

7 Summary

There is no doubt that transport infrastructure is essential for the development of rural areas in Sub-Saharan Africa. Consequently for a long time economic theory emphasised the positive role of transport infrastructure investments in the development process. This optimism faded away in the 1960s when empirical studies showed up the permissive character of transport investments. Infrastructure has henceforth been regarded as necessary, but not sufficient precondition for economic growth. Negative impacts might occur if formerly protected markets are exposed to international competition, if increasing human activity entails environmental degradation or if out-migration is stimulated by better access. The "New Growth Theory" inflamed again the discussion about the macroeconomic role of transport in the process of economic development.

This study contributes to the discussion from the regional perspective by assessing the impacts of a pilot project in the Makete District (Tanzania). For the first time a variety of integrated transport interventions were implemented. Two comprehensive household surveys before and at the end of the project form the basis for the assessment of the interventions. The results of the field study are used to calibrate an econometric model with a systems dynamics approach, which is meant to give more insights into the interrelations of the observed effects.

The empirical evidence in the Makete District shows, that **Road and Track Construction** entailed mainly positive effects, which are often emphatically affirmed by the rural population. Roads can stimulate agricultural production and save time which would have been used for the transport of crops to local markets. But the effects of roads are very much dependent on the existing local conditions. For example 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 the agricultural production stagnated. The second village could not compensate for the breakdown of the regional pyrethrum market, while a neighbouring village with a worsening road access performed surprisingly well. The latter village profited from its traditional trading links and transported the whole market production on headload down a steep escarpment. The strongest impacts of the road investment 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.

Agroecological and historical frame conditions very much seem to determine the effects of rural road investments. In order to reduce the unreliabilities of ex-ante-assessments, a risk reducing strategy should be applied: build as cheaply and extensively as possible. Further investments can be warranted later for the

'successful' roads, if farmers increase production and administrators show their ability to maintain the infrastructure. The construction and maintenance of rural roads would be most favourably undertaken with labour based construction technologies, because project funds and foreign currency are saved and local employment is created.

But roads are not enough! Even a good road access does not enable households in Makete to undertake more than two motorised trips per year¹. Rural households walk the overwhelming majority of the remaining 1860 trips, mainly for water and firewood collection and to the fields. Most of the rural transport activities take place in and around the villages on paths and trails. Women carry the greatest share of the loads on their heads which accumulate to considerable transport burdens in terms of tons, tkm and time. Not only the effort and drudgery of the transport activities, but also the time constraints especially during peak labour periods hamper the growth of agricultural production. A rural development strategy must take into account that expanding agricultural production entails growing transport activities to the fields and to markets, which increase existing transport problems. Road investments only influence the transport of goods to the markets, but the bulk of the household's transport burden does not change. An integrated transport approach is more appropriate to stimulate rural development. This approach takes into account

- the improvement of infrastructure, including roads, tracks and paths,
- the supply of conveyances available, including motor vehicles and Intermediate Means of Transport (IMT),
- the implementation of transport avoiding measures, e.g. water supply, woodlots, low consumption stoves,
- and the provision of transport services like bus-services, the location of motorised and non-motorised vehicles.

The field study and the system-model demonstrate that non-motorised transport interventions generate the same magnitude of effects as road investments.

The cheapest transport intervention was the improvement of a **Footpath** with regional importance leading down a steep escarpment to a regional market. Gang leaders and foremen were trained to conduct simple improvements on the path such as building wooden bridges and stairs, digging small ditches for drainage, constructing timber guard barriers and winding the path on steep slopes. The local population gave very positive feedback regarding the effects of the improvements; travel is much faster and safer, bigger loads can be carried and one third of the households is 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

¹ In the village with the best motorised access two trips per year are registered, while in the most remote village less than half a trip can be observed.

increased more strongly than in the remaining villages. The number of pedestrians using the path to reach a regional 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. But the low construction costs attribute a relatively high benefit-cost-ratio to the footpath improvement.

Both the field study and the model show that in an initial phase, when the economy is exclusively relying on subsistence production and barter, a footpath improvement can give stimulus to regional development especially if 'traditional' trading links are ameliorated. Low costs and high efficiency favour this transport investment. The impact of a footpath is limited because the catchment area is restrained to half a day's walking distance. Therefore peripheral regions will hardly be affected at all by the improvement of footpaths before a road opens up the area. Footpath improvement might be the initial stimulus for a growth process if a village lies within walking distance from a road and if light high-value-crops can be produced.

Transport restrictions occur if agricultural production grows and bigger weights have to be transported. Road construction can only solve the problem of market related transport, but not that of transporting the harvested crops to the collection points. In this case **Intermediate Means of Transport (IMT)** can reduce the transport bottlenecks by more sizeable carrying capacities and a faster speed. The IMT have strong impacts on the welfare of their owners in that they enable the farmers to cultivate bigger fields and use more fertiliser, which gives rise to much higher production and income. The purchase of an IMT changes the productivity of the household from decreasing to increasing returns to scale. In Makete donkeys have more important effects than bicycles and wheelbarrows. Donkeys are mainly used to transport agricultural products and farm inputs, while bicycles mainly carry persons on external trips to markets, health facilities and grinding mills. The latter reduce the isolation of the households by enabling them to undertake more external trips.

The IMT were exclusively owned by men and thus not used for the female tasks of water and firewood collection. IMT-possessing households are comparatively wealthier and have higher productivity than non-IMT households. It could not be clarified if the purchase of an IMT was the reason or the consequence. Further research is therefore necessary in this field.

If these IMT are so effective, why are they not purchased? The reason for this is that the IMT are too expensive to be bought by households which primarily rely on subsistence production. In Makete a household had to spend its total annual marketing revenue to purchase a donkey or a bicycle. The model demonstrates that a revolving credit fund for the purchase of IMT in combination with a feeder road entails the biggest production and income

increases. Even if a real interest rate² of 12 % is levied, the growth in income will more than compensate for the household's debt service. A credit system has the advantage that the decision about the viability is left to the farmer, who probably can estimate the future benefits better than a planner.

The credit fund would be sustainable even if a repayment quota of only 80 % is assumed. The Grameen Bank in Bangladesh demonstrates how an efficient credit system can be organised on the basis of rural saving groups with a much higher payment-moral. Since the effects of IMT would most probable be stronger if possessed by women, the credits should be primarily distributed to female saving clubs, like the West African "Tontine".

Box 7: Empowerment of Women in India

The Total Literacy Scheme has the aim of empowering women in Pudukkottai District, Tamil Nadu, India. Because mobility is one of the five pillars of the programme a revolving credit fund for 1,500 ladies bicycles was installed. The empowering impact of the scheme can perhaps be best gauged by one of the songs they sing while riding their bicycles:

We have learned to ride the cycle sister,
We have set in motion the wheels of life sister.
We no longer beg our men
To visit the hospital in times of need.
Once confined to the kitchen,
Now round the world we go with speed.

Nitya RAO, University of East Anglia, Norwich, in: International Forum for Rural Transport and Development, Forum News Vol. 2, Issue 3, September 1994

The female transport burden can also be reduced if **Transport Avoiding Measures** are undertaken. Women have to walk long distances to reach the sources of water and firewood or to carry their grains to the next grinding mill. The effects of a piped water supply and repaired grinding mills were observed in Makete. Even though after the installation of a piped water system the consumption of water increased, the total transport time per household decreased considerably. Grinding mills have a smaller impact, because less trips are annually undertaken. The benefit-cost efficiency for both interventions is low, because the investment costs are relatively high. These costs can be reduced if wells instead of expensive water pipes are installed. Other non-transport effects like improved health situation and reduced drudgery for hand-grinding occur. Woodlots and low consumption stoves would most probably entail the same magnitude of transport time reductions but cause a higher cost efficiency. Theo-

² Nominal interest rate minus consumer price increase (inflation rate).

retical deliberations show, that time savings will probably be used either for direct productive activities or to increase the welfare of the household e.g. by better child care or cooking. The model demonstrates that production and income effects of transport avoiding measures remain below the impacts of IMT.

The Sub-Saharan rural roads are in a bad condition due to lack of maintenance caused by institutional and financial constraints. Diseconomies occur, because every Dollar saved on road maintenance entails a three dollar increase in Vehicle Operating Costs. World Bank reforms include the implementation of independent road agencies under the control of a board of directors including private and public representatives. One of its main features is the financial independence of these agencies including the right to collect their own revenues. The construction of new infrastructure is difficult to finance in consideration of the constraints on African public budgets. The levy of user charges on new roads can be an adequate solution. The model shows that a 30 km feeder road, which gives access to a region with 20,000 inhabitants, can be financed entirely by road pricing under the following conditions:

- only the regional centre is connected with the external market,
- a low-cost-road is constructed using labour based technology,
- the investments are financed by international credit (real interest rate 8 %),
- road charges are used to pay the debt service and maintenance expenditures,
- the road charges are designed in such a way that after 20 years the debt is completely extinguished.

It can be assumed that traders deduct the road user charges from the producer prices they pay to the farmers. The model estimates that the charges reduce the disposable income of the farmers by 4 %. This amount seems to be a reasonable price to pay for an external access, which enables the farmers to export their products. If all villages in the region receive motorised access, then 138 km of motorable tracks would have to be constructed next to the feeder road. Even with a low cost-construction, the necessary user-charges would leave no extra benefits to the farmers. Thus in an initial stage of development the implementation of motorised access to all villages cannot be recommended.

The system model also shows, that the timely scheduling of different transport interventions is the most favourable scenario. In an initial period, when the economy is predominantly relying on subsistence, the improvement of footpaths to local markets and the promotion of IMT can be the starting point for economic development. When transport loads to markets grow, the construction of a low cost road access to the regional centre can improve the evacuation of crops. Road user charges contribute to the redemption of the debt and a decade after the road construction sufficient funds will be collected to finance local tracks to all villages. After two decades enough money can be raised to pay even expensive transport avoiding measures.

Why have these often inexpensive and efficient measures not been implemented by communities or districts? On the communal level the lack of decision competence, scarce funds and little local initiative can be suggested. On the district and national level the awareness about integrated transport planning is often low, while the international donors mostly favour the 'road and car' approach.

An integrated transport approach necessitates the development of new assessment methodologies for all types of the rural transport interventions described above. Future production increases and time savings are the main benefits which have to be assessed on the basis of household and road surveys. Several problems occur, which cannot be solved satisfactorily today: how can the future motorised transport be predicted? How can reductions in transport time be monetarised? How can the improved safety and health situations be included in the valuations? Which evaluation methodology is inexpensive and simple enough to be used by local decision makers? Future research is warranted in this field as well.

The Makete Project also demonstrates that the involvement of the local population in planning and construction is a step towards sustainability. The project components with strongly individual or communal interests were most successful. Ex-ante-evaluations should therefore appraise local needs e.g. the demand for IMT, as well as the willingness to give their own contribution to the project and the ability to adequately maintain the infrastructure.

The economic and social development of rural areas in Sub-Saharan Africa remains one of the most important tasks for the decades to come. In most rural areas labour intensive shifting cultivation is practised using hoes, little fertiliser and practically no improved seeds. In addition transport activities are very time consuming and therefore hamper the growth of production. A eurocentric transport approach, which focuses exclusively on motorised transport, does not reflect the production constraints of African rural households. This study demonstrates that the improvement of the local transport system in and around the village can free up forces 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. Intermediate Means of Transport can increase agricultural productivity, reduce rural isolation and thus raise the acceptance of agricultural innovations. A productivity increase due to the use of ploughs, fertiliser and improved seeds is the next step towards a modern agricultural system. Growing rural incomes will lead to an expansion in the demand for consumer goods and thus create non-agricultural employment in commerce and in small scale industries. Transport improvement for rural households is an important precondition

for this dynamic process, which can be the basis for the development of the whole national economy.

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