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Viewpoint

Appropriate transport and rural development in Makete district, Tanzania

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Poor transport conditions are a substantial constraint on the increase of agricultural production in sub-Saharan Africa. Conventional rural transport projects, which focus exclusively on motorised transport, can only partly remove these restrictions. Therefore an appropriate transport approach is proposed, which also takes into account non-motorised transport. A field study in Makete District, Tanzania demonstrates that these interventions are at least as effective as rural road improvements.

Keywords: appropriate transport, intermediate means of transport, rural development, Tanzania

Introduction

Poor transport conditions are regarded as one of the main constraints on rural development in Sub-Saharan Africa. Since the 1940s the World Bank has spent more than $62 billion world-wide on over 1000 transport projects. Transport investments, comprising 13–16% of the World Bank's expenditure, were however exclusively used for the improvement of motorised transportation.

The focus of donors on 'roads and cars' has been criticised since the 1980s, because the transport needs of rural households, comprising two thirds of the population, are neglected. Chambers (1980) linked rural indigence firmly to lack of mobility in his paper entitled "Rural poverty unperceived". Edmonds and Relf (1987) conclude that plans, projects and existing policies in the transport sector do nothing or little for the rural poor. This group of 'transport disenfranchised' can be conservatively estimated at 700 million people world-wide. One of the main reasons is the low rate of motorisation, with an average in Sub-Saharan Africa of only 8 vehicles per 1000 inhabitants[1].

[1]UNCTADA II, The Republic of South Africa is excluded.

Transport constraints on rural households

A number of recent studies (Airey, 1992; Barth and Heidemann, 1987; Barwell, 1993; Barwell *et al*, 1985; Barwell and Dawson, 1993; Howe and Richards, 1984; Kaira, 1993; Riverson and Carapetis, 1991) show that the rural population of many less developed countries move mainly by walking on paths and trails away from the rural road network and undertake very few motorised trips. The majority of time and effort is spent on transport purposes which secure the household's subsistence needs. The Makete District in Tanzania serves as an example (Barwell and Malmberg-Calvo, 1989) An average household comprising five persons undertakes more than 1600 trips annually, which require more than 2500 hr (*Figure 1*). The procurement of energy and water, which is available in industrialised countries within a few seconds, requires annually more than 1000 hr. During one year an average household transports 85 t km. Two-thirds of the transport time is spent in and around the village and the biggest share of the transport burden is carried by women.

The effort, drudgery and high time requirements for transport purposes significantly hamper the growth of agricultural production. In labour intensive economies

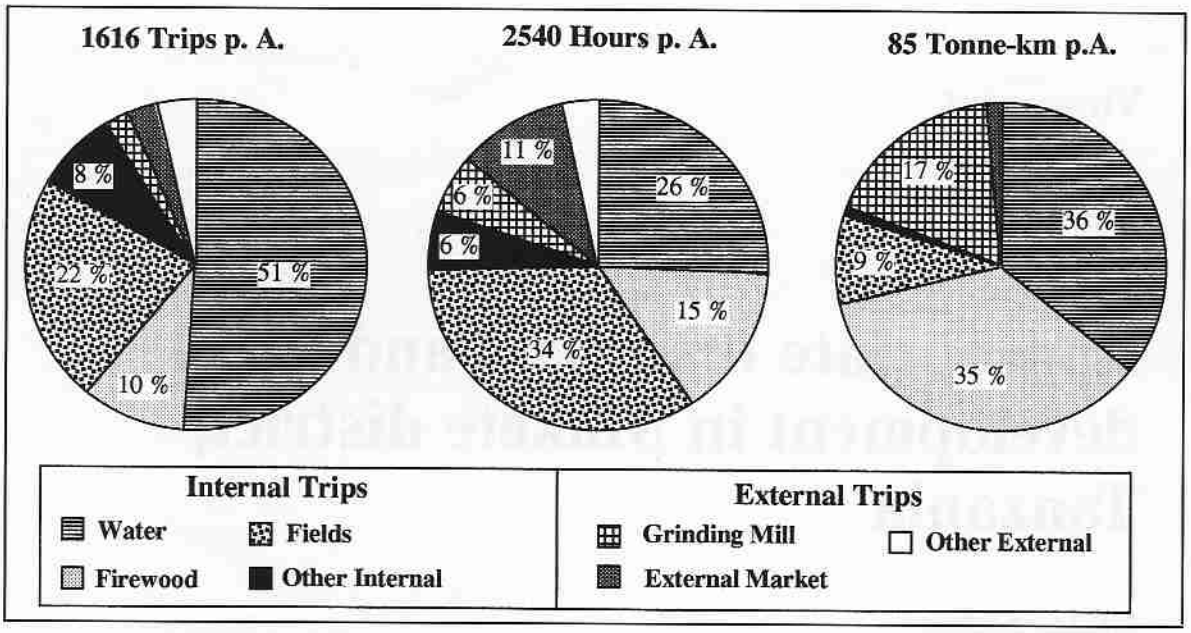

Figure 1 Transport activities in Makete District, Tanzania 1986-7.*Source*: adapted from Barwell and Malmberg-Calvo (1989).

this allocation of time is a drain on the household's labour resources. Time constraints may have severe negative impacts on productivity, especially during peak working periods, such as in the harvesting season. In Makete more time is spent on transport activities than on labour in the fields. Jennings (1992) (p. 29) reports that many women in the Makete District "indicated that they had additional shambas (fields) which they could cultivate if they had additional time". According to the International Food Policy Research Institute (Mellor, 1985) the lack of labour is the main reason for low agricultural production: "Africa's poor record on food production is largely due to labour constraints... These serve to reduce labour input into agriculture, slowing the expansion of area cultivated as well as the yields per acre."

Therefore, one of the main goals of rural transport projects should be to reduce the household's time requirements for transport purposes. Transport planning must be adapted to the needs and economic means of the rural population by:

- Promotion of affordable Intermediate Means of Transport (IMT) such as donkeys, bicycles, and wheelbarrows.
- Creation of a network of paths, trails and tracks, which can be used by IMT and which complement the existing road network.
- Using labour based, low cost construction and maintenance of transport infrastructure (Edmonds and van de Veen, 1993).
- Using transport avoiding measures to reduce trip length to public services and to sources of energy and water.

The Makete Integrated Rural Transport Project

The understanding that "Roads are not enough" (Barwell and Dawson, 1993) was the reason why the International Labour Office conducted an Integrated Rural Transport Project in Makete District, Tanzania. The district is located in the south west of Tanzania and stretches over a mountainous plateau containing mountains, hills, ridges, valleys and steep escarpments. The population lives mainly in scattered settlements and the average density amounts to 18 persons/km^2. The economy basically relies on subsistence agriculture. The agro-ecological conditions are favourable for the rainfed cultivation of crops from tropical and moderate climates. The latter are traded with the hot lowlands. The salient feature of the regional development is the shift from subsistence economy towards market orientation. However, in 1994 still less than half of the products harvested were marketed which generated annual revenues of $80 per household.

The project aimed to reduce the transport burden of rural households (Strandberg, 1993). Low-cost roads and tracks were constructed and improved with unpaid self-help labour, IMT were developed and promoted and a number of transport avoiding measures introduced. Before the project started and at its termination a survey of the transport and production activities of rural households was conducted. In 1986 and 1987 a survey conducted by Barwell and Malmberg-Calvo (1989) questioned rural households about their household endowment, expenditure, transport behaviour, agricultural production and marketing. In 1994 this survey (Sieber, 1996) was conducted in a similar way in order to appraise the socio–economic changes by

comparing the evaluated data with the previous studies. Two hundred and forty eight households in eight villages in Makete District were interviewed: 171 households belonged to a 10% random sample of households in the villages and 77 households were interviewed, because they possessed a donkey, bicycle or wheelbarrow. In addition, the traffic was counted on improved footpaths and roads.

The data base allows a detailed analysis of the impacts of the various transport interventions at the household level. Most effects can be assessed by comparing the changes in a village with transport improvements to the changes in a control group of villages without any transport improvements. The impacts of IMT are estimated by comparing households with a similar household structure in the two types of villages.

Time savings

One of the salient effects is time savings, which are an indicator of the reduction of the transport burden. *Figure 2* shows the changes in the time budget of an average household benefiting from transport improvement. The biggest effects can be achieved by the installation of water supply systems followed by the use of bicycles and donkeys. While it is mainly women who benefit from the first intervention, the bicycle reduces the time consumption predominantly for men. Women benefit more from the introduction of grinding mills and the use of donkeys. Feeder roads also significantly reduce the time taken by women for crop marketing.

Monetary benefits and cost efficiency

Figure 3 lists the total monetary benefits, which are made up of the monetarised time values[2], the increase in marketing, the salaries earned by the project implementation and other sources of income like hiring of vehicles and lending of donkeys. The biggest monetary benefits are generated by *donkeys* and *bicycles*. The survey found that both have very strong impacts on the market production as they enable the farmers to cultivate bigger fields and use more fertiliser. Donkey-households are marketing twice as much, and bicycle-households two-fifths more than comparable non-IMT households. The purchase of an IMT changes

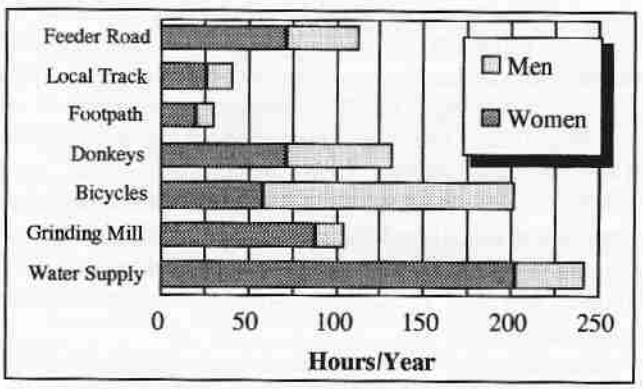

Figure 2 Annual time saved per household.

[2]Time savings are valued with the opportunity cost of time: The marginal productivity of labour was derived from a production function, estimated by multiple regression.

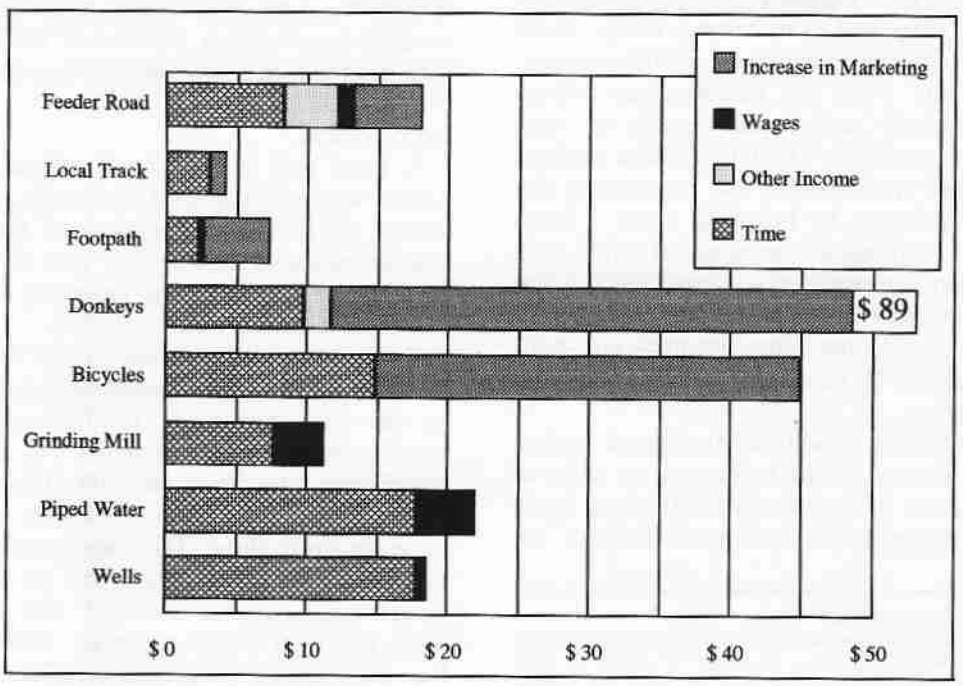

Figure 3 Average monetary benefits per household.

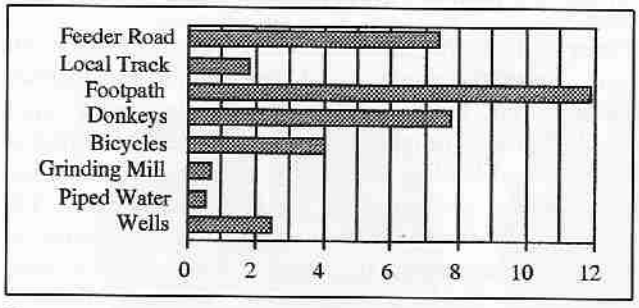

Figure 4 Benefit/cost ratio.

the productivity of the household from decreasing to increasing returns to scale. Donkeys are mainly used for the transport of products from the field, while bicycles transport fertiliser and grain to the grinding mills and reduce isolation by generating more trips outside the village. The latter reduces the isolation of the household. The main restriction on the purchase of IMT are the relative high procurement costs, and 80–90% of the households desiring an IMT stated that they could not afford the price, which amounts to the annual marketing revenues. The benefit/cost ratio, plotted in *Figure 4*, ranges between four (bicycles) and eight (donkeys).

The benefits of the *feeder road* consist of time savings (46%), marketing increases (27%), income by hired vehicles (21%) and income by project employment (6%)[3]. The benefits from road improvements are distributed unequally among the survey villages. Two survey villages with the best road access could not take advantage of the improved marketing possibilities. In the first village which was a traditional source for migrant labour, the rural exodus increased and agricultural production stagnated. The second village could not compensate for the breakdown of the regional pyrethrum market, while a neighbouring village performed surprisingly well, even though its road access strongly deteriorated. The latter village profited from its traditional trading links and transported the whole market production by headload down a steep escarpment. The strongest impacts of the road improvements were registered in a village, which is too far away from the market to undertake daily return trips and where heavy, low value products are cultivated. Here transport by headload would be too time consuming and tiring.

Agro-ecological frame conditions, traditional trading links and walking access to the markets seem to be as important for market integration as road access. Many inhabitants of villages within walking distance of the market prefer to carry a big portion of their goods by headload to the market in order to profit from price arbitrage. This is even the case when a good road access exists. The feeder road has a high benefit/cost ratio (*Figure 4*). The main reason is the low cost of road rehabilitation with high labour- and low machinery-input. If the costs of commercial capital based road construction projects in Tanzania were applied the benefit/cost ratio of the feeder road would decrease to two!

The cheapest transport intervention was the improvement of a *footpath* leading down a steep escarpment to a regional market. Particularly during the rainy season, when the paths become as slippery as soft soap, travelling is a dangerous undertaking and more often than not these paths are avoided. Obstacles like rivers, marshes and invading vegetation force the travellers to walk big detours. The project trained gang leaders and foremen to conduct simple improvements on the path, such as building wooden bridges and staircases, digging small ditches for drainage, constructing timber guard barriers and winding the path on steep slopes. The local population gave very positive feedback on the impacts of the improvements — travel is much faster and safer, bigger loads can be carried and one third of the households are able to reach new places. The latter statement must not be underestimated because the path improvement is an appropriate measure to reduce rural isolation. Agricultural production in the catchment area increased more strongly than in the comparable villages. The number of pedestrians using the path to the market is higher than that of passengers using the feeder road mentioned above. A considerable amount of traffic was generated by the footpath improvement. The absolute benefits from the improvement are nevertheless quite small, because the catchment area has a 'traditional' low market orientation. However, the low construction costs attribute the highest benefit–cost ratio to the footpath improvement.

A local trail connecting a village with the ward centre was widened to a *motorable track*. While the village representatives emphasised the large benefits due to increased health care and the appearance of traders in the village, the monetary benefits and the benefit/cost ratio are relatively low.

Transport avoiding measures like the installation of *water supply* and *grinding mills* have a significant impact on the time budget of rural households and thus generate high monetary benefits. The high costs yield a benefit/cost ratio lower than one (*Figure 4*). If low cost wells instead of expensive pipes are chosen the ratio increases up to three. The non-monetary benefits from the improved water supply due to enhanced health conditions cannot be assessed. The fact that households use their scarce monetary resources to pay the fees for grinding shows that benefits other than transport time savings must be taken into account.

[3]The direct income effects are high, because a labour based construction technology was chosen. Compared to capital based technology the labour based approach increases the share of wages on total expenditure, reduces the financial costs and the need for foreign exchange.

Conclusions

The improvement of footpaths can be a very efficient and cheap measure to stimulate the marketing of produce from primarily subsistence oriented villages within walking distance of regional markets. If the distance to the market is longer than half a day's walk than motorised access is a necessary precondition for regional market integration, but it does not automatically stimulate the development process. Increased marketing entails the growth of production and market related transport tasks; in this phase the purchase of IMT can induce another sharp increase in agricultural production. The strong effects and the high benefit/cost ratio warrant the promotion of IMT. Traffic avoiding measures can only be economically justified if they are low cost interventions. Other non-transport effects, such as health improvements, are probably larger than transport related benefits. Comparing the absolute effects and the cost efficiency it can be safely stated that non-motorised transport interventions have the same magnitude of impact as interventions in the motorised sector.

There is no economic reason why donors and governments spend large amounts of money on roads, and very little on non-motorised transport improvements. The eurocentric focus on motorised transport does not reflect the production constraints of African rural households. The improvement of the local transport system in and around the village can set forces free which stimulate economic development. Reduced effort and drudgery in transport, decreasing time constraints, and better access to public facilities and markets will most probably entail an expansion of agricultural production. IMT can increase agricultural productivity, reduce rural isolation and thus raise the acceptance of agricultural innovations. Transport improvement for rural households is an important precondition for a dynamic rural development process.

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