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COSTS AND BENEFITS OF INVESTMENT IN  
TRANSPORT IN EAST AFRICA

I. Introduction.

The purpose of this project will be to devise ways of estimating the costs and benefits of possible capital investments within East Africa to aid in the planning of an integrated transport system. The scope of the project will be limited by the following considerations:

- (1) The project will consider only possible expansions of road and rail transport facilities, although the effects of such projects on water and air transport will be considered.
- (2) Emphasis will be placed on improvements of trunk roads rather than feeder roads and on investment in new railroad main lines and branch lines.
- (3) The net benefits of investment in transport facilities will not be compared with alternative investments in other sectors. I will consider, however, the possibility of investing in projects which might reduce the need for transport facilities.

The above terms of reference for the project are fluid and may be altered as the result of suggestions from the staff of the EDRP and from government officials or as the availability of data may require.

In this working paper, I will discuss some of the conceptual difficulties of measuring costs and benefits, assuming that the transport system as it exists and as it would be after improvements were made is rational in the sense that prices of all goods reflect the relative scarcity of resources and the relative wants of consumers (given a distribution of income), that the costs of transport facilities are assessed in such a way that those who benefit are those who pay, and that the distribution of goods by the transport system is done in such a way that transport costs are minimized. Although I call a transport system exhibiting these characteristics a rational system, this does not necessarily imply that a rational system is the best in some sense. Any deviation from such a system, however, may involve costs, and it is important to determine what these costs might be. Thus I will discuss possible irrationalities in the transport system of East Africa. Then I will consider some of the problems in the measurement of costs and benefits given the limited availability of data.

II. The Cost of an Investment in Transport Facilities.

For convenience, the costs of an improvement in transport facilities can be divided into five parts:

- (1) The initial investment cost of providing new or improved roads or rail lines.
- (2) Possibly an increase in maintenance costs, although frequently an investment in road transport may give rise to a reduction in maintenance costs in which case it must be considered a benefit, (For example, a bituminized road is less costly to maintain than a heavily traveled gravel road.)
- (3) The costs of providing additional rolling stock in the case of railroads or additional motor vehicles in the case of road transport.

- (4) The additional administrative overhead costs,
- (5) The variable costs of additional transport such as fuel and labor costs.
- (6) The interest on any capital expenditures.

In the case of road transport in East Africa, the initial costs of investment, road maintenance costs, and part of the administrative overhead costs are borne by the respective governments of the three territories. In the case of rail transport, all costs are borne initially by the East African Railways and Harbours Administration, an autonomous, self-financing unit of the East African Common Services Organization. In a rational transport system, the price paid by the final user of road transport ought to equal the marginal cost of providing the last unit of transport. Many of the costs above, however, are not marginal in the sense that for certain ranges of output, they remain fixed, i.e., they occur in a discrete fashion. In order to build a road or rail line between points A and B, it requires an investment which is equal to building a road or rail line of minimum standards. It is possible, however, to achieve greater variability than might be supposed in the case of road construction, for example, by considering alternative surfaces and alternative grade and curvature requirements. Maintenance costs are not strictly variable and neither are interest and administrative overhead costs. The cost of providing rolling stock only varies when capacity is reached. Thus a marginal cost pricing procedure may not always cover all these overhead costs (although if marginal cost is rising, part of the overhead may be recovered). To the extent that there are non-monetary benefits accruing to the population at large, part of these overhead costs may justifiably be recovered by general taxation. There is an abundant literature on the subject of recovering costs of public projects and many solutions have been proposed. Among them are pricing above marginal cost, or average cost pricing, discriminatory pricing, and various two-part pricing schemes. In any case, let us assume that the problem of cost allocation is solved and that the full cost of a program can be recovered in an equitable fashion in the form of charges to final users or in the form of tax levies.

Once the problem of allocating costs has been solved, one can then attempt to calculate the net benefits of any investment in transport facilities. Once costs have been distributed, the private costs of transport along any link in the transport network may be altered. Unless there are net non-monetary returns an improvement in transport facilities must result in the lowering of costs along at least one link if there are to be positive net benefits. The reduction of costs along any link may take several forms:

- (1) It can mean a reduction in the price paid per ton-mile for a final uses of transport facilities.
- (2) It may take the form of a reduction in the time required to travel between any two points. This saves a deterioration of perishable goods and saves capital in the sense that goods in transport may be regarded as goods in inventory.
- (3) It may mean a reduction in transshipment costs which can be a large item if the goods being transported are breakable or bulky.
- (4) It may mean a reduction in uncertainty because good roads, for example, increase the expectation of shipments arriving on time.

III. Net Present Benefits of an Investment in  
Transport Facilities.

For those links in the transport network for which transport costs are lowered there are net benefits. For those links where transport costs are raised, there are net losses. The total net benefits is the sum of the net benefits along all routes for which costs are lowered less the net loss for all routes along which transport costs are raised. The net present benefits for any particular link may be classified into six categories:

- (1) The lowering of transport costs per unit along a particular route  $\times$  times the existing traffic.
- (2) The lowering of transport costs per unit along a particular route may result in diversion of traffic from other routes. The benefits of traffic diversion cannot be measured in the same way as the benefits arising from the reduction in transport costs of existing traffic. The reason is that if the cost becomes lower along a particular route, traffic will be diverted from other routes if thereby there is any difference in traffic costs. Some traffic will save the full difference in costs, other traffic will save half the difference and some traffic will save very little. A rough approximation of such benefits is  $\frac{1}{2}$  times the change in transport cost per unit.
- (3) The lowering of transport cost along a particular route will have the immediate effect of a lower price for any commodity which is transported to a particular location. This means that the quantity demanded will increase and net result will be an increase in short run equilibrium output, the extent of which is determined by the elasticities of short run supply and demand for each commodities which has been transported or would now be transported with the reduction in transport costs. Here again we must not make the mistake of evaluating the benefits by multiplying the trade created in this manner by the reduction in transport cost. A reduction of transport costs by half the amount might bring forth only half the additional trade. A rough approximation may be made by multiplying the trade created by one half the reduction in transport costs per unit.

- (4) We can assume that there will be a secular growth in trade along any particular route which would occur as the result of improvements in the general level of income and would occur regardless of a decision to lower transport costs. Each unit of such additional traffic will save an amount which is equivalent to the reduction in transport costs. Of course, such future benefits ought to be discounted by an approximate rate of interest.
- (5) One might assume also that the secular growth in traffic will be that much greater because of the reduction in transport costs. Here again we must discount in the same manner as in (4).
- (6) In addition to the above benefits, one ought to mention the non-monetary benefits of the improvement of any link in a transport network. These include such things as reduced accident rates, improved communications and more efficient political administration. On the other hand, improving a road surface may increase the accident rate in which case this must be considered a cost.

The net loss resulting from a rise in transport costs may be calculated in an analogous fashion.

In the determination of the benefits of improvements in transport, there may be a problem of interaction. That is, the benefit which might result from one project may be influenced, adversely or positively, by the completion of another project. There is the possibility that the sum of the benefits from any two projects individually is not equivalent to the benefits which would accrue if both projects were completed together. For example, if a road between points A and B is completed, the benefits may be greater than the sum of the benefits which would be obtained by completing the road from A to C and the road from C to B where C is a point in between A and B. On the other hand, if there are alternative routes between A and B the benefits by completing both routes might be less than the sum of the benefits which would occur if one route and the other were completed individually.

One must not neglect the possibility that investment in projects which would reduce the need of road transport may be more beneficial than improvements in transport. For example it might pay to locate consumers industries close to the source of consumption and agricultural processing industries close to the source of supply. There is also the alternative of supplying storage facilities for agricultural products which give rise to seasonal demands for transports.

#### IV. Rationalization of East African Transport.

As we mentioned above, the determination of net benefits is based on the assumption that prices of all commodities reflect their relative scarcity, costs of transport facilities are allocated in such a way that they are imposed upon those who benefit, and the transport system is organized so that the costs of distributing goods by the system is minimized. Such a system is rational. A system may not be rational, however, because it is impossible to determine correctly those who will benefit from an improvement in transport facilities; because it is administratively impossible to assess those who benefit; because of a political decision to provide incentives for social change or for encouraging certain types of activity; or because of imperfections in market behavior due to lack of information, to lack of foresight, to exploitation, to discrimination, or to the power of vested interests.

Several writers have already considered such possible divergences from a rational system. For example, the effects of the system of licensing road transport haulers in Kenya and Tanganyika are frequently discussed. Essentially, there are three reasons for this kind of restriction of road transport:

- (1) To correct a situation where road hauling industry is characterized by chronic over-optimistic expectations of profits with the result that there is chronic excess capacity and losses incurred by road haulers,
- (2) To protect the railways,
- (3) To enforce safety standards in order to reduce accident rates.

With regard to the

"On the main long-distance routes the road transport industry still shows abundantly the disorderly features of a growing, but, as yet, uncoordinated system... The mission suggests the position taken by the Licensing Authority that the full-time long-distance haulers should be protected by limiting the numbers of licenses issued to public carriers along a determined route".<sup>1</sup>

Implicit in this statement is the assumption that it is the large, full-time, long distance operators which have the lowest costs. The mission to Tanganyika, however, does not back up its position with any concrete facts. The IBRD missions to Kenya and Uganda take an opposite point of view.<sup>2</sup>

The mission to Kenya and Uganda likewise base their assertions on little fact and assert their positions in a dogmatic fashion, maintaining that competition is best and restrictions are bad. A more cogent argument which maintains that the first reason given above is invalid is given by E.K. Hawkins.<sup>3</sup> Hawkins argues that if the argument were valid, then one would expect to find fluctuating and instable road rates, but this does not seem to be the case in Uganda at least. Hawkins also asserts that entry is not as easy as one might think. "The cost of a vehicle, even second-hand, is relatively heavy in relation to the average level of income in Uganda". On the other hand, Hawkins fails to take notice of an earlier conclusion of his vehicle might lead to an opposite conclusion. In analyzing the results of a sample traffic survey, Hawkins notes earlier that "70-80 per cent of the vehicles were not being utilized to the fullest extent. The freight moved could have been carried by a third or a quarter of the vehicles actually in use (if this could have been arranged). Such a situation has consequences for all branches of transport policy..."<sup>4</sup> A. Hazlewood takes a mixed view, praising Hawkins' argument and mentioning the additional fact that hire-purchase arrangements have become more difficult and thus tend to restrict entry. Hazlewood adds, however, that a transport licensing system could be justified if it were used to encourage and protect African entrepreneurs so that they might develop their abilities.<sup>5</sup>

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1. Pp. 280-281.
  2. The Economic Development of Kenya, Baltimore, Johns Hopkins Press, 1963, p. 191 and The Economic Development of Uganda, Baltimore, Johns Hopkins Press, 1962, p. 322.
  3. An Economic Study of Roads and Road Transport in Uganda. A Study Prepared for the Government of Uganda, 1959, p. 131.
  4. Op. cit., p. 54
  5. A. Hazlewood, Road and Rail in East Africa, 1963 (unpublished), Appendix II.

A more sophisticated version of the second argument above for the licensing of road transport is based on the fact that the East African Railways and Harbours is given a mandate that: "so far as it is not inconsistent therewith or with the principles of prudent finance, cheap transport shall be provided by the Administration to assist agriculture, mining, and industrial development in the Territories<sup>6</sup>. It is claimed that the effect of increasing road competition is such as to make it impossible for the railways to subsidize certain traffics for development purposes and at the same time remain financially solvent.

The only way financial solvency can be maintained is to tax some traffic (charge above cost) in order to subsidize others. The existence of road transport as an alternative for those goods which are taxed makes it impossible to collect such taxes. Thus road transport licensing can be viewed as a method of collecting taxes to subsidize certain goods by limiting the access of taxed goods to road transport facilities.<sup>7</sup> Hazlewood disputes the validity of this argument on several grounds:

- (1) The EARH is not free to set rates but must submit all rate changes to a ministerial committee called the Transport Advisory Council for review. This limits the ability of the administration to charge rates which reflect costs and to meet road competition by pricing at marginal cost..
- (2) Certain goods which are thought to be subsidized are not in fact subsidized upon close examination of the tariff structure. For example, on the basis of certain calculations, Hazlewood shows that coffee, cotton, tea, lead, and copper are taxed and not subsidized.<sup>8</sup>
- (3) Rail charges are not related to costs. The "taper" does not reflect decreasing costs with distance<sup>9</sup> and certain goods are subsidized which are not usually thought to be subsidized.<sup>10</sup>
- (4) Certain commodities which are transported in bulk over long distances could be taxed because the advantages of rail transport far outweigh those of road transport.
- (5) Road transport is not now paying its fair share of costs. In the case of Uganda this assertion is based on some calculations by Hawkins (op.cit. pp.200-207) which show that the revenues obtained by license fees on road vehicles and duties on road vehicles petrol, lubricating oil, tires, tubes, and spare parts more than covers recurrent expenditures on roads but that only a small fraction of the interest on capital expenditures is recovered in this way. The IBRD mission report on Kenya also maintains that "At present revenues - which are derived from fees for driver's and vehicle licenses and from some gasoline and diesel fuel taxes - are barely sufficient to cover recurrent expenditures, with no surplus available for capital expenditures". (p.186).

Hazlewood proposes a solution to the problem of a rationalization of road and rail transport. He suggests:

- (1) A rail tariff based on costs,

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9. Op. cit. Chapter VI, p.3.

10. Op. cit.



- (2) Subsidization of certain traffic for developmental purposes.
- (3) Freedom in rate setting for the railways.
- (4) The losses which might be incurred by subsidization should be made up by taxing coffee and Bulk Oil traffics.
- (5) Taxation on road transport should be reviewed on the basis of benefit principles.
- (6) The traffic in Bulk Oil should be assured to the railway by prohibiting its movement between main centers by road.
- (7) Road transport licensing should be abandoned.

If, however, there is an abandonment of the principle that railroads should pay for themselves, Hazlewood recommends that a Transport Authority for East Africa be set up to provide direct subsidies to those goods which are to be subsidized by increasing rail rates and petrol taxes by an amount sufficient to provide the subsidies. If the railroad should run a deficit it would be financed by the Transport Authority.<sup>11</sup>

The IBRD missions to Kenya and Uganda make recommendations similar to (3) and (5) above on essentially the same grounds as Hazlewood.

Evidence of another example of a departure from a rational system is given by Hawkins where he suggests the existence of discrimination in road transport in Uganda. The road transport industry in Uganda is dominated by European and Asian road haulers. The rates charged by African road haulers tend to be below the others, usually larger road haulers. Hawkins suggests that African haulers must cut their margins in order to capture any part of a market where the users of road transport are mainly Asians and Europeans themselves who tend to deal with Asian and European road haulers by habit or custom.<sup>12</sup>

Hawkins also claims that the policies of the Lint Marketing Board in Uganda encourage an uneconomical use of the road transport system.<sup>13</sup> The transport of cotton from the field to the ginneries is performed by the ginners themselves. The ginners are reimbursed by the Lint Marketing Board for this transport on a cost plus basis. Not only does this tend to equalize the price paid to the grower, regardless of his location relative to the ginnery, but the

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11. Hazlewood, op. cit., Chapter IX

12. Hawkins, op. cit. p.86.

13. pp. 82-83.

cost plus basis for reimbursement encourages an uneconomic utilization of the lorries used in this transport.

Another problem arises from the fact that while the roads of Kenya, Uganda, and Tanganyika are maintained by the respective territories, vehicles licensed by one of the territories may operate on the roads of the other. Likewise foreign vehicles may operate on the roads of the three territories. Since foreign vehicles and vehicles of other territories do not pay the same taxes as local vehicles they may therefore be at an advantage relative to local road haulers. There is a history of concern in Uganda for the effects of foreign vehicles. Hawkins, however, as the result of his traffic survey has shown that there is reason to believe the number of foreign vehicles is only a very small proportion of the total vehicles on the road.<sup>14</sup>

In this section I have considered a few of the problems of rationalization of transport in East Africa. I intend to consider these and other problems in more detail in later reports.

#### V. Problems in Measurement.

The possibility of an accurate measurements of net benefit depends on the availability and the accuracy of various statistics. Vehicle registration statistics by type of vehicle (omnibus, commercial vehicle, saloon, motor cycle, and bicycle) are obtainable from the Registrar of Motor Vehicles in the respective territories. The registration information is kept on punched cards at the Registrars of Motor Vehicles in Kampala, and I hope to be able to extract further information from these cards.

For example, it would be useful to know the registration of commercial vehicles and omnibuses by net weight and maximum loaded weight.

All three territories conduct traffic counts both by manual and automatically operated counters. For Uganda, the information on traffic counts is available in the P.W.D. reports until 1961. Later data on Uganda and the other territories must be obtained through the Ministry of Works. The data on traffic counts - especially those obtained by manual counts - is likely to be unreliable for obvious reasons. Ideally, the traffic count data could be used to obtain estimates of vehicle miles travelled on various routes. In fact, however, the traffic counts tend to be taken close to urban centers and would result in an upward bias of estimates of vehicle-miles. The only way vehicle-miles can be estimated with any degree of accuracy is to use a random location of traffic counters which is, of course, not the case.

Hopefully, rail traffic on various routes on a ton-mile basis by commodity can be obtained from the East African Railways and Harbours. In addition it would be useful to obtain data on origin and destination and the rate of utilization of rolling stock. In the case of road transport, this kind of data is very difficult to obtain.

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14. Op. cit. .pp. 71-75.

It might be possible to obtain the data from the large transport firms but road transport in East Africa is characterized by very small firms, by the fact that many whole-salers and retailers own their own vehicles for transport, and by goods being carried often in passenger vehicle. Hawkins (op. cit.) has done a sample survey to obtain information on origin and destination, types of goods carried, and rate of utilization of capacity. His results, however, are incomplete, refer to Uganda, and in any case are by now out of date. To conduct similar surveys in all three territories would be expensive and require the co-operation of hundreds of government officials and civil servants.

Estimates of capital expenditure and recurrent costs for railroads can be obtained from the annual reports of the EARH and from periodic reports on estimates of revenues and expenditures. Capital costs of proposed investments in road transport in Kenya can be obtained in the estimates of expenditure and revenues published by the Road Authority. In Uganda and Tanganyika, these estimates must be obtained directly from the Ministry of Works.

It would be useful to have data on the costs of operation of different types of vehicles on various road surfaces and gradients and over different distances. Some of this information may be obtained from transport companies who keep detailed accounts. Another source of information is the Road Research Laboratory in England which apparently has been receiving returns on a questionnaire sent to transport firms in East Africa.

Another set of useful figures would be on the rate of fuel consumption in each of the three territories. Hopefully, these can be obtained from the petroleum companies.

Finally I would like some estimates of the terminal and transshipment costs and estimates of the average speed of vehicles on various types of roads to compare with the time required for rail shipments. Hawkins has done a stopwatch study to arrive at estimates of speed. Hopefully, this data might also be obtained from transport companies.

In the matter of techniques of measuring net benefits, I am debating the relative merits of using a systems approach as opposed to a piecemeal approach. A systems approach would entail the setting up of a mathematical model which would automatically take into account the effects of interaction among various component parts in the transport network, when one link in the system is altered. The difficulties of such an approach are numerous. Data on road transport is most usually obtainable in terms of vehicle-miles. It is difficult to obtain breakdowns by commodity. Railway data is more easily obtainable in terms of ton-miles and on a commodity basis. In order to use a systems approach one would need a map of commodity flows between various destinations and the ton-mile costs along various routes. In addition, we would need projections of supply and demand for various commodities according to location. In order to do this we would need projections of income and population by geographical area. Since it would be impossible to obtain such information on all commodities we may have to use a systems approach in ascertaining the distribution of individual commodities such as sugar or effect a judicious compromise between the two approaches through improvisation. Computations on the net benefits of actual proposed road projects in Uganda have been done by Hares Meyer for the World Bank in a private report. Hawkins (op. cit.) has also calculated returns for various hypothetical projects in Uganda.

Neither uses a systems-approach, but both arrive at the conclusions that the returns from road investment in Uganda is high by any standards.

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