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THE NATIONAL BUREAU OF STANDARDS

WASHINGTON, D. C.

ALTERNATIVE MODELS OF S & T DEVELOPMENT

Teodoro M. Santos*

ABSTRACT. *The demand for S & T development derives from the demand for social and economic development, hence the same factors that motivate the latter likewise propel the former. For instance, the solution to poverty, unemployment and income inequality which are at the core of every socioeconomic development plan for a developing country like the Philippines must be the same concerns which justify a S & T development program in such a country. To provide an analytical apparatus for examining S & T development, the social production function of economics is introduced. Within this framework, it is found that S & T can play either of the following roles: as a factor in producing social goods, or as a shift parameter which enhances the productivity of other input factors. Two general planning approaches for developing S & T are identified: central planning and planning based on market mechanism. As an application of the analytical machinery, the DOST's S & T development plan for 1987-1992 is examined. It is concluded that the present plan, essentially based on market mechanism, is reasonable and its emphases are properly placed.*

INTRODUCTION

As the title of this paper suggests, it is supposed to deal with alternative models of science and technology development, the idea being to determine what models are currently available in the market and then be able to choose from them based on some rational criteria. A brief review of the pertinent literature indicated that there are already existing good works on the subject, though scattered. More importantly, we realize that the choice of development strategy is but a small part of a bigger and more important work, the S & T Development Plan. Hence, this work focused on the S & T Development Plan and then treated the original topic as a subset.

Since the work is intended to be a chapter of a textbook, a deliberate effort has been made to present an analytical tool which the reader can use as basis for analyzing and explaining the elements or details of a S & T plan, as well as in predicting its possible consequences. Our search led us to borrow the social production function concept, along with the indifference analysis technique from development economics. We think that this is quite appropriate, particularly since we are interested in analyzing the impact of science and technology on society.

With the help of the social production function, we predict, as an exercise, from general considerations, such as from the general provisions of the national development plan, what the elements of a S & T Development Plan should be. Among others, they include the choice from alternative development strategies.

As a final exercise and to give empirical content to this work, we examined the country's S & T Development Plan for 1987-1992 which

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was prepared by the Department of Science and Technology (DOST). We cast the plan in the format required by the social production function so that the logic of this analytical device can be used to analyze the plan and to predict its consequences.

THE RATIONALE FOR S & T DEVELOPMENT PROGRAM

The demand for S & T development is a derived demand. It does not exist for its own sake, but rather for the sake of some social good, viz., national economic and social development or simply national development. Specifically, S & T has work to do in helping solve the problems of national development. Such problems must determine the configuration, substance and direction of a S & T development program.

Though numerous problems currently plague the country, three general problems common to most developing countries are paramount, viz., (a) poverty, (b) massive unemployment, and (c) inequitable income distribution. These problems tend to undermine the very foundation and integrity of society.

In solving these problems and hence, achieving development, the national government decided to choose the agricultural sector as the main engine of development for the following reasons: (a) it includes a very large (about 70%) segment of the population, the bulk of which being poor; (b) the pool of low productivity rural workers can be tapped for greater agricultural production, for rural industries and agricultural capital formation; (c) more productive rural employment will result in direct income redistribution; (d) higher level rural income will result in greater voluntary savings for investments and higher level of tax revenues and capital formation for the government in behalf of society; and (e) productive farmers act as source of effective demand from the industrial sector (Kindleberger and Herrick, 1977:215).

Although in the short and medium term, agriculture can serve as the main engine of development, in the long term the manufacturing (and service) industries must play the major role in the economy as experience in the developed countries shows, since agricultural land is rather limited. To play such role, however, the sector must rectify some of the problems which it has met so far, viz.: (a) it is very costly in terms of imports and other scarce resources, in fact, it imports both capital goods and raw materials; and (b) it is also very capital intensive, hence, it creates employment at a very high unit cost.

While agriculture plays the greater role in national development, the industries can grow alongside, though on a more modest scale. In fact, industries can help agriculture become more productive, as they promote their own growth, by gearing some of their activities towards the needs of agriculture.

The preceding discussions have focused mainly on production for internal consumption. However, national wealth can be enhanced through trade. S & T nowadays is a very important factor for success in international trade. Innovation in terms of a new product may confer at least temporary monopoly during which substantial economic profits may be derived. Advantages gained in trade through S & T innovation is illustrated by the "Product Life Cycle" theory which is briefly discussed in the following paragraphs.

Product Life Cycle Theory

A version of the Product Life Cycle theory postulates that a product undergoes three stages: (a) specialty; (b) standard product; and (c) commodity. The life cycle of a product starts when a company sells a new product that is entirely or partially different from an old product. At this stage the product is a specialty and the company enjoys a monopoly and hence earns very substantial profits. The onset of the second stage occurs when other companies imitated (even improved upon) the product, thus becoming a standard product. Some product differentiation may be maintained in this stage through different packaging and other nonprice competition techniques. Nevertheless, considerable profits may still be derived at this stage. Finally, the product may slip into the third, the commodity stage, when many firms produce the same product which look the same to the consumers. At this stage price competition becomes operative and high profits become rather unlikely.

When applied to the behavior of the U.S. exports of manufactures, the theory assumed four stages:

- (1) U.S. possessed monopoly in the export of a new product
- (2) Start of foreign production (other industrial countries)
- (3) Foreign production becomes competitive in the export market (U.S. start being beaten in the export market)
- (4) U.S. imports the no-longer new product (Developing countries with cheap labor gain advantage here)

The theory as expounded, along with the empirical evidence, indicates that the innovator enjoys monopoly profit or rent. Such profits, however, are competed away during the later stages of the cycle. Finally, the innovator loses its comparative advantage even in its home market and becomes a net importer (Root, 1973:120-123).

After society, represented by government, has chosen what it desires to do, then it is appropriate to make a S & T plan which will help implement the national development plan. However, it is first necessary to have a reference framework which will provide guidance in making the plan.

ANALYTICAL FRAMEWORK

How can S & T help in national development? To answer this question, we can examine an analytical apparatus used by economists in analyzing growth or development — the *social production function*. Within this framework we can see that S & T plays two important roles: (1) as a shift parameter, a factor which makes production in society more efficient or use less of an input factor than another, and (2) as a factor which can enhance the productive attributes of the other factors.

What is a social production function? It is a formula which describes the technical relationship among a set of factors in the production of social good. In symbols, we can represent it as follows:

$$Y = f [\text{Labor, Capital, Resources, Technology, Organization}] \\ X_1, X_2, \dots, X_n$$

where Y = social good or social welfare, the measure of development;

X_1, X_2, \dots, X_n are factors usually assumed constant like population, culture, time and geography;

Labor, Capital, Resources, Technology and Organization are independent inputs which determine the value or level of Y .

Due to the fact that the Euclidian geometry with which most analysts are familiar is limited to three dimensions, the above formula is further simplified to three variables by assuming that, among others, technology and organizations are constants. In this sense they become shift parameters, i.e., when they change, they determine the position and direction of Y even if they are not the variable determinants. That is, given the same quantity of inputs (hence costs), these shift parameters can influence the level and bias of Y .

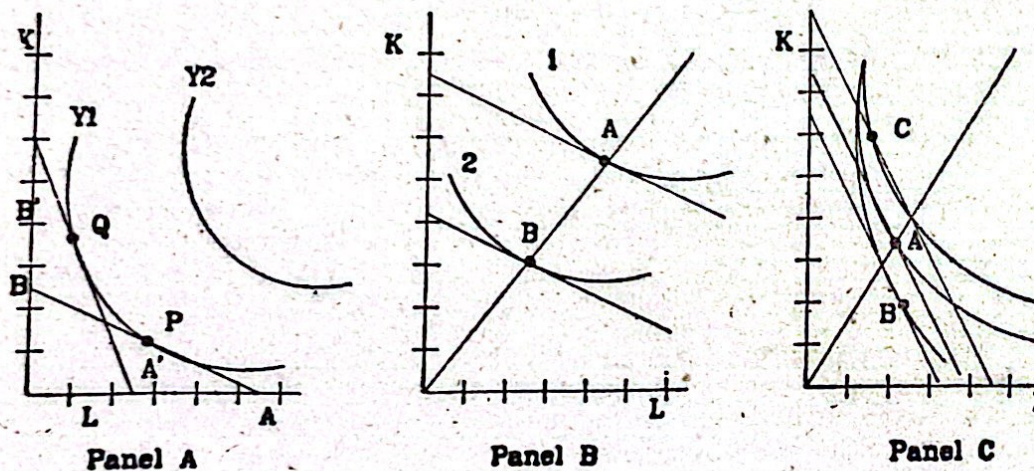


FIG. 1. COMMON PROPERTIES OF PRODUCTION FUNCTION
(After Kindleberger and Herrick, 1977:130)

In panel A of Fig. 1, Y_1 (isoquant) represents the same level of welfare determined by different combinations of L and K . Y_2 represents a higher level of welfare due to the employment of higher levels of L and K . Line AB , budget line, represents different combinations of L and K that can be had with the budget. In the limit, if total budget is used on L alone, OA units will be purchased; if budget is used on K , OA units will be used. Given the price ratio of K and L , P , the point of tangency with Y_1 , represents the optimal combination of L and K . An increase in the price of L rotates the budget line AB to $A'B'$ so that the optimal combination is now at Q .

Panel B represents neutral technological change favoring neither K nor L . Curves 1 and 2 represent the same level of welfare. Curve 2 describes the situation after the technological change. Change is neutral since optimal combination of factors fall along the same radial line of constant prices.

Panel C represents biased technological changes. Reference to line OA indicates that curve 2 represents K saving change while curve 3 represents L saving change.

Ease of comprehension oftentimes forces further the analysts to reduce the three variables to two, as graphical presentation is relatively easier with two variables than with three. This is done by omitting (hence assuming constant) resources, or by taking the ratio of capital to labor as a single variable.

Some of the attributes and implications of the production function which are relevant to the present discussion are described below:

- (1) Given any value of Y , i.e., any level of social good, one can always find a number of combinations of inputs which yield that same result, given an appropriate set of socio-technical arrangements. This means that, up to a limit, the same level of welfare can be attained by using more of an abundant (cheaper) factor input and less of the scarcer (more expensive) input. For instance, if more employment is a desirable end, then it is good for society to employ more labor (of which the country has plenty) and less capital (which is relatively scarce) to produce a given level of welfare. S & T can therefore help achieve such an objective by producing technologies (machines, processes, organizations, socio-technical arrangements, etc.) which conduce to employing more labor than capital.

The number of alternative combinations of inputs that yield the same Y depends upon the available alternative processes (i.e., technology). The more alternative processes there are, the easier a society can adjust to changes in factor scarcities. S & T can help society by providing the processes and socio-technical conditions which are consistent with its pool of factor endowments.

- (2) The level of welfare Y can be increased, say from Y_1 to Y_2 , all other factors remaining the same, by correspondingly increasing the inputs capital, labor and resources in a proportion dictated by the existing technology. It is important to note here that the technology determines the ratio at which the factors are employed. Such ratio, however, reflects the peculiar problems faced by the manufacturer such as labor scarcity. This implies that the machines we import from rich countries will force us to employ labor as if we were also as rich. This implies further that if such technology were modified (or redesigned) to fit the domestic relative factor scarcity, the same level of welfare Y_2 can be attained while employing more of our abundant factors, say labor. Deliberate policy on technology adaptation or generation to incorporate in the technology the local relative factor intensities, whichever is more cost effective, is therefore indicated. Since local relative factor scarcity of necessity changes over time, either through design or otherwise, technology must adjust similarly.

We must also be aware that, regardless of the factor ratios, an appropriate technological innovation can produce more social good even if the same amount of factor inputs as before were used. (Here technology acts as a neutral shift parameter.)

- (3) *Capital* usually represents productive facilities like machineries, equipment and factories. They reflect, of necessity, the problems

of producing certain goods or services within the constraints of existing relative factor scarcities faced by the designer (inventor, innovator). This is physical capital, the usual product of S & T research programs.

But there is also *human capital*. This comes in the form of people who acquire productive knowledge either through practical experience, formal education or other means. They are scientists, engineers, artists, technicians, managers and the like. They produce machines, materials, ideas, procedures or policies which make society more productive of social goods.

It is obvious that human capital can be deliberately improved by providing training of the proper kind (that needed by society) to an increasing number of people. Human capital, as viewed here, encroaches into the domain of labor and entrepreneur.

- (4) *Resources*, in traditional economic analysis, are represented by land. They usually refer to natural resources like soil, forest, minerals, fisheries, rivers and seas. They serve many purposes like providing the medium for agricultural production, transportation and communication; they also provide raw materials for manufacture such as minerals and forest products; they provide fuel such as petroleum, coal and geothermal power. The quantity and quality of resources can be increased or improved, thereby promoting development through the improvement of pertinent S & T. For instance, geothermal energy in the Philippines was a mere geological curiosity before the energy crisis of 1973; however, due to the rapid development of the resource with the use of imported technology, it now contributes very substantially to the country's energy budget.
- (5) *Organization*, just like technology, is a shift parameter in the production process. They are essentially the medium through which development is achieved (or not achieved). They combine factors of production according to the technology available to them. Whether they use technology and factor inputs efficiently (or inefficiently) in the desirable proportion to produce the desired social good, they would impact immeasurably on national development. To a large extent, the managers, the administrators, the directors — in short, the entrepreneurs, provide the direction to these organizations, and hence to development. These organizations are illustrated by the business firms, central government, banks, labor unions and the military. Innovations in running such organizations so that they become efficient in producing the desirable social goods are germane objects of S & T programs.
- (6) *Labor*, as a factor input, refers to two components: (a) It refers to activities that can be done by any normal person without much training, such as rowing a boat or cleaning a house; and (b) It can also refer to activities which require substantial training whether through experience or formal education. Scientists, engineers and managers belong to this group. This second component therefore grades into human capital.

Productivity of labor can be improved through (a) provision of affordable food and nutrition, and (b) provision of appropriate training, including formal and informal education. These are developmental objects reachable by a S & T program.

- (7) *Technology*, another shift parameter in the production process, consists of a body of knowledge which deals with the production of goods and services. It may be embodied, among others, in a machine, device, procedure, process or formula. Improvement of technology is the common object of a S & T development program.

The logic of the production function theory indicates that S & T can help national development in two ways:

Firstly, S & T can be employed to improve both the quality and quantity of factor inputs such as human capital, labor and natural resources which in turn could result in the increase in the production of social goods, even without any change in the socio-technological arrangement.

Secondly, S & T can also be used to produce new technology, both of the hard and soft varieties, which can cause expansion of social output even without increasing the employment of input factors.

In the next section, we employ the concept of social production function in analyzing and planning the development of S & T. In this context, S & T is viewed as a subset of national development, and the logic of the production function also applies.

PLANNING TECHNOLOGICAL PROGRESS (OR DEVELOPMENT OF S & T)

We have seen in the preceding sections, that the demand for S & T development is derived from the demand for social and economic development and that the objectives of a S & T development must be equivalent to that of social and economic development. To be successful, a S & T development plan must not only harmonize in terms of objectives with the national plan but also in terms of philosophy, strategy, and methodology. Finally, the plan must also consider the available resources and constraints.

For analyzing the actions that are discussed below like planning, invention or research, it is useful to refer to Usher's classification which says that any act can be classified as: (a) innate activities which are unlearned and instinctual; (b) acts of skill which are learned whether through formal training or imitation; and (c) inventive acts of insight resulting from new organization of prior knowledge and experience (Kindleberger and Herrick, 1977:138). Acts of skills which are learned can serve as important medium for acquiring new technologies, new knowledge and, in their highest level, grade into inventive acts of insight. This means that proper education can be used as a cheap means of rapid technological development.

What Strategy to Choose?

There is a plethora of nomenclature of S & T development in the literature. Table 1 attempts to put them in some explicit classification. However, as far as this paper is concerned the most important are the

categories based on planning mechanism, viz., centrally planned and market mechanism. However, for completeness, we also present categories based on methods of developing S & T and based on the driving force.

Centrally planned development. Under this scheme, a central authority, on the basis of a perceived need, drafts the development plan, then proceeds to implement it. It requires a strong, firm and sustained commitment from the highest to the lowest officials. The recent Korean experience illustrates this scheme. The series of five-year development plans indicated a well-thought out, internally consistent S & T development plan which spelled out how western technology shall be endogenized, the resources necessary and the social and economic targets. Educational policy, investment and technology transfer, among others, were aligned with the S & T program, indicative of a very strong government commitment and national consensus. The recent Chinese experience falls also under this category. So with the Japanese experience during the Meiji era (Roque, 1986:54-55).

On a smaller scale, central planning for S & T development takes place within the confines of a corporation. For instance, several mining consortia have been competing, for about two decades, in developing technologies to mine polymetallic nodules in the ocean at depths of five to seven or more kilometers. At the same time, they are also developing suitable metallurgical processes to extract the nickel, cobalt, copper and manganese from the nodules.

Motives that impel such development are, among others, the prospects for profits, or military advantage.

Central planning, though quite attractive from the viewpoint of planners, has one important disadvantage. The plan is usually massive, time-consuming, and expensive. If it fails, then vast amounts of resources are wasted while development is set back. The method does not have an automatic feedback mechanism so that gradual corrections can be made before the damage caused by some errors in the plan or its implementation becomes too great.

Market mechanism. The development plan under this category must be similar in many ways to any other plan. The objectives and targets can be the same. However, the means to implement the plan must be different. Under the market mechanism, the price system is the driving force which may take various forms of pecuniary and similar awards like grants, subsidies or tax credits.

It is more likely, however, that plans under the market mechanism are parsimonious in detail. General guidelines are more likely than specific details of the "nut and bolt" variety. This is so because it is the market which is supposed to give specific signals continuously to the decision makers on the basis of which gradual or incremental adjustments can be made. Consequently, errors in the original plan can be rectified early enough before the damage takes disastrous proportions.

Planning based on the market mechanism usually takes place in countries under a republican system of government where individual freedom or self-interest is paramount, such as in the U.S.A. Activities of small innovative firms in the Silicon Valley, where high risks are taken in the expectation of large profits, fall under this heading, if taken

from the national context. Again, the development of deep seabed mining systems, taken from the viewpoint of the corresponding national governments of the participating firms, can also be classified under this heading. Finally, development of S & T in Europe and America since the Industrial Revolution must have taken place under this type of plan.

One drawback of planning by market mechanism is that it is difficult to understand. Details of implementation are very scarce and do not show in the same clarity, as in a centrally planned program, how the objectives can be realized. In fact, to the extent that the market is working effectively, there is no need for an explicit plan. One must therefore be familiar with the workings of the market before he can appreciate its value.

It is very unlikely nowadays for a plan to be purely of the first or second type. If we take any specific plan, it is likely to contain elements of both schemes though one surely predominates over the other.

Table 1 presents different strategies for developing S & T. Given enough information, they can be classified as falling into centrally planned strategies, or those planned based on market mechanism. For instance, *leapfrogging*, *stage development* or *technological complex* can be planned using either mechanism. The DOST's plan, in fact, adopts all these methods for acquiring technology.

Methods of Developing S & T

If we focus on the methods of development or acquiring S & T rather than on the planning and implementing scheme, at least three categories are discernible as shown in Table 1.

Stages of development. Five types of technological capabilities have been recognized (Posadas, 1986) which we reclassify here as five *stages of S & T development*. It essentially suggests a strategy of development based on technology imports. In the earliest stage, the best that can

TABLE 1. PARTIAL NOMENCLATURES FOR S & T DEVELOPMENT STRATEGIES

Basis	Categories
Origin	a. Endogenous (generated within) b. Exogenous (generated outside)
Planning Mechanism	a. Central (plan by central authority, e.g., government) b. Market (plan based on market signal)
Method of Development	a. Leapfrogging (bypass lowstage) b. Technological Complex (blend traditional with modern) c. Stages (operative, adaptive, replicative, innovative, creative)
Driving Force	a. Demand Pull (stimulated by market demand) b. Supply Push (stimulated by perception, intuition, inspiration)

References: Posadas, Roger, "Leapfrogging the Scientific-Technological Group," *Diliman Review*, Vol. 34, No. 1 (1986), pp. 1, 32-27;
Roque, Celso R., "Models of Development," *Diliman Review*, Vol. 35, No. 2 (1986), pp. 50-55.

be done is to operate the technology as done in the source. Of course, at this stage the technology reflects the conditions and problems faced by the designer. Though it produces a good, say a car, as in its point of origin, such technology does not reflect local problems such as the need to create more employment and to use abundant raw materials such as the kind of iron ores, coal, copper and chromium which are locally available.

Better understanding of the technology might lead to its alteration or modification to *adapt* to local conditions. In the process of learning, a point may be reached when the technology is *replicated*, either entirely or in its major aspects through local efforts. Mastery of the technology may permit local innovators to effect major improvements in the design of the technology, reflecting more faithfully local problems and conditions, and possibly produce better or cheaper products. These stages evolve essentially as acts of learned skill in the context of Usher's scheme. They represent the process of endogenizing foreign S & T.

Finally, after having mastered up to the innovative stages a considerable number of imported technologies, the ground is now ready to produce new technologies from the combination of old and possibly new knowledge developed through R & D in an act of *creative insight*. The highest level of the innovative stage grades imperceptively into this *creative stage*.

A further elaboration of the stage concept can be made by introducing the classification of technologies into First Wave (pre-industrial technologies), Second Wave (industrial technologies developed since the Industrial Revolution up to World War II) and Third Wave technologies (post-industrial or high technologies, science-based). The five stages of technological development just described characterize each wave (Posadas, 1986).

This writer is struck by the similarity between the intellectual development of an individual and the S & T development of a society. May we not be guided by this similarity as we plough through the intricate business of S & T development?

A variant of the stage concept is development by *leapfrogging*. By this is meant that one can leap from one stage, say operative, to innovative, without passing through the adaptive and replicative stages. It is even possible to leap from the First Wave to the Third Wave. Conceivably, leapfrogging is a possible strategy, at least for specific technologies. However, the risks, the dangers, the desirability must be carefully evaluated, especially if it will be employed on a large scale. We have heard about gifted children who earned their Ph.D.s or did monumental works in their teens by forfeiting their childhood and adolescence, in the process suffering perpetual maladjustment or the feeling of not belonging to their social milieu, among others. Will this experience be replicated in the social scale?

Technological complex, another variant of the stage concept, is a method of developing technology adopted by China (Roque, 1987). It consists in blending existing traditional technologies (early stages) with modern technologies (later stages). This method of development prevents social displacement and promotes social harmony while achieving technological advancement.

Driving force. Strategies for developing S & T can also be classified on the basis of the driving force that moves S & T development. Two categories fall under this scheme, the "Demand Pull" and "Supply Push," terms obviously borrowed from economics.

Under the Demand Pull, elements of the S & T plan are deduced from market signals. For instance, a good which accounts for a large chunk of national consumption, or production, can be a target for technological development. This is the reason why energy development is a priority, and why agriculture takes a special position in the S & T development scheme. More precisely, the demand pull is propelled by what is needed by the users, say the farmers, the fishermen or the industries (Javier, 1984).

The Demand Pull strategy is generally criticized for being short-term in orientation. But this need not be the case. One only needs to extend his vision and imagination to see that market signals on current demand for goods and services today suggest demands for goods or services which are currently scarce. For instance, the proliferation of microcomputers today suggests large future demands for locally designed softwares, consultancy services and repair services. Or the increasing depletion of our forests, in the context of increasing scarcity of imported oil, requires the development of low-cost fuel for cooking, particularly in the countryside.

A development plan anchored on the Demand Pull is said to be cheap since it depends on the use, adaptation, or innovation on existing technologies. It is also cheap because errors committed can be detected early enough by means of the market and can be rectified in small increments.

A Supply Push strategy is based on the premise that when technology is made available then it shall be used. The premise is valid in certain societies where people do not have options. The strategy, in order to succeed, needs a visionary who could see through the future, probably the likes of Edison, Ford and the Wright brothers. It also needs the firm commitment of a strong, powerful authority to plan and implement the same.

Given a true visionary who can correctly foretell the demand for a particular technology, the Supply Push merges with the Demand Pull.

One criticism against the Supply Push is the difficulty of predicting what technology will be demanded in the future. It has to depend upon the insight of a man, or a small group of men, which can be wrong. If a plan based on the Supply Push fails the cost could be very high.

Parameters of S & T Development Plan

Assuming that the development strategy has been chosen, then it is necessary to specify the parameters of the plan. To identify what the relevant factors are and to facilitate analysis, it is useful to have a theoretical framework. Since S & T is a sector of the economy or society, it is possible to conceive of the plan as a *production function* meant to produce S & T development, a social good. This framework suggests that to produce the *social good*, we must identify and assess the input factors as well as the shift parameters. S & T progress, the model

suggests, can be achieved by either of the following methods: (a) by increasing substantially the input factors, or (b) by enhancing the shift parameters.

To illustrate how the framework works, let us consider the Philippine case. Among others, the identifiable input factors for this production function are the following:

- (a) Human capital (inadequate quality and quantity)
 - Highly trained teachers
 - Highly trained researchers
 - Efficient, innovative S & T managers, planners
- (b) Physical capital (inadequate quality and quantity)
 - Educational infrastructure, particularly tertiary, their laboratories and other facilities
 - Research institutions and their facilities
 - Industry facilities
- (c) Natural resources (considerable and can still improve in quantity and quality)
 - Relatively productive land and climate suitable to agriculture
 - Forest and agricultural products
 - Minerals like gold, copper and chromite
 - Fuels like petroleum, coal and geothermal
 - Ocean and other water bodies (vast especially if we consider the Exclusive Economic Zone [EEZ])

Upon examination, it is obvious that S & T development can be enhanced by improving the input factors, both qualitatively and quantitatively. This is very true for all the factor inputs. Hence, even without the shift parameters, substantial progress can be achieved if the input factors can be improved.

As regards the shift parameters, the most important is the central government. Its most pertinent attributes are listed below:

- * Survival-oriented, plagued by disunity and instability
- * Lacks firm direction and unity of purpose
- * Major problems are insurgency, corruption and huge foreign debt
- * Favorable perception, attitude or awareness about the value of S & T in development is very low
- * Commitment to S & T development is virtually nil (outside DOST)

Considering the attributes of this factor or shift parameter, we can arrive at the following conclusions:

- * If these conditions will persist over time, the production level cannot improve. In fact, S & T development output might even decline.
- * The cause of S & T development can be served very well by undertaking R & D to help government solve its debilitating problems. This means, among others, innovations in constructing social and political institutions and in transforming attitudes and behavior. This may also mean improving the performance of government leaders, managers and the like.

But if the negative conditions we identified above improve, particularly if government fully commits itself to S & T development, then it can shift the production process so that technological progress can be achieved in a relatively short span of time.

How Do We Make a S & T Development Plan?

At this juncture, it is possible to answer the above question with some degree of confidence since considerable foundation has already been laid down. Of course, we assume that what we want is an implementable plan.

A viable development plan must answer at least the questions that we pose below. Among others, these are:

What are the *objectives* of the S & T plan? Are they consistent with the national plan in substance, in philosophy and methodology? If not, then the objectives must be harmonized with the national plan to serve its proper role.

What are the *resource inputs* available to us? Are they adequate in quantity and quality? Do we have enough men? Do we have enough equipment? Do we have enough budget?

What sort of *organizational machinery* do we have? Is it conducive to efficiency?

What are the *constraints or problems* we face? Can we solve them within the domain of our authority or competence? Will their presence allow reasonable achievement?

What are the *programs and projects* that we must and can undertake? Do we have a reasonable timetable?

Who are our *target beneficiaries*? What are our targets? Are these realizable?

What are the *institutions* with whom we have linkages?

Do we have easily measurable *indicators of success or performance*? Are they adequate to evaluate the plan?

If we are able to answer fully these questions within the context of the preceding discussions, then we can make a S & T plan. That is, we will know how to choose from a set of alternative strategies and, better still, we will be able to prepare a S & T development program.

Table 2 illustrates some of the important parameters that must be identified and assessed in preparing a S & T development plan. It is particularly geared to the Philippine situation, and predicted on the basis of the production function theory as well as from general information about the national development plan.

TABLE 2. INVENTORY FOR S & T DEVELOPMENT (PERSONAL ASSESSMENT)

General Objectives

Achieve (a) social and political stability, (b) generate adequate employment, (c) reduce, if not eliminate, poverty, and (d) achieve equity in income distribution

Specific Objectives

Develop S & T system, with emphasis, though not exclusively, on the agricultural sector that will help solve the problems above

Resources (or Factor Inputs)**Human Capital**

- High literacy rate, including that which enrolled in tertiary education
- Relatively large managerial class with exposure to relatively high level of technology
- Very large number of enterprising labor which had relatively good technical skills and which were sharpened by work experience abroad

Physical Capital

- Educational infrastructure, particularly universities, colleges and high schools
- Research institutions
- Industry facilities

Natural Resources

- Relatively fertile land and favorable climate
- Forests
- Minerals
- Fuels
- Ocean and other water resources

S & T Tradition

- Relatively well-developed S & T in agriculture, including institutions
- Poor to moderately developed S & T schools
- Low to moderate experience in industries
- New centers of excellence in S & T

Organization

- Firms, small to medium size, not able to undertake meaningful R & D; mainly natural resource-based
- Banks, relatively numerous but small, unable to finance long-term development
- Central government survival-oriented, plagued by insecurity, disunity, lack of firm direction, insurgency, huge foreign debt and corruption

Strategy: Agriculture as main origin of growth under the free enterprise system

Constraints: Government by social and political problems

External: No national consensus on role of S & T in development

Internal: Huge foreign debt, corruption in government

Illustration of an Application of Production Theory

The preceding section can be made more interesting and informative by illustrating how specific programs or projects can be deduced with the use of the analytical apparatus we have developed.

Consider, for instance, that the country's iron and steel industry has been criticized for: (a) being highly capital intensive, hence does not provide sufficient employment in proportion to investment; and (b) very import-intensive as the industry purchases its equipment and

scrap iron input from abroad. Analysis of this problem suggests specific S & T projects or programs.

Since the iron and steel-making machines reflect the relatively abundant capital and scarce labor in the country of origin, it is an appropriate R & D activity to adapt that type of machine so that it employs more labor than before. In fact, producing locally an equivalent machine but reflecting the local optimal capital/labor ratio, if warranted by cost and adequate demand, is an appropriate R & D project as it will reduce imports and employ more labor.

As regards the dependence on foreign scrap iron, it may be an appropriate R & D activity to adapt small, direct-reduction facilities which use small domestic iron ore deposits (of which the Philippines has many) and domestic low-grade coal. If successful, the resulting direct-reduced iron will serve as substitute for scrap iron imports and at the same time save foreign exchange, as well as generate income and employment. The use of local coal generates additional economic activity which in turn creates additional jobs and increases local production.

The solutions to the two problems posited above through S & T activity, as can be inferred from the social production function, generate social and economic development.

After examining the salient elements of a S & T development plan, such as the alternative strategies, methods of development and important parameters, we then consider the application of the principles developed in this and the preceding chapters.

THE DOST'S S & T PLAN

In this section, we summarize briefly the DOST's S & T plan to demonstrate how we can analyze it using the analytical tool introduced in this work. We likewise try to deduce some conclusions on the possible outcome of the plan.

How do S & T activities contribute to national development? The DOST 1987-1992 S & T Plan indicates clearly how S & T activities are envisioned to help the country. In the context of the national production function, the S & T activities are designed to enhance national development by deliberately improving the quality and quantity of the factor inputs, including the shift parameters.

To illustrate the idea, Table 3 presents the salient features of the plan in the format suitable for analysis in the production function.

A very important emphasis is in the development of human capital. Specifically, the program seeks to develop more S & T personnel who can man R & D projects and institutions from the undergraduate through graduate and professional levels. It even includes development of manpower for new and emerging technologies. Elaborate programs on health and nutrition are, of course, long-term investments in human capital.

Complementary to human capital development is the development of R & D networks which will reach as far as the countryside. Among others, these include R & D networks for industry, energy and utilities; R & D for health; and R & D for agriculture. Existing R & D networks for agriculture and the national centers of excellence in the basic sciences

shall be further upgraded to international standards. Deliberate involvement of the private sector in the R & D program is an innovative component.

The main focus of the program is the development of appropriate science and technology pertinent to the production of important goods and services. In essence, it consists of, among others, the selection, acquisition, adaptation, adoption and mastery of imported technology. In the scheme, traditional technologies shall be improved by "blending" with the new and advanced technology.

**TABLE 3. DOST S & T DEVELOPMENT PROGRAM 1987-1992
(CAST IN THE FORM OF NATIONAL PRODUCTION
FUNCTION)**

General Objectives

"To provide substantial scientific and technological inputs to realize national development objectives. Existing policies shall be redirected and programs shall be refocused to effectively translate the employment-oriented rural-based strategy into S & T activities..."

Specific Objectives

(a) To generate, upgrade and utilize technologies needed for countryside development; (b) To employ an appropriate mix of locally generated and imported technologies in meeting the requirement for economic recovery and growth; (c) To build up an indigenous capacity for science and technology.

Resources (or Factor Inputs)

Natural Resources

Agricultural Lands — directed towards increased productivity in crops, livestock, fisheries, forestry through S & T efforts such as appropriate policies, management and conservation, and other types.

Mineral Lands — exploration and development of mineral deposits for iron making, small-scale mining, chemical raw materials, import substitute minerals, utilization of locally abundant ceramics raw materials, and management and conservation policies.

Physical Capital — program centers mainly on the adaptation or generation of technologies that have low gestation period, labor-intensive and use abundant local resources (increased financial budget).

Human Capital Development — a key strategy

Attention to prepare technological manpower development for R & D; increase undergraduate scholarship by 25%, graduate scholarship by 50%. Establish academic and technician training programs geared towards new and emerging technologies for industries. Foreign scholarships and training, attendance in scientific conferences and gatherings (increased financial budget). Heavy focus on health and nutrition activities.

S & T — main focus of the program

Selection, acquisition and dissemination of essential and appropriate technologies. Adaptation, adoption and mastery of imported technology. Blending of traditional and new advanced technology in agriculture. High quality S & T manpower for basic science as well as new and emerging technologies.

Organization

Nationwide network of R & D centers and higher educational institutions to be strengthened for countryside development. Existing R & D centers for agriculture shall be developed according to international standards.

R & D network for industry, energy and utilities shall be established.

7 Regional R & D centers for health to be operationalized throughout the country.

Existing centers of excellence in basic science shall be developed further according to international standards.

Induce private firms to participate in R & D of DOST.

Information

Increase accessibility to S & T information and services. Network of centers for testing, standards setting and technical services; specialized services for pilot plant designs and fabrication and process engineering for industrial plant installation.

Computerized S & T data bank utilizing and linking the information bases of the entire scientific community shall be provided to facilitate access to S & T development.

Targets: Selected Only

- (a) Expected R & D expenditure to increase from 0.3% of GNP in 1986 to 1.5% in 1992
- (b) Private sector contribution to increase up to 30% of S & T expenditure
- (c) Technologies expected to come out of R & D effort shall be of the lowest cost input type that can be used to increase production in the rural and industry sectors, S & T to increase yield and improve quality of export
- (d) Mastery of technology in strategic areas such as agro-industrial machineries, energy systems, chemical, pharmaceutical and electronics expected to considerably advance technological development of the country
- (e) The number of S & T professionals engaged in R & D expected to increase by 32 percent to attain a ratio of 380 R & D professionals per million population
Regional S & T manpower base established for long-term growth

Constraint:

- (a) Financial constraint — low R & D expenditure compared to other ASEAN countries
- (b) Inadequate manpower and institutions

Source: National Economic and Development Authority, *Philippine Development Plan, 1987-1992* (Manila: NEDA, 1987), pp. 335-356.

No less important components of the program are the improvement of natural resources, physical capital and information.

Viewed from the social production function, the country's S & T Development Plan is low profile, but quite reasonable. It adheres to the objective of national development, i.e., enhancing national income and improving income distribution through the acquisition and use of appropriate technologies.

Emphasis on S & T manpower training and R & D institution building is quite well-placed. These elements are prerequisites to the endogenization of S & T in the country. Participation of the private sector in the execution of the program in a meaningful way is a good insurance for making the program relevant to the needs of the country and for avoiding costly mistakes. The involvement of the private sector is an ingenious way of implementing the 'demand pull' strategy as the sector feels the signal and pressure of the market.

A good plan, though, is not an assurance of success. The quality of S & T leaders, their competence, dedication and vision, and ultimately the support of the national leaders are indispensable.

SOME CONCLUSIONS

Our conclusions fall under three major headings on which our work focused, namely: (a) alternative strategies; (b) social production function; and (c) S & T Plan for 1987-1992.

Alternative Strategies

Depending on the criteria used, alternative strategies can be classified into several categories. For purposes of this work, the most important categories are based on the planning mechanism, namely: (a) Central planning — prepared and enforced by a strong central authority; and (b) Market mechanism — plan is made and enforced based on market signals.

The first is very detailed and cumbersome but details are clearly and neatly defined. Its main risk rests on the fact that since it is quite expensive and time-consuming, failure could be disastrous. Market mechanism plans are generally simple, and errors need not lead to disasters since the market gives continuous signals on the basis of which incremental adjustments can be made.

Other categories based on other criteria exist too. However, they can also be classified under the two categories above. Some of the more familiar are the following: (c) Demand pull strategy determined by the price mechanism, specifically the value of the goods or services involved in the market, very close to market mechanism; (d) Supply push, based on nonmarket considerations, very close to central planning; (e) Technological complex, blending of traditional with modern technologies; and (f) Leapfrogging, jumping from one stage to another stage while some stages in-between are bypassed.

Social Production Function

This theory provides a convenient and powerful framework for analyzing the following:

- (a) The role of technology development in national development. The effect is direct, acting as a shift parameter or as an autonomous influence for development. New technology may give rise to a new production function.
- (b) The role of technology in improving the quality and quantity of factor input and autonomous factors. This could also cause a shift in the production level, or even in the relationship of factors in the production process.

DOST S & T Plan for 1987-1992

The plan is based on the market mechanism. The demand pull approach it adopted insures that the S & T acquired is labor-intensive as desired. In part, it also uses the technological complex approach as well as the stage approach.

Emphasis on manpower and institution building is quite appropriate in view of budget and other constraints. With adequate manpower prepared for a high stage of technology development, it is possible to bypass certain stages to attain a high level of technological development, through learning and mastering of relevant skills, in the context of Usher's classification.

As conceived, the plan is consistent with the national development objectives, strategies and predicament. S & T will serve as an autonomous influence in development as it improves the input factors and the other autonomous factors. Hopefully, S & T development success may also confer the country comparative advantage in the production and trade of some valuable products.

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METROPOLIZATION AS A DEVELOPMENT PROBLEM*

Lysander A. Padilla**

ABSTRACT. *Metropolization or metropolitanization characterizes the latest trends in urbanization particularly in Third World countries, including the Philippines. Metropolitan urbanization in developing countries is marked by severe imbalances as indicated by the primate city phenomenon. Metropolitan Manila, with its demographic and functional primacy, presents a development problem in terms of depriving other regions of their labor and capital resources and in turn causing poverty in the rural areas; at the same time, it creates such problems as urban unemployment, deterioration of urban services, and loss of prime agricultural lands to urban uses. Reflecting the Todaro migration model, these problems call for industrial dispersal policies and creation of metropolitan countermagnets that would help promote inter-regional equity and ecological balance.*

INTRODUCTION

In 1985, the Philippines was 40 percent urbanized, making it the most highly urbanized country among the lesser developed countries of Asia (Table 1). A large proportion of this urbanization, however, is due to only one region of the country — the National Capital Region, also known as Metropolitan Manila.

TABLE 1. URBAN INDICES, 1987

Country	Popula- tion (000)	GNP Per Capita (1984 US\$)	Urban %	Urban Population	Population in Largest City	Year	Percentage of Total Urban
Philippines	54,709	660	39.6	21,664,764	7,000,000	'85	32.31%
Indonesia	172,245	540	25.3	43,577,985	7,829,000	'85	17.97%
Malaysia	16,538	1,980	38.2	6,317,516	1,103,200	'85	17.46%
Thailand	53,722	860	19.8	10,636,956	5,363,378	'86	50.42%
Taiwan	19,630	*	72.1	14,153,230	2,507,620	'86	17.72%
Vietnam	62,468	*	19.0	11,868,920	2,441,185	'79	20.57%
Korea, South	42,082	2,110	65.4	27,521,628	9,645,932	'85	35.05%
Japan	122,100	10,630	76.2	93,040,200	8,366,000	'87	8.99%

* no data

Source: 1988 *Brittanica Book of the Year*; World Bank; United Nations.

The positive association between urbanization, defined as the proportion of total population living in urban places, and socioeconomic development, defined as income per person or household, has been repeatedly observed in empirical studies across nation-states (Adelman and Morris, 1967; Berry, 1971; Hay, 1977, among others). These studies

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usually employed data that were aggregated for whole countries, and thereby tended to conceal the "distributive" aspect of both socioeconomic development and urbanization processes. The most convenient summary measure of urbanization, which is the *proportion of total population enumerated as living in urban places* is, in this context, alike to that of *gross national product (GNP)*, which does not tell us how this total product is distributed among its productive units.

Similar to the way that we are bothered about the inequalities in the distribution of income, we are also concerned with the imbalances in the *areal pattern of urbanization*. The overwhelming weight of the metropolitan city in national urbanization has strengthened the concepts of polarization (Hermoso, 1983) and dependent development (Abu-Lughod and Hay, Jr., 1977).

Most students of urbanization,¹ when writing about contemporary trends in the process, place the development of the major cities of the world into a category over and above that of classical urbanization. Honjo (1981), writing about the historical trends of urbanization in the more developed countries, places those activities that he calls as metropolitanization on a later stage than classical urbanization. Some of these activities are the movement of urban population away from the original city center toward the suburbs, and the appearance of "megapolises," or extremely huge, contiguous metropolitan areas.

This paper argues that "metropolitanization" or "metropolization" (Bronger, 1985) characterizes the latest trends in urbanization. It further argues, as we will try to support later, that it characterizes substantially, the urbanization that is occurring in the Third World countries in general, and in the Philippines in particular. This paper also gives a discussion of some salient characteristics of the relationship between metropolization and development in the Philippines.

SOME DEFINITIONS

The term "metropolitan area" is lifted from the U.S. Bureau of Census' phrase "Standard Metropolitan Statistical Areas" (SMSAs). "Metropolitan" was used since 1940 as in "metropolitan district" to refer to an urban area with one or more central cities with a population of at least 50,000 plus adjacent, contiguous or adjoining units with population densities of at least 150 per square mile. It was used since 1950 as SMSA to define an extended urban area which includes a city of at least 50,000 inhabitants in addition to all contiguous counties which are economically and socially integrated with it even if the city was located in a separate county. The total population of this area must be at least 100,000, and its average density must be at least 1,000 persons per square mile. These definitions of the Census were designed to

¹ Various definitions of urbanization have been given, each reflecting the theoretical incline of the researcher. The demographic definition, which is the proportion of total population living in places defined as urban, correlates well with other definitions, such as functional centrality and population engaged in non-agricultural pursuits. For this reason, we start from the demographic definition. After 1980, the latest year of the national census, other measures have been used to estimate the levels and trends of urbanization. As expected, these measures correlated strongly with earlier demographic measures.

facilitate its task of data gathering. The U.S. Bureau of Census also uses the term "Urbanized Area," which refers to the actual urban population of an area regardless of any local boundaries, e.g., city, town or country. The Urbanized Area can be of any size, and may include several cities and counties. The conurbation as originally defined by Geddes is an urbanized area. When urbanized areas that were formerly separate reach out to one another and begin to form one interwoven, continuous urbanized area, it has been called a megalopolis (Gottman, 1961).

Thus, the term itself is descriptive of the genesis of the metropolis. "Metropolis" comes from two Greek words — *metro*, meaning "mother" or "matrix," and *polis*, meaning "city." The present-day metropolis was really a mother city giving birth to daughter cities. Together, they form a giant supercity, with population characteristics, such as size and density, in multiples of that of the original central city, and certainly a correspondingly larger area.

The World Resources Institute and the International Institute for Environment and Development list the major cities of the world as those with populations of at least 1 million in 1980. Of these, at least half are in the developing countries. Of the 17 cities with more than 5 million, 11 are found in countries that are called either "developing" or "newly industrializing," or "middle income" countries. And of the 9 cities with more than 10 million inhabitants, only 3 come from the developed countries, namely, Los Angeles, New York and Tokyo. Thus, the largest metropolises are mostly found in countries which are less equipped to manage their growth and its ill effects.

SOME CHARACTERISTICS OF THIRD WORLD METROPOLIZATION

The characteristics of metropolitan urbanization in the Third World differ from those of the more developed countries. In the Soviet Union, for example, urbanization in terms of proportion urban and the appearance of cities occur in formerly less urbanized regions (Padilla, 1987). The countries of Asia, in general, are characterized by a pattern of severe imbalances in urbanization, particularly indicated by the phenomenon of the primate city. The primate city is usually the capital, whose population becomes larger than those of the next three cities combined. Table 2 shows us the sizes of some Southeast Asian capitals in relation to their other large cities.

TABLE 2. PRIMACY, AND FIRST TO SUCCEEDING CITIES RATIOS OF SOME ASIAN COUNTRIES

Major City	Population	First/Next	Primacy
<i>Philippines, 1984</i>			
Metro Manila	6,720,050		4.3
Davao	709,521	9.3	
Cebu	552,155	12.2	
Bacolod	287,830	23.3	
Cagayan de Oro	275,938	24.4	
Iloilo	263,422	25.5	

<i>Thailand, 1983</i>			
Bangkok	5,018,327		11.0
Nakhon Ratchasima	190,692	26.3	
Chiang Mai	150,499	33.3	
Khon Kaen	115,515	43.4	
Hat Yai	113,964	44.0	
<i>Indonesia, 1985</i>			
Jakarta	7,829,000		1.3
Surabaya	2,345,000	3.3	
Medan	2,110,000	3.7	
Bandung	1,633,000	4.8	
Semarang (1984)	1,077,000	7.3	
<i>Malaysia, 1980</i>			
Kuala Lumpur	565,329		0.7
Ipoh	293,849	1.9	
Pinang	248,241	2.3	
Johor Baharu	246,395	2.3	
Petaling Jaya	207,805	2.7	
<i>Taiwan, 1986</i>			
Taipei	2,507,620		1.0
Kao-hsiung	1,302,849	1.9	
T'ai-chung	674,936	3.7	
T'ai-nan	639,888	3.9	
Pan-ch'iao	479,748	5.2	
<i>South Korea, 1985</i>			
Seoul	9,645,932		1.4
Pusan	3,516,807	2.7	
Taegu	2,030,672	4.8	
Inch'on	1,387,491	7.0	
Kwangju	906,129	10.6	
<i>Burma, 1983 estimates</i>			
Rangoon	2,458,712		2.7
Mandalay	532,895	4.6	
Moulmein	219,991	11.2	
Pegu	150,447	16.3	
<i>Korea, North, 1981 estimates</i>			
Pycnyang	1,283,000		0.7
Hamhung	775,000	1.7	
Ch'ongjin	490,000	1.6	
Kimch'aek	490,000	1.0	
<i>Sri Lanka, 1984 estimates</i>			
Colombo	643,000		1.4
Dehiwala	184,000	3.5	
Moratuwa	138,000	4.7	
Jaffra	133,000	4.8	
<i>Vietnam, 1979</i>			
Ho Chi Minh	2,441,185		1.7
Hanoi	819,913	3.0	
Haiphong	330,755	7.4	
Da Nang	318,655	7.7	

Source: *Brittanica Data Book*; Davao estimate is from the National Statistics Office (NSO).

Among the countries included in the table, only Thailand has a higher primacy rating than the Philippines. Both these countries have primacy ratings which are much higher than those of their Asian neighbors. Nevertheless, only Malaysia, Taiwan and North Korea may not be considered to have primate cities at all, because in their cases, the largest city does not exceed the combined sizes of the next three succeeding ones. On the contrary, according to Zipf's rank-size rule, their second largest city is approximately of the correct size. The appearance of a rank-size distribution in a country's system of cities is considered an indication of the integration of the space economy, which is attained through socioeconomic development. In the Philippines, as also in the rest, the determination of primacy is affected by the definition of the metropolis. There are, in fact, two measures that have been given: one for the small metropolitan area, and another for the large metropolitan area (Pernia, 1983; Raymundo, 1983). It follows that the measure for the large metropolitan area will be bigger. These indices are given in Table 3 below.

TABLE 3. INDICES OF URBAN PRIMACY, 1948-1984

Area	1948	1960	1970	1975	1980	1984
Small Metro Area ^a	3.5	3.3	3.3	3.2	3.0	4.3
Large Metro Area ^b	—	—	4.2	4.3	4.1	4.3 ^c

^aThe small metropolitan area of Manila comprises the four chartered cities of Manila, Pasay and Caloocan, and the four municipalities of Makati, Mandaluyong, Navotas and San Juan.

^bThe large metropolitan area includes all the areas of the small metropolitan area as well as nine other municipalities, namely: Pasig, Las Piñas, Malabon, Marikina, Muntinlupa, Parañaque, Pateros, Taguig and Valenzuela. In 1948 and 1960, the next three largest cities were Cebu, Davao and Basilan; Davao, Cebu and Iloilo for 1970; Davao, Cebu and Zamboanga for 1975 and 1980; and, Cebu, Bacolod and Cagayan de Oro in 1984.

^cPreliminary

Source: For 1984, *Britannica Data Book*; NSO.

If our data are correct, the primacy rating for the metropolis can be seen to have grown back to its former value in 1975 — an increase of 4.9 percent from the last census date. This can be seen as an indication of the failure of the urban decongestion and regional development policies of the former government. The demographic supremacy of Metropolitan Manila is evident in 1985 when its population reached 7 million, while the unabating concentration in the region is further attested to by the relentless rise in its density. A computation based on a 1985 density of 11,000 per square kilometer that has been calculated from the figures of the United Nations Department of International Economic and Social Affairs (1985) makes Metro Manila 60 times as crowded as the whole country. At the same time that it takes up 13 percent of the national population, it receives 32 percent of the total urban population (Table 4).

TABLE 4. METROPOLITAN MANILA, 1948-1984

Year	Population	Percentage of Total Urban Population	Annual Growth Rate	Density Per Sq. Km.
1948	1,569,128	30.3		2,467.2
1960	2,462,489	30.5	3.83	3,871.8
1970	3,966,695	34.0	4.88	6,236.9
1975	4,970,006	37.4	4.61	7,814.5
1980	5,925,884	33.0	3.58	9,317.4
1984	6,720,050 ^r		3.35	10,566.1

^rEstimate

Source: NSO.

TABLE 5. URBAN SECTOR OF ASIAN COUNTRIES, 1985

Country	Urban/ Total	Total Population	Urban Population	Population in Largest City	% in Urban Population
Burma	30.0	39,487	11,846	*	
India	25.5	761,175	194,100	11,000	5.67%
Indonesia	25.3	164,887	41,716	7,900	18.94%
Japan	76.5	120,072	91,855	17,200	13.73%
Korea, North	63.8	20,082	12,812	*	
Korea, South	65.3	40,872	26,689	10,200	38.22%
Malaysia	31.5	15,551	4,899	*	
Philippines	39.6	54,709	21,665	7,000	32.31%
Sri Lanka	21.1	16,404	3,461	*	
Vietnam	20.3	59,451	12,069	*	

* no data

Source: U.N. Department of International Economic and Social Affairs; World Bank.

Bronger (1985) makes the claim that it is not only *demographic primacy* but the concentration of *all* of the major functions (which he calls the *primacy indices*) of society that defines the Third World metropolis. He considers this "*functional primacy*," as he calls it, as crucial and defines it to be the concentration of political, administrative, economic, social and cultural activities upon the metropolis. He constructs his *primacy ratio* as a primacy index (PI) over the metropolitanization quota (MQ), defined as the ratio of the metropolitan population over the national population (Table 6). Bronger asserts that only when $PI > MQ$, or $PR > 1$ can we consider the urban area a primate metropolis.

TABLE 6. SOME PRIMACY RATIOS (MQ = 12)

Prime Index	National (000)	Metro (000)	Year	PI
Income, P	305,775,274	74,954,826	1985	24.51
Telecomm	590,697	526,171	1986	89.08
Teachers, Coll	50,767	14,797	1985	29.15
Priv Build Con	30,508	11,386	1985	37.32
Manufacturing				
Establishments	5,369	2,801	1985	52.17
Employees	694,879	386,918	1985	55.68
Value Added (P Million)	55,477.5	27,122.6	1985	48.89

Source: *Philippine Statistical Yearbook, 1987.*

All the primary indices for Metro Manila are much larger than the metropolitan quota of 12.6, using the low projection figure of the NSO and the estimated population of Metro Manila from the *Brittanica*, thereby fulfilling Bronger's requirement of functional primacy. The indices are supposed to reflect the productive, communicative, educational and construction sectors of the metropolis.

The notion of primacy becomes critical when we remind ourselves of the relationship between development and urbanization. Foremost to understanding the gravity of the situation is the acceptance that population processes are influenced by the parameters of economic growth, and that in turn, overall societal development is defined by them. When, as in the case of the Philippines, resources are strapped, metropolization occurs at the detriment of the other regions. The metropolis has, by far, been the primary recipient of infrastructure and social service inflows. Metro Manila's income level has been consistently highest among the regions and shows a tendency to outdistance the rest of the country (Table 7). It is, therefore, no wonder why it has been the popular target of employment-seeking immigrants from the rest of the country.

TABLE 7. INCOMES BY REGION

Region	Average Income			
	1985	Ratio to Natl	1975	Ratio to Natl
Philippines	31,502		6,698	
Metro Manila	57,193	1.82	11,279	1.68
Central Luzon	38,819	1.23	6,355	0.95
Ilocos	31,463	1.00	5,555	0.83
Southern Tagalog	29,985	0.95	6,328	0.94
Southern Mindanao	28,222	0.90	7,131	1.06
Cagayan Valley	27,441	0.87	6,305	0.94
Northern Mindanao	27,402	0.87	6,004	0.90
Western Visayas	24,807	0.79	6,696	1.00
Central Mindanao	24,366	0.77	6,518	0.97
Western Mindanao	23,779	0.75	6,351	0.95
Central Visayas	20,756	0.66	5,717	0.85
Bicol	20,221	0.64	6,269	0.94
Eastern Visayas	17,767	0.56	5,428	0.81

Source: NSO.

Thus the growth of the metropolis owes much to the influx of migrants who settle more or less permanently. Although studies try to show that natural increase contributed more than immigration, the latter show an increasing weight in the growth of the metropolis (Table 8). Further, as a factor in the growth of the city, natural increase may be masking the real impact of migration, since immigrants to the metropolis who stay permanently contribute to urban births, particularly of females in the childbearing ages, who are in a position to maximally contribute to what will be considered in the next census as the city's natural growth (Table 9).

TABLE 8. TRENDS IN THE COMPONENTS OF URBAN GROWTH, NATIONAL CAPITAL REGION

1960-1970			1970-1975			1975-1980		
NR	NI	NM	NR	NI	NM	NR	NI	NM
8.2	54.3	37.5	0.0	56.1	43.9	0.0	54.2	45.8

Source: NSO.

TABLE 9. POTENTIAL MIGRANTS TO METRO MANILA, AGES 15-64, BY SEX AS PERCENT OF TOTAL INTENDING TO MOVE

	Within 3 Years	Within 10 Years
Male	27.8	19.0
Female	27.9	33.9

Source: 1983 National Demographic Survey (University of the Philippines Population Institute)

Moreover, it may be argued that the urbanward movement of labor is detrimental to the region of destination, when movement serves to depress wages, or bring on a worsening of the employment situation there, in this case, the Metropolitan Area. This and related issues have been discussed by Raymundo (1988). From the standpoint of this paper, the impact on the metropolis is mostly harmful. The metropolis is already incredibly crowded, and consequently the provision of services is witness to the inability of the metropolis to accommodate new migrants. The unemployment in the region has, since 1980, been consistently higher than the rest of the country (Table 10).

TABLE 10. UNEMPLOYMENT BY REGION IN PERCENT

Region	1980	1984	1986
Philippines	5.0	6.2	6.7
Metro Manila	10.5	16.3	19.3
1	2.8	2.7	3.6
2	3.9	5.0	7.9
3	6.0	6.7	7.0
4	5.2	6.6	5.6
5	2.6	3.9	4.0

6	4.2	4.5	4.4
7	3.6	2.5	2.9
8	4.0	7.6	5.5
9	5.6	3.0	4.9
10	5.1	3.2	5.8
11	4.0	5.6	5.8
12	3.9	3.1	2.1

Source: *Philippine Statistical Yearbook, 1987.*

TABLE 11. DRINKING WATER AND SANITATION, 1980s

Country	Percentage of Population with Access to:			
	Drinking water		Sanitation Services	
	Urban	Rural	Urban	Rural
Burma	36	21	34	15
Indonesia	40	29	31	30
Korea, South	86	61	100	100
Malaysia	97	71	100	59
Philippines	53	55	75	47
Thailand	50	70	50	44

Source: United Nations World Health Organization.

The countries which are relatively more developed had reached more people to serve (Table 11). The two countries with high primacy rates, the Philippines and Thailand, had also more people who were unable to avail of water. Given the higher urban population of the Philippines, more urban inhabitants suffer water deprivation in the Philippines than in Thailand.

The enormous weight of migration as a cause of metropolitan growth immediately suggests one direction of policy: that of stemming immigration. A paradox is indicated in that while the index of unemployment is higher in the NCR, immigration remains unabated. Perhaps this is due not only to the higher incomes in Metro Manila but also to the worsening conditions in the other regions. Referring back to Table 7, in all regions except the NCR and its periphery — Central Luzon, Southern Tagalog and Ilocos — average incomes relative to the national mean fell. Thus, the "push" factor reinforced the metroward pull in migration.

The present trends of metropolization do not seem to warrant an overly optimistic projection. Although the rest of the country posted rapid tempos of urbanization, the decline in the metropolitan rates of growth do not seem to be an indication of a reversal in the overall trend of concentration, but rather a continuation of the metropolization process in a new stage, as what has transpired in those of the developed world. In these countries, the growth of the metropolis continues further as the differential growth between the center and the immediate periphery gives way to the dominance of the latter. The border between the metropolis and the peripheries, however, is constantly expanding outwards, such that more and more of the contiguous countryside later become part of the great city, transforming ever larger tracts of prime

agricultural land into urban pavements. We see this in the proliferation of subdivisions in the southern fringes of Manila, where the once rich farms of Laguna become converted daily into residential subdivisions. In Table 12, the fastest urbanizing regions in 1970-1975 were the National Capital Region and its peripheries as well as the Central Luzon and Southern Tagalog regions. In the next quinquennial period (1976-80), they gave way to Southern and Central Mindanao, but still were among the fastest. These contiguous regions taken together identify an

TABLE 12. INDICES OF URBANIZATION

Region	Level of Urbanization			Tempo	
	1970	1975	1980	1970-75	1976-80
Philippines	31.2	33.4	37.3	1.5	3.5
Central Luzon	30.1	33.9	41.8	3.6	7.0
Southern Mindanao	26.6	26.7	33.5	0.1	6.9
Central Mindanao	14.9	15.5	18.8	0.9	4.9
Southern Luzon	29.8	31.8	36.9	2.0	4.7
Bicol	19.2	18.4	21.5	-1.0	3.9
Eastern Visayas	19.4	18.7	21.8	-0.9	3.9
Northern Mindanao	20.9	23.2	26.6	2.8	3.8
Cagayan Valley	14.1	13.4	15.5	-1.4	3.6
Metro Manila	100.0	100.0	100.0	4.6	3.6
Western Mindanao	15.6	14.9	17.0	-1.4	3.4
Ilocos	19.4	21.0	23.8	2.1	3.2
Central Visayas	27.6	28.9	32.0	1.3	3.0
Western Visayas	21.5	26.7	28.3	0.0	1.7

Source: NSO.

area of polarized urbanization, whose development traces back to what has been called the period of import substitution (Hermoso, 1983). On a more positive note, we regard the rapid urbanization of the Mindanao regions as indicative of the beginnings of the effectiveness of the government's regional policies. Similarly, the rapid growth of non-agricultural employment augurs well for these regions as well as in the Bicol Region (Table 13). It remains to be seen whether this growth will be sustained, and by doing so, attenuate the overwhelming pattern of primacy in the future.

In the absence of census data on the regional urban population after 1980, some other indicator was used to estimate the levels in urbanization after that year. The percent of non-agricultural employment was used, since it had high correlations with urban level in 1980 and the indices of manufacturing in 1985, which in turn had very high correlations with the urban level in 1980 (see matrices of correlations — Table 16). In Table 13, we use the percent employed for the years 1983 and 1986, and the percent change from 1983 to draw conclusions on the pattern of urbanization in the country. From this table, we see that the trend of metropolization is confirmed, with the highest rates concentrated in the central industrial region. It is encouraging to note, however, that the other regions showed desirable changes. The Central Mindanao and the Bicol regions had the best showing, with Central Visayas coming

next. Cagayan Valley, Central Luzon and Eastern Visayas kept their old proportions, while Eastern Mindanao declined by three percent. The figure for the National Capital Region diminished by 1 percent.

TABLE 13. NON-AGRICULTURAL EMPLOYMENT, 1986

	Region	1983	1986
	Philippines	0.17	0.50
NCR	Metro Manila	0.99	0.98
I	Ilocos	0.41	0.43
II	Cagayan Valley	0.31	0.31
III	Central Luzon	0.63	0.63
IV	Southern Tagalog	0.55	0.56
V	Bicol	0.38	0.43
VI	Western Visayas	0.37	0.40
VII	Central Visayas	0.43	0.47
VIII	Eastern Visayas	0.34	0.34
IX	Western Mindanao	0.39	0.36
X	Northern Mindanao	0.41	0.44
XI	Southern Mindanao	0.38	0.41
XII	Central Mindanao	0.30	0.36

Source: NSO.

Of the provinces of the central industrial regions, those provinces nearest to the metropolis are either the most urbanized or the fastest urbanizing (Table 14).

TABLE 14. VELOCITY OF URBANIZATION

Province	Percent	
	1980	1975-1980
<i>Southern Tagalog</i>		
Rizal	75.0	87.9
Laguna	61.0	30.2
Cavite	59.8	34.7
Quezon	29.1	15.0
Aurora	25.3	37.8
Palawan	22.8	50.6
Occ. Mindoro	18.8	17.7
Batangas	17.0	32.7
Or. Mindoro	15.0	13.5
Marinduque	13.8	13.5
Romblon	12.4	12.5
<i>Central Luzon</i>		
Zambales	59.1	14.5
Pampanga	52.7	49.9
Bulacan	52.7	50.3
Bataan	44.4	92.5
Nueva Ecija	26.0	25.9
Tarlac	18.1	20.2

Source: NSO.

The conversion of prime agricultural land into urban residential and business uses is a matter of concern not only for agriculturists, but for ecologists and ordinary citizens as well. For this reason, it is dangerous to leave the decision of alternative land uses to the market. In a purely competitive market, the highest rents or returns will determine the ultimate choice between competing land uses. Between agricultural or commercial and industrial alternatives, the end use will most likely be industrial, and the prospect of a lovely open space suffers the fate of being the least competitive. In all cases, the demand for higher productivity will always lead to more intense exploitation per unit space. The most fertile land is often the cheapest to build factories or subdivisions on. Slopes and inclined lands are more expensive because of the necessary substructural adjustments against slippage and erosion. But land as a source of food is not the only useful alternative for the land. The provision of parks and open spaces, as sources of fresh air and as places for reflection and socialization, are also worthy of consideration.

POLICY IMPLICATIONS

In addition to the equity concerns that was mentioned in the introduction, there is also the ecological question. How far can the city grow and still thrive? More importantly, does it flourish in symbiotic relationship with the countryside, or at the expense and detriment of the latter? While admitting that the broader the scope of the question, the harder it is to answer, it is necessary to understand that relationships such as those that embody socioeconomic development and its impact on national settlement patterns are by nature systemic. When policies intended to impact them are formulated, the same systemic perspective is called for.

The improvement of employment conditions and the upgrading of social services for the National Capital Region will most surely invite renewed migration streams. A model exists which predicts that the reduction of urban unemployment will only induce further unemployment due to an influx of surplus labor from the rural regions (Todaro, 1978). At the same time, there is no question that the conditions in the primate city must be improved.

The search for policies and programs which can reduce the imbalances in population distribution implies an investigation into the spatial pattern of production.

TABLE 15. MANUFACTURING INDICES

Region	Census Value Added		Total Employed		No. of Establishments	
	1983	1985	1983	1985	1983	1985
Philippines	55,477,503	79,020,469	700,895	623,671	5,733	5,369
Metro Manila	27,122,595	35,855,731	388,657	333,578	2,778	2,801
4 Southern Tagalog	11,588,293	20,692,713	81,833	77,507	675	573
8 Central Luzon	3,769,792	4,057,842	49,923	46,181	449	415
12 Central Mindanao	3,085,771	2,210,455	15,431	13,797	101	78
7 Central Visayas	2,611,975	4,487,130	39,467	41,491	446	395
10 Northern Mindanao	2,275,551	3,331,725	24,949	24,939	190	174

11 Southern Mindanao	1,962,472	3,017,475	32,888	28,041	243	237
5 Western Visayas	1,385,708	2,013,252	30,560	23,656	268	212
9 Western Mindanao	575,155	601,990	7,400	5,516	94	72
1 Ilocos	437,435	1,029,305	10,442	11,287	150	143
5 Bicol	256,093	200,837	5,438	3,931	166	138
2 Cagayan Valley	254,031	270,436	10,808	8,114	114	38
8 Eastern Visayas	152,631	1,251,578	2,966	4,942	59	43

Source: NSO.

The measurement of the relationship between some indices of urbanization can help us clarify the connection between the location of productive opportunities, migration and urbanization. The dynamics of population distribution as effected through migration and the areal patterns of settlement that it forms into over a longer period of time both respond to the spatial distribution of productive assets and activities. The net movement of the population across regions for the period 1975-

TABLE 16. CORRELATION MATRICES FOR REGIONAL VARIABLES

Correlations:	VALUE 83	VALUE 85	EMPLOY 83	EMPLOY 85	ESTAB 83	ESTAB 85	TEM 7075	TEM 7580	NM 7580
VALUE83	1.000	.988	.973	.977	.971	.936	.412	.093	.722
VALUE85	.988	1.000	.936	.943	.939	.929	.368	.171	.693
EMPLOY83	.973	.936	1.000	.999	.998	.998	.463	-.033	.664
EMPLOY85	.977	.943	.999	1.000	.998	.998	.457	-.018	.665
ESTAB83	.971	.939	.998	.998	1.000	.999	.465	-.027	.635
ESTAB85	.966	.929	.998	.998	.999	1.000	.478	-.041	.635
TEM7075	.412	.368	.463	.457	.465	.478	1.000	.228	.016
TEM7580	.093	.171	-.033	-.018	-.027	-.041	.228	1.000	.021
NM7580	.722	.693	.664	.665	.635	.635	.016	.021	1.000

Correlations:	VALUE83	EMPLOY83	ESTAB83	URBLEV80	TEM7075	TEM7580	NM7580
VALUE83	1.0000	.9726**	.9714**	.9424**	.4120	.0931	.7217*
EMPLOY83	.9726**	1.0000	.9976**	.9758**	.4628	.0330	.6642*
ESTAB83	.9714**	.9976**	1.0000	.9786**	.4647	-.0266	.6351*
URBLEV80	.9424**	.9758**	.9786**	1.0000	.4052	-.0630	.6335
TEM7075	.4120	.4628	.4647	.4052	1.0000	.2285	.0162
TEM7580	.0931	-.0330	-.0266	-.0630	.2285	1.0000	.0214
NM7570	.7217*	.6642*	.6351*	.6335	.0162	.0214	1.0000

1-tailed Signif: * — .01 ** — .001

Correlations:	VALUE85	EMPLOY85	ESTAB85	NONAGR86	URBLEV80
VALUE85	1.0000	.9433**	.9288**	.8927**	.9081**
EMPLOY85	.9433**	1.0000	.9982**	.3413**	.9778**
ESTAB85	.9288**	.9982**	1.0000	.8364**	.9787**
NONAGR86	.8927**	.8413**	.8364**	1.0000	.8632**
URBLEV80	.9081**	.9778**	.9787**	.8632**	1.0000

1-tailed Signif: * — .01 ** — .001

Source: Various tables in the study.

1982 is strongly related to the local build-up of manufacturing establishments and their productivity. Migrants who find urban employment are most likely to settle permanently, thus pushing the index of urbanization upwards in two ways: (1) by augmenting the proportion of total population residing in urban places; and (2) by magnifying the proportion employed in non-agricultural activities. Since the location and growth of establishments are easier to control than human reproduction and movement (at least in democratic societies), the problem of population distribution can be managed through industrial location policies. Returns to such policies are also greater, at the same time that the rationale for their existence and implementation become more substantive. There are reasons for the dispersal of industries that are over and above their impact on population distribution. That of equity is one. The prevention of ecological damage is another.

Among the measures to lessen the economic and social differentials between the capital region and the rest of the country, intensive rural mobilization in terms of higher agricultural productivity and higher employment have been recommended (Ranis, *et al.*, 1974). However, there seems to exist a true attraction for urban employment, over and above the wage consideration (Todaro, 1978). As Table 17 shows, there is an increasing tendency to derive income from non-agricultural sources.

TABLE 17. SOURCES OF INCOME

<i>Percent of Families by Main Source of Income</i>		
	1961	1985
Wages and Salaries	36.0	40.3
Entrepreneurial	58.0	40.9
Other Sources	5.9	18.8
<i>Percent Distribution of Total Income</i>		
Wages and Salaries	41.9	36.8
Entrepreneurial	41.3	31.2
Other Sources	16.8	31.9
<i>Percentage Distribution from Wages and Salaries</i>		
Agricultural	6.1	4.8
Non-agricultural	35.7	32.0
<i>Percentage Distribution from Entrepreneurial</i>		
Crop Farming	19.8	11.7
Fishing	4.6	2.2
Others	16.9	17.3
<i>Percent Distribution from Other Sources</i>		
Gifts and Assistance	2.0	14.3
Others	14.8	17.6

Source: NSO.

An interesting question then is whether higher agricultural employment and productivity alone can restrain or reverse the exodus from the countryside. A further question is related to movement from smaller urban centers to the metropolis in what has been called "stepwise" migration (Raymundo, *et al.*, 1983; Survey Phase II, UPPI, 1982). The importance of cities in other regions as countermagnets relative to the National Capital Region is nullified when they only serve as transit stops in the long-run move to the metropolis.

It appears then that there are reasons for fostering other metropolitan centers in regions not contiguous to Manila. The prospects for a Metro Cebu are not only feasible but encouraging. As early as 1974, official agencies have referred to the Cebu-Mandaue-Lapu-Lapu conurbation as a "metropolitan complex" (Development Academy of the Philippines Task Force on Human Settlements, 1974: *passim*). It was clear that the government was seriously considering the promotion of a countervailing metropolis in the south, namely, Cebu and its contiguous cities, to offset the overwhelming dominance of Manila. Viewed in terms of a more balanced spatial development, this was a laudable goal. It now appears that this projection of a southern metropolis was justified. Another possibility is, of course, a Metro Davao.

We include the term "Metro" intentionally, although some will view this as premature. Our view is that for alternative magnets to counter the pull of Manila, they must be powerful enough. These alternative poles must be as diversified as Manila or offer other attractive specializations. As long as their importance is considered secondary to Metro Manila, any further upgrading of Manila's industrial level and services will drain them of valuable human resources through migration. There still seems to exist a preference for locating large-scale manufacturing and service concerns in the metropolis and its periphery, but only small-scale activities and agriculture-based industries in other regions (see the *Five-Year Philippine Development Plan, 1983-1987: Technical Annex*).

Economic policies that encourage concentration have been linked to taxation benefits and economies of scale (Pernia, *et al.*, 1983). These may be among the important reasons why even the export processing zones have not advanced regional development as much as intended (Hermoso, 1983). Perhaps policies for regionalization are not so much inappropriate as they are not applied in the Philippines. At present, when most policies of the former government are either outrightly repudiated or pursued half-heartedly, it is well to consider if some, as for instance those related to the provision of parks and open spaces for the metropolis, or the full legalization of a unified authority for the future megalopolitan region, are not, in fact, appropriate. At the same time, it might be time for policies with direct demographic effects, such as a taxation scheme based on spatial or density categories, where additional residents and businesses relocating are assessed in direct proportion. The incorporation of pollution devices as integral to fixed or operating costs of the firm has long been considered. On the individual level, costs should be borne by those most able to bear it. For example, car owners should be taxed for parking in public roads.

We would like to make a case here for a more direct spatial planning. Rather than just a statement of principle, these plans must be effectively translated at the regional level. Its integration into the national development plan should not diminish its specific local impact. Most importantly, anyone desiring to do so must be able to identify measures of effect, both manifest and latent, again hopefully, at the local level. As an illustration, we take the case of a national transport and communication system. Among its goals was the development of the heretofore inaccessible hinter regions by diffusing progress from the national center. But the latent (or unintentional) effect has been the facilitation of the loss of manpower from these regions through outmigration, and its encouragement by highlighting the metropolis. In the fostering of a Metro Cebu, for example, we would prefer a system of roads intended for exchanges with the regions' peripheries, more than with the central industrial region.

Finally, we are encouraged by the current government's tolerance of regional and ethnic diversities. By allowing the creation of autonomous regions, the focus of administrative solutions to local problems is enhanced, and thus, becomes more effective. Both policies enacted by the local government and by the national government through the region's representatives will begin to reflect regional needs and, therefore, foster true decentralization.

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REORIENTATION OF REGIONAL DEVELOPMENT STRATEGIES IN WEST MALAYSIA, 1976-1990

Mohd R. Agus*

ABSTRACT. *The general development policy in Malaysia is aimed at reducing regional economic disparities. The regional development policy in West Malaysia for the period 1976-1985 was aimed specifically at developing new industrial estates near large cities. There were development constraints, however, in terms of conflicting interests and overlapping policies among different administrative levels. The result was the non-attainment of targetted employment capacities and the persistence of income disparities between regions. For the period 1986-1990, the Fifth Malaysia Plan introduced a strategy reorientation that addressed spatial, financial and social issues and which was generally marked by the integration of regional spatial planning with national agricultural and industrial policies.*

INTRODUCTION

The regional development strategy in Malaysia is aimed at reducing economic disparities among regions (Malaysia, 1976;1981;1986). Included under this strategy is the provision and modernization of public amenities and facilities to further improve the standard of living of the lower-income groups in less developed regions. New land development programs were created by the Malaysian government to carry out large-scale FELDA (Federal Land Development Authority) settlement and integrated agriculture schemes (Malaysia, 1976).

This paper traces the development of regional policies in Malaysia from 1976 to the present. It examines issues related to the planning and implementation of regional development in less developed areas in West Malaysia. It highlights the main features of the new policy of regional development started in the *Fifth Malaysia (Development) Plan, 1986-1990*.

REGIONAL DEVELOPMENT POLICY IN WEST MALAYSIA, 1976-1985

In the early 1970s, regional development policy was geared towards developing new industrial areas near big cities. These new areas are known as the Free Trade Zones (FTZs). Most of the industrial activities were concentrated on the manufacturing and services sectors. The switching of the industrial strategy from import-substitution to export-oriented industrialization was carried out mainly in the FTZs. By the end of 1983, nearly 60,000 jobs were created in the FTZs (Daud, 1985; Jamilah, 1980;1981). In contrast, new regions continued to be neglected even though total operating and development expenditures in them had reached almost M\$1.5 billion (equivalent to US\$0.6 billion) at the end

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of 1984. Only 30 percent (48,878) of the expected employment was created in these new regions which covered nearly 0.5 million hectares at the end of 1984 (Malaysia, 1986a).

Based on the evaluation of past experiences in regional development planning, conflicting interests and overlapping development policies and strategies at the federal, regional, state and local levels have created constraints in achieving the objectives of economic growth proposed in the national development plans (see Malaysia, 1979;1981;1984). For instance, in implementing an industrial policy, industrial dispersal has been identified as a strategy to achieve a more balanced growth and development between developed and less developed regions. This is evident at the Southeast Johor region area whereby Kejora, the Regional Development Authority of the region, had to compete with Johor's State Economic Development Corporation (SEDC) in attracting and promoting industrial development. Since Kejora is a federal agency and funded by the federal government, it had very little say in land matters. In fact, Kejora was dependent on the decision of the state government in getting approval for land development. In short, there had been less than adequate coordination and cooperation between the state SEDC and Kejora in developing new industrial areas.

The performance of regional development programs in the previous plans gave an indication that successive development plans were able to raise the per capita GDP in absolute terms. They also extended public services and amenities to reach a larger segment of the population in the less developed regions (see Malaysia, 1979;1984;1986). However, disparities between regions in per capita income (GDP) were not reduced as expected (Table 1).

TABLE 1. REGIONS OF MALAYSIA: TOTAL LAND AREA, POPULATION SIZE, POPULATION DENSITY AND TOTAL GDP, 1985

Regions	Total Land Area (Sq. Km.)	Population Size ('000)	Population Density	Total GDP (MS)	Per Capita GDP (MS)
Northern	32,258	4,360	135	13,789	3,162
Central	16,492	4,093	248	21,781	5,322
Eastern	63,850	2,662	42	8,281	3,111
Southern	18,984	1,854	96	6,163	3,324

Source: Malaysia, *Fifth Malaysia Plan, 1986-1990* (Kuala Lumpur: The Government Press, 1986), p. 167.

Note: US\$1 is equivalent to approximately M\$2.5.

A report on the performance of regional development programs from 1976-1985 pointed out that the programs implemented have been fairly successful in terms of their agricultural component, but less successful in population and industrial development (Asian Development Bank, 1985:35). More specifically, both the Malaysian government and international agencies showed that the constraints consisted of high-cost

subsidy requirements and slow population build-up. In addition, marginal levels of industrialization and an uneven distribution of employment opportunities between urban and rural areas continued to affect the overall performance of the regional development strategies (Asian Development Bank, 1985:75).

THE MID-TERM REVIEW OF THE FOURTH MALAYSIA PLAN

As early as 1984, several elements of a new regional development strategy were introduced by the Malaysian government (see Malaysia, 1984). First, participation by the private sector was made an integral part of the development process, with the public sector playing a major role in the national development plan. Second, farm incomes were to be maximized by: raising productivity through shifting, where feasible, to more remunerative crops and cropping patterns; increasing farm size by rehabilitating and consolidating farm holdings; and introducing new modes of farm organization. Third, regional development in economically depressed areas were to continue to be promoted by the orderly development of various urban centers and industrial areas. Fourth, it was envisaged that planning for regional development should gradually shift from the traditional method of planning based on state boundaries and on uncoordinated procedures to that based on economic regions. Finally, the growth of small towns, especially in less developed areas were to be accelerated through resettlement of traditional villages in order to form new urban centers.

THE FIFTH MALAYSIA PLAN: 1986-1990

Beginning in 1986, a new strategy based on integrated regional development planning was introduced (Malaysia, 1986; Sirat, 1987). This strategy is what Richardson (1982) calls "regional metropolis and subsystem development strategy." It focuses on all levels of the regional urban hierarchy in one or two regions of the national spatial system. The largest city in the region is given considerable attention by promoting it as the regional metropolis. In reorienting the previous regional development strategies, four issues were given much more attention by policy-makers and planners.

The first issue involved the concentration and integration with urban centers of new industrial areas in new regions within the new regional framework (Malaysia, 1986:199). This move is seen as a new development in deemphasizing states in favor of regions. To accomplish this strategy, four urban development regions have been identified (see Table 1):

1. The East Region: Kelantan, Terengganu and Pahang,
2. The Central Region: Federal Territory, Selangor, Negeri Sembilan and Melaka,
3. The North Region: Perlis, Kedah, Penang and Perak, and
4. The South Region: Johor.

In the previous development plans, there was a tendency to develop industrial areas at many locations in new regions. Efforts in the new strategies would be geared towards identifying comparative advantages,

location and types of industries that should be set up within the framework of regional development. The Malaysian government envisaged that the concentration of efforts in selected centers rather than the development of many industrial areas in all regions would enable industries to reap the benefits arising from urban concentration and, more importantly, the benefits afforded by a steady supply of specialized labor and services.

The second reorientation under the new strategy involved the planning of the apex of the regional urban hierarchy in such a way that maximizes downward spillovers into the smaller towns. Whether this strategy will work or not, planners, decision makers and urban and regional managers will have to face this challenge, particularly its implementation phase. However, there are some possible means for implementing the integrated regional, metropolitan and subsystem approach and these would lie in: (1) promoting backward linkages to firms in small towns from the regional center's major industries; and (2) implementing a region-wide transportation plan as well as a plan on administrative decentralization to the regional and state levels.

The third issue takes cognizance of the fact that efforts in evaluating and measuring the progress of new township development within the regional framework has always been focused on physical development and demographic objectives of new regions. Financial performance should be given more attention in evaluating the regional development policy. As budget allocations and actual achievements are compared, the question of the cost effectiveness of implementing regional development should be raised. The Asian Development Bank's urban sector profile (1985) pointed out the possibility of considering an index of beneficiary investment cost. This would give a clearer measurement of the success of regional development policy in Malaysia.

Lastly, the *Fifth Malaysia Plan* (1986:200) pointed out the need to strike a balance between the so-called "people-prosperity" and "place-prosperity" strategies. The people-prosperity strategy involves moving people to where the jobs are. On the other hand, place-prosperity strategy means moving jobs to where the people are. Both of these strategies have advantages as well as trade-offs. This requires a re-thinking of distributional, growth and efficiency considerations in the spatial aspect of regional development in West Malaysia.

CONCLUSION

Since the introduction of the National Agricultural Policy in 1984 and the Industrial Master Plan in early 1986, the need to integrate regional spatial planning with these policies became a concern of planners and policy-makers at the national level (Sirat, 1986:584). It became a reality with the completion of the national spatial plan within the framework of the national urban and regional development in the *Fifth Malaysia Plan, 1986-1990*. However, its implementation will depend on how well the coordination and cooperation of administrators, politicians and the public transpire at all levels. Since the *Fifth Malaysia Plan* has been implemented only recently, an assessment should be undertaken at the end of the plan period, i.e., in 1990.

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