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IMPACT OF INFRASTRUCTURE ON DECENTRALIZATION OF MANUFACTURING INDUSTRIES IN ASEAN COUNTRIES*

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1. 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 ASEAN countries, namely Malaysia, Thailand, Indonesia and the Philippines provide typical examples of the above phenomena. These countries are making an enormous effort to decentralize their industrial activities to the lagging regions. The Klang valley region (Johor, Meleka, Selangor, Sembilan, Perak and Penang) of Malaysia consist about 80% of the total manufacturing value added of the country. In Thailand, 72.8% of the manufacturing sector's value added in 1992 was generated in Bangkok. The manufacturing employment in Manila and its peripheral regions (Southern Tagalog and Central Luzon) for 1992 accounted about 76.7% of total manufacturing employment in the Philippines. Similarly, Java occupied about 75.6% of manufacturing employment in Indonesia. The concentration of industrial activities in the core regions 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 core regions. The role of infrastructure in regional development is assessed along with the above policies. The paper is based on a survey done by one of the authors in the four countries in 1996.

2. Regional Development and Industry Location Theories

(1). Regional development theories

Beginning in the late 1950's theories to explain the persistence of unbalanced regional development emerged. These literature can be divided mainly into three schools of thought. They are;

(a). Neoclassical equilibrium models and the inverted "U" shaped curves

The thrust of the arguments presented in this school of thought is that regional imbalances in economic development are short term phenomena characteristic of the "early stages" of development. As an economy reaches maturity, both the market forces and the state work to initiate a polarization reversal that eventually leads to an equilibrium at which regional differentials are very low and stable. This path was assumed to take an inverted "U" shape [1)-2)].

(b). Cumulative causation and polarized development

In contrast to the largely economistic explanation of regional inequalities offered by the above school of thought, a second set of views gave equal stress to sociological and political aspects of polarization. The central argument of these theories was that the underdevelopment of peripheral regions was not an outcome of their isolation, but, to the contrary, the result of processes of regional integration which allowed the more advanced regions to appropriate resources, labour and capital for the benefit of the core at the expense of the periphery. It argues that the inequality between the regions is continuously reinforced by processes of "cumulative causation" which undermines the lagging regions to develop [3)-4)]. Since no automatic turning point resulted from such a process of regional development, policy interventions became a key ingredient in initiating a more balanced pattern of regional development.

(c). The political economy of uneven development

The third view, which is rather new and that of political economists who argue that capitalist development is inherently uneven, much more complex than the explanations given by the above theories. It argues that, regional development is fundamentally disequlibriating rather than equilibrating and geographically moved beyond the nation-state and into the international scale. Comparative advantage in this context becomes a matter of political stability and the right set of public policy incentives needed to attract internationally mobile industry rather than resource endowments or historical stages of industrial development. However, more generally, the concentration of political and economic power in the core regions would continue to inhibit decentralization [5)-6)].

* Key Words: Regional Development, Infrastructure Development

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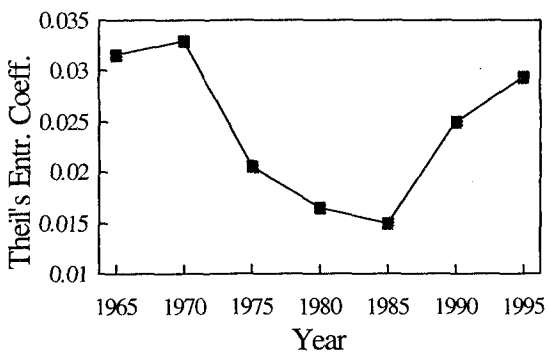
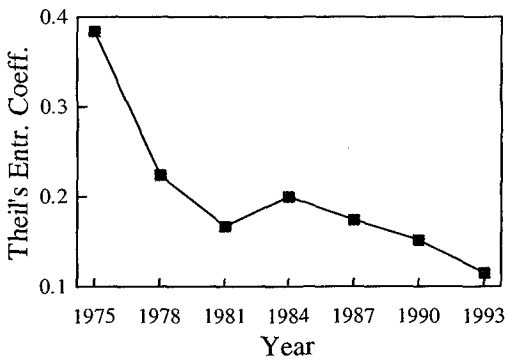
(2). Application of regional development theories to ASEAN countries

Although there are obvious differences between ASEAN countries, namely, Malaysia, Indonesia, Thailand and the Philippines, it can be argued that the historical patterns of development are likely to be more similar among them than with countries in other regions. Long histories of human settlement, the singularities of peasant farming centering on wet rice production and nucleated villages are common features of the historical development of these four countries. Villages developed along the great rivers and their connecting canals. The concentration of human settlement in these nucleated villages have historical roots for the present structure of uneven development. All these four ASEAN countries were historically linked by long distance trade routes to each other and to Europe and East Asia. This international trade created ports and the surrounding areas as cities serving mainly the merchant community. Three of the four countries were under colonial power for a long time. During colonial period port city became the center of the government and connected to the plantation and industrial sites by road and rail. After independence, all these countries sought an accelerated industrialization strategy to gain economic development. Both import-substitution and export promotion strategies used by these countries favoured the regions which had a comparative advantage in international transportation. Obviously port cities became the most favoured sites for industrial location and other economic activity. Therefore, to explain the regional inequalities of ASEAN countries the cumulative causation theory seems to be more appropriate than the other two theories.

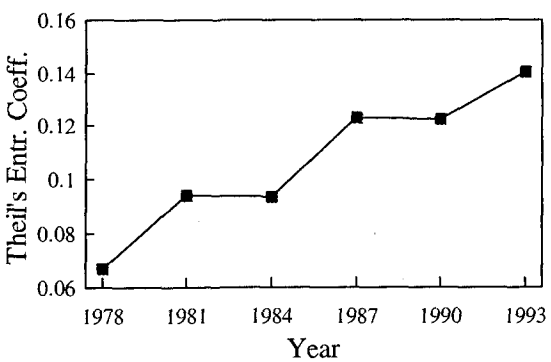
To empirically test the appropriateness of these theories to the ASEAN context, Theil's entropy coefficient [7] is used as a measure of regional inequality. The Theil's entropy coefficient is a statistical measure of concentration or dispersion of certain attribute over space (see Appendix A). The Gross Regional Product (GRP) per capita is used to represent the inequality among the regions of a country. Generally, in all four countries, the administrative divisions follow the hierarchy of regions, provinces, districts, towns and villages. This analysis is based on administrative regions designated by the four countries. This is the most practical unit of analysis in view of the availability of statistical data for a considerably long period. The total number of administrative regions of Malaysia, Indonesia, Thailand, and the Philippines are 13, 27, 7, and 13 respectively. According to Williamson's theory, over the time, the Theil's entropy coefficient has to follow an inverted "U" shape. As given in Figure 1, instead of following the Williamson's hypothesis, regional inequality measure shows almost the opposite. It leaves the other two theories to be the most appropriate to explain the unbalanced regional development in the ASEAN countries.



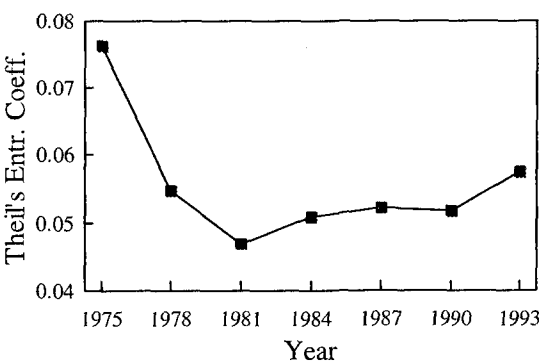
(a) Malaysia



(b) Indonesia



(c) Thailand



(d) Philippines

Figure 1: Change of Regional Inequality in ASEAN Countries

However, as discussed above, the political economy view is rather new and could not be used to explain the whole situation of a country. Instead, it is relevant to explain the fast growing metropolitan regions and international boarder regions for their phenomenal growth in the recent past. This leaves the cumulative causation theory to be the most appropriate theory to explain the uneven development of the ASEAN countries. It leads to the notion that government intervention is needed to reverse the polarized development experienced by the ASEAN countries.

Regional inequality continue to be a major issue in national development planning, starting from late 1960's. Governments have found themselves devising policies to break the polarized pattern of development by trying to either directly slow down the growth of core regions or by creating incentives to attract industries and to stimulate economic growth in lagging regions. The location of industrial activity is one of the important determinant of the relative development potential of a region. This warrants another area of literature which seeks to explain why industries locate where they do. What are the factors underlying industrial location decisions?. The next section will explore the literature pertaining to the location decisions of industries.

(3). Industrial location theories

There is considerable literature on industrial location. Theories of industrial location may be broadly divided into two sets. One of the theories can be called the neoclassical economic theory of location. It derives from the original Weberian model which assumes profit maximization as the primary motives of firms in deciding a location. The theory emphasizes cost reduction, particularly, transportation cost reduction, as the primary motive of firms in selecting a location. The other set of theories, the behavioural approach to industrial location, emerged largely as a reaction to unrealistic assumptions of the Weberian model. The assumptions of profit maximization, perfect information, and instantaneous response to changes in the spatial variation in factor prices are the major objections given to the neoclassical school of thought by the behavioural approach. This challenge has encouraged the neoclassical location theory school to incorporate greater complexity into their models of industrial location.

Most of the literature on industrial location is based on the experiences of the developed countries. The factors affecting industrial location of ASEAN countries were only reported in very few literature. The location factors abstracted as most commonly cited factors in these literature are compared to explain the position of ASEAN [8)-15)]. The common factors in all four ASEAN countries and the developed countries are selected. As given in Table 1, the proximity to markets and availability of transportation facilities are the only common factors in all five groups.

Table 1: Factors Affecting Industrial Location Decisions in ASEAN countries

Common Factors
Markets
Transportation

Specific Factors				
Developed Countries	**Malaysia**	**Indonesia**	**Thailand**	**Philippines**
Labour	Proximity to raw materials	Availability of telephone connection	Proximity to raw material sources	Reliable electric power
Raw materials	Land availability	Speed of land acquisition procedure	Adequacy of infrastructure facilities	Adequate communication facilities
Tax effect	Supporting industries	Supply of qualified labour	Inexpensive land prices	Availability of suitable plot of land and buildings
Financial incentives		Ease of obtaining permit	location close to ancillary services	Adequate space for expansion
Business climate		Presence of supporting industries	Better access to government services	
Welfare expenditure				

As discussed in the preceding section, cumulative causation theory of regional development closely resembles the ASEAN conditions. Consequently, government intervention becomes a necessary means of achieving polarization reversal. When the location factors are combined with the notion of government intervention, only a few factors shown in Table 1 will remain as appropriate for policy intervention. Other factors are beyond the direct control of the government, and to be taken as given. Transportation infrastructure becomes the only common factor which can be manipulated by the government. As such, transportation infrastructure can be used for inducing industrial development in the lagging regions.

3. Regional Development Policies and Industrial Location in ASEAN Countries

The following chapter briefly discusses the industrial decentralization policies adopted by the four ASEAN countries. Five year national development plans of these countries are studied to extract the regional industrial development policies during the last three decades. The effectiveness of these policies are evaluated using pre and post policy Theil's entropy coefficient of manufacturing concentration. The dotted line in the Figures 2 to 5 shows the percentage share of manufacturing value added in GDP, while the solid line shows the change of Theil's entropy coefficient over time.

(1). Malaysia

The industrial decentralization efforts of Malaysia fall into three categories; Growth pole strategy, industrial estate development, and investment incentives. The earliest evidence of growth pole strategy dates from the end of sixties and became more apparent after the introduction of New Economic Policy (NEP) in 1970. It was envisaged that towns with a population of between 40,000 and 75,000 in 1970 should assume the role of growth poles [16]. The second strategy started with the establishment of the first industrial estate in Petalin Jaya near Kuala Lumpur in the mid fifties. By 1970, a further nine industrial estates had been created on the West coast of Malaysia. In subsequent years, however, the industrial estates were used as instruments for decentralization of industrial development in Malaysia. Today there are 198 industrial estates and 12 free trade zones in all over Malaysia.

Investment incentives in Malaysia started in 1958 with the Pioneer Industries Ordinance of 1958. Assistance were provided to new manufacturing establishments which came under pioneer industries. In 1967, Malaysian Industrial Development Authority (MIDA) was established to promote and coordinate industrial development in Malaysia. However, until 1968 with the enactment of Investment Incentives Act of 1968, locational priorities were not taken into the investment incentives. The year 1968 saw, therefore, the first example of a direct link between investment incentives and choice of location. The Act was amended twice in 1971 and 1973. Both amendments fully endorses the policy of industrial decentralization. This period also saw the introduction of the Industrial Coordination Act of 1975 as an instrument to achieve the New Economic Policy (NEP) objectives with regard to Bumiputra equity participation and employment in the manufacturing sector. However, the act did not influence the spatial distribution of manufacturing industries.

A change in the perception of decentralization of manufacturing industries started with the introduction of Fourth Malaysia Plan (1981-1985). The equity consideration has been gradually transformed into efficiency with the introduction of privatization and private sector participation in industrial development. The Investment Incentives Act was replaced by the Promotion of Investments Act (PIA) in 1986 to include more incentives for research and development and for high technology industries. However, the act did not give much consideration to spatial aspects of investment incentives. Thus, in line with the objectives of the IMP, the Action Plan for Industrial Technology Development was launched in 1990. As seen in Figure 2, investment incentive policies were effective in decentralization of manufacturing activities until the introduction of IMP in 1986. The change of the Theil's entropy coefficient in 1988 clearly shows the effect of IMP in manufacturing decentralization.

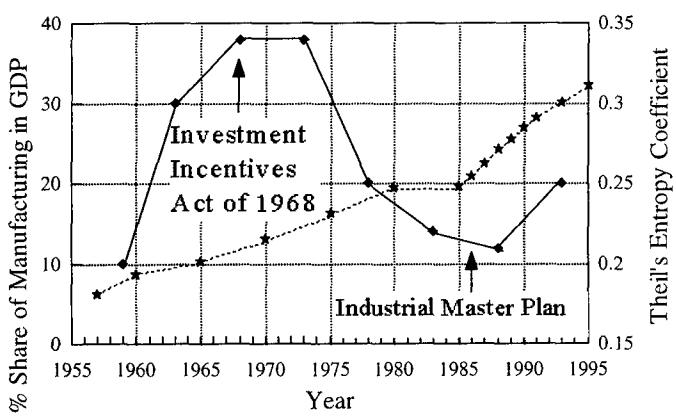


Figure 2: Industrial Dispersion Policies of Malaysia

(2). Indonesia

Since 1966, Indonesia has emphasized industrial development as an important policy goal of the government. Indonesia enacted its first export promotion law with the Capital Investment Law No. 1 of 1967, amended by Law No. 11 of 1970. The first three *Replita's* (five year national development plans) did not show any signs of regional industrial development. The regional industrial development was first appeared in *Replita IV* (1984/85-1988/89) and emphasized in *Replita V* (1989/90-1993/94). A concept of regional industrial growth centers was promoted by the Law No.5 of 1984 to optimize industrial locations based on available resources and environmental considerations. However, until now such promoted areas were not officially designated.

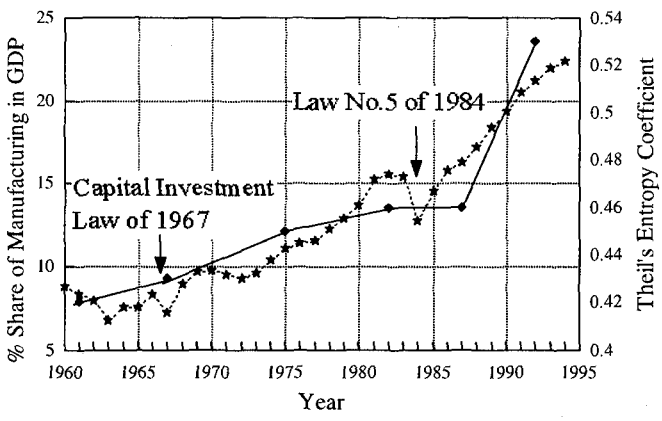


Figure 3: Industrial Dispersion Policies of Indonesia

The concept of industrial estates in Indonesia was first introduced with the development of a Study Project on Industrial Estate in Cilacap (Central Java) in 1968. However, the first physical development was not implemented until the Jakarta Industrial Estate Pulogadung in 1971, which was then followed by several industrial estates. The presidential decree No. 53/1989 has made a great change in the industrial estate development concept by introducing opportunity for the private sector to develop industrial estates. In the absence of a clear and concrete industrial location policy, manufacturing plants have mostly chosen to locate in core regions, particularly in Java. This has created an ever increasing regional disparity in industrial development. An increasing Theil's entropy coefficient in Figure 3 clearly portrays the regional disparity of industrial development in Indonesia.

(3). Thailand

The role of the private sector in promoting industrial development was first acknowledged in 1954 when the government enacted the "Industrial Promotion Act". However there was no serious effort to implement the act until 1960, when the Board of Investment (BOI) was established. Since the early sixties, Thailand's industrialization process changed significantly. The first National Development Plan prepared by the National Economic and Social Development Board (NESDB) was introduced in 1961. Industrial development strategies were spelled out in the successive development plans. The first explicit support for regional industrial development was spelled out in the Third National Economic and Social Development Plan (1971-1976). Under this plan, the Board of Investment started granting investment incentives to industries those located in the promoted zones of various regions. The policy of dispersing industrial development to lagging regions continued to be emphasized in the Forth (1977-1981), Fifth (1982-86) and Sixth Plans (1987-91). In the Fifth Plan there was an explicit strategy to target the Eastern Seaboard area, located in Chon Buri in the Eastern region, for industrial development. Other areas targeted as growth poles include Chiang Mai in the Northern region, Khon Kaen and Nakhon Rachasima in the Northeastern region, and Songkhla in the Southern region.

In accordance with the Third National Economic and Social Development Plan, a revolutionary decree (Decree 227 of 1972) was issued in 1972 providing a number of investment incentives for areas designated as promoted investment zones. The following year, in 1973, BOI designated 72 districts in 21 provinces as promoted zones for industries. BOI's power in designating promoted investment zones was again formally incorporated with the enactment of the Investment Promotion Act of 1977. This was followed by redefinition of promoted zones in 1978, 1983, 1985, 1987, and 1991. The latest act which is implemented in 1991 amending the 1977 Investment Promotion Act divides the country into three zones for incentives. Zone one which obtains the least privileges comprises 6 provinces surrounding Bangkok. The zone 2 includes 10 provinces surrounding zone 1. Zone three, which obtains the highest privileges, comprises of remaining 60 provinces of Thailand. The continuous effort to decentralize industries using investment incentive policies were effective in Thailand as given in Figure 4. The reduction of Theil's entropy coefficient after 1975 shows the effectiveness of the investment incentive policies.

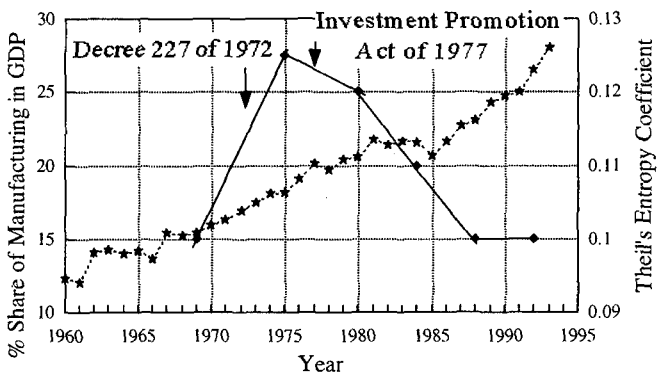


Figure 4: Industrial Dispersion Policies of Thailand

(4) The Philippines

Towards the end of the 1960's regional industrial development became one of the priorities of the government. Major indications of the change in emphasis included the various incentive acts of the late sixties and early seventies. Although the regional development was first articulated in the 1963 Integrated Socio-Economic Plan, the continuing and more serious attempt surfaced in the regional dispersal thrust of the Industrial Incentives Act of 1967 (Republic Act No. 51869). It granted a

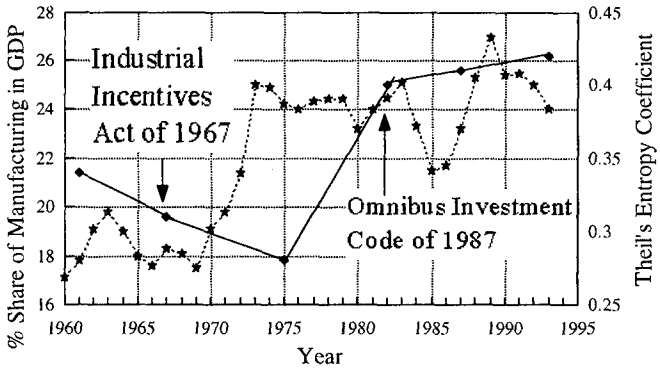


Figure 5: Industrial Dispersion Policies of Philippines

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.

The regional development initiative gained further importance in the Integrated Reorganization Plan in 1972 and became an on-going objective of subsequent development plans. Additionally, direct policies for regional dispersal, such as fifty-kilometer radius ban in Manila (in 1973) and concerted efforts at integrated area development, have been instituted. In the 1980's three major incentive acts were passed. They are the Omnibus Investment Codes (OIC) of 1981, 1983 and 1987. The OIC of 1981 (Presidential Decree No. 1789) consolidated all the provisions of the Investment Incentives Act of 1967 and Export Incentives Act of 1970 without any major changes. Even though industrial decentralization was implemented as a national policy, specific areas were not designated for industrial development. Except a few, almost all industrial estates have been located in and around the National Capital Region (NCR). Therefore, as seen in Figure 5, industrial decentralization strategies were not fully successful. Even though Theil's entropy coefficient reduces initially, it increases after 1975.

Tables 2 to 5 shows the regional distribution of new industrial approvals during the study period. It conforms the results of the above analysis. As a summary, it can be concluded that the investment incentive policies of Malaysia and Thailand were

Table 2: Percentage Distribution of New Industrial Approvals in Malaysian Regions

	1969-1980	1981-1990	1991-1994
Regions Designated as Locational Incentive Areas	26.6	31.4	34.1
Other Regions	73.4	68.6	65.9
Total	100	100	100

Data Source: Malaysian Industrial Development Authority (MIDA).
Note: Regions which come under "locational Incentive Areas" include Johor, Kedah, Kelentan, Pahang, Perlis and Terengganu.

Table 3: Percentage Distribution of Investments Approved Under Various Investment Incentive Laws of Indonesia

Region	Upto 1985	1985-89	1990-94
Java	61.2	64.5	65.1
Regions Outside Java	38.8	35.5	34.9
Total	100	100	100

Data Source: Capital Investment Coordination Board (BKPM), 1995.

Table 4: Percentage Distribution of BOI Promoted Firms by Investment Zones in Thailand

	1960-73	1974-78	1979-83	1984-88	1989-91
BOI Zone 1	77.5	68.6	62.7	63.9	45.2
BOI Zone 2	6.9	11.3	9.9	13.6	25.9
BOI Zone 3	15.6	20.1	27.1	22.0	28.8
Total	100	100	100	100	100

Data Source: Board of Investment (BOI), Thailand.
Note: BOI Zone 1 include Bangkok and the 6 surrounding provinces. Zone 2 include the 10 provinces surrounding Zone 1. Zone 3 includes the remaining 60 provinces.

Table 5: Percentage Distribution of Investments Approved Under Various Investment Incentive Laws of the Philippines

Region	1970-77	1980-85	1986-90
NCR	72.9	26.8	35.1
Immediate Peripheral Regions	12.7	16.9	47.9
Others	14.4	56.3	17.0
Total	100	100	100

Data Source: Unpublished data of the BOI, 1994.
Note: Immediate Peripheral Regions include Central Luzon and Southern Tagalog

relatively successful in decentralizing industries from the core regions. On the contrary, the policies adopted in Indonesia and the Philippines did not produce successful results. The latter two countries have not provided specific action plans or promotional areas like the former two. In the Philippines, most of the industries have selected the immediate periphery of the National Capital Region for their plant location. Similarly, Java still attracts the majority of industries compared to outer islands of Indonesia.

Despite the government's attention on financial incentives for decentralization of manufacturing industries, the theoretical discussion in Chapter 2 pointed out the importance of transportation and other infrastructure services for industrial location decisions. As such, the following chapter intends to discuss the role of transportation infrastructure in regional industrial development of ASEAN countries.

4. Transportation Infrastructure and Regional Industrial Development

Literature on the effect of infrastructure on private sector production in developed countries shows that infrastructure can expand the productive capacity of a region, both by increasing the amount of private inputs and by enhancing the productivity of existing inputs [17)-19)]. However, much less work has been done in this regard in developing countries. When we closely look at the regional distribution of manufacturing industries in ASEAN countries, it is clear that the availability of transportation infrastructure becomes an important factor in attracting firms. Firms seek areas that offer greater opportunities for economic profit. To empirically test the importance of transportation infrastructure in attracting private capital, the manufacturing output of a region is related with the availability of national ports and the average road density for 1980-1992 period (data for manufacturing output is obtained from Annual Survey of Manufacturing Industries, while road density data is obtained from regional statistics published by the National Statistics Office of the respective countries). Road density is portrayed by an ordinal scale of three; high, medium and low; obtained using percentile points as boundaries. When the road density values are given in an ascending order, the values less than the 33.3rd percentile point are considered "low", the values between 33.3rd and 66.6th percentile points are considered "medium", and the values higher than the 66.6th percentile point are considered "high". Road density is combined with the availability and non-availability of national ports to represent the independent variable. The dependent variable, percentage of average manufacturing output, is calculated for each group and given as in Table 6. The AMOPR refers to "Average Manufacturing Output Per Region". It is clear from the table that when

(a) Malaysia

Road Density	Port Availability	
	Yes	No
High	No. of Regions: 4 AMOPR: 14.8%	No. of Regions: 1 AMOPR: 0.4%
Medium	No. of Regions: 2 AMOPR: 9.2%	No. of Regions: 2 AMOPR: 4.7%
Low	No. of Regions: 3 AMOPR: 4.0%	No. of Regions: 1 AMOPR: 0.7%

(b) Indonesia

Road Density	Port Availability	
	Yes	No
High	No. of Regions: 1 AMOPR: 20.8%	No. of Regions: 0 AMOPR:
Medium	No. of Regions: 7 AMOPR: 6.0%	No. of Regions: 6 AMOPR: 4.3%
Low	No. of Regions: 6 AMOPR: 1.0%	No. of Regions: 7 AMOPR: 0.8%

(c) Thailand

Road Density	Port Availability	
	Yes	No
High	No. of Regions: 1 AMOPR: 54.1%	No. of Regions: 1 AMOPR: 11.5%
Medium	No. of Regions: 1 AMOPR: 21.1%	No. of Regions: 1 AMOPR: 3.1%
Low	No. of Regions: 1 AMOPR: 8.3%	No. of Regions: 2 AMOPR: 1.9%

(d) Philippines

Road Density	Port Availability	
	Yes	No
High	No. of Regions: 4 AMOPR: 19.0%	No. of Regions: 1 AMOPR: 1.0%
Medium	No. of Regions: 2 AMOPR: 3.7%	No. of Regions: 2 AMOPR: 4.3%
Low	No. of Regions: 2 AMOPR: 2.9%	No. of Regions: 2 AMOPR: 0.6%

Table 6: Transportation Infrastructure Availability and Regional Manufacturing Output in ASEAN

transportation infrastructure reduces, the percentage of average manufacturing output per region get reduced (with the exception of few cases). For example, the average manufacturing output of a region with a port in the high road density group in Malaysia is 15% compared to the medium and low density groups which are 9% and 4% respectively.

To explore the above relationship in a detail manner, an aggregate production function has been estimated for the regional manufacturing in ASEAN countries. The transportation infrastructure becomes another input in the regional production function and the equation looks as follows:

$$Q = (MFP) * f(K, L, I) \qquad (1)$$

where Q is the 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:

$$Q = MFP * K^a L^b I^c. \qquad (2)$$

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

$$\ln Q = A_1 + A_2 \ln MFP + a \ln K + b \ln L + c \ln I. \qquad (3)$$

The coefficient a, b, c are the output elasticity of the factor inputs. The equations were estimated using pooled regional data for Malaysia, Indonesia, Thailand, and the Philippines during 1980-1992 period. Infrastructure is represented by road density (Rd) of a region and availability of national ports by a dummy variable (PDUMMY). After including these two variables the equation becomes:

$$\ln Q = A_1 + A_2 * PDUMMY + A_3 \ln MFP + a \ln K + b \ln L + c \ln Rd. \qquad (4)$$

The above equation was estimated using data obtained from annual survey of manufacturing industries, physical infrastructure data and education data compiled by the national statistics office of the respective countries. For the manufacturing output, manufacturing value added data were converted into constant prices using deflators. Similarly, for private capital stock, value of fixed assets owned by manufacturers as at 31st December of the respective years were converted to constant prices using deflators. For labour, the total number of persons worked during that particular year is obtained from annual survey of manufacturing industries. As a proxy for marginal factor productivity (technology standard), the education level of the regions, measured as a ratio of the number of teachers to the number of students, is used.

The regression results, which are summarized in Table 7, confirm, on the regional level, infrastructure has a significant positive impact on the level of manufacturing output. Road infrastructure has an elasticity of 0.06 for Malaysia, 0.22 for Indonesia, 0.16 for Thailand, and 0.58 for the Philippines. The port dummy also has a positive, statistically significant

Table 7: Ordinary Least Squares Estimation of the Regional Manufacturing Output for the ASEAN Countries, 1980 - 1992

	Malaysia		Indonesia		Thailand		Philippines	
	Without Infra.	With Infra.	Without Infra.	With Infra.	Without Infra.	With Infra.	Without Infra.	With Infra.
Const.	2.33	3.45	2.50	2.80	2.28	2.73	4.29	4.43
PDUMMY		0.18 (5.42)		0.10 (2.05)		0. 16 (3.06)		0.15 (0.59)
ln MFP	0.10 (0.19)	0.63 (0.91)	0.46 (4.57)	0.06 (0.50)	0.45 (0.96)	0.83 (1.12)	-1.95 (0.61)	-1.58 (0.55)
ln K	0.42 (9.94)	0.35 (8.73)	0.73 (22.34)	0.67 (20.06)	0.68 (6.88)	0.59 (7.54)	0.92 (3.56)	0.78 (3.13)
ln L	0.73 (13.17)	0.75 (12.39)	0.19 (6.18)	0.13 (4.48)	0.19 (8.85)	0.18 (9.95)	0.17 (1.06)	0.17 (1.11)
ln Rd		0.06 (2.31)		0.22 (6.09)		0.16 (4.46)		0.58 (2.37)
$\bar{R}^2$	0.90	0.92	0.77	0.80	0.83	0.87	0.78	0.82
SE	0.17	0.15	0.41	0.39	0.24	0.23	0.35	0.32

Note: t-statistics are shown in parenthesis.

coefficient for all four countries . The comparison of the regression results with and without infrastructure shows that when infrastructure is added to the equation, it enters with a positive, statistically significant coefficient and reduces the standard error of the equation.

The above discussion shows that transportation infrastructure is an important determinant of manufacturing industry location. Transportation infrastructure enters into the regional production function as an unpaid factor. Therefore, infrastructure should play a major role in decentralization of manufacturing industries from the core regions. The above analysis does not provide a direct link between transportation infrastructure and industrial decentralization. The analysis should be directed towards the policies and strategies followed by ASEAN countries. As discussed in the preceding chapters, ASEAN countries have been using the growth pole strategy, industrial estate development and investment incentives, as main policy instruments in regional development. The following chapter will look into the role of transport infrastructure in growth poles and industrial estates.

5. Growth Pole Strategy and Infrastructure

As discussed in the previous chapters, ASEAN countries have been using growth poles as a feasible way of providing scarce resources for regional development by lumping them in growth centers than thinly spreading over space. However, all growth poles were not successful as expected. When the distribution of new manufacturing firms among these growth poles were considered, it became clear that regions with good port facilities and road infrastructure were much more successful than the ones without them. Johor can be named as the most successful growth pole in Malaysia. Table 8 provides the distribution of industrial approvals in all the growth poles in Malaysia. As clearly seen from the table, Johor has attracted the majority of industries during 1969-94 (growth pole strategy was first introduced by the New Economic Policy in early 1970's) . Similarly, Riau region in Indonesia outweighs the other lagging regions in terms of new industrial approvals. Even though there were no specific growth poles designated in Indonesia, major cities in the eastern part have been targeted as growth centers. The Table 10 shows the increasing attractiveness of Riau region, especially among foreign investors. As discussed in Chapter 3, Thailand introduced the growth pole strategy in the fifth National Economic and Social Development Plan (1982-1986). Among the five growth poles, Eastern Seaboard has been highly successful in attracting manufacturing industries. The growth of manufacturing value added for the 1986-1993 period shows that Chonburi province (Eastern Seaboard) has doubled its value added, while the other regions have achieved less than half of it (refer Table 9).

Table 8: Percentage Distribution of Industrial Approvals in Growth Poles in Malaysia 1969-1994

	1969-1980	1981-85	1986-89	1990-94
Johor	57.2	50.9	72.7	67.1
Kedah	16.5	18.7	13.1	19.0
Kelanthan	5.8	10.0	2.9	1.4
Pahang	13.9	10.7	6.8	5.0
Perlis	1.5	3.5	4.1	2.5
Terengganu	5.2	6.4	0.5	5.1
Total	100	100	100	100

Data Source: Malaysian Industrial Development Authority (MIDA).

Table 9: Growth of Manufacturing Value Added in Growth Poles in Thailand, 1986-1993

Unit: 1000 Baht

	1986	**1993**	**% Growth**
Chonburi	31523008	63252326	100.7
Songkla	1337321	2099195	57.0
Khon Kaen	2965954	4168720	40.6
Chiang Mai	2921457	4006851	37.2
Nakohn Rachashima	2911580	3287846	12.9

Data Source: NESDB, Thailand.

Table 10: Approved Domestic and Foreign Direct Investment in Riau, Indonesia 1969-1994

Year	Domestic Investment (in Billion Rupiah)			Foreign Investment (in Million US$)		
	Riau	Indonesia	% of Indonesia	Riau	Indonesia	% of Indonesia
1969-1980	86114	4265029	2.0	61.7	6442.6	1.0
1981-1985	48063.4	1157954.5	4.2	118.6	1838.5	6.5
1986-1989	3589.7	49191.5	7.3	933.6	11436.6	8.2
1990-1994	14896.6	219669.6	6.8	7505.9	59720.8	12.6

Data Source: Capital Investment Coordination Board (BKPM), Indonesia .

The success of Johor and Riau as growth poles is partly attributed to the Johor-Singapore-Riau (JSR) growth triangle. The main concept of the JSR triangle is maximization of comparative advantages possessed by each region of the triangle. The relative cheap land and labour availability of Johor and Riau is compromised for the highly advanced infrastructure and management services of Singapore. As such, from the regional development perspective, Johor and Riau is reaping the advantage of being close to developed infrastructure services and international boarders, which other growth poles do not possess. The Eastern Seaboard in Thailand also succeeded mainly due to its proximity to Bangkok and the availability of deep sea ports. The Eastern Seaboard area has three ports (Sattahip, Laem Chabang and Map Ta Phut) and possesses a good road network which connects it to the Bangkok. Except Songkla other three growth poles do not have direct access to ports. As such it becomes clear that port and road infrastructure facilities are important for the success of growth poles.

Apart from growth poles, industrial estates were developed with an aim of providing attractive incentives to the prospective investors. Also it is one of the feasible ways of providing adequate infrastructure for industrial activities. In addition, as discussed in the preceding sections, these industrial estates became another important tool in decentralizing of industrial activities from the core regions. Explicit efforts were taken to create industrial estates in lagging regions. However, when the total area or the number of industrial estates are taken into concern, most of these estates are located in the core regions. One of the main reason behind this bias is the availability of adequate road infrastructure, ports and airports in the core regions. As given in Tables 11 to 14, the majority of industrial estates are located in the core regions of the country. Even though there is an obvious need to decentralize industrial activities away from the core regions, the government agencies or the private developers of these industrial estates were not successful enough to act against the force of comparative locational advantages possessed by the core regions. Apart from the location bias, performance of the industrial estates are also biased towards the core regions. To empirically analyze the relationship between performance of the industrial estates and the transportation infrastructure of the locality, data were obtained for all the operational industrial estates in the four ASEAN countries (data were obtained from MIDA in Malaysia, BKPM in Indonesia, BOI's in Thailand and the Philippines). Performance is measured using the occupancy 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 occupancy rate. These performance indices were compared with an accessibility index developed using the distance of the industrial estate from the ports, airports and the road density of the region. Following Ottensmann [20] and Bruinsma et al. [21] the equation 5 is used to calculate the accessibility index of an industrial estate relative to the infrastructure facilities of a region.

Table 11: Location of Operational Industrial Estates in Malaysia as at January 1996

	Number	Area (Ha.)	Occupancy Rate (%)
Core Regions	146	14674	77.2
Lagging Regions	89	8623	75.2
Total / Average	235	23297	76.2

Data Source: Malaysian Industrial Development Authority (MIDA).

Table 12: Location of Operational Industrial Estates in Indonesia as at July 1994

	Number	Area (Ha.)	Occupancy Rate (%)
Java	127	33382	81.0
Outside Java	27	8742	56.1
Total / Average	154	42124	68.6

Data Source: Indonesian Industrial Estate Association (HKI).

Table 13: Location of Operational Industrial Estates in Thailand as at August 1994

	Number	Area (Ha.)	Occupancy Rate (%)
BOI Zone 1 (Bangkok Area)	11	2935	92.3
BOI Zone 2 (Outer Ring)	13	4211	58.0
BOI Zone 3 (Other Regions)	17	6151	32.9
Total / Average	41	13297	61.1

Data Source: Board of Investment (BOI), Thailand.

Table 14: Location of Operational Industrial Estates in Philippines as at April 1994

	Number	Area (Ha.)	Occupancy Rate (%)
Within a radius of 30 Km to Manila	7	1669	71.9
30 Km - 60 Km	13	1040	53.6
60 Km - 100 Km	3	517	21.6
Outside Manila	8	5957	50.4
Total / Average	31	9183	49.4

Data Source: *Philippines Industrial Estates*, Bonded Export Marketing Board, Department of Trade and Industry, Manila, 1995.

$$Ai = \frac{\sum_{j=1}^{n} W_j / d_{ij}^2}{\sum_{j=1}^{n} W_j} \qquad (5)$$

Where,
A_i accessibility index of industrial estate i,
W_j is the weighted attractiveness of infrastructure facility j, and
d_{ij} is the distance between industrial estate i and the infrastructure facility j,

Attractiveness is given by the capacity of a infrastructure facility. Capacity is measured using several physical parameters of the facility in a hierarchical order of importance. These parameters are reduced to one single measure using Analytic Hierarchy Process [22]. When the accessibility indices were plotted against the occupancy rates, a relatively good correlation could be obtained for all four countries. As an example, Figure 6 shows the relationship for the Philippines. Accessibility to major infrastructure facilities determine to a large extent the popularity of the industrial estates and consequently their performance.

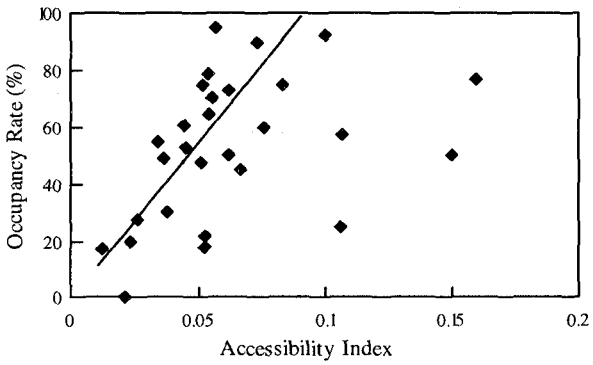


Figure 6 : The Relationship Between Infrastructure and Performance of Industrial Estates in Philippines

7. *Conclusions*

Even though the accelerated industrialization strategies adopted by most of the ASEAN countries are fairly successful, the regional disparity created within those countries could be regarded as one of the negative consequences. The decentralization of industrial activities from the core regions has become one of the targets of the national policy. Theoretical discussion on regional development shows that government intervention is needed to reverse the polarization experienced in the ASEAN countries. Coupled with industrial location theories, it can be argued that the possibility of government intervention rests mainly in the transportation and other infrastructure allocations. The main regional development strategies of the ASEAN countries are the growth pole strategy, industrial estate development and investment incentives to induce industrial development. Malaysia and Thailand have used these policies successfully. They have provided specific action plans with designation of promotional areas. Transportation infrastructure plays an important role in the regional manufacturing production. It also determines to a large extent the success of growth poles, location and performance of industrial estates.

Appendix A

For the measurement of inequality or dispersion, Theil's entropy coefficient (T) has been used throughout this paper. T is defined using following formula:

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

Where,
n is the number of regions, μ is the unweighted 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.

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アセアン諸国における産業立地に及ぼす社会基盤整備の影響

R．ラミースディーン、赤塚　雄三

第 2 次世界大戦後にアジア諸国が採った工業化促進戦略は押し並べて成功している。これらの諸国では経済成長の帰結の一つとして地域格差の拡大に悩まされていることも事実である。こうした地域格差は開発途上国が戦略対象として誘致した先進企業がその国の中でも比較優位の特定地域に集中した局地化現象に因る所が大きい。アセアン諸国の中でも、特に、マレーシア、タイ、インドネシアおよびフィリピンではこの企業立地の局地化現象が顕著である。本研究ではこの現象に着目し、開発途上国政府が地域格差是正のために採用した製造業地方分散化政策について検討し、その過程で運輸基盤整備が地域開発に果たす役割の評価も試みる。

Impact of Infrastructure on Decentralization of Manufacturing Industries in ASEAN Countries

By Raufdeen Rameezdeen and Yuzo Akatsuka

Accelerated industrialization strategies adopted by most of the developing countries in Asia in the post World War II period had been generally successful. 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. The ASEAN countries, especially Malaysia, Thailand, Indonesia and the Philippines provide typical examples of the above phenomena. This paper discusses the policy measures adopted by the above countries for decentralization of manufacturing industries from the core region. The role of transportation infrastructure in regional development is assessed along with the above policies.
