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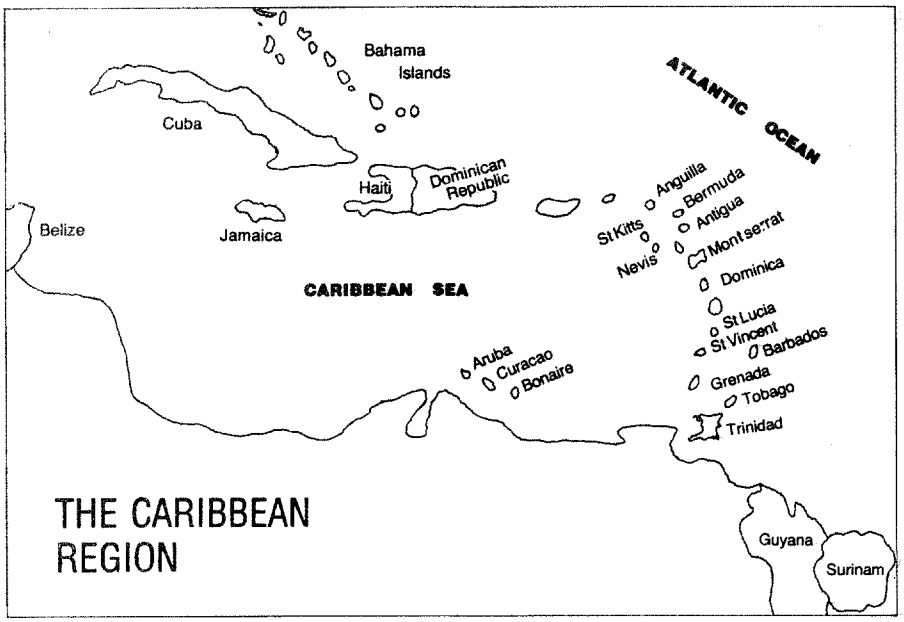

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TOWARDS A MACRO DYNAMIC METHODOLOGY FOR TRANSPORTATION PLANNING IN THE CARIBBEAN ENVIRONMENT

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by Winston Dookeran

Transportation has played an important part in the historical processes of economic growth and development. The railroads, it was argued were prime movers in the development of the western states of America and the pace of the modern industrial revolution in Europe was accelerated by the emergence of an extensive transport system.[1/] How critical this role has been remains a matter of concern to the policy-makers and academic researchers. This is especially so for developing countries as they attempt to determine the optimal resource allocation for the transport sector.

The debate on the dynamic nature of the transport sector is yet to come into full focus. The developing world in this, as in other situations, faces the need to make transport decisions without a clear specification of the macro economic role of transportation in the development processes. Planning, in such circumstances may result in internally inconsistent programmes, measured against micro and macro economic criteria. In this paper, we hope to open a dialogue on some of these issues as they pertain to planning methodology in the Caribbean transport environment.

The Transport Function

We shall identify three major components to the transport function viz., the capital component, the spatial component and the technological component. These broad classifications would be used to interpret and analyse the functional relationship between the transport sector and the rest of the economy. The aggregate effect of transport decisions on the overall economic performance of the economy may be traced through an analysis of the capital coefficient and aggregate production function.

1/ See, for a full discussion Fogel (3), Hawke (6) and O'Connor (15).

The spatial component draws into focus the question of spatial and sectorial linkages, and as such allows transport decisions to be evaluated against the effect they may have on the level and sectorial accessibility[2/] of factor endowments in the economy. Technical progress operates through increasing productivity and/or lowering of real costs, both of which may be used as proxies to measure and evaluate the effects of transport decisions on macro economic quantities.

Transport as Social Overhead Capital

Traditionally, transport investments have been lumped as part of social overhead capital. The transport development effect could be traced on the resultant changes that these investments may have on the level, internal structure and behaviour of the capital coefficient.[3/] This implies that the incremental capital output ratio is a good proxy for measuring macro economic effects. Such a measure must take into consideration the lumpiness of investment (a feature of transport investment), as this would certainly influence the sizes of the increment that are operationally meaningful. The capital coefficient tends to exhibit a cyclical behaviour over the development period. This implies a situation where each period of high productivity of capital is preceded by a period of low productivity, a period in which "the infrastructure of the national economy and the opening up of the community is taking place". [4/]

2/ "Sectorial accessibility" is related to the concept of inter-spatial efficiency and refers to that distribution of factor endowment across sectors (or regions) that would yield maximum input-output combinations.

3/ The capital coefficient is used here as the output capital ratio. In cases where the population constraint is endogenized, the per capita capital output ratio may be used without loss of generality.

4/ Bicanic /2/ p.

The capital coefficient or its incremental counterpart does not itself unlease forces that would cause substantial changes in these ratios. The dynamics of the environment becomes the crucial factor for such changes to take place. Hence, the transport component of the capital coefficient becomes a necessary but not sufficient condition for altering the internal structure of the capital coefficient. This probably explains why the early enthusiasm for transport investments in the developing world did not sustain itself. The environment may have lacked complementary endogenous forces that were necessary to move the economy. The view that transportation has a catalytic effect "capable of inducing reactions in otherwise inert situations"[5/] did not prevail under real world conditions in developing economies. Hence, the focus of attention shifted to the determination of the "optimal distance" between the demand for and supply of transport infrastructure and services.

As such, the overall strategy of development "via excess capacity" envisaged in the early literature, resurfaced again in recent works on transport development under the guise of "optimal distance" required to assure the maximum transport development effect.[6/] Attempts to measure this "distance" imposes some theoretical ambiguities and call for the differentiation of transport demand between consumer and producer goods. It is likely that any approach to differentiate transport demand may produce a measuring basis. This could lead to what appears to be a reduction in the demand for transport but may really mean the shifting of the burden of transport costs to the economic activities or to consumers by imposing locational and mobility inefficiencies on them. There is also the problem of disaggregating excess transport demand to clearly distinguish between the problem of the peak and the infrastructural congestion problem. The policy prescriptions would of course differ depending on the exact nature of excess transport demand.

5/ Gwilliam /47 p.

6/ See for a full discussion Hirsham /87 and Hoyle /77. Hoyle argues that transport investment may have a positive, permissive or negative effect on development, depending on the "distance" between supply and demand for transport. Wilson /97 provides a useful summary of the arguments.

Spatial and Linkage Effect of Transport

Unlike the capital component of the transport function which operates through the capital coefficient (and aggregate production function), the spatial component affects the level and sectorial accessibility of factor endowments in the economy. Transportation changes the production and exchange frontiers of an economy, thus enlarging the base and deepening the spatial and sectorial linkages. This has the effect of encouraging a greater diffusion of the growth process, although the consequent distribution of the benefits of the growth process, need not follow the same pattern. This distinction is important, but is outside the main argument of this paper.

There are two aspects to the spatial component of the transport function. Firstly, there is the evolvement of a spatial interactive process that explains what has come to be described as the formative power of the transport sector. Voigt identifies the dynamic of self-development of the transport sector and its macro-economic formative power (its effect upon sectors outside itself) as key to understanding the potency of transport policy in a dynamic setting. Transport service is not merely desired but "it can innovate itself and induce new production possibilities ... it is structure determinative".[7/] The second aspect leads to a consideration of technology. As such it calls for a discussion of the relations between price relations, factor endowment and choice of techniques.

The linkage role of transport systems is an interactive one as "few forces have been more influential in modifying the earth through transportation, yet transportation itself is the result of other forces".[8/] The interaction between the spatial economy and the transport system, influences the pattern of growth and the spatial distribution of development in an economy. In this sense, the spatial boundaries for which a transport system is being planned would significantly affect the transport system itself. This emphasizes the long run formative power of transport development on the structure of the economy. The degree of this effect

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7/ Voigt /18/ p.

8/ Ullman /17/ p.

in the short run would depend on the extent to which transport costs are sensitive in outputs of the production structure. Here the planning methodology can implicitly or explicitly provide a particular bias to the structure of production and settlement[9/] in an economy.

9/ Toaffe et al /16/. Toaffe's well known model for "an ideal-type regime of transport development" brings out clearly the spatial interactive processes. Toaffe identifies six processes in his model, processes that need not occur in discrete units nor do they need to take place in a continuous frame. These processes are summarized as follows:-

- Small ports and trading posts are scattered along the sea cost. There is little lateral interconnection and each port services a limited hinterland.
- Emergence of penetration lines to the interior which sets in motion spatial readjustment in accordance with slightly comparative locational advantages.
- Development of feeder routes and the beginnings of lateral interconnections.
- Creation of modes serving the feeder network and the deepening of lateral interconnections.
- Full lateral interconnection as the system links all the ports, internal centres and nodes.
- Development of truck routes largely in response to the effects of the existing activity system on the transportation network.

In this model, the spatial linkage effect dominates the development process as the production and exchange frontiers of the economy are enlarged. This gives rise to the modification of the economy production transformation curve and hence alter the factor endowments facing that economy. On the exchange side, the transport system could alter the price relations in the economy, either consistent with the transformation curve movement or in an opposite direction. To the extent that the price relations and the transformation curve move in harmony, more efficient trading routes would be opened up.

Transport as a Technological Phenomenon

Transport infrastructure and services constitute a cost to the economy which may be measured in terms of real resources consumed.[10/] This aspect could be measured by estimating the absolute and/or relative changes in the real resources utilised for the realisation of the transport function. Such changes take place either through technological innovations and/or changes in the price relatives facing that economy. Innovations would be economically positive if they induce changes in the factor price relatives that results in higher output input ratios at the aggregate level. On the other hand, changes in price relatives may be caused by factors other than innovations. In either case, transport decisions consume real resources. Where such resources are decreased significantly, a new dynamism is set in motion that may draw inert resources into activity. On the other hand a relative increase in the real resources consumed for transportation may have a dampening effect on the economy and even contract the production and exchange frontiers of that economy.

Technological innovations in the transport field respond to the private demand for transport i.e both as producer and consumer goods. Such demand creates a complementary pull on publicly financed resources. It is possible that innovations that are economic with respect to satisfying private demand may exhibit diseconomies when applied to the complementary public demand. This is so because of divergences between private and social cost in an economy. For instance, the use of privately owned vehicles as the dominant mode to satisfy mass transport demand has a hidden and lagged effect on public resource requisites. This along with the high cost of reversing transport technology emphasize the need for inter-temporal efficiency in the planning methodology. Technological forecasting is an essential input to the planning methodology if inter-temporal efficiency is to be achieved.

10/ For an interesting discussion on this aspect see Lee Vance /12/. Lee Vance worked out a methodology for calculating resources consumed in the provision of transport infrastructure and services and provides a framework for deriving the "optimal technology" in given environment.

The following table attempts to summarize the main operational quantities appropriate for the different aspects of the transport function.

a.	Capital aspect	- aggregate capital coefficient - incremental capital-output ratio - "optimal distance" between supply and demand
b.	Spatial aspect	- level and mix of factor endowments - sectorial accessibility of factor endowments - formative power on the structure of the economy
c.	Technical progress aspect	- real resources consumed - self dynamism of transport investment - structure of transport demand

The planning methodology for transportation has largely ignored the dynamic component of the transport function. It is certain that this has not been without cost to developing countries. There is a clear need for the re-orientation of research and policy perspectives in this area. There is still a very long way to go towards developing a transport development theory. As the transport relationship becomes clearer, appropriate changes at the level of methodology will follow. The link between micro-economic efficiency and social efficiency remains the key methodological issue facing transport planning.

Towards a Methodology for the Caribbean Environment

Transport planning in the region is relatively new and it is perhaps fair to say that there has been little discussion on questions on Methodology. Transport programmes have generally been formulated within a partial analytical framework and little attention has been given to the macro dynamic aspects of the transport function. Some of the

theoretical constructs around which a macro dynamic framework may be built have been identified in the earlier part of this paper.

A first appraisal of planning methodology in the transport economy of the region does suggest that there has been an underlying conceptualization of the role of the transport sector in the development processes. Historically, transport decisions have been geared to the interest of the export oriented sectors of the economy and to consideration of public administration and security. There were high priority issues during the colonial era. Consequently, the development of inter-island transport and the fusion of internal transport networks with the productive potential of the economy did not attract public policy focus. Emerging from the priorities of historical times therefore is a pattern of transport development that cannot be easily changed.[11/] The persistence of economic dependency in the post-colonial period continues to discourage the emergence of dynamic forces that may transform the pattern of transport development.

A feature of the transport environment is the extent of outside investment in the transport sector of the region.[12/] A proportionately large part of these investments are for infrastructural projects like ports and airports with little emphasis on services. Wickenden [20] argued that in the Caribbean region there appears to have been over-investment in infrastructure and due to the lack of regional planning there has been no attempt made to vary equipment or services to overcome

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11/ This is due to the difficulties in reversing a set pattern of development in the transport sector. The difficulties arise out of the cost of such a process as well as possibilities of changing activity patterns based on the transport development.

12/ The Caribbean Development Bank 1977 Annual Report indicated that 17.4% of net loans approved were for Ports, 97% of which were allocated to the LDCs. In addition, Airport Loans were granted to St. Lucia and Antigua. A large part of bilateral financial flows from metropolitan countries is for transport infrastructure (particularly airport).

deficiencies and thus obviate the need for further infrastructural development.[13] This assertion, if correct[14] underlines the need for a more comprehensive domain within which planning methodology must function.

The reliance on external financing of transport projects raises another issue. Because of the continuing (and perhaps increasing) economic dependency of the region, external financing is more likely to maximize the complementarity of the local economy with its external counterpart. That is to say that projects that are financed are likely to increase the degree of dependency rather than to encourage the spatial or sectorial integration of the region. In this situation, a macro dynamic methodology for transport planning must, apart from broadening the domain, ensure that implementation variables be endogenised in the analysis.

The international nature of the transport industry and the openness of the Caribbean economy almost makes transport technology an exogenous factor in the planning process. In a dynamic sense, high technology levels may consume larger quantities of resources and in the absence of scale operations yield a proportionately lower output. To the extent that this assertion is empirically valid, the policy implications are clear. There must either be a lower level of technology or an increase in the scale of operations, otherwise the balance between resource used and macro benefits may not be achieved. If the transport function is viewed as having a technological component (as suggested earlier), then the planning methodology must attempt to achieve this balance.

13/ Wickenden /20/ p. 10

14/ A cursory examination of the types of transport investment undertaken in the Caribbean validates Wickenden's point. Wickenden goes on to argue in his paper that the mix of transport investment that has occured in the region during the last decade would have been much different if one were aware of the available resources at the start of the period.

The conceptual understanding of the transport-development effect in the contemporary environment has meant that transport investment has been viewed myopically in a totally infrastructural sense. Most development plans in the region relegate the discussion of transport to Chapters dealing with infrastructural investments. Also, Ministerial responsibility for transport has tended to be located fully in Ministry of "Works".[15/] Transport investments are thus viewed in the context of social overhead capital rather than transport policy. The domain of transport policy is constricted largely by questions of public subsidies for transport enterprises and consequential transfer issues. This has led to the use of public subsidy analysis for the justification of major transport decisions.[16/] Public subsidy analysis could only be part of a methodology that is appropriate for the evaluation of transport decisions. On the same vein, the regulation of the transport sector has been concerned more with public safety issues than with economic objectives.

In general, transport decision in the Caribbean environment are analysed through partial analysis. In some cases, the partial analysis used may even be inappropriate to the transport problem. This approach has meant a heavy reliance on matters like traffic forecasting, assessment of market shares, determination of infrastructural requirements and opportunities for development assistance. Transport planning in this framework is pre-occupied with reducing bottlenecks and responding to demand generated by an "unequal"[17/] market. Such an approach would lead to an incongruence between the transportation and general economic plan. Internal inconsistency within the transportation plan (formal or informal) could be a consequence of this methodological approach.

15/ In the Caribbean, Works Ministries are primarily concerned with physical implementation and construction.

16/ The decision to withdraw the railway service in Trinidad in the 1960's was a major transport policy decision. The Madory Report, the basis upon which this decision was analysed, used theminimization of public deficits as the major objectives in the decision matrix.

17/ The term "unequal" is used instead of "imperfect" to emphasize that there are both allocational and distributional considerations to be taken into account.

Methodology and theory cannot be divorced. The absence of a clear specification of the role of the transport function in the development processes has limited the development of a comprehensive planning methodology for the transport economy. This in turn has meant large inconsistencies within transportation plans and between such plans and the overall economic plan. In general there has been a variance between micro economic efficiency and social efficiency in the methodology. An integrated transport plan where intra and inter modal inconsistencies are eliminated, and where allocative and distributional effects are socially efficient is unlikely to evolve from the current planning environment. A macro dynamic conceptualization of the role of the transport economy may suggest a re-appraisal of planning methodology for this sector.

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