The expansion of marketing entails bigger loads which favours the use of animal carts. GRISLEY (1995) reports that as well bicycles had positive effects on marketing of agricultural produce in Uganda.

If markets are not accessible by walking or by IMT, transport by motor vehicles is essential. However, a wider approach can be as well applied in this case, if multi-modal transport is taken into account.

The conventional approach is focusing exclusively on market oriented transports with motor vehicles on roads. The World Bank (CARNEMARK et al 1976) economically justifies new rural roads by using the 'producer surplus approach'. This approach assumes that economic effects occur due to reduced transport costs which will have a double impact on agricultural marketing. Firstly inputs will be cheaper and secondly producer prices will be lower.



Source: CARNEMARK et al. 1976, Annex 1 p.5

Fig. 2: Producer Surplus approach

Fig 2 visualises these economic effects. It is assumed that the reduction in transport costs will be passed on to the producers, that all the products are marketed via the improved road and that a perfect competition exists. In a situation of complete competition the farmers offer their products according to the marginal cost curve MC_1. If the producer price is P_1 they offer Q_1 tons of products. The reduced transport costs will cause an increase in the producer prices to P_2, which entails a shift of the market production to Q_2. The benefits are represented by the area to the left of MC_1 between P_1 and P_2. On top of that the prices for inputs will decline due to lower transport costs: the supply curve shifts from MC_1 to MC_2 causing another increase of the market production to Q_3. The benefit area is located between MC_1 and MC_2. Both benefit areas represent the producer surplus.

In the last years this approach has been widely criticised. Even CARNEMARK et al admit that the development impact might be low, if transport cost savings are not transmitted to producers, either because of government controls or due to non-competitive transport services. HINE (1993) corroborates that road investments had very low impacts on the producer prices. The Transport Research Laboratory observed that in Ghana producer prices increased by less than one percent after road improvements from earth to gravel surface. However the conversion of a footpath into a road entailed benefits to the order of hundred times greater.

In 1988 in Sub-Saharan Africa[3] an average of only nine motor vehicles per 1,000 inhabitants were registered (UNCTADA II, pp 52). This ratio has most probably not increased significantly during the following years due to the economic crisis and the foreign exchange shortage. The static or declining transport fleet has created a situation, which favours the sellers of transport services and not the buyers. HOWE (1992, p.3) states that in many rural areas transport enterprises are not under pressure to transmit cost reductions to their clients.

AHMED and HOSSAIN (1990) found out that African farmers receive only 50% of the final price of products, compared to 70-85% in Asia. An explanation for this phenomenon is given in a comparative study by HINE and RIZET (1991) between three francophone African countries and Pakistan. The study shows that transport costs are not only influenced by the quality

of the infrastructure, but also by the efficiency of the transport services: the costs in Africa are four times higher than in Pakistan, where the trucks run twice the number of kilometres, register less empty trips, have lower maintenance costs due to low speeds and the responsibility involvement of the driver. While in Pakistan a competitive environment favours the purchase of cheaper appropriate vehicles, in Africa sophisticated vehicles are bought, which run at low utilisation levels.

DELAQUIS (1993, p.121) researched the vehicle operating costs for the marketing of agricultural produce in Ghana. He found out that low vehicle utilisation due to long waiting times, small payloads and overloading were the main features of agricultural transport. This was leading to high fuel consumption and thus high transport costs. DELAQUIS proposes to reduce the number of smaller vehicles by introducing bigger trucks and plan new routes. This would imply small quantities have to be transported with smaller vehicles from the producer to the collection points. This exactly is the leverage point for a broader approach towards transport to distant markets.

This broader approach emphasises the important role which IMT can have in the transport chain from the producer to the market. Three theoretical scenarios where developed in order to describe the role of IMT in the transport chain. Fig 3 depicts a sketch of the region, with 10 villages V1, V2, ..., the market town M and the roads connecting these locations. It is assumed that each of the villages intends to transport one ton of crops to the market M. Scenario 1 reflects the actual situation in many rural areas of SSAfrica: Agricultural products are evacuated by pickups with a payload of one ton. The cars serve each village separately. Scenario 2 assumes that a 10 ton truck is making a round trip to every village. In Scenario 3 it is assumed that the truck only serves the villages V1, V2 and V3, where the produce are collected. The transport from the villages to the collection point is undertaken by animal carts, with a payload of one ton.

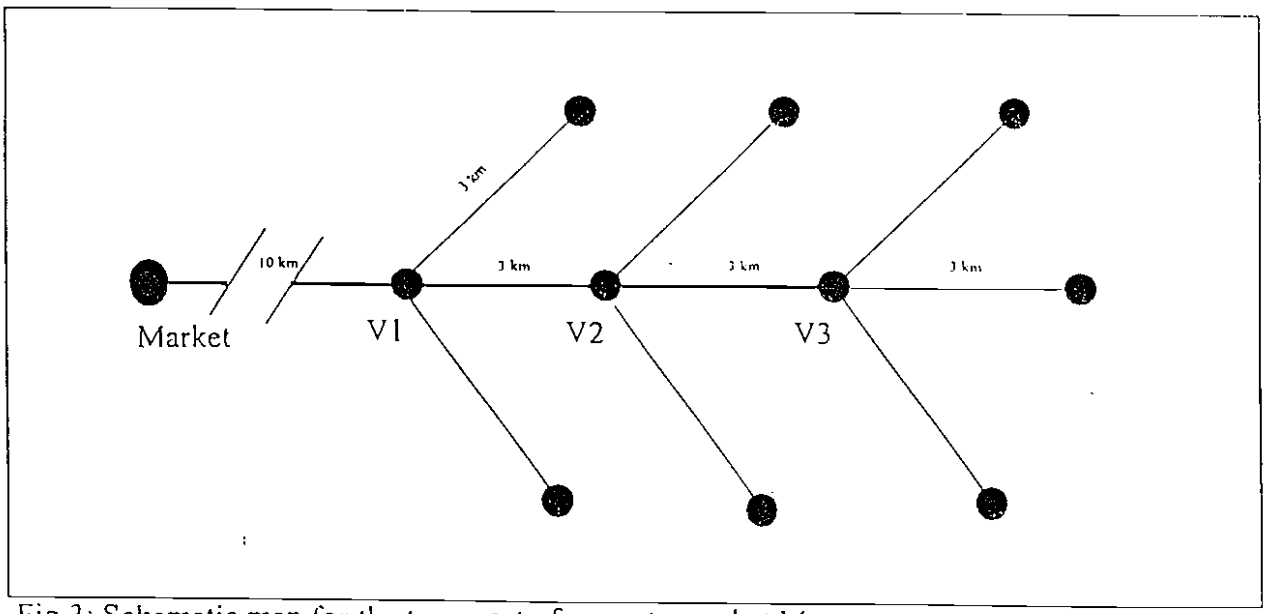


Fig 3: Schematic map for the transport of crops to market M

Table 3 lists the main indicators for the transport efficiency of the scenarios. The highest transport costs are accrued in Scenario 2 (trucks), due to high transport volume in terms of tonne kilometres covered during the round trip. The trucks only work efficiently on long

distances, on good roads and with a high load factor. The efficiency would increase if trucks could be fully loaded in one village and would operate on a good road. Because in SSAfrica this is often not the case, the economic rationality favours pickups (Scenario 1) for the marketing of cops. However, the best cost efficiency can be achieved in Scenario 3: IMT transport the produce over short distances to collections points where trucks pick them up and transport them very efficiently to the market. Total transport costs are 1/3 to 2/3 cheaper than transport with pickups. Assuming free market entry for truck operators the competition will increase, forcing transport costs down and thus raise the income of rural producers.

	Scenario 1	Scenario 2	Scenario 3
Vehicles	Pickup	Truck	Truck and IMT
Description	Every village is served by a pickup	Every village is served by a truck (round trip)	Truck collects products at V1, V2 and V3
Infrastructure	37 km suitable for pickups	37 km suitable for 10 t truck	16 km suitable for trucks, 21 km tracks for IMT
Payload	1 ton	10 ton	IMT: 1 ton, truck: 10 tons
Specific costs[4]	0.29 - 0.65 $/tkm	0.11 - 0.47 $/tkm	IMT: 0.11 - 0.20 $/tkm
Tonne km	154 tkm	316 tkm	151 tkm Truck: 130 tkm, IMT 21 tkm
Total transport costs	$45 - $100	$ 35 - $148	$16- $65 Truck: $14-61, IMT: $ 2-4

Tab. 3: Transport efficiency in the scenarios

A broader approach takes as well into account the costs for the provision and maintenance of roads and tracks. Scenario 1 needs 37 km of roads designed to be used by pickup. In scenario 2 all the roads have to be designed for 10 ton trucks. In Scenario 3 only 16 km roads (thick line in Fig 3) have to be suitable for trucks, while 32 km can be low cost tracks used by animal carts.

This theoretical exercise demonstrates the advantages of combined transport with ox carts and trucks to markets. Ox carts operate more efficiently with small loads on poor roads over short distances. Trucks are favourable for bigger loads on good roads over long distances. A combination of both conveyances reduces transport costs and increases the farmers' income. The different requirement for road standards reduces public expenditure for infrastructure provision and maintenance can be reduced.

Conclusion:
If markets are within walking distance headloading is an important means of transport. The transport efficiency can be significantly increased by improvement of footpaths or the use of IMT. If markets are more distant than half a day's non motorised travel, combined transport is an appropriate solution. While trucks are unbeatable on long distances on good roads and fully loaded, IMT operate more efficiently on short distances with small loads on bad roads.

3. Empirical evidence of impacts of IMT on production and marketing

The economic effects of IMT have rarely been researched until today. AIREY (1992) compared the transport activities of successful, average and unsuccessful households in five study areas in Zambia, Uganda and Burkina Faso. The study revealed that in all study areas the successful households owned more IMT than typical or unsuccessful households. The study corroborated many of the findings explained in the previous sections. IMT

- shorten the time required for trips to the fields,
- increase the efficiency with which loads are carried,
- reduce the effort and drudgery involved in human porterage,
- reduce the pest damage and spoilage at crop harvest time and
- increase the use of fertiliser.

The study comes to the following conclusion: "In economic terms these benefits of IMT can be considered as releasing latent factors of production, principally land, and increasing the efficiency with which the existing labour endowment is utilised. IMT enable the household to extend the distance over which agriculture is practised" and they release the household's time requirements, which can be used for productive activities[5]. The households are able to expand their agricultural production by putting more plots under cultivation.

BARWELL (1993) summarises the effects of IMT as follows: "Thus IMT alleviate the task of moving large quantities of agricultural inputs and outputs, facilitate local crop marketing, support small enterprise activities and provide access to employment and are used for social travel by men."

These studies did not quantify the economic impacts of IMT. This was done in a field study in Makete District, Tanzania by SIEBER (1996). A comparison of households with comparable socio-economic structures shows that donkeys have strong impacts on the welfare of their owners. The donkey enables the household to cultivate bigger plots, because the transport from the field can be managed more easily. The farmers use more fertiliser, because it can be effortlessly carried home and to the fields. The bigger size of the fields and the higher inputs enable the farmer to double the amount harvested as well as the tons marketed. The revenue received from marketing activities increases from $ 120 annually for non-donkey-households to $ 241. The higher income gave rise to bigger expenditures and a better endowment of the household with kerosene lamps, radios, sewing machines and tin roofs. Similar effect were observed for households with bicycles.

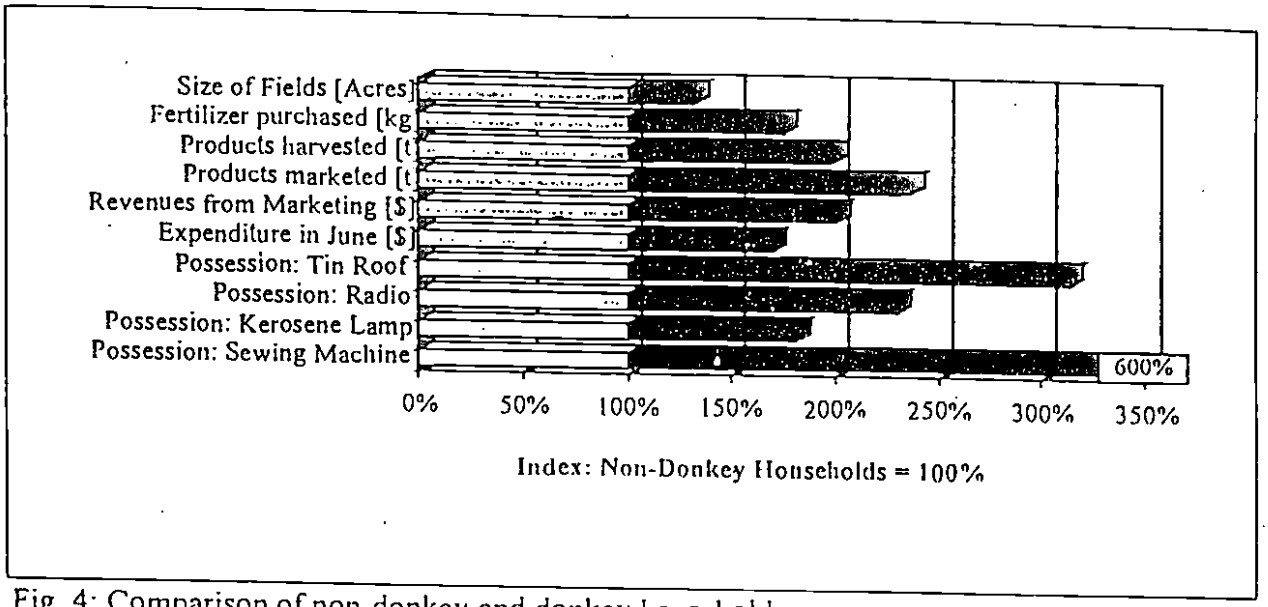


Fig. 4: Comparison of non-donkey and donkey households

The problem with this comparison is, that the survey did not observe the economic performance before and after the purchase of the donkey. It is probable that donkey possessing households were already wealthier before they procured the animal. On top of that the survey sample was quite small. Here only further research can give reliable information on the economic impacts of donkeys on agricultural production and marketing.

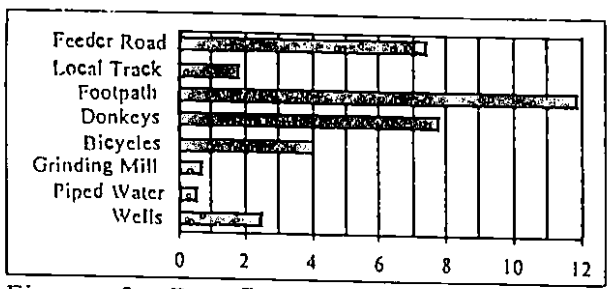


Figure 5: Benefit/cost ratio of different transport interventions in Makete, Tanzania

If these benefits can be quantified, a comparison with other transport interventions is possible The cost/benefit ratios of different transport interventions in Makete, as depicted in Fig.5, show that non motorised transport has a better cost efficiency than conventional transport projects. The shortcomings of this empirical study are the small number of households observed and very strong local bias due to natural conditions (mountainous region). Further studies need to be undertaken which

- collect bigger samples,
- compare the impacts of different IMT,
- observe the efficiency of IMT in different agro-ecological environments, and
- undertake long term observations.

Conclusion:

The economic effects of IMT on production and marketing have been rarely researched. Existing studies indicate strong effects, but they lack a monetary quantification of impacts or only allow to draw conclusions for a special region.

4. Restrictions against the use of IMT

If IMT are so efficient, why are they not widely used in SSAfrica? Amongst the many restrictions which exist against the used of IMT (e.g. terrain, climate, cultural restrictions, gender division, lack of awareness, etc.) here only the economic constraints shall be mentioned. Low purchasing power is probably the main reason, why IMT are not widely used in SSAfrica. In the Makete District 60 % of the households would purchase a bicycle, 30 % a donkey and 6 % a wheelbarrow if possible. 80-90 % of the households did not purchase their desired IMT, because it was too expensive. In Malawi a rural household would have to spend 19 times its monthly income to purchase a wheelbarrow, 27 for a bicycle and 113 for an oxcart (DEGWITZ 1992, p. 53). Tab. 4 shows that the price of IMT lies within the range of the annual per capita GNP. Thus, IMT seem to be mostly available to the wealthier classes.

IMT	Country	Cost [$]	GNP [$ per capita]
Animal Cart	Zambia	150-450	450
Animal Cart	Tanzania	150-450	110
Animal Cart	Malawi	up to 1000	200
Bicycle	Tanzania	77-120	110
Bicycle	Burkina Faso	210	330
Source: Dawson/Barwell (1993), p.48			

Tab. 4: Price for IMT and GNP per capita

The Fig. 6 shows the demand curve of households in Makete stating they would purchase a donkey: half of them cannot pay more than $10, a quarter is able to pay $20, and less than 10% can afford $40. Without access to credit none of the households would be able to buy a donkey at current prices. A credit scheme could increase the number of donkeys sold. If four fifth of the price for a donkey was financed by a credit scheme then more than 40% of the said households would be able to purchase an animal.

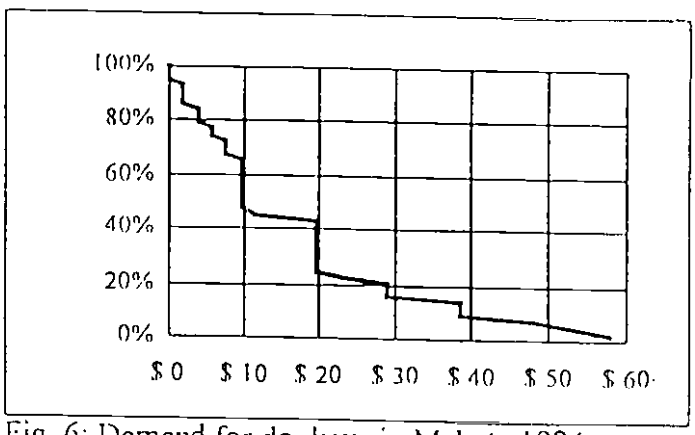


Fig. 6: Demand for donkeys in Makete 1994

The existing credit systems usually make it almost impossible for anyone other than relatively well-off business men, who are mainly urban biased to purchase an IMT (CARAPETIS et al 1985, p. X). MOSLEY (1994 in ELLIS 1996 p.45) describes the conditions for successful small scale credit schemes:

- Allow to pass the full costs to the borrower.
- frequent collection of loan instalments.
- incentives for payment,
- insurance of lenders in case of loan default.

The experience with rural credit facilities for IMT in some African and Asian countries shows that credit schemes for IMT can be successfully operated[6]. The example of the Grameen Bank in Bangladesh shows how the borrowing arrangements can be efficiently organised. West Kenyan experience[7] of a credit system demonstrates that farmers were able to repay their debt

Kenyan experience[7] of a credit system demonstrates that farmers were able to repay their debt for an ox cart after only one harvesting period. Most probable the individual investment decision made by thousands of farmers improves the rural transport system more than the plans of a few highly educated administrators.

While the above listed restrictions focus on the demand for IMT the supply side shall not be forgotten. Not only low purchasing power, but as well lack of private enterprises in the fields of manufacture, repair and transport services are a bottleneck for agricultural transports. The question is which of the problems will disappear automatically, when rising demand for IMT, following the introduction of credit schemes, allows the establishment of small enterprises. Further information on these issues are given in ELLIS (1996), ITTRANSPORT (1996), MALMBERG CALVO (1994) and CARAPETIS et al (1984).

Government regulations often hamper the proliferation of IMT. HOWE (1994) emphasises that bicycle imports are often charged with an import tax for luxury items. ITTRANSPORT (1996, p 25) gives the example of Malawi, where the price of bicycles decreased after the government deregulated the number of import licences, causing almost immediately an increase of imports.

Conclusion:
Low purchasing power is the main economic constraint hampering the proliferation of IMT. Small scale credit schemes have proven to overcome these constriants. Supply side constraints have to taken into account as well.

5. Conclusion, research needs and outputs

The conventional approach towards agricultural transport focuses exclusively on motorised transport between the farm and the market. Numerous studies have demonstrated that this approach is far to narrow because it does not reflect the transport requirements of small scale farmers in Developing Countries. Transport for agricultural production and marketing is dominated by small loads, transported over short distances, mostly on paths and tracks and not on roads. Even if there are roads, motor vehicles can only operate with a low efficiency, while Intermediate Means of Transport are more appropriate.

A broader approach does not only concentrate on roads but includes as well paths and tracks, it not only focuses on trucks but also non motorised means of transport. However, the knowledge about the economic impacts of this approach for agricultural transports is poor. Some studies show evidence of strong impacts in selected regions, but they do not allow to draw broader conclusions.

Planners and politicians are supposed to make rational decisions, using (among others) economic indicators. They need reliable quantitative evidence about the benefits of this new approach not only to convince them, but as well to enable them to make rational planning decisions. For example a comparison of the costs and benefits would allow them to plan for the most efficient system according to the local conditions. The problem is that these data are not available.

Research needs

The benefits generated by IMT during transport of agricultural produce have been rarely researched. The empirical evidence from existing studies indicates that IMT generate strong economic effects, but the impacts on marketing and production have not yet been quantified. Tab.5 summarises the *costs and benefits* identified in sections 2 and 3. An ideal research would estimate the figures for different modes of transport, in different agro-ecological zones, with various distances to fields and markets. The outcome of this exercise would allow a cost-benefit comparison for various conditions.

Item	Transport Mode	Distance Fields/ Market	Crops produced	Agro-ecological Zone
Production related transports (house-field)				
Transport costs of inputs	1. Walking 2. Bicycles 3. Pack animals ...	1. 10 min 2. 20 min 3. 30 min ...	1. Coffee 2. Maize 3. Yams ...	1. Zone 1 2. Zone 2 3. Zone 3 ...
Transport costs of labour to the fields	"	"	"	"
Increased Production	"	"	"	"
Marketing related transports (field-marketing point)				
Costs of transporting to market/collection point	"	1. less than 1 hour 2. 1-2 hours ...		1. Zone 1 2. Zone 2 ...
Losses during transport field-marketing point	"	"	"	"
Opportunity costs for other products marketed	"	"	"	"
Opportunity costs different marketing time	"	"	"	"
Costs for storage	"	"	"	"
Benefits from increased marketing	"	"	"	"

Tab.5: Costs and benefits for various modes and agro-ecological conditions

In section 4 low purchasing power, generating a low demand for IMT, was identified as the main economic constraint for the proliferation of IMT. The research needs a comprehensive *demand analysis* for IMT for each of the in Tab. 5 listed agro-ecological zones. Farmers should not only state their preferences towards the type and design of IMT, but as well their ability to pay for it. The resulting demand curve could be an indication for the lay out of small scale credit schemes and for further research on low cost design of vehicles. The research should as well give hints on how to design these credit schemes in order to be economically sustainable.

The demand analysis will also give information on the requirements on the *supply of goods and services*, provided by enterprises in the fields of manufacture, repair and transport services. The important question is, if the supply restrictions can be overcome by the initiative of private enterprises. Which measures have to be taken, in case that the market is not able to cope with the transport demands?

Research outputs

Research is more often than not regarded as 'l'art pour l'art' and the report disappears forever in the drawers. To avoid this the research should have three outputs:

1. A *scientific report*
2. In order to make the findings available for planners at the district level a *planning handbook* should be produced. The booklet should be formulated in an easily understandable manner and include tables and graphs which enable planners to make

decisions. These shall not only concern infrastructure, but as well vehicles, transport services and credit schemes.

3. The scientific report should include an annex giving *proposals for future projects* to improve agricultural transport systems in the observed regions.

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EAST AFRICAN WORKSHOP on AGRICULTURAL RURAL TRANSPORT &

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NON-MOTORISED TRANSPORT

A User Experience

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Introduction

The development of air filled tyres about 100 years ago came at the same time as that of the internal combustion engines whose power allowed greater loads to be moved at ever increasing speeds. The steel rimmed or solid rubber tyred wheels then in use were only suited to low speeds so the solution of pneumatic tyres appeared at an appropriate moment.

The main advantage of pneumatic over solid tyres is their shock absorbing qualities which reduce impact loads transmitted from the road to the vehicle to acceptable levels even at high speeds.

Over the last century wheels, tyres and the surfaces they run on have been much improved as a result of massive research and development. One disadvantage, still not yet completely overcome, is that of finding a reliable means of keeping the air in the tyre so that its service life approaches that of other components of the engine and vehicle.

It is thus remarkable that, more than 100 years after the introduction of the pneumatic tyre, manufacturers still consider it prudent to supply each vehicle with at least one extra wheel as a spare part and motorists are well aware that any journey may be interrupted due to a puncture and the need to use the spare wheel.

Tyres & Rims used by NMT

Non-motorised transport used in urban and rural areas has adopted, in a large measure, the pneumatic tyre and conventional wheel rim particularly for two and four wheel carts but, for reasons of cost, the tyre/rim specification is generally below that used in engine powered vehicles. It frequently consists of a worn tyre and a much repaired tube fitted to a rim which no longer runs as true as when manufactured. The components used are those which have been rejected by owners of motorised transport due to wear or damage and are obtainable for mimimum cost.

Roads used by NMT

Most tyres are designed to be used on smooth tarmac surfaces with the tread being the main contact between the tyre and the road but rural transport takes place on a wide range of conditions many of which are inferior to those intended by the designer of the tyre. Track surfaces may be deeply rutted and embedded with objects such as roots, stones or thorns which can penetrate the tread and particularly side-walls of the tyre.

Puncture Resistance of NMT

The combination of these factors means that tyres used by NMT's have low resistance to punctures compared with those of motorised vehicles and developing a puncture in a remote place becomes a major problem as neither spare wheels nor puncture repair equipment are normally carried for reasons of cost.

Firstly, the occurance of a puncture must be recognised by the vehicle owner before the tube has been irreparably damaged, the wheel must then be removed, transported to repair facilities which tend to be found only on roads with reasonable levels of motorised traffic, repaired, returned to the vehicle and replaced before the journey can proceed.

Even the apparently simple removal of the wheel can be a problem as the owner must have at hand the necessary tools to loosen the wheel nuts, which due to age, may be rusty or damaged as a result of the use of inappropriate tools.

On some large ranches in Northern Kenya where animal drawn transport is used on a large scale the carts are often equipped with a spare wheel to avoid delay when punctures occur but this solution is too costly for the normal NMT user.

Influence of Tyre on Puncture Resistance

The type of tyre used has a major influence on puncture resistance and a comparison of the available quality range and approximate cost of tyres is given:

Tyre Type, Cost & Puncture Resistance

Rim Size 14" Conventional Tyre	Approx cost in US$ Tyre	Tube	Total	Puncture Resistance
New tyre	123	11	134	Good
New Tyre - Animal cart type	?	11	?	Good
Re-tread tyre	77	11	88	Good
Imported worn tyre (2mm tread)	27	11	38	Average
Worn but not damaged	5	16	21	Very low
Puncture proofed Tyres				
Worn but not damaged	5	NA	5	Very Good
Rejected re-tread	1.5	NA	1.5	Very Good

Description of Tyres

New Tyre: This is a regular tyre made for high speed vehicles and is overdesigned and very costly for NMT vehicles.

New Tyre - Animal Cart Type: In some countries tyres are made specially for low speed use on animal carts (max 25km/h). They have a lower specification and price than normal tyres and often carry a warning on the sidewall concerning their maximum allowable speed. Their availability appears to be limited perhaps due to the cost and the danger of their being fitted on high speed vehicles with the ensuing risks.

Imported Worn Tyre: Many European countries have stringent laws on wear levels for motor vehicle tyres which must be replaced when the tread is worn to an average depth 2mm. They have zero value as scrap but are imported to countries with less stringent regulations where they are used as second-hand tyres.

Worn but not Damaged: This is the type most commonly found on animal drawn carts due to its low cost having been rejected by motor vehicle users but where re-treading factories exist this tyre may some value and therefore cost more.

Rejected Re-Tread: Despite the rigorous inspection for suitability prior to re-treading some tyres do not pass inspection after re-treading and to prevent them being used a section of the tread is cut out prior to returning them to the supplier as scrap. If the cause of rejection is not severe damage the tyre may be used for NMT with or without a tube. The part of the tread missing can be replaced by carefully cutting and shaping a similar piece from an old tyre and vulcanising it into place.

Potential Benefits of Improved Puncture Resistance

A direct cost reduction of between US$ 39-265 for a two wheel cart is possible if acceptable means of puncture proofing tyres can be developed which dispenses with the need for a tube. The value of owning a NMT vehicle whose tyres have very high puncture resistance is difficult to quantify but users and potential purchasers of NMT are likely to appreciate the benefits.

Techniques for Improving Puncture Resistance

Methods of improving puncture resistance already exist for certain situations other than that under discussion and some are described below.

Mechanical Barriers: A liquid is injected into the tube through the valve and forms a thin layer covering the inside of the tube as a result of the rotation of the wheel which automatically seals any punctures appearing in the tube. A demonstration of driving a six-inch nail through the tyre no less than 30 times without any apparent air loss has been seen so the technique seems to be effective but not widely practised and is intended to be used on normal motor vehicle tyres.

Grass or other Organic Matter: Former Kenya settlers talk of filling tyres with grass as an emergency measure but when questioned closely admit that it is done only as a get-you-home measure when all else fails and that the tyre is of little use afterwards.

Chemicals: The interior of tyres of earthmoving equipment is injected with two chemicals through the valve hole which react producing a spongy material completely filling the tube. This filling has similar load bearing and traction characteristics to air. It is, however, costly and only suitable for high capital undertakings where down-time of machines must be mininmised.

Solid Tubes for Bicycles: Solid tubes for bicycle tyres have been marketed and a personal experience of them is illuminating. The bicycle was regularly used to carry a can of up to 40kg of milk lashed on the carrier a distance of 2km while the rider walked alongside and rode the return journey carrying an empty can. Due to the occurance of many punctures it was decided to try a locally made solid tube as a possible solution.

The first difficulty involved the fitting the tyre over the tube and while the rider normally had sufficient skills to carry out his own maintenance he had to seek 'professional' assistance to fit the tyre/tube combination.

The next problem arose when, after a short period of use, the spokes started to break. Each was replaced with a heavy duty version but regular breakage continued until eventually all the original spokes had been replaced.

The rear wheel bearings then started collapsing and had to be replaced at higher than normal frequency while the rider complained of discomfort when in the saddle so it was decided to move the tube to the front wheel. A week after this the front fork fractured at speed, fortunately without injury to the rider, but the use of the solid tube was abandoned.

While being puncture free it was clear that the solid tube transmitted high impact loads to the frame causing unacceptable levels of wear and damage.

Solid Rubber/Steel Wheels: Some types of puncture free wheel are already in limited use in rural areas. Steel wheels have been made by artisans in rural areas of Machakos but are barely accepted due to their ride characteristics.

Rubber tyred steel wheels of small diameter are succesfully used on wheel barrows and one type of larger diameter has is found on a handcart in urban areas (mkokoteni). Larger diameter wooden wheels with a layer(s) of rubber cut from a tyre and attached to the rim have been developed for animal drawn carts but their acceptance is limited.

Characteristics of media for puncture proofing NMT Tyres

The average speed of NMT is well below that of motorised vehicles and the tyre can be more resilient or 'harder' than its high speed relation yet still not transmit severe impact loads to the body. Media which replace the air and possibly the tube require certain characteristics to be acceptable:

- Offer a performance similar to conventional air filled tyre.
- Have low cost and good availability.
- Operating characteristics of medium should not change with use.

- Filling or re-filling of tyres fitted to conventional or rolled rims should be possible.

- Weight increase, if any, to be acceptable.

Media used experimentally for filling tyres

Sawdust: This is cheap and generally available but exists in different forms depending on origin, type of the wood, particle size and moisture content.

Rubber grindings: Re-treading factories produce large quantities of rubber particles from the grinding of tyres prior to rebuilding the tread. The grindings are disposed of as scrap so where such factories exist the material is free. Being composed of small rubber particles it has resilience which should not change with use.

Materials proposed as having potential but not tested

Rice husk: This has been proposed as the high level of silica causes a handfull to lock together and perhaps the characteristics may be suitable but as it is of low density considerable volumes would have to be introduced to be load supporting.

Polystyrene granules: Raw granules are similar to sugar grains and are expanded by steam prior to being compressed into boards. Two techniques are possible the first being to load the tyre with expanded granules but as they are of low density they may not be compressable into a sufficiently dense mass to support the load. A further possibility is to charge the tyre with raw granules then introduce steam so they expand and fill the tyre. The material would have cost implications and specialised filling techniques .

Methods of Filling Tyres

Two techniques have been developed depending on the design of wheel. The first is used on the standard one piece pressed steel rim.

Pressed Steel Rim

1) Three extra holes are drilled in the rim at 90 degrees from and of similar diameter to the valve hole.

2) The tyre is fitted without a tube.

3) The rim is laid on its side and the medium forced through the holes with a wire rod. The medium is pushed as far as possible into that part of the tube between the holes until it becomes difficult to fill by hand.

4) Further material is hammered through the holes until the walls of the tyre expand to 'click' into the tyre well in a similar fashion to that of an air filled tube.

5) Tapered wooden plugs are then hammered into the holes.

6) If re-filling becomes necessary the plugs can be removed, the tyre topped up, then replaced.

Rolled Rim

1) The tyre is fitted to one side of the rim and pushed against the far ring. The wheel is then laid on its side in the frame and the loose side of the tyre held open by blocks to receive the filling material.

2) A circular disk is laid on the wheel to assist in holding the material used for filling then the material is poured in layers and packed with rods.

3) When the tyre is reasonably full the jack is used to compress the material then the wheel turned a little, re-compressed and repeated until the whole diameter has been compressed. A second jack or piece of metal may be needed to keep the wheel stable while it is being compresssed (see photo).

protruding above the top of the rim.

5) The loose ring is then placed over the rim, squeezed into place with the jack then fastened with the bolts and angle iron.

Performance Evaluation for Conventional Rims filled with Sawdust

An evaluation of the performance of the tyre must be carried out to ensure that it behaves in a similar manner to an air filled tyre.

The method chosen, for sawdust filling, was based on the natural rise in tyre temperature which occurs in service. The flexing of the walls due to the rotation causes a temperature rise which reaches an equilibrium when the heat lost is equal to the heat gained. The actual equilibrium temperature varies depending on the operating conditions, load, average speed, tyre pressure, ambient temperature and surface characteristics.

One critical factor affecting temperature rise is tyre pressure. Low pressure causes rapid and excessive rise in temperature and destroys the sidewalls which, in the case under discussion, are likely already to be weakened. Thus if the filling of the tyre is adequate for the load then the temperature rise will be normal.

The speed of NTM is normally up to 8km/h but in order to impose a greater load than would occur in service a speed of 12-15km/h was used for the trials. The vehicle, a two wheeled donkey cart, was drawn behind a small tractor round a ciruit with surface conditions typical of a rural track.

The temperature of the inner sidewall were measured after each circuit to avoid any rise due to direct contact of the sun's rays. This was repeated until the reading became constant and it was then compared with ambient conditions. A load was added and the procedure repeated to a maximum load of 500kg.

Results

The results showed that a rise in temperature of between 8-10 degrees C above ambient was an indication of a correctly filled tyre. Increases above that level indicated that, for the load being carried, there was inadequate filling. However when more material was added to the tyre the subsequent temperature rise was considered normal.

Conclusion

The trials indicated that tyres sufficiently well packed with sawdust are capable of carrying loads of 250kg per tyre without excessive temperature rise and behave in a similar manner to air filled tyres.

Results of Further Experience

The limited trials described above were carried out on conventional rims filled with sawdust. Subsequent work carried out on similar wheels and tyres produced gave problems in persuading the tyre to 'click' into the well of the rim.

It was then noticed that the original tyres had soft, flexible beads while other tyres had stronger and less pliable beads which proved difficult to move. If the wheel was used in this condition the sawdust was seen to leak out of the tyre with the inevitable results of it becoming flat.

A better filling technique which could increase the pressure in the tyre would be useful. Some form of a nozzle and mechanical compressing system may be a solution.

The filling of rolled rim wheels is relatively easy using the frame and jack but in extended use, however, there were several cases of leakage of sawdust between the tyre and rim. Examination of the beads showed several cases of damage and missing sections due to abuse when removing and replacing the tyre.

One solution was to increase the diameter of the rim slightly over standard when making the rim. This proved reasonably satisfactory but made some tyres a very tight fit on the rim. This is of little consequence providing there is no need to re-pack the tyre.

However after being used for periods of time some tyres showed signs of softness and investigation indicated the particles of sawdust had been reduced to a powder. This did not happen to all tyres for reasons as yet unknown but it was decided to suspend thw use of sawdust until further investigations could be made.

A change of material to rubber grindings was made in an attempt to overcome the powder problem of sawdust. The filling methods used are similar to sawdust and no problems have been encountered in its use while some tyres have been running for four years. It may be that the particles, by their nature, remain locked together and thus the characteristics do not change over time. The density of the grindings is higher than sawdust but the weight penalty appears to be acceptable.

Justification of Further Investigational Work

The previously described work and results show that if suitable puncture proofing methods can be developed then two advantages accrue to the user, firstly the elimination of the problems connected with a flat tyre and secondly the possiblity of a cost reduction of a tyre/wheel assembly.

There is need to further develop and refine the techniques at an experimental level then to undertake field trials on users vehicles to obtain more practical experience and reaction.

If the results are positive the development of training materials and courses to extend the techniques would follow.

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2 The assumed distance is distance 5km.

3 The Republic of South Africa is excluded.

4 Crossley, Ellis (1996), medium to short distances

5 See as well the discussion in the following Chapter 2.4.2 about the effects of time saving

6 In Burkina Faso credits are distributed by the Caisse Nationale de Credit Agricole to village groups and the repayment rates are close to 100 %. In India the Integrated Rural Development Programme provides credits and a 25 % subsidy for the purchase of IMT. In 1992-93 loans of $ 331 million were distributed. In 1993 the Bangladesh Rural Advancement Committee distributed credits worth $ 3 million mainly for the purchase of rickshaws through village associations. A 96 % repayment quota was achieved. In the decade following it's inception in 1976 the Grameen Bank funded the purchase of 15,212 rickshaws, animal carts, and bicycles. Here the repayment quota is 98 %. In Sri Lanka loans were given by the Intermediate Technology Group through farmer societies, while in Zimbabwe credits are only given to farmers who did not receive any loans before. Most of the credit schemes do not demand any collateral and the nominal interest rates range between 11 % and 21 % with a repayment time of 3-7 years. Further information: International Forum for Rural Transport and Development, Forum News, Vol. 2, June 1994.

7 IT Transport (1989), ITDG Kenya Animal Cart Project

Economic Analysis: Research Objectives and Outputs

Objective	Activity	Output
Costs and Benefits of IMT		
• Convince decision makers, planners and donors • Produce data for planning input	Produce a C/B matrix for various IMT and according to • different agro-ecological zones and • distances to markets.	Identify most efficient means of transport for each agro-ecological zone
Demand Analysis		
Analyse the transport demand of rural farmers	• Transport demand: tons, distances frequencies • preferences for vehicles: type and design • willingness to pay	Design of • small scale credit schemes • layout of vehicles • transport infrastructure • etc ...
Supply Analysis		
Analyse if • market forces are able to satisfy existing and future demand for vehicles and transport services • governments are able to supply the required transport infrastructure	Identify constraints: • macroeconomic policies • manufacturing • transport services • infrastructure provision • financial constraints	Define measures to overcome the constraints: • change macroeconomic policies • support of manufacturers and transport enterprises • implement low cost infrastructure • etc...

Infrastructure and Planning for Rural Agriculture Transport and Development

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Abstract

Rural transport infrastructure is an important input in agricultural production. Agriculture is a dominant sector of most African economies, accounting for about 30% of the gross domestic product (GDP). It is therefore important to analyze the different factors which influence its development. This paper presents an over-view of the factors which have determined the present approaches used in the planning and development of rural transport infrastructure. Linkages between these approaches are drawn. It is apparent that major transport infrastructure development thrust in the past few decades has not been directed towards meeting the transport requirements agriculture development. The overall effect of this move has been the neglect of agriculture and the development of a transport infrastructure that has no firm economic base to support and sustain it. The paper suggests a number intervention proposals to reverse these situation.

Key words: subsistence agriculture, biochemical inputs, physical inputs, transport means, transport infrastructure, agricultural industry, specialization, commercialization.

Introduction

Poor agricultural production performance among small holder farming systems in Africa has been pointed out as being one of the major causes of the economic backwardness and poverty among the majority of the people, the rising rural to urban migration of the young and talented sections of the population and the destruction of the environment (Adams, 1988). Although the need to reverse this deteriorating situation is generally accepted, there has been great difficulty in identifying the key factors needed to achieve this aim.

Transport has generally been mentioned in agricultural and transport policy and planning studies as having important role in agriculture development (MAC, 1997; Lyatuu, 1996). In most of these studies however, the analysis has been superficial to warrant any move in the planning and implementation strategies away from the traditional approaches used in the past. The end result is that the role of transport in the agriculture policy strategies is not given due weight while at the same time agriculture does not feature in the transport policy strategies. Due to the centrality of agriculture in rural development, the huge transport investments aimed for rural development end up producing little impact as a result of the deficient planning done.

Recently, there has been a number of studies which have made in-depth analyses of the role of transport in agriculture development. The comprehensive review by Niklas Sieber (1996) presents much of this work. Some of these works have come out with

concreate suggestions on measures and intervention strategies for improving rural access and transport. One of such work is the ILO (1997) Guide to Integrated Rural Accessibility Planning in Tanzania.

The objective of this paper will not be to repeat what is mentioned and suggested in these highly searching reviews and analyses but rather to extend the analyses by looking at some of the issues raised from a different viewpoint which present opportunity for additional intervention avenues.

One such view-point is the perception of transport interventions (infrastructure, means of transport and transport avoidance measures) as existing at the same level as other physical inputs in agricultural production such as mechanization inputs. Analysis along this perception has potential for deriving additional interventions.

In this regard, the paper produces an over-view analysis of the agricultural production system making distinction between subsistence and commercial agricultural production systems and how each of the two systems is likely to support mechanization inputs. It is envisaged that this kind of analysis will assist in answering such questions as how to mobilize the financial capacity for transport interventions from agriculture production and how the different agricultural production systems may be used to identify priority areas for transport interventions.

Another view-point explored in the paper concerns matters which influence policy formulation at different levels - national and sector level. The discussion centers on the relatively unexplored linkages between the extent to which agriculture will permeat physical inputs such as energy saving technologies (including improved transport systems) and the development philosophies and policies which have directed national development in sub-Saharan African countries during the past few decades.

This analysis is done with the view of identifying the role which these development policies and philosophies have played in influencing the current levels of physical input utilization - including transport means.

Throughout the discussion, clear distinction is made between infrastructure and the means of transport which differ in many characteristics including size (magnitude of investment), ownership (individual or communal), and nature of their impact on agriculture at the different development stages.

Analysis of the transport problem

Role of transport in agriculture

One of the critical inputs in the agricultural production process is energy. Without the use of an external source of energy, either in form of fuels or draft animals, man's ability to increase agricultural productivity is severely limited (Chapman, 1975). Farming carried with entire reliance on human energy rarely exceeds subsistence level.

The role of transport in agricultural production occurs at both the input and output side of the production process. At the input side, the level of transport system used will influence the amount of household time and labour which will be available for carrying out agricultural production activies whereas at the output side, the level of transport used will have a significant role in the marketing of produce at the output side. For this reason, the development of rural transport is central in improving agricultural development.

Hierarch of the transport intervensions

Transport interventions for improving agricultural production are complex and involve many interacting factors. These interventions involve one or a combination of the following components of the transport system:

- Infrastructure; and
- Mechanical systems.

Characteristics of the two items (above) differ with respect to among others, the following:

- Acquisition;
- Ownership; and
- Use.

Infrastructural systems will often involve large capital (human and/or financial) investments in their acquisition; they will often be owned and used by a community. On the other hand, mechanical items involve relatively small investments and will often be owned by individuals or entrepreneurs. Although mechanical systems may at times be involved in multi-user applications, such application differs in many signifant ways from that of community use for infrastructure.

Interventions in each of the two categories may fall under the following groups, namely:

- Direct measures;
- Indirect measures; and
- Transport avoidance measures.

Direct measures

Direct interventions involve provision (acquisition) of actual transport items including:

- infrastructure - roads, tracks, paths;
- mechanical systems - vehicles and their power sources (carts, donkeys, wheelbarrows).

Indirect measures

Indirect measures include provision of support systems for the direct measures such as:

- infrastructure - institutional support (organization, training, etc.);
- mechanical systems - repair kits, fabrication gear etc.

Transport avoidance measures

Transport avoidance measures involve provision of things which will reduce the need for travel, including:

- infrastructure - health centres, water supply, community wood-lots, etc.;
- mechanical systems - grain mills, oil expellers, etc.

Characteristics of different measures

As has been mentioned above, the measures (above) differ in many ways, including:

- the factors which influence their availability;

- strategies required to acquire them (including the available opportunities for financing them);
- their relative impact on agricultural development;

Interventions in infrastructure involve mobilization of large resources in terms of finance or labour. As a result of this, provision of transport infrastructure may require certain institutional set-up which is able to mobilize the resources (such as sensitisation for voluntary labour or cash contribution, provision of skill, supervision, etc.). Within this group, again it is possible to distinguish between infrastructure which is directly related to transport such as a village paths which is relatively easy to provide through mechanisms instituted within the transport or agricultural production sector.

The other category of infrastructure (indirect) such as a health centre will normally have to be provided through strategies developed under the relevant sectors. Provision of such infrastructure will require supportive policy and organizational strategy which strives to integrate the different sectors within the overall system for a common goal.

On the other hand, the acquisition of mechanical systems will be influenced by commercial factors operating at the individual person or enterprise level. Often, these factors will invariably affect the other mechanical inputs in the system on a compititive manner. For example, the acquisition of a cart will perhaps be hampered by the same factors which will hamper the procurement of a plough by the same farmer.

It is mentioned in the following discussion below that the inhibiting factors responsible for this situation are those factors which promote subsistence agriculture. It has been shown that by its nature, subsistence agriculture does not provide the potential for supporting the use of mechanical inputs (including those used in transport) in its system.

At the same time, it is argued that lack of concrete policy in form of a paradigm for agricultural development weakens the institutional infrastructure which would among other things strive to re-orient agricultural production away from a subsistence one towards specialized commercial farming. It is mentioned that such policy out-look would allow the integration of the different sectors with the economies of the countries concerned in tackling the transport problem through direct, indirect and 'avoidance' measures. Through specialization and commercialization, the farmers' interests will be unified into a viable working (and pressure) group able to provide the huge resources required for infrastructure development within their areas.

Inhibiting factors under subsistence farming

The non-commercial orientation of subsistence agriculture has a major influence in limiting the use of mechanical inputs and other purchased inputs on the farm. This is caused by a complexity of factors within the farming systems which support subsistence agriculture.

The primary inputs under subsistence agriculture are land and labour (Hossner and Dibb, 1995). These two inputs are used in conjunction with biological systems to substitute the commercial inputs. The strategies used to accomplish this substitution and to deal with the uncertainties that go with this kind of production system are what define subsistence agriculture with all its characteristics - low productivity (mainly for home consumption), small fragmented farms, low specialization, low commercialization, and low use of capital-input technologies. These factors are inter-linked and together produce the conditions of poverty under subsistence agriculture which tend to be self-perpetuating (rather than correcting) and produce the vicious circle of poverty.

However, it is important to note at this juncture that farmers subjectively choose subsistence farming because it is the best option open to them given the constraints they face. (von Braun, 1995).

Prospects -

Use of increased mechanical systems (including transport systems) and other improved technological inputs in agriculture is a pre-requisite for increased agricultural productivity, and sustainable development.

Commercialization of agriculture has been shown to hold great potential in transforming subsistence agriculture and re-orienting it towards a market economy in which investiment in new technology and infrastructure are enabled by the increased income. (Farrington, 1989; von Braun, 1995). To succeed, the commercialization process has to be accompanied by specialization of commodity production. (von Braun, 1995). Specialization of production has many benefits, including those of allowing production to be made for the commodity that has comparative advantage in the given situation.

Many of present day constraints in production such as low rainfall, or poor soils are accentuated by the desire to grow crops which are not compatible with wealther and the land resource in the area. For example, semi-arid central Tanzania can grow short growing season crop of groundnuts successfully most of the years while other more humid crops like maize fail so frequently in the same area. Many of current research programs are directed at trying to support production of crops which are not in tune with the environment in the given area but which are deemed necessary to grow in order to support the subsistence (peasant) cropping requirements in which the farmer strives to meet all his household food requirements from his farm.

From the above discourse, it would appear quite apparent that subsistence farming stands in the way to inhibit true sustainable agricultural development. If this be the case, what then has preserved this production system over these decades or centuries ? The reasons to these questions hold some of the solutions to reverse the situation.

Lack of development paradigm

Two major reasons may be attributed to account for the continuation of subsistence farming over the years despite its most obvious disadvantages. One is the fact that developing African countries have had no development paradigm (comprehensive national policy for development) of their own to direct the political, economic and technological development initiatives.

Much of their strategies are short term, narrow interventions which as such, fail to form a coherent body of knowledge that is able to mobilize the thinking among all sectors of the social, political and economy towards meeting set objectives.

The other reason is the fact that subsistence agriculture, like poverty, is by nature very conservative. This is mainly caused by the high risk aversion strategies that are part and parcel of subsistence farming system. Partly, the high risk aversion tendency is a product of the lack of any measures to counteract its effect through some form of insurance. Such 'assurance infrastruture' would be part of the development policy strategy within the development paradigm.

Major implications

Lack of comprehensive national policy for development has caused a number of problems, including:

- Allowing each sector to define its objectives and policies. In the end, the formulated policies under the different ministries are not tied together to create the necessary institutional infrastructure which would have helped in the implementation of the different intervention approaches (direct, indirect and 'avoidance' measures);
- Failure to address the negative aspects in agricultural production for the purpose of making it responsive to mechanical inputs for agricultural development;
- Propagation of poverty and destruction of the environment as farmers continue to rely solely on land and labour for their survival;

Major issues for implementation

The negative issues mentioned in the above discussion can be reversed to form strategies for research. The following issues emerge:

- Policy framework: Need for comprehensive policy around which the different sectors (ministries, education institutions, etc.) will be integrated and focussed.
- Institutional infrastructure: Presently the institutional structure under the different ministries is not integrated and as a result does not provide the necessary support for mobilizing resources, providing skills and supervising the provision of transport means and infrastructure. For example, the use village agricultural extension officers (VEO) could be mobilized to disseminate, motivate and train farmers;
- Scientific research: Since the concept of transport for agricultural production is still new, there will still be need to conduct further research on the impact of various transport parameters on agricultural production.

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Technological Support
for Rural Agricultural Transport and Development

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Keynote paper presented to the Workshop:

Improving Rural Agricultural Transport System for Enhanced Production and

Marketing in Small-holder Farms of East Africa

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Abstract

The development of any industry, especially agriculture with its widespread production, requires an effective transport system. The development of small-holder agriculture in developing countries is particularly sensitive to transport strategies and many isolated subsistence farmers have little or no opportunity to escape poverty, as their potential marketing activities are hampered by inadequate or poor transport facilities. Extending effective transport systems to subsistence farmers, particularly through technological developments, helps them to harvest and market crops more efficiently, reduces drudgery and, by facilitating communication, helps stimulate social integration and improve quality of life.

Studies have revealed that, outside big cities in East African countries, as in other developing countries, motorised transport is very limited and the mobility of the large majority of small-holders depends on walking on footpaths. Further, the transport needs of these people are largely ignored by the transport policies implemented by their Governments. Any attempt to satisfy the needs of most rural people by the conventional provision of some extra roads and motorised transport would not properly address their needs. Rural transport, right from the planning stage must address the needs expressed by these people, as far as is possible at the household level. It may be argued that because of their the productive (eg crop care) and reproductive (eg fetching water and fuel-wood) responsibilities, the needs of women should be put first.

Small-holders will never make the transition from subsistence to small-scale commercial farming without a reliable transport system. Typically for small-holders, 95 % of their transport takes place on the paths and tracks around their villages. In one study, almost 90 % of the transport effort was undertaken by women and effected mostly by head-loading. The most important needs of small-holders have been characterised as the movement of small loads (10 to 150 kg) over modest distances (1 to 25 km). For on-farm activities, typical distances are less (1 to 13 km). For these load characteristics, conventional motorised transport is not necessarily the answer to the small-holders' needs and the merits of Intermediate Means of Transport (IMT) should be considered.

The design of IMTs to service these characteristics could be powered by humans, animals or small engines. The optimum choice depends on the particular combination of load and distance, together with

considerations of (at least) the terrain and topography. Human devices include yokes, carts, barrows and biltricycles with loads up to 150 kg and distances up to 120 km. Head-loading is a topic of sustained interest with some controversial research results: there is some evidence that up to 20 % of body weight can be carried at no (extra) metabolic cost. The benefits of pedal power have, to date, probably been under-exploited in rural communities, more so in Africa than in Asia.

Displacing human power with animal power in agricultural systems has been associated with increased production. As with crop production tasks, transport tasks can be facilitated by the use of pack animals and animals to pull carts or sledges, or as pack animals. At least ten species have been so domesticated, and their (absolute) capabilities depend primarily on body size. In relative terms, pack animals can carry 12 to 30 % of their body weight and can pull horizontally with a force of about 8 to 14 % over a working day. These values depend on species, but field observations have returned higher values, probably at some cost to the animals' well-being.

Examination of the transport structure in Africa reveals a very low take up of IMTs. This 'transport gap' between human porterage and pick-up trucks could be met by the greater development and use of IMTs. These, however, with their payloads of 10 to 100 kg at speeds of 10 to 90 km h^{-1} (depending on infrastructure), are still unaffordable to most small-holders. The challenge is therefore, to overcome the technological and financial constraints surrounding their adoption and utilisation. This challenge may be strengthened by the application of logistics, by studying material (and information) flows to reduce transport demand and, by implementing more favourable transport policies, to address in particular, improvements in infrastructure.

The technological issues which warrant research and development activities include analyses of:

- *transport needs for people and goods,*
- *capabilities and requirements of various categories of IMT,*
- *design constraints imposed on IMTs by operational factors in different agricultural production systems.*

1. Introduction

Economists usually emphasize the central role of transport in economic development. Ville (1990) summarised the arguments of Adam Smith and others who considered transport as "the main spring of economic development through its market-widening effect". As the development of modern transport technology enabled the movement of tons of goods from any corner of the globe to any other and caused a significant increase of mobility, transport became a major benchmark of progress.

The development of agriculture and industry requires improvement in transport facilities in any country. Though transport may not be the ultimate goal in the development process, it plays a crucial role in facilitating both industrial and agricultural development. It provides necessary activity for primary, secondary and tertiary production and may thus be considered as social overhead capital (Ville *ibid*). He argued further that transport plays the supporting role rather than leading in the industrial development process. Owen (1987) argued that agricultural incomes are driven not only by productivity from the fields, but also by other sectors such as schools, health services, infrastructure, technology support and maintenance, availability of market and reliable transportation.

Technological development of transport clearly has a number of potential benefits:

a) reduced of drudgery,
b) increased efficiency,
c) decreased transport time,
e) reduced spoilage and pest damage especially during post-harvest,
f) stimulated economy - by increasing marketing opportunities for farm products,
g) stimulated social integration,
h) increased quality of life.

A simplified block diagram of the dynamic interaction of infrastructure, transport, other agricultural inputs such as land, fertilizer, implements (for tillage, harvesting, processing) and produce, is shown in Figure 1. Because transport enhances agriculture development there is a clear feedback in the system, ie an increase in production also supports the development of transport technology.

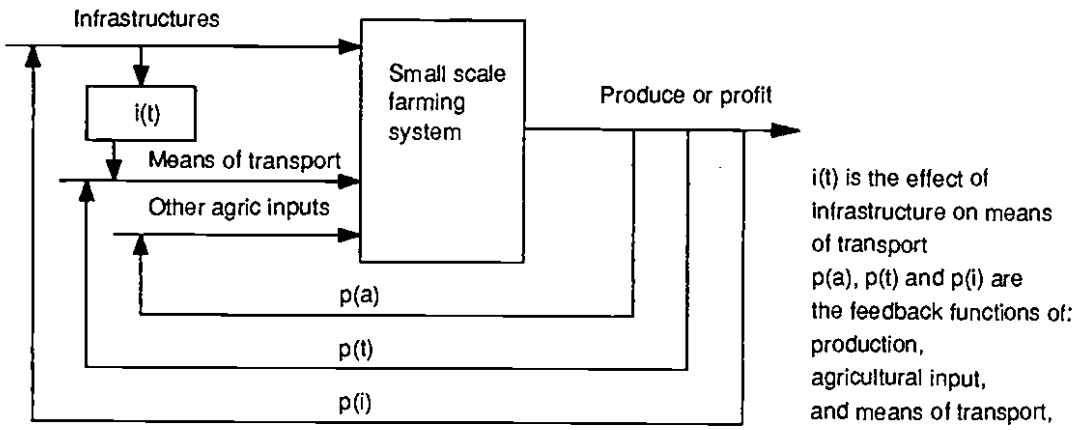

Figure 1. Block diagram to show the feedback behaviour of transport and agriculture development.

In most developing countries however, development strategies related to transport are designed to promote manufacturing industry and large-scale state and commercial farmers only. Small-scale subsistence farmers are ignored and isolated and thus remain poor. Isolated communities lose the incentive to grow surplus and, in the long run, become ignorant of market opportunities. Thus agricultural activities are severely hampered by inadequate or poor transport facilities.

Motorised transport is very limited in East Africa and therefore population mobility in the region is achieved mainly by walking on footpaths. Table 1 shows the distribution of vehicles per 1000 inhabitants in selected countries. Almost all vehicles in developing countries are concentrated in big cities, for example in Kenya about 47% of vehicles are concentrated in Nairobi.

The question is how best to proceed from the current situation using available and appropriate technology to meet the need of the very poor sector of the society in the region. Important research work has been carried out on rural transport to achieve an understanding of the transport needs of rural populations in developing countries and to contribute to the development of policies which may better meet the needs of rural communities.

Barwell et al (1985) reported the results of case studies made in some developing countries in Africa and Asia (Nigeria, Kenya, Tanzania, Malaysia, India, Korea, Bangladesh, Western Samoa and the Philippines).

These studies highlighted means, policies and patterns of transport. The report concluded that in all these countries transport policy ignored the transport requirement of small-scale farmers, which are the majority of the population, and emphasised those of large scale commercial farmers.

Owen (1968) described the status of transport in India up to the 1960s. He gave detailed assessments of the constraints associated with immobility in India (including technological innovation and transport policy) and proposed several measures to be taken by policy makers.

O'Connor (1965) studied the role of railways in Uganda and reported that the railway definitely favoured and promoted cotton cultivation (one of the major exported cash crops) - the availability of railways made possible an increase in cotton production. He also noted that railway transport had no direct effect on cotton distribution *within* Uganda. Coffee, another important cash crop, also benefited from the availability of railways for export, but not for *local* distribution.

Table 1. Vehicle in use in selected countries (International Road Federation, 1997)

Country	Total vehicles	Veh/1000 inhab	Veh/ km of road
Kenya	346 900	14	5.4
Ethiopia	66 021	1.2	2.3
Mozambique	88 800	5.5	3
Tanzania	133 800	4.6	1.5
South Africa	5 450 000	137.1	30
Zimbabwe	600 000	48.8	6.5
Uganda	33 080	1.7	1.2
Sweden	3 958 048	447.3	29
UK	23 077 000	406.2	42.9
Egypt	1 703 300	28.3	29.2
Haiti	53 000	7.7	13.5
Nicaragua	140 503	33.9	8.2
Mexico	12 551 000	140.4	50.5
USA	198 798 000	750.2	31.1
China	9 190 000	7.6	8.3
India	4 927 000	5.5	2.5
Laos	23 220	4.9	1.3
Philippines	830 900	11.8	4.1
Japan	67 245 000	538.3	58.8

Gleave (1992) classified transport networks into two: indigenous networks and modern networks. The access of small-scale farmers to modern networks is limited because of the nature of their activities and their ability to afford the costs, and therefore on-farm transport relies almost exclusively on indigenous networks.

Discussing transport and technology Owen (1965) described transport as 'an essential ingredient of almost everything man does to supply himself with the necessity of life and science: technology provides the means of overcoming the obstacles to movement.'

The growth of road construction for goods transport by truck and the mobility of people by bus between major cities in a region is remarkable. However, transport barriers for the majority of the rural population in

developing countries remain the main constraint to be tackled. To break the barrier the question of which mode of transport is to be promoted should be answered.

Owen (1987) highlighted the transport evolution and revolution in the United States as being similar to the current situation in developing countries. He classified transport technological development into five stages. He called the period prior to the first stage of the transport evolution as the age of immobility and poverty. It may be noted that this stage remains the transport status in the majority in developing countries where the current mode of transport is predominantly walking. In the first stage of transport evolution in the US, ox-carts played an important role in transporting agricultural products. Owen noted that at this stage it was cheaper to move a ton of goods to Europe than to move a ton of goods ten miles through Pensylvania. In the second stage (1820s) the role of animal powered transport declined and the application of steam power to the development of railroads took over. The third stage was characterized as the motor age in the twentieth century. At this stage farmers were rescued from isolation enabling them to apply modern methods of cultivation.

In the present day, vehicle technology and operating costs are fairly well established, although data for real costs in developing countries is less reliable. In general, costs of transport (in terms of cost per tonne.km) fall with vehicle capital cost. Fig 2 taken from Oram and Thomas (1995) shows typical operating cost in kg km $\$_{us}^{-1}$. Very marked is the 'transport gap' between headloading and the pick-up truck observed in sub–Saharan Africa, but which in Asia and other developing regions is filled with (IMTs).

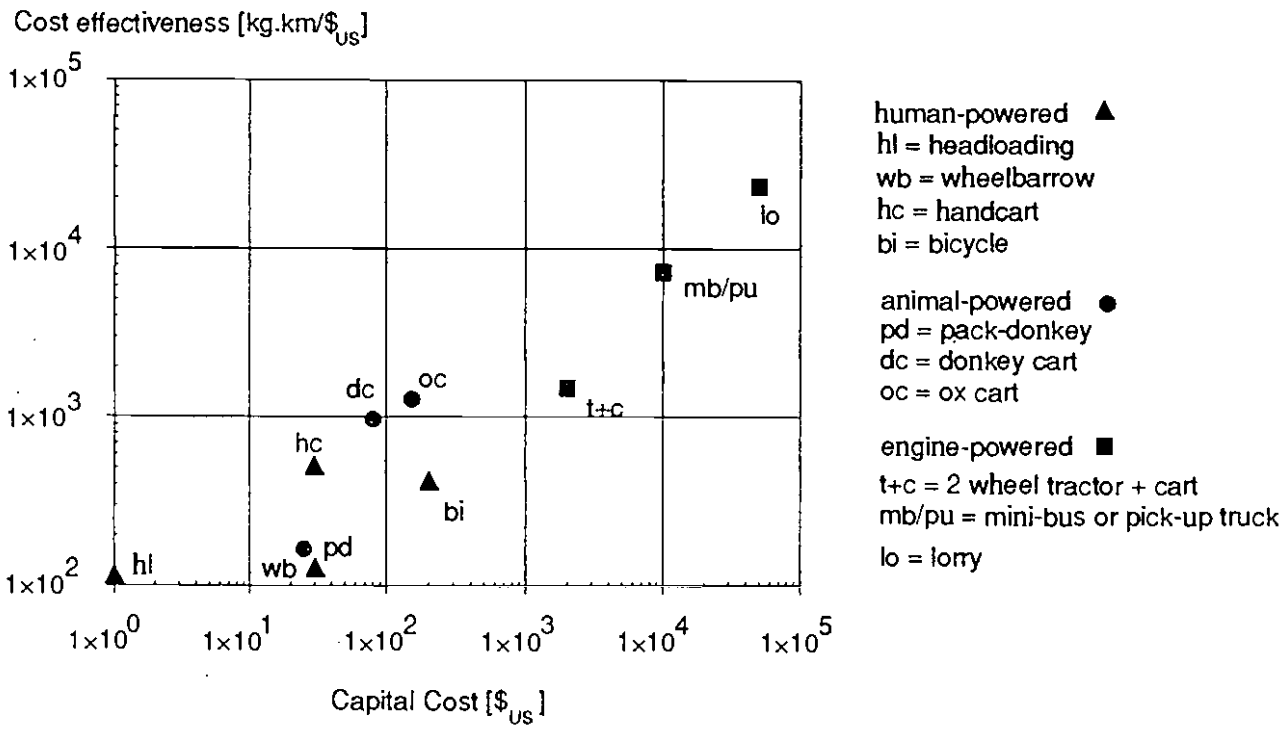

Figure 2. Cost effectiveness and capital cost of various transport modes.

2. Rural transport in sub-Saharan African countries

The roads structure in sub-Saharan African countries and particularly in East Africa is still far from adequate. Most rural homesteads are still many kilometres from the nearest road and consequently most rural travel takes place off road - usually on foot (Dawson *et al* 1993). Rural people are therefore isolated from a wide range of social and economic opportunities. According to Chambers (1983) isolation sustains poverty because services do not reach those isolated, thus keeping them uninformed and out of contact with opportunities for income generation. The roads structure in rural areas is not likely to improve in the future,

as governments have now been forced by budgetary constraints to shift the focus of rural transport from expansion to rehabilitation and maintenance of the existing infrastructure.

Moreover, most people in rural areas have little access to or ownership of, any means of transport. Provision of roads and motorised transport alone cannot therefore solve the travel needs of rural people. It is now widely acknowledged that rural transport planning must focus essentially on the real needs of the rural people as defined by them.

This new approach in rural transport planning re-defines rural transport to encompass the movement of rural people and their goods, to meet their domestic, economic and social needs by any means - along paths, tracks and roads Barwell *et al* (1985). In this approach the household becomes the unit of analysis, and emphasis is placed on transport needs of individual households and the community as a whole.

Barwell *ibid* conducted a comparative study on transportation in two Kenyan villages. He reported that walking (for the transport of goods) is the most dominant mode of transportation, comprising about 60% - 80 % of the total transportation in the village.

In sub-Saharan African countries, the overwhelming majority of the rural population are small-scale farmers. For most of these farmers, the farming plots are at different places far away from each other and at considerable distances from their homesteads. Farmers must therefore carry farming equipment and other inputs from homesteads to their plots and from one plot to another. Long-distance trips (sometimes up to 12 hours) are required for water and firewood collection for domestic purposes and stock-watering. Women are the main hauliers of agricultural products from fields to storage. They are also responsible for the transport of other inputs such as commercial fertilizer, seeds and implements (from markets to villages and thereafter to the fields), firewood from forests and water (about 20 to 30 litre) from water sources. This is an inordinate burden on women.

Without reliable transport and a good farm-market relationship it may not be possible to shift from today's subsistence farming to commercial agriculture. The narrow rural roads leading to and from the cities of the overwhelming majority of the developing countries are crowded with teeming mass of beasts of burden, head-loading or back-loading pedestrians and pack-animals (Owen, 1968). In some places, animal drawn carts and wheelbarrows are also seen together with the above.

Typical transport activities of a small-scale farmer may represented as in Figure 3. The arrows show people mobility and goods flow to and from a homestead. Rural transport is usually classified into on-farm and off-farm transport.

On-farm transportation includes:

a) transportation within fields (collecting harvested crops to one point for processing in the fields and temporary storage; distribution of fertilizers and seeds; transporting of firewood and water; transport to the grinding mills);
b) transportation of agricultural products from fields to homesteads, transport of agricultural implements from homesteads to fields and vice-versa, transport of seeds and fertilizers to the fields; and
c) transport of implements between different plots etc.

Off-farm transportation includes:

a) transport of agricultural products including animals to markets,
b) transport of industrial products (commercial fertilizers, implements, seeds, etc) from markets to homesteads,
c) transport to health centres and schools.

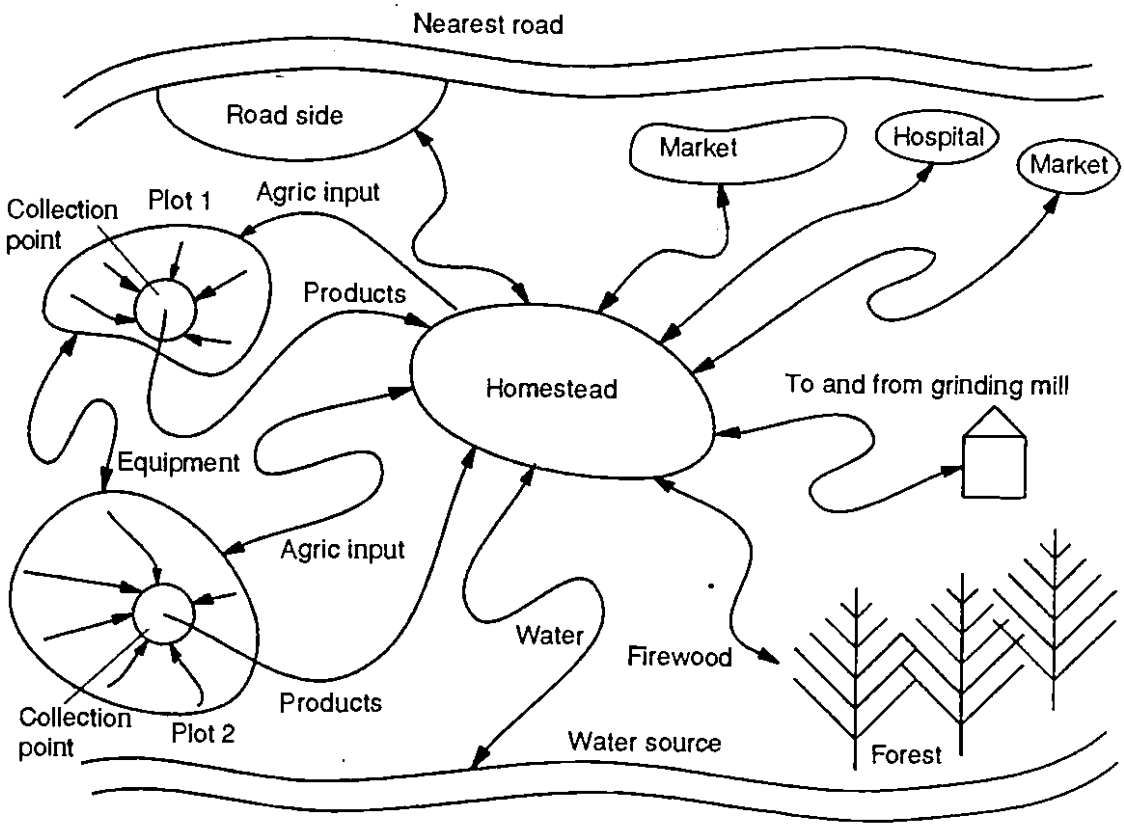

Figure 3. Transport requirements for a typical smallhouseholder

Studies have been carried out to assess rural transport needs from the household perspective in the East African region, the most comprehensive one being the Makete Integrated Rural Transport study carried out in Makete District in western Tanzania in 1986/87. The study revealed the following:

- About 95% of rural transport effort took place in and around the village, on paths and tracks, mostly by head-loading.
- Only 5% of household transport effort was undertaken on roads by motorised vehicles. About 80% of the time spent on transport and 81% of transport effort was classified as internal transport, defined as transport in and around the village, which includes the collection of firewood and water; trips to the field for crop establishment, weeding and harvesting, and marketing inside the village.
- Almost 89% of transport effort was devoted to water, firewood and grain carried to the mill. Women undertook 89% of transport work in terms of transport effort, and 76% in terms of time spent.
- On average, women spent 30 hours per week on transport tasks.

In Kenya during a study carried out in Kajiado (IT Kenya 1994) the following facts were established. During the dry season women walk 10-20 km round trip per day to fetch water. It takes 4-12 hours per trip with donkeys. Firewood collection involves a 5-10 km round trip. This task is performed twice a week by women and takes 4-6 hours per trip on foot. It takes 10-30 km one way to go to the grinding mill, a trip made once per week and takes 10-12 hours per trip. Reaching health centres means a 10-25 km trip to the road, then taking a vehicle with a sick person. Selling livestock requires a two-day trip for men trekking with animals and then returning on foot.

In another study carried out in 1980 in two villages in Mwea Division of Kirinyaga District in the central Province of Kenya, the following statistics were revealed:

- Walking was the predominant means of transport. Walking to shops and leisure trips accounted for 60-

80% of trips, the remainder being by bicycles or *matatu* (minibuses).

- Over 80% trips for these purposes were less than 7km, suggesting that they are usually within the village neighbourhood. The different levels of access to road transport in the two villages had no significant effect on this.
- Head or back-loading accounted for one in three of all trips and 95% of these loaded trips were carried out by women and children.
- About 70% of trips involving carrying a load were for water collection. The usual loads were about 25 kg and the distances ranged from zero to 8 km. Both water and firewood collections were female activities.

Although all small-scale farmers need transport for their produce and marketing of crops and livestock and household activities, transport needs vary depending on the crops grown, number of livestock owned, size of farms, distance to market outlets, and the range of inputs used. For the Kenyan situation, which may not be very different from the other two East African countries, the most important needs can be characterised as the movement of small loads (10-150 kg units) over relatively short distances (1-25 km). The range of loads is likely to be the same for on-farm but the typical distances are shorter (1-13 km).

3. Appropriate means of transport

Most transport activities in rural areas are walking to and from fields, collection of harvested crops and long-distance walking for water and firewood collection. These activities are the most time consuming burden, in comparison to the transport between homestead and market. Many researchers have argued that road construction may not solve on-farm transport constraints. They would favour the improvement of non-motorized intermediate means of transport (in terms of the efficiency and carrying capacity, design development and maintenance) which may reduce burdens and transport time.

Intermediate means of transport (IMTs) are used mainly for relatively short distances (up to about 30 km), i.e for on-farm activities for material transport between homesteads and markets. IMTs may be classified on the basis of their power sources, i.e motorized (light motorized vehicle) and non-motorized (human powered and animal powered means of transport Fig 4).

Kaira (1983) argues that motor vehicle services in rural areas are not only limited but inflexible in addressing the transport demands of the rural people. This is because transport demands in rural areas are characterised by short trips and movements of small loads over relatively short distances. Motorised transport is therefore, not the usual solution to the transport needs of rural people. The provision of a wide range of transport choices within the means of rural people may be the starting point in solving their transport needs. Adoption would then be based on need, performance and cost in proportion to investment capabilities.

Currently available means of transport within the East African region include bicycles and animal-based devices. There are other modes of transport that can be adapted to the rural scene by designing appropriate attachments. These range from low-cost vehicles to motorcycles and their adaptation for load-carrying, eg trailer and side cars. Bicycles can also be adapted to carry more loads by attaching specially designed trailers or side cars.

Intermediate Means of Transport (IMTs) have a significant role to play in addressing the transport needs of rural communities. They are particularly suited to carrying agricultural produce to markets and, to a lesser extent, transportation of production supplies and building materials from supply centres to points of use.

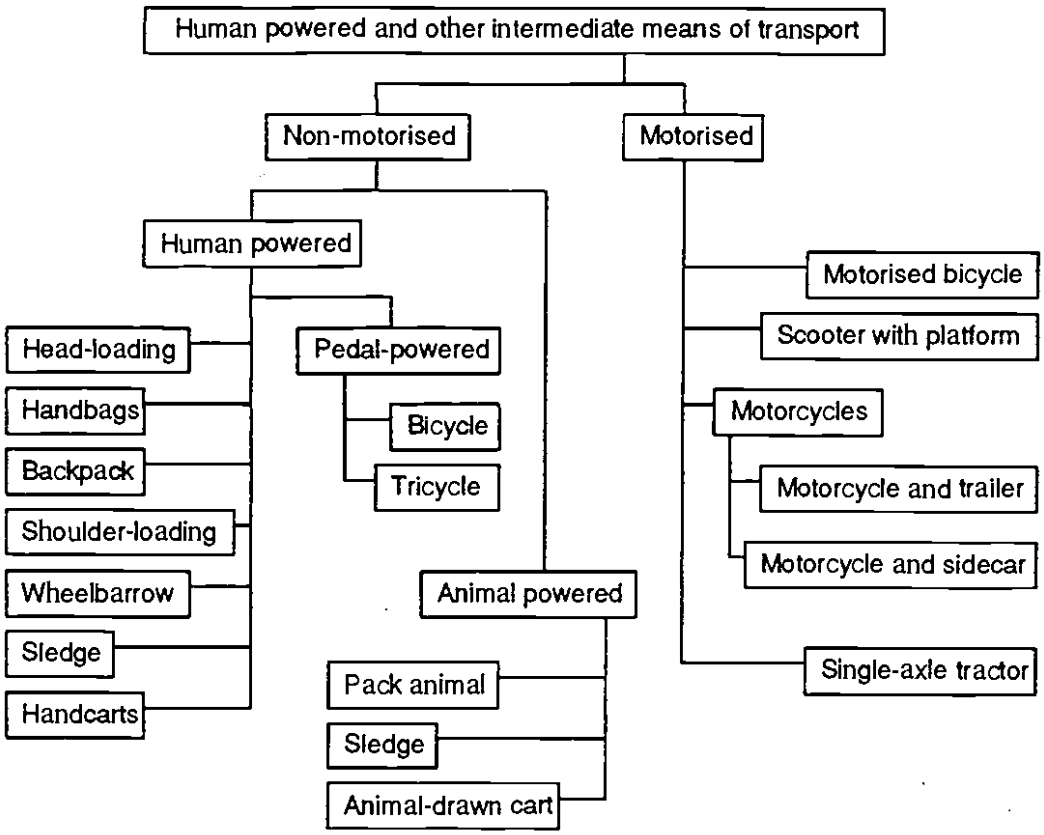

Figure 4. Components of human powered and other intermediate means of transport

Human powered transport

Prior to the domestication of animals and the invention of motorized vehicles, only human power was used to move loads and as a means of communication. Runners were used efficiently about 500 BC to deliver messages using a relay system (Lay, 1992). The most noticeable was the system called *chasqui* developed in North America and able to transmit messages at 400 km/day by using fast runners over 2.5 km stages.

Human power can be used in (at least) two ways: moving a load supported entirely by the body, and moving a load which is totally or partially supported by another structure (eg sledges, wheelbarrows, carts etc).

Typical methods of supporting loads by the body include head-loading, back-packs, shoulder-loading, hand-bags, and yokes. To carry goods on the head, sacks or other types of containers are usually used. On shoulders, either sacks or shoulder poles are used. A shoulder pole is a long thin rounded piece of wood about 1000 to 2000 mm long with loads suspended from its ends.

To carry loads on the back, special frames or wrapping ropes are used in such a way that the load is not only carried by the back, but also by a shoulder. It is very common for the women to transport children, firewood, water and almost anything that can be put in sacks, by this method.

The definition of an optimal load is an elusive issue. There are many possible determinants of load-carrying ability: body size, body shape, strength, age, nature of the load, nature of its support (if any), nature of the terrain, slope, climate, clothing, etc. It may be preferable to express maximum load as a proportion of body weight, rather than as an absolute number.

Haisman (1988) has suggested that a useful 'rule of thumb' would be a loading of 1/3 body weight for healthy young men. He is not however, specific about modes of carriage or gender effects, as most of his

source material was from the military.

Table 2 shows load maxima for sustainable and healthy conditions. However in practice loads transported usually exceed the figures given in the table. The entries in the time column are rather arbitrary as in many cases the time is dictated by the need.

Table 2. Human load carrying performance

Mode	Load, kg	Speed, km/h	Time, hours
Head-loading	20	5	4
Back-packs	30	5	6
Yokes /poles	40	5	6
Hand-carts	100	5	8
Bicycle	75	15	8
Tricycle	150	15	8
Wheelbarrow	100	5	1

It is interesting to note that, moving down the mode column, load carrying ability increases but so does the financial investment needed to effect these modes. Headloading may be attractive or popular simply because it requires the least capital outlay and is the most immediately available. However, there may also be physiological reasons.

Balogun et al (1986) investigated three modes of load carrying and concluded that his subjects (American college students) preferred a head pack to a transverse yoke and the latter to a frontal yoke. In fact, the frontal yoke (i.e., with loads in front of and behind the body) was deemed as unacceptable. It was reported that in all cases the metabolic efficiency decreased as the external load increased.

Bedale (1924) studied eight modes of load carrying (ranging from 20 to 60 lb, i.e 9 to 27 kg) and found that the yoke was the most efficient in terms of both oxygen uptake and the work done (measured as ml of oxygen per horizontal kg m). This yoke was similar to the transverse yoke of Balogun *et al.* Hip loading was least efficient, with head-loading in between.

Kram (1991) investigated the use of springy poles as yokes and concluded that although springy poles affected force patterns, they had little effect on metabolic costs.

Page (1996) investigated four carrying devices in the laboratory: the Tigrayan water pot, the frontal yoke, the back-strap and the back-frame. The water pot seemed the least acceptable in terms of metabolic cost, perceived exertion and postural discomfort, with little to choose from between the other modes. Dufaut (1988), in a brief review, quotes an ILO recommended loading of 25-30 kg and suggests the yoke as the most energy-economic method. She also notes that other carrying aids reduce the problem: a wheelbarrow for example, where the loads is taken directly by the wheel, allows a load of 200 kg to be moved. It is often not realised that the forward position of the wheel of a wheelbarrow transfers weight to the operator increasing his/her stability and grip.

Head-loading is a topic of sustained interest with some conflicting research results. The work of Heglund *et al* (1995) (which has been widely quoted) suggests that loads of up to 20% of body weight can be carried with no apparent metabolic cost and loads of up to 70% of body weight can be carried more efficiently than when using back-packs or aids. In a succinct review of posture and load carrying in the tropics Patrick (1993) also noted that free-loading up to 20% of body weight had been observed in a study of head loading by five Kenyan women[1]. This study had been conducted using a treadmill and initially, when a headload of

[1] Maloiy *et al* 1986.

34 kg (ie 61% of body weight) was carried, optimum walking speeds were found to be the same as for the unloaded condition. Cathcart *et al* (1923) suggested that, for (British) soldiers at a speed of about 5.6 km/h, the most economical load would be around 40% of body weight. Interpreting this, Datta *et al* (1975) suggested that maximum permissible load should not exceed 56% of body weight. Referring to the Indian situation, Datta *ibid* suggested that the maximum head load for an Indian male on firm terrain should be 30 kg.

Animal powered transport

In conjunction with the documentation of evolutionary development of roads and transport, Lay (1992) presented chronologically the gradual change of beast of burden from humans to domesticated animals and to wheeled vehicles. Travel for collection of water and food was the basic demand for transport. The rise of agricultural communities in about 9000 BC, the blossoming of settled agriculture (about 2000 BC) and the trade between settlers and the human desire to know what lies beyond the horizon (and to find ways to get there), required the development of efficient transport beyond walking. According to Lay, domestication of large animals probably occurred about 7000 BC - initially to provide humans with a secure source of food - the use of animals for transport power was a secondary development. Cattle, onagers, donkeys, dogs, goats, horses, mules, camels, elephants, buffalos, llamas, reindeer, yaks, and, of course humans, are some of the better known species to have found useful transport employment.

In about 5000 BC domesticated and castrated oxen became the best power source and could haul payloads four to ten times greater than they could carry on their backs. However, a wheeled cart requires a wider track than does a headloader. Pack transport became popular when domesticated donkeys came out of Africa in 3500 BC and was widely used in the Middle East. In about 3000 BC horse riding probably began in Russia and thereafter was introduced into other regions. The saddle was probably developed in India and greatly improved horse riding.

Animals have an extremely useful ability to transport people and freight over significant distances, hauling relatively simple wheeled vehicles. Animal hauling of simplified wheeled vehicles gives a great opportunity to transport both people and goods over relatively long distances. This technology is still important and appropriate in developing countries, but there has always been an increasing demand for more effective and efficient methods of transporting tonnes of goods. This has necessitated further development of transport technology.

An increase of production when using animals rather than humans is significant. In comparative studies Liag *et al* (1989) reported that use of buffalos for transport of oil palm increased harvest production by 30.7% and labour requirement decreased by 23.5%. These figures could be increased by 50 to 100% if suitable transport implements were to be developed.

Pack animals

The ability to carry loads depends largely on the size and species of the animal. A simple rule of thumb is that animals can carry, on a sustainable basis, about 25% of their body weight. However, this is dependent on some of the variables listed above and of course on the state of the animal. Also, it must be noted that many animals, especially donkeys, are frequently observed carrying much greater loads, perhaps 70% to 80% of their body weight. Typical sustainable loads would be between 80 and 300 kg.

Speed and range also depend on the size of the animal because of leg length and energy reserves respectively. However, if the pack animals are accompanied by people walking alongside, speed and range might be limited by the peoples' abilities and motivation. Some research reports produced in the early 1980s (McDowell and Goe, 1980) are given in Tables 3 and 4. However many of the figures for the carrying capacity are lower than observed in practice and their accuracy should be questioned.

Table 3. Capabilities of various species for pack load over 6 to 8 hrs per day

Animals	body weight [kg]	load [N]	speed [km/h]	load/body wt [%]
Horse	618	725	5.6	11.8
Mule	400	500	7.2	12.5
Donkey	210	565	5.6	26.9
Ox	555	675	3.5	12.1
Lama	103	325	4.5	31.4
Buffalo	650	800	3.0	12.4
Camel	485	1200	4.0	25.0
Elephant	3250	5180	3.5	15.9
Yak	413	1175	2.8	27.2

NB: 1 kg = 9.81 N.

Pulling loads by animals

The pulling ability of animals depends on the same factors as mentioned earlier for carrying loads. Another rule of thumb is that animals can pull about 12% of their body weight (although a higher value of 16% may be accepted for donkeys), but the payload must depend on the performance of the cart, particularly the friction in the bearings and the rolling resistance of the wheels over the terrain. For pulling ability, typical values would be 200 to 1000 kg for up to 6 hours at 4 to 12 km/h. It has been reported elsewhere that a single bullock can pull up to 2000 kg using carts on a good roads (IT, 1985).

Table 4. Pulling capacity of draught animals (McDowell and Goe, 1980)

Animals	body weight [kg]	load [N]	speed [km/h]	load/body wt [%]
Horse	618	770	3.3	11.3
Mule	400	640	3.3	13
Donkey	210	335	3.3	13.9
Ox	555	795	3.3	12.2
Cow	550	390	3.0	9.0
Buffalo	650	910	2.9	12.0
Camel	485	670	3.8	12.0
Elephant	3250	2575	2.0	7.9

Pedal-powered transport

Liu *et al* (1993) described the status of bicycle transportation in China. They noted that the revision of policy in the 1970s resulted in a significant increase in bicycle ownership, from one bicycle for every three persons, to one for every two persons in 1990. The number of bicycle quadrupled over the same period.

They summarized the advantages of using bicycles as:

a) flexibility (because of its private ownership nature),
b) efficiency (the bicycle requires less power)
c) environmental friendly (pollution free),
d) affordability (bicycles are relatively cheap),
e) land use (bicycles require less space during riding and less space for parking than cars).

State interventions which promoted bicycle transport were: tax-free status, traffic subsidies for bicycle owners, subsidized bicycle parking and encouragement of increased manufacturing capacity to increase competition. Chinese experience of state intervention to promote both manufacture and ownership of bicycles may be a good example for the development of bicycle transport in any developing countries in general and sub-Saharan countries in particular. The success of bicycle industries in Bangladesh, China, El Salvador, Ghana and Nigeria may also encourage other countries to follow suit.

Kuranami *et al* (1994) quoted the report of Heieli (1993) on a comparative study on the energy consumption of bicycle and a private car use. The study showed that a bicycle consumes 92 kJ/passenger-km while a private car requires 4900 kJ/passenger-km when used by a single person.

The International Bicycle Fund (1997) summarized the advantages of using bicycles as follows:

a) reduced energy consumption,
b) no dependency on petroleum,
c) minimized destruction of natural environment and less air pollution
d) increased mobility in busy urban environments,
e) increased access to education, health
f) increased opportunities for small-scale private enterprise.

Motorized intermediate means of transport

Motorized vehicles (trucks, cars, buses, etc) are not only unaffordable but also unsuitable for small-scale farmers (as mentioned earlier, intensive transport activities are made in and around their fields). However, motorized bicycles, tri-wheelers, single-axle tractors with attachments, scooters with attachments and motor cycles with their attachments are usually considered more appropriate. Nevertheless the change in status from portering to wheeled and motorised vehicles is large and may be daunting for the subsistence farmer.

Performance of scooters, motorbikes and single-axle tractors are given in Table 5 adapted from Crossley *et al* (undated) and Table 6 from Riverson and Carapetis (1991).

Table 5. Performance of scooters and motor-bikes

Mode	Load [kg]	Speed [km h^{-1}]	Time [hr]
Scooter with front platform	150	50	Depends on fuel available
Scooter with rear platform	500	50	as above
Motor-bike with carrier	100	100	as above

Table 6. Performance of intermediate means of transport (Riverson and Carapetis, 1991)

Mode	Max load [kg]	Max speed [km/h]	Max range [km]	Topography reqd
Wheelbarrow	100	5	10	Flat narrow path
Bicycle	75	20	20	Flat narrow path
Bicycle and trailer	200	10-15	15-20	Flat, wide track
Bicycle and slider	150	10-15	15-20	Flat, wide track
Pack animals	100 - 250	5	15-20	Hilly, narrow path
Animal-drawn sledge	200 - 400	5	10	Flat
Animal drawn cart	500 - 1500	5	15-20	Flat wide track
Motorcycle	100	40-90	100	Motorable path
Motorcycle and side-car	250 - 500	30-60	60	Flat
Motorcycle and trailer	250	30-60	60	Flat
Single-axle tractor + trailer	1500	15-20	40	Flat
Asian utility vehicle	1000	60	60	Motorable road/ track

Energy consumption

Availability of energy sources has a multi-dimensional impact on technological and socio-economic development. In the overwhelming majority of developing countries the growth of energy requirement is much higher than the economic growth in terms of GNP. It is noted elsewhere in the literature that energy consumption and GNP per capita grew in Africa in the last two decades by 44% and 30% respectively, while the situation is the opposite in developed countries. Nowadays, fossil fuel is the most dominant energy source and many developing countries import petroleum using foreign exchange. However, the economy of these countries may not allow them to continue importing fossil fuel. Moreover the emissions from fossil fuel consuming machines pollute the air and contributing to global warming.

Reports of research made hitherto into the energy requirements of intermediate means of transport show that they vary significantly and thus there is a need for comprehensive research to determine the energy requirement of both human and animal powered means of transport. The results of this type of research are required to develop transport equipment and transport policy which may adequately meet the transport needs of rural populations.

4. Manufacture of low-cost means of transport

Manufacturing industries in general and those manufacturing transport equipment in sub-Saharan African countries are very few in number. In his assessment on tropical African development, Gleave (1992) noted that the share of industrial manufacture in GDP in Sub-Saharan African countries is very low (for example, Zimbabwe 20%, Zambia 18%, Kenya 11%, Tanzania 8% and Uganda 7%). Most of the motor industries in the region assemble trucks using imported components and vehicle maintenance is carried out at these same industrial sites and workshops. However, the number and the manufacturing capacity of small-scale industries which produce equipment for intermediate means of transport are both limited.

Many researchers and investigators have suggested development of low-cost means of transport. An important meeting of the United Nations Industrial Development Organization (UNIDO) was held in Lima (Peru) in 1975 (UNIDO, 1978) where UNIDO initiated a concerted effort to promote the development of appropriate technology in developing countries. Following the Lima target, the UN (1979) suggested promotion of manufacturing of low-cost vehicles (two-, three- and four-wheeled) in and for developing countries. It was emphasized in the document that such transport facilities should be designed both for the movement of people and materials in rural areas, at a price that the rural population can afford. However,

there has been no substantial progress made in this respect after about twenty years.

Promotion of local manufacturers of appropriate transport equipment and power sources may be the prerequisite for transport development. Local manufacturers should get opportunities to manufacture and deliver to end users at a price which the end users can afford, whilst also enabling them to support maintenance and service. Manufactured equipment should be simple, efficient, productive, cheap, strong and durable.

The successful production and maintenance experience of low-cost vehicles such as scooters, motor cycles, three-wheelers and mopeds in India, the *jeepney*, the Asian utility vehicle, motor cycles and side-cars in the Philippines and the single-axle tractor and trailer combination in China (UNIDO, 1978) can definitely encourage the countries of Eastern Africa.

Technological constraints to agricultural rural transport.

Technological constraints include:

- poor adaptation of intermediate means of transport,
- poor state of available IMTs
- inadequate service and maintenance,
- poor design of equipment for pack and load pulling,
- inadequate knowledge of the performance of animal powered transport,
- inadequate local manufacturing capacity,
- lack of design and production standards,

Although the cost of appropriate means of transport is considerably less than that of conventional motor vehicles, it is still expensive and represents a substantial investment for most rural households. The cost of IMTs is still high because of several factors, such as poor access and availability of raw materials used in their manufacture (eg high carbon steel, bearings etc). Import duty imposed on raw materials has increased the cost of local manufacture.

What could be the technological support to facilitate and promote agricultural transport ?

In the case of transport technology for the agricultural sector in developing countries as a whole, and in East Africa in particular, attention should be paid to:

a) sources of power for transport,
b) transport equipment,
c) packaging technology,
d) infrastructure.

The benefits of improvements in packaging technology include:

a) protection of produce from mechanical, biological and climatic threats,
b) minimization of contamination, degradation and improvement to the quality of the products,
c) easier for handling and transport,
d) information about the contents.

Appropriate power sources and equipment which may require attention for on-farm transport development include:

a) equipment used by humans to carry or otherwise move products,
b) animal-drawn transport devices,
c) equipment for riding,
d) equipment used for pack-animals,
e) bicycles and equipment to be pulled by bicycles,
f) single-axle tractors and attachments to the tractors,
g) equipment to be pulled by motorcycles,
h) scooters and attachments.

The above mentioned equipment developments may be possible only if local manufacturers are supported and stimulated. Moreover, the integration of on-farm transport with off-farm motorized transport is essential. To this end technological support to advance infrastructure development, availability of small, medium and large scale motorized vehicles and support of information technology are important.

Is it possible to reduce transport work?

If industries and processing plants are located near to raw materials or primary production sites, demand for freight transport may be reduced. It seems reasonable that development of new and distant industrial centres will give rise to large freight traffic demand. Conversely, transport work may be significantly decreased by taking measures to reduce transport need, ie if farm plots are near homesteads, water pumps are available near homesteads and alternative energy sources replace firewood for cooking, Seiber (1996).

Environmental considerations.

Environmental impacts of transport should be taken into consideration for two main reasons:

a) air pollution in urban areas,
b) many roads become water ways in rural areas during periods of heavy rainfall and therefore construction of non-asphalted roads usually leads to severe soil erosion.

5. Transport logistics

Logistics is a relatively new concept which has been developed from the idea of material administration. It describes the flow of input resources and final products from sources of production (including input raw material for production) through distribution to consumers. Fig 5 shows the flow of information (Tarkowski *et al*, 1995). The main components of logistics are planning, organization, steering and control of material flows. Within the logistics system, packaging, storage, operation and transport play major roles whenever the distance between production site and population centre is significant.

Fabbe-Caster and Colin (1994) define the logistics of any commercial concern as follows: 'logistics defines the technology of control of the physical flow of materials, goods and related information that a firm sends, transfers and receives. It appears as an organizational approach that can conserve and improve the flexibility and reactivity of the firm vis-a-vis its environment.'

The interesting question is then whether the basic concept mentioned above is applicable for small-scale farmers in developing countries or not. The answer is apparently yes. The flow of input resources for agricultural production and the management, coordination and control of the products from farms to consumers through market, needs to be described in detail using this approach to determine the constraints in each sub-process and to develop appropriate solutions. The most important components in small-scale

production systems are: collection and distribution in the fields, processing, storage, packaging and transport and steering the whole system (Fig. 5). It is important to note that lack of packaging facilities may be one of the constraints in the logistics system of small-scale farmers during the transition from subsistence to commercial farming. Significant post-harvest losses occur when especially vulnerable crops and fruits are subjected to mechanical damage (Ferris *et al*, 1993). Therefore packaging should be taken into consideration in the development of agricultural logistic systems.

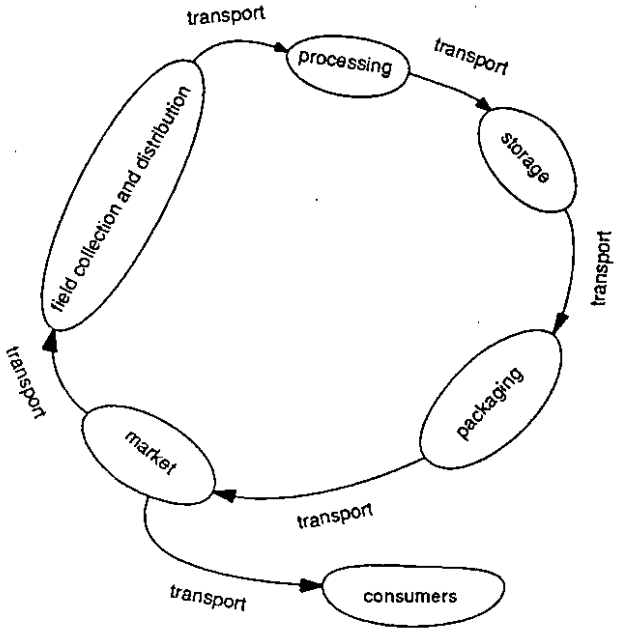

Figure 5. Simplified logistic system for agriculture - arrows show material and transport flows.

A detailed description of material flow from various sources (agricultural fields, water points, forests, markets, health centres, grinding mills) to homesteads and vice-versa is required. Thereafter the material flow can be modelled and pertinent steering parameters determined. The conventional modelling process includes problem identification, conceptual or hypothetical modelling, inventory assessment, computer modelling, simulation and evaluation of the model using known data (Gebresenbet 1996).

6. Future research topics.

Technological topics which should be emphasised to promote intermediate means of transport and their integration with advanced means of transport (AMT) in the foreseeable future are:

a) load carrying or pulling capacity of various categories of IMT,
b) energy requirements of various categories of IMT,
c) material flows from and to a small household in a specific region,
d) transport needs for goods transport,
e) transport needs for humans,
f) availability of transport facilities,
g) utilization level of available transport facilities,
h) design constraints of IMT equipment,
i) material availability for manufacturing,
j) manufacturing capacity of local manufacturers,

k) availability of spare parts,
l) maintenance and services of transport facilities by the farmers,
m) potential of new/ novel IMTs
n) efficiency of various categories of IMT,
o) affordability of small household to own various categories of IMT,
p) environmental impact of IMT,
q) available potential for research, development and dissemination,
r) possible integration of IMT with 'AMT',
s) government policy in relation to rural transport,
t) possible solutions and implementations.

Implementation of the above mentioned topics requires a multi-disciplinary and comprehensive research activity in which the full participation of farmers and the collaboration of national, regional and international researchers are required.

7. Policy interventions.

Although there is a huge demand for appropriate rural transport, no independent policy statements have been devoted to rural transport in East Africa. Recent rural transport policy papers and the current development plan give only passing mention of rural transport and concentrate on rural infrastructure. Very limited attention has been paid to non-motorised transport in the current development plan. However, given that *roads are not enough* (Dawson and Barwell 1993) and that there is an increased interest in rural transport, this situation is bound to change.

The current approach in rural transport analysis has identified policy areas that could enhance the mobility of rural communities (for example subsidizing local manufacturers of relevant transport equipment). It now hoped that policy makers in rural transport planning will put in place broad and well-defined policy interventions extending beyond rural infrastructure. Such policies should be location-specific to respond more closely to particuar physical, cultural and socio-economic characteristics and needs of target areas.

Policy should not be limited to measures to enhance mobility, it should also encompass measures to reduce the need for travel and transport primarily by locating facilities and services closer to the communities that need access to them. This makes rural transport planning a multi-sector phenomenon, requiring the participation of various sectors.

8. General conclusions.

Extending transport systems to subsistence and small-holder farmers, particularly through technological developments, helps them to harvest and market crops more efficiently, reduces drudgery and, by facilitating communication, helps stimulate social integration and improved quality of life.

In East African countries, where the transport needs of small-holder farmers are largely ignored by policy-makers, motorised transport is very limited. The mobility of small-holders depends mainly on walking on footpaths, with loads carried on women's heads. Furthermore, small-holders will never make the transition from subsistence to small-scale commercial farming without a reliable transport system. The most important needs of small-holders are the movement of small loads (10 to 150 kg) over modest distances (1 to 25 km). As most of the transport burden is carried by women, their needs are particularly acute.

Intermediate Means of Transport (IMT) should be considered as a possible solution to the needs of small-holders. IMTs to service their typical loads could be powered by humans, animals or small engines. The optimum choice would depend on the particular combination of load and distance, in the context of their locality. Human devices include yokes, carts, barrows and bi/tricycles, with loads of up to 150 kg and

distances up to 120 km. The benefits of pedal power have probably been under-exploited in rural communities, particularly in East Africa.

Transport tasks can be facilitated by the use of pack animals and animals to pull carts or sledges. In relative terms, over a working day, animals can carry 12 to 30 % of their body weight and can pull 8 % to 14 % of their body weight.

The "transport gap" which exists between human porterage and pick-up trucks could be met by the greater development and use of IMTs. These, however, with their payloads of 10 to 100 kg at speeds of 10 to 90 km h^{-1}, are still unaffordable to most small-holders.

For IMTs to be adopted by small-holders, the technological and financial constraints must be overcome. The application of logistics, to reduce the transport demand, and the implementation of more favourable transport policies, with respect to infrastructural improvements, would help promote the use of IMTs for the benefit of small-holder production.

Technological issues which warrant research and development activities include analyses of:

- transport needs for people and goods;
- capabilities and requirements of various categories of IMT;
- design constraints imposed on IMTs by operational factors in different agricultural production systems.

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