

# **Spatial Analysis for Regional Development**

**A Case Study in the Bicol River Basin of the Philippines**

**By A. Rondinelli**

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### ARTICLE I

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RESOURCE SYSTEMS THEORY AND METHODOLOGY SERIES, NO. 2

**SPATIAL ANALYSIS  
FOR REGIONAL DEVELOPMENT**

**A Case Study in the Bicol River Basin of the Philippines**

**Dennis A. Rondinelli**

**THE UNITED NATIONS UNIVERSITY**

**RESOURCE SYSTEMS THEORY AND METHODOLOGY SERIES**

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# CONTENTS

<b>Acknowledgements</b> .....	<b>iv</b>
<b>Introduction</b> .....	<b>v</b>
<b>I. Marginal Resources and Regional Development</b> .....	<b>1</b>
Marginality and Development Policy .....	<b>2</b>
<b>II. Spatial Dimensions of Regional Resource Development</b> .....	<b>4</b>
<b>III. Background and Concept of the "Urban Functions in Rural Development" Projects</b> .....	<b>6</b>
The Conceptual Framework .....	<b>6</b>
<b>IV. Selection of the Bicol River Basin</b> .....	<b>8</b>
Background and Conditions .....	<b>8</b>
Development Problems .....	<b>10</b>
Future Development Plans .....	<b>13</b>
The "Urban Functions in Rural Development" Project .....	<b>14</b>
<b>V. Principles of Organization and Methodology Selection</b> .....	<b>16</b>
<b>VI. Analytical Methods and Planning Procedures</b> .....	<b>20</b>
Regional Resource Analysis—Data Inventory and Baseline Study .....	<b>21</b>
Analysis of Centrality, Functional Complexity, and Hierarchy of Settlements .....	<b>24</b>
Analysis of Linkages Among Settlements in the Region .....	<b>32</b>
Analytical Mapping of Functional Complexity and Linkage Data .....	<b>35</b>
Delineation of Unserved and Marginal Areas .....	<b>35</b>
Determination of Regional Development Needs and Adequacy of the Spatial Structure .....	<b>37</b>
Translation of Spatial Analysis and Development Plans into an Investment Programme .....	<b>38</b>
Creation of a Monitoring System and Institutionalization of the Planning Procedure .....	<b>40</b>
<b>VII. Conclusions and Implications</b> .....	<b>41</b>
<b>References</b> .....	<b>44</b>

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Development Program: Prototype of an Equitable Growth Project," *Modern Government/National Development*, vol. 20, no. 1 (1979), pp. 47–56; and from an unpublished report, "Bicol River Basin Urban Functions in Rural Development Project: Summary and Evaluation," (Washington: US Agency for International Development, 1978). Although the field work was partially supported by USAID, the interpretations and conclusions of this analysis are those of the author and do not necessarily reflect USAID policy.

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## INTRODUCTION

Despite the impressive progress made in economic and social development in much of Asia over the past three decades, a substantial proportion of the population in Asian societies remains in dire poverty, and the gaps between the richest and poorest groups continue to widen. The World Bank has found that two-thirds of the world's poorest people—those living in “absolute poverty” with incomes of less than US \$50 a year—can be found in Asia. Most are concentrated in Bangladesh, Pakistan, India, and Indonesia, but large numbers of people also live at or near subsistence levels in rural hinterlands and on the fringes of the urban economy in Thailand, Burma, Sri Lanka, Malaysia, Korea, Nepal, the Philippines, and other Southeast Asian countries.<sup>1</sup> In its study of poverty in rural Asia, the International Labour Office notes that over the past two decades the incomes of many of the rural poor fell and the percentage of the rural population with incomes below the poverty line increased. The inequitable distribution of income and wealth in some countries was

more pronounced by the middle of the 1970s than at the beginning of the 1960s.<sup>2</sup>

The distribution and severity of poverty within Asian countries are related to patterns of regional resource development. The limited access of some regions and population groups to the natural and man-made resources needed to satisfy basic needs, increase productivity, diversify economic activities, and raise incomes is an underlying cause of poverty. Growing disparities in levels and rates of growth are evident between those countries that have been able to use their resources effectively to stimulate agricultural and industrial development, and those unable to mobilize resources for productive purposes.

Serious disparities in levels of development and standards of living also appear between urban and rural areas, and among subnational regions with different levels of resource endowment and productive assets.

## I. MARGINAL RESOURCES AND REGIONAL DEVELOPMENT

"Marginality" is a distinguishing characteristic of nearly all who live in poverty. In much of Asia the poorest groups inhabit sparsely populated and ecologically hostile environments—marginal and infertile areas subject to recurrent natural hazards such as droughts, floods, and insect plagues. The natural adversities are often exacerbated by man-made hazards of accelerating environmental destruction. These marginal zones are usually incapable of yielding large agricultural surpluses using traditional methods of cultivation, and the huge differentials in productivity between better-endowed and marginal zones within the same country often squeeze marginal people out of agricultural markets entirely, invariably leaving them more impoverished. The World Bank estimates that 40 per cent of the world's poorest people live in areas with seriously adverse climatic and ecological conditions—regions such as the arid and semi-arid uplands of Iran, most of the Himalayan chain from Afghanistan to Burma, vast drought-prone tracts of India, the swampy lowlands of Indonesia and East Malaysia, and the Philippine uplands and river basins.<sup>3</sup>

But the majority of Asia's poor live in densely populated areas with relatively favourable climates and with vast and potentially productive resources. They remain poor because of their marginal access to the means of procuring, transforming and delivering those resources more productively.<sup>4</sup> They inhabit areas where competition for existing resources, especially agricultural land, is intense; where the physical, social, and administrative infrastructure needed to transform and use resources is scarce or where deliberate patterns of government investment have placed them at a locational disadvantage for competing with other regions in national and international markets.

In most of Asia the intense competition for arable land is a primary cause of poverty. "Within the rural sector," the World Bank has found, "at the very core of the poverty problem are families who either own and cultivate very small holdings or own no land at all."<sup>5</sup> Severe pressures on land resources from high rates of rural population growth are expected to continue in south and southeast Asia for at least the rest of this century.

But problems also arise from the marginal use of existing resources: from the inability to identify productive uses

for indigenous resources or from inefficient practices of resource transformation and delivery. The inefficient use of labour—its low productivity and sporadic employment—in rural areas is perhaps the most apparent example of under-used resources in Asia. The ILO has found, however, that "labor is not the only resource that is poorly utilized, in many countries land and other resources are not efficiently exploited." Inefficient farming practices reduce the overall productivity of land in many regions. Excessively long fallow periods, low intensity of cropping, large amounts of land left in natural pastures, and similar practices—especially on larger farms—reduce the possibility of raising yields from existing arable land. "At the same time," ILO analysts note, "many of the smallest farmers are forced to overexploit their land, with the result that useful land is destroyed through exhaustion of soil fertility."<sup>6</sup>

Inefficient or inadequate use of existing resources is often caused by another form of marginality: the limited access of the poor to supplementary services and facilities needed to procure, transform, and deliver productive resources. In many regions of Asia the intense competition for available resources is exacerbated by lack of credit facilities for small farmers and entrepreneurs, the shortage of marketing centres, the inadequacy of co-operative organizations or other arrangements for transporting and selling goods, poor communications, insufficient physical infrastructure and poorly organized agricultural extension services. Most subsistence activities, moreover, depend entirely on manual labour or animal power, sometimes aided by handmade, simple implements. New forms of technology needed to transform resources and increase the productivity of labour are not available to the rural poor. In addition, the administrative and institutional arrangements needed to maintain supplementary resources are often inadequate or missing entirely.<sup>7</sup> "Underutilization of labor and land often is accompanied by underutilization of capital," ILO analysts found. "Large irrigation facilities are not used to capacity; irrigation canals and drainage ditches are allowed to fall into disrepair; fish ponds are permitted to become overgrown with weeds, mechanical equipment becomes inoperative because of poor maintenance and lack of spare parts."<sup>8</sup>

Moreover, the rural poor generally lack access to town-

based facilities and the health, education, and social services that would allow them to increase their productivity. Nor can they easily learn of new ways of identifying potentially productive resources or of using them more effectively. The limited access of rural people to market towns and small cities, in which the services and facilities needed to support rural resource development are located, places them at a serious disadvantage.

### Marginality and Development Policy

The marginality of poor regions in Asia is not due entirely to differences in natural resource endowments. Disparities among regions in income and wealth—and in the overall ability to exploit existing resources productively—are often created by public investment and development policies. “The unequal distribution of benefits among the population and the unbalanced pattern of sectoral development that characterize Philippine growth for much of the past three decades,” the World Bank insists, “was closely linked to resource management policies and to patterns of resource allocation.”<sup>9</sup> In many of the developing nations of Asia, as in the Philippines, investments were heavily concentrated in large-scale, capital-intensive industries, usually located in a primate city or a few metropolitan centres, and allocated to physical infrastructure development in a few favoured regions, usually in and around the metropolitan centre.<sup>10</sup> The concentration of productive assets in the primate cities allowed these centres to exploit opportunities for development, create competitive advantages over other locations within the country, and drain peripheral rural areas of their resources.

These favoured locations now have concentrations of productive and social overhead assets vastly greater than their share of national population. They continue to attract human and capital resources from rural regions, thereby slowing or retarding rural development and maintaining subsistence populations in poverty. In the Philippines, for instance, although Manila has only about a quarter of the national population, it accounts for more than 72 per cent of the nation’s manufacturing firms, 80 per cent of all manufacturing employment and production, and 61 per cent of the nation’s hospital beds. It consumes 83 per cent of the nation’s electrical power and generates more than 65 per cent of the country’s total family income.<sup>11</sup> Similarly, Bangkok absorbs about 65 per cent of the annual investment in construction in Thailand, has 72 per cent of all commercial bank deposits, consumes 82 per cent of the nation’s electrical power and has 77 per cent of the nation’s telephones.<sup>12</sup> Jakarta’s growth is due in large measure to the overwhelming share of foreign and domestic investment it receives compared to other areas of Indonesia and to its percentage of the national population. Between 1968 and

1972, more than 32 per cent of domestic investments and 20 per cent of foreign investments approved by the government were located in Jakarta, which during that time had about 4 per cent of Indonesia’s population.<sup>13</sup>

The relatively high levels of economic development in the Central Luzon and Southern Tagalog regions of the Philippines cannot be attributed solely to their natural advantages. They are the result of sustained concentrations of public and private investments in infrastructure, services, and productive activities in these regions over a long period of time. In every aspect of economic and social development, these regions now have advantages over all others in the country. Agricultural production in Central Luzon outpaces that of other regions because 50 per cent of its cultivated land has been irrigated, as opposed to 13 per cent of cultivated areas in the rest of the Philippines. The region reports the highest percentage of farmers obtaining credit from institutional sources and greater access to fertilizers and other farm inputs than other regions of the country. For over a quarter of a century these two regions have received preference in government resource allocations. In fiscal years 1959 to 1961, for example, nearly 57 per cent of infrastructure expenditures were made in these two regions, slightly more than 70 per cent of expenditures on ports and harbours, 49 per cent on waterworks, 61 per cent on flood control and drainage, and almost 70 per cent on buildings, schools, and hospitals were made in and around metropolitan Manila. From 1971 to 1973, these two most urbanized regions received 56 per cent of all infrastructure investments, 64 per cent of port projects, 91 per cent of waterworks, 63 per cent of irrigation, 67 per cent of flood control and drainage projects, and 60 per cent of buildings, schools, and hospital investments.<sup>14</sup>

Moreover, Central Luzon and Southern Tagalog were favoured with higher allocations for social services and economic development expenditures. Nearly two-fifths of all community development projects funded between 1956 and 1973 were concentrated in these two regions, and 43 per cent of the enterprises assisted by the National Cottage Industries Development Administration (NACIDA) were found there. Indeed, these two regions accounted for nearly 70 per cent of the total capitalization of all NACIDA projects by 1972. More than 43 per cent of the Board of Investment’s (BOI) large-scale industrial assistance, by 1973, was allocated to firms located in these regions.<sup>15</sup>

It has become increasingly clear that the over-concentration of social and productive investments in a few favoured locations is not only detrimental to the marginal regions excluded from development, but to national economic progress as well. The inability to mobilize and use resources to develop marginal regions not only contributes to geographically unbalanced and socially inequitable growth, but leaves large numbers of the population on the fringes

of, or excluded entirely from, the national system of production, exchange, and consumption, thereby constraining expansion of the domestic economy. Indeed, the only market economies in Asia that have been able to grow rapidly with relatively equitable distribution of benefits are those that have taken strong measures to develop resources widely and to increase the access of a large majority of the population to productive assets and skills.

Rao notes of Korea, for instance, that "the broad distribution of land contributed importantly to the fact that farmers gained equitably from the growth of farm incomes, and the early spread of education enabled a wide segment of the population to participate in the rapidly expanding modern manufacturing sector and was instrumental in the extensive modernization of agriculture."<sup>16</sup> In Taiwan, strong emphasis was placed on developing agricultural resources throughout the

country, equalizing wages and prices between urban and rural sectors, and decentralizing industry to peripheral areas. Moreover, in both Korea and Taiwan, physical infrastructure and basic social services were widely distributed in order to increase the productivity of labour and to enhance the capacity of rural villages to become economically viable. Taiwan extended rural roads to all parts of the island, expanded rail systems, created rural industrial estates, strengthened farmers' associations, and assisted raw materials-based industries in marginal areas.<sup>17</sup> In Korea, primary and middle schools are well dispersed and are within easy access of most rural villages. Most villages are connected by roads and have access to telephone communications and electrical power. The government's Saemaul Undong programme continues to provide assistance for self-help projects in rural villages to increase their self-reliance, mobilize leadership and raise productivity.<sup>18</sup>

## II. SPATIAL DIMENSIONS OF REGIONAL RESOURCE DEVELOPMENT

Studies of economic development in both industrially advanced and developing nations have shown that a key to internal economic growth has been the creation of mutually beneficial relationships between urban centres and the countryside. The emergence of a spatial system that stimulated the commercialization of agriculture, allowed natural resources from rural regions to be used productively within those regions, facilitated the dissemination of innovation and the delivery of public and commercial services, aided in the efficient production and exchange of goods throughout the national economy, and drew larger numbers of the population into productive economic activities, was crucial to widespread development.<sup>19</sup>

But in much of Asia such spatial systems are not well developed; systems of central places of different sizes, performing specialized functions, widely dispersed but linked together in a mutually beneficial system of production and exchange, have not yet emerged. Economic development has generally been dualistic, and the over-concentration of investments in infrastructure and services in one or a few major urban centres has created polarized spatial systems that inhibit further expansion of the domestic economy, adversely exploit the resource base of marginal regions, and prevent widespread distribution of the benefits of economic growth. In many countries, as in the Philippines, Thailand, and Indonesia, production and infrastructure investments have been so heavily concentrated in one major city and region that over time the largest metropolitan area has attained "primate city" status. That is, the city has grown so large as to dominate the entire national economy. Secondary cities either do not develop, or grow very slowly. They are usually few in number and not distributed widely enough to act as catalysts for development in marginal regions. In highly polarized spatial systems, market centres are usually small and scattered, and are poorly equipped to provide services to rural areas. Small cities and market towns are not efficiently linked to each other or to larger urban centres and thus marketing networks that could integrate rural areas economically and incorporate marginal populations cannot easily emerge. A large percentage of the urban population lives in the primate city and a few other secondary centres; but the overwhelming majority of people remain in rural areas, scattered in small settlements that are not large enough to support basic services

and facilities needed to promote economic growth and resource development.

International assistance agencies and governments in developing countries have increasingly recognized in the past few years that if they are to ameliorate rural poverty, integrate marginal areas, and incorporate subsistence population groups into the national economy, they must promote a more spatially balanced pattern of development based on "bottom-up" stimulation of rural economies. Redistribution alone would do little to overcome rural poverty of the magnitude found in Asia. The emphasis on "growth-with-equity" would require the development of new resources within developing countries and the steady inclusion of marginal and subsistence populations in productive economic activities. This in turn would require extensive investment in physical infrastructure, services, and productive activities in rural regions, located strategically in intermediate sized cities, smaller towns, and rural market centres. The growth of "rural service centres" that could link towns to rural hinterlands would also be encouraged in order to increase the access of the rural poor to basic services and facilities.<sup>20</sup> The investments, moreover, would have to be located in such a way as to create an articulated and integrated regional spatial system capable of facilitating, 1. the extension of markets for increased agricultural production and other rural resources, thereby raising income for rural families; 2. more widespread distribution of services such as health, education, family planning, and vocational training, the technical inputs needed for increased agricultural production such as new seed varieties, appropriate technology, farm-to-market roads, and rural electrification, as well as communications and transportation; 3. creation of new rural employment opportunities, especially in agro-processing, agribusiness, small-scale manufacturing, and cottage industries that use local resources as the primary inputs for production; and 4. a slowdown the rate and an alteration in the pattern of rural to urban migration.<sup>21</sup>

But the pattern and composition of spatial systems and the roles of various types of settlements differ drastically among developing nations, and any serious effort to shape spatial systems to promote more equitable and widespread development, especially in marginal zones, requires careful analysis and planning. Ruddle and Grandstaff point out

two of the dangers of inappropriate development policies in marginal regions. First, they note that these areas are not necessarily ecologically marginal and that the ecological stability of more populated and developed regions often depends on the stability of marginal areas. Major disruptions of ecological systems in marginal areas could have adverse effects on more developed areas of the country. Moreover, if development is inappropriate or ill-considered it would likely leave people in marginal regions worse off and more alienated. "Marginal area populations are particularly susceptible to this because their resource systems and ways of life are often radically different from those of more developed areas," they note. "There is, therefore, a real likelihood for increased poverty, alienation and cultural disintegration under conditions of radical disruption."<sup>22</sup> In the past, however, spatial analysis for regional development had been constrained by three other problems: the failure to recognize the importance of spatial factors in national and regional resource development; the lack of an operational framework for integrated spatial analysis; and the paucity and unreliability of data in rural regions for formulating effective development plans.

\* \* \*

This paper describes and evaluates a pilot project undertaken from 1976 to 1978 in the Bicol River Basin of the Philippines to address these problems and to develop an operational framework for integrated spatial analysis and regional resource development. It describes the background and rationale of the project, outlines principles for selecting applied research methodologies, describes the methods and techniques that were used in the Bicol River Basin, and compares them with methodologies tested in previous experimental projects in other developing countries. In addition, it identifies the results of the project and evaluates the behavioural and organizational problems of implementing it.

The Bicol project is of general interest to resource development planners for three reasons. First, the analyses employed in the Philippines are potentially replicable, with appropriate testing and adaptation, for integrated spatial development planning in rural regions of other developing countries. Second, the problems of designing applied policy analyses for spatial development in Bicol are quite common in much of the developing world. And, finally, the results of the analysis provide insights into the spatial dimensions of regional resource development, especially the relationships between urban and rural sub-systems.

### III. BACKGROUND AND CONCEPT OF THE "URBAN FUNCTIONS IN RURAL DEVELOPMENT" PROJECTS

The Bicol River Basin of the Philippines was chosen as the site for the first of a series of projects to test approaches to and methodologies for strengthening urban analysis and for locating services and facilities in urban centres that can promote rural development.<sup>23</sup>

The designers of the project contended that spatial factors were crucial to the success of the "new directions" in international aid policy, which is aimed at assisting the poor majority in the Third World, primarily through intensified rural development. Moreover, they argued that the functions of urban centres are essential to stimulate growth in rural economies and to increase the access of the rural poor to those services and facilities needed for development. "In addition to being the loci of opportunities for off-farm employment," they noted, "urban centers provide marketing, storage, processing, supply, credit, health, educational and other services to the rural areas they serve." They concluded that rural areas without access to urban centres and services cannot prosper and "those without access to fully functional and efficient [urban] centers are denied their full development potential."<sup>24</sup>

The projects would both gather additional information about the nature of the relationship between urban and rural development and test analytical and planning methodologies for promoting integrated spatial development in rural regions. The sponsors of the Bicol study pointed out that:

The linkages between rural development and urban centers are clear, and the existing literature identifies and provides considerable insight into the kinds of general services and functions required at the level of the rural market town to support rural development. Less progress has been made in identifying similar facilities and services at other levels of the urban hierarchy—i.e., in the regional and supraregional centers—and little has been written of a comprehensive nature. More understanding is needed of the mix, magnitude and timing (i.e., order of priority) and location of facilities and services at all levels and for different types of agricultural patterns. In addition, practical information is needed on alternative ways of providing the required services and facilities.<sup>25</sup>

The ultimate outputs of the pilot projects would

be a process of analysis and a "package" of analytical techniques and methods for planning that would assist developing country planners to design policies and programmes for strengthening the role of urban centres in rural development. The methods tested and proven effective in these developing countries would be disseminated to development institutions throughout the world.

#### The Conceptual Framework

The importance of the spatial dimension to "growth-with-equity" policy was strongly confirmed in preparatory research conducted in 1976.<sup>26</sup> The study found that spatial systems in most developing countries were not conducive to equitable growth. Although metropolitan centres and smaller cities could play an important role in stimulating rural economies, in most less-developed countries they were not well dispersed, and were often poorly linked to rural hinterlands and, thus, the rural poor generally lacked access to the services, facilities, and productive activities located in them. As a result the cities did not provide inputs needed to develop new resources, increase agricultural production, or meet basic human needs in rural regions.

The report proposed a general framework for analysing rural regions and determining the degree of articulation and integration of the settlement system, and the linkages between urban and rural areas. Functional analysis of settlement systems in developing countries could help determine the types of "urban" services and facilities needed at each level of the spatial hierarchy and the means of providing better access for the rural poor to those functions. The study pointed out, however, that any analytical framework would have to be modified in application, adapted to local conditions, and tested in a number of developing countries. The scarcity of data and general unreliability of statistics in developing nations, and the need for analytical techniques that could be easily applied by planners and readily understood by policy-makers in rural regions, mandated substantial testing through experimental and pilot projects.

The report suggested that the pilot projects focus on three areas of analysis.

1. ***Analysis of Regional Resources and Activities:*** including such factors as physical characteristics of the region, land and resource uses, cropping patterns, volume and diversity of agricultural production, population distribution and rural settlement patterns, services and facilities distribution, non-agricultural and commercial activities, and subsistence system characteristics.
2. ***Analysis of Central Places:*** including the location of market towns, small cities, intermediate or regional centres; the size, composition and density of towns, the location, concentration and dispersion of central functions, changes in the size and concentration of social and economic activities over time, and the labour force and income distribution characteristics of settlements.

3. ***Analysis of Regional Spatial Linkages:*** including physical, economic, population movement, technological, social service delivery, political and institutional interaction patterns among settlements within the region, and linkages with external centres.

A number of specific analytical techniques, and the types of information needed to apply them, were also delineated. The report emphasized, however, that the pilot projects should be tailored to the needs and constraints found in the regions under study. A predesigned package of methods could not be imposed; methodology should be designed in collaboration with planners and researchers in the country chosen for study only after initial data inventories and surveys of available information were conducted.

## IV. SELECTION OF THE BICOL RIVER BASIN

An economically depressed region on the southwestern end of the Luzon peninsula, the Bicol River Basin manifests almost classic characteristics of marginal areas in developing countries. The Basin's marginality is owed in part to its physical isolation from Manila and other regions of the Philippines and to a physical environment that is hostile to productive activity for much of the year. Income is low and inequitably distributed. Production and marketing technologies are inefficient compared to the rest of the Philippines and other Asian countries. Infrastructure and capital are scarce and local government institutions are weak and ineffective. High rates of population growth prevent appreciable increases in standards of living even in developing sections of the Basin, and in much of Bicol the land-tenure arrangements constrain increased agricultural production and more equitable distribution of income. Poverty and the lack of modern sanitation facilities perpetuate widespread health and nutrition problems.<sup>27</sup>

### Background and Conditions

The Basin is a sub-area of the Bicol Region consisting of two provinces—Camarines Sur and Albay—with 700,000 acres of land, about half of which are arable, and nearly 1.8 million people.<sup>28</sup> (See Fig. 1.) For decades, the Bicol River Basin has experienced high levels of rural poverty. The predominantly subsistence agricultural economy has created chronic underemployment and serious malnutrition among the population and encouraged relatively high rates of migration. In 1971, over 80 per cent of the population had incomes below the national poverty level. By 1975, nearly 90 per cent of the Basin's families had annual incomes below the poverty threshold and nearly 65 per cent had incomes of less than half of the poverty mark, classifying them as the "poorest of the poor" (Table 1). About 28 per cent of the labour force is either unemployed or seriously underemployed, and non-agricultural job opportunities in the Basin's towns

TABLE 1. Regional Poverty Threshold and Income Levels, Philippines  
1971 and 1975

Region	Number of families (in thousands)		Average family incomes (in pesos)		Families with income below food threshold, 1971		Families with income below poverty threshold, 1971	
	1971	1975	1971	1975	Number (000s)	Per cent	Number (000s)	Per cent
Ilocos	346	558	3,209	5,525	213	72.6	447	85.2
Cagayan Valley	260	329	2,390	5,102	231	75.8	293	84.8
Central Luzon	855	662	4,127	5,773	224	36.5	178	68.5
Southern Tagalog	869	888	4,332	5,441	436	30.6	466	54.5
Bicol	496	518	2,784	4,280	351	70.9	759	87.3
Western Visayas	670	679	3,260	5,484	418	65.3	419	84.5
Central Visayas	980	441	2,548	4,834	388	70.7	572	85.4
Eastern Visayas	NA	595	NA	5,172	718	73.3	847	86.4
Western Mindanao	522	370	3,062	3,803	NA	NA	NA	NA
Northern Mindanao	825	433	3,577	6,307	339	65.1	449	86.1
Southern Mindanao	NA	314	NA	5,662	480	58.3	654	79.8
Central Mindanao	NA	301	NA	5,025	NA	NA	NA	NA
Manila and suburbs	525	770	7,785	10,469	128	24.7	NA	NA
The Philippines	6,347	8,859	3,736	5,840	3,774	69.0	5,039	79.4

Sources: National Census and Statistics Office, Special Release No. 190, and National Economic and Development Authority, *Statistical Yearbook*, 1975. Manila: NEDA, 1975.

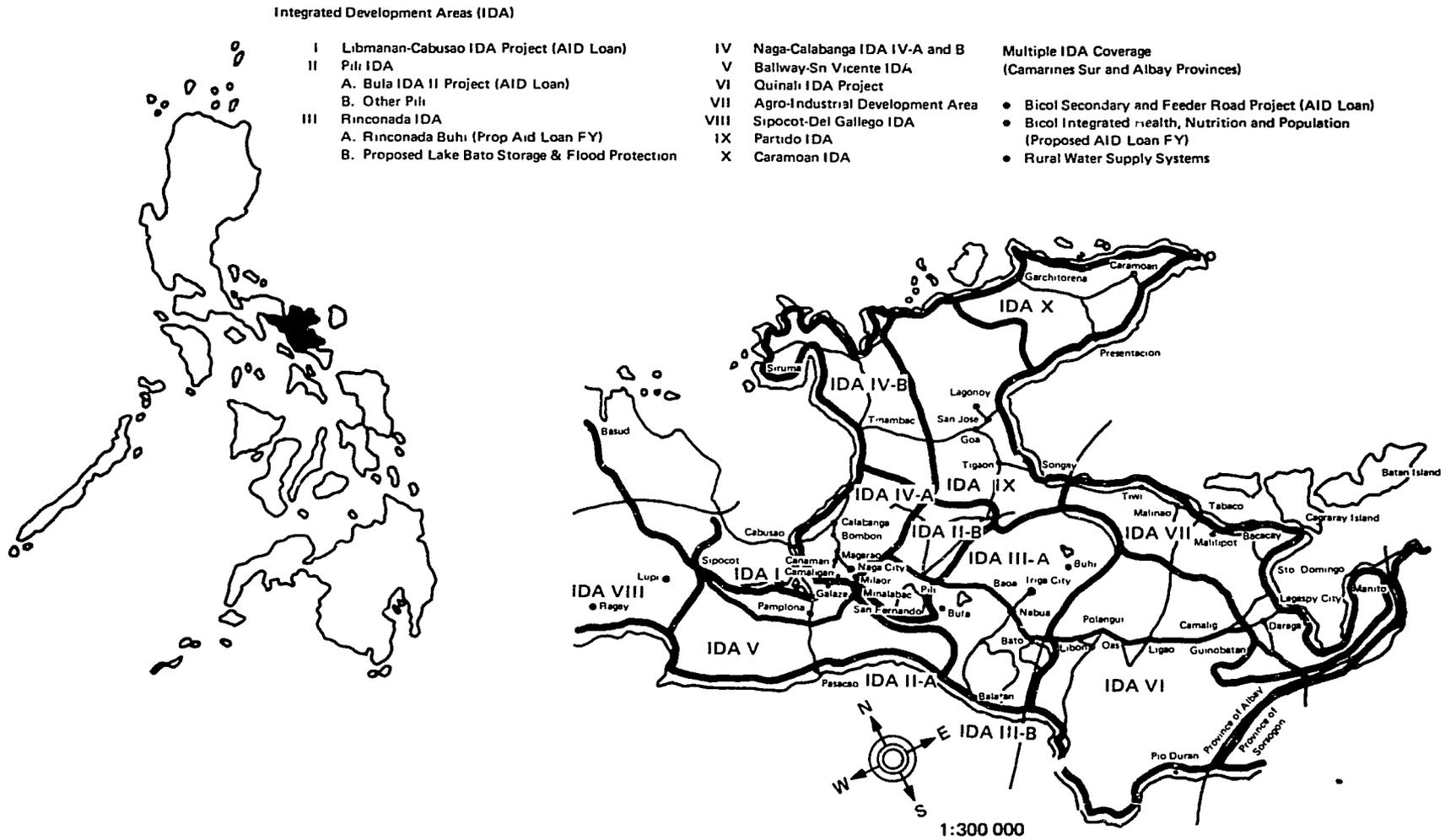


FIG. 1. Map of the Philippines, Bicol River Basin and Integrated Development Areas, 1979.

14

and villages are limited. Income levels of the Bicol River Basin's population are not only low, but income and wealth are inequitably distributed. Ten per cent of the households in the Basin receive 43 per cent of the total income, and the poorer 50 per cent of the population receives only 13 per cent of income. The poorer half lives on about US\$45 per capita a year, only enough to buy rice, occasionally some fish, and the barest necessities of life.<sup>29</sup>

Standards of living in the Basin are far below those of the Philippines. Although outright starvation is not prevalent in the area, 80 per cent of pre-school children suffer from serious malnutrition. A majority of the population is afflicted with water-borne enteric diseases and intestinal parasitism, resulting from contaminated water supplies and poor environmental sanitation. Nearly 73 of every 1,000 infants born in the Bicol River Basin die during their first year, primarily of pneumonia, gastro-enteritis, and bronchitis. There is only one physician for every 4,600 people and most of the doctors are located in larger towns, inaccessible to rural people. Surveys estimate that no more than one-quarter of all women living in the Basin have ever visited a health clinic, hospital, or family planning centre; most rural families seek assistance from healers, or from midwives during pregnancy. Housing conditions outside of the larger towns are also poor. In rural areas homes are built of scrapwood and *nipa*, with grass roofs and bamboo or dirt floors. Less than one-third of the Basin's households have adequate water supplies or sanitary toilets. Sounder structures, more typical of the towns, are scattered in rural barangays, but the overwhelming majority of houses throughout the Basin are constructed of weak building materials and are highly susceptible to fire, flooding, or destruction during typhoons. Few homes are served by piped water or electricity; in the vast majority kerosene or wood is used for lighting and cooking.

The population growth rate of 3.3 per cent a year results in a high dependency ratio—nearly half of the population is under 14 years old—and more than one per cent of the population migrates out of the Basin each year. Most migrants are younger, more productive people seeking job opportunities in larger towns outside the Basin, and usually in metropolitan Manila. The Bicol Region, of which the Basin is a part, has had the lowest net domestic product (NDP) in the Philippines over the past decade; it declined in real terms by an average of 1.5 per cent between 1972 and 1974, at a time when the national average was growing by nearly 4 per cent. The Bicol Region in the early 1970s had the lowest share of employment and production among all regions in the Philippines as well as the lowest proportion of modern manufacturing establishments to population in the country. Indeed, the only industrial capacity in the Basin takes the form

of small, family-owned agro-processing and cottage industries. Nearly all manufactured goods sold in Bicol are imported from Manila.<sup>30</sup>

### Development Problems

Ironically, most Bicolanos live in poverty in a land of great natural beauty and abundant natural resources (Fig. 2). Properly irrigated and cultivated, the Basin's rich alluvial soil could produce enough rice to sustain an additional 8 million people. Production of corn, abaca, sugar, coconuts, and vegetables is only a fraction of the Basin's potential under favourable conditions. The Bicol also has a wealth of untapped mineral resources—about 30 per cent of the marble deposits, 75 per cent of the perlite and about 20 per cent of the coal reserves of the Philippines. The Tiwi geothermal plant, located on the Basin's northeastern border, will soon generate substantial amounts of relatively cheap energy.

But as a regional economy, the Bicol River Basin currently is poorly equipped for increased productivity and widespread development. Through much of the year the Basin is battered by frequent typhoons, bringing high winds and heavy rains. The perennial flooding destroys crops and homes, pushes saline water into interior rice fields and causes widespread silting and erosion. The area is physically isolated from the rest of the Philippines during the worst of the typhoon season and poorly linked to other regions or to Manila even during good weather. A single paved highway that weaves tortuously through the mountains of central Luzon corrects Bicol to Manila. During the typhoon season even this link becomes tenuous as sections of the road are washed out and collapse down the sides of steep mountains. Daily flights to and from Manila, buses, and one railway provide limited capacity for travel or interregional communications, and small ports in coastal villages provide limited access for inter-island trade. Regional transportation and communications are not much better, limiting travel and marketing, and leaving the Basin's settlement system a scattering of relatively isolated and poorly integrated clusters of villages.

Nor are current land-tenure arrangements conducive to increasing family incomes. Farmholdings are small and fragmented. From a third to half of all rice and corn farmers work as tenants or landless labourers, and farm productivity is nearly 10 per cent lower than that of the Philippines. Owners of large landed estates have reinvested little of their profits in the Basin over the years, and agricultural technology on both large and small farms is primitive. Manpower and draught animals provide the bulk of agricultural labour. Relatively few milling or processing facilities have been established, marketing networks in

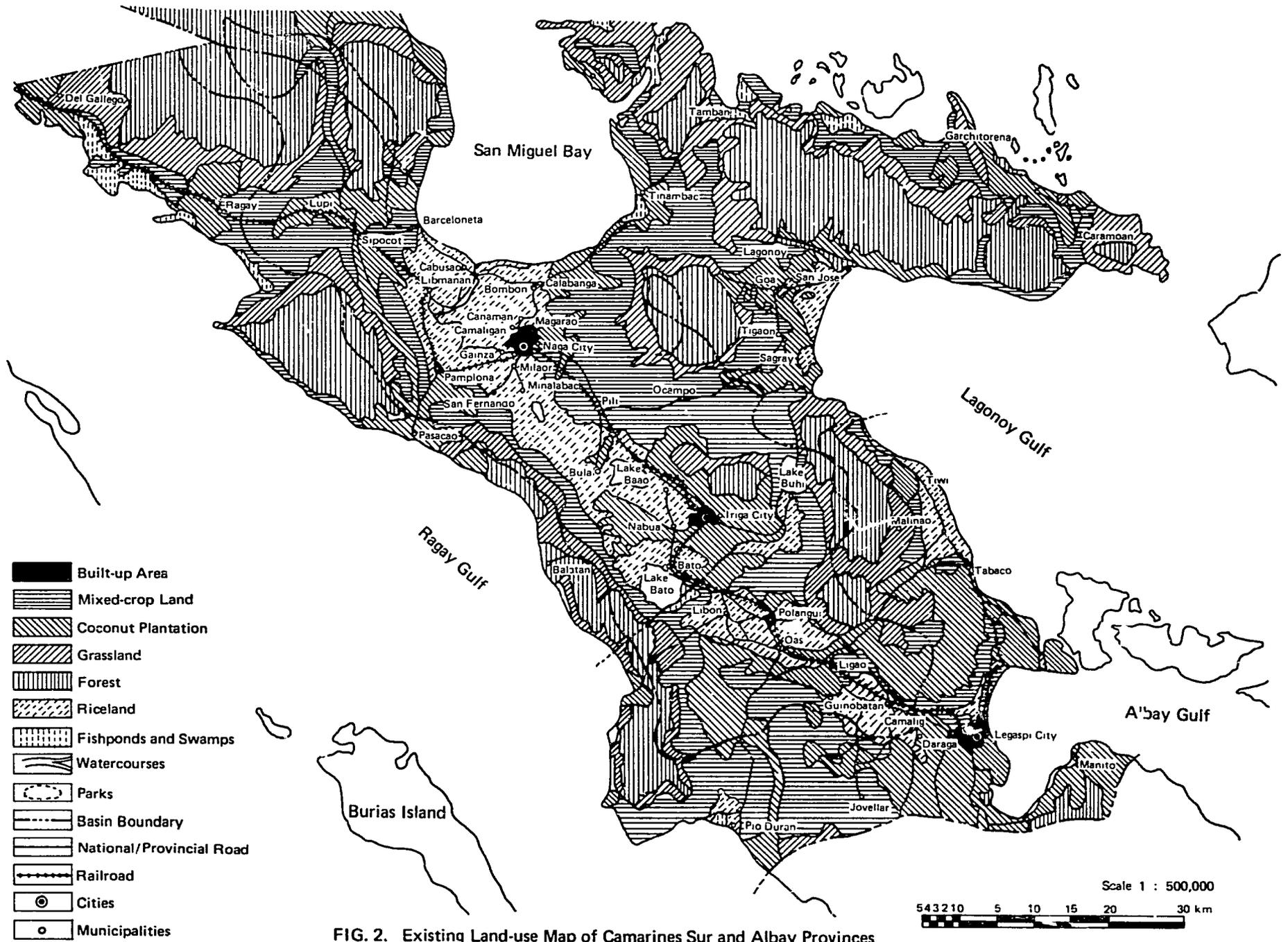


FIG. 2. Existing Land-use Map of Camarines Sur and Albay Provinces

16

rural areas are poor, and storage capacity is limited. Because productivity and income are so low, both tenants and small landowners are continuously in debt. Whatever small surpluses they accumulate are quickly spent on baptisms, weddings, funerals, children's schooling, and the annual fiesta, and on repaying loans. Only about half of the Basin's 100,000 hectares of potentially irrigable ricelands are irrigated; nearly 50,000 hectares of prime agricultural land is flooded during the typhoon season and that located adjacent to the Bicol River suffers from saline intrusion.

Because of its large size, rich potential, and severe poverty, both the national government and international assistance agencies have taken a strong interest in the Basin's development. The Bicol River Basin Development Program (BRBDP) was established by executive order in 1973 and strengthened by presidential decree in 1976. The programme seeks to promote development of agriculture, natural resources, infrastructure, social services, and private sector investment through integrated rural development; to provide comprehensive but decentralized planning and management of programmes and projects; and to combine national with local resources in attaining regional development goals.<sup>31</sup>

The BRBDP and three other regional development programmes come under the jurisdiction of the National Council on Integrated Area Development (NCIAD), which was recently placed in the Office of the President. The

Minister of Public Works serves as co-ordinator for BRBDP and regional directors of national ministries and agencies operating within the Basin; the governors of the participating provinces and the BRBDP programme director form the Bicol River Basin Coordinating Committee (BRBC). A council with representatives from private business, farmers, and religious groups, the media, and civic and youth organizations advises the programme. To facilitate local planning and programme implementation, the Basin is divided into Integrated Development Areas (IDAs), each with a development team headed by a municipal mayor, and consisting of local government officials, community leaders, and technical personnel from national ministries and line agencies working in the Basin. These area development teams are assisted with planning and technical tasks by BRBDP and line agency professional staff (Fig. 3).

Development planning, technical studies and project design have been funded in part by grants and loans from the US Agency for International Development in amounts about equal to those provided by the Government of the Philippines. Thus far, three major capital construction projects in water resources development and secondary and feeder roads are underway and one is in the design stage. Comprehensive studies of water resources, land classification and mapping, intermodal transport, hydro-meteorology, and others have been completed. Data collection and feasibility studies for agricultural education,

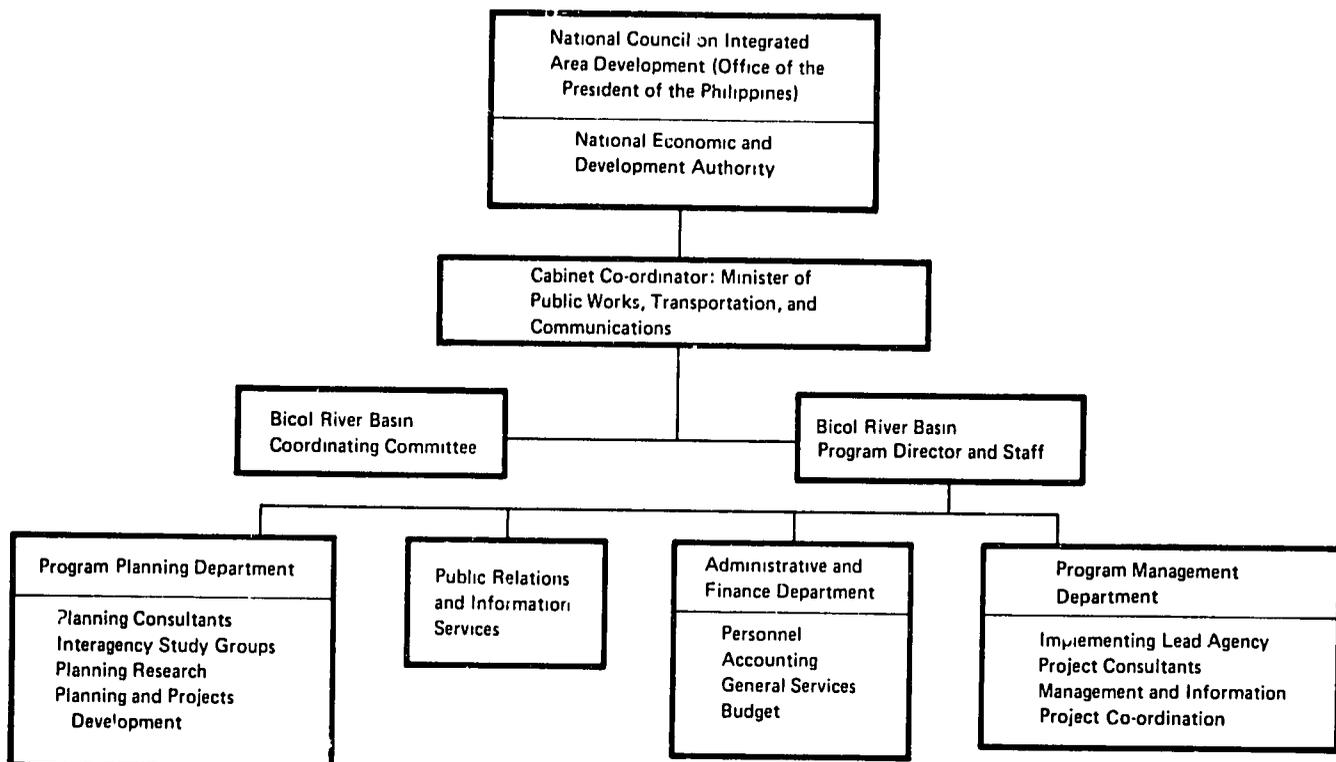


FIG. 3 Organizational Structure of Bicol River Basin Development Program

health, nutrition, and population planning, crop production, and compact farm projects are in progress, as is a comprehensive socio-economic survey that will be updated every three years. An agribusiness reconnaissance survey, pre-feasibility studies, and rural industry analyses have recently been initiated.

### Future Development Plans

Early success with regional planning and development in the Basin has attracted the attention of other assistance organizations. The World Bank, the Asian Development Bank (ADB), and the governments of Germany and Japan have expressed interest in assisting with various projects identified in the Bicol Comprehensive Plan for 1978–1987. Over the next decade extensive physical infrastructure, agricultural production, agribusiness, small-scale manufacturing, and social services projects are planned for the Basin (Table 2), some of which were included in proposals presented to the World Bank Consultative Group meetings in Japan in 1978. A second farm-to-market road

construction programme, estimated to cost more than US\$40 million, has been identified. The World Bank and the Japanese government are now funding some road projects and the ADB is financing rehabilitation of the railroad from Manila to Bicol. In addition, the ADB has expressed willingness to consider proposals for loans to supplement government irrigation and agricultural activities in several IDAs. Germany and Japan have sent representatives to investigate possible investments, particularly in the industrial IDA. A World Bank loan is proposed for upgrading the quality and expanding the facilities of local agricultural colleges. Moreover, both the World Bank and ADB may assist with projects to upgrade smaller ports in the Basin, extend and improve domestic water supplies, and contribute to agribusiness, fisheries development, and rural industry studies. USAID is expected to continue providing financial support for planning and project preparation, capital projects in some IDAs, an integrated project for health, nutrition, and population, and for technical assistance to augment the BRBDP's growing staff of trained planners, technicians, and administrators.

TABLE 2. Bicol River Basin—IAD Agricultural Development Implementation Schedule

Project/Component	YEAR									
	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
Physical infrastructure										
A. Transportation										
1. Secondary roads										
Rehab/upgrading	XXXX	XX								
Construction	XX									
Maintenance	XX									
2. Feeder roads										
Rehab/upgrading	XX									
Construction					XX					
Maintenance	XX									
3. Ports										
Improvement/ports of entry	XX	XX								
Improvements/municipal ports		XX	XX							
4. Airport upgrading	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX	XX								
B. Telecommunications	XX									
C. Water resources										
1. Irrigation/drainage	XX									
2. Flood control	XX	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX								
3. Domestic water		XX								
4. Watershed management	XX									
D. Power/rural electrification	XX	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX								
E. Social infrastructure	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX									



essential for designing realistic surveys and interpreting results. Second, the planning process was to be institutionalized in the Bicol River Basin Development Program, requiring that its staff and consultants be intimately involved in the entire study. Project design assistance, technical aid in selecting and adapting methodology, review and evaluation of working papers

and the final report, and assistance with training were provided by international consultants, who also monitored and evaluated the project. These consultants were available at regular intervals during the project, but did not reside full-time in the Philippines. Final responsibility for all phases, and for completion of the project, was vested in the Philippine staff.<sup>32</sup>

## V. PRINCIPLES OF ORGANIZATION AND METHODOLOGY SELECTION

Decisions were made about organization and design of methodology on the basis of specific principles related to the need for using analytical techniques that could be easily applied in rural areas of developing countries. Methodology was adapted both to the characteristics of decision-makers in rural regions where the project was likely to be replicated and to the availability of data in the Bicol River Basin. Some of the principles used to organize the project and select methodologies were inherent in the conceptual framework used to design the project, some were recommended by the international consultants, and others emerged from experience with the project as it progressed. Some specific techniques of analysis had been tested earlier in experimental projects in India, Brazil, and Ghana, and they were included in the methodology devised for Bicol.<sup>33</sup>

The project had four distinct phases: first, an extensive inventory was made of data, information, and existing studies to formulate a statistical profile of the region and to delineate existing resources in rural settlements and urbanized centres of the Basin; second, a functional complexity analysis of the region's settlement system was undertaken to determine the distribution of services, facilities, and productive activities and to delineate the settlement "hierarchy"; third, an analysis was made of "linkages" among settlements within the region and with places outside of Bicol; and finally, an analysis was done of the access of the rural poor to services and facilities located in urbanized settlements. The adequacy of the distribution of urban functions for rural development was evaluated and a spatial-policy plan for future development of the Basin was formulated. The plan would then be transformed into recommendations for identification, selection, and location of investment projects designed to increase the access of the poor to urban functions needed for rural development and to strengthen the spatial system for equitable economic development.

Among the operating principles used in the organization of the project and in selection of analytical techniques were the following.

1. *Create an ongoing planning process as well as production of a spatial development plan.* The objective of the project was twofold: first, "to develop a planning process—

potentially valid for application elsewhere in the Philippines and in other countries," and second, to develop "a plan for strengthening the contributions of urban centers to rural development in the Bicol."<sup>34</sup> Thus the project would not only test an analytical and planning procedure but also institutionalize the process in the Bicol River Basin Development Program so that the analyses could be revised on a continuing basis.

Although the CPDS staff made extensive efforts to fulfil both objectives—primarily through eliciting the participation of technical personnel, BRBDP planners, and Philippine consultants in the project's operations, and informing local political leaders through training and workshop sessions—staff time and attention inevitably focused on analysis. Formulating an ongoing planning process and institutionalizing it were often subordinated to completion of more immediate tasks. Workshops held quarterly in Bicol proved to be an effective way of keeping a core of technical personnel and political leaders informed of activities during the first months of the project, but participation fell off as the project progressed. The pressures of time and conflicting commitments for political leaders made their attendance at workshops sporadic. Once staff activities were moved from Bicol to the University of the Philippines at Los Baños it became more difficult to provide information and elicit participation. Moreover, as pressures began to build on the staff to complete various stages of the project on time, more expedient and less participatory procedures were adopted.

2. *Design the spatial analysis and development plan to be policy-oriented and adjunctive in nature.* The plan or spatial analysis would be oriented to the decision-making requirements of the Bicol River Basin Development Program, regional offices of national government agencies, and provincial and local governments that would be making investment and location decisions in the Basin over the next ten years. As the regional director of the Department of Local Government and Community Development expressed it during an early organizational workshop, the outputs of the Urban Functions in Rural Development project should be "inputs" for the planning efforts of other organizations. The plan would not be a comprehensive regional development scheme per se, since the National Economic and Development Authority (NEDA), the major

cities, and the BRBDP already had comprehensive development plans. Instead, the Urban Functions report would provide a spatial dimension useful for making locational decisions and for revising comprehensive development plans. Planning would be adjunctive, and the data and analysis could be used to supplement technical criteria used by various organizations in making investments in the area.<sup>35</sup>

**3. Use applied research methods and analytical techniques easily performed by rural planners and easily understood by policy-makers.** The analytical techniques used in the project would have to be appropriate for applied policy analysis and to the planning capacities found in rural areas. The consultants believed that conditions found in most developing nations imposed tight constraints on the complexity of applied policy analysis. Policy plans must be done quickly and be timely if they are to have an impact on investment decision-making. Thus, policy studies cannot usually depend on time-consuming data collection and highly sophisticated research techniques. They cannot, moreover, use techniques that impose overly complex, costly, or time-consuming requirements on users. They should be relatively easy to apply and not require, at least initially, sophisticated equipment or high levels of technical skill and training, which are not usually found in rural regions. If the methods are to be institutionalized in local planning and decision-making processes they must be of a type that can be applied manually or with easily acquired and operated equipment such as desk calculators. If they are to be applied by planners and administrators without advanced technical training in spatial analysis, they should involve relatively simple and easily learned operations.

In addition, it was considered crucial that the methods and techniques be comprehensible to rural policy-makers and that the results of the analyses be clearly presented to local and national officials who would have limited exposure to or interest in spatial analysis methodologies, and, indeed, who might be alienated by complex methodology. The primary audience for the analysis would in most cases be government officials and political leaders with limited education and technical training. The analytical techniques most easily understood by them would be descriptive statistics, analytical mapping, scaling, and charting.

Although most participants in the project eventually accepted the general principle, strong tendencies to deviate from it were apparent in the early stages. Some of the staff members (most of whom had masters degrees), the University of the Philippines' professors who acted as consultants, and some of the BRBDP planners often showed more interest in relatively sophisticated methodology and often viewed the project as research rather than as an exercise in applied policy analysis. Staff

members worried that the results derived from more simplified descriptive techniques would not carry the "authority" of those generated by sophisticated statistical methods and computer analysis. However, as the project progressed, and the limitations of available data, the requirements of collecting additional information to fit complex analytical methodologies, the difficulties encountered in explaining more sophisticated techniques to political leaders and technical personnel in government agencies, and the constraints on operationalizing computer-based analyses became more apparent, the principle became more acceptable.

**4. Use as much existing data as possible; limit new data collection to areas where significant "information gaps" appear.** Because a number of studies had been previously conducted in the Bicol and because the Philippines had extensive census and statistical information, the planning and analysis methodologies were tailored as much as possible to using existing data. Methods requiring additional data collection were used sparingly and only when crucial "information gaps" were identified. In any case, limitations of time and money made large-scale data collection and extensive original research impossible. The Urban Functions study would draw as heavily as possible on census materials, previous resource and social-survey studies of the Basin, and the specialized feasibility and technical studies performed by and for the BRBDP.

Although the Bicol River Basin was relatively "data rich" for an economically depressed region, it soon became obvious that much of the available data were not collected or reported in forms appropriate for spatial analysis. Nearly all socio-economic data, for example, were reported at either the provincial or municipal level and could not be disaggregated to the barangay (village) settlement level. Thus, it was often difficult or impossible to make meaningful distinctions between *poblaciones* (town centres) and rural barangays with socio-economic data reported at the municipal level. Moreover, much of the data collected by the National Census and Statistics Office (NCSO) were on a sample basis, making it impossible to attribute them to specific settlements or to use original field sheets to disaggregate data for settlements. Some of the data were reported at different units over time, or the unit boundaries changed from one reporting period to the next, making time series or temporal comparisons difficult. A good deal of the information available from technical reports, special BRBDP studies, and national ministries was collected for specific purposes and communities and did not cover the entire Basin. Thus, many aspects of the analysis had to be based on "sample" studies of sub-areas within the Basin.<sup>36</sup>

Moreover, there were other limitations to the information available. Accurate maps delineating towns and barangays

did not exist when the project began, and a good deal of time had to be devoted to locating and mapping settlements. Air photos were available for only about 10 per cent of the Basin, and neither time nor money was available to complete the photo surveys. Thus, information concerning the location of settlement boundaries had to be collected through field and key informant surveys. The excellent social surveys conducted by the Social Science Research Unit of Ateneo de Naga University—especially municipal and transport inventories and programme evaluation studies—provided strong insights into various aspects of underdevelopment in the Basin, but they covered only Camarines Sur province. Some of the studies had to be updated or extended in Albay Province in order to obtain complete coverage of the Basin. In addition, the lack of family-income and employment data at municipal and barangay levels created serious analytical problems that were never fully overcome. Finally, except for some data found in the transport studies, virtually none of the existing information was useful for linkage analysis; transport linkages, market and social interaction patterns, service linkages, and governmental relationships all had to be determined through original studies done on a sample basis by the project staff or its subcontractors.

*5. Use a combination of analytical methodologies, and rely heavily on staff knowledge of the area under study.* It became clear early in the project that, given the constraints of time and money and the need to develop a useful policy document quickly, it would not be possible to undertake a comprehensive statistical analysis of the Bicol River Basin. Where comprehensive coverage could not be attained using existing or easily collected data, the staff used partial analysis, sample studies, and sub-area analysis. Formal statistical analysis was supplemented, where appropriate, with "softer" methods: case studies, participant observation, and interviewing of key informants. The staff was encouraged to be creative in developing analytical methodologies suited to the conditions and needs of the area. To the extent that the output of the project would be a policy plan rather than a scholarly research study, the staff was urged to employ a wide variety of techniques for obtaining information, and to cultivate and use their own knowledge of the region in arriving at judgements and conclusions concerning crucial development issues.

Although a large number of possible analytical techniques were suggested in an initial conceptual study, the project was not designed to test a pre-selected set of methods. Design of the analytical methods and techniques evolved during the project as opportunities and constraints became apparent, and was selected on the basis of criteria outlined earlier. Under any conditions, heavy reliance on multi-variate statistical techniques seemed questionable given the types and quality of data available and the purposes of the study.

The staff accepted the necessity of using a variety of formal and informal, "hard" and "soft" analytical methods, and the application of their own judgement to the study, although they were initially sceptical and somewhat uncomfortable without a pre-selected and designed approach. Their initial reaction was that one or two statistical techniques would provide the "answers" and that conventional regional-analysis methods should simply be applied in Bicol. Indeed, in the early stages of the project, statistical methods were often used as "crutches." Manipulation of numbers was substituted for hard thinking and conceptualization about spatial systems in the Basin. To some extent both reactions were mitigated as the project progressed and the staff saw the limitations inherent in each statistical technique they tested, and the need to use methods of analysis as a way of testing conceptions and preliminary judgements rather than to provide unequivocal "answers" and irrefutable conclusions.

In retrospect, it is clear that no pre-selected package of techniques would have exactly fit the conditions in the Basin. Many analytical techniques that were thought to be important for analysis at the outset had to be discarded either because of lack of available data or because they yielded inappropriate or useless results. Even simple location quotients could not be calculated, for instance, because of the lack of employment or production statistics; coefficients of segregation and Gini Concentration ratios could not be determined for many socio-economic indicators, and distance-accessibility analysis was found not to be very useful in the context of rural underdevelopment in the Basin. Even some standard techniques of analysis such as centrality indexing were not helpful; attempting to calculate Guttman scales by computer proved futile given limited computer capacity and lack of trained manpower. In each instance, the staff had to fall back on descriptive and manually-calculated statistics. Overall, however, this provided a strong learning experience for most of the staff; doing short field surveys, hand-calculating results, manually constructing scalograms, and testing alternative statistical techniques forced the staff to think seriously about the types of data needed, their real worth, the cost-effectiveness of gathering more, and the meaning of the results in terms of the conditions they observed in the Bicol River Basin.

Moreover, the initial exercise of inventorying existing data prior to designing analytical techniques and collecting additional information—although it required much more time than originally estimated—yielded an important output: the first statistical compendium of social, economic, demographic, and physical information, disaggregated to the municipal level, that had been compiled for the Bicol. It categorized data from myriad sources that heretofore had been scattered in specialized technical reports. This compendium alone would provide an important planning

tool for the BRBDP and other government agencies within the Basin, and eventually can be used to assist in making private sector investment and location decisions. Finally, the exercise yielded the first comprehensive settlement map of the Bicol River Basin that identified and located

barangays. Again, this would provide BRBDP planners with a valuable tool for future planning, and when combined with the analyses of municipalities, functional complexity of settlements, and indicators of linkage, can be used to make more informed and effective location decisions.

## VI. ANALYTICAL METHODS AND PLANNING PROCEDURES

The integrated spatial-analysis methodology tested in the Bicol River Basin of the Philippines involved ten major components.<sup>37</sup>

1. An overall regional resource analysis and socio-economic and demographic profile of the Basin that would serve as a data inventory for planning purposes and as a "baseline" study for monitoring and evaluation.
2. An analysis of the existing spatial structure, describing elements of the settlement system, the functional complexity and centrality of settlements, the hierarchy of central places, and the distribution of, and patterns of association among, functions within the region.
3. Description and analysis of the major socio-economic, organizational, and physical linkages among settlements within the Basin and between them and centres located in other regions of the country.
4. Mapping of information obtained from the functional complexity, settlement hierarchy, and spatial-linkages analyses to determine "areas of influence" or service areas of various settlement categories within the region.
5. Delineation of areas where linkages are weak or non-existent, and of marginal areas that are not served by central places or in which rural populations have poor access to town-based services and facilities that are crucial for rural development.
6. Comparison of information from the regional resources survey, settlement system, and functional distribution analyses to regional development plans and objectives to (a) determine the adequacy of the spatial system to meet development needs and facilitate the implementation of equitable growth policy, and (b) identify major "gaps" in the spatial system, in service areas for crucial functions, and in linkages among sub-areas of the region.
7. Translation of the spatial analyses into an investment plan that identifies the projects and programmes that will be needed to ameliorate major development problems, to strengthen and articulate the regional spatial structure, and to integrate various levels of settlement within it.
8. Integration of projects identified through spatial and economic analyses into spatially and functionally co-ordinated "investment packages" for different locations within the region, and combination of the investment packages into a priority-ranked and appropriately sequenced investment budget for the development of the region over a given period of time.
9. Creation of an evaluation system for monitoring the implementation of projects and programmes, and for determining the substantive results of development activities on marginal areas and population groups within the region.
10. Institutionalization of the planning procedures in local and regional public agencies charged with investment decision-making and with revising the spatial analysis and development plans at appropriate intervals.

This section of the case study reviews these ten activities in detail, describes the methods of analysis used in the Bicol River Basin, outlines the substantive findings and results of the analyses, and compares the techniques used in Bicol with those tested in similar projects in other developing countries.

An underlying assumption of the spatial analysis in Bicol was that it would be "problem oriented"; that is, the spatial analysis and planning would deal primarily with problems of stimulating growth with equity, and with providing essential information needed to make effective investment decisions. It was assumed that the spatial system in Bicol should be developed to stimulate "bottom-up" development in rural areas, facilitate the spread of growth from urban centres, increase the access of marginal groups to centrally located services and facilities, and use existing and potentially productive resources in ways that would benefit people living in the Bicol River Basin. The approach to planning would be *developmental* rather than adaptive, in that it would, as Hermansen describes it, "seek to identify and achieve within a dynamic and historical context a pattern of evolution of the spatial structure that at any point in time is judged to be most efficient from the point of view of promoting a sustained process of rapid economic development."<sup>38</sup> Developmental spatial planning would attempt to create a spatial structure that would act



1

1. Much of the Bicol River basin is inaccessible by road; many barangays can only be reached by dirt trails that become impassable during the rainy season. Buses or jeepneys provide transportation only to villages along the major roads during the dry season.

2. Families scattered on individual farmsteads have little access to town-based services and facilities. They depend on an infrequent jeepney service or on slow-moving, animal-drawn carts to bring their produce to market.

3. Agricultural production in much of the Basin depends on traditional methods of cultivation using manual labour and draught animals. Production remains at subsistence levels and provides low returns to farmers in peripheral areas.



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4 and 5. The vast majority of Bicol's population lives in small, subsistence villages that have few, if any, of the services and facilities needed to stimulate development and use existing resources more productively.



6

6,7,8. Bicol has no large industries. Cottage industries such as copra-making and handicrafts, which could use local resources productively, are not well organized.

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9. Nearly all of the rice and grain production is processed by hand using traditional methods in rural areas and by small mills located in market centres.

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10. The terrain of much of the Bicol River Basin has been moulded by centuries of volcanic deposits. Mt. Mayon in Legaspi City remains an active volcano of almost perfect conical shape.



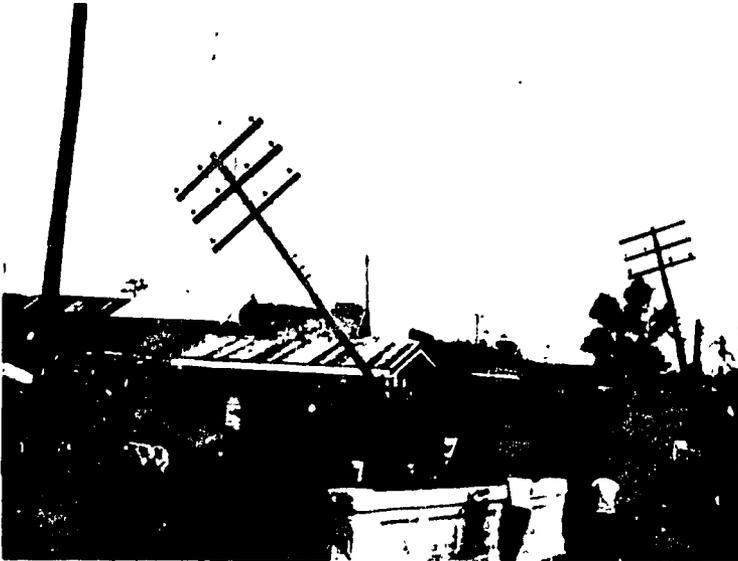
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11. The volcanic terrain also provides a strong source of potential energy. The Basin's energy-producing potential is just beginning to be tapped by the Tiwi Geothermal Power Pilot Plant.

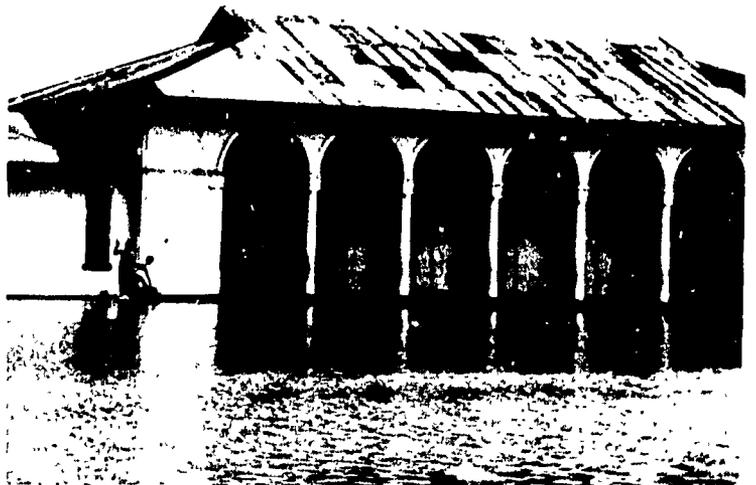


11

12 and 13. Frequent storms and typhoons flood farmland, disrupt communications and transportation, and cause serious physical damage.



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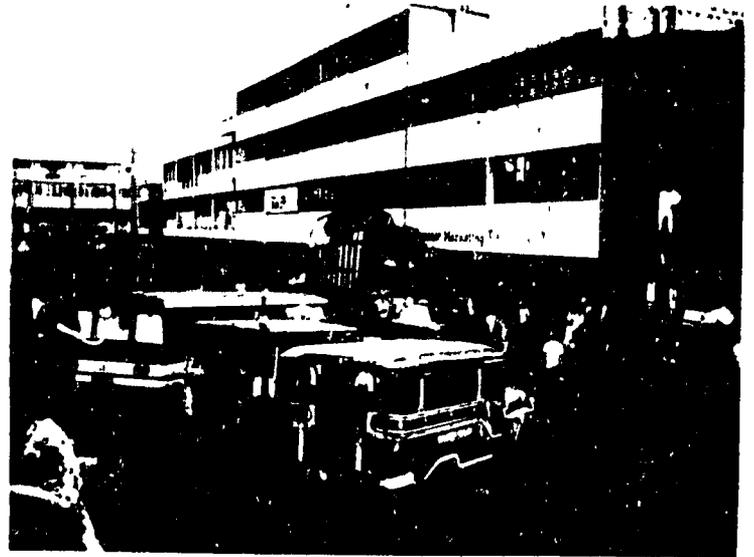
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14. Much of Bicol's rural population lacks access to regular or periodic markets. Most periodic markets are found in the few larger towns of the Basin.

15. Regular markets are found only in larger towns along the Manila South Road—the only paved highway in the Basin. Basic consumer goods, some agricultural inputs, and parts and supplies can be found in the town centres.



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16. The Basin's two provincial centres—Naga and Legaspi cities—offer the widest range of goods and services needed to stimulate regional development. These centres are accessible to only a small percentage of the Basin's population.

17. Naga City is an outlet for the few larger, better organized fishermen. Most of the potentially productive coastal and fishery resources in Bicol are used only marginally by subsistence fishermen. Surplus catches in the small fishing villages are sun-dried and stored, or sold in small quantities in the markets.



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as a catalyst for economic and social progress by transforming traditional organizations and patterns of interaction as development occurred.

Spatial development planning would seek to integrate and locate investments in such a way that they not only stimulate economic growth but also contribute to the evolution of an articulated and integrated spatial system capable of more widely spreading the benefits of growth to all areas of the region. Investments would be selected and located to enhance the capacity of various types of settlements, especially towns and cities, to act as service centres and catalysts of growth for rural development. As Babarovic notes of a similar experiment in regional development planning in Brazil, "location should be such that the accessibility of [urban centres] to the unincorporated rural population as a whole should be as great as possible in the marginated rural group."<sup>39</sup> Moreover, it was assumed in the Bicol project, as it was in similar attempts at area development in India, that "an economic system works best and works in an efficient manner when appropriate linkages are established" among settlements of various sizes and that "the location and provision of missing infrastructure is a necessary exercise in regional spatial planning."<sup>40</sup> But the project's advisers and designers also recognized that articulation and integration of the spatial system alone, although a necessary condition for equitable growth, would not solve the problems of marginality and poverty in economically lagging regions. Other government policies, which often allow exploitation of poor regions and subsistence populations, must also be changed so that the "terms of trade" between urban and rural areas, agricultural and industrial sectors, and traditional and modern occupation groups become more equitable.<sup>41</sup>

### Regional Resource Analysis—Data Inventory and Baseline Study

The Bicol River Basin Urban Functions in Rural Development project began with the preparation of a profile of socio-economic, physical, and demographic characteristics of the region. This analysis of regional resources would serve as an inventory of existing data, contribute to a comparative analysis of the region with other regions in the Philippines, and provide a baseline evaluation of conditions in the Basin at the time the project began.

Data were compiled and then disaggregated to provide a comparative profile of social, economic, physical, institutional, and demographic characteristics of Bicol's 54 municipalities. Primarily descriptive, this aspect of the study made use of data on population size, density, and composition, levels of dependency, literacy, educational

attainment, conditions of dwelling units, size of municipal revenues, land area, crop production, value of production, and experienced work force. Also included were comparative analyses of changes in population sizes of barangays, per cent distribution of population by municipality, number and per cent of households with lighting and toilet facilities, strength of construction of dwelling units, distribution of market receipts by municipality, and distribution of agricultural resources. The types, numbers, and distribution of productive and commercial establishments were compared by municipality as were the numbers and capacities of hospitals, educational institutions, and service establishments.

Constraints of time and money allowed little original data collection, which was not a serious problem in the relatively data-rich Bicol River Basin. But in other regions or nations without the extensive statistical base of Bicol, more primary data collection would have been required. Integrated spatial analysis of community development blocks (districts of from 60 to 80 villages) in India, for instance, was based on extensive original data collection at the village, household, firm, and shop levels using questionnaires especially designed to determine location-specific information. Village and household questionnaires were administered to every settlement within each block, and samples of households within each village provided detailed information on the location of services and facilities within the area and on socio-economic characteristics of families. Production, distribution, and other economic information was obtained from sample surveys of cottage industries, larger firms, and commercial establishments.<sup>42</sup> In Bicol, however, these data could be derived from census reports, key informants, ministry studies, and from project-feasibility analyses commissioned by the BRBDP. Most of the data were analysed by descriptive statistical techniques, and significant changes in conditions between 1960 and 1970, and 1970 and 1975, were calculated. Location quotients were derived for some of the economic and social data and others were used to form a quartile ranking of municipalities by relative levels of development.

1. *Location Quotient Analysis.* Location quotients are easily calculated indices of the relative specialization of settlements in specific activities or characteristics. They are especially useful for determining relative industrial or occupational specialization using employment as a surrogate for production. A location quotient is basically a "ratio of ratios" comparing, for example, the ratio of employment in a given industry or occupation in a municipality to employment in all industries in that municipality, to the ratio of employment in that industry in a larger reference area, such as a region, to all industrial employment in that region. The formula is as follows:

TABLE 3. Occupation Quotients, Selected Municipalities in Camarines Sur Province Compared to Bicol River Basin Area

Municipality	Experienced Workers by Occupation Group			
	Professional, technical, managerial, and administrative	Farmers, fishermen, miners, and related workers	Craftsmen, production-process workers, and labourers	Service, commercial, and related workers
Naga City	1.31	0.81	0.73	1.08
Bombon	0.58	0.89	1.29	1.48
Bula	0.49	1.42	0.46	0.71
Calabanga	0.91	1.06	1.01	0.81
Camaligan	1.12	0.55	1.35	1.15
Canaman	0.61	1.16	1.24	0.82
Gainza	1.78	1.07	0.54	0.33
Magarao	1.32	0.85	1.06	1.54
Milaor	0.57	1.13	1.09	0.88
Minalabac	0.66	1.48	0.38	0.29
Pamplona	0.09	1.44	0.51	0.31
Pasacao	0.15	1.46	0.20	0.67
Pili	1.09	1.12	0.59	1.09
San Fernando	0.37	1.48	0.49	0.32
Camarines Sur Province compared to Bicol River Basin	1.03	1.12	0.71	1.01

$$LQ = \frac{M_i/M}{R_i/R}$$

where  $M_i$  = employment in industry  $i$  in municipality  
 $M$  = total industrial employment in municipality  
 $R_i$  = employment in industry  $i$  in the region  
 $R$  = total industrial employment in the region

A location quotient greater than unity indicates that the municipality or settlement is more specialized in that activity than the region, and implies that the settlement is performing an "export" activity. A location quotient of less than unity implies that the settlement is less specialized in the activity than the region, and may have to "import" services or goods to satisfy local needs. The occupation quotients for selected municipalities in the Bicol River Basin listed in table 3, for example, indicate that the municipalities of Naga City, Camaligan, Gainza, and Magarao are slightly more specialized in professional, technical, and managerially experienced workers than either the province in which they are located or the Bicol River Basin. Those municipalities that have occupational location quotients at or near unity are sufficiently specialized in those occupations to service local needs at their present levels.<sup>43</sup>

A variety of socio-economic data can be analysed using the location quotient to determine relative specialization, and location quotients can be calculated to determine relative specializations in the region compared to the entire country. Moreover, a time-series of location quotients can be calculated to show changes in specialization among settlements over a period of time. Location quotients are very rough indicators, however, and must be carefully interpreted within the context of regional conditions and refined by the use of other analytical techniques. In Bicol the location quotient was of limited significance for analysing occupational or industrial specializations of municipalities because employment data were reported only at the provincial level and could not be disaggregated by municipality.

2. *Quartile Rankings.* The primary use of regional-resource survey information in Bicol was to determine differences in, and levels of development among, municipalities in the region. Municipalities were ranked by level of development based on three derived analyses: ranking of socio-economic and demographic characteristics associated with levels of development in the Philippines; ranking by share of industrial, commercial, and agricultural production establishments in Bicol; and ranking by transportation

TABLE 4. Socio-economic Profile of Municipalities in Bicol River Basin, the Philippines, 1970

Per cent distribution of:	Developing municipalities (N = 6)	Less-developed or transitional municipalities (N = 10)	Underdeveloped and peripheral municipalities (N = 38)
Population	22.4	26.4	51.2
<b>Educational attainment</b>			
High school graduates	31.2	26.3	42.4
College graduates	44.8	23.2	32.0
Dwelling units of strong construction	32.6	26.9	40.4
Municipal revenues	44.5	18.6	36.9
Financial institutions	48.1	13.4	38.2
Deposits and loan assets of financial institutions	86.9	4.7	8.4
<b>Agro-processing,</b>			
Storage and commercial establishments	24.9	31.4	36.7
Rice and corn mills	23.9	32.8	43.3
Warehouses	36.5	33.0	30.4
Agro-supply stores	41.7	30.6	27.7
Farm machine and tool stores	64.5	9.7	25.8
<b>Manufacturing, commercial and service establishments</b>	45.4	29.8	24.8
<b>Health facilities</b>			
Hospitals	51.2	25.5	23.8
Hospital beds	58.9	11.7	29.3

Source: Government of the Philippines, National Census and Statistics Office, unpublished reports, 1970.

access, which was a function of the number of transportation outlets found in the municipality. Quartile rankings were done for selected socio-economic indicators and weighted rank calculations were used to cross-check the results with other analyses in arriving at three development levels of municipalities in the Basin.

**3. Substantive Findings.** The analyses verified that, although the entire Bicol River Basin is predominantly rural, municipalities differ significantly in socio-economic characteristics. The distribution of services, facilities, infrastructure, and productive and social organizations among municipalities is highly skewed (Table 4). If these socio-economic variables are used as indicators of development, municipalities in the Basin can be classified into three major levels.

*a. Developing Municipalities* include the six most urbanized, encompassing the two provincial centres of Naga and

Camaligan, and Legaspi and Daraga, the city of Iriga and the town of Tabaco. Services, facilities, and productive activities are highly concentrated in these six municipalities, especially in Naga and Legaspi cities. The developing municipalities contain about one-quarter of the population (386,000 people or 22 per cent) but account for more than 40 per cent of the "urban" population; raise 45 per cent of the Basin's municipal revenues; and have significantly higher percentages of households served by piped water and electricity. Most of the Basin's educational and vocational training institutions are concentrated within them as are most of the major health care institutions. The developing municipalities contain nearly a third of all high school and 45 per cent of all college graduates in Bicol. They are the financial centres of the Basin, with nearly half of all financial institutions and more than 85 per cent of deposit and loan assets. More than one third of all corn mills, agricultural warehouses, farm supply stores and farm machine and tool establishments, and nearly half of the

cottage industries and commercial, financial, and service establishments are within their boundaries.

b. *Less Developed or Transitional Municipalities* are ten that lie at or near the Manila South Road within the central plain of the river basin. They are closer in socio-economic and physical characteristics to the underdeveloped municipalities than to the developing ones. But they are distinguished from the former primarily by the fact that their access to the Manila South Road or provincial arteries connecting them to the major cities of Naga and Legaspi has generated some diversification of economic and social activities in their *poblaciones*, and that they contain the potentially richest agricultural land in the Basin. This group of municipalities accounts for slightly more than 26 per cent of the population and has concentrations of services, cottage industries, infrastructure, and facilities slightly larger than its share of the population. Rural areas of these municipalities are largely underdeveloped: less than 20 per cent of households are served by piped water, they have few educational or health institutions, and commercial establishments are rare and scattered. Perhaps because of their physical proximity to the major provincial centres, these areas have not become highly specialized and seem to depend on the larger centres for marketing and trade.

c. *Underdeveloped Municipalities* include 38 predominantly rural, subsistence-agriculture areas forming the periphery of the Basin. Slightly more than half of the population of the Bicol River Basin lives in these municipalities, which, by all socio-economic characteristics, are the poorest and least developed. These 38 municipalities have a far smaller proportion of facilities, services, educated manpower, financial resources, and productive economic activities than their share of population. Their residents are scattered in rather small barangays. Only 8 per cent of households receive water and less than 6 per cent have electrical power. Only five of the 38 municipalities have post-secondary educational or vocational training institutions; nearly 40 per cent have no markets of any kind, and eight contain no financial institutions. These municipalities collect less than two-fifths of all municipal revenues and, on the average, depend on the national government for nearly a third of their municipal income. Some of the municipalities obtain more than half of their revenues from the national government and have few sources of internal income. The financial institutions in these underdeveloped municipalities have less than 10 per cent of the deposit and loan assets in the Basin. As a group, these municipalities contain less than one-quarter of the manufacturing, commercial, financial and service establishments, only a little more than a third of agro-processing, storage and commercial establishments, and one-fourth of the health facilities.

Thus, the analyses revealed that a majority of the

population in the Bicol River Basin lives in municipalities with few services or facilities needed to meet basic human needs or to increase agricultural production and expand non-agricultural employment opportunities. Moreover, they are generally isolated from or have extremely poor access to the municipalities in which services, facilities, and markets are most highly concentrated.

### Analysis of Centrality, Functional Complexity, and Hierarchy of Settlements

This aspect of the analysis attempted to describe the existing spatial structure in the Bicol River Basin and to delineate the elements of the settlement system, the functional complexity and centrality of settlements, the hierarchy of central places, and the distribution of, and pattern of association among, functions within the region. As noted earlier, increasing the access of rural people to services and facilities located in towns and cities was considered important for incorporating marginal population groups and rural hinterlands into the regional economy. In many marginal areas resources cannot be mobilized and used for development because a spatial structure that facilitates the procurement, transformation, and delivery of those resources is not well-articulated and integrated. In marginal regions of some countries, central places that can support services and facilities requiring large market areas or higher population thresholds are neither numerous enough nor adequately dispersed to provide easy access for the rural poor. In other countries, as Johnson notes, the problem "is not that underdeveloped regions lack central places, for some have too many! What is amiss is that they rarely constitute a functional hierarchy, and for this reason they fail to provide an intermeshed system of exchange that will provide the requisite incentives for increased application of labor, capital and human skills."<sup>44</sup> In most marginal regions, the population remains scattered in very small hamlets and villages that are incapable of supporting moderate or high threshold functions, of forming regular, institutionalized markets, or of allowing functional specialization and division of labour. Thus, there is little incentive for people in marginal areas to save and invest, seek productive uses for existing resources, or develop new resources. Opportunities for market expansion and non-agricultural employment are usually minimal.<sup>45</sup>

The objectives of this phase of the analysis in the Bicol River Basin closely approximated those of the integrated spatial analysis undertaken in India, which as Shah points out were:

- a. To study . . . focal points of growth with ecological settlements coming within their ambit, and to suggest a scheme for the development of a hierarchy of growth

- centers for an efficient provision of goods and services;
- b. To identify the functional gaps in the physical and institutional infrastructure of these centers and their related settlements and to meet their present and future needs; and,
- c. Recognizing the varying patterns of resource endowments and likely trends and temporal patterns . . . to plan alternative courses of action for the provision and development of various service facilities.<sup>46</sup>

In the Bicol River Basin, the analysis was used to determine the extent and pattern of centrality, and the distribution, concentration, and ubiquity of services, facilities, and other developmental functions among settlements. The methodology included the following types of analytical techniques.

1. *Functional Complexity Analysis of Municipalities Using the Guttman Scalogram.* In regional analysis, the Guttman scalogram can be used to develop a cumulative scale of functions (items)—such as services, facilities, organizations, and establishments—and to rank settlements (cases) on the basis of the total number of functions located within them. In a perfect scale, each settlement would be expected to possess all functions of those places with lower or equal scores and would not be expected to possess those functions of places ranking higher in the scale. Assuming that a settlement's level of development is reflected in the number and diversity of functions located within it, relative levels of development for all settlements within a

region can be determined by the array of scale scores. Combined with other analyses the Guttman scale can be used to group settlements into different levels of a hierarchy or categories of development and to depict relative levels of development within a region by plotting scale scores of each place on a map. Voelkner has used the scale scores, for instance, to classify settlements by degree of "modernization"—ranging from traditional villages with few functions through early transitional, late transitional, early modern, and modern, depending on the diversity and types of functions found within them. Scalogram analysis also indicates the centrality of settlements, assuming that centrality is the ability of a settlement to provide varied goods and services to less-developed areas.<sup>47</sup>

The Bicol project initially attempted to extend the scalogram of municipalities that had been done earlier for Camarines Sur Province to the rest of the Bicol River Basin.<sup>48</sup> The analysis by the Social Science Research Unit at Ateneo de Naga University was a typical application of Guttman scaling in regional analysis and clearly illustrates the procedure. First, a survey identified existing institutions, services, facilities and establishments in town centres (*poblaciones*) of each municipality. The items were coded as being either present or absent and scaled by the Guttman method. A computer programme arranged the towns in a scale, with those having the least number of functions scoring low and those with the most scoring high. The municipalities were then arrayed in a hierarchy of

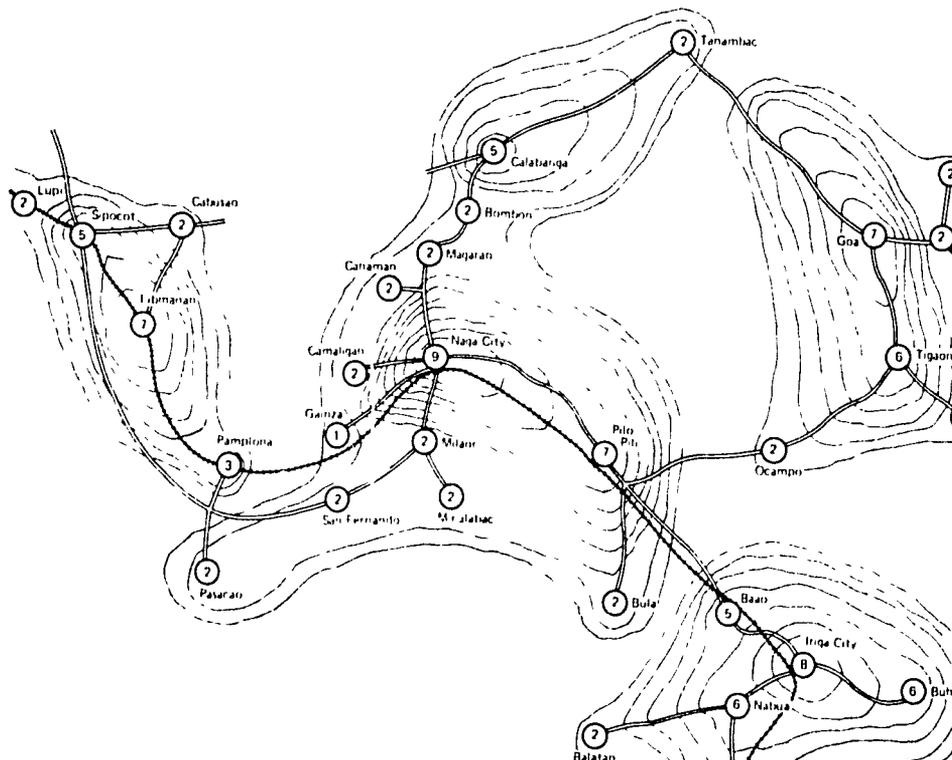


FIG. 4 Isopleth Map of Development Levels of Municipalities in Camarines Sur Province, Bicol River Basin

34

TABLE 5. Guttman Scale of Functional Complexity of Municipalities in Camarines Sur Province, Bicol River Basin, 1975

Rank	Municipality	Scale score		Scale step	
		Number of functions discriminated in scale	Percentage of functions in municipality relative to number of functions in most "developed" municipality	N	Condensed
33	Gainza	29	19	1	1
32	Del Gallego	48	32	2	2
31	Lupi	53	35	3	2
30	Tinambac	55	36	4	2
29	Balatan	55	36	4	2
28	Minalabac	57	38	5	2
27	Pasacao	59	39	6	2
26	Bula	61	40	7	2
25	Bombon	63	41	8	2
24	Camaligan	63	41	8	2
23	Cabusao	65	43	9	2
22	San Fernando	66	43	10	2
21	Milaor	66	43	10	2
20	Ocampo	67	44	11	2
19	Magarao	68	45	12	2
18	Canaman	70	46	13	2
17	Sangay	71	47	14	2
16	San José	73	48	15	2
15	Lagonoy	74	49	16	2
14	Pamplona	81	53	17	3
13	Ragay	88	58	18	4
12	Bato	93	61	19	5
11	Sipocot	96	63	20	5
10	Calabanga	97	64	21	5
9	Baao	99	65	22	5
8	Buhi	104	68	23	6
7	Tigaon	109	72	24	6
6	Nabua	111	73	25	6
5	Libmanan	117	77	26	7
4	Pili	119	78	27	7
3	Goa	122	80	28	7
2	Iriga City	134	88	29	8
1	Naga City	152	100	30	9

Source: S. Roco, Jr., and F. Lynch, "Development Levels in Bicol River Basin," *SSRU Research Report Series, No. 17*, unpublished draft, 1975.

functional complexity and, based on scale scores, were regrouped into scale steps (Table 5). The 30 scale steps were condensed to nine and plotted on a map. Using the condensed steps as indicators of development levels of municipalities, cumulative isopleth lines were drawn around municipalities of equal levels of development (Fig. 4).

The analysis clearly identified Naga City and Iriga as the

most functionally complex centres in the province, delineated their apparent "areas of influence," and pinpointed the satellite or supplementary centres within those influence areas. The analysts found a strong correlation between transport access in settlements and their functional complexity, concluding that "accessibility coupled with complexity is a major factor in the evolution of a center" in the Bicol River Basin.

The Urban Functions in Rural Development project sought to extend the methods used in Camarines Sur to all 54 municipalities in the Bicol River Basin, employing 64 functions in eight categories—economic, social services, physical facilities, communications, recreational facilities, personal services, community organizations, and extension and protective services—identified in the SSRU's municipal inventory. The validity of using these items in Albay province was later verified by a sample survey of municipalities in that province.

Although this exercise provided useful information concerning the functional complexity and concentration of various services and facilities in municipalities—and strongly confirmed the findings of the quartile analyses of regional resource data concerning levels of development among municipalities within the Basin—its most important deficiency was that the municipalities in the Philippines are administrative areas and not necessarily discrete settlements. A second scale, of urbanized or "built-up areas," was done to rank settlements by functional complexity and delineate a hierarchy of central places. The built-up areas consist of (a) *poblaciones* and contiguous barangays with approximately the same land use characteristics as the *población*, and (b) other barangays within the municipality with a population size of at least 50 per cent of the *población*.

Neither the municipal nor built-up area scales, however, distinguished barangays as discrete settlements. Indeed during the surveys it became clear that many barangays, like municipalities, were only administrative areas rather than discrete settlements. And since accurate boundaries for many barangays could not be determined, population density criteria had to be eliminated. It was decided, instead, to test the census definition of settlements: *poblaciones* and other barrios with a population of at least 1,000 in which the occupation of the inhabitants is predominantly non-farming/fishing and which have specified physical characteristics.<sup>49</sup> All barangays not meeting these minimum population-physical facilities criteria were considered to be non-central places and would be treated as a group at the lowest order in a hierarchy of functional complexity. A survey was later done of all barangays, which confirmed the validity of this judgement. To get a better indication of the hierarchy and functional complexity of settlements, the staff turned to other methodologies, including a manual version of the Guttman scale for all barrios in Bicol.

**2. Manual Scalogram Analysis of Settlements.** The manual version of the Guttman scale is primarily a graphic and non-statistical device that arrays functions by ubiquity (frequency of presence) and ranks settlements by functional complexity on a matrix chart. The Guttman scales calculated by a computer programme presented two major problems for analysis in the Bicol River Basin. First, the

functions that seemed to be of most interest for rural development—farm-equipment repair shops, vocational schools, credit unions, rural banks, farm supply stores, etc.—did not scale and were eliminated from the scale scores by the computer. Second, the computer output was difficult to understand and could not be easily presented to show the distribution of functions by place. The computer version required detailed explanation and interpretation, which technically untrained policy-makers—at least those attending the Bicol technical workshops in which the method had been presented—found difficult to understand. Nor did they immediately see its relevance.

A graphic scale used successfully in India and Indonesia was adapted for the Bicol study. All settlements were included—a total of 1,419 built-up areas and barangays. The technique resulted in a graphic presentation illustrated in figure 5.<sup>50</sup> Both data collection and calculation requirements for constructing a scalogram are minimal. They include:

- a. a list of all settlements in the area under study (hamlets, villages, market towns, small cities, larger urban centres);
- b. population size of all settlements in the area or region;
- c. a map pinpointing the location of all settlements in the study area; and
- d. an inventory showing the presence or absence of functions (services, organizations, facilities, establishments, or other activities) in each settlement.

The procedure for manually constructing a scalogram is as follows.

- a. On the left side of a worksheet, list settlements as rows in descending order of their population;
- b. across the top of the worksheet, list the functions found in the region in their descending order of ubiquity (frequency of presence);
- c. draw row and column lines so that the worksheet becomes a matrix in which each cell represents a function that may appear in the settlement;
- d. fill in with a dark colour all cells in which a function is actually found in a settlement, leave cells for which a function does not appear in a settlement blank;
- e. reorder the rows and columns so as to visually minimize the blank cells appearing in the dark pattern found in the upper left section of the matrix;
- f. the scalogram is complete when no shifting of a settlement row or function column can reduce the number of blank cells in this pattern;
- g. the final order of settlement rows identifies a ranking of settlements which can be interpreted as an ordinal centrality score.

As Fisher notes, "the scalogram provides a visual description of the . . . settlement and institutional hierarchy that is easy to read and useful as a reference in analyzing numerous issues for planning."<sup>51</sup> This observation was

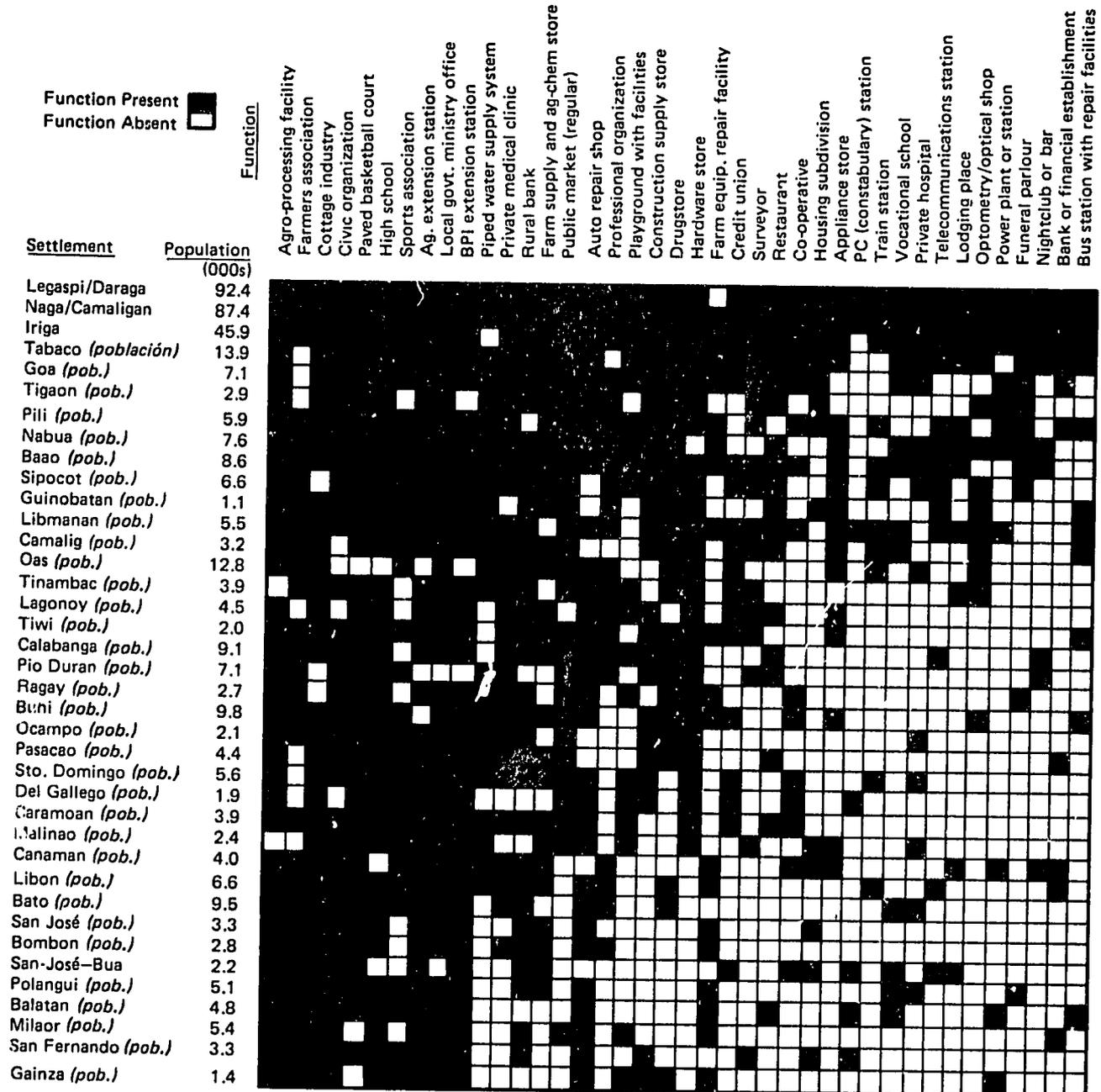


FIG. 5 Section of a Scalogram for "Built-Up Area" Settlements, Bicol River Basin

confirmed in the presentations at technical workshops, where both technically-trained personnel and local political leaders examined an initial version of the scalogram prepared for the 120 settlements at the "top" of the hierarchy. Moreover, as Voelkner observes of the application of scalogram analysis in Thailand, the Philippines, and Sri Lanka, it can "systematically process and measure qualitative data which previously permitted only intuitive analysis."<sup>52</sup> It can also process quantitative data that are error-prone or not statistically reliable by using only their qualitative content, for which the error margin is low, and can serve as a substitute for quantitative analysis when

reliable statistical data cannot be collected quickly or economically.

Among the potential uses of the scalogram in regional planning are the following.

- It can be used to categorize settlements into levels of functional complexity and determine the types and diversity of services and facilities located in central places at various levels of a hierarchy.
- The scalogram shows rough associations among services and facilities in specific locations and potential linkages among them.

- c. The scalogram indicates the sequence in which settlements accumulate functions and the implications for sequencing complementary or catalytical investments.
- d. By reading any column the ubiquity of a service or facility, and its distribution among settlements, can be easily seen.
- e. The array of items in the scalogram, analysed in conjunction with a map showing locations of functions and their distribution and with population-service criteria, can be used to make determinations about the adequacy of services and facilities in the region.
- f. "Missing" or unexpectedly absent functions are clearly identified and investigations can be made into the reason that settlements at that scale level do not have the services or facilities, and decisions can be taken about the appropriateness of investing in those functions.
- g. Unexpectedly present functions are also identified, and the reason for the appearance of services and facilities in those settlements can be determined.
- h. Rough indicators of population threshold size needed to support various services and facilities can be determined from scalograms that show the population sizes of settlements in which functions currently appear.
- i. The scalogram can be used to make decisions about appropriate "packages" of investments for settlements at different levels in the spatial hierarchy.

Thus, a manual scalogram has definite advantages over the computerized Guttman scale for application by rural planners, since it is easy to construct and interpret, requires no sophisticated training or equipment, and can be easily updated and revised using either "windshield surveys" or good aerial photography. More systematic reporting schemes can be designed to obtain information about changes in services and facilities in settlements of a region, as has been done in the village headman surveys in Thailand.<sup>53</sup>

**3. Threshold Analysis.** In order to obtain better approximations of the population sizes required to support existing services and facilities in the Bicol, the staff adapted Marshall's approach to threshold analysis.<sup>54</sup> Marshall argues that "the threshold is that size of center which divides the ranked list of centers in such a way that the number of centers lacking the function above the division is equal to the number of centers possessing the function below the division." The method is especially appropriate to analysis of rural regions and to the type of data already collected for scalogram analysis, in that it requires only a ranked listing of settlements and the presence or absence of functions. Marshall suggests a modification on the general rule: "Once a threshold has been determined, this threshold (and the function to which it applies), will subsequently be disregarded unless at least half of all the centers above the threshold size possess the function in question."

TABLE 6. Calculation of Threshold Levels for Central Place Functions

Central places in descending order of rank	Population Size	Function		
		1	2	3
A	10,000	1	1	1
B	8,000	0	1	1
C	6,000	0	1	1
D	5,500	0	0	1
E	3,000	0	0	1
F	2,700	1	1	0
G	1,900	0	1	1
H	1,700	0	0	0

The staff adopted the procedure which is illustrated in table 6.

- a. Construct a table with a rank listing of centres according to population, a corresponding list of population data and the presence (1) or absence (0) of every function in each of the centres listed;
- b. apply Marshall's rule and identify each function's population threshold; and
- c. apply Marshall's supplementary rule and disregard functions eliminated by this process.<sup>55</sup>

There were, however, definite limitations on the use of this technique. Current threshold levels may not realistically represent the potential for settlements of various sizes to support services and facilities, and may reflect locational decisions not based on market considerations. They also fail to reflect development obstacles that may have prevented services and facilities from being efficiently located in settlements that do have the required population sizes to support them. The technique does offer a "quick and dirty" means of calculating the thresholds for currently available services and facilities, however, and was used in conjunction with other methods of estimation.

#### 4. Weighted Centrality Indexing for all Settlements.

Another complementary exercise to obtain an indication of centrality was the calculation of weighted centrality indices for all settlements. The staff devised a method of adapting Marshall's centrality index, assigning weights on the basis of ubiquity of functions. The procedure is as follows.

- a. Reproduce the largest Guttman scale in an inverted form with cases arranged vertically and items horizontally;
- b. total each row and column.
- c. using the assumption that the total number of functional attributes in the entire system has a combined centrality value of 100, determine the weight or "location

coefficient" of the functional attribute by applying the formula:

$$C = t/T$$

where C = the weight of functional attribute t  
 t = combined centrality value of 100  
 T = total number of attributes in the system;

- d. add one block to the table and enter the weights computed;
- e. reproduce another table similar to that in step 1

displaying the weights calculated in step 3 and the total centrality values; then

- f. sum the weights of each row to produce the indices of centrality.<sup>56</sup>

Tables 7 and 8 illustrate the calculation of the centrality index. The centrality index allowed use of attributes or functions that appear as "errors" in the Guttman scale, based on the assumption that the presence of "rare" functions in an otherwise lower scale centre does contribute to its centrality.

TABLE 7. Calculating Weights of Functions

Places	Functions										Total	
	1	2	3	4	5	6	7	8	9	10		
A	1	1	1	1	1	1	1	1	1	1	1	10
B	1	1	1	1	1	1	1	0	1	0	0	8
C	1	1	1	1	1	1	0	0	0	0	0	6
D	1	1	1	1	1	1	0	1	0	0	0	7
E	1	1	1	1	1	0	0	0	0	0	0	5
F	1	1	1	1	0	0	0	0	0	0	0	4
G	1	1	1	0	0	0	0	0	0	0	0	3
H	1	1	1	0	0	0	0	0	0	0	0	3
Total functions	8	8	8	6	5	4	2	2	2	1		46
Total centrality	100	100	100	100	100	100	100	100	100	100		
Weights	12.5	12.5	12.5	16.6	20.0	25.0	50.0	50.0	50.0	100.0		

TABLE 8. Calculating Centrality Indices

Places	Functions										Total	
	1	2	3	4	5	6	7	8	9	10		
A	12.5	12.5	12.5	16.6	20.0	25.0	50.0	50.0	50.0	100.0		349.1
B	12.5	12.5	12.5	16.6	20.0	25.0	50.0		50.0			199.1
C	12.5	12.5	12.5	16.6	20.0	25.0						99.1
D	12.5	12.5	12.5	16.6	20.0	25.0		50.0				149.1
E	12.5	12.5	12.5	16.6	20.0							74.1
F	12.5	12.5	12.5	16.6								54.1
G	12.5	12.5	12.5									37.5
H	12.5	12.5	12.5									37.5
Total centrality	100	100	100	100	100	100	100	100	100	100		1,000.0*

\* Total does not add due to rounding.

39

TABLE 9. Distribution of Functions Among Settlements in Bicol River Basin, 1977

Range of settlements with functions	Number of functions	Type of functions (per cent of settlements with function)	
80 – 100%	0	—	
60 – 79%	0	—	
40 – 59%	1	Agro-processing facility (41.1)	
20 – 39%	3	Farmers' association (38.9)	
		Cottage industry (26.7)	
		Civic organization (26.7)	
10 – 19%	3	Sports association (13.6)	
		Paved basketball court (13.5)	
		Piped water supply (12.5)	
5 – 9.9%	2	High school (7.8)	
		Agricultural extension station (6.1)	
2 – 4.9%	18	Photo studio (4.8)	Ministry of Local Government Office (4.1)
		Professional organization (4.1)	Animal industries extension office (3.9)
		Plant industries extension office (4.3)	Auto-repair shop (4.1)
		Private medical clinic (3.8)	Cockfighting pit (3.6)
		Farm supply/agro-chemical store (3.4)	Construction supply store (3.4)
		Regular public market (3.2)	Hardware supply store (3.1)
		Farm equipment repair shop (2.9)	Playground with facilities (2.9)
		Rural bank (2.8)	Housing subdivision (2.8)
		Labour union (2.3)	Co-operative organization (2.2)
1 – 1.9%	19	Drugstore (1.8)	Police constabulary station (1.8)
		Restaurant (1.8)	Nightclub or bar (1.7)
		Credit union (1.8)	Surveyor (1.7)
		Train station (1.7)	Gymnasium/auditorium (1.6)
		Appliance store (1.6)	Private hospital (1.5)
		Bus station with repair facilities (1.5)	Vocational school (1.3)
		Lodging place (1.3)	Power plant or station (1.2)
		Telecommunications station (1.1)	Bank or financial establishment (1.1)
		College (1.1)	Optometry/optical shop (1.1)
		Funeral parlour (1.0)	
Less than 1.0%	18	Telephone exchange (0.9)	Photocopy service (0.9)
		Cinema with daily run (0.8)	Paluwagen (welfare society) (0.7)
		Operational government hospital (0.7)	Fire station with trucks (0.7)
		Shopping centre (0.6)	Cinema with less than daily run (0.7)
		Cemetery (0.6)	Port or pier (0.5)
		Radio station (0.4)	Nursing school (0.4)
		Newspaper publisher (0.3)	Security agency (0.3)
		Red Cross office (0.2)	Hotel (0.3)
		Airport (0.1)	Bowling alley (0.2)

TABLE 10. Functional Complexity of Levels of Settlements in Bicol River Basin, 1977

Level of hierarchy	Functional characteristics	Number of settlements	Settlements	Range of functions	Per cent of all settlements	Per cent of basin population	Average population size
I	Provincial service centres	2	Naga-Camaligan Lagaspi-Daraga	60 – 61	0.14	10.6	89,892
II	Local service centres	11	Iriga, Tabaco, Goa, Tigaon, Pili, Nabua, Baa, Guinobatan, Libmanan, Ligao	31 – 54	0.77	7.3	11,107
III	Rural service centres	43	37 <i>poblaciones</i> 6 barangays	10 – 28	3.03	10.5	4,196
IV	Non-central places	1,363	2 <i>poblaciones</i> 1,361 barangays	0 – 9	96.06	71.6	922

### 5. Substantive Results of Functional Complexity Analyses.

The functional complexity and scale analyses showed quite clearly that the Bicol River Basin is a sub-region in which services and facilities necessary for fulfilling basic human needs and generating economic development for the rural poor are not only inadequate but also highly concentrated in a few small central places, which are not easily accessible to people living outside of their immediate boundaries. The hierarchical distribution of settlements is strongly skewed and the spatial system is neither well articulated nor tightly integrated. Of the 1,419 discrete settlements located in the basin—120 built-up areas and more than 1,200 barangays—little more than *half* contained any of the 64 functions. Nearly 90 per cent of all functions appeared in less than 20 per cent of the settlements. Most of the other functions that appear in more than 20 per cent of the settlements are either highly localized services or social organizations with little or no productive capacity. And even among the built-up areas functions are unevenly distributed. Nearly 60 per cent of all central functions appear in less than 20 per cent of the built-up areas, with one-fifth of these places containing no functions at all (Table 9).

Only two central places—the Naga-Camaligan and Legaspi-Daraga urban areas—contained most of the functions found in the Basin's settlements. These two places represent less than one per cent of all communities and contain about 10 per cent of the Bicol's population (Table 10). At a second level are 11 settlements which as a group seem to function as local service centres with from 31 to 54 functions. These centres perform a few area-wide and a larger number of local, commercial and administrative functions. Most are clustered along the national highway or at a junction of provincial roads. A third level of about 43 settlements, representing 3 per cent of all communities and about 10 per cent of the Basin's population, act as small rural service centres, in which from 10 to 28 functions appear. But most

of these are highly localized activities accessible only to people living in the immediate vicinity of the barrio. The overwhelming majority of settlements—over 1,300 or about 96 per cent of the total—are residential non-central places. They are villages of a few hundred families engaged in subsistence or near-subsistence agriculture or working as tenants or on small family-owned plots. All communities in this category have fewer than nine functions; most contain only a few or none at all. The only activities consistently found in these barrios are ubiquitous local functions serving a neighbourhood or cluster of houses. Most of the settlements have populations smaller than is necessary to support most functions found in the Basin.

### Analysis of Linkages Among Settlements in the Region

The conceptual study on which the Bicol River Basin Urban Functions in Rural Development project was based contended that neither the goals of increased productivity and income expansion in rural areas nor those of achieving greater equity in income distribution can be attained in developing nations without increasing the interaction among components of the spatial system. The integration of villages, market towns, intermediate cities, and metropolitan areas, and the incorporation of rural areas into the national spatial system, can transform rural regions and accelerate national development.<sup>57</sup>

Two basic observations were made of developing countries where spatial articulation had occurred. First, an increase in the number and diversity of linkages among central places and the growth or transformation of those places were inextricably related. In some cases new linkages, such as the extension of roads, river transport, or rail connections, promoted growth and diversification of existing centres or generated new towns and cities. In others

the appearance of new productive activities promoted new or strengthened linkages between the places in which those activities appeared and other points in the spatial system. That is, some linkages promoted accelerated growth of villages, market towns, and intermediate size cities, and others were the result of nodal growth. To distinguish cause-and-effect relationships, however, was often extremely difficult because nodal and linkage growth may take place simultaneously or in rapid succession. Second, the variety of linkages that integrate urban and rural areas into an articulated spatial system are themselves inextricably linked. Creation of one new linkage may produce a "cascade effect," making other activities and forms of interaction possible, and promoting the growth of existing or new central places. Once a new set of linkages is introduced into a rural market system, for instance, it can trigger a set of "circular and cumulative changes" toward further growth and change. Simply improving transportation linkages among villages leads to reorganization and expansion of existing periodic markets. Displacement of weak or unsuccessful markets and redistribution of trade can create entirely new markets and increase the demands on the transport system.<sup>58</sup> New urban-rural physical linkages can change the flow of economic resources, the spatial pattern of social and economic interaction, and the movement of people. Closer interaction among villages, market towns, intermediate cities, and major metropolitan centres can make it less expensive and more convenient to integrate technology among levels of the spatial hierarchy and to distribute more widely the services that fundamentally transform economic structure and increase standards of living within rural areas. Among the types of linkages that should be examined in developing regions are the following.

- a. Physical linkages such as road networks, river and water transportation channels, rail networks, and systems of ecological interdependency.
- b. Economic linkages reflected in market patterns, raw material and intermediate goods flows, and capital or trade flows; production linkages among industries located within the region, and consumption and shopping patterns; income flows and sectoral and inter-regional commodity flows.
- c. Population movement linkages, including permanent and temporary migration patterns and journey-to-work patterns, traffic flows and other forms of temporary population flow.
- d. Technological linkages as reflected in telecommunications, energy, or irrigation networks.
- e. Social interaction linkages reflected in visiting patterns, kinship patterns, tribal or social group interaction, marriage areas, and others.
- f. Service delivery linkages for credit and financial institutions, educational, training, or institutional services, health service delivery, and transport service systems.

- g. Political, administrative, and organizational linkages as represented in governmental structural relations among different levels, governmental budgetary flows, formal and informal decision-making procedures, and inter-jurisdictional transaction patterns.

The analysis of linkages in Bicol remained partial and descriptive because of the large amount of original data that would have had to be collected in order to do a complete mapping of physical, social, and economic linkages in the Basin. Yet, through sample surveys and synthesis of socio-economic studies already done in the Basin, the staff made substantial progress in obtaining information that provided useful insights into how activities located in various settlements are related to each other, and into the interaction patterns among settlements within the Basin.

The studies showed that the adverse effects on the rural poor of Bicol's highly skewed distribution of services and facilities are exacerbated by extremely weak economic, physical, service, and social linkages among settlements. Although some of the functions included in the scale could not be expected to be widely distributed—they are central functions requiring high population thresholds—most were basic commercial, administrative, or service functions essential to meeting human needs and accelerating rural development. If they are not widely distributed in settlements throughout the Basin, then equity criteria would suggest that those living in rural areas should at least have physical access to places where they are located. But central places within Bicol are not easily accessible to most rural areas, and the urban and rural settlements are not strongly linked.

1. *Transportation and Physical Linkages.* The staff compiled information on transportation linkages among sub-areas of the Basin by mode, on road networks by conditions of road, and interpoint distances among barangays and between barangays and *poblaciones*. In addition, information on traffic volumes, means of transportation, and selected commodity flows was made available through various transportation studies conducted by BRBDP. The staff contracted for a survey of "informal" transport of goods and passengers by railroad "skates." Many of the data were mapped and provided a detailed profile of physical linkages among sub-areas within the Basin.

Transport studies showed that more than 70 per cent of all roads in the Basin are of poor quality and need upgrading. Only the national highway cutting through the centre of the Basin, and a few provincial roads, are of all-weather construction and passable during the rainy season. Farm-to-market roads are few and of poor construction. Many rural barrios can only be reached by small boat or

on foot. The inadequacy of regular transport linkages is reflected in part by the use of non-motorized vehicles, animal-drawn wagons, use of illegal "skates" along the railroad tracks, and small boats and barges, and in part by the fact that the majority of trips taken within the Bicol River Basin are on foot. The railroad provides limited service to points outside the Basin and the major centres are linked to Manila only by infrequent bus and air service.

Roads are used by 95 per cent of the passengers taking trips within the Bicol River Basin and to transport over 80 per cent of agricultural commodities. But as physical linkages among communities, the roads provide rather poor service. Most of the rural population lives in settlements not easily accessible by road, and transport is difficult and expensive in most of the Basin. The cost of transporting commodities in interior rural areas is up to six times more than in areas connected by roads passable by motorized vehicles. Farmers from rural areas must often walk for hours to the nearest road and carry their produce on their backs or on slow-moving *carabao* or horses. Even after they reach a provincial road, the waiting times for a jeepney or bus are long and the costs so high that marginal profits are sometimes completely wiped out. Rural farmers must wait an average of 30 times longer for transportation at secondary roads than at places adjacent to the Manila South Road and in some more remote sections of the Basin they may wait as long as three or four hours. Because of the cost of transportation and difficulty of travelling, 85 per cent of all trips taken within the Basin are among places within the same municipality and 99 per cent are within the same province. Relatively little travel—for shopping, work, trade, social interaction, or any other purpose—takes place among municipalities and there is little interaction on a regular basis between the Basin's two provinces.

**2. Economic and Market Linkages.** The staff completed surveys of six regular and six periodic markets to determine the origin and destination of selected commodities through major markets, to estimate the physical "reach" of marketing centres for those commodities, and to identify spatial and functional linkages among producers, middlemen, and buyers. Although the sample surveys were not an adequate substitute for a complete market study they did provide indications of linkage and raised important questions for further marketing research. In each of the six major markets 100 middlemen and 50 producers were interviewed with prepared questionnaires. Information was obtained on source and destination of commodities, type of seller, place of sale, and volume of trading. Similar information was garnered from periodic market middlemen. The survey was limited to public markets and did not include private stalls located adjacent to public markets.

Information on each commodity's source, destination,

and mode of transport was mapped, showing linkages among places within the Basin and between market centres within Bicol and those outside. The studies clearly demonstrated that market linkages, which should form a major network of commercial interaction within and among rural areas, are extremely weak in Bicol. The greatest amount of market interaction occurs through central markets in Naga and Legaspi cities. But a significant portion of the Basin's population lives in settlements too small to support even a periodic market, which adversely affects their ability to sell agricultural surpluses, raise their income levels, obtain household goods, or buy inputs needed to increase agricultural output.

Analysis of the commodity flows indicates that markets within the Bicol River Basin are primarily local exchange centres serving residents of the places in which they are located; that they have limited "reach" or service areas and are not well integrated into a network of area-wide exchange and trade. The survey indicated that a "nested" hierarchy or articulated network of markets, characteristic of more economically developed regions, does not exist in Bicol. Markets within the Basin are primarily undifferentiated agricultural exchange points trading almost exclusively in six commodities (rice and palay, coconut, copra, fresh and dried fish, poultry, and livestock) with some larger regular markets also providing limited amounts of household goods. Bicol River Basin markets, even in larger towns, have insignificant external trade linkages and the periodic markets are generally isolated, highly localized, and virtually unintegrated collection and exchange points, most of which are barely accessible to rural people beyond 10 or 15 kilometres from the village in which the market is located.

**3. Social Linkages.** To the extent that the integration of settlements within a region occurs through social interaction among residents—through kinship ties, visiting among kin and friends, inter-village marriages, and for recreation and ritual—social linkages reflect the degree to which people perceive of a region as a coherent and unified unit of society. Surveys of selected social interactions show relatively little linkage among settlements within sub-areas of the Bicol River Basin. A sample survey of marriage records revealed that an average of less than 19 per cent of all spouses were chosen from outside the same municipality during a three-year period in the mid-1970s. Over 80 per cent of all men and women in Bicol, during that period, tended to choose spouses from within their own municipality, and in most cases from within the same or a neighbouring barangay. Since social interaction patterns in the Philippines are shaped strongly by family visiting, marriages among people from different towns and municipalities would be expected to increase social interaction among those places. But the inter-modal transport studies confirm the indications of marriage-

pattern studies, that relatively few inter-municipal trips are for social purposes.

**4. Administrative, Political, and Service Linkages.** The nature of relationships among levels of government within the Bicol, including formal and informal political and administrative decision-making, the linkages among and between government units in the provision of services and facilities, and the characteristics of the network of planning organizations affecting development policy within the Basin were some aspects of administrative, political, and governmental linkages explored in a study subcontracted to the College of Public Administration at the University of the Philippines.

It was found that formal government linkages among levels are dominated by national ministries operating within the Basin, and that formal structure is highly centralized. Most local officials are appointed by and responsible to national ministries. Municipal officials generally are not under the authority of the mayors, themselves hold-over appointees under martial law, who have few resources to solve local problems. Most municipalities in the Basin are dependent on the national government for part of their revenues and most of their authority. Decisions are often made through highly personalized relationships.

Studies of government structure and services in Bicol indicated that services provided by all levels are highly localized. Health, education, and other public institutions generally extend services only to populations living in the immediate vicinity of their sites or to the few who can afford to travel from rural barangays to obtain them in the larger cities. Even the post-secondary schools in the larger centres primarily serve only the local area. Health, education, and agricultural extension services are far below standards set by national ministries.

### Analytical Mapping of Functional Complexity and Linkage Data

Information about levels of development and accessibility of centres is mapped in conjunction with analyses of the functional complexity and linkages of settlements in order to determine the "areas of influence" for each type of settlement, determine where linkages are weak, and locate peripheral areas that are not served by central places or in which rural populations have poor access to urban functions.

The Bicol River Basin project produced a number of analytical maps that showed the distribution and concentration of essential functions, the centres linked by various forms of interaction, and rural hinterlands that remained marginal and unintegrated. Transport and

physical accessibility maps showed areas of the Basin that can be reached by roads, water transport, and railway. The volumes of goods flowing through major markets were mapped to show the "reach" of each market centre and the sources and destination of commodities traded. The maps delineated the secondary and periodic markets in rural areas that participated in trade relationships with larger markets. Travel volume and origin and destination data were derived from the modal transport study and were mapped along with the service areas of selected institutions and public facilities. The project staff made a number of transparent overlays that could be used with a base map of the settlement system to show the distribution of services and facilities and that could be employed in baseline comparison and evaluation after development plans were implemented. They also produced the first comprehensive map of barangay settlements in the Bicol River Basin, itself a tool that would be important in future development planning.

### Delineation of Unserved and Marginal Areas

Judgements about marginal or unserved areas can be made on the basis of scalogram, linkage, and baseline studies in conjunction with the isopleth and functional distribution maps, as was done in the Bicol River Basin. This requires intimate knowledge of the region under study and depends on the staff's ability to draw conclusions from a variety of different analyses, none of which alone will identify marginal areas or population groups with poor access to town-based functions.

More complex statistical techniques have been used in regional planning to identify the "optimal" locations of growth centres or service centres aimed at overcoming rural marginality. Babačovic used a variation of the population-potential model in Brazil to measure the potential accessibility of different urban centres within the national urban system to the incorporable rural population.<sup>59</sup> The optimum locations of new growth poles or secondary growth centres would be those urban places that have the highest potential for incorporating rural population. The analysis assumed that at any given urban centre  $j$ , the rural population "accessible" to the impact of a new growth pole would be limited to some extent by: "a) the intensity of the impact exercised by the existing urban system on point  $j$ ; and b) the permeability of the rural population surrounding point  $j$  to the urban impact (attraction/diffusion)."<sup>60</sup>

Attempts were made to calculate the urban potential of urban centre  $j$  in relation to the total population of the urban system by using a variation of the potential model with per capita income of each urban centre as the weighting coefficient:

$$V_j = \sum_{i=1}^n \frac{r_i \cdot U_i}{(d_{ij})^\alpha}$$

- where:  $r_i$  = income coefficient of urban centre  $i$
- $U_i$  = urban population of urban centre  $i$
- $r_i \cdot U_i$  = weighted population of centre  $i$
- $d_{ij}$  = distance between urban centre  $j$  and other urban centres  $i$
- $\alpha$  = empirically derived exponent indicating the degree to which distance adversely affects the potential.

It would thus be expected that  $V_j$  would be high for large urbanized centres and low for peripheral towns and small cities.

Babarovic calculated  $V_j$  for 112 urban centres in Brazil and standardized the values on a scale of 0 to 100, assigning an index of urban exposure,  $E_i$ , to each centre to show its relative degree of "exposure" to the urban system. He then calculated a "coefficient of rural incorporation," a measure of the rural population that can be expected to be influenced by exposure to the urban system. The "coefficient of rural incorporation" is calculated by combining the items  $E_i$  and a coefficient of "rural permeability"  $m_i$ , the values of which must be established from knowledge of the susceptibility of rural population to the influence of urban centres. The coefficient  $m_i$  ranges from 0 to 1, where 0 represents total impermeability based on long distance and lack of linkages, and 1 is total permeability for populations living close to the centre and having strong linkages to it. The coefficient of rural accessibility is expressed as:

$$a_i = \frac{m_i \cdot E_i}{100}$$

After the values for  $m_i$ ,  $E_i$ , and  $a_i$  are calculated, they can be used to determine, statistically, that part of regional rural population,  $R_i$ , that can be expected to be incorporated or influenced by exposure to an urban centre  $i$ , through the expression:

$$R'_i = a_i \cdot R_i = m_i \frac{E_i}{100} \cdot R_i$$

The part of the rural population that will be influenced by the centre will either migrate to it or be incorporated locally by participating in productive activities for which the urban centre will create demand. This latter part of the rural population will not be affected by the creation of a growth centre and is excluded from the calculation of the potential incorporable rural mass index.

Babarovic suggested designating those urban places as

growth centres where there is maximum "accessibility to the total incorporable rural mass," measured by the potential incorporable rural mass index,  $W_k$ , for urban centre  $k$ :

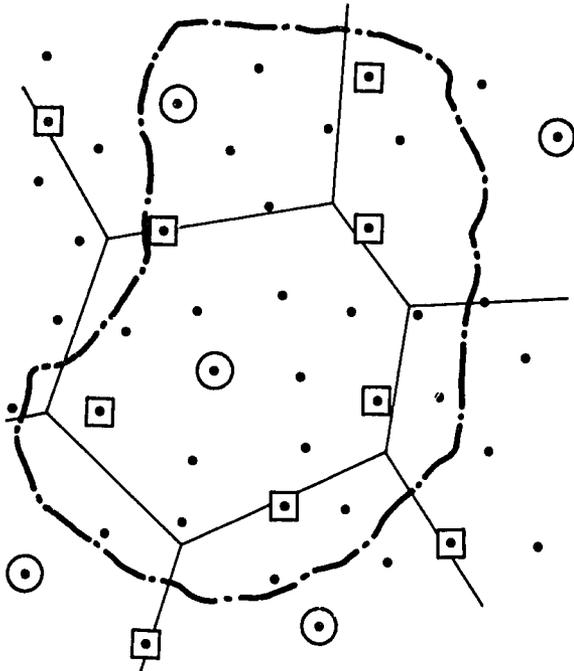
$$W_k = \sum_{i=1}^n \frac{b_i \cdot R_i}{(d_{ik})^\alpha} = \sum_{i=1}^n \frac{m_i (1 - \frac{E_i}{100}) R_i}{(d_{ik})^\alpha}$$

The expression  $b_i = m_i (1 - \frac{E_i}{100})$  is a "coefficient of incorporability" of the rural population remaining marginal in the vicinity of an urban centre  $i$ , given an existing value for an index of urban exposure ( $E_i$ ).

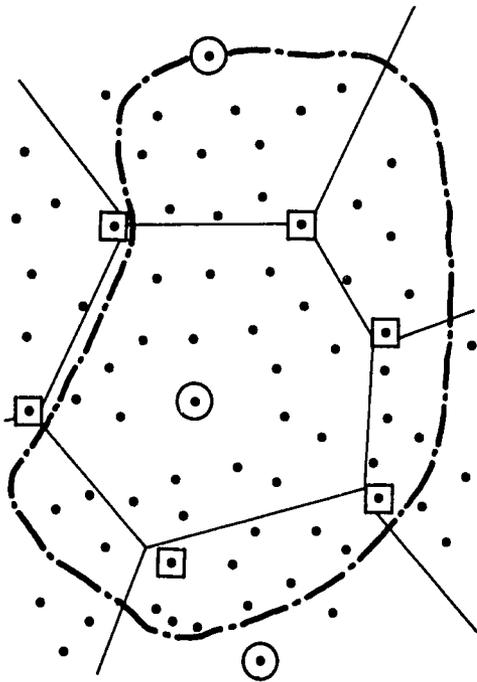
The population potential model has a number of limitations as an analytical tool in developing regions, and Babarovic notes some of them in his report. Among the most important limitations, however, is that the methodology only provides indications of the growth-centre potential for existing urban places in relationship to the national urban system, and does not suggest guidelines for locating services and facilities to stimulate the growth of new urban places.

Other, less complex methods were used in India to identify efficient locations for growth centres at each level of the spatial hierarchy. Manual methods of absolute or relative partitioning, using maximum travel distances as standards, assist in determining which settlements should be identified as potential service centres to supplement existing centres in areas poorly served by town-based functions. The technique applied in various districts of India for relative partitioning used the following procedure.<sup>61</sup>

- a. Identify the largest and most functionally complex settlement in the region;
- b. search in all directions for other settlements inside or outside of the region (but not farther outside than the approximate diameter of the region);
- c. draw lines from the most important place to settlements of approximately equal importance identified in step b, using transport routes if places are connected by reasonably direct links or, otherwise, straight lines;
- d. bisect each of these lines and construct perpendicular lines at these points of bisection;
- e. the innermost area formed by the intersection of these perpendicular bisectors delineates the sub-region that will be served from the most important centres with functions not offered by subsidiary centres, and other areas will be served from other central places;
- f. identify settlements of local importance performing some functions found in higher level centres within the area of this boundary; and
- g. select subsidiary centres to become lower order service centres from among these places, so that they are distributed approximately uniformly over the boundary area.



**Planning Model A:** In this model the subsidiary centres are located along the edges of the boundaries between the major centres



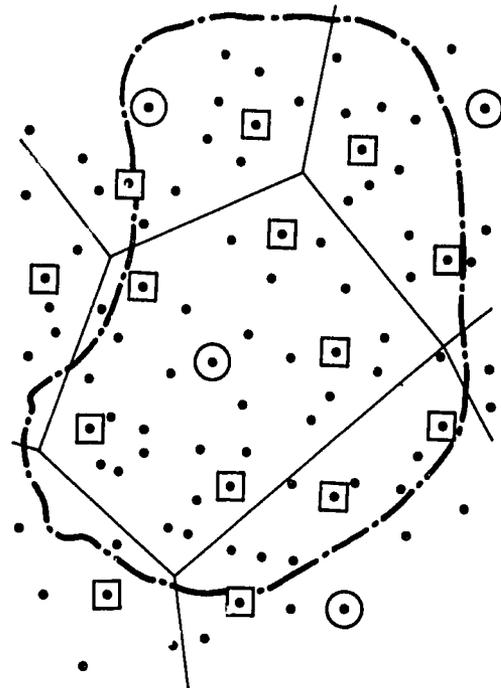
**Planning Model B:**  
In this model the subsidiary centres are located at the corners of the boundaries around the major centres.

The selection of subsidiary centres could follow one of three models: settlements at the edges of the boundaries between major centres, at the corners of the boundaries around major centres, or on either side of the boundaries between major centres (Fig. 6). Local variations in topography, settlement pattern, transportation, and social interaction should be taken into consideration in applying the criteria for selection.

**Determination of Regional Development Needs and Adequacy of the Spatial Structure**

Examining the plans of the Bicol River Basin Development Program, the project staff concluded from the spatial analysis that adjustments would be needed in investment strategy over the next few years.

First, it suggested that BRBDP plans, based on the assumption that the Basin is now a cohesive economy, be re-examined and fundamental changes be made in planning strategy to integrate the Basin economically and spatially. At least five sub-area economies operate almost



**Planning Model C:**  
In this model the subsidiary centres are located on either side of the boundaries between the major centres.

Source: C. Andrade, S. Banerji, H.B. Fisher, G. Rushton, N.S. Saini, A. Sharma. *A Graphical Approach to Settlement Planning for Integrated Area Development* (New Delhi: Ford Foundation, n.d.), pp. 45-47.

Legend:   
 - - - - - Block boundary   
 ○ Major centres   
 □ Subsidiary centres

**FIG. 6 Selection of Subsidiary Service Centres Using Relative Partitioning Technique**

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independently of each other. Naga and Legaspi cities and their immediate rural hinterlands form two largely autonomous economic areas and a cluster of villages surrounding the smaller city of Iriga form another. Smaller, primarily subsistence, agricultural trade areas are scattered in rural municipalities of the Basin operating at relatively low levels, in virtual isolation. They are centred on small regular or periodic markets. Finally, relatively isolated rural areas with subsistence agricultural and fishing economies and with access only to small periodic markets, or none at all, are found in coastal and peripheral areas of the Basin.

Second, the BRBDP's IAD boundaries, which were drawn on the basis of water resource and physical criteria, will be less useful for later economic development planning since they take virtually no cognizance of economic and spatial sub-systems in the Basin, and in fact divide what seem to be economically related clusters of communities. The staff suggested that more attention be given to how IAD development will integrate rural production areas with urban-centred marketing towns, and promote market-centre growth, spatial specialization, and division of labour and exchange among settlements. The settlement-system analysis, analytical maps, and linkage studies done in the Urban Functions in Rural Development project provide the basis for evaluating and redrawing IAD or other planning unit boundaries.

Third, it was suggested that the BRBDP and other national ministries operating in the Basin give immediate attention to providing increased transportation access to a large number of rural areas. The staff noted the improbability of BRBDP attaining its goals of increased agricultural production, economic diversification, and more equitable distribution of services and facilities without first extending transportation access. A network of all-weather and farm-to-market roads is an essential precondition to extending services to rural people, locating agro-processing facilities in rural areas, and providing access to the services, facilities, and productive activities now located in the larger towns, or for decentralizing those functions to smaller communities.

Fourth, they noted that the paucity of markets and market towns within the Basin requires the immediate attention of BRBDP planners. Future investments in services, facilities, and infrastructure must be located strategically in existing or incipient rural service centres to stimulate the growth of markets. Without a well-dispersed, integrated, and easily accessible network of market centres in rural areas it is unlikely that farmers will increase production to the levels projected by the BRBDP. The BRBDP has, to this point, concentrated on planning for the provision of agricultural inputs to stimulate production, but has given little attention to marketing and distribution of outputs. Experience in the Philippines and other developing nations clearly

shows that both must be done simultaneously. The UFRD study pinpointed the location of existing or incipient market centres and the analysis, supplemented by more intensive marketing studies, can be used to plan the location of investments that will stimulate rural market-centre growth.

Finally, the UFRD study provided a descriptive profile of all settlements and of the distribution of services and facilities in the Basin that could be used in developing more detailed locational criteria for investments in public services and facilities, infrastructure, and private productive activities. Plans must be made for increasing the access of the rural poor to town-based services and facilities, building and integrating settlements of sufficient size to support a diversity of productive and social functions, and co-ordinating agricultural with industrial development projects. The study recommended that BRBDP create "minimum packages" of investments for three major types of settlements: rural service centres, market towns and small cities, and regional trade centres.

### **Translation of Spatial Analysis and Development Plans into an Investment Programme**

This aspect of the project involved two planning activities. First, the planning analysis is translated into an investment programme that identifies the types and locations of projects needed in the region, suggests appropriate projects for overcoming "gaps" or bottlenecks to development of sub-areas within the region, and recommends investments that will build the locational advantages of strategically important settlements in the regional spatial system. Second, the projects should be combined into "investment packages" for various locations in the region, and the investment packages should be combined into an operating plan for development of the region over the next planning period. The investments are ranked by priority and sequenced for funding and implementation. Supplementary investments and support services are identified and included in the annual operating or short-term investment plan.

From the various functional and spatial analyses, the staff of the Bicol project was able to identify a set of appropriate services, facilities, and institutions needed at each of three levels of settlement—rural service centres, market towns, and regional urban centres—to meet basic human needs, articulate the settlement system, and stimulate resource development (Table 11).

1. *Rural Service Centres* would contain services and facilities to assemble agricultural commodities for marketing, provide local periodic marketing functions, extend transport access to market towns and larger urbanized centres, accommodate small-scale agro-processing and

TABLE 11. Services, Facilities, and Infrastructure Proposed for Each Settlement Level, Bicol River Basin

General functions	Rural service centres	Market towns and centres	Regional urban centres
Transport and communication	<p>Surfaced, all-weather roads Farm access roads Bus stop Regular bus or jeepney service to rural collection points Gas station Telegraph service Postal service</p>	<p>Asphalted, all-weather roads Bus terminal Trucking or bulk-distributing Regular bus or jeepney service to rural service and regional urban centres Gas and service station Auto spare-parts retail store Telegraph-radiogram service Postal services</p>	<p>Concrete highway to major urban centres Bus terminal with major repair facilities Auto and machine repair shops Vehicle and machine spare-part shops Regional and interregional trucking or J bus services Gas and service stations Railroad, port and air terminals Telephone exchanges linked to major urban centres and market towns Postal distribution centres</p>
Marketing, trade and shopping	<p>Periodic market facilities Farm implements and agricultural supply shop Marketing co-operative outlet Storage facilities General store or <i>sari-sari</i> stores Milling facilities</p>	<p>Daily market facilities Retail outlets for farm supplies Wholesale outlets for farm implements Cold storage and warehouse facilities Grocery shops Household-goods retail shops Grading and bulk-assembly facilities</p>	<p>Diversified daily market Distribution outlets and sales offices for farm machines Farm-supply wholesalers Cold storage and warehousing Agricultural commodity brokers and distributors' outlets Diversified commercial retail and wholesale establishments Retail outlets for consumer goods, household goods Consumer specialty shops</p>
Industrial and manufacturing	<p>Cottage industry Small-scale craft shops Small machine repair shops and metal shops</p>	<p>Bulk-commodity processing Agricultural processing plants Small-scale consumer goods manufacturing facilities Small machine, implement and metal shops</p>	<p>Agro-industry and agribusiness facilities Commodity processing and packaging Rural goods production and distribution facilities Small tool and implement production facilities</p>
Finance	<p>Rural bank Credit co-operative</p>	<p>Commercial and savings bank facilities Rural bank with non-agricultural loan programme Credit co-operatives Money lenders and pawnshops</p>	<p>Development and commercial bank branch Savings and loan associations Insurance and financial establishments Urban and rural credit co-ops Brokerage firms Chambers of commerce Small industry and business incentive programme</p>
Public utilities	<p>Piped water supply point Small water filtration facilities</p>	<p>Electrical energy station Residential piped water supply Residential and commercial area drainage systems</p>	<p>Electric supply grid Piped water system Sewerage and drainage system Waste disposal system</p>
Administration	<p>Municipal service office Barangay government office Police or PC sub-station Municipal court branch Agricultural extension station</p>	<p>Municipal or barangay gov. office IAD team headquarters office Police or PC station District offices of agricultural extension Judicial facilities National ministry programme district offices</p>	<p>Provincial government offices Municipal hall and administrative offices Regional planning and development agency offices Municipal and provincial court Branch offices of national ministries Regional office headquarters</p>
Recreation and social	<p>Paved basketball court Multi-purpose community centre</p>	<p>Paved basketball court Small gymnasium/auditorium Restaurants and coffee shops Cinema Playground with facilities</p>	<p>Paved basketball courts Parks and plazas Cinema with daily run Hotel with nightclubs Restaurants Gymnasium/auditorium Multi-purpose community centre Diversified social activities</p>

General functions	Rural service centres	Market towns and centres	Regional urban centres
Education	Primary schools Vocational education facilities	Primary schools High schools Vocational schools Extension and home economics classes Agricultural demonstration facilities	Primary and secondary schools Small colleges and technical schools Specialized vocational training programmes Regional agricultural research station
Health	Dispensary-clinic Maternal/child care service	Multi-purpose clinic Area health office Physicians, dentists Drugstores	General hospital Public health offices Physicians, dentists, surgeons Retail pharmaceutical outlets

handicrafts, distribute credit, market information and other technical inputs, facilitate savings mobilization, and provide basic health, recreation, educational, and administrative services.

**2. Market Towns and Centres** would provide an area-wide exchange point for trade in agricultural commodities, processed goods, household and common consumer products, and farm inputs; offer access to an all-weather road network; serve as a node of transportation and distribution linked to regional centres within the Basin; provide the preconditions and infrastructure to stimulate agro-processing plants and small-scale bulk commodity handling facilities; make available a variety of rural financial and credit services; meet rural energy and utility needs; provide higher-level administrative services that cannot be found in rural service centres; and offer vocational and secondary education, health and child-care services, and rural commercial services.

**3. Regional Centres** would be physically linked to each other and to urban centres outside the Basin by frequent and reliable transportation and all-weather roads, offer diversified commercial, financial, professional, and administrative services, and accommodate regional offices of national government ministries and branch offices of provincial government agencies; provide facilities for large-scale and diversified markets, function as a communications node for a broad rural hinterland, provide sites for agribusiness and large-scale agricultural processing; offer incentives for a variety of small-scale consumer-goods industries, tool-making and repair workshops, machine shops and light durable-goods industries; offer higher educational opportunities and more specialized vocational training, and provide diversified and multi-purpose hospitals and health clinics.

The recommendations of the Urban Functions in Rural Development project in Bicol were guidelines for investment analysis and project identification rather than detailed proposals for particular investments in specific locations.

Examples were given of the types of settlements that might be strengthened through integrated investment, but a systematic evaluation of potential growth centres, as had been done in India and Brazil, was not part of the Bicol project. Time and budget constraints prevented the project staff from actually proposing, and testing the feasibility of, specific investment projects.

The next logical step, of course, would be to assign priorities to investments in specific functions and locations. Not all of the infrastructure, services, and facilities that are needed can be financed at once, nor can all settlements be strengthened and up-graded at the same time. Criteria must be established for choosing the towns and villages that will receive investments first, and a ranking system must be created for sequencing investments in various functions and settlements over a four- or five-year planning period.

### Creation of a Monitoring System and Institutionalization of the Planning Procedure

Two activities form the final stages of integrated regional development planning. First, an evaluation system must be created for monitoring the implementation of projects and programmes, and for determining the substantive results of development activities on marginal areas and population groups within the region. Second, the planning procedures should be institutionalized in local or regional public agencies charged with investment decision-making and with revising the spatial analysis and development plans at appropriate intervals. In the Bicol River Basin, the Urban Functions in Rural Development project sought primarily to devise and test a methodology for integrated urban-rural development planning, and the details of institutionalization and monitoring were left almost entirely to the Bicol River Basin Development Program. The project staff recommended that a small follow-on project be funded by USAID to complete the project identification work and to assist BRBDP with organizing future spatial analysis efforts.

## VII. CONCLUSIONS AND IMPLICATIONS

Experience with development in the Third World over the past three decades clearly indicates that traditional macro-economic approaches to accelerating growth will have little effect on ameliorating poverty in marginal regions with spatial structures such as that in the Bicol River Basin. Simply reallocating national investments more equitably among regions or favouring those previously given low priority, although necessary, are not sufficient to reduce spatial inequalities, incorporate marginal populations, or increase the access of the poor to the resources necessary to free them from poverty. Similarly, traditional "growth centre" approaches to spatial planning are likely to exacerbate already severe urban and rural differences within regions. Given the highly skewed, poorly articulated, and weakly linked settlement hierarchies within rural regions, these policies often replicate national patterns of economic dualism at the regional level, leaving the vast majority of the rural poor living in scattered villages with little access to the benefits of investments concentrated in the growth centres.

Instead, a strategy combining reallocation of national investments among regions and the selective location of various combinations of infrastructure, social services, facilities, and productive activities in settlements at different levels in the spatial hierarchy must be pursued in order to articulate spatial systems in marginal regions, extend services to the rural poor, and increase their access to town-based functions.

A national strategy for marginal area incorporation and development involves four major components.

First, the strategy must seek to deconcentrate important development investments from already burgeoning primate cities and metropolitan centres to other less developed regions, both to provide the opportunities for developing potential resources in those regions and to create a more articulated and integrated national space economy. In countries like the Philippines this requires a regional investment programme primarily focused on rural industrialization and infrastructure support—one that extends communication and transportation linkages to peripheral areas and promotes investment in agribusiness, small- and medium-scale industries, and local consumer-goods manufacturing using indigenous resources. Such a

strategy, in addition to providing the means for absorbing, processing, and distributing agricultural surpluses could also provide a wider range of household and local consumer goods to rural people at lower cost, and expand off-farm employment opportunities. The International Labour Office observed the paucity of appropriate industries in the rural Philippines and that "in spite of substantial transport costs, textiles are shipped from Manila to the smallest towns in Mindanao. Shoes are produced only in large towns. There is, in short, a surprising absence of the kind of lower cost adaptive consumer good produced for the domestic rural market and traded among and within the islands."<sup>62</sup>

Although the Philippines has extensive programmes for industrial promotion, these alone will not generate the volume of private investment needed to vitalize and diversify marginal economies. Indeed, the promotion programmes have generally benefitted those industries that located where previous priorities for infrastructure investment have made operation most advantageous—in and around metropolitan Manila. Unless infrastructure investments are also deconcentrated and support facilities extended to rural areas, private investment will not precede them. The World Bank has argued that "to direct investments into desired locations it is absolutely essential to provide adequate supporting infrastructure such as electricity, water, transportation and communications as well as financial and technical services and a supply of qualified labor." The Bank notes that "fiscal incentives without these provisions are unlikely to stimulate much new investment in the outer provinces, and with such infrastructure incentives are probably not needed."<sup>63</sup>

A second element of the strategy requires careful location and "decentralized concentration" of relatively higher population threshold investments in intermediate and secondary cities, which would serve as inter-regional production centres, act to counter-balance continued rapid growth in primate cities, and become part of a network of domestic exchange and market centres. The World Bank correctly observes that "to date the intermediate size cities have been neglected in the Philippines as a focus of policy."<sup>64</sup> The high priorities that Manila received in public investment and expenditures allowed the metropolitan area to grow at the expense of both rural areas and other urban centres. Manila's primacy is now extremely high, with well

over ten times the population of the next largest cities—Davao and Cebu. Yet these two smaller metropolitan areas and a number of other secondary cities—such as Iliolo, Zamboanga, Bacolod, Cagayan de Oro, Angeles, and Olongapo—might serve as inter-regional production and exchange centres if appropriate investments were made in public infrastructure and productive activities.

Third, as the final report of the Bicol River Basin Urban Functions in Rural Development project pointed out, a spatial strategy for more equitable development requires locating infrastructure investments and productive activities within regions in such a way as to articulate the spatial system and integrate urbanized centres and rural hinterlands. A deliberate policy of decentralizing investment in lower population threshold functions and combining in “minimum investment packages” the services, infrastructure, and facilities needed to promote functional specialization and trade among settlements within rural regions is essential for accelerating and spreading the benefits of development. Articulation of the spatial system implies the development of at least three levels of settlements within regional economies: rural service centres, small cities, and regional centres.

With careful allocation and packaging of investments, towns and villages that already exist within marginal regions of developing countries could be made to perform these three levels of functions. In some regions substantial investments would be necessary to create regional centres, and in most areas the paucity of market towns and rural service centres would require careful analysis of incipient centres prior to designing investment packages. Creation of this hierarchy of settlements, however, would provide a spatial framework for spreading the benefits and increasing the multiplier effects of public and private investment.

Finally, creation of a more equitable development pattern requires increasing the linkages among rural settlements and between them and urbanized centres within regions. Among the most important linkages are farm-to-market roads and all-weather arterials between market centres and larger towns and cities. It is inconceivable that the Philippine government, for instance, will be able to attain its goals of increased agricultural production, economic diversification, and more equitable distribution of services, facilities, and income without first extending transportation access within and among regions. A network of all-weather and farm-to-market roads in regions like Bicol is an essential precondition for extending services to rural people, promoting investment in agribusiness and small-scale manufacturing, and providing access for rural people to the higher threshold services and facilities that must be located in cities and *poblaciones*. Without access to markets

farmers will simply not increase output. The costs of transporting agricultural goods in peripheral areas of regions like Bicol wipe out marginal profits of increased production for farmers without access to roads and highways.

This four-pronged strategy of regional reallocation of investments in infrastructure, the gradual building up of secondary and intermediate size cities as interregional production and market centres, articulating the spatial systems of marginal regions, integrating town centres with rural hinterlands, and increasing linkages among settlements in rural areas, would both promote greater spread effects from development in larger urban centres and generate more diversified economic growth in smaller rural villages. It combines “bottom-up” and “top-down” development strategies to forge an integrated national economy in which the benefits of accelerated growth could be more equitably distributed and the high levels of rural poverty more easily and effectively ameliorated.

All of this must be done carefully, however, with sensitivity to the needs and capabilities of people living in marginal areas and to the nature and characteristics of the ecosystems in those regions. As Rondinelli and Ruddle have argued elsewhere, and in more detail, such planning must employ a “transformational” development approach. Transformational development seeks to increase incrementally the productivity of indigenous resources, institutions and population groups, reinforcing practices and building on organizations that are appropriate to local conditions and needs and adaptive to changing circumstances, and gradually displacing those that are not.

The concept of transformational development involves eight basic principles: 1. building on existing culturally embedded resources, institutions, and practices; 2. involving local people, who will be affected by transformation and change, in the processes of development planning and implementation; 3. adapting modern technologies, services, and facilities to local conditions; 4. promoting specialization in production and exchange activities based on existing spatial comparative advantages; 5. using appropriate, low-cost, culturally acceptable methods of change to generate “demonstration effects” that lead to widespread adoption of those that prove successful; 6. planning for displacement of unproductive and unadaptable traditional institutions and practices as change occurs; 7. establishing, through planning based on “strategic intervention,” the preconditions for transformation and change in social, technical, political, economic, and administrative structures and processes and in elements of the spatial structure; and 8. creating a planning process that is flexible, incremental, and adaptive and that provides for experimentation and adjustment as transformation takes place.<sup>65</sup>

Organizational transformation and spatial integration are inextricably related in the development of resource systems in marginal areas. They must be carefully planned if

marginal populations are to be effectively assisted in increasing their capacity to procure, transform, and deliver the resources needed to raise their standards of living.

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