Infrastructure and Regional Development in Developing Countries*
開発途上国における社会基盤整備と地域開発に関する実証的研究

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Introduction

Accelerated industrialization strategies adopted by most of the developing countries in Asia in the post World War II period had been generally successful. These countries introduced import substitution strategies during the 1950-1970 period followed by export promotion strategies after 1970. These concerted efforts to promote modern technology and to concentrate investments in the industrial sector, although varied in degree, have been fairly successful in terms of the growth of GDP. However, one of the serious consequences is the ever widening regional disparities within these countries, due to polarization of modern industries in one or few relatively developed regions in contrast to the vast rural areas which remain in a state of stagnation.

The Philippines and Indonesia, both archipelagoes in Asia provide typical examples of the above phenomena. Both countries, with large number of islands, are trying to decentralize their industrial activities to the lagging regions. The concentration of industrial activities in the capital region were only felt in the latter half of the import substitution period. Since then the governments have taken a more active role in the planning and management of spatial development. This paper discusses the policy measures adopted by the government in the form of investment incentives and their effectiveness in decentralization of manufacturing industries from the capital region. The role of infrastructure in regional development is assessed along with the above policies. Finally the current infrastructure development trend and their impact on regional development is analyzed.

Concentration of Manufacturing Activity

The pursuit of rapid industrialization during the import substitution period (1948-70) in the Philippines shifted the concentration of population and economic activity to Manila, or broadly to the National Capital Region (NCR) due to its locational advantage, its status as the country's capital city and its comparative advantage for manufacturing, among others. Subsequently, the spillover of industrialization to Manila's peripheral regions (Southern Tagalog and Central Luzon) could be seen. Manufacturing employment distribution in 1967 and 1975 shows that NCR accounts for 51.3% and 46.8%, while peripheral regions accounts for 13.0% and 17.7% respectively. The figures in 1982, 1987 and 1992 shows that NCR accounted for 55.1%, 55.5%, and 32.8% while peripheral regions 20.1%, 18.8%, and 43.9% respectively. Similarly, it can be traced that the promotion of import substitution policies facilitated an excessive industrial development in Java, since the market potential of Java was much higher than that of outer Java regions. Manufacturing employment data for 1980, 1985 and 1990 shows that Java occupied a share of 86.1%, 78.6%, and 75.6% respectively.

Investment Incentive and Regional Development

The Philippines enacted its first Investment Incentives Act in September 1967 (Republic Act No. 5186). It granted a broader set of tax incentives to all industries which could qualify for registration with the Board of Investment (BOI) which was formed under the law. Then the Export Incentives Act was passed in October 1970 (Republic Act No. 6135). Under this law further incentives were granted for export oriented industries. In addition to the export incentives, incentives for regional dispersal were added. As a further support for the export drive, the Philippines Export Credit Insurance was created in March 1972 (Republic Act No. 6424). Similarly, Indonesia enacted its first export promotion law with the Capital Investment Law No. 1 of 1967, amended by Law No. 11 of 1970. These measures, however, did not change the regional distribution of investments in both countries as shown in Table 1 and 2.

Table 1: Percentage Distribution of Investments Approved Under Various Investment Incentive Laws of the Philippines by Region

Region	1970-77	1980-85	1986-90
NCR	72.88	26.78	35.05
C Luzon	5.58	4.83	10.23
S Tagalog	7.12	12.05	39.33
Others	14.42	56.3	17.1

Source: Unpublished data of the BOI Information Dept., 1994

In order to analyze the effect of investment incentive policies on the concentration of manufacturing activities, pre-policy concentration indices were compared with post-policy indices of manufacturing concentration. Theil's Entropy Coefficient (Theil 1967) is used as an index of inequality measure to analyze the impact of investment

* Key Words: Regional Planning, Rural Development Planning, Industrial Location, Land Use Planning.
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Table 2: Percentage Distribution of Investments Approved Under Various Investment Incentive Laws of Indonesia by Region

Region	Upto 1985	1985-89	1990-94
Java	61.2	64.5	65.1
Regions Outside Java	38.8	35.5	34.9

Source: Capital Investment Coordination Board, 1995

incentive policies. Theil's Entropy Coefficient is calculated using the following formula.

$$T = \frac{1}{n\mu} \sum_{i}^{n} y_i \, In\left(\frac{y_i}{\mu}\right) \qquad (1)$$

Where, n is the number of regions, μ the unweigted average of the attribute considered and y_i is the value of the attribute considered for region i. A value of 0 is the lower bound value of Theil's Entropy Coefficient indicating the absence of inequality. The coefficient has 1 as the upper bound indicating that the whole quantity available of the attribute concerned is distributed to one region. Theil's Entropy Coefficients were calculated for the Philippines and Indonesia for years 1961 and 1967 as pre-policy indicators of manufacturing distribution, while indices for the years 1975, 1982, 1987 and 1992 are used as post-policy indicators. As given in Table 3, the entropy coefficients do not change much as one move from pre-policy phase to post-policy phase. From the analysis, it is clear that investment incentive measures were not effective in dispersing manufacturing industries to the lagging regions.

Table 3: Theil's Entropy Coefficient for Manufacturing Concentration for the Philippines and Indonesia

	1961	1967	1975	1982	1987	1992
Philip.	0.34	0.31	0.28	0.40	0.41	0.16
Indon.	-	0.43	0.45	0.46	0.46	0.53

Infrastructure and Manufacturing Activity

Literature on the effect of infrastructure on private sector productivity in developed countries show that infrastructure can expand the productive capacity of a region, both by increasing resources and by enhancing the productivity of existing resources (Mera 1973, Munnel & Cook 1990, Garcia-Mila and McGuire 1992). However, very little work has been done on the developing countries. Hence, an aggregate Cobb-Douglas production function has been used to analyze the impact of infrastructure on manufacturing output of the regions in the Philippines and Indonesia. The infrastructure becomes another input in the regional production function and the equation looks as follows:

$$Q = (MFP) * f(K, L, I) \qquad (2)$$

where Q is manufacturing output of a region, MFP is the level of technology, K is the private capital stock, L is labor and I is the stock of infrastructure. Assuming a generalized Cobb-Douglas form of technology yields a more specific relationship between inputs and outputs:

$$Q = MFP * K^a L^b I^c. \qquad (3)$$

Translating this equation into logarithms produces a linear function that can be estimated:

$$\ln Q = \ln IFP + a \ln K + b \ln L + c \ln I. \qquad (4)$$

The coefficient a, b, c are the output elasticities of the factor inputs. The equations were estimated using pooled regional data for the Philippines and Indonesia during 1982, 1987 and 1992 periods. Infrastructure is represented by road infrastructure data (Rd) and data on port cargo handling capacities (Pt) of these two countries. Here, it is assumed that road and port infrastructures are the most important infrastructure categories for archipelagoes.

The regressions results, which are summarized in Table 4, confirm, on the regional level, infrastructure has a significant positive impact on the level of manufacturing output. Road infrastructure has an elasticity of 0.57 for the Philippines and 0.23 for Indonesia. The elasticity of ports on manufacturing output is about half of that of road infrastructure. The comparison of regression results without infrastructure and with infrastructure shows that when infrastructure is added to the equation, it enters with a positive, statistically significant coefficient and it reduces the standard error of the equation. Standard error reduces from 0.35 to 0.32 for the Philippines and from 0.17 to 0.12 for Indonesia.

The response of private sector investors to a regions' infrastructure could be evaluated by their investment decisions. Infrastructure could influence the location decision of both firms and households. Although an enormous number of literature explores the factors entering the firm location decisions, relatively little work has been done focusing on the role of infrastructure in that process. Also the amount of research on developing countries are very scares. It is intended to analyze regional level data for the Philippines and Indonesia to see whether infrastructure is important in explaining the private sector investment decisions.

Weberian industrial location theory suggests that location of manufacturing activity is determined primarily by resources, markets, labor supplies and agglomerate economies. The latter represents reductions in transportation costs achieved by the spatial concentration of economic activity. Underlying this theory is the notion of transport cost minimization. To capture all of these variables in explaining manufacturing investment decisions, a disequilibrium adjustment model, which commonly used in cross-sectional studies of regional economic growth is used. In this model, the change in the dependent variable, i.e., growth rate of private sector manufacturing investment, is related to levels of the explanatory variables at the beginning of the period. For both countries models were estimated, one with infrastructure and one without infrastructure, for the

Table 4: Ordinary Least Squares Estimation of the Regional Manufacturing Output for the Philippines and Indonesia, 1982, 1987 and 1992

	Philippines		Indonesia	
	Without Infra.	With Infra.	Without Infra.	With Infra.
Const.	4.27	4.42	5.67	5.71
In MFP	-1.94	-1.60	0.19	0.21
	(0.60)	(0.49)	(2.10)	(3.11)
In K	0.96	0.80	0.82	0.59
	(3.54)	(3.05)	(14.65)	(10.38)
In L	0.15	0.15	0.16	0.17
	(0.76)	(0.79)	(6.34)	(8.09)
In Rd		0.57		0.23
		(2.35)		(3.31)
In Pt		0.15		0.09
		(0.56)		(9.43)
$\bar{R}^2$	0.78	0.82	0.89	0.95
SE	0.35	0.32	0.17	0.12

t-statistics are shown in parenthesis.

1980-1990 period. Non-agricultural primary sector per capita value added (VA) is used to represent natural resource availability in the regions. Population density (PD) and unemployment rates (UN) are used to represent market and labor supplies in the regions. Agglomeration of economic activity (AGG) is represented by the GRDP per square Km of land area of the regions and the infrastructure availability is included by using both road infrastructure data (Rd) and cargo handling capacity of the ports (Pt) of the regions. The regression results, which are shown in Table 5 suggest that infrastructure does contribute in explaining the investment decisions of the private sector manufacturers. From the above two analyses it is clear that infrastructure has a very important role in regional distribution of manufacturing activity.

Infrastructure and Industrial Estates

During the export promotion period, both in the Philippines and Indonesia, industrial estates were created with an aim of providing attractive incentives to the prospective investors. Also it was one of the feasible ways of providing adequate infrastructure for industrial activities. Therefore, the above results will not hold true for these special zones. In addition, these industrial estates became another important tool of decentralization of industrial activities away from capital region. Explicit efforts were taken to create industrial estates in lagging regions. Even though there is not much of a difference in infrastructure developed inside the industrial estates, the infrastructure in the locality differed substantially. In view of analyzing the impact of these locational infrastructures on the industrial estates, performance data were obtained from all the operational industrial estates in the Philippines and Indonesia (BOI 1995, BKMP 1996).

Table 5: Ordinary Least Squares Estimation of the Regional Manufacturing Investment for the Philippines and Indonesia, 1980 - 1990

	Philippines		Indonesia	
	Without Infra.	With Infra.	Without Infra.	With Infra.
Const.	-7.23	-8.92	3.22	4.56
VA	-3.20	-1.80	0.20	0.35
	(1.98)	(2.68)	(4.50)	(3.44)
PD	0.78	0.84	0.78	0.21
	(9.33)	(3.36)	(9.80)	(4.45)
UN	1.32	0.54	0.14	0.002
	(3.89)	(2.35)	(2.33)	(1.37)
AGG	-0.03	-0.002	-0.08	-0.78
	(5.59)	(4.93)	(5.33)	(2.33)
Rd		0.08		0.12
		(5.80)		(2.56)
Pt		0.06		0.03
		(3.33)		(2.25)
$\bar{R}^2$	0.41	0.62	0.53	0.58
SE	3.28	1.45	2.33	1.95

t-statistics are shown in parenthesis.

Performance is measured by the land utilization rate of the industrial estates. Land area which is occupied or reserved by the investors is divided by the total land area developed by an industrial estate to obtain the utilization rate. These performance indices were compared with an accessibility index developed using the distance of the industrial estate from the nearest port, airport and the road density of the region. Weightages were used ranging from 1 to 5 for hierarchical scale of ports and airports to capture the quality of operation. For manufacturing, ports were regarded as the most important infrastructure followed by airports and roads. Using an exponential scale of weigtages, importance of these three infrastructures were built into the accessibility index. When the performance indices were plotted against the accessibility indices, Figure 1 and Figure 2 can be obtained for the Philippines and Indonesia respectively. It clearly shows that, accessibility to major infrastructure facilities determine the popularity of the industrial estates and consequently their performance.

Current Trend of Infrastructure Development and Their Regional Consequences

The shortage of public funds to finance the construction of new infrastructure projects and the rehabilitation of existing facilities, coupled with increased demands for capital on traditional alternative sources (e.g., national and international development banks and agencies) has contributed to the private sector involvement in infrastructure development. Well-publicized examples are BOT (build-operate-transfer) and BOO (build-operate-own) projects where private sector companies become responsible for project promotion. In the recent past Indonesia and the Philippines used various

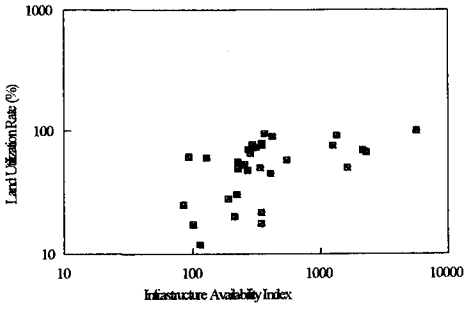

Figure 1: The Relationship Between Infrastructure and Performance of Industrial Estates in Philippines

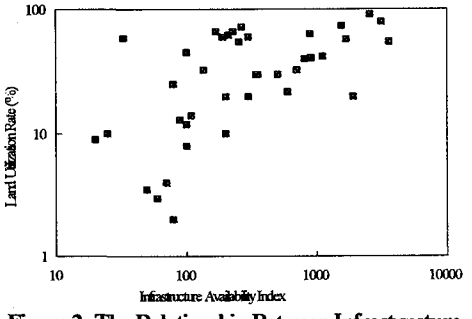

Figure 2: The Relationship Between Infrastructure and Performance of Industrial Estates in Indonesia

mechanisms to induce private sector participation in infrastructure development. In the Philippines, investment incentives with risk and cost sharing mechanisms have been institutionalized with BOT Laws enacted in the form of presidential decrees, executive orders related to various infrastructure agencies stating from late 1980's. However, the Republic Act No. 7718 enacted in May 1994 authorizes financing, construction, operation and maintenance of infrastructure projects by private sector. Also the creation of Private Sector Infrastructure Development Fund (PSIDF) to coordinate the cost sharing mechanisms obtains support from international agencies such as World Bank, ADB, USAID, EXIM Bank of Japan etc.,. Similarly in Indonesia, a healthy legal climate for private sector investment was provided under the Capital Investment Law No. 1 of 1967, amended by Law No. 11 of 1970. The most recent deregulation following the issue of Government Regulation No. 20 of 1994, is perhaps the most profound demonstration of the determination of the government to attract and safeguard private sector investment generally, and in infrastructure services in particular. Again varying degrees of investment incentives were provided through the establishment of the Investment Coordinating Board called BKPM.

One of the important shortcomings of private participation in the transport infrastructure is the affordability problem related with return. Since the initial investments are huge and return is comparatively small, particularly in developing countries, investors tend to pick up the most profitable projects. These projects would be the kind like urban railways, container terminals in ports, airport terminal buildings etc.,. The locations of these projects would certainly be in large urban areas where households and firms are agglomerated. By looking at the past BOT/BOO projects implemented in the Philippines and Indonesia it is very clear that they are certainly oriented towards urban regions. Even the projects which are in the negotiation state or to be implemented in the near future seems to be located in urban agglomerates. This bias is certainly against the regional development efforts of the government. If infrastructure development and management is entirely handed over to the private sector, as we see in the current trend of the Philippines and Indonesia, the regional development will get reversed and polarization would be unavoidable.

Concluding Remarks

Even though the accelerated industrialization strategies adopted by most of the Asian countries are fairly successful, the regional disparity created within those countries could be regarded as one of the negative consequences. The dispersal of the concentration of industrial activities from the capital region has become one of the targets of the government policy. Investment incentives were used to disperse the manufacturing industries to the lagging regions. However, these policies were not successful in the light of lack of infrastructure. Infrastructure plays a major role in determining the success of even the industrial estates which were designed specifically with high incentives.

The importance of infrastructure was felt by the governments and explicit efforts have been taken to induce private sector participation in infrastructure development. However, private sector involvement is becoming another threat to regional development due to the profit motives behind these investments. Government intervention is essential to strike the balance between private motives and regional needs.

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