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Theoretical Framework of the Relationship between Transport Development & Economic Growth in a Developing Country

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ABSTRACT — Two central questions have been raised and discussed in this paper: (1) what role the transport sector should play in the developing process? (2) what relationship can be found to exist between transport development and economic growth in a developing country. To answer both questions a new unbalanced growth path hypothesis has been offered. Further, in this paper the utilization of the investment as a "strategic decision leverage" in the development of, alternatively, a developing nation's economic production activities and transport service capability is also implied and suggested.

I. Introduction

To have an economic and reliable transport system is one of the conditions if a developing country such as Taiwan is to attain its goal of economic growth. An efficient transport system can help to establish a national industrial infrastructure capable of earning foreign exchange, supplying domestic markets, utilizing idle natural resources, as well as maintaining a high level of employment. Besides, a good transport network increases national defense capabilities, social cohesion and political stability.

A close relationship between transportation and economic growth can thus be hypothesized [1]. However, neither over nor underemphasis of the importance of the transport sector will help the economic development of a developing country. In reality, transportation is not a separate entity of the economy -- it should be viewed, in terms of the economic development process, as the linkage among various production sectors of the national economy. A better understanding of this linkage relationship between transportation and economic growth -- especially of the proper role played by the transport sector in the development process -- will no doubt benefit the economic

policy planners and the general public alike.

In this paper an attempt has been made to provide some plausible answers to the often raised question: How should one interpret the causality between transportation and the nation's economic growth?

II. The Classical View

1. Generating The Stimulating Effects

In a developing country where the internal distances are great, the production and consumption centers are widely scattered, and the terrain and climate are hostile, the construction and establishment of a new transport link -- especially when it is closely associated with some potential manufacturing activities--can be especially useful to stimulate the growth and the further development of its national economy.

Transportation could generate new and tradition-breaking economic activities -- it could easily shift the production possibility functions by altering or lowering the relative costs of the input production factors on the one hand and the distribution and marketing factors on the other. Transportation, therefore, creates and sustains internal economies for many industries, and fosters external economies for all the sectors, including manufacturing. The opening up of a new transport link often enlarges the extent of the purchasing and marketing activities of manufacturing firms as well as enabling goods and customers of these firms to be transferred between and within the population and consumption centers.

The new transport link also extends the monetary economy to the agricultural sector and raises its productivity.

Transportation also functions with remarkable effectiveness in the discovery, excavation and utilization of a nation's natural resources. A new transport link makes the interior region of a developing country more attractive especially where there are plenty of rich natural resources lying over-and under-ground. A new transport link can also open up the isolated area, forge links between these regions and the outside world, and even create, in some instances, for the first time for these areas direct contact with the civilization.

In short, transportation generates both time and place utilities -- it not only shortens the time required to move raw materials

to the production facilities as well as the finished products to the hands of consumers but also generates economy of scale for the manufacturing firms and enlarges their markets as well. Furthermore, transportation can quicken commercial intercourse, expand the foreign exchange earned, as well as yield indirect social and political benefits. It also evokes induced investments and thus starts up a whole new development sequence beneficiary to the national economy.

Since a developing country ought to acquire adequate transport service capabilities before any real economic development can begin, it is therefore no exaggeration at all to state that transportation will make a positive contribution to the economic growth of a developing nation. No wonder that after a depth examination of the effects of the new transport development of the time--the American railroads between 1830 and 1865 -- Fishlow [2] concludes forcefully that rail construction and improvement definitely provided a positive stimulating effect to the transformation of the nineteenth century American ante-bellum economy.

Often the construction of a new transport link will also bring about what may be called as "the spillover effect" -- the newly established transport link provides a development break-through or threshold so that a variety of satellite industries can now be induced to provide the finished and the semi-finished products, machinery and services needed for the future development of the economy of the region or nation [3].

2. Responding to the Induced Demands

It has been certified in a separate study [4] that improvements which reduce transport costs, increase transport speed or improve the quality of transportation services often come about as a response to the pressures generated by the expanding economic production activities.

Historical experience also leads one to believe that the growth in freight traffic volume corresponds closely to the growth in the economic activities. Little wonder that we are told: railroad development was one result of the nineteenth century American economic expansion; and also that the market responses determined the pace and timing of the construction of the rail networks in America [5]. In Russia's case, except for those railroad lines built to tap specific mineral deposits, resources were, as the official action made

it clear, never diverted into expanding the transport service capacity unless in response to the occurrence of the actual or anticipated traffic bottleneck -- to this day the transport sector is still considered secondary in Russia to that of the industrial production [6]. As for Taiwan, the rapid economic growth in the past five or six years has put pressures constantly on the transport sector to expand and improve in order to satisfy the ever-growing induced economic demands. Furthermore, evidences in other developing countries also suggests that the transport improvements made often respond closely to the economic pressures generated by the level of the economic activities of the country concerned.

The pattern and locations of various industrial activities in a developing country also shape up the different transport improvements made in that country. For instance, in a country with widely scattered sources of supply, far from each other and far from the population centers, if there were also in existence many decentralized small-scaled production units, then, a large, spread, sprawling type of transport network would probably be initiated in the early stage of development. Transport improvements can be expected at a later development stage in that country. If, on the other hand, the existing industrial and production activities are concentrated at a handful major centers in a given country, then a smaller transport network will be required in the beginning, and extensive mode expansion may be needed to satisfy the demands generated by booming economic activities later.

In summary one has to conclude that the growth and further development of a developing economy requires an adequate and effective transport system to proceed and to develop with it; that the lack of a satisfactory level of transport services in a developing country will often result in a freight traffic bottleneck and prove harmful to the industrialization process and the healthy economic development of that country.

III. A New Hypothesis

The economic policy makers or planners in some developing countries are often found more than willing or at least appear to be eager to allocate the precious development resources of their countries to expand the transport services without seriously scrutinizing the validity of the degree of investments made, or asking whether

they will ever get a fair social return on these investments -- as a result the transport sector becomes, in some instance, the single largest claimant on the public investment funds in the nation's economy [7]. It is not difficult to understand the argument that the investments made in the transport sector are diversified investments, and they are in fact also invested in the general growth potential of the economy rather than merely in the growth of any one specific production activity. These investments are also considered to be "safe investments", which cannot be proven wrong before the investment projects are fully implemented or in operation, and are unlikely to become obvious failures later. Since, nevertheless, investing scarce public development funds in the nation's transport services in this process is largely a matter of faith, and over-investment is certainly a distinct possibility, one cannot afford not to ask the question: even if a developing country has acquired a first-rate international airline or super highway network, can one be certain that the desperately needed manufacturing activities for the developing economy will be generated immediately after the successful completion of these projects? Can one also be sure that the total investment funds spent in purchasing of Boeing 747 or Concorde, or in constructing the airports and highways are not too much and wasted? Most important of all, how to devise a development strategy to maintain the delicate balance between the required transport service capabilities on the one hand and the demand pressures generated from the production activities of the nation at a specific developing stage on the other? [8]

Lately Hirschman [9] has asserted that a positive linkage exists in almost all developing economies between "social overhead capital" and "directly productive activities". Hirschman defines "social overhead capital" as comprising those essential services of the society such as "law and order, education, public health, power and water supply, communication, etc." -- without which, he claims, the "primary", "secondary" and "tertiary" production activities can hardly be initiated or function effectively in the long run. Since transportation provides services to a great variety of the other economic activities and is considered to generate the intermediate product to a society, especially in the freight transportation services, it is often viewed to possess the characteristics common to social overhead capital, and is therefore regarded as a pre-requisite

to economic growth.

Borrowed from Hirschman's concepts and assertions, in the following pages I will first derive the aggregate total production activities (TPA) curve of the developing economy, then discuss the relationship between the transport services and the production activities associated with them.

1. The Total Production Activities (TPA) Curve

In Figure A the vertical axis represents the aggregate costs of production activities outputs, the horizontal axis designates, on the other hand, the availability of transport service capabilities of a developing economy. The TPA curve is designed to illustrate at any specific time interval the curvilinear relationship between the degree of availability of transport services and the aggregate costs (including the transport costs) of all the production activities generated in a developing economy. Notice also that the level of the aggregate total production activities is often determined by the level of the aggregate investments made in the recent past in that developing country which is implicitly presented in Figure A.

Aggregated Costs of All
Production Activities

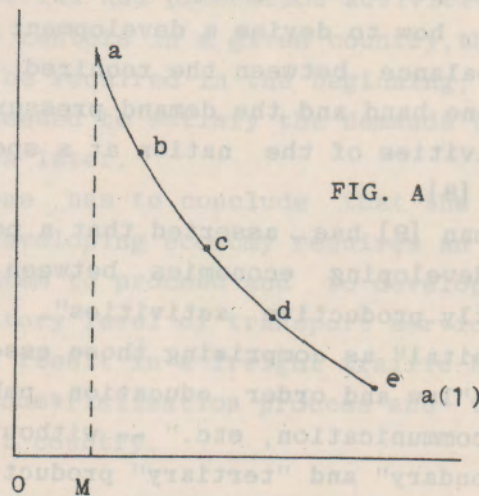


FIG. A

Availability of the Transport
Service Capabilities

Note: a(1): Total Production Activities (TPA) curve
which is generated by a known level of
investment.

Notice that the TPA curve can also be viewed as a curve reflecting the variations of the nation's resources being allocated to the different combinations of production activities and to transport services.

Examining the TPA curve in Figure A again, starting from the far right of the curve, one will see that the transport service capabilities are plenty, so the aggregate production activities costs are low. As one moves leftward along the TPA curve, the aggregate costs for a given amount of production activities outputs rise slowly at first and more rapidly later with each curtailment of the transportation services. When the TPA curve eventually becomes vertical, it indicates the fact that a minimum level (OM) of the transport services capabilities is indispensably required to generate a given amount of the modern production activities.

It is also possible to define the characteristics of points along the TPA curve within the range of the two extreme points "a" and "e". At point "a", OM level of transport service capability is a prerequisite to the establishment of modern production activities -- the available transportation service is of such a nature that no large-scale production activities can be initiated before OM level of transport capabilities has been reached. At point "b" a fair level of transport service is available, there is, however, room for further improvement. At point "c", the level of the transportation service is generally considered to be good even though traffic congestion does exist occasionally. At point "d", an excellent level of transportation service has been achieved as a result of the increased share of the nation's resources devoted to the development of the transport sector. Also, it is assumed at this point that traffic congestion has been eliminated. At point "e", it has been assumed that an excessive level of transport services capabilities exists -- it indicates two points: (a) as far as the efficiency of the economy is concerned, that relative transport services capabilities is excessive in the long run. Also, even if for some reason (increased labor productivity perhaps) the transportation services provided have been enlarged slightly, it is unlikely that the aggregate production costs to the economy as a whole will be brought down further. (b) in anticipation of the arrival of point "e" on the TPA curve, the nation's entrepreneurs will, it is assumed, create more production activities by taking the advantages and opportunities of the emerging low ship-

ping costs and better transport services provided. As a result a second or a higher level of the TPA curve will be generated and take effect. By definition the first TPA curve will, after point "e", be flattened out and become inoperative.

2. The Development Process

Since investment is the key to the increase of production activities, I postulate here that a large investment made in the production sector produces, with a level of the transport service capabilities given, a higher level of production activities -- as a result, it causes, as in Figure B, the TPA curve $a(1)$ to make a right-upward shift movement, the TPA curve $a(2)$ is then generated. Notice that in Figure B I use a two dimensional diagram to express the three dimensional changing process -- a successive higher level of investments (such as $I(1), I(2), I(3), I(4), \dots$) with a known level of transport service capabilities will generate successively higher TPA full-capacity outputs. (which are represented by the TPA curve $a(2), a(3), a(4), \text{etc.}$)

Aggregated Cost of All
Production Activities

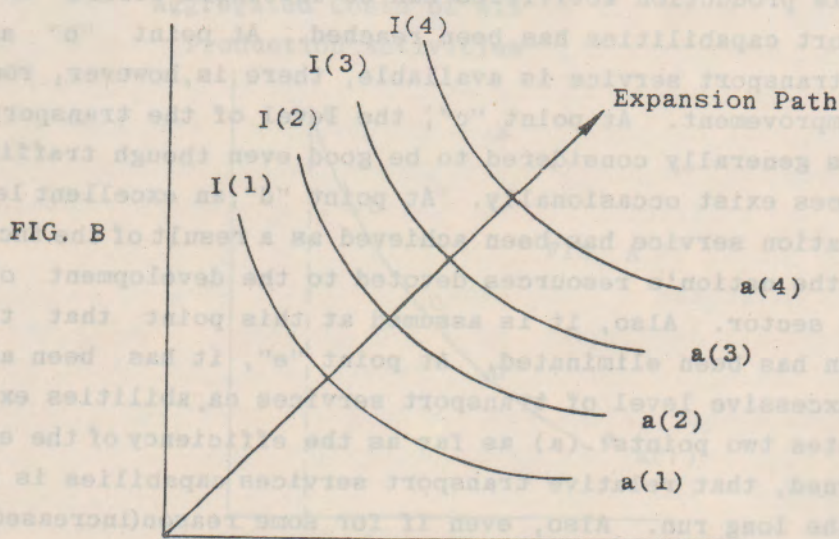


FIG. B

Availability of the Transport
Service Capabilities

Note: $a(1), a(2), a(3), a(4)$: Total Production Activities (TPA) curves, indicating that with the same transport service capabilities, a successive higher level of investment will generate a higher TPA full capacity outputs.

Since the objective of economic development is to obtain increasing outputs of production activities at minimum costs to the nation's resources, it can be seen that at point C, under the 5-point classification system of the TPA curve mentioned in the previous section, the sum of the resources devoted to both the production activities and the transportation service is the smallest, and thus cost is least to the economy, also on each and every TPA curve such a point can easily be identified and determined. If one draws a line now that goes through the origin and connects these desirable points of the different TPA curves, one will have an optimal, balanced expansion path on hand, in which the successive increased investments in the production activities, with a given level of transport service capabilities, will bring the nation's economy to a successively higher level of economic gains.

3. The Unbalanced Growth Path Hypothesis

Only direct investment in production activities originates real economic growth even though continuous improvement in the nation's transport system is essential and important at the time of the economic expansion -- the incremental transport service capabilities will stimulate economic development in indirect way since it will create a favorable environment in which direct production activities can be generated more easily. Furthermore, historical experience in most developing countries points out the fact that real economic growth often is accomplished through the unbalanced expansion path of shifting investment emphasis between the production and transport sections respectively.

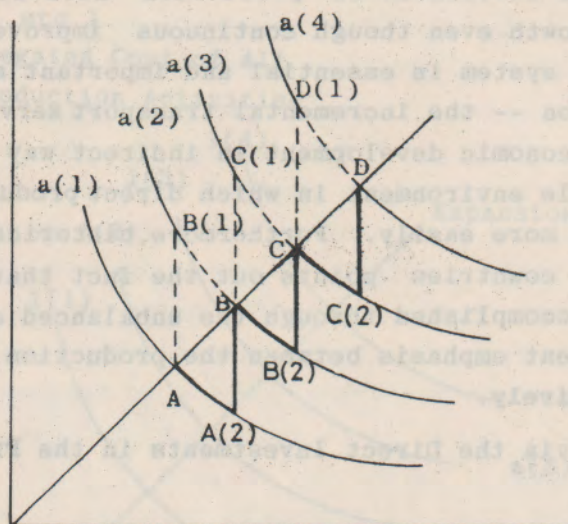
(1). Development via the Direct Investments in the Production Activities

Examining the upper left part of Figure C, one will see that with a given level of transport service capabilities the production activities in a developing country will rise, as a result of the direct investments made in the production sector, to a higher level and jump from TPA curve a(1) to TPA curve a(2), and thus, put enough pressure to demand an improvement in the nation's transport sector. Also, the additional production activities are likely to rise substantially higher once again to TPA curve a(3) soon after the first increase in transport service capabilities is achieved from B(1) to B. As a result of this shifting investment priority back and forth

between the production and the transport sectors, the nation's economy grows at the zigzagged unbalanced expansion path of AB(1)BC(1)CD(1)D -- this can happen mainly because normal production activities in a developing country are often held back because of the bottleneck experienced in the transport sector. As soon as the entrepreneurs as a group in the country realize that the elimination of this shortage in the transport service capabilities will lower substantially their combined production and distribution costs, they will no doubt generate enough pressure to compel public officials or other responsible parties to increase the transport service capabilities to the level needed. Improved transportation services will, interestingly enough, in turn provide a climate attracting still more investments in the production activities, and thus set in motion another round of the expansion process.

Aggregated Costs of All
Production Activities

FIG. C



Availability of Transport Service
Capability

Note: a(1), a(2), a(3), a(4): Total Production Activities (TPA) curves indicating that with the same transport service capabilities, a successive higher level of investment will generate a higher TPA full-capacity outputs.

(2). Development via the Increase of the Transport Service Capabilities

Referring back to the lower-right part of Figure C mentioned

in the previous section, one can see that it is also quite possible to begin the development process by first investing in the transport sector and expanding the transport service capabilities from A to A(2). As a result the entrepreneurs in the country will expand their production activities in order to take advantage of this favorable operating environment in which shipping costs become lower, and better and faster transportation service is a reality, and thus move the expansion from A(2) to B. At this point, the expanding economic activities will require, sooner or later, a further improvement in the relatively deteriorating transportation services and prepare the ground for pushing production activities to a higher level later. Thus development continues on the zigzag unbalanced expansion path, AA(2)BB(2)C.

Notice that strengthening the transport service capabilities is not merely an economic decision, but, in many instances, also a political and/or a military decision as well. Further, the decision to invest in the transport sector often is advocated, examining it strictly from the economic point of view, not because of its short-run direct benefits, but rather because the expansion of the transport service capabilities will enable a region to become more attractive in the long run to entrepreneurs for new production activities. For this reason transportation is widely accepted as a pre-requisite to economic growth and also as first item in many economic development plans.

(3). Development via the Over-Expansion in the Transport Service Capabilities

Over-reaction is often encountered in economic life. Economic policy makers or planners in the government may very well over-react to the shortage observed in the transport sector with a quantum jump in the development of new transport service capabilities and bring the expansion path all the way down from A(1) to A(2) in Figure D. On the other hand, the entrepreneurs may also over-react to the newly-added, current or anticipated, transport service capabilities by increasing their production activities to such an extent that they skip TPA curve a(2) altogether, jump to TPA curve a(3) and create, conceivably, a new shortage situation at point C(1). So A(1)AA(2)BC(1) is the zigzag unbalanced expansion path in this case.

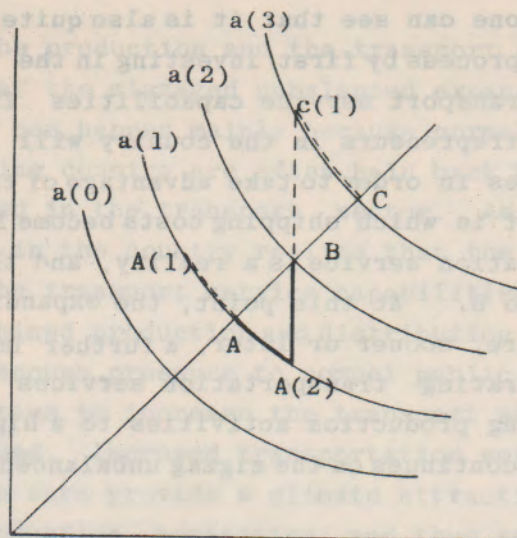


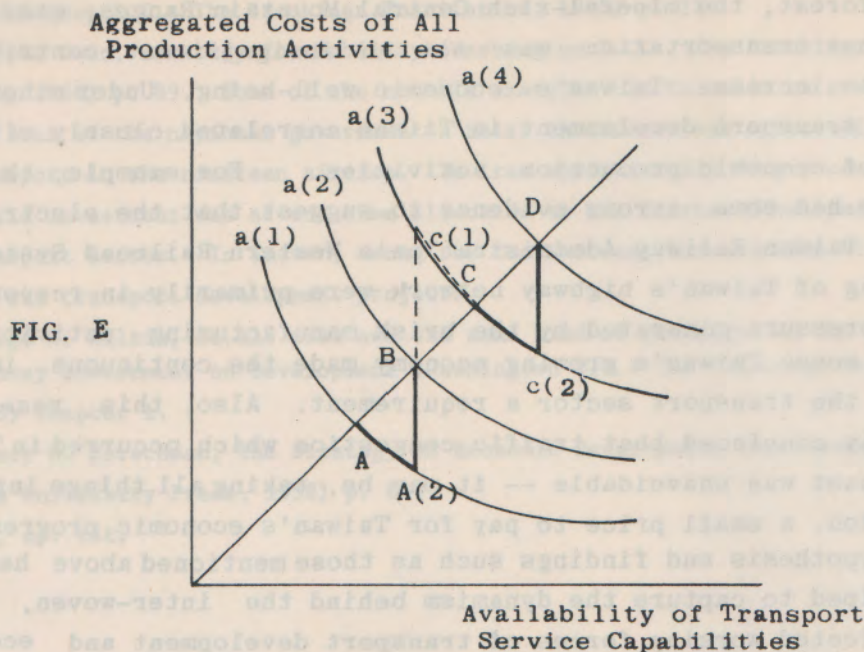
FIG. D

Availability of Transport Service
Capabilities

Note: $a(1)$, $a(2)$, $a(3)$, $a(4)$ in both Figures D and E: Total
Production Activities (TPA) Curves.

(4). Development via the Over-Expansion in the Production Activities

The expansion path in some developing countries may look like Figure E -- in which, a new transport improvement project has been initiated and implemented, as a result the transport service capabilities of the country have increased from A to A(2), and this prospect will induce entrepreneurs to increase their production activities from A(2) to B. However, in the developing countries it is not unusual for the entrepreneurs showing an upward bias in over-estimating the anticipated benefits from the expanded transportation services by over-expanding their production activities. Further, the time required to build up the pressure to force a transport improvement and the time required for the transport improvement project to be accomplished further complicate this complex development process. By the time the traffic bottleneck problem is serious enough to cause public officials to react to it, the production activities of the country may already be entering into a new and higher phase such as in TPA curve $a(3)$. Also, with over-reaction by the government officials in their struggle to correct the transport shortage situation a distinct possibility, the expansion path is, under the circumstance, more likely to come down from C(1) all the way to C(2), rather than staying at point C -- and this will start the mechanism for a whole new development sequence once again.



IV. Conclusion

In this study an interdependent, unbalanced growth path and linkage relationship has been hypothesized between transport development and economic growth, even though the precise, direct measurement of the causality between the two can not be made.

Further, in a separate study [10] this unbalanced growth path hypothesis has also been applied to and tested in Taiwan's case, it is found that transport development alone can not and will not generate economic growth. Only direct investment in manufacturing activities originates real economic growth. Nevertheless, transportation is found to be a very important and inseparable component of Taiwan's booming economy in the past twenty odd years. Transportation has played the role of "stimulator" and "respondent" simultaneously in the development of Taiwan's economy -- under certain specific conditions transport development in Taiwan is found to be a pre-requisite and has to be engaged preceeding the establishment of modern economic production activities. For example, Taiwan's rail and highway links were built, in many instances, specifically for the purposes of supporting the economic construction projects, such as to support the electric power plants; the water dam projects; new international harbours and airports; industrial parks and export-processing zones; new factories and plants or even to bring the civilization

to the forest, the mineral-rich Central Mountain Ranges, etc. -- in this sense transportation was not an insignificant contributory factor to increase Taiwan's economic well-being. Under other conditions transport development in Taiwan correlated closely with the growth of economic production activities. For example, this researcher has come across evidence to suggest that the electrification of Taiwan Railway Administration's Western Railroad System and upgrading of Taiwan's highway network were primarily in response to demand pressure generated by the brisk manufacturing activities -- in this sense Taiwan's growing economy made the continuous improvement in the transport sector a requirement. Also, this researcher is deeply convinced that traffic congestion which occurred in Taiwan in the past was unavoidable -- it may be, taking all things into consideration, a small price to pay for Taiwan's economic progress.

Hypothesis and findings such as those mentioned above have not only helped to capture the dynamism behind the inter-woven, mutually-affected working forces of transport development and economic growth, but also led to the determination of the development speed and future direction of the economy of a developing country -- they all have immediate relevance to the economics of development indeed.

References

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- (Washington D.C.: The Brookings Institution, 1968) p. 124.
7. Wilfred Owen, *Strategy for Mobility* (Washington D.C.: The Brookings Institution, 1964) p. 89. Some of the notable example: In Colombia an average 74 per cent of the national government's total investment was allocated to transport in the nineteen sixties. In Iran approximately 68 per cent of all public investment was at one time allocated to the further development of the transport sector. In Taiwan, among the Ten National Construction Projects, Six are transport development projects.
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 9. Albert O. Hirschman, *The Strategy of Economic Development* (New Haven, Conn.: Yale University Press, 1958) p. 84.
 10. Pan, op. cit.