Applied Methods of Regional Analysis

The Spatial Dimensions of Development Policy

Dennis A. Rondinelli

A Westview Special Study

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About the Book and Author

Promoting widespread economic growth while allowing a majority of those living in economically lagging regions to participate more effectively in productive activities and to obtain greater benefits from the development process is a fundamental development problem. Dr. Rondinelli offers an approach to regional spatial analysis that can help planners and policymakers build the productive and service capacity of settlements in rural regions. He describes methods of regional resource, settlement system, and spatial linkage analysis that identify and locate investments in productive activities, social services, and physical infrastructure that will more effectively promote widespread regional development. Application of these methods is illustrated by examples from several developing countries.

Dr. Dennis A. Rondinelli is professor of social science and development planning at the Maxwell School of Citizenship and Public Affairs, Syracuse University. He is the author of *Secondary Cities in Developing Countries: Policies for Diffusing Urbanization* (1983) and *Development Projects as Policy Experiments: An Adaptive Approach to Development Administration* (1983).

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Contents

List of Tables and Figures xi
Foreword, *Gerald J. Karaska* xv
Acknowledgments xvii

1 SPATIAL PLANNING AND REGIONAL DEVELOPMENT . . 1

Concepts of Spatial Development 3
Growth Pole Concept 3
Functional-Spatial Integration 4
Decentralized Territorial Approach 8
A Conceptual Framework for Settlement Systems 12
Roles of Settlements in Regional Development 12
The Underdevelopment of Small Towns and Cities in Rural Regions 16
Spatial Policy and Regional Development . . . 20
Notes 22

2 THE UFRD APPROACH TO REGIONAL PLANNING . . . 27

The Dimensions of Underdevelopment in Rural Regions 28
Concepts Used in the UFRD Approach 33
The Process of Spatial Analysis 36
Characteristics and Principles of UFRD . . . 38
Notes 47

3 REGIONAL RESOURCE ANALYSIS 49

Organizing a Regional Profile Analysis . . . 50
Regions as Agricultural Production Systems 51
Regions as Core-Periphery Areas 51
Regions as Economic and Trade Areas 53
Regions as Integrated Resource-Production-Human Settlement Systems 56

Inter-Regional Profiles 60
Descriptive Statistical Measures 60
Mix-and-Share Analysis 70
Intra-Regional Profiles 77
Descriptive Statistics 79
Measures of Distribution and Association . . 83
Location Quotients 84
Level of Development Index 90
Notes 97

4 ANALYSIS OF THE SETTLEMENT SYSTEM 99

Morphological and Population Size Analyses 100
Functional Analysis of the Settlement System 106
Scale Analyses 106
Scalograms 114
Threshold Analysis 121
Weighted Centrality Indexes 125
Distribution of Functions and Delineation of Settlement Hierarchies 127
Notes 138

5 SPATIAL LINKAGE ANALYSIS 141

The Role of Linkages in Regional Development 141
Market Center Studies 148
Transportation Linkage Studies 160
Social Interaction Linkage Studies 164
Social Service Linkage Studies 165
Political, Administrative and Organizational Linkage Studies 169
Notes 174

6 APPLYING SPATIAL ANALYSIS IN REGIONAL PLANNING 177

Analytical Mapping 179
Accessibility and Service Area Analysis 182
Functional Service Area Index 183
Market Area and Commodity Flow Networks 185
Service Area Clusters 187
Accessibility Models 191
Implications of the Spatial Analyses 204
Notes 212

7 INTEGRATING SPATIAL ANALYSIS IN REGIONAL PLANNING 213

Framework for Strategic Planning 214
Formulating Spatial Investment Strategies . . . 218
Spatial Strategy for Potosi 218
Spatial Strategy in the Bicol River Basin . . 223

Formulating Investment Programs and Projects 230
Demand Analyses--Household and Social Surveys 230
Partitioning Methods for the Location of New Centers 232
Use of Service Standards for Equitable Distribution of Functions 233
Identification and Design of Project Portfolios 236
Monitoring, Evaluation and Institutionalization of Spatial Analysis Methods 240
Monitoring and Evaluation 240
Institutionalizing Spatial Analysis in Regional Development Planning and Policy-Making 243
Conclusions 249
Notes 250

Bibliography 253

Index 261

Tables and Figures

TABLES

3-1 Socio-economic characteristics of Bicol and other regions in the Philippines 61

3-2 Comparative socio-economic indicators for Bicol River Basin, the Bicol Region and the Philippines 64

3-3 Selected characteristics of Departments in Bolivia 69

3-4 Percent contribution by sector of regions to Gross Domestic Product, Bolivia, 1977 . . . 71

3-5 Distribution of workers by sector, Philippines and Bicol River Basin 73

3-6 National growth effect on employment in Bicol River Basin, 1970-1975 74

3-7 Industry effect on employment in Bicol River Basin, 1970-1975 76

3-8 Employment and components of employment change in Bicol River Basin, 1970-1975 78

3-9 Socio-economic profile of provinces in the Department of Potosi, Bolivia 80

3-10 Social indicators for provinces in the Department of Potosi, Bolivia 81

3-11 Concentration of manufacturing establishments among municipalities in Albay Province, Bicol River Basin 85

3-12 Association between manufacturing and wholesale and retail trade establishments in Albay Province, Bicol River Basin 86

3-13 Location quotients for selected municipalities in Camarines Sur Province 88

3-14 Sectoral location quotients of employment for provinces in the Department of Potosi, Bolivia 89

3-15 Socio-economic profile of municipalities by levels of development, Bicol River Basin 92

3-16 Rankings of provinces by levels of development, Department of Potosi 95

4-1 Urban and rural settlements in Bicol River Basin 102

4-2 Changes in population size of settlements in the Department of Potosi 105

4-3 Guttman scale of functional complexity of municipalities in Camarines Sur Province, Bicol River Basin 112

4-4 Functions analyzed in Bicol River Basin UFRD project 118

4-5 Calculation of threshold levels for central place functions 123

4-6 Calculating weights of functions 126

4-7 Calculating centrality indexes 126

4-8 Distribution of functions among settlements in Bicol River Basin 128

4-9 Functional complexity of levels of settlements in Bicol River Basin 131

4-10 Functional characteristics of settlements in Potosi, Bolivia 134

4-11 Functional attributes of settlements at each level of the hierarchy, Potosi, Bolivia 136

5-1 Major linkages in spatial development 143

5-2 Trading distances of six major markets in Bicol River Basin 159

5-3 Population and settlements served by roads and other means of transportation in Bicol River Basin 163

5-4 Service areas and linkages of schools in Bicol River Basin 167

5-5 Service areas and linkages of hospitals in Bicol River Basin 168

5-6 Summary of infrastructure indices for Department of Potosi 172

6-1 Weighted accessibility indexes for functions in Potosi, Bolivia 200

6-2 Cumulative percentages of visits to selected functions by travel time, Potosi, Bolivia 201

6-3 Subregional centers in the Department of Potosi, Bolivia 203

6-4 Proposed subregional planning areas and centers, Potosi, Bolivia 207

7-1 Proposed project portfolio for Norte de Potosi area of Potosi, Bolivia 238

FIGURES

3-1 Region as an agricultural production system 52

3-2 Region as an economic area 55

3-3 Region as integrated resource-human settlement system 57

4-1 Population growth and rank size changes of settlements in the Department of Potosi, Bolivia 107

4-2 Bicol River Basin, levels of municipalities . 113

4-3 Portion of a scalogram for settlements in the Bicol River Basin 116

4-4 Scalogram of settlements in Potosi, Bolivia 120

4-5 Reed-Muench graphic method of plotting threshold levels of functions 124

4-6 Distribution of functions among settlements of the Bicol River Basin 132

5-1 Organizational linkages among six major markets in Bicol River Basin 155

5-2 Linkages among six major markets in Bicol River Basin 156

5-3 Trading linkages of six periodic markets in Bicol River Basin 158

6-1 Origin and destination of salt water fish through Payatan periodic market, Bicol River Basin 186

6-2 Graphic illustration of settlement service area as composite of functional service areas 188

6-3 Functionally related settlement subsystems in Bicol River Basin 192

6-4	Graphic illustration of accessibility model	193
6-5	Map of accessibility zones, centroids and road links, Potosi, Bolivia	198
6-6	Proposed functional planning areas, Department of Potosi, Bolivia	206
6-7	Proposed changes in subregional planning units based on spatial analysis	210
7-1	Alternative approaches to spatial development	215
7-2	Sectoral strategies for achieving regional economic growth	217
7-3	Integrating spatial, sectoral and target group planning	219
7-4	Development strategy for Bicol River Basin	225
7-5	Services, facilities and infrastructure proposed for each settlement level, Bicol River Basin	227
7-6	Selection of subsidiary service centers using relative partitioning techniques	234
7-7	Project design summary, logical framework	242

Foreword

The Urban Functions in Rural Development (UFRD) Project began in 1976 as an attempt by the Office of Urban Development of the U.S. Agency for International Development to introduce spatial analysis into regional development planning in Third World countries. This subject has a long history in the academic literature, particularly in geography, regional science, regional economics and rural sociology and in the initial formulation of UFRD leading authorities in those fields actively participated in discussions and workshops. It is interesting to note, however, that while a rich academic literature with theory, concepts and empirical investigations was readily available, little effort had been made by international assistance organizations to apply them to practical planning problems. It was only through considerable personal effort by Dr. Eric Chetwynd, Jr., and Dr. William R. Miner that this seminal spatial project was initiated within USAID.

Dennis Rondinelli became the field leader of the UFRD efforts, beginning in 1976, and he remains today its leading proponent. He formulated what is now called the "UFRD Approach" from the perspectives of the theorist E.A.J. Johnson, and like Johnson's his view is principally that of a development planner who recognizes that Third World policy-makers face pressing day-to-day problems that must be met with actionable programs and viable projects. But, as a result of its characteristics as a rapid, low cost and simple way to begin the long and difficult task of spatial analysis and regional planning, UFRD has often had to be defended from the criticisms of some academics, who saw it as an overly simplified interpretation of a complex reality, of some Third World planners, who wanted more definitive prescriptions for solving pressing problems, and of official donor agencies, for whom regional planning plays a minor role in international development assistance. Rondinelli has responded repeatedly that

UFRD is only the first step to a better comprehension of the critical roles that towns and cities play in the regional development process.

Since 1976, and after numerous demonstrations of UFRD in the Philippines, Bolivia, Upper Volta, the Cameroons and Guatemala, this book closes the first chapter on attempting to achieve that comprehension. While Rondinelli maintains that UFRD is an invaluable tool in development planning, he recognizes from the experiences of the demonstration projects that other key issues also influence the results of regional development activities. Since the UFRD approach was first conceived, Rondinelli has helped to formulate studies for USAID which concentrate on food marketing chains in rural areas as they are reflected in the dynamics of periodic markets and small market towns, and he has been one of the principal architects of yet another USAID thrust which focuses upon the middle-size or secondary cities in developing countries as centers of employment generation and service provision for rural areas. I and my colleagues at Clark University and a network of development planners are privileged to work with Dennis Rondinelli, and we are all indebted to USAID for its foresight in recognizing the critical importance of a regional perspective in development planning. This book serves, in an invaluable way, to express the merits of that perspective to a larger audience.

Gerald J. Karaska
Clark University

Acknowledgments

This book reflects a large number of intellectual debts that I owe to friends and colleagues. The concepts and methods described here were developed and tested in field projects funded by the United States Agency for International Development. Eric Chetwynd, Jr., played a central role in the Urban Functions in Rural Development (UFRD) projects on which the book is based. Without his advocacy, interest and support for nearly a decade, the projects could not have been undertaken.

I have drawn heavily on the field work of collaborators in the Philippines and Bolivia, without whose help this process of regional planning and analysis would not have been applied. Emmanuel I. Astillero and Junio M. Ragragio made an important contribution in the Bicol River Basin of the Philippines. Field studies in Bolivia were carried out under the supervision of Hugh Evans, from whose reports I have borrowed freely for illustrations and examples. Evans, over a two-year period as resident advisor, and I on frequent visits to Bolivia, worked closely with a dedicated staff of the Development Corporation of the Department of Potosi (CORDEPO), including Alfredo Bellott, Braulio Ore, Hugo Solis and their colleagues.

This book was completed with strong support from the Cooperative Agreement on Human Settlements and Natural Resources Systems Analysis at Clark University. Gerald J. Karaska and Eric Belsky sharpened my thinking, focused my attention on the strengths and weaknesses of the UFRD approach and provided the necessary logistical support.

All of these people and organizations, however, should be absolved of responsibility for the interpretations and conclusions that follow. The UFRD approach to regional analysis and planning remains controversial. It attempts to combine time-tested, perhaps some would call them conventional, methods with new techniques and field applications to provide a process that is flexible and adaptable under a wide variety of economic, political and cultural conditions, that is easy to use

with limited data and skilled personnel, that can be understood by policy-makers who have little or no experience in regional science or planning, and that can be completed quickly to influence on-going investment decision-making. Some readers will undoubtedly question whether or not such an approach is appropriate; others if, in fact, it meets all of these objectives.

In ten years of testing and revising the methods described here, I have come to appreciate Disraëli's aphorism that "it is easier to be critical than to be correct." More testing and revising and searching for alternatives need to be done. But if these concepts and methods, at this stage in their evolution, help planners, community organizations, public officials and private investors to understand better the regions that they are trying to develop, then they will have served their purpose. My hope is that those who use these concepts and methods will join the effort to improve them.

Dennis A. Rondinelli

1
Spatial Planning and Regional Development

This book addresses a basic development problem: how to promote widespread economic growth in ways that will allow a large majority of people living in rural areas and in economically lagging regions to participate more effectively in productive activities and to obtain greater benefits from the development process. It offers an approach to spatial analysis and regional planning that focuses on building the productive and service capacity of settlements of different sizes and functional characteristics--rural service centers, market towns, intermediate-sized cities and regional centers--to provide the services, facilities and economic activities that can promote rural and regional development. It seeks to describe the locational dimension of regional and rural development planning and to offer guidelines for improving the capacity of settlements to offer an appropriate range of services, facilities, infrastructure and economic activities for their own residents and those of surrounding rural areas.

This approach to regional development planning is based on a fundamental assumption: that if governments in developing countries want to achieve geographically widespread development, they must invest in a geographically dispersed pattern. The concentration of investments in one or a few large cities will not result automatically in the spread of development through trickle-down processes. In most countries the spread effects of investments are highly constrained. At the same time, many of the services, facilities and productive activities that are needed for regional development cannot be provided economically or efficiently to widely dispersed populations living at very low densities. Few developing countries have sufficient financial resources to offer a wide range of basic services everywhere at the same time. Essential services and facilities must be located in places that

have a sufficiently large concentration of population or a broad enough market area to support them economically. Thus, if economic development is to be achieved with greater social and geographical equity, investments must be made in a pattern of "decentralized concentration." That is, they must be strategically located in settlements that can serve a large population living in and around them, and to which people living at relatively low densities in rural areas have easy access.

This pattern of "decentralized concentration" can be achieved most efficiently and effectively through an articulated and integrated system of settlements. A hierarchical or diffuse settlement system can provide not only the critical mass of services and facilities needed in rural areas to increase agricultural productivity and income but also provide the trade, transportation, administrative and social linkages that integrate a region into a self-sustaining economy.

This book describes an approach to spatial analysis that can help policy-makers at national, regional and local levels to allocate investments in services, facilities and infrastructure in ways that build up the capacity of settlements to serve residents more effectively and to stimulate development throughout a region. The approach has been tested in more than a dozen developing countries under a variety of labels: block-level planning in India, settlement systems analysis in Indonesia, market center analysis in Kenya, Peru and Ecuador, growth center analysis in Ghana, Malawi and Thailand, "urban functions in rural development" planning in the Philippines, Bolivia and Upper Volta, and central place analysis in other countries.[1] Whatever it is called, the general approach to settlement system analysis described here seeks to provide a spatial and locational dimension to regional planning by (1) identifying settlements that can most effectively act as service, production and trade centers for their own populations and those of surrounding areas; (2) determining the strength of linkages among these settlements and between them and their rural hinterlands; and (3) delineating those areas in which people have little or no access to town-based services and facilities. It attempts to provide the information needed by planners and policy-makers to allocate investments in services, facilities and productive activities to the smallest efficient units of settlement and to maximize the access of rural residents to those communities. Thus, it provides a spatial or locational framework for incrementally increasing the capacity of a larger number of communities to serve their residents more effectively.[2]

The process of planning and analysis described here was most recently tested in a series of pilot

projects sponsored by the U.S. Agency for International Development in the Philippines, Bolivia and Upper Volta. They were known as Urban Functions in Rural Development (UFRD) projects and the process has widely been referred to as "the UFRD approach." This book draws heavily on the Philippines and Bolivia experiences in describing this process of regional planning.

UFRD focuses not only on the spatial or locational dimensions of regional planning, but also on strategies for integrating urban and rural communities into a system of settlements through which a wide range of mutually beneficial economic, social and physical interactions can occur. It is meant to supplement sectoral, technical and problem-oriented planning and not to supplant them. It seeks to add a locational and spatial dimension to other forms of regional and national planning rather than to produce a comprehensive regional development plan. Thus, UFRD concentrates on locational factors and spatial concerns; it is assumed that many other factors of equal or more importance in regional development are being considered through other forms of planning and analysis. An underlying assumption of the UFRD approach is that planning and decision-making are continuous processes to which spatial analysis can make an important contribution. UFRD is a place-oriented approach to regional analysis that can be used to supplement sectoral and technical planning, as well as "people-oriented" approaches to social services planning.

CONCEPTS OF SPATIAL DEVELOPMENT

Three major concepts of spatial development have emerged in recent years. They have been described as the growth pole, functional integration, and decentralized territorial approaches.[3]

Growth Pole Concept

The growth pole concept of spatial development suggests that by investing heavily in capital-intensive industries in the largest urban centers, governments in developing countries can stimulate economic growth that will spread outward to generate regional development. The economies of scale found in the largest cities would provide high rates of return on investment, support the commercial, administrative and infrastructural services needed by industries to operate efficiently, and bring about the diversification of the growth pole's economy. It is assumed that the goods produced in the growth pole would be exported to the country's metropolitan center and abroad, that other manufactured goods would come from the metropolitan center to the

growth pole, and that the free operation of market forces would create "ripple" or "trickle down" effects that would stimulate economic growth throughout the region. Investment in industry at the growth pole would be the "engine of development" for agricultural and commercial activities.[4]

But where growth pole policies were tried in developing countries--mostly in Latin America and Africa--they generally failed either to promote the economic growth of the cities selected as poles or of the regions in which the growth poles were promoted.[5] Experience suggests that ripple and trickle down effects were not strong enough to generate regional development, and that if they worked at all, growth poles often became "enclaves" of modern activities that drained raw materials, capital, labor, and entrepreneurial talent from surrounding rural areas. Hansen argues that "the trickling down of modernization has not reached the poor, especially in rural areas, or else has yielded to them no more than marginal benefits." He concludes that "the optimistic view that economic growth would result in a convergence of regional per capita income has not been supported by evidence."[6]

In many countries with highly polarized settlement systems, failure of development to spread is attributed at least in part to inadequately articulated and integrated systems of settlements through which innovation and economic stimuli could be diffused. Without an articulated and integrated system of growth centers--as opposed to one or a few growth poles--the impulses of concentrated investment could not spread and the economic incentives for widespread productivity could not be created. Under such conditions, as Berry has observed, "growth and stagnation polarize; the economic system remains unarticulated."[7]

Functional-Spatial Integration

An alternative approach is based on the concept that a well-articulated and integrated system of growth centers of different sizes and functional characteristics can play an important role in facilitating more widespread regional development. It assumes that in most developing countries the primary stimulus to regional development must be through agricultural rather than industrial development. The goals of this strategy are to achieve higher levels of food production, expand employment and achieve higher levels of income for larger numbers of people, especially those living at or below subsistence levels. The primary beneficiaries of investments must be small-scale farmers, landless laborers, and those engaged in small-scale commercial enterprises--that is, people usually living on the margin of the organized economy. If

greater productivity and higher income are to be achieved, some critical mass of services must be available in rural areas, including appropriate agricultural technology, research and extension services, high-yielding seed varieties, adequate credit and other inputs. Organizing accessible financial institutions that increase the flow of capital to and promote savings among rural people is crucial, as is the creation of a stable marketing system through which farmers can sell their products.

Building the institutional framework for rural development is essential to promote regional growth and to transform subsistence farming into commercial agriculture. Rural residents must have access to self-sustaining organizations capable of identifying and solving rural development problems and of delivering needed services. Greater opportunities for nonagricultural employment in rural areas must accompany increased agricultural production. Jobs must be found for those freed from agricultural employment as productivity increases. Agricultural processing and distribution activities must be established, and industries must be created to provide low-cost inputs and equipment for farmers. Finally, if rural development is to go beyond simply increasing farm output, attention must be given to providing for basic human needs--health and education services, vocational training, safe drinking water, sanitary facilities, and adequate shelter.[8]

A crucial element in providing the basic preconditions for the commercialization of agriculture is a well-articulated and integrated system of settlements in which services and facilities can be efficiently located and to which rural people have easy access. The absence of such a system of central places, some theorists argue, obstructs the emergence of a sectorally and geographically balanced pattern of economic growth. E.A.J. Johnson argues that the "varied hierarchy of central places has not only made possible an almost complete commercialization of agriculture but facilitated a wider spatial diffusion of light manufacturing, processing and service industries... [and provided] employment of a differentiated variety," in most countries with more advanced economies.[9] Without access to an integrated system of market centers farmers cannot easily sell their surpluses, obtain inputs, modernize their technology and adapt products to consumer demand. Nor can they easily obtain the services needed to make living in rural areas acceptable.

Theorists such as Brian Berry have long insisted that in market or mixed economies a diffuse and integrated system of central places usually emerges with economic growth and is a necessary but not sufficient condition

for achieving widespread development.[10] A network of central places--settlements that serve populations from a surrounding hinterland--is necessary to distribute goods produced in specialized locations to consumers in other places. Central places make available to people living in rural areas those services requiring fixed locations or large numbers of customers. Goods produced in various locations must be assembled in local collection points and distributed to consumers through markets, thus making specialized goods and services of particular communities available to consumers in other places.

Fisher and Rushton point out from their experience with area development planning in India and Indonesia, that creating an integrated system of service, trade and production centers has benefits both for governments attempting to promote regional development and for people living in the region. They note that an integrated hierarchy of service centers:

1. Is convenient and efficient for the consumer because it allows for the satisfaction of several different needs on the same trip out of the village.
2. It reduces the amount of transportation required to connect villages to facilities because, from among the many possible transport links between places, those few links connecting villages to their local service center and to more important places will be recognized by all to be the priority links where public transportation facilities should be provided.
3. It reduces the length of roads that require improvement before every village is connected to places having facilities to which they need access.
4. It economizes on the cost of providing services to the facilities themselves, because these costs can be shared among several facilities located in the same place.
5. It enables a more economical and effective monitoring of the regulated activities in market and service centers.
6. It facilitates the exchange of information and qualified personnel between related activities.
7. It focuses the development efforts for a region on a few places with superior locations and resources and this increases the likelihood that some of the places will spontaneously generate additional activities catering to the needs of their hinterland region.[11]

Others have also noted the benefits of an integrated system of settlements for regional development. Bromley contends that "such central places are indispensible elements in the functioning of rural and regional economies, articulating the diverse specialized forms of production and consumption, and facilitating numerous forms of interaction and exchange."[12] Roy and Patil note in their analysis of central places in India that "there is a symbiotic relationship between the development of service centers and the development of service areas around them."[13] In a region with a well articulated and integrated system of central places, people living in or near towns of different sizes and functional characteristics have easy access to basic necessities, convenience goods and services in local markets as well as to more diversified and higher order functions that must be located in cities of larger size. "All of these concepts" Roy and Patil point out, "convey the idea of locating at different levels primary and secondary goods and services that are functionally interlinked, mutually complementary and supplementary, well-integrated vertically and inter-sectorally, to maximize the benefits to users and minimize the costs." A well-integrated system of settlements provides potential access for people living throughout a region to markets of different sizes and to a wide variety of urban amenities and inputs needed for agricultural development. The objective of locational strategies based on the functional integration approach is "to identify the lowest level service center and villages within its gambit, which together form a viable unit which can support a minimum package of services."[14]

Decentralized concentration of investment through settlements of different sizes and functional characteristics, Rondinelli and Ruddle point out, can:

1. Create economies of scale, spillover and spread effects that are beneficial to both residents of those centers and people living in surrounding rural areas;
2. Help organize the economies of rural hinterlands through supply, market, administrative and service delivery systems that provide increased and diversified employment opportunities;
3. Aid in attracting creative and innovative personalities and entrepreneurs with values, attitudes and behavior patterns that can create an environment conducive to further innovation;
4. Provide returns from previous investment that can be used for future development and for creating comparative locational advantages and more and better opportunities for future growth through inducement effects;

5. Create pressure and demand for extending new services, facilities and infrastructure, thus creating a continuing cycle of growth and expansion;
6. Create physical and economic linkages among settlements and between them and their rural hinterlands that increase the accessibility of central places;
7. Attract related economic and social activities that create--through economies of proximity--new markets for raw materials, semi-finished goods and new commodities.[15]

Perhaps most importantly, decentralized investment in strategically located settlements can create the minimal conditions that enable rural people to develop their own communities through "bottom-up" and autonomous processes. For higher levels of government, Roy and Patil claim, "the major utility of the service center strategy is the combination of social, economic and spatial planning."[16]

Decentralized Territorial Approach

A third concept of spatial development is sometimes called a decentralized territorial, agropolitan, or selective regional closure approach. It is usually based on the argument that urban growth centers--even market towns and intermediate-sized cities--are parasitic; that they allow town-based elites, large corporations and central government agencies to exploit the rural population and to drain rural areas of their resources. The implication is that investments should not be located in these places, but dispersed in rural areas where people have direct access to them. If small towns and cities are encouraged to grow they will simply become the instruments through which the privileged classes will exploit rural people more effectively. Schatzburg, for example, insists that the "structures and organizations of these small towns usually benefit the already wealthy elements of local society who have the means and skill to co-opt most developmental resources and initiatives that originate with the national governments." Thus, he maintains, even small towns are "structured to enhance the well-being (social, economic and political) of those who are relatively advantaged." Their development, he implies, would be detrimental to the rural poor because small towns and cities "are both centers of extraction that siphon off financial and human resources from the countryside and blockage points that inhibit the downward flow of resources as well."[17]

Others argue that rural people have limited access to farming innovations and that this lack of access

makes small towns and cities ineffective in disseminating modern ideas and practices. Moreover, although farm people participate actively in town-based market trade, urban traders dominate the markets and merely seek to maximize their profits. They are not interested in diversifying the agricultural economies of the areas in which goods are produced or in increasing the incomes of the producers. It is argued that capital and credit are controlled by townspeople who are reluctant to lend to farmers. Strengthening the linkages between small towns and cities and the metropolitan centers would make many rural workers redundant, undermine the network of local trading and petty production activities and weaken the economic structure of small towns, making them dependent on the metropolitan economy.

The policy implications of such concepts are not always clearly stated. At one extreme it is suggested that nothing done at the local level within developing countries will be effective until the world economic order, which allows exploitation of the rural poor, is changed.[18] Others argue that development strategies should seek to create self-reliant rural economies with minimal linkages to the metropolitan economy. Friedmann and Douglass suggest an "agropolitan" approach of concentrating development activities in rural districts with from about 50,000 to 150,000 people. Planning and decision-making authority would be decentralized so that people living in the districts would be primarily responsible for their own development.[19] Stohr and Todtling have suggested a strategy of "selective spatial closure" as a way of protecting small towns and rural populations from potentially adverse effects of interaction between rural areas and larger cities.[20]

A counter argument is that small towns and cities per se are not necessarily parasitic; many perform beneficial functions that are essential to rural development. Nor is interaction with larger, more modern and economically diversified urban centers necessarily exploitive. Much depends on how the economies of small towns and cities are developed and the ways in which the linkages between them and larger communities are organized.

Once urbanization begins, even at very low levels, it is impossible to expect spatial closure. Leeds argues that no nucleated settlement can be closed because its very existence is based on some degree of specialization. Specialization requires exchange, and thus "no town is an island of itself." The concentration of people in towns is based on exchange and interaction and thus, "theoretically, never should one expect to find autonomy, closure or boundedness. On

theoretical grounds one should always expect flows of goods, services, personnel, property, knowledge, information or possibly other values going in and out of any locality."[21] Moreover, a good deal of empirical evidence suggests that small towns and cities can and do perform beneficial functions for rural people. Not all of the interactions between urban and rural people are detrimental to the latter. New linkages with larger communities can create new opportunities for the poor in the hinterlands of smaller towns and intermediate cities.

Preston found in his study of highland towns in Bolivia, for example, that their negative impact on the rural poor was usually minor, and that many offered new economic opportunities to rural residents. He found that the most important influence on agricultural innovation in highland Bolivia had been personal contacts among farmers and that those contacts most often took place in market towns. Farmers, he points out, are "much more likely to be impressed by seeing large healthy new varieties of potatoes in the market rather than being told about them or even to some extent than actually seeing them growing."[22] The degree to which market towns made available new products was crucial in disseminating agricultural innovations. Moreover, he found little systematic or serious exploitation of rural people by market operators or merchants, nor did individuals or institutions in the towns seem to be obstacles to capital accumulation by farmers. Preston concluded that "there is little feeling of injustice at the distribution of income" and that most rural families could get access to some capital. Likewise, the negative effects of administration in the towns were, with the exception of a few individual cases, not a serious problem for farmers and, indeed, municipal officials had a good deal of popular support.[23]

Other studies of market towns indicate that rural people can compete fairly with townspeople and that the linkages between the towns and rural areas are the primary channels through which rural people derive income. Studies of marketplace interaction in the Guatemalan town of Antigua, for instance, document the ability of rural people "to establish themselves as permanent market participants in competition with urban vendors, to obtain permanent rights in market space, to cope with hostile administrative structures and to form trading partnerships with urban customers."[24] Indeed, the very existence of the urban market in Antigua depends on linkages between the city and its rural hinterland, linkages in this case that seem to benefit rural residents as much as townspeople. Swetnam points out that

> While the Antigua Guatemala market-place is an institution organized and maintained by the city government, the bulk of its trade lies in the hands of rural middlemen. Vendors from outside Antigua outnumber city dwellers not only among the ranks of producer-sellers but also among the middlemen who constitute two-thirds of the selling population. ...The market is not a spot where urban merchants fleece rural producers, but rather an institution in which urban and rural dwellers mix freely playing the role of both buyer and professional market trader.[25]

Only about one-fifth of the market participants live in the city; more than half come from the surrounding rural hamlets or from other municipalities. Rural vendors come to the thrice-weekly market from as far as 100 kilometers away. Linkages between small towns and cities and larger metropolitan centers do not necessarily work to the disadvantage of the towns.

Dannhaeuser's studies of Dagupan City--a medium-sized town in Pangasinan Province of the Philippines that has had strong trade relationships with the primate city, Manila, as well as with other towns and cities in its region--conclude that trade and commercial linkages have not been detrimental to Dagupan's economic development nor to those people living in the town's surrounding areas. Sales penetration and contractual-ownership penetration by large Manila-based firms changed but did not destroy local trade relationships. Instead, they stimulated local innovations in distribution and opened new employment opportunities. Over a twenty-five year period of high inflation, household income in and around Dagupan remained stable. "Moreover, the expansion of infrastructure in Dagupan and Pangasinan, the rise in revenue base, continued brisk trade and vigorous demand in the province and in the city do not convey a picture of large segments of the population sinking into poverty" Dannhaeuser concludes.[26] He argues that trade with Manila was one of the major factors that has kept capital within the Dagupan region instead of being transferred elsewhere. The expansion of active marketing by Manila-based firms in Dagupan seems to have mobilized local capital and labor resources that had previously been idle. The economic ties did not impose a political dependency on the city. Local officials have levied high license fees on companies and taxes on salesmen doing business in the city, often to the dismay of the large companies.

Richardson comes closer to the truth in pointing out that "neither the 'diffusion pole' nor the 'parasitic' views of the role of small cities are correct as

a general rule. Much depends on how the functions of these cities have evolved with respect to their hinterlands, on the institutional and cultural features of the country in question and on how policies for strengthening the small cities are formulated and implemented."[27]

A CONCEPTUAL FRAMEWORK FOR SETTLEMENT SYSTEMS

The Urban Functions in Rural Development (UFRD) approach to regional planning is based primarily in the functional integration concept of spatial development. It is based on the assumption that settlements of various sizes and functional characteristics--and especially smaller rural service and market centers--can and do play important roles in regional and rural development, but that in most developing countries the settlement system may not be well enough articulated and integrated to allow these centers to perform their potential functions effectively.

Roles of Settlements in Regional Development

Although the literature on small towns and intermediate-sized cities in developing countries has grown so large in recent years that it is impossible to summarize it all here, samples can be cited to indicate the range and types of functions that these settlements can perform. Studies of towns in West Bengal, India, for example, reveal that even those with as few as 5,000 residents can act as "minimal urban centers" for their rural regions. West Bengal towns:

> (1) serve as economic, political and cultural centers for the population of the villages in the surrounding rural micro-region, (2) provide the market where products not locally produced and specialized goods and services are available, and where local products may be sold; (3) provide the wide range of occupational specialists not usually found in rural villages, but necessary for the continuing existence of a primary agricultural rural population; (4) serve as centers in which administrative and educational specialists representing wider society and its urban centers meet and interact with the local rural populations; (5) are characterized by extreme diversity in occupation and heterogeneity in population compared to their relative size as urban centers (as rural towns, such settlements exist to serve a nonresident population dispersed in agricultural villages) and (6) characteristically draw a large segment of the elite population from far outside

> the immediate locality, recruiting on the basis of education and experience in specialized administrative, professional and educational positions.[28]

Johnson found in his studies of small central places in India that they are particularly conducive to the types of commercial and industrial activity that cater to local, short-radii market demand and that have a small potential number of customers who are within easy reach by foot, bicycle or other forms of transport.[29] Thus small towns in India frequently contain a wide array of retail stores, personal and commercial services, and cottage processing, fabricating or simple manufacturing operations. Those activities that cater to a small portion of a larger region can also be located successfully in small towns and cities if adequate transport and ancillary services are present. The most frequently found economic activities in Indian towns are weight-losing and bulk-reducing processing activities, such as sugar mills, saw mills, livestock slaughtering houses, canneries and oil crushing mills. These localized activities in turn create demand for transport and supply services, brokerage, credit and insurance services.

World Bank analysts assert that nonfarm enterprises and activities--especially small scale construction, commerce, service, transport, processing and manufacturing--are an important source of employment and income for more than a quarter of the rural labor force in developing countries. They are also a significant source of secondary or supplementary income for farm households and they provide on-the-job training and apprenticeships in commercial and processing activities for rural youth.[30]

Studies of rural industries in South Korea and Taiwan indicate that small towns and cities, in addition to supporting resource processing activities, are also good locations for small market-oriented activities such as animal feed shops, ice manufacturing plants, clay building products, earthenware and hand tool producers and makers of small concrete products. Medium-sized towns support a wider variety of services including commercial printing, motor vehicle repair and small machine, galvanizing and metal processing shops. Simple assembly, mixing or finishing activities and separable manufacturing operations can also be efficiently located in small towns and cities if they have good transport linkages with larger urban centers.[31]

In Southern Thailand towns from 14,000 to 57,000 in population provide health clinics, small hospitals, postal and district government services, elementary and

secondary schools, small libraries, banks, bus service, telephone exchanges, and some types of vocational and higher education. Although few systematic studies have been done of the "influence" areas of small towns and cities in developing countries, estimates made in South Thailand indicate that the larger and more diversified centers--with median populations of about 33,000--have influence areas averaging almost 10,000 km^2 and serve hinterland populations averaging 630,000. Such centers are linked to up to 22 smaller and less diversified towns within their influence areas.[32]

Studies of the people who migrated from rural villages to small towns and cities in northeastern Thailand found a high level of satisfaction. Most migrants were able to increase their incomes and find better educational and health facilities than in their villages of origin. Although housing conditions in the towns seemed to be of lower quality, the studies revealed that migrants on the whole were "rather pleased with their new life in town," and that among those who migrated voluntarily to small towns and cities "there is widespread satisfaction with the quality of life found at the destination."[33]

Indications that small towns and cities in Latin America can perform important economic and social functions come from Mexico, Bolivia, Honduras and Guatemala. Small cities in Mexico--such as Oaxaca--are important market centers for their regions.[34] The market in Oaxaca, for example, provides outlets for agricultural goods, livestock, nonagricultural products such as fibers and firewood, and a wide variety of artisanal products--pottery, baskets, mats and household and agricultural implements. An impressive array of people find employment directly or indirectly through market activities--carpenters, stonecutters, healers and curers, butchers, blacksmiths, small-parts sellers, and marriage arrangers, mechanics and seed and equipment vendors. The market offers opportunities for farmers to sell their own goods and for a large number of intermediaries to engage in trade. Oaxaca supports traders who buy and resell goods within the market, traders who travel to small rural markets to collect goods for resale in the urban market, and traders who buy goods in the market and resell them door-to-door in town. The market offers opportunities for rural people to shop in stores located on the market's periphery and to visit doctors, dentists, clinics, lawyers and lenders. Wholesalers collect small quantities of local products in the Oaxaca markets and sell them in bulk to retailers in larger cities; they also buy manufactured goods in the city to sell in small lots back in Oaxaca. The city's market and other commercial activities provide employment for field buyers, agents, truckers and small-load haulers.35

Even very small towns in Mexico--those with 2,000 to 5,000 residents--can support minimum basic services that are not available in rural villages--primary schools, medical doctors' offices, health clinics, pharmacies, gasoline stations, secondary schools, cinemas, restaurants, small banks and hotels and in some places dentists, lawyers, veterinarians and technical schools.[36]

The degree to which intermediate-sized towns and cities absorb rural-to-urban migrants in Mexcio depends very much on the settlement structure within states. The degree of primacy has been found to be an independent factor in migration. In those states with the highest degree of primacy more migrants are attracted to the largest city than in states with a more diffuse pattern of urbanization. Studies have found that

> The mere existence of a greater number of medium and large cities in a nonprimate state provides options for maximization of choice which are denied to migrants in a primate state. Migrants pushed from rural areas in primate states do not have the same spectrum of options for settlement and job opportunity.[37]

Field studies of small towns in Honduras and Bolivia indicate that even in the poorest countries of Latin America, towns with average populations of 10,000 to 12,000 can provide basic health, agricultural supply, educational, and commerical services. They are most important as transport and distribution centers and as markets for agricultural products grown in surrounding rural areas.[38] The degree to which markets in small towns facilitate and promote interaction between urban and rural residents is seen in anthropological studies of towns such as Antigua in Guatemala, where the bulk of trade is controlled by rural middlemen and where rural vendors travel long distances to participate in the periodic market.[39]

Similar roles are played by small towns and cities in many African countries. In Tanzania small towns provide the only real opportunities for employment in the nonagricultural sectors. On average about one-quarter of the economically active labor force in Tanzanian towns is employed in agriculture. The other three quarters are in nonagriculture jobs--about 10 percent are employed in manufacturing, about 15 percent in construction, utilities and communications, another 15 percent in commerce, and about 32 percent in services.[40] Small towns in Ghana--like Techiman with less than 20,000 population--are periodic market centers for their rural areas. Wunsch notes in his study of Techiman that trucks come on market day from as far away as

Kumasi, Tamale, and Accra, as well as from rural areas in Upper Volta, Mali and the Ivory Coast. The town supports retail stores, schools, hospitals and a wide range of skilled and semi-skilled craftsmen, including tailors, carpenters, masons and mechanics, physicians, nurses, ministers and civil servants. Larger towns like Obuasi, with a little more than 30,000 residents have a wider range of agro-processing, marketing, service, commercial and informal sector activities. Moreover, it encompasses population that is socially, religiously and ethnically heterogeneous. In the 1970s, it had more than 90 voluntary associations including religious, ethnic, occupational, trade, religious, and recreational associations, unions and trade associations, lodges and secret societies.[41]

The Underdevelopment of Small Towns and Cities in Rural Regions

Growing evidence that small towns and cities can perform the wide variety of functions just described has been accompanied by strong indications that relatively few of them that could promote growth, transformation and integration in rural areas actually do. There is usually a wide gap between potential and actual performance in poorer rural regions.

The settlement systems of rural regions and of many of the poorest developing countries are inadequately articulated and integrated for three basic reasons:

1. Lack of Sufficient Numbers of Lower Order Central Places. As noted earlier, in many countries a large majority of the rural population is scattered in settlements that are simply too small and too isolated to support even basic services and facilities and to perform the variety of functions that larger and more accessible places can and do perform.

Studies of rural settlements in Northern Nigeria, for example, conclude that the vast majority of villages are "too small to provide the minimum population threshold for the successful provision of such amenities as water, electricity, health, postal facilities and educational centers." They also emphasize the fact that villages are "too far apart to be conveniently grouped into one central service system."[42]

In the poorest Latin American countries only a small percentage of rural settlements perform important functions. Studies of Honduras indicate that less than one percent of the country's settlements have a sufficient range of functions to be considered central places for their rural hinterlands. Less than 800 of the nearly 20,000 villages and towns that are non-

central places have more than a few services or facilities that serve their own populations. Moreover, in a sample of 925 towns and cities ranging in population from less than 1,000 to more than 160,000 surveyed in 1980, it was found that 88 percent were non-central places, having from none to less than 12 basic services and facilities. All had populations of less than 5,000. Only 23 towns were market centers and 75 offered services for their own residents.[43]

Similar results were found in surveys of settlements in Bolivia. That country's recent five year plan noted that the majority of urban centers "do not completely fulfill a dynamic role for their respective areas of influence because they do not function adequately as marketing centers and as centers for the diffusion of cultural and technological innovation."[44] A survey of 112 settlements in the Department of Potosi found that about 63 percent did not have a sufficient range of functions to be considered central places. Another 26 settlements were so small in size and lacking in services, facilities and infrastructure that they could only serve their own residents. Only 16 towns had a wide enough range of functions to act as sub-regional or rural service centers and these were not widely distributed throughout the region.[45]

Studies of Melanesia--Papua New Guinea, Vanuatu and the Solomon Islands--found only a small number of towns performing central functions.[46] Studies of the Bicol River Basin in the Philippines yielded similar findings. Of the 1,419 discrete settlements in Camarines Sur and Albay Provinces, only 2 had a sufficient range of functions to act as provincial service centers and only 11 others served significant numbers of people outside of their boundaries. About 43 small towns--mostly with periodic markets--served some residents of their immediately surrounding areas, but over 1,300--about 96 percent--were non-central places. They had average population sizes of less than 1,000 and provided either no services or facilities at all or less than 9, most of which were small-scale residentiary functions.[47]

The underdevelopment of small towns in Thailand creates significant opportunity costs. Douglass points out in his studies of the Central Plain region that the government could use existing administrative districts (amphoe) to organize the 100,000 to 200,000 population usually living in them, and the more than 800 lower order centers ranging in population from 2,000 to 40,000, to create integrated settlement networks linking rural villages to urban centers.[43] He argues that with proper services, facilities and linkages to smaller and larger settlements many towns could "by generating non-farm employment opportunities, increase incentives for local investment and production which

might retain those rural surpluses now being transferred to the metropolis and abroad."[49]

2. Inadequate Distribution of Services and Facilities Among Small Towns and Cities in Rural Regions. Part of the reason that small towns and cities in rural regions are underdeveloped is that they lack essential services, facilities and infrastructure. A survey of the distribution of services, facilities and organizations in settlements in Honduras indicate that less than 7 percent had even the most ubiquitous function, an elementary school, less than 4 percent had a minimal water supply facility and that less than 3 percent had a third-level post office. Less than 3 percent of the 925 settlements surveyed in 1980 had grain marketing facilities, public health clinics, small hospitals, a permanent market or a postal facility. Only about 4 percent had a government store, second class market or complete secondary school, all of which could be efficiently located in small central places.[50] In the Potosi region of Bolivia, only 5 of the 112 settlements surveyed had more than half of the 56 functions found in the largest town. In the Bicol River Basin of the Philippines, less than 1 percent of the settlements had half of the basic services, facilities and infrastructure found in the largest town. Nearly 90 percent of all of the types of services, facilities, organizations and infrastructure in the Basin appeared in less than 20 percent of the settlements. Moreover, nearly 60 percent of these functions could be found in less than 20 percent of the towns that were capitals of their municipalities.[51] These highly skewed distributions of services and facilities are not unusual, they are reported in both small island countries in the South Pacific and poor regions of large countries such as India and the Sudan.

3. Lack of or Weak Linkages Among Settlements in Rural Regions. The relatively small number of settlements performing central functions and the highly skewed distribution of services and facilities would not in themselves necessarily be serious problems if those settlements that do perform central functions were accessible to their rural populations and were linked to each other and to larger cities and towns. In an integrated settlement system, not all settlements provide all services and facilities: people can easily travel to the most convenient next larger center to obtain goods and services that are not located in smaller and less diversified centers closer to where they live. Indeed, the value of an articulated and integrated settlement system is that it is locationally efficient--it allows clusters of services, facilities and infrastructure that cannot be economically located

in small villages and hamlets to serve a widely distributed population from an accessible central place.

But large opportunity costs are incurred in developing countries because of the inadequate number and distribution of small central places. They are exacerbated by weak linkages among those settlements that do perform central functions. Johnson was led in his studies of the settlement system in India to conclude that although that country was not lacking in central places, "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."[52] A similar situation exists in Papua New Guinea, where in the 1970s, there was not a single road network linking towns and villages to each other. The Wards found that "no roads join the northern and southern side of the mainland and the principal towns of the 13 mainland provinces have no road links with any other major town."[53] In some provinces more than 40 percent of the population lives more than a 2-hour overland journey from any town.

In the Bicol River Basin of the Philippines no level of the settlement hierarchy is well integrated with the others. Most of the rural population lives in settlements that are not easily reached by roads. The cost of transporting farm products in interior rural areas is up to six times the amount in areas connected by access roads. Rural settlements are poorly connected to periodic markets and, as a result, they rarely attract people from more than 15 kilometers away. As will be seen later, studies show that as a result of the weak or incomplete linkages among settlements, the health, educational and other facilities located in some towns tend to serve only people living in them or those from nearby barangays (villages). Social interaction among communities is limited, intermunicipal travel is low and trade and communications between the two largest towns in the Basin are weak.[54] The access of rural people to town-based services and facilities was also found to be weak in the Potosi region of Bolivia. Surveys indicate that because of the paucity of central places, the highly skewed distribution of central functions, and weak physical linkages among them, "overall accessibility throughout the Potosi region is extremely low."[55]

Thus, increasing evidence shows that small towns and cities in developing countries can perform a wide range of social and economic functions that contribute to economic growth and social transformation in rural areas and that integrate these rural areas with urban centers. But in many countries the full potential for development is lost because of the paucity of small

central places, the highly skewed distribution of functions among them, and the weak linkages between them and larger and smaller settlements.

SPATIAL POLICY AND REGIONAL DEVELOPMENT

The foregoing analysis suggests that small towns and cities in developing countries can and do perform a wide variety of social, economic, and service functions that are important to regional and national development, although not all towns perform all of these functions and many do not perform them well. Moreover, under proper conditions, small towns and cities can be positive forces for developing their hinterlands, for transforming subsistence rural societies into commercial agricultural areas and for integrating urban and rural economies within developing nations. Creation of industrial "growth poles" in the ways attempted by many developing countries during the 1960s, however, seems to be neither appropriate nor sufficient to generate widespread development. Service, distribution, commercial, marketing, agro-processing and other functions may offer a far better base for stimulating the growth of towns and cities in rural regions than large scale manufacturing.[56]

And even if industrialization is one of the means of promoting the growth and diversification of small towns and cities, it is clear that the economic activities encouraged within them must create and serve regional demand as well as external markets. Although cities can have a strong and pervasive influence on the development of their regions, their areas of influence are clearly limited and the impact of urban centers on villages and rural populations declines with distance. Stohr's studies of diffusion influences in Latin America suggest that the spread effects from intermediate cities tend to deteriorate rapidly;[57] Gilbert's studies of the development impacts of the second largest city in Colombia found that they were highest within a 25 kilometer band around the city and dropped sharply for towns and populations located more than 50 kilometers away.[58]

Thus, the creation of selected industrial "growth poles" in rural regions is not sufficient to stimulate widespread economic growth in rural areas, nor to spread the benefits of development throughout a region. Because the spread effects tend to weaken rapidly with distance, a system of towns and cities--in which larger settlements are linked to rural villages and farm settlements--seems necessary to ensure wider diffusion of innovation, the stimulation of economic activities in rural areas and greater access for rural people to town-based services and facilities. Stohr argues that the only urban centers in Latin America that have been able

to act effectively as regional growth centers are those that have developed a combination of externally-oriented and regionally-based economic activities. These towns and cities, "while producing for extra-regional (national or international) demand, usually possess sufficient integration between regional supply factors (capital, technology, labor, societal innovation) and regional demand (effective purchasing power) to provide for self-sustained growth."[59]

Regional development policies must be focused on increasing agricultural production and the marketing of agricultural goods, supporting small-scale agro-processing industries and diversifying the economic base of market centers. Activities must be organized to link town-based enterprises with rural supply areas and to make services, facilities and inputs essential for agricultural production and marketing easily accessible to rural populations living at low densities or scattered widely over the landscape. Investment in farm-to-market roads and all-weather access roads are essential to linking rural areas and central places. Attention must be given to providing water, basic housing, health and social services in towns to increase the productivity of the labor force. Attention must also be given to providing off-farm job opportunities and urban amenities that will keep people in rural areas.[60]

Not all small towns and cities can or should be developed as central places, nor should they all have a full range of services, facilities and infrastructure. As noted earlier, one of the benefits of an articulated and integrated settlement system is that it provides access to a wide range of functions without each settlement having to provide them all. Thus, regional development requires careful planning to ensure that essential services and facilities are provided in strategically located settlements and that these places are linked to their rural hinterlands. The Urban Functions in Rural Development approach to spatial analysis can help planners to make better locational decisions.

The rest of this book describes the UFRD approach to regional planning. Chapter Two examines in more detail the conceptual framework, procedures of planning and characteristics of the UFRD methodology. Chapter Three outlines methods and techniques of macro-regional analysis; Chapter Four surveys the methods of analyzing the settlement system and the distribution of functions among settlements; and Chapter Five describes approaches to identifying and assessing the strength of linkages among settlements and between them and their rural hinterlands. In Chapters Six and Seven the applications and implications for implementation in a regional setting are examined.

NOTES

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2
The UFRD Approach to Regional Planning

Urban Functions in Rural Development (UFRD) emerged from a series of pilot projects sponsored by the U.S. Agency for International Development (USAID) during the late 1970s and early 1980s. The projects that were initiated in the Philippines, Bolivia and Upper Volta drew heavily on experience with similar approaches to planning in other developing countries. They were motivated by the recognition that despite the economic and social progress made in much of the developing world during the previous two decades, a substantial portion of the population in the Third World still lives in dire poverty. In many countries, the gaps between the richest and poorest groups continue to widen. The World Bank estimated that the number of people living in absolute poverty--"a condition of life so characterized by malnutrition, illiteracy and disease as to be beneath any reasonable definition of human decency" and in which people survive on a per capita income of less than $75 a year--at 780 million in 1980. This represents an increase over a decade of 30 million people living at or below subsistence levels. Millions more people live in relative poverty, with incomes substantially below the average of their countries.[1] According to studies undertaken by the International Labor Office (ILO) the incomes of many of the poorest families in Asia fell during the 1970s and the percentage of rural population with incomes below the poverty line increased. Inequities in the distribution of income and wealth in some developing countries were more pronounced by the mid-1970s than they had been 15 years earlier.[2] The UFRD projects were aimed at both helping to alleviate rural poverty and to increase productivity and income in rural regions.

THE DIMENSIONS OF UNDERDEVELOPMENT IN RURAL REGIONS

About 85 percent of the people living in absolute poverty in developing countries can be found in rural areas. The distribution and severity of poverty in developing countries are closely related to levels of agricultural productivity and regional resource development. In most poor regions people have limited access to the natural and man-made resources needed to satisfy basic needs, increase productivity, diversify economic activities and raise incomes. Growing disparities can be seen in levels and rates of economic growth between those countries and regions that have been able to mobilize and use their resources effectively to stimulate agricultural and industrial development, and those less able to do so. Serious disparities in levels of living also appear between urban and rural areas and among subnational regions with different levels of resource endowments and productive assets.[3]

Ironically, the majority of the poor live in areas with relatively favorable climates and with potentially productive resources. They remain poor because they lack access to the means of procuring, transforming or distributing those resources more effectively.[4] 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 disadvantage in competing with other regions in national or international markets.

In much of the developing world 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."[5] Severe pressures on land resources from high rates of rural population growth are expected to continue in areas with the highest levels of poverty for the rest of this century.

But problems also arise from inefficient use of existing resources: from the inability to identify productive uses for indigenous renewable resources or from inefficient resource transformation and delivery. Inefficient use of labor--its low productivity and sporadic employment--is perhaps the most apparent example of underused resources in rural regions. 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."[6] The intense competition for available resources is often exacerbated by lack of credit facilities and

marketing outlets for small farmers and entrepreneurs, the inadequacy of cooperative organizations or other arrangements for selling goods or obtaining inputs, poor communications, insufficient physical infrastructure and poorly organized agricultural research and extension services. Most subsistence activities, moreover, depend on manual labor or animal power; the technology needed to transform resources and increase productivity are not available to the rural poor. In addition, the administrative and institutional arrangements needed to provide and maintain services, facilities and infrastructure are often missing or inadequate.[7]

As noted earlier, the rural poor generally lack access to town-based services and facilities that would allow them to increase their productivity and to market their goods. Their limited access to market towns and small cities, in which the services and facilities they need to promote rural development are located, places rural people at a serious disadvantage.[8]

By the mid-1970s many governments in developing countries and most international assistance organizations recognized that if they are to ameliorate rural poverty, integrate poor regions into the national economy and increase agricultural productivity, they must promote development in a way that supports the internal growth of rural economies.[9] Redistribution alone does little to overcome rural poverty of the magnitude found in most developing countries. The emphasis on equitable growth that emerged during the 1970s requires the development of new resources in rural regions and the steady inclusion of marginal and subsistence populations in productive economic activities.[10] This in turn requires extensive investment in physical infrastructure, services and productive activities in rural regions, located strategically in intermediate-sized cities, smaller towns and rural market centers. The growth of "rural service centers" that link towns to rural hinterlands must also be encouraged in order to increase the access of rural people to basic services and facilities.[11]

The investments, moreover, have to be located in such a way as to create an articulated and integrated regional settlement system capable of (1) strengthening markets for agricultural goods and other rural resources; (2) distributing more widely 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) creating 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) slowing the rate and altering the pattern of rural to urban migration.[12]

Those within the U.S. Agency for International Development who promoted the UFRD pilot projects recognized that spatial and locational factors were crucial to the success of rural and regional development and that urban centers played an important role in rural transformation. "In addition to being 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 concluded that rural populations "without access to fully functional and efficient centers are denied their full development potential."[13] Strengthening the linkages between rural areas and urban centers can extend services and facilities into rural areas and expand markets for agricultural products. Major economic linkages for rural areas are established almost entirely through urban activities and institutions, making cities essential components of any strategy for developing rural regions. "The system of cities and towns in any country is a totality," USAID's Working Group on the Rural Pool pointed out. "There are a number of linkages and interdependencies between the essentially rural based centers at the lower end of the urban hierarchy and the larger cities in the urban system which ought to flow in both directions, up and down the hierarchy."[14] But the critical problem in most developing nations is that almost all linkages needed to promote and sustain agricultural growth are downward, because the lower levels of the national spatial system are neither well-developed nor properly organized. USAID strategists argued that in most developing nations villages are too small to support the services needed for growth, that vertical linkages between farms, small towns and cities which could provide rural areas with needed services and facilities and link them to the national economy have been neglected in previous development strategies, and that linkages must be created between rural settlements and urban centers if development policy is to succeed.[15]

The importance of the spatial dimension of equitable growth policy was strongly confirmed in research conducted for USAID in the mid-1970s. The study found that settlement systems in many developing countries were not conducive to widespread regional development. Although metropolitan centers and smaller cities could play important roles in facilitating economic growth, in most less developed countries they were not widely dispersed and were often weakly linked to rural hinterlands. Thus, the rural poor generally lacked access to

the services, facilities and productive activities concentrated in them. As a result these towns and cities did not provide the stimuli needed to develop new resources, increase agricultural production or generate new employment.[16]

The report also emphasized that locational factors, which were often overlooked or neglected in rural development planning, were crucial in implementing regional development programs effectively. It noted that proper location of public services and facilities and private investment stimulates development in a number of ways. Even within relatively small and homogeneous countries, regions differ in their suitability for, and attractiveness as, locations for investment. The creation of locational advantages in the future depends in part on past decisions--on the quantity and quality of facilities available for production, and on the existence of infrastructure and services that attract and support investment. Although suitable natural resources--land, water and mineral endowments--must be available, man-made facilities are also crucial. The existence of a transport network, of rail, air, water and highway linkages, for instance, determines the cost of moving raw materials from supply sources to points of production and finished goods to distributors and final markets. Public investment in water supply, waste disposal and energy helps determine the productivity of the labor force and of economic enterprises. Social services can contribute to the quality of human resources and to general standards of living in the community.[17]

The report pointed out that in developing nations the proper location of services and facilities is particularly important, for with scarce resources, limited administrative capability, increasingly urgent needs to expand food production and manufacturing, projects must be assessed not only by their efficiency and feasibility, but also by their "multiplier effects."

Distribution of services and facilities is crucial not only for promoting economic growth, but also for achieving social equity and improving the quality of life. Disparities in economic and social well-being are often measured by the number and diversity of productive and social functions located within a community or region. The growing gap between the richest and poorest groups in developing nations is largely attributable to differences in access to productive activities and social services. In a policy paper on rural development, World Bank officials argue that any strategy for dealing with poverty in the Third World, to be effective, must recognize that "the need for special intervention to raise rural production and income applies also to the provision of social and other

services, such as health and education. . . . Compared with urban areas, rural areas have a smaller share of economic infrastructure services such as domestic water, electricity and waste disposal." And even in areas where services do exist, Bank analysts observe, "the poor often do not have access to them because organization is inadequate and the cost is high. A special effort is needed to provide appropriate social and economic infrastructure for the rural poor, and it is important to integrate these components into rural development projects."[18]

The USAID report proposed a general framework for analyzing 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 services and facilities needed at each level of the spatial hierarchy and the means of providing better access for the rural population 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 because of 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 policymakers in rural regions.

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

1. Analysis of Regional Resources and Characteristics: 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 Settlements: including the location of market towns, small cities, intermediate or regional centers; 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 labor force and income distribution characteristics of settlements; and,

3. Analysis of Spatial Linkages: including physical, economic, population movement, technological, social service delivery, political and institutional interaction patterns among settlements within the region, and linkages with urban centers in other regions.

A number of specific analytical techniques, and the types of information needed to apply them, were

also described. The report emphasized, however, that the pilot projects should be tailored to the needs and constraints found in the regions under study. A pre-designed package of methods could not be imposed; methodology should be designed in collaboration with local planners and researchers only after initial data inventories and surveys of available information were conducted.[19]

CONCEPTS USED IN THE UFRD APPROACH

The Urban Functions in Rural Development approach used in the Philippines, Bolivia and Upper Volta drew on central place and service center concepts described in Chapter One. Among the most important assumptions underlying these concepts are the following derived by Roy and Patil from their studies of spatial development in India:

1. People are distributed in various size settlements in space;
2. They have bio-physical as well as socio-economic needs;
3. They utilize physical and human resources, i.e., goods and services to satisfy their needs;
4. They form settlements in space in the form of homesteads, hamlets, villages, towns or cities and continue to stay together as long as resources are adequate to meet their needs;
5. They utilize resources for basic needs which are limited or wants which are unlimited; and,
6. They go to other places in search of goods and services that are not (or cannot be) available in their own settlements.[20]

Other important assumptions were, as noted earlier, that central places--market towns, small cities, regional centers and metropolitan areas--all play important roles in regional economic and social development. Their number, geographical distribution and functional characteristics are crucial factors in the way regional development occurs and in its pace and pattern. Moreover, the linkages among settlements must be strong if access to services and facilities located in central places is to be extended and if social, political, economic and physical interaction among centers of different sizes and specializations is to be enhanced. Three types of linkage are especially important:

1. Those between a central place and its surrounding rural areas (hinterland);

2. Those among central places within a region (internal); and
3. Those between central places within a region and places outside the region (external).

The UFRD approach employs a number of concepts of regional economics and geography which are defined in the following way.[21]

Urban functions are those services, facilities, infrastructure, institutions or economic activities that must be located in settlements of some minimum population size in order to be offered economically and efficiently. Some functions serve only the residents of the place in which they located and are called local or residentiary functions; others serve a larger market or the residents of other settlements and are called basic or central functions.

Settlements with a significant number of basic functions are called central places. The number of people required to support a function, or a combination of functions, is called a threshold population level. Each function has a different population threshold. Some provide daily goods and services and require only a relatively small number of people to make their operations profitable and efficient. Large numbers of these functions are found in a region and some are located in nearly every settlement. Others offer goods and services that are rarely needed or that are expensive to produce or deliver. These require large market areas and populations to support them and are located only in larger urban centers. The degree to which a settlement acts as a central place depends, therefore, on (1) its number, concentration and diversity of basic functions; (2) its population size and density and the size of the population in its market or service area; (3) the volume of interaction among activities located within it and with similar complementary functions in other locations, and (4) the degree of convenience it offers as a point of interaction among people living in the geographical area in which it is located.

Generally, the larger the number of basic functions located in a settlement, the greater their diversity and the higher their population threshold, the higher is the settlement's centrality. A central place consists of a core area in which basic functions are physically located, and service area or hinterland from which people come to avail themselves of services and facilities located in the central place. The market, service or hinterland area--sometimes called a complementary region--is determined largely by distance, cost of travel, and the ranges of services and facilities provided in a center. "The range of a good is the farthest distance a dispersed population is willing to

go in order to buy a good offered at a place," Berry and Garrison point out.[22] Other things being equal, the range will be lower if there are competitive goods being offered by nearby centers. Usually goods and services will have a larger range in larger places and a smaller range in smaller places. "Range is actually a ring with an upper limit beyond which a good can no longer be obtained from a center, and a lower limit which is determined by the minimum amount of consumption which is necessary before production or offering the central good will pay."[23] Settlements within a region can be ranked in a hierarchy, based on their levels of centrality. The service areas of central places can be determined and the degree of interaction or trade among them can be estimated.[24]

Regions that have a well developed hierarchy of central places--settlements of different sizes with different combinations of central functions--are considered to have more articulated spatial systems. For various reasons such as a unique location, an important natural resource base, or large numbers of people with particular kinds of skills, some settlements achieve a larger concentration of one or two functions than others, and are considered to be functionally specialized communities. They may be industrial, commercial, administrative, mining or agricultural marketing centers in which a large percentage of local residents are employed in producing goods or providing services of a particular type. Strong trade linkages usually develop among such highly specialized centers.

Those regions in which all, or nearly all, of the population have easy access to at least one central place, in which the service areas of the larger centers "overlap" with each other and encompass the service areas of small centers, and in which the central places of different sizes are physically linked with each other in such a way as to allow their populations to interact, can be considered integrated.[25] In an integrated and articulated region, "there is a system of central places comprising several size-types, determined in general by the spatial effects of the upper and lower limits to the range of central goods," Berry and Garrison observe. "Lower order centers and their complementary regions 'nest' within those of larger centers."[26]

The degree of integration in a spatial system depends, therefore, on the degree of articulation in the settlement hierarchy, the distances among centers, the effective access that people have to other centers, and the diversity and magnitude of functions within centers. Thus, integration is primarily determined by the amount of interaction that takes place among settlements within a region. In turn, integration is

an indicator of the degree to which a region has a viable internal economy and participates in mutually beneficial interaction with external regional or national economies.

There is also a minimum population size and service area below which settlements are not able to supply central goods and services. These settlements usually only offer ubiquitous functions for their own residents, or may offer nothing more than the benefits of mutual security from having houses and families clustered together in spatial proximity. Service center theory suggests that the lowest order central place is one that provides basic inputs for agricultural producers. In its guidelines for rural service center planning, the UN Economic and Social Commission for Asia and the Pacific suggests that they perform the following functions: (1) facilities or arrangements for the marketing and collection of agricultural surplus production; (2) services and facilities for the distribution of essential farm inputs such as fertilizers, tools, implements, and credit; (3) services and facilities for basic agricultural processing both for subsistence and commercial purposes; and (4) services and facilities that fulfill basic human needs.[27] Those settlements that do not offer these basic services and goods are considered to be <u>non-central places</u>.

There are few, if any, absolute standards for measuring these characteristics of a regional system. All are relative concepts and must be defined within the social, economic, physical and cultural context of the societies in which they are examined. Spatial and economic factors are closely related in the development of regions in nearly all societies, however, and effect each other over time. The degree of articulation and integration in a settlement system depends on past rates and patterns of economic development, which in turn have been influenced by the interaction of people, the performance of activities and the flow of resources in geographic space. Thus, over time, the pattern of economic development in a region strongly influences the pattern of spatial development, which shapes the future rate and direction of economic growth and the distribution of its benefits among people and places within the region.

THE PROCESS OF SPATIAL ANALYSIS

Urban Functions in Rural Development is a process of analysis and planning that involves the following stages or phases:[28]

1. An overall regional resource analysis and socioeconomic and demographic profile that serves as a

data inventory for planning purposes and as a "baseline" study for monitoring and evaluation;

2. An analysis of the existing system of settlements, describing its elements, 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 region and between them and centers 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 nonexistent, and of marginal areas that are unserved by central places or in which rural populations have poor access to town-based services and facilities that are crucial for regional development;

6. Comparison of information from the regional resources survey, settlement system, functional distribution and linkage analyses to regional development plans and objectives to (a) determine the adequacy of the spatial system to meet development needs and facilitate equitable growth and (b) identify major "gaps" in the spatial system, in service areas for crucial functions, and in linkages among subareas of the region;

7. Translation of the spatial analyses into investment proposals that identify the projects and programs 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 coordinated "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 programs, and for determining the substantive results of development activities on areas and population groups within the region; and

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.

These phases of the process evolved from experiments with spatial analysis in the Philippines and Bolivia. However, they should be seen only as guidelines for regional development planning rather than as a "tool-kit" of methods or an invariable series of steps that must be followed slavishly in every situation. Each region has different problems and characteristics, and planning agencies in every region have different capabilities and requirements for information. Thus, the UFRD approach can only provide a point of departure for analysis rather than a comprehensive model. In some areas, such as the Eastern Region in Upper Volta, only some of the stages and methodologies were used. In Bolivia, new methods and techniques and different approaches to analysis were added to those applied in the Philippines. In some countries the analyses suggested here can be expanded and followed by more detailed and comprehensive studies. In other situations, a "quicker and dirtier" version of the approach can be applied to gather essential information rapidly. More systematic approaches can be used later when more time and resources are available.

Thus, although the chapters that follow describe the UFRD approach in the sequence described above, it should be remembered that in any given region the process should be tested anew and adapted or tailored to local needs. Other appropriate methods and techniques can be added to or substitute for those that are described here. The ultimate objective is to develop a process of spatial analysis that can be used effectively in local planning and decision-making and that can be adapted and up-dated as time goes on.

CHARACTERISTICS AND PRINCIPLES OF UFRD

The UFRD approach is based on six principles or characteristics, some of which are inherent in its conceptual framework, some of which have emerged from early field testing, and some of which arose from experience with applying similar methods of analysis in other countries. Among the principles underlying UFRD are the following:

1. UFRD should focus on the spatial and locational dimensions of regional development and be primarily a "place-oriented" form of planning and analysis.

Unlike most forms of regional planning used in developing countries, UFRD focuses primarily on the spatial and locational dimensions of regional development. It seeks to add a spatial dimension to the sectoral and technical planning that is more frequently

done in developing countries. UFRD is used to analyze a regional settlement system in order to determine the degree to which settlements of different sizes and functional characteristics are accessible to people living in different areas of the region and the degree to which those settlements are linked to each other and to their rural hinterlands. The information gathered through spatial analysis can give sectoral and technical planners a framework for locating services, facilities, infrastructure and productive activities more effectively to serve a larger number of people and to strengthen the settlement system's capacity to facilitate spontaneous or induced development activities.

The UFRD approach is a process of regional spatial analysis that gathers information about four basic questions:

a. How are functions (services, facilities, infrastructure, socioeconomic activities) distributed geographically among settlements or communities?
b. How much physical access do residents of settlements and of rural areas surrounding them have to the functions located in central places?
c. How widely do services and facilities located in settlements throughout the region serve their rural hinderlands? and,
d. How can the distribution of functions and of settlements be improved and how can physical access of rural residents be increased?

The UFRD approach is primarily descriptive; it is a means of gathering information about the spatial system that will contribute to normative or prescriptive plans. As Fass noted in his review of the UFRD approach in Upper Volta, "where the UFRD concept and method differs from more conventional sectoral approaches is that it does not presuppose which of the 'functions' would have the most significant effects, does not presuppose which of the effects are most appropriately called 'significant' and does not presuppose that the same set of functions can be, or ought necessarily to be, universally applied in all places."[29] UFRD attempts to find out "what is located where" as a means of analyzing better how to achieve what planners and policy-makers conclude "ought to be." Moreover, the UFRD methodology is based on the assumption, as Fass notes, that "in any region there is heterogeneity and that social, economic, or environmental circumstances can vary considerably. Thus, the kinds of functions which would be appropriate to and or

strengthen one place might not necessarily be the same in another. In other words, the UFRD concept is 'place specific' rather than sector specific and represents a kind of integrated or multisectoral approach to rural development."[30] In asking "what kinds of functions are located where?" the analyst is implying that some of the missing functions provide opportunities for new investments. But it should be remembered that more intensive studies than those encompassed in the UFRD approach must be carried out to determine whether or not the lack of services and facilities in some places is a problem. Much depends on what sectoral, technical and regional planners and local residents want to accomplish through regional development activities.

2. The UFRD approach should seek to create an ongoing planning process rather than to produce a comprehensive regional development plan.

Because the objective of the UFRD methodology is to add a spatial and locational dimension to regional analysis and planning, it should not be seen as a process that will produce a comprehensive regional development plan or supplant sectoral, program or technical plans. Spatial analysis can complement and strengthen other forms of planning and provide locational guidelines for the formulation, design and allocation of investment projects. Although the spatial analysis must be presented clearly, sometimes in the form of a spatial plan, UFRD is most effectively used as a method of assessing the spatial distribution of services, facilities, infrastructure and productive activities among settlements in a region on a continuing basis. To do a spatial analysis once and present it as a long range plan for regional development both ignores the realities of the decision-making process in most developing countries and makes the analysis static rather than dynamic. In a sense, UFRD presents a picture of the spatial structure of the region at the time the study is completed. But the spatial system within regions changes continuously as economic, social, political and physical changes occur. Thus, spatial analysis must also be continuous in order to provide a better understanding of those changes. Although the emphasis of the following chapters of this book is on the methods and techniques of spatial analysis and planning, it should be kept in mind that they are less important than the process for which they serve merely as instruments.

3. UFRD should be a process of spatial analysis that is policy- and problem-oriented and indicative and adjunctive in nature.

The planning activities and spatial analyses embodied in the UFRD approach should be attuned to the decision-making processes and requirements of regional planning agencies, regional offices of national government ministries and agencies, provincial and local governments, private investors and community groups that are involved in making investments and location decisions in a region. The analyses can be used to add a place-oriented dimension to sectoral and technical planning as well as provide a framework for making better regional development decisions.[31] As such, UFRD is strategic rather than comprehensive planning, it is an adjunct to other forms of analysis and planning in which private organizations and government agencies are already engaged.

Rather than leading to a long range comprehensive plan, adjunctive planning seeks to facilitate interaction among a wide variety of organizations and interests within a region, focus attention on solving remediable aspects of known problems, identify courses of action that move marginally and incrementally--through successive approximation--away from unsatisfactory social and economic conditions, especially when "optimal" or ideal goals cannot be agreed upon. It is used to explore alternatives upon which diverse interests can act jointly.[32] Strategic planning seeks to disaggregate problems into decisions that can be made incrementally and that can be dealt with through discrete but related investments over a long period of time.

To be most effective, the UFRD approach should be used in a way that elicits widespread participation--not only of national, regional, provincial and local governments, but of private sector organizations and community groups as well. Technical analysis alone will not provide "answers" to locational questions about investment and development activities. It will merely provide information that can be used by various groups within a region to make more informed decisions.

In this sense, UFRD should be seen as a process of learning about the settlement system and the distribution of functions among communities within a region. UFRD is a process of indicative planning. It should lead planners and policy-makers to ask better and more informed questions about why the spatial system and geographical distribution of functions exist as they do; how changes might be brought about by reinforcing the growth of existing settlements or stimulating the development of new ones; what types of investments might be needed in different places; when it is possible for communities to support new functions or combinations of activities; and which organizations and

agencies might play an important role in helping them to do so.

Ultimately, rather than providing answers to these questions or solutions to regional development problems, the UFRD approach allows planners and policy-makers to gather important information quickly, and to ask more refined and detailed questions that will help them make better judgments from a spatial or locational perspective. Being adjunctive, indicative and focused on the spatial dimensions of regional development, UFRD must be used in combination with other forms of economic and social analysis in order to be useful for policy-making and problem-solving.

4. The UFRD approach should use research methods and techniques that are easily applied by regional planners and easily understood by policy-makers.

UFRD's analytical techniques are intended to be used in applied policy analysis and to be appropriate for the relatively low levels of planning capacity found in most developing countries. Those tested in the USAID pilot projects in the Philippines, Bolivia and Upper Volta were designed to avoid many of the limitations of the sectoral systems analysis and regional planning models used by USAID during the 1960s and 1970s. Those models were found to be of limited value for project and program planning. Sectoral systems analysis and comprehensive planning models came under increasing criticism during the 1970s because they were usually inappropriate for the conditions in and needs of developing countries. Evaluations indicate that there were severe difficulties in obtaining adequate and reliable data by which to make the models operational. Most of the sectoral systems studies had to be designed and applied by contractors or Western experts because of the shortages of professionals in developing countries trained in systems analysis and regional economics. Moreover, the models could not be easily calibrated, not only because of the lack of adequate data but because the models were often too complex or comprehensive in scope. Analysts had to use inaccurate, unrealistic or greatly simplified assumptions about sectoral activities or regional economies that made the results of limited value to government officials. Few policy-makers below the central government level, or within international assistance agencies, fully understood the models, the results of their application, or their policy implications. As one USAID evaluation concluded, "computerized sector models are rarely understood by more than a half score of people in many LDCs and these are unlikely to be decision-makers. And what people do not understand

they may well be skeptical of and the approach itself may be self-defeating."[33] Thus, few governments used the results of sectoral or regional systems analysis in decision-making and project design.

The UFRD approach was designed to reflect the fact that decisions are made continuously; they rarely await comprehensive and systematic analysis. Information must be gathered and analyzed quickly if it is to influence regional investment decisions. UFRD is based on the assumption that studies done to influence decision-making cannot rely on time-consuming, sophisticated and costly techniques. Nor can they use methods that impose overly complex, costly or time-consuming requirements on planners and policy-makers. They must, instead, adopt methods and techniques that are relatively easy to apply and that do not require sophisticated equipment or high levels of technical skill and training. If the results are to be useful in regional planning and decision-making the analytical methods must be applied quickly, make use of calculations that can be done manually or with easily acquired and operated equipment such as desk calculators or simple micro-computers. They should be relatively easy to learn by planners and their results should be comprehensible to technical planners who lack special training in spatial or regional analysis and especially to government officials and local leaders who may not have high levels of formal educational attainment. In most developing countries, the methods most likely to meet these requirements involve descriptive statistics that can be presented easily in maps, charts, graphs and tables.

5. The UFRD approach should use as much existing data for analysis as possible and limit new data collection to areas where significant information gaps appear.

Regional and sectoral planning are often criticized for being merely extensive data gathering exercises. They often take years to complete and are not well structured at the outset, so that only the most important information for decision-making will be collected. As a result, data gathering and statistical analyses often become ends in themselves. Many of the data collected are never analyzed and much of what is analyzed is never used. Moreover, a careful search of government offices and organizations in a region often uncovers similar data already collected for other purposes or information that could have been used for regional planning that was collected for special studies, feasibility analyses or previous investment decisions.

The UFRD approach attempts at the outset to inventory existing data and to make as much use of them as possible in spatial analysis and regional planning. New studies are designed and carried out only when crucial "information gaps" appear. As will be seen in Chapter Three, the emphasis at the beginning of the planning process is on inventorying and ordering existing data, on identifying information needs and on tailoring new data collection activities that are focused on specific spatial and locational issues. In the UFRD approach data collection is seen as an instrument for better decision-making and not as an end in itself.

6. The UFRD approach should use a combination of analytical methods and rely heavily on "ordinary knowledge" about the area under study.

In situations where analysis must be done under severe time constraints and with limited resources, it is not possible to engage in comprehensive, systematic and long term research. Policy proposals must be produced quickly if they are to influence investment decisions. Usually, formal statistical analyses must be replaced or supplemented with "softer" methods of qualitative analysis, participant observation, interviewing of key informants, short case studies, and descriptive analyses. Planners must be encouraged to be creative in developing methods of information gathering that are suited to the conditions and needs of the area in which they are working. They must employ a wide variety of techniques for collecting data, and cultivate and use their own knowledge of the region in arriving at judgments and conclusions. They must elicit information from a variety of sources. Under such conditions planners must depend heavily on what Lindblom and Cohen call "ordinary knowledge", that is "common sense, casual empiricism or thoughtful speculation or analysis."[34] They point out that although such knowledge is not derived from systematic, scientific research it is information that is commonly held by people who have lived in an area and which is used "as a basis for some commitment to action."[35] More formal scientific inquiry usually only modifies and never fully replaces ordinary knowledge in decision-making; therefore, effective methods of spatial analysis and regional planning must draw on both.

The UFRD approach makes heavy use of techniques and methods of analysis--especially in describing the settlement system and distribution of functions among settlements--that can substitute easily gathered qualitative and ordinal information for quantitative data needed in more sophisticated techniques. Such methods

as scalogram analysis, which is described in Chapter Four, require only information about the presence or absence of functions in settlements. Unlike factor analysis, which is used in many studies of settlements systems in scholarly or academic research, scalogram analysis does not require quantitative data. Yet, Voelkner and others have found that simple scalogram studies can often produce results that are highly correlated with those of more complex factor analyses. Voelkner notes that "factor scores per community have a very high correlation with scale scores and that if mapped produced nearly exactly the same development contours." Where quantitative data do not exist or cannot easily be collected, or where studies must be done quickly and cannot await the collection of quantitive data, less complex methods such as scalogram analysis can produce comparable results.[36] Collecting information on the presence or absence of functions or activities does not require highly sophisticated surveys; information can be gathered from key informants or from local residents. Voelkner points out that drawing an ordinary knowledge is essential in many rural regions and commonly yields more reliable information than formal surveys:

> Professionals working in the field with rural development have often experienced that traditional populations do have an acute awareness of many relevant data on their social and physical environment. This awareness is in terms of the presence or absence of clearly recognizable phenomena especially material manifestations of structure or behavior. Rural people recognize when wells or rivers dry up more often than before, when rivers become too dirty for drinking, washing or bathing, when fields become infertile or erode. They also know where they are able to obtain agricultural production inputs and whether they can afford them or not. Similarly, they know where to obtain essential items for living, whether for housing, or clothing or sickness. They know whether in their own community or how far away are such services as a dispensary, a school, or a variety store. Quite often, they also know who in the community has a radio, or whether anybody uses synthetic fertilizers. In the close proximity in which people live in traditional society, there is little that remains secret to community knowledge, even whether and which contraceptives are used for family planning.[37]

Although the UFRD approach makes use of formal statistical techniques and surveys whenever possible, it does not rely on them exclusively. A wide variety of methods, both "hard" and "soft", must be used to gather the kinds of information that will be useful for regional planning and development decision-making. UFRD is less concerned with achieving scholarly standards of research than with gathering, classifying and assessing information about spatial and locational dimensions of regional development in as effective a manner as possible and presenting it in forms that are understandable to the people who participate in regional planning and decision-making.

In Chapters Three, Four and Five, the methods and techniques that were tested in the Philippines, Bolivia and a few other countries are described and their uses are examined. In each chapter the methods and techniques used in the UFRD approach are identified and described and illustrations of their application and results are drawn from two pilot projects--the Bicol River Basin in the Philippines and the Department of Potosi in Bolivia.

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3
Regional Resource Analysis

If one does not already exist, it is useful to begin the study of a region by creating a profile of socioeconomic and physical conditions. In the UFRD approach, a "macro-analysis" of a region is based primarily on data that have already been collected. The information is organized into categories that enable planners and policy-makers to analyze the region's level of development compared to other regions in the country and the levels of development of various areas within the region. This "regional profile" serves three important purposes. First, it encourages planners to make a thorough inventory of existing data in censuses, special studies, project analyses, feasibility studies and other reports about the region. The information is used not only to create a profile of conditions within the region but also to formulate programs and projects in later stages of spatial analysis and regional planning. The exercise gives planners an overview of the region and an appreciation of the kinds of information that have already been gathered. Time and money can be saved by not duplicating studies that have been done or that yield information that can be used for other purposes. Second, the data gathered through this exercise can be compiled into a regional statistical compendium that can provide planners, government officials, private investors and community groups with information about the region that previously had been scattered in inaccessible or little-known reports. Third, the profile provides a baseline analysis of conditions within the region that can be used later in assessing changes that result from regional development programs and projects.

More specifically, the objectives of creating a social, economic, demographic and physical profile of a region are to:

1. Describe the overall strengths and weaknesses of the regional economy by assess-

ing the types, characteristics and distribution of human and physical resources;
2. Compare the level of development of human, economic and physical resources of the region with those of other regions in the country;
3. Determine the relative position of the regional economy within the national economy;
4. Identify subareas of the region with particular strengths and weaknesses for development, with lagging or underdeveloped economies, and with higher than average levels of poverty;
5. Compare the distribution of human, economic and physical resources and their levels of development among administrative jurisdictions or market areas within the region; and
6. Identify historical trends and changes in the development of the region that help explain its position in the national economy and the conditions of communities within it.

Such an analysis can also help to classify regions within the country, or areas within a region, by various socioeconomic and physical characteristics. This can help planners and policy-makers to understand the region's unique circumstances and its relative position within the national space-economy.

ORGANIZING A REGIONAL PROFILE ANALYSIS

Data on the human, social and physical resources of a region can be organized in a variety of ways. No single approach is universally correct or always useful: much depends on the amount and quality of information available, the types of problems or issues that are important to local and regional planners, and prevailing concepts of the region's potential for development. Since the purpose of creating a regional profile is to collect and order information in ways that will assist planners and policy-makers to understand better the conditions of areas within the region and the dynamics of growth or underdevelopment, the choice of methods for organizing it should be based on local judgments about which approach is likely to achieve those objectives most effectively.

Ultimately, however, prevailing concepts of the region's potential for development inevitably influence the ways in which planners and policy-makers think about policy problems and determine how information is

organized and interpreted. Alternative perceptions of regional development allow planners to determine what information to collect, how to organize it and how to interpret it. Some of the major concepts and their implications for collecting and categorizing information include the following.

Regions as Agricultural Production Systems

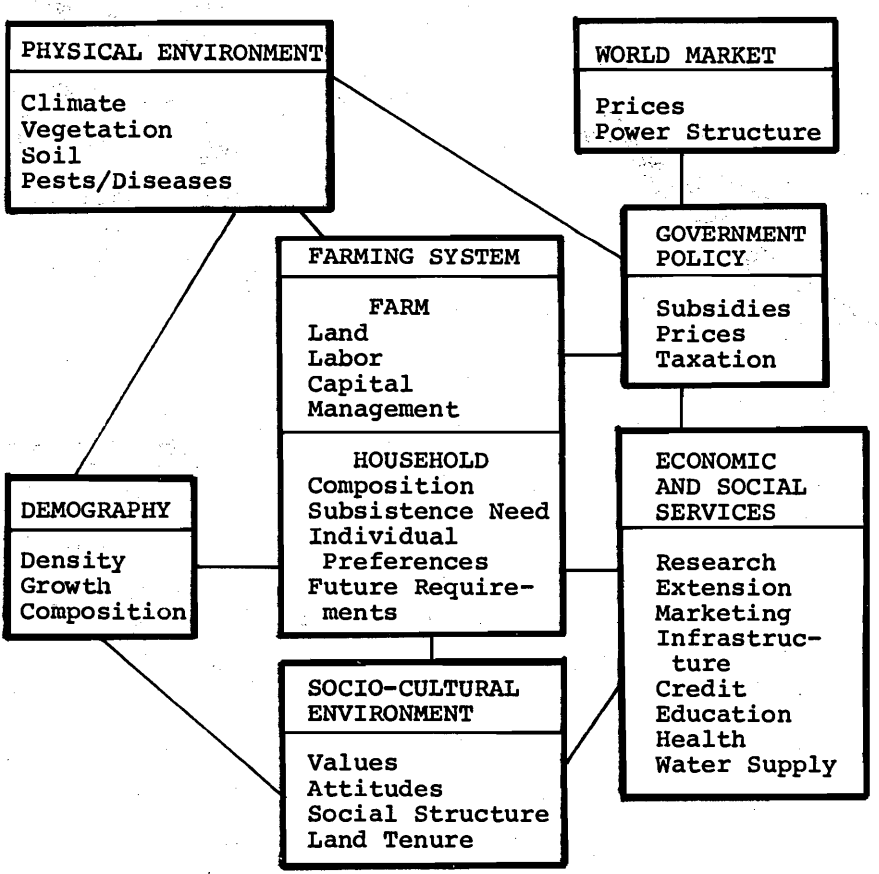
One view of regions, especially in countries that are predominantly rural, is that they are primarily agricultural areas. Regional development policies and programs focus on improving agricultural output and farm efficiency. Information about the region would be related to the factors that must be managed in order to increase agricultural productivity. In its manual on rural service center planning, the Economic and Social Commission for Asia and the Pacific (ESCAP) considers the farm and farm-household as the basic units of activity accounting for regional agricultural productivity.[1] Information therefore should be collected about agricultural land, labor, capital and management conditions in the region and about the composition, subsistence needs, preferences and requirements of farm households (see Figure 3-1). Farms and farm-households in turn are influenced by the condition of the physical environment (climate, vegetation, soil, pests and disease), the region's demographic characteristics (population size, density, and composition), sociocultural factors, the level of economic and social services, prices and conditions of trade in the world market, as well as national price and support policies. Policy formulation and implementation would focus on coordinating those inputs needed to increase regional and agricultural production and income.

Regions as Core-Periphery Areas

Others view a region as a set of social and economic relationships between core urban centers and peripheral rural areas. Friedmann classifies regions and areas within regions by various socioeconomic indicators that determine the relationships among them in a larger space-economy.[2] He classifies core areas as those with high potential for growth and for dispersing innovation stimuli for development. They consist of one or more clustered cities and their immediately surrounding rural hinterlands. Upward-transitional areas have characteristics that relate favorably to core areas and have the capacity for more extensive use of their resources. Generally they respond to increasing demand at the core and are areas of net immigration. Resource frontiers are areas in which there is new

FIGURE 3-1

REGION AS AN AGRICULTURAL PRODUCTION SYSTEM



Source: After UNESCAP, Guidelines for Rural Center Planning, New York, United Nations, 1979

settlement by populations taking advantage of favorable agricultural or natural resources. Downward-transitional areas are older, long settled areas of net emigration in which rural economies are either stagnant or declining. Special-problem areas are those, such as river basins, with particular locational or resource constraints that require specialized development strategies.

Friedmann suggests that information be collected on the social and economic characteristics of a region in order to characterize areas with it. Information on spatial organization; locational characteristics of major economic activities; land use types; social, economic and infrastructural characteristics of urban centers; demographic trends and behavior; human resource characteristics; natural resource complexes and characteristics; economic activities and trade patterns; and indicators of regional economic performance would be included in the profile.[3]

In a manual on rural center planning, ESCAP officials note that regional planning rarely takes place in entirely undeveloped areas.[4] Careful attention must be paid therefore to existing patterns of settlement, economic interaction and physical endowments. Information about a region that indicates how it has developed in the past is important for distinguishing among areas within Friedmann's core-periphery framework. Thus, a regional profile should, at least, describe:

1. Already existing settlement patterns--including the location, level, and functions of existing centers and their relationships to each other;
2. Location and characteristics of existing landscapes and land use and physical constraints, such as mountains, rivers, marshes and deserts;
3. Administrative boundaries and political constraints;
4. Existing and proposed communications patterns and their linkages;
5. Variations in regional development levels, potentials and constraints;
6. Differences in main economic activities; for example, the existence of mining, industrial, forestry, cattle breeding, plantation, irrigated agriculture and rainfed farming areas; and
7. Variations in social, cultural, ethnic and religious characteristics in the way people live, their needs and economic prospects.

Regions as Economic and Trade Areas

Others view regions as systems of economic production and interaction. Regional development is seen as

a process through which regional factors of production are mobilized and invested in ways that increase the region's productive and social capacity to attain higher levels of production and income in the future. Rondinelli and Jones contend that regional development occurs primarily through the internal mobilization and investment of regional resources in activities that increase gross regional product (GRP) and social decision-making and problem-solving capacity.[5] Increases in productive and social capacity yield higher levels of regional income, which allow higher levels of savings, consumption and import of goods needed for production. New capital resources can be used to create a greater capacity for the region's social system to sustain itself in the future by raising the level of entrepreneurial skills, providing new social goods and services, satisfying the political and social interests of a wide variety of groups, acquiring new social resources and adapting existing legal and social codes to changing economic and social conditions. Capital resources can also be used to adapt or invent new technology, extend communications systems and promote social progress (see Figure 3-2).

Higher levels of regional expenditure and greater capacity to mobilize social resources increase expectations about the potential for development by creating a favorable investment climate and greater social commitment to the region's economic growth and progress.

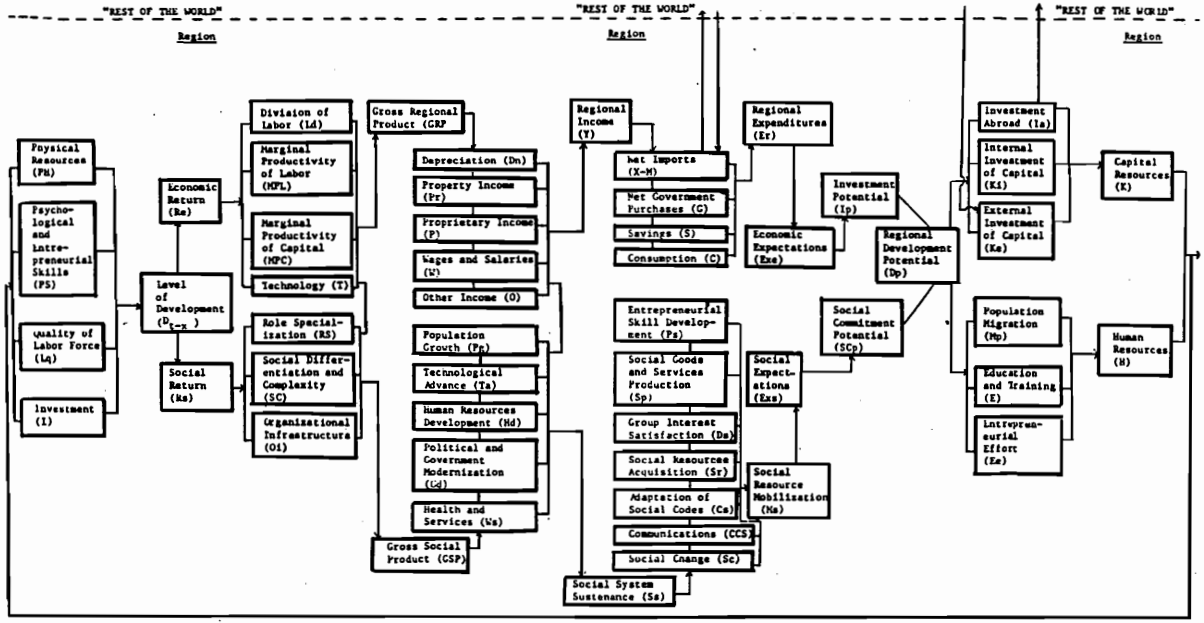
The perception that a region is likely to develop in the future reduces the leakage of resources through investment in other regions or countries, increases the willingness of entrepreneurs to re-invest their resources locally and expands the flow of external capital into the region. Moreover, a favorable regional development climate reduces population out-migration, increases people's incentives to seek higher education and better training and stimulates entrepreneurial effort. The resulting increases in capital and human resources can be used to enhance the region's physical resources, increase entrepreneurial skills, raise the quality of the labor force and expand investment, leading to higher levels of development in the future.

One approach that has been used to organize information within this framework for regional development is what Bendavid-Val calls the HINCO format.[6] Data are organized into human, institutional, natural, capital and other aspects:

1. Human aspects include data on population size and demographic characteristics, labor force characteristics, skills, income and wages, health, productivity, and educational characteristics of the

FIGURE 3-2

REGION AS AN ECONOMIC AREA



Source: D. Rondinelli and B. Jones, "Decision-Making, Managerial Capacity and Development: An Entrepreneurial Approach to Planning," African Administrative Studies, No. 13 (1975).

population, occupational characteristics and housing conditions;

2. Institutional aspects include the organizational structure of regional and local governments, public revenue and expenditure patterns, availability and location of social and public services, characteristics of business establishments, cooperatives, trade and labor organizations, landownership patterns and the mix of economic activities;
3. Natural aspects include information on land use patterns, mineral resources, soil and water resources, topographic features, historic and scenic features, environmentally sensitive and hazard prone zones;
4. Capital aspects include data on distribution and types of infrastructure, land use potentials, transportation and communications facilities, types and location of public and private investment, savings rates, housing stock, firm size, gross product, and construction trends; and
5. Other aspects include information on development plans and strategies of other levels of government, trade areas, trade and exchange relationships with other areas, energy resources, and data that provide insights into the relative economic and locational advantages of the region.

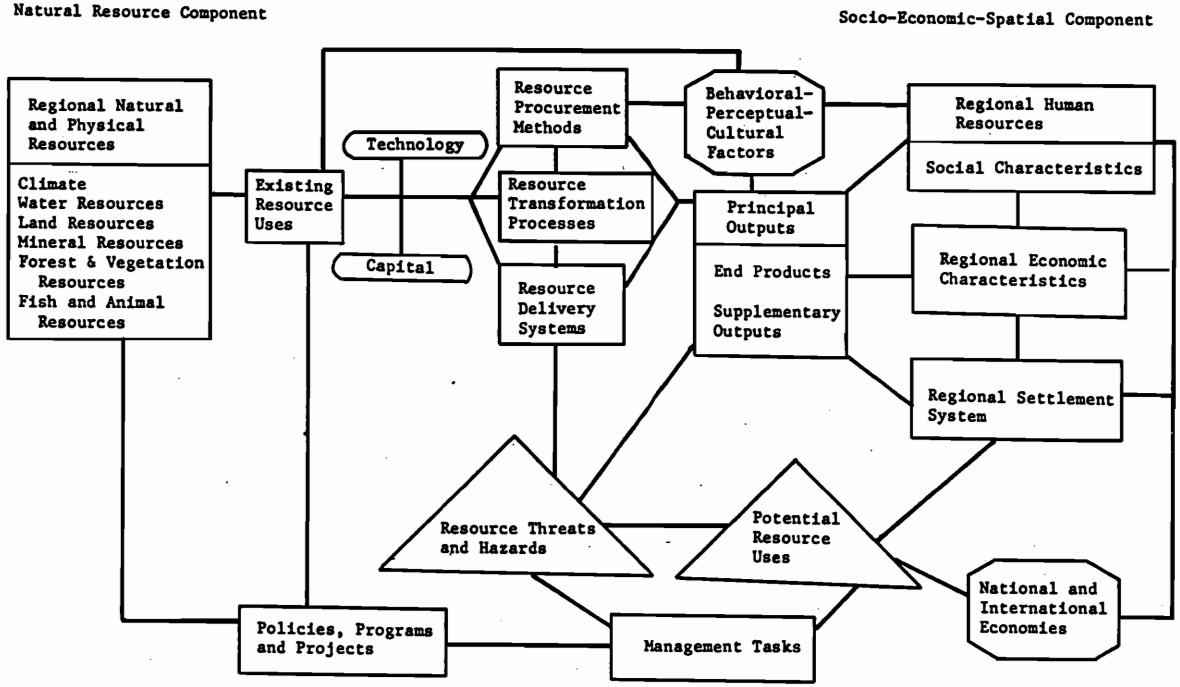
Such information would give planners and policymakers better insights into the obstacles to and ways of increasing regional development potential.

Regions as Integrated Resource-Production-Human Settlement Systems

A more encompassing concept of a region, in which resource, production and human settlement systems are seen as interacting forces in regional development, has been described by Ruddle and Rondinelli (see Figure 3-3).[7] In this concept of regional development natural and physical resources must be procured and transformed into productive goods, and delivered to internal and external markets. The way in which a region's natural resources are transformed depends not only on the application of technology and capital but also on behavioral, perceptual and cultural factors, social characteristics of the human population, regional economic factors, and the pattern of settlement and interaction. National and

FIGURE 3-3

REGION AS INTEGRATED RESOURCE-HUMAN SETTLEMENT SYSTEM



After Ruddle and Rondinelli, 1983

international economic conditions also affect how the regional economy is organized and the potential uses to which regional resources can be applied. The tasks of regional development planning are to enhance the region's natural and physical resources, increase the productivity of existing uses, and increase the quality of human resources and the capacity of the settlement system to support new economic and social activities. Regional planning would also promote new potential uses of resources, reduce resource hazards and threats, and in so doing improve the transformation of natural and man-made resources for human development.

Within this framework of regional development, one approach to organizing information is by resources, settlements and linkages. The types of information collected include those on physical characteristics, land and resource use, cropping patterns, volume and diversity of agricultural productivity, population distribution and human settlement patterns, and services and facilities distribution. Also information on non-agricultural commercial and manufacturing activities, subsistence farming characteristics and patterns, location, concentration and dispersion of major social and economic activities and labor force characteristics would be gathered. Data on the interaction among settlements through physical, economic, social, and organizational linkages would be analyzed as well.

Another way of organizing data about the region is the Population-Location-Activities format.[8] This approach categorizes data into six groups:

1. Population and Social Characteristics--including such information as population size, age distribution, family or household characteristics, educational levels, work experiences, income and wealth, health and living conditions, and characteristics of subsets of the population such as farmers, minorities, rural population, urban dwellers and others.
2. Location Characteristics--including information on physical resources, natural, locational, climatic and other geographic features, social capital, infrastructure, and transportation investments, structure of government and spatial and locational linkages;
3. Economic Activities Characteristics--including information about firm size, concentration and distribution of economic activity, value added, gross regional product, productivity, farm characteristics, investment and capital accumulation, and industry mix characteristics;

4. Population-Location Relationship Characteristics--including data on population size, density, and distribution, travel patterns, migration and land-ownership patterns;
5. Population-Activity Relationship Characteristics--including information on employment by industry, income and wages by employment source, unemployment by industry, labor productivity and labor-capital ratios; and
6. Location-Activity Relationship Characteristics--including information on the location of commerce and industry, intra- and inter-regional trade flows and linkages, trade areas, labor-market characteristics, and economic relationships with other regions.

Other concepts of regional development may prevail in a region and can also be used to classify data for a regional profile. The point is that planners should invest an adequate amount of time in thinking about how to select and organize the data they need for spatial analysis and regional planning before beginning data collection. Collecting data is not an end in itself. The information that is gathered about a region should provide a statistical profile that is meaningful to public officials, private investors, local interest groups and others who participate in development activities. The profile should provide a broader framework for interpreting the results of the analysis of settlements and spatial linkages from a regional perspective.

Four major methods or techniques are used in the UFRD approach to analyze and present data collected in the first phase of planning. They include: (1) descriptive statistics for comparing the region with other regions and for assessing economic conditions of communities or areas within the region; (2) ranking and scaling techniques to highlight differences among areas within the region; (3) measures of distribution, specialization, concentration and association to show comparative strengths and weaknesses within the regional economy; and (4) indexes of levels of development of administrative units or economic areas within the region. The methods are applied at two levels. Inter-regional analysis attempts to compare the economy of the region with that of others in the country. Intra-regional analysis attempts to compare communities, administrative sub-divisions, or economic sub-units within the region.

INTER-REGIONAL PROFILES

Information about the region described earlier can be used to obtain insights into its comparative strengths and weaknesses within the national economy. Descriptive statistical measures and mix-and-share analysis are two easily applied techniques for interpreting the information.

Descriptive Statistical Measures

Most of the information that is already available from censuses, surveys, special studies, feasibility analysis and other sources can be reorganized and summarized using simple descriptive statistics--averages, percentages, ranges, ratios, frequency distributions, indexes, rates of change and time series. These measures can be calculated quickly and are easy for people involved in regional development to understand and interpret. They can be presented effectively in tables, charts, graphs, curves, pictographs and analytical maps. They emphasize important relationships, trends and classifications.[9]

These methods were used to summarize information about the region in relationship to other regions in both the Bicol River Basin in the Philippines and in the Department of Potosi in Bolivia.

The profile of the Bicol region in the Philippines, for example, showed clearly its relative deprivation within the national economy and highlighted reasons why Bicol continues to be at a disadvantage within the national economy. One detailed profile (see Table 3-1) compared number of families, average family income, percentage of families with income below the poverty level, percentage of families with incomes below the minimum food needs level, enrollment rates in elementary and secondary schools, population per hospital bed, physician and midwife, percentage of malnourished children, index of industrial production, and index of agricultural productivity. All of the information for this inter-regional profile came from secondary sources--that is, from information collected and published by government agencies.[10]

The profile indicated that the six-province national planning region of which the Bicol River Basin is a part was one of the poorest in the Philippines. Average family income during the mid-1970s, when the Bicol UFRD project began, was nearly 26 percent below the national average and the second lowest in the country. More than 70 percent of the families in the Bicol Region had incomes below the amount needed to obtain adequate food; it had the third highest percentage of families with incomes below the food threshold. More

TABLE 3-1

SOCIO-ECONOMIC CHARACTERISTICS OF BICOL AND OTHER REGIONS IN THE PHILIPPINES

Region	Number of Families (000s)	Average Family Income (Pesos)	Percent Difference in Average Family Income from National Average	Percent of Families Below Food Threshold	Percent of Families Below Poverty Level	Percent Malnourished Children
Ilocos	558	5,525	-5.3	72.6	85.2	31.0
Cagayan Valley	329	5,102	-12.6	75.8	84.8	29.3
Central Luzon	662	7,773	-1.1	36.5	68.5	32.2
Southern Tagalog	888	5,441	-6.8	30.6	54.5	29.2
Bicol	518	4,280	-26.7	70.9	87.3	30.6
Western Visayas	679	5,484	-6.1	65.3	84.5	39.0
Central Visayas	441	4,834	-17.2	70.7	85.4	27.0
Eastern Mindanao	595	5,172	-11.4	73.3	86.4	36.3
Western Mindanao	370	3,803	-34.9	NA	NA	28.9
Northern Mindanao	433	6,307	+7.9	65.1	86.1	28.2
Southern Mindanao	314	5,062	-3.0	58.3	79.8	24.9
Central Mindanao	301	5,025	-13.9	NA	NA	27.7
Metro Manila	770	10,469	+79.3	24.7	NA	30.4
Philippines	6,859	5,840	100.0	59.0	79.4	30.6

(continued)

TABLE 3-1 (continued)

Region	Enrollment Rates in Schools		Population Per Hospital			Percent Irrigable Land Irrigated	Index of Industrial Production	Agricultural Productivity
	Elementary	Secondary	Bed	Physician	Midwife			
Ilocos	114.7	84.2	769	2,000	2,707	56	53	60
Cagayan Valley	116.9	30.0	1,428	4,762	6,667	36	24	90
Central Luzon	113.0	37.4	1,428	4,167	5,882	79	89	118
Southern Tagalog	86.1	49.7	NA	NA	NA	30	102	100
Bicol	111.3	29.1	1,667	5,263	9,091	32	25	86
Western Visayas	139.2	64.3	2,000	3,703	5,263	46	91	137
Central Visayas	101.0	74.0	1,111	3,030	6,250	25	81	68
Eastern Mindanao	101.0	37.4	1,667	6,250	8,333	31	27	90
Western Mindanao	93.3	17.2	2,500	6,667	9,091	24	24	132
Northern Mindanao	98.1	35.9	1,428	4,762	5,556	11	41	110
Southern Mindanao	131.9	51.4	1,667	6,667	9,091	19	59	129
Central Mindanao	99.4	64.3	2,500	6,667	7,143	15	32	84
Metro Manila	85.5	47.3	334	1,724	5,556	NA	391	135
Philippines	105.1	48.0	833	3,125	5,882	38	100	100

Source: Republic of the Philippines, National Economic and Development Authority; World Bank and USAID.

than 87 percent of its families had incomes below the poverty level--the highest in the Philippines. Although enrollment rates in elementary schools were relatively high, those for secondary schools were the second lowest in the country. Population per hospital bed, physician and midwife were extremely high compared to the average in the Philippines, indicating relatively low levels of health care services in the Region. Nearly a third of the children in Bicol were found to be malnourished. Only a third of the irrigable land was irrigated. Bicol's agricultural productivity was only 86 percent of the national average. The Bicol's industrial production was about one-quarter that of the Philippines.

Socio-economic profiles were also constructed for the Bicol River Basin from statistics published for Camarines Sur and Albay, the two provinces that were included in the Basin's boundaries when the project began. Indicators for population density, average net population growth rates, percent population under 14 years old, average annual family income, percent of household population over 10 years old in gainful occupations, sectoral distribution of employed population, farm-land tenure status, percent of farm households with off-farm employment, birth and death rates, quality of housing and percent of municipal revenues derived from local sources formed this profile (see Table 3-2).

These data, along with others collected for the two provinces allowed planners to describe the Basin as an agricultural production area. They showed that this economically depressed region at the southern tip of the Luzon peninsula manifests almost classic characteristics of what in Friedmann's classification would be a perhiperhal, downward-transitional area.

The profile indicated clearly that the Basin's poverty was due in large part to its physical isolation and to a physical environment that was hostile to productive activity for much of the year. In relationship to other areas of the Philippines, Bicol lacks the physical infrastructure, social services and productive inputs to increase its agricultural and manufacturing output. The profile suggested that the predominantly subsistence agricultural economy of the basin created chronic underemployment and serious malnutrition among the population and encouraged relatively high rates of outmigration. About 28 percent of the labor force was either unemployed or seriously underemployed and non-agricultural job opportunities in the rural areas were limited. Income levels of the Basin's population were not only low, but income and wealth were inequitably distributed. Ten percent of the households in the Basin received 43 percent of total income. The poorer half of the population received only 13 percent of the income.

TABLE 3-2

COMPARATIVE SOCIO-ECONOMIC INDICATORS FOR BICOL RIVER BASIN, THE BICOL REGION, AND THE PHILIPPINES

Indicator	Bicol River Basin	Bicol Region	Philippines
Population Density (No. of People Per Square Kilometer)	226	168	140
Annual Average Net Population Growth Rate	1.6	1.6	2.9
Percent Population Under 14 Years Old	48.1		45.7
Average Annual Rate of Natural Increase in Population	2.4	2.5	3.0
Average Annual Family Income (Pesos)	4,778	4,280	5,840
Percent of Household Population Over 10 Years Old in Gainful Occupations	41.0	40.4	42.6
Percent of Household Population Over 10 Years Old Gainfully Employed by Sector			
Agriculture, Fishing, Forestry and Related	59.2	66.2	54.3
Mining and Quarrying	0.1	0.3	0.5
Manufacturing	13.3	8.5	10.7
Gas, Electric, Sanitation, Water	0.2	0.2	0.3
Construction	2.9	2.4	3.4
Commerce	6.4	5.5	8.3
Transportation, Communication, and Storage	2.7	2.4	4.2
Services and Other Activities	15.2	14.6	18.4

TABLE 3-2 (continued)

Indicator	Bicol River Basin	Bicol Region	Philippines
Tenure Status of Farms			
Full Owner	51.9	59.0	58.0
Part Owner	10.5	9.0	11.4
Tenant	36.0	30.4	29.0
Manager	0.1	0.2	0.1
Other	1.4	1.4	1.6
Percent of Farm Households Reporting Off-Farm Employment	31.4	27.8	17.9
Birth Rate (Per 1,000)	34.8	28.0	26.0
Death Rate (Per 1,000)	8.4	8.0	7.0
Population Per Physician		5,263	3,125
Population Per Midwife		9,091	5,882
Type of Housing Construction			
Strong	18.0	15.5	38.4
Mixed	37.8	40.9	36.5
Light	44.6	43.6	25.1
Percent of Municipal Revenues from Local Sources	78.0	78.5	83.5

These people lived on about $45 per capita a year, only enough to buy basic necessities.[11]

Other data collected by the UFRD project staff indicated that standards of living in the Basin were far below those of the Philippines. More than half of the children suffered some form of malnutrition. A majority of the population was inflicted with water-borne enteric diseases and intestinal parasitism, resulting from contaminated water supplies and poor environmental sanitation. Nearly 73 of every one thousand infants born in the Bicol River Basin died during their first year, primarily of pneumonia, gastro-enteritis and bronchitis. There was only one physician for every 4,600 people and most of the doctors were located in larger towns, inaccessible to rural people. Surveys estimated that no more than one-quarter of all women living in the Basin had ever visited a health clinic, hospital or family planning center; most rural families sought assistance from healers or midwives during pregnancy.

Housing conditions outside of the larger towns were also poor. In rural areas homes were built of scrapwood and nipa, with grass roofs and bamboo or dirt floors. Less than one-third of the Basin's households had adequate water supplies or sanitary toilets. Sounder structures, more typical of the towns, were scattered in rural barangays, but the overwhelming majority of houses throughout the Basin were constructed of weak building materials, highly susceptible to fire, flooding or destruction during typhoons. Few homes were served by piped water or electricity; in the vast majority kerosene or wood was used for lighting and cooking.

The population growth rate of 3.3 percent a year resulted in a high dependency ratio--nearly half of the population was under 14 years old--and more than one percent of the population migrated out of the Basin each year, resulting in an average annual net population growth rate of 1.6. Most migrants were 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, had the lowest net domestic product (NDP) in the Philippines, which was declining in real terms at a time when the national average was growing. The Bicol Region 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. Nearly all manufactured goods sold in Bicol were imported from Manila.[12]

The profile also indicated that, ironically, most Bicolanos lived in poverty in a land of abundant

natural resources. 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 was only a fraction of its potential under favorable conditions. The Bicol had a wealth of untapped mineral resources--about 30 percent of marble deposits, 75 percent of perlite and about 20 percent of the coal reserves of the Philippines. The Tiwi Geothermal plant, located on the Basin's northeastern border, generates substantial amounts of energy.

But as a regional economy, the Bicol River basin was poorly equipped for increased productivity and widespread development. Through much of the year the Basin was battered by frequent typhoons, bringing high winds and heavy rains. The perennial flooding destroyed crops and homes, pushed saline water into interior rice fields and caused widespread silting and erosion. The area was 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 connects Bicol to Manila. During the typhoon season even this link became tenuous as sections of the road were washed out and collapsed down the side of steep mountain banks. Daily flights to and from Manila, buses, and one railway provided limited capacity for travel or interregional communications, and small ports in coastal villages provided 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.

Those people living in coastal areas depended on traditional fishing methods that yielded small catches. Much of the catch was consumed locally. The rest was dried and sent to markets within the region or to Manila. In either case the prices fishermen received were low and provided only subsistence incomes.

Nor were land tenure arrangements conducive to increasing family incomes. Farm holdings were small and fragmented. From a third to half of all rice and corn farmers worked as tenants or landless laborers, and farm productivity was nearly 10 percent lower than that of the Philippines. Owners of large landed estates reinvested little of their profits in the Basin over the years, and agricultural technology on both large and small farms was primitive. Manpower and draft animals provided the bulk of agricultural labor. Relatively few milling or processing facilities had been established, marketing networks in rural areas were poor and storage capacity was limited. Because productivity and income

were so low, both tenants and small landowners were continuously in debt. Whatever small surpluses they accumulated were quickly spent on baptisms, weddings, funerals, children's schooling and the annual fiesta, and on repaying former loans. Only about half of the basin's 100,000 hectares of potentially irrigable rice-lands were irrigated; nearly 50,000 hectares of prime agricultural land was flooded during the typhoon season and that located adjacent to the Bicol river suffered from saline intrusion.[13]

In the Department of Potosi in Bolivia, the inter-regional profile compared principal socio-economic characteristics of the department with those of the other eight departments in the country. It compared these administrative regions in terms of population trends, migration flows, the composition of economic activities as measured by labor and capital inputs, the value of output, per capita income and location coef-ficients. The profile illustrated a familiar paradox: a region that had provided great wealth for the Spanish empire for nearly two centuries and much of Bolivia's foreign earnings more recently, had become the most backward area of the country. The rich mineral depo-sits of silver, tin and other metals had created an enclave economy in Potosi that provided wealth for foreign investors but meagre benefits for the local population.[14]

The profile of Potosi, moreover, showed that although the mining sector still dominated the economy, it had generated few forward linkages to related acti-vities. The industrial sector was extremely weak. Although mineral processing plants had been built in the area, they used capital-intensive technology that generated little local employment. The multiplier effects of industrial activities within the local econ-omy were highly constrained.

The profile indicated that Potosi was a region with characteristics common to economically lagging or downward transitional areas. Table 3-3 indicates that more than 70 percent of the population lived in rural areas, the population growth rate of the Department was substantially lower than that of the other regions in the country and that it had the highest average annual rate of outmigration. The productivity of Potosi's economic activities was the lowest in Bolivia. Heavy outmigration and high mortality rates resulted in a net population growth rate of less than one percent a year during the quarter century between 1950 and the mid-1970s. Per capita income in Potosi was 30 percent lower than the average in Bolivia and less than 60 per-cent of the income of the adjoining Department of Oruro.[15]

TABLE 3-3

SELECTED CHARACTERISTICS OF DEPARTMENTS IN BOLIVIA

Department	Population (000s)	Percent of Population in Rural Areas	Average Annual Population Growth	Percent Annual Average Migration	Regional Product Per Capita	Annual Growth Rate of Regional Product Per Capita	Per Capita Gross Regional Product (in Pesos)	Regional Product As Percent of National Product
Potosi	657.7	71.0	0.99	-0.64	458	2.3	2,884	10.3
Chuquisaca	358.5	87.4	1.23	-0.59	515	5.8	3,092	6.0
La Paz	1,465.0	52.4	2.07	-0.11	619	5.6	3,872	31.1
Cochabamba	721.0	62.3	1.79	-0.12	694	7.1	4,312	17.0
Santa Cruz	710.7	47.3	4.09	+1.49	767	8.0	4,683	18.6
Oruro	310.4	48.9	1.84	-0.51	802	6.0	5,049	8.6
Tarija	187.2	61.1	2.28	+0.74	681	11.7	4,099	4.2
Beni	168.4	51.8	3.28	-0.61	595	13.0	3,601	3.4
Pando	34.5	89.4	2.88	+0.96	698	12.8	4,421	0.8
Bolivia	4,613.5	58.3	2.05		637	6.3	3,951	100.0

Source: Hugh Evans, Urban Functions in Rural Development: The Case of the Potosi Region in Bolivia, Washington: USAID, 1982.

Although a large portion of the population of Potosi derived its living from agriculture, the cultivation of crops was confined to a transitional area of temperate valleys between the soaring mountains that dominate the physical terrain of Potosi in the western and eastern parts of the Department. The wheat, corn, potatoes, other vegetables and some fruits grown in Potosi were used primarily for subsistence. On the altiplano and the mountains, sheep and llama raising and cereal grain production were the main sources of income. Farm output of Potosi generated less than 7 percent of agriculture's contribution to gross national product in Bolivia and contributed only about 6 percent to Potosi's gross regional product. Potosi's gross regional product was nearly 30 percent below that of the average for all departments in the country (see Table 3-4).

In constructing the regional profile planners found that Potosi, being relatively isolated from other parts of Bolivia due to its mountainous terrain and poor air, road and rail service, had little economic interaction with other regions of the country. They also confirmed that rural areas within the Department were poorly linked to the few towns that had the infrastructure, services and facilities that might stimulate rural development. Lack of access roads made travel to the nearest towns for most rural people a long and arduous journey.

As the Bicol and Potosi cases show, descriptive statistics can provide planners with a general outline of the major strengths and weaknesses of the regional economy, but other methods and techniques must often be used to analyze and interpret these data, especially in assessing the region's position in the national economy.

Mix-and-Share Analysis

One technique of comparing changes in regional economic activity--such as in employment or occupational composition--with changes taking place nationally, is mix-and-share analysis.[16] Underlying mix-and-share analysis is an assumption that changes in employment in a region are influenced by three sets of factors:

1. Changes in total employment in the national economy,
2. The distribution of the labor force in particular industries or sectors in the region that may be growing slower or faster than those sectors or industries nationally, and

TABLE 3-4

PERCENT CONTRIBUTION BY SECTOR OF REGIONS TO GROSS DOMESTIC PRODUCT - BOLIVIA, 1977

Sector	La Paz	Cocha-bamba	Santa Cruz	Oruro	Potosi	Chuqui-saca	Tarija	Beni	Pando	Total	Sectoral Contri-bution to GDP
Agriculture	17.5	22.0	22.5	3.3	6.8	11.3	7.1	31.9	1.1	100.0	15.6
Minerals	32.0	3.0	--	25.0	40.0	--	--	--	--	100.0	8.4
Petroleum	--	--	81.3	--	--	12.2	6.5	--	--	100.0	1.6
Manufacturing	39.9	19.8	19.3	8.2	3.0	4.3	3.6	1.4	0.5	100.0	15.3
Construction	36.1	18.0	25.1	6.8	4.4	4.3	3.8	1.2	0.6	100.0	4.3
Energy	39.5	25.3	18.1	4.0	5.0	3.4	3.1	1.0	0.6	100.0	1.5
Transporta-tion and Com-munications	25.0	20.0	20.0	9.0	9.8	6.0	4.5	4.2	1.5	100.0	8.8
Commerce and Finance	32.0	16.5	18.0	8.8	9.7	6.0	4.5	3.5	1.0	100.0	19.3
Government	44.0	15.0	15.0	6.0	9.0	5.0	3.0	2.0	1.0	100.0	9.0
Housing and Real Estate	35.0	17.0	16.3	7.5	9.0	6.5	4.5	3.2	1.0	100.0	7.7
Other Services	28.5	18.0	19.0	8.8	10.8	6.4	4.2	3.5	0.8	100.0	8.0
Percent Region-al Contribution to GDP	31.1	17.0	18.6	8.6	10.3	6.0	4.2	3.4	0.8		100.8

Source: Government of Bolivia, Ministry of Planning and Coordination; H. Evans, Urban Functions in Rural Development: The Case of Potosi Region in Bolivia, Washington: USAID, 1982.

3. Changes in the region's share of total national employment in each sector or industry.

Mix and share analysis helps explain changes in a region's employment (R) or occupational structures over time by disaggregating them into three sets of factors: national growth effects (N), sectoral or industry mix effects (M) and regional shares effects (S):

The measurement of these effects can be illustrated by examining changes in the employment structure of the Bicol River Basin between 1970 and 1975, the five-year period just before the UFRD project began.

The first step is to compare changes in employment distribution by sector for the region and the nation, as illustrated in Table 3-5 by:

1. Listing the numbers of people employed in each sector or industry for a "base year" and a later year;
2. Calculating the absolute change in employment over the period in each sector or industry; and
3. Calculating the percentage change in employment over the period in each sector or industry;

Table 3-5 indicates that while national employment grew by nearly 5.5 percent over the period of analysis, employment in the Bicol River Basin declined by about 4.7 percent. Only in the utilities sector did employment in the Bicol River Basin grow faster than in the Philippine economy. While agricultural employment grew by nearly 6.5 percent in the Philippines, the BRB's employment declined by nearly 2 percent. Manufacturing employment in Bicol declined at a rate almost three times higher than the decline in manufacturing employment in the Philippines, and while national employment increased in commercial activities by nearly 20 percent, Bicol's commercial employment dropped by almost 12 percent.

The next step in mix-and-share analysis attempts to answer the question: "How much would have employment in the region grown if it had expanded in each sector at the same rate as national employment?" The national growth effect (N) can be computed as in Table 3-6 by:

1. Listing the number employed in each sector of the regional economy for the base year;
2. Multiplying the numbers of people employed in each sector or industry by the national employment growth rate (from upper half of column 4 of Table 3-5);
3. Listing the absolute growth of employment in each sector or industry in the region; and

TABLE 3-5

DISTRIBUTION OF EXPERIENCED WORKERS BY SECTOR
PHILIPPINES AND BICOL RIVER BASIN

Philippines	Employment (000s) 1970 (1)	1975 (2)	Employment Change 1970-1975 Absolute Numbers (2)-(1) (3)	Percent (3)/(1) (4)
Agriculture, Forestry	6,334.7	6,743.5	+408.8	+6.5
Mining and Quarrying	52.7	62.1	+9.4	+17.8
Manufacturing	1,398.5	1,328.8	-69.7	-4.9
Elec. Gas, Sanitation	33.8	37.3	+3.5	+10.4
Construction	461.3	422.2	-39.1	-8.5
Commerce	861.8	1,030.8	+169.0	+19.6
Transport, Communication	512.5	521.6	+9.1	+1.8
Services	1,926.0	2,098.8	+172.8	+8.9
Other	194.0	173.9	-20.1	-10.4
Total	11,775.3	12,419.0	+643.7	+5.5
Bicol River Basin				
Agriculture, Forestry	303.5	297.7	-5.8	-1.9
Mining and Quarrying	.6	.5	-0.1	-16.7
Manufacturing	68.3	58.2	-10.1	-14.8
Elec. Gas, San.	1.1	1.5	+0.4	+36.4
Construction	14.9	12.7	-2.2	-14.8
Commerce	32.6	28.8	-3.8	-11.7
Transp., Comm.	13.7	13.7	0	0
Services	68.4	66.9	-1.5	-2.2
Others	9.6	8.8	-0.8	-8.3
Total	512.7	488.8	-23.9	-4.7

TABLE 3-6

NATIONAL GROWTH EFFECT ON EMPLOYMENT IN BICOL RIVER BASIN 1970-1975

Sector	Employment 1000s in Bicol River Basin 1970 (1)	National Growth Effect N=(1) X National Growth Rate (.055) (2)	R = Actual Regional Employment Growth (3)	M+S = R-N Net Regional Change to be Accounted for (3)-(2) (4)
Agriculture, Forestry	303.5	16.69	-5.8	-22.49
Mining and Quarrying	0.6	0.03	-0.1	-0.13
Manufacturing	68.3	3.76	-10.1	-13.86
Elec. Gas, Sanitation	1.1	.06	+0.4	+0.34
Construction	14.9	.82	-2.2	-3.02
Commerce	32.6	1.79	-3.8	-5.59
Transporation, Communications	13.7	.75	0	-0.75
Services	68.4	3.76	-1.5	-5.26
Others	9.6	.53	-0.8	-1.33
Total	512.7	28.19	-23.9	-52.09

4. Subtracting the national growth effect (column 2) from rate of employment growth of the regional economy (column 3).

Table 3-6 indicates that had employment in each sector grown in the Bicol River Basin at the same rate as in the Philippine economy, the total employment of the Basin would have increased by 28,190 jobs, whereas in reality it decreased by 23,900. Employment in agriculture would have grown by 17,000 jobs, manufacturing by nearly 4,000 jobs, commerce by almost 1,800 jobs and services by nearly 3,800 jobs. Table 3-6 seems to indicate that it is the characteristics of the regional economy that probably explain the shortfall of 52,000 jobs in the Bicol River Basin compared to the potential number of jobs that could have been available had the Basin's sectors grown at the same rate as the nation's.

Calculation of the industry mix effect (M) attempts to determine to what extent the deviation of the growth of employment in the Bicol River Basin from that of the Philippines was attributable to the fact that workers were distributed more heavily in industries that grew below the national average. The regional mix effect is calculated as in Table 3-7 by:

1. Listing the percent of workers in each sector or industry in the base year for the nation and the region;
2. Calculating the deviation by subtracting the national growth rate from the sector or industry growth rate (from upper half of column 4 of Table 3-5);
3. Listing the number of workers in each sector of the regional economy in the base year; and,
4. Calculating the regional mix effect by multiplying the deviation (column 3) by the number of experienced workers in each sector (column 4).

Table 3-7 indicates that a negative industry mix in Bicol offset the national growth effect by 113,760 jobs. The percentage of experienced workers in agriculture in Bicol was higher than in the national economy, but employment in Bicol grew far less than in the Philippines. Indeed, while employment in Philippine agriculture grew by 6.5 percent, it declined in Bicol by 1.9 percent. The high proportion of workers in agriculture in Bicol could not offset the relatively lower proportion of workers in other sectors nor the relatively slow rate of employment growth in Bicol compared to that of the national economy.

Finally, the regional shares effect (S) can be computed to determine what part of the net relative change in employment in the Bicol River Basin--61,670 jobs--was

TABLE 3-7

INDUSTRY EFFECT ON EMPLOYMENT IN THE BICOL RIVER BASIN, 1970-1975

Sector	Percent Distribution of Employment, 1970 in Philippines (1)	Percent Distribution of Employment, 1970 in Bicol River Basin (2)	Deviation: Industry Growth Rate Minus National Growth Rate (3)	Regional Employment, 1970 (4)	Industry Mix M=(3)X(4) (5)
Agriculture, Forestry	53.8	59.2	6.5 -5.5 = +1.0	303.5	+303.50
Mining and Quarrying	0.5	0.1	17.8 -5.5 = +12.3	0.6	+7.38
Manufacturing	11.9	13.3	-4.9 -5.5 = -10.4	68.3	-710.32
Electric, Gas, Sanitation	0.3	0.2	10.4 -5.5 = +4.9	1.1	+5.39
Construction	3.9	2.9	-8.5 -5.5 = -14.0	14.9	-208.60
Commerce	7.3	6.4	19.5 -5.5 = +14.1	32.6	+459.66
Transport., Communic.	4.3	2.7	1.8 -5.5 = -3.7	13.6	-50.69
Services	16.4	13.3	8.9 -5.5 = +3.4	68.4	+232.56
Others	1.6	1.9	-10.4 -5.5 = -15.9	9.6	-152.64
	100.0	100.0		512.7	-113.76

not accounted for by regional mix effect. Regional shares effect is a residual and can be calculated as in Table 3-8, by:

1. Calculating the change in employment in the region for each sector between the base year and the later year (R); and,
2. Subtracting the national growth effect and the industry mix effect from the change in the number of workers in each sector.

Table 3-8 provides an indication of the effects of national employment growth, industry mix and regional shares on various industries in Bicol and on regional employment. For example, had agricultural employment in the Philippines grew at the national employment growth rate and had employment in agriculture grown in Bicol at the national rate, experienced agricultural workers in Bicol would have increased by 16,690 from 303,500 in 1970 to 320,190 in 1975. But regional employment in agriculture declined by 5,800 jobs to 297,700 in 1975. The net change of minus 22,490 jobs over the period can be accounted for by the fact that national agricultural employment grew faster than total employment, and that Bicol's employment growth rate in agriculture during the same period declined.

For the regional economy, Table 3-8 indicates that the net impact of the negative industry mix in Bicol (-113,760 jobs) was far greater than the positive national growth effect (+28,190 jobs) and the regional shares effect (+61,670) to leave a net decline of 23,900 jobs.

The mix-and-share analysis raises a number of other questions, of course, that must be examined carefully before final conclusions are made. Mix-and-share analysis, like all other methods used in the UFRD approach, is less likely to yield definitive answers to policy questions than to allow planners and policymakers to ask more refined and better directed questions.[17] Descriptive statistics and mix-and-share analysis can be combined with location quotients to indicate relative concentration or specialization in the region. Inter-regional indexes and other methods can be used to determine the relative position of the region within the national economy.

INTRA-REGIONAL PROFILES

A second aspect of the regional profile is to compare administrative or economic areas within the region by their share of resources, socio-economic characteristics and levels of development. Descriptive statistics, location quotients, measures of concentration, deconcentration and association, indexes, scales and weighted rankings are most useful for this task.

TABLE 3-8

EMPLOYMENT AND COMPONENTS OF EMPLOYMENT CHANGE IN BICOL RIVER BASIN, 1970-1975
(THOUSANDS OF PERSONS EMPLOYED)

Sector	Employment in Bicol River Basin 1970 (1)	1975 (2)	Regional Employment Change (R) 1970 and 1975 (3)	National Growth Effect N (4)	Industry Mix Effect M (5)	Regional Shares Effect S=R-N-M (6)
Agriculture, Forestry	303.5	297.7	-5.8	16.69	+303.50	-325.99
Mining and Quarrying	0.6	0.5	-0.1	0.03	+7.38	-7.51
Manufacturing	68.3	58.2	-10.1	3.76	-710.32	+696.46
Elec., Gas and San.	1.1	1.5	0.4	0.06	+5.39	-5.05
Construction	14.9	12.7	-2.2	0.82	-208.60	+205.58
Commerce	32.6	28.8	-3.8	1.79	+459.66	-465.25
Transport., Commun.	13.7	13.7	0	0.75	-50.69	+49.94
Services	68.4	66.9	-1.5	3.76	+232.56	-237.82
Others	9.6	8.8	-0.8	0.53	-152.64	+151.31
	512.7	488.8	-23.9	28.19	-113.76	61.67

Descriptive Statistics

Intra-regional analysis attempts to identify the distinguishing characteristics of administrative or economic sub-units within the region. The information gathered at this stage of the analysis can also be used later to supplement the settlement and linkage analyses, to assist planners with interpreting data on accessibility and to help assess the productive potential of each area within the region. As in inter-regional analysis, simple descriptive statistics--averages, percentages, ratios and frequency distributions--are often the most useful methods of determining differences in levels of development within the region and of providing a clearer description of the region's strengths and weaknesses.

Ideally, the analysis should take into account the distribution of population and of major economic activities and physical resources, and especially data on water resources, soil types, land use patterns, crop cultivation and other information related to the region's economic base. Social welfare data that indicate levels of development and differences in standards of living should also be reflected in the profile. Obviously, the types of data that are included in the profile depend heavily on those that are available or that can be easily and quickly collected. These can later be supplemented with information collected through field surveys or special studies.

The intra-regional profile for the Department of Potosi, Bolivia, for example, was composed of the demographic and income data listed in Table 3-9 and social service, education, and health indicators listed in Table 3-10. The results offer a detailed profile of a downward-transitional region with underdeveloped peripheral areas and a weak core. Evans points out in his analysis of Potosi that socio-economic conditions differ rather drastically even in a poor region.[18] Housing indicators show that few homes in the Department were connected to modern infrastructure and that in the most rural provinces--Saavedra, Chayanta, Charcas, Ibanez, Sud Lipez, and Linares--less than 10 percent of the households had access to piped water, sewers, and electricity. Even in the urban areas less than 60 percent of the households had access to these basic services. People in most provinces had low rates of literacy and opportunities for education, but again those living in provinces with towns and urban centers were generally better off than people living in rural provinces. More than half of the population was illiterate in six of the provinces, more than half of the school age children had dropped out in nine of the provinces, and the vast majority of people had never attended high school.

TABLE 3-9

SOCIO-ECONOMIC PROFILE OF PROVINCES IN THE DEPARTMENT OF POTOSI, BOLIVIA

Province	Population	Percent of Department	Pop. Per Sq. Km.	Income Per Capita	Percent Annual Net Migration	Percent Annual Population Growth	Percent of Workforce Fully or Partially Employed
Bilbao	9,683	1.5	15.1	678	-0.51	0.15	93.0
Ibanez	22,635	3.6	10.9	609	-0.30	0.27	96.0
Charcas	32,302	4.9	10.9	861	-0.54	0.52	94.0
Bustillos	91,418	13.9	40.9	688	-0.47	1.61	91.0
Chayanta	88,969	13.5	12.7	580	-0.51	1.10	96.0
Frias	122,810	18.8	35.9	410	-0.28	1.86	93.7
Saavedra	54,113	8.2	22.8	389	-0.17	0.64	96.0
Linares	53,481	8.1	10.4	156	-1.10	0.55	97.0
Quijarro	38,723	5.9	2.7	231	-0.85	0.26	92.0
Nor Chichas	47,965	7.3	5.3	207	-0.23	0.02	95.0
Sud Chichas	51,115	8.4	6.5	270	-0.76	1.38	94.0
Omiste	20,651	3.1	9.1	473	+1.22	0.70	94.0
D. Campos	5,567	0.8	0.5	384	-0.85	0.80	97.0
Nor Lipez	9,162	1.4	0.4	217	-0.89	0.95	90.0
Sud Lipez	4,149	0.6	0.2	191	-0.33	1.28	84.0
Department	657,743	100.0	5.6	--	-0.64	0.99	

Source: H. Evans, Urban Functions in Rural Development: The Case of the Potosi Region in Bolivia, Washington: USAID, 1982.

TABLE 3-10

SOCIAL INDICATORS FOR PROVINCES IN THE DEPARTMENT OF POTOSI, BOLIVIA

	Housing				Education				Health		
Provinces	A1	A2	A3	A4	B1	B2	B3	C1	C2	C3	C4
Frias	59.2	29.5	48.9	67.4	65.9	55.7	20.5	13.15	0.8	2.4	8.0
Bustillos	53.1	8.2	42.6	63.0	60.6	54.5	15.0	6.71	0.7	4.0	11.0
Saavedra	9.6	1.0	5.4	36.1	34.0	35.1	1.9	6.31	0.1	0.5	10.9
Chayanta	7.2	0.4	3.5	12.0	25.0	28.0	1.5	0.85	0.1	0.8	4.5
Charcas	2.8	0.1	0.9	7.0	26.0	35.0	1.7	0.34	0.0	0.0	10.8
Nor Chichas	16.1	1.5	12.9	28.0	50.0	47.0	4.3	1.34	0.3	3.0	19.2
Ibanez	4.1	0.2	0.1	7.0	36.7	35.4	2.8	0.92	0.0	0.8	11.2
Sud Chichas	48.1	8.7	42.5	59.0	70.4	30.7	14.4	0.82	1.1	7.1	14.8
Nor Lipez	25.2	1.8	1.5	21.0	72.7	52.0	5.8	0.34	0.2	3.5	11.8
Sud Lipex	0.0	0.5	8.8	15.8	68.0	43.8	4.0	0.05	0.0	0.5	18.7
Linares	4.8	0.9	2.8	26.0	43.0	43.6	3.0	1.36	0.1	1.1	11.7
Quijarro	39.0	7.0	26.0	40.0	67.4	55.0	11.0	1.01	0.5	3.3	13.2
Bilbao	60.0	0.8	0.5	13.0	43.5	42.0	1.3	1.60	0.0	0.0	15.4
D. Campos	43.0	4.5	18.0	43.0	88.0	64.0	17.0	0.41	0.2	0.9	24.5
Omiste	42.0	22.0	34.0	52.0	69.0	54.0	14.0	3.10	0.1	1.5	9.7

A1 = % households with direct connection to water
A2 = % households with direct connection to sewer
A3 = % households with electricity
A4 = % homes with at least 2 of 3 elements (wall, floor, roof) build from permanent materials
B1 = % population that is literate
B2 = % school age children attending school
B3 = % population with some high school education
C1 = # of health facilities per 1000 square kms
C2 = # of doctors per thousand inhabitants
C3 = # of hospital beds per thousand inhabitants
C4 = infant mortality, measured as % live births ending in death within first year
D1 = % workforce employed full or part-time

Source: CORDEPO, Functiones Urbanas en el Desarrollo Rural: Resultados del Estudio en Potosi, Vol. 1, CORDEPO, Potosi, 1981; Hugh Evans, Urban Functions in Rural Development: The Case of the Potosi Region in Bolivia, Washington: USAID, 1982.

Unemployment was estimated to be less than 10% in most provinces but this disguised the fact that many people had only part-time work. Health indicators varied widely, showing one doctor for every 900 inhabitants in Sud Chichas, but no doctors at all in the provinces of Sud Lipez and Bilbao. Infant mortality rates in Bolivia were among the highest in Latin America, reaching their peak in the Department of Potosi: in all but three of the provinces more than one out of every ten children died before their first birthday, and in three provinces more than one out of six.[19]

The highest per capita income levels were found in those provinces with the highest proportion of people living in urban areas and with the highest degree of access to social services. The five most urbanized provinces, Frias (with the city of Potosi), Omiste (with the city of Villazon), Bustillos (with mining towns around Llallagua/Uncia), Sud Chichas (with the town of Tupiza) and Quijarro (with the town of Uyuni) had the highest income levels.

In the Bicol River Basin of the Philippines the intra-regional profile consisted of social, economic, physical and demographic data disaggregated by municipality, which is the major administrative level below the province. The profile consisted of data on population size, density, and composition; percent of children under 14 years old; levels of literacy and educational attainment; conditions of dwelling units; size of municipal revenues; land area; crop production; value of production; and size of the work force. The statistical compendium on muncipalities also included information about population changes in villages (barangays), number and percent of households with lighting and sanitary facilities, strength of building materials used in housing construction, distribution of market receipts, and distribution of agricultural production. Types, numbers and distribution of commercial, service and business establishments, and the numbers and distribution of hospitals, educational institutions and health facilities and services were also included in the profile.

In Bicol the data were derived from national census reports, key informants within muncipalities, special studies conducted by Ministries operating within the Basin, and from project feasibility analyses commissioned by the Bicol River Basin Development Program. In both Potosi and Bicol, these data were used not only to provide a statistical description of differences among administrative units within the region, but also later to formulate a development index.

Measures of Distribution and Association

Measures of concentration, deconcentration and association also provide useful insights about the degree to which activities and characteristics are distributed among communities in the region, and about the activities and characteristics that tend to be concentrated together in the same areas.

The measure of concentration indicates the degree to which activities or characteristics are dispersed widely among, or highly concentrated within, subareas of a region. The measure is expressed in the formula:

$$C = \frac{\Sigma|X - Y|}{2}$$

or, the sum of the absolute values of X, which is the percent of the region's physical area in each territorial unit, and Y, which is the percent of an activity or characteristic in each territorial unit. The measure has utility in a comparative sense, indicating the status of one region or subarea relative to another, or for areas at different points in time 0. Values of C vary from 0 to 100. The higher the value of C, the more unevenly distributed or highly concentrated the activity or characteristic is within the region.

The measurement of concentration is calculated by:

1. Listing the physical area (in square kilometers, hectares, miles, etc.) of each territorial unit with the region;
2. Calculating the percentage of physical area (X) of the region in each territorial unit;
3. Listing the number of activities or magnitude of characteristics to be measured in each of the territorial units of the region;
4. Calculating the percentage of each activity or characteristic (Y) in each territorial unit;
5. Subtracting the value of Y from the value of X and recording its absolute value;
6. Dividing the sum of the absolute values of X-Y by 2.

The calculation of the degree of concentration of manufacturing establishments in Albay Province in the Bicol River Basin, for example, is shown in Table 3-11. It shows that manufacturing activities are not highly concentrated in the Province; indeed, they are quite widely distributed among municipalities. This should not be surprising, given the characteristics of manufacturing in the Basin: it is primarily cottage and very small-scale industry which does not require highly urbanized locations or economies of scale.

Moreover, a distribution quotient can be calculated by dividing the percentage of manufacturing establishments by the percentage of land area for each municipality:

$$D.Q. = \frac{Y}{X}$$

Relatively higher degrees of concentration of manufacturing activity can be found in those municipalities with distribution quotients greater than unity, such as Daraga, Legaspi City, Malilipot, Polangui, Santo Domingo and Tabaco (last column of Table 3-11).

By comparing measures of concentration over time it is possible to determine whether manufacturing or other economic and social characteristics of an area have become more or less concentrated. The measure of deconcentration is calculated by subtracting the value of C for an earlier date (1) from the value of C for a later date (C_2):

$$D = C_2 - C_1$$

The values of D can range between -100.0 and +100.0. Positive numbers indicate deconcentration and negative numbers greater concentration.

Another useful measure is the degree of association between selected activities in a region. The measure of association is expressed by the following formula:

$$La = 100.0 - [\Sigma|X-Y|/2]$$

where X and Y are percentages of two types of activities or characteristics located in each territorial unit. Values of La range from 0.0 to 100.0. The higher the value of La, the stronger the locational association between the two activities within the region. For example, the degree of association between manufacturing and wholesale and retail trade establishments in Albay Province of the Bicol River Basin is shown in Table 3-12. It shows a relatively high degree of association between manufacturing and trade establishments in municipalities of the province. A time series of measures of association can also be constructed to show changes in the locational association of activities over a number of years.

Location Quotients

Location quotients are easily calculated indices of relative specializations of areas in particular 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

TABLE 3-11

CONCENTRATION OF MANUFACTURING ESTABLISHMENTS AMONG MUNICIPALITIES IN ALBAY PROVINCE, BICOL RIVER BASIN

Municipality	Total Area in Sq. Kilometers	Percent of Area (X)	Number of Mfg. Est.	Percent of Mfg. Est. (Y)	X-Y	Distribution Quotient
Bacacay	112.2	4.7	50	3.1	1.6	0.66
Camalig	130.9	5.5	73	4.6	0.9	0.84
Daraga	118.6	4.9	189	11.9	7.0	2.43
Guinobatan	203.0	8.5	64	4.0	4.5	0.47
Jovellar	105.4	4.4	27	1.7	2.7	0.39
Legaspi City	153.7	6.4	132	8.3	1.9	1.30
Libon	185.4	7.8	95	6.0	1.8	0.77
Ligao	246.4	10.3	159	10.0	0.3	0.97
Mililipot	53.6	2.2	112	7.1	4.9	3.22
Malinao	107.5	4.5	13	0.8	3.7	0.18
Manito	107.4	4.5	7	0.4	4.1	0.09
Oas	271.3	11.3	116	7.3	4.0	0.64
Pio Duran	133.7	5.6	27	1.7	3.9	0.34
Polangui	145.3	6.1	206	13.0	6.9	2.13
Sto. Domingo	76.6	3.2	104	6.6	3.4	2.06
Tabaco	116.4	4.9	150	9.5	4.6	1.94
Tiwi	123.4	5.2	64	4.0	1.2	0.77
Albay Province	2,390.8		1,588		57.4	

$$C = \frac{\sum |X-Y|}{2} = \frac{57.4}{2} = 28.7$$

TABLE 3-12

ASSOCIATION BETWEEN MANUFACTURING AND WHOLESALE AND RETAIL TRADE ESTABLISHMENTS IN ALBAY PROVINCE, BICOL RIVER BASIN

Municipality	No. of Manufacturing Establishments	Percent (X)	No. of Wholesale and Retail Est.	Percent (Y)	|X-Y|
Bacacay	50	3.1	373	5.5	2.4
Camalig	73	4.6	289	4.2	0.4
Daraga	189	11.9	794	11.6	0.3
Guinobatan	64	4.0	514	7.5	3.5
Jovellar	27	1.7	143	2.1	0.4
Legaspi City	132	8.3	1,285	18.8	10.5
Libon	95	6.0	483	7.1	1.1
Ligao	159	10.0	410	6.0	4.0
Malilipot	112	7.1	103	1.5	5.6
Malinao	13	0.8	180	2.6	1.8
Oas	116	7.3	298	4.4	2.9
Pio Duran	27	1.7	250	3.7	2.0
Polangui	206	13.0	495	7.3	5.7
Santo Domingo	104	6.5	171	2.5	4.1
Tabaco	150	9.5	711	10.4	0.9
Tiwi	64	4.0	225	3.3	0.7
Albay Province	1,588		6,825		47.4

$La = 100.0 - [\sum|X-Y|/2] = 100.0 - 47.4/2 = 76.3$

"ratio of ratios." It compares, 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:

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

where: M_i = employment in industry i in muncipality;
M = total industrial employment in muncipality;
R_i = employment in industry i in the region;
R = total industrial employment in the region.

A location quotient with a value greater than 1.0 indicates that the municipality is more specialized in that activity than the region, and implies that the municipality may be engaged in an "export" activity, that is, that it is satisfying the needs of other areas, settlements or regions. A location quotient of less than 1.0 implies that the municipality is less specialized in that activity than the region, and may be "importing" goods and services to satisfy local needs, or that local people must go to other areas in order to obtain them.[20]

Planners in the Bicol River Basin used employment data to construct location quotients for municipalities in order to create a regional profile of municipal specializations. Table 3-13 shows location quotients calculated for selected municipalities in Camarines Sur Province. It indicates that the municipalities of Naga City, Camaligan, Gainza and Magarao, for example, are specialized in professional, technical, and managerial workers serving the province. It is assumed that those municipalities that have location quotients at or near unity are sufficiently specialized in those occupations to serve local needs.

In the Department of Potosi in Bolivia, location quotients of major economic activities differentiated the economic bases of provinces quite clearly (see Table 3-14). Some provinces have economies heavily dominated by mining--Bustillos, Frias, Nor Chichas, Sud Chichas and Sud Lipez--for example; while others--such as Bilbao, Ibanez, Charcas, Chayanta, Saavedra, and Linares--are relatively specialized in agriculture. Only a few provinces were relatively specialized in manufacturing--Bilbao and Omiste, for example--and further investigations revealed that their manufacturing base was composed almost entirely of handicrafts and small-scale processing. Location quotients calculated for employment in various sectors in the Department of Potosi

TABLE 3-13

LOCATION QUOTIENTS FOR SELECTED MUNICIPALITIES IN CAMARINES SUR PROVINCE

Municipality	Experienced Workers by Occupation Group			
	Prof., Tech. Managerial, and Administrative	Farmers, Fishermen, Miners, and Related Workers	Craftsmen, Production Process Workers and Laborers	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
Pasaeao	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

Source: Bicol River Basin Urban Functions in Rural Development Project; and D. Rondinelli, "Spatial Analysis for Regional Development: A Case Study in the Bicol River Basin of the Philippines," Resource Systems Theory and Methodology Series, No. 2 (Tokyo: United Nations University, 1980.

Table 3-14

SECTORAL LOCATION QUOTIENTS OF EMPLOYMENT FOR PROVINCES

IN THE DEPARTMENT OF POTOSI, BOLIVIA

Province	Agriculture	Mining	Manufacturing	Energy	Construction	Commerce and Finance	Transport & Communications	General Services
Frias	0.53	1.54	1.16	1.68	1.87	2.00	1.54	1.94
Busillos	0.73	2.03	0.82	1.00	0.82	0.98	0.89	1.41
Saavedra	1.31	0.41	1.21	0	0.70	0.55	0.38	0.33
Chayanta	1.44	0.19	1.31	0.27	0.18	0.27	0.15	0.17
Charcas	1.49	0.01	1.20	0	0.13	0.16	0.04	0.25
N. Chichas	1.06	1.47	0.48	0.47	1.05	0.50	0.57	0.71
Ibanez	1.59	0.04	0.13	0	0.13	0.08	0.08	0.30
S. Chichas	0.46	1.97	0.66	2.51	2.29	1.55	2.13	2.01
N. Lipez	1.08	0.61	0.36	0	0.94	0.31	3.12	1.19
S. Lipez	1.02	1.72	0.12	0.81	0.90	0.70	0.78	0.74
Linares	1.40	0.24	0.89	0	0.63	0.38	0.29	0.39
Quijarro	0.81	1.19	0.61	6.36	1.04	1.09	3.73	1.31
Bilbao	1.30	0	2.81	0	0.29	0.14	0.05	0.26
Campos	1.10	0.87	0.12	0.56	0.41	0.36	1.54	1.12
Omiste	0.48	0.27	1.85	0.61	2.85	5.10	2.38	1.71
Department	0.64	3.00	0.27	1.00	0.50	1.05	0.88	1.11

Source: H. Evans, Urban Functions in Rural Development: The Case of the Potosi Region in Bolivia, Washington: USAID, 1982.

compared to Bolivia indicate quite clearly that Potosi, from a national perspective, was highly specialized only in mining. It was relatively deficient in employment in agriculture, industry and construction.[21]

A variety of socio-economic data can be analyzed using the location quotient to determine relative specialization. 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 or areas over a period of time. Location quotients are very rough indicators, however, and must be carefully interpreted and refined using other analytical techniques.

Level of Development Index

Finally, the UFRD approach attempts to discern and explain differences in levels or degrees of development among territorial units within the region based on a composite of social and economic indicators. Weighted or composite rankings are used to distinguish between those areas that have a greater number and higher level of social and economic resources and those that have a relatively lower or higher standard of living or welfare.

In the Bicol River Basin, for example, municipalities were ranked by level of development based on three sets of indicators--socio-economic and demographic characteristics; share of industrial, commercial and agricultural production and establishments; and degree of transportation access based on the length and condition of roads passing through the municipality. Among the socio-economic indicators used were: population size, percentage of settlements with more than half of the population living in urban areas, percentage of literate population, level of educational attainment, percentage of labor force employed, per capital municipal revenues, per capita market receipts, number of enterprises or commercial establishments, percentage of workforce in farming occupations, number of hospital beds per 1,000 population, number of households served by water and sanitary facilities. Share of production and productive establishments was determined directly and through surrogate indicators. Among the indicators used were: total amount of land in agricultural production; value and yield of rice, coconut and other major crops per hectare; number of establishments in all industries in the municipality; numbers of wholesale and retail trade, transportation and communications, manufacturing, business, service, financial and real estate establishments; and percentage of population employed in personal

service occupations. The third set of indicators--transportation access--consisted of measures of road lengths and types and rankings of road conditions.

The indicators were weighted according to local planners' perceptions of their importance in determining the level of socioeconomic development within the Basin. Municipalities were scaled from 1 to 4, depending on their share of those indicators within their boundaries. A composite ranking was developed to classify all municipalities into three categories: relatively high ranking areas that were considered to be developing, transitional or less developed municipalities, and relatively underdeveloped or declining areas.

The analysis showed that although the entire Bicol River Basin was relatively poor and underdeveloped, municipalities differed significantly in their socioeconomic characteristics. The distribution of services, facilities, infrastructure and productive and social organizations among municipalities was highly skewed. Table 3-15 summarizes some of the characteristics of municipalities in the three categories of development that were determined by the composite rankings.[22]

1. Developing municipalities included the six most "urbanized," encompassing the two provincial centers of Naga and Camaligan, and Legaspi and Daraga, the city of Iriga and the town of Tobaco. Services, facilities and productive activities were highly concentrated in these six municipalities, especially in Naga and Legaspi cities. The developing municipalities contained about one-quarter of the population (386,000 people or 22 percent) but accounted for more than 40 percent of the "urban" population, raised 45 percent of the Basin's municipal revenues, and had significantly higher percentages of households served by piped water and electricity. Most of the Basin's educational and vocational training institutions were concentrated within them as were most of the major health care institutions. The developing municipalities contained nearly a third of all high school and 45 percent of all college graduates in Bicol. They were the financial centers of the Basin, with nearly half of all financial institutions and more than 85 percent 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 were located within their boundaries.

2. Less Developed or Transitional Municipalities were ten that lay at or near the Manila South Road within the central plain of the river basin. They were closer in socio-economic and physical characteristics to the underdeveloped municipalities than to the developing ones. But they were distinguished from the

TABLE 3-15

SOCIOECONOMIC PROFILE OF MUNICIPALITIES BY LEVELS OF DEVELOPMENT, BICOL RIVER BASIN, PHILIPPINES

	Developing Municipalities (N=6)	Less Developed or Transitional Municipalities (N=10)	Underdeveloped and Peripheral Municipalities (N=38)
Population	22.4	26.4	51.2
Educational Attainment			
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
Agro-processing, 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
Manufacturing, Commercial and Service Establishments	45.4	29.8	24.8
Health Facilities			
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.

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 had generated some diversification of economic and social activities in the poblacions, and that they contained the potentially richest agricultural land in the Basin. This group of municipalities accounted for slightly more than 26 percent of the population and had concentrations of services, cottage industries, infrastructure and facilities slightly larger than its share of population. Rural areas of these municipalities were largely underdeveloped: less than 20 percent of households were served by piped water, they had few educational or health institutions, and commercial establishments were rare and scattered. Perhaps because of their physical proximity to the major provincial centers, these areas had not become highly specialized and seemed to depend on the larger centers for marketing and trade.

3. Underdeveloped Municipalities included 38 predominantly rural, subsistence agricultural areas forming the periphery of the Basin. Slightly more than half of the population of the Bicol River Basin lived in these municipalities, which, by all socioeconomic characteristics, were the poorest and least developed. These 38 municipalities had a far smaller proportion of facilities, services, educated manpower, financial resources, and productive economic activities than their share of population. Their residents were scattered in rather small barangays. Only eight percent of households received water and less than six percent had electrical power. Only five of the 38 municipalities had post-secondary educational or vocational training institutions; nearly 40 percent had no markets of any kind, and 8 contained no financial institutions. These municipalities collected less than two-fifths of all municipal revenues and, on the average, depended on the national government for nearly a third of their municipal income. Some of the municipalities obtained more than half of their revenues from the national government and had few sources of internal income. The financial institutions in these underdeveloped municipalities had less than 10 percent of the deposit and loan assets in the Basin. As a group, these municipalities contained 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 lived in municipalities with few services or facilities needed to meet

basic human needs or to increase agricultural production and expand nonagricultural employment opportunities. Moreover, they were generally isolated from or had extremely poor access to the municipalities in which services, facilities and markets were most highly concentrated.

In the Department of Potosi in Bolivia a somewhat different set of indicators were used to construct a development index. Evans notes in his study of Potosi that a series of development indicators were calculated for the fifteen provinces, including housing conditions and services provided to dwellings, education, health, employment, transport and communications. These were either derived from data in the population and housing censuses or were based on information collected in a survey of towns as part of the settlement system analysis. Information used in the development index is listed in Table 3-10.[23]

To arrive at a development index a ranking method was used. For each indicator the difference between the top and bottom score was divided into three equal parts. Since the number of indicators for each category of data varied from one to four, they were assigned different weights by the local planners in order to balance their importance in the overall rankings. Provinces were classified as more developed, less developed, and least developed based on their composite weighted rankings (see Table 3-16). Those with from 29 to 35 points (34 was the highest number of points scored by any province) were considered to be the more developed; those with 22 to 28 points, less developed; and those with from 15 to 21 points, the least developed.

In addition, estimates were made of the per capita income levels in each of the provinces. These estimates were based on output per unit of labor in each sector at the departmental level, and sectoral employment in each province. This assumed that productivity levels were constant across all provinces, which is obviously not true, but in the absence of alternative data it provided at least a first approximation.[24]

Income per capita in province i, Y_i, is calculated as follows:

$$Y_i = \frac{1}{P_i} \sum_{j=1} N_{ij} \times Y^*_j; \quad \text{with } Y^*_j = Y_j/N_j$$

where: P_i = population of the province i;
N_{ij} = labor in sector j in province i;
Y^*_j = estimated output per labor in sector j in province i;
Y_j = output in sector j in the Department;
N_j = labor in sector j in the Department.

TABLE 3-16

RANKINGS OF PROVINCES BY LEVELS OF DEVELOPMENT, DEPARTMENT OF POTOSI, BOLIVIA

Levels of Development and Provinces in Each Level		Housing A1	A2	A3	A3	Housing B1	B2	B3	Employment C1	D1	Health D2	D3	D4	Transportation and Comm. E1	E2	Total
More Developed	Frias	3	3	3	3	2	3	3	2	3	3	1	1	2	2	34
	Omiste	3	3	3	3	3	3	2	2	1	1	1	1	2	3	31
	S. Chichas	3	1	3	3	3	1	2	2	1	3	2	2	2	3	32
	Bustillos	3	1	3	3	2	3	2	1	2	3	1	1	1	2	29
Less Developed	Quijarro	2	1	2	2	2	3	2	2	1	2	2	2	1	1	25
	N. Chichas	1	1	1	2	2	2	1	3	1	1	3	3	1	1	22
	Campos	3	1	2	2	3	3	3	3	1	1	3	3	1	1	28
Least Developed	Saavedra	1	1	1	2	1	1	1	3	2	1	1	1	2	3	21
	Linares	1	1	1	2	1	1	1	3	1	1	2	2	2	2	21
	Bilbao	1	1	1	1	1	1	1	2	1	1	2	2	3	3	21
	N. Lipez	2	1	1	1	3	3	1	1	1	1	2	2	1	1	20
	Ibanez	1	1	1	1	1	1	1	3	1	1	2	2	1	2	18
	S. Lipez	1	1	1	1	2	2	1	1	1	1	3	3	1	1	18
	Chayanta	1	1	1	1	1	1	1	3	1	1	1	1	1	1	16
	Charcas	1	1	1	1	1	1	1	2	1	1	1	1	1	1	15

Indicators:
- A1 - % of houses with water
- A2 - % of houses with sewers
- A3 - % of houses with electricity
- A4 - % of houses of strong building materials
- B1 - % of population literate
- B2 - % of population that attended school
- B3 - % of population with elementary education
- C1 - % of population employed
- D1 - number of health facilities
- D2 - physicians per thousand population
- D3 - hosptial rooms per thousand population
- D4 - mortality rate
- E1 - condition of roads
- E2 - telegraph facilities

Source: H. Evans, Potosi Urban Functions in Rural Development field research data.

The results are listed in column 5 of Table 3-9.

The index of development tended to confirm the findings of other elements of the regional profile. It indicated that the provinces that were most urbanized and that had strong mining activities tended to have the highest levels of social and economic services and facilities. The rural agricultural provinces tended to be the least developed and to have the lowest levels of services and facilities. The index of development provided planners a broader framework in which to conduct a more detailed analysis of discrete settlements within the region.

Thus, the regional profile can be useful in confirming or documenting the relative strengths and weaknesses of the regional economy and in determining the distribution and levels of development of human, social and physical resources among areas within the region. In most developing countries, however, detailed information is usually only available for major administrative subdivisions or for principal economic areas, and not for discrete settlements. Relatively little data are usually available for most towns and villages. Thus the UFRD approach makes use of simple and rapid methods of collecting and organizing information on the distribution of functions among settlements and the functional characteristics of different types of settlements within a region. These are described in Chapter Four.

NOTES

1. United Nations Economic and Social Commission for Asia and the Pacific, Guidelines for Rural Centre Planning, New York: United Naitons, 1979.

2. John Friedmann, Regional Development Policy: A Case Study of Venezuela, Cambridge, Mass.: MIT Press, 1966.

3. John Friedmann, Urbanization, Planning and National Development (Beverly Hills: Sage Publications, 1973), pp. 302-303.

4. United Nations Economic and Social Commission for Asia and the Pacific, op. cit., p. 109.

5. Dennis A. Rondinelli and Barclay G. Jones, "Decision-Making, Managerial Capacity and Development: An Entrepreneurial Approach to Planning," African Administrative Studies, No. 13 (1975), pp. 105-118.

6. Avrom Bendavid-Val, Regional and Local Economic Analysis for Practitioners, New York: Praeger, 1983.

7. Kenneth Ruddle and Dennis A. Rondinelli, Transforming Natural Resources for Human Development: A Resouce Systems Approach Development Policy, Tokyo: United Nations University Press, 1983.

8. Bendavid-Val, op. cit., pp. 23-28.

9. F.E. Croxton, D. Cowden and S. Klein, Applied General Statistics, Englewood Cliffs, N.J.: Prentice-Hall, 1967.

10. Bicol River Basin Development Program, Urban Functions in Rural Development: A Research Project in Spatial Analysis and Planning (Pili, The Philippines: BRBDP, 1978), Chapter 1.

11. See Dennis A. Rondinelli, "Spatial Analysis for Regional Development: A Case Study in the Bicol River Basin of the Philippines," Resource Systems Theory and Methodology Series, No. 2, Tokyo: United Nations University Press, 1980.

12. Dennis A. Rondinelli, Bicol River Basin Urban Functions in Rural Development Project: Summary and Evaluation, Washington: U.S. Agency for International Development, 1978.

13. Ibid.

4
Analysis of the Settlement System

Although intra-regional analysis provides a good deal of information about territorial units within a region, it does not offer much insight into the characteristics of the communities in which people live and carry out the social and economic activities that contribute to local and regional development. The major sources of information about those activities in most countries are national censuses and specialized demographic surveys that usually do not disaggregate data to the level of discrete communities or settlements. Usually this information is only available for larger administrative units such as provinces, districts or municipalities, which may contain many settlements of different types and characteristics.

Geographers, demographers and planners have usually used three methods to analyze settlement systems:[1]

1. Morphological classifications that attempt to distinguish urban and rural communities on the basis of demographic and physical characteristics;
2. Population size classifications that seek to categorize settlements into metropolitan areas, cities, towns, villages and hamlets based on the number and density of residents within their boundaries; and
3. Functional classifications that attempt to distinguish among settlements on the basis of the types, combinations and diversity of social and economic activities located in them.

The UFRD approach to regional planning is concerned primarily with the social and economic functions that discrete communities perform and how in combination they form a pattern or system that can influence economic and social development. Thus, this stage of the analysis focuses heavily on the functional characteristics of communities and describes a region as a pattern of human settlement defined by both population and functional features.

The objectives of this stage of the analysis are to:

1. Identify the discrete elements or components of the regional settlement system--that is, the number and location of communities in which people live and interact with each other in performing significant economic and social activities;
2. Determine the functional characteristics of communities and the degree to which the settlements serve populations living outside of their boundaries--that is, the degree to which settlements in the system are central places;
3. Delineate the pattern of settlement within the region--that is, its levels of hierarchy and diffusion and the centrality of places within it; and,
4. Determine the distribution of and patterns of association among social and economic functions--services, infrastructure, organizations and facilities--within settlements that are important for local and regional development.

This information, together with the analysis of spatial linkages, can assist planners and policy-makers in understanding how the pattern of settlement and the level of development within the region are related. It can help them determine the degree of access that people in different communities and parts of the region have to various services, facilities, infrastructure and organizations; in determining where functions are adequate or deficient; and in judging where the location of new investments will increase the capacity of communities to provide the access that people living in rural areas need to town-based services, facilities and infrastructure. Moreover, the information can be useful in making location decisions about new investments and about the potential for clustering services and facilities in new ways to increase the capacity of settlements to stimulate development in their areas.

MORPHOLOGICAL AND POPULATION SIZE ANALYSES

The most frequently used methods of analyzing settlements in developing countries are morphological and demographic, primarily because population data are the most commonly available. As noted earlier, the morphological approach attempts to determine which communities are "urban" or "rural" based usually on a definition that sets a minimum population size and a few easily observed physical characteristics as the distinguishing criteria. Demographic analyses usually use population size to determine the pattern of settlements--that is, the degree of hierarchy or diffuseness, the rank-order, and the degree of urbanity. Although these approaches yield little information

about the social and economic characteristics of communities, they do provide an initial and easily determined profile of the settlement pattern that can be analyzed in more detail and cross-checked with functional analyses.

In the Bicol River Basin of the Philippines, for example, the UFRD analysis began with an examination of the morphological and demographic characteristics of the region's settlements. Settlements were divided into "urban" and "rural" areas by using the national census definition of urban areas: (1) all settlements or municipalities having a population density of at least 1,000 persons per square kilometer; (2) central districts of municipalities or places having a population density of at least 500 persons per square kilometer; (3) central districts not included in criteria 1 and 2, regardless of population size, that have (a) a street pattern, i.e., network of streets in either parallel or right-angle orientation, (b) at least six commercial, manufacturing, recreational or personal services, and (c) at least three of the following functions: a town hall, church or chapel with religious services at least once a month, a public plaza, park or cemetery, a market place or building where trading activities are carried on at least once a week and a public building such as a school, hospital, health center or library; and (4) those settlements with at least 1,000 inhabitants that meet conditions set out in criterion 3, and where the occupation of the inhabitants is predominantly non-farming or non-fishing.[2]

Using this definition, barangays (administrative subunits of municipalities) could be categorized as either urban or rural places and the percentage of population in each municipality and in the Bicol River Basin living in urban and rural settlements could be roughly estimated. Table 4-1 indicates that few municipalities in the region had a large percentage of population living in urban areas. Only Naga City was considered totally urbanized; even other larger municipalities in the region, such as Legaspi City, Camaligan, and Magarao had substantial numbers of residents living in rural places. More than 87 percent of Albay's and 79 percent of Camarines Sur's residents lived in rural places. Overall, less than 18 percent of the Bicol River Basin's population was urbanized.

The morphological and demographic data also provided some indication of the size classes of settlements in the Bicol River Basin and the average population size of barangays. The analysis showed, for example, that less than 5 percent of all barangays in the Basin had populations of 3,000 or more, about one-third of the barangays had populations of between 1,000

TABLE 4-1

URBAN AND RURAL SETTLEMENTS IN THE BICOL RIVER BASIN

Municipality	Population (1975)	No. of Barangays	Urban Settlements			Rural Settlements		
			No. of Barangays	Urban Population	Percent of Municipal Population	No. of Barangays	Rural Population	Percent of Municipal Population
Bacacay	39,500	46	4	4,187	10.6	42	35,313	89.4
Camalig	41,702	45	1	3,210	7.7	44	38,492	92.3
Daraga	63,265	54	2	4,011	6.3	52	59,254	93.7
Guinobatan	49,724	46	2	1,080	2.2	44	48,644	97.8
Jovellar	14,121	23	9	2,335	16.5	14	11,786	83.5
Legaspi City	88,378	65	35	37,724	42.7	30	50,654	57.3
Libon	47,890	41	1	6,645	13.9	40	41,254	86.1
Ligao	61,549	55	1	1,741	2.8	54	59,808	97.2
Malilipot	20,497	14	-	-	-	14	20,497	100.0
Malinao	24,889	26	-	-	-	26	24,889	100.0
Manito	13,647	14	-	-	-	14	13,647	100.0
Oas	50,293	53	1	281	0.6	52	50,012	99.4
Pio Duran	31,188	29	-	-	-	29	31,188	100.0
Polangui	52,541	44	2	5,085	9.7	42	47,456	90.3
Sto. Domingo	17,562	17	4	5,550	31.6	13	12,012	68.4
Tabaco	65,254	47	7	13,955	21.4	40	51,269	78.6
Tiwi	24,350	25	1	2,040	8.4	24	22,310	91.6
Albay	706,350	644	70	87,844	12.4	574	618,485	87.6
Baao	30,219	30	7	8,641	28.6	23	21,578	71.4
Balatan	13,159	17	1	1,808	13.7	16	11,351	86.3
Bato	28,492	33	6	9,501	33.3	27	18,991	66.7
Bombon	7,494	6	-	-	-	6	7,494	100.0
Buhi	44,226	38	6	9,848	22.3	32	34,378	77.0
Bula	36,904	31	-	-	-	31	36,904	100.0
Cabusao	10,110	9	2	1,369	13.5	7	8,741	86.5
Calabanga	40,274	48	8	6,413	15.9	40	33,861	84.1

TABLE 4-1 (continued)

Camaligan	9,853	13	7	4,058	41.2	6	5,795	58.8
Canaman	14,522	24	5	4,014	27.6	19	10,508	72.4
Caramoan	31,399	49	3	2,587	8.2	46	28,812	91.8
Del Gallego	13,754	32	3	1,914	13.9	29	11,840	86.1
Gainza	5,931	7	-	-	-	7	5,931	100.0
Garchitorena	16,438	20	-	-	-	20	16,438	100.0
Goa	34,049	34	10	7,133	20.9	24	26,916	79.1
Iriga City	75,885	37	3	13,938	18.4	34	61,947	81.6
Lagonoy	33,297	38	6	4,469	13.4	32	28,828	86.6
Libmanan	66,601	75	1	2,041	3.1	74	64,560	96.9
Lupi	19,682	38	1	1,274	6.5	37	18,408	93.5
Magarao	11,846	15	8	7,984	67.4	7	3,862	32.6
Milaor	13,167	14	-	-	-	14	13,167	100.0
Minalabac	27,089	25	4	2,817	10.4	21	24,272	89.6
Naboa	48,635	40	9	7,611	15.6	31	41,024	84.4
Naga City	83,337	27	27	83,337	100.0	-	-	-
Ocampo	19,283	25	3	2,068	10.7	22	17,215	89.3
Pamplona	18,350	17	1	3,123	17.0	16	15,227	83.0
Pasacao	21,809	19	3	4,350	19.9	16	17,459	80.1
Pili	36,676	26	6	5,984	16.3	20	30,692	83.7
Presentacion	13,555	18	-	-	-	18	13,555	100.0
Ragay	32,798	38	2	2,686	8.2	36	30,112	91.8
Sangay	18,013	18	4	2,854	15.3	14	12,259	84.7
San Fernando	15,524	22	4	3,317	21.4	18	12,207	78.6
San Jose	21,859	29	6	3,329	15.2	23	18,530	84.8
Sipocot	39,457	45	-	-	-	45	39,457	100.0
Siruma	10,435	22	1	430	4.1	21	10,005	95.9
Tigaon	25,282	23	1	2,912	11.5	22	22,370	88.5
Tinambac	34,415	44	6	3,908	11.4	38	30,507	88.6
Camarines Sur	1,023,819	1,046	154	215,618	23.1	892	805,201	78.9
Grand Total (Basin)	1,730,169	1,690	224	303,462	17.5	1,466	1,423,686	82.5

Source: Center for Policy and Development Studies, Urban Functions in Rural Development, Bicol River Basin Development Program, Vol. II-B (College, Laguna: University of the Philippines, Los Banos, 1978).

and 3,000, and that about 62 percent of the barangays had populations of less than 1,000. The average size of all barangays in the Bicol River Basin was about 1,100 people. The analysis seemed to confirm that the Bicol River Basin suffered from many of the adversities described in Chapter One of a settlement system with very small populations. Relatively few settlements in Bicol had large enough population size, it would seem, to be able to support a wide variety of central functions. The demographic data would only allow planners to surmise that population levels were too low for most settlements to offer central functions, however, and they would have to be cross-checked by a functional analysis of settlements to determine the types and ranges of functions supported by communities of different size groups.

Morphological and demographic analyses, in addition to helping planners to distinguish quickly between urban and rural settlements, also provides some insights into size classes of settlements and changes in them over time. Similar studies in the Department of Potosi in Bolivia revealed a pattern of settlement similar to that in Bicol. Table 4-2 indicates that there were only 2 settlements in the region with more than 13,000 population; only 6 with between 5,000 and 13,000 residents, only about a dozen settlements with between 2,000 and 5,000 people; and the large majority--more than 40 towns and villages--had between 500 and 2,000 residents when the last census was taken in 1976.

The settlement pattern in the Department of Potosi showed a high degree of primacy, measured by the four-city primacy index, or the ratio of the population of the largest city to the combined populations of the next three largest cities.

$$Pr = \frac{P_1}{P_2 + P_3 + P_4}$$

The city of Potosi, the largest settlement in the Department, had more than three times the population of the next largest town in the region, and a primacy index of 1.65, indicating that it was more than one and a half times the size of the next three largest towns.

The population size data indicate that the primacy of the city of Potosi among settlements in the Department declined slightly from about 1.91 in 1950 and that the number of settlements with more than 500 population increased from the 32 that existed in 1950 to 60 in 1976. Moreover, a rank ordering of the settlements with more than 500 people shows a substantial number of shifts in the population rank among towns in the region over the quarter of a century (see Figure 4-1). In

TABLE 4-2

CHANGES IN POPULATION SIZE OF SETTLEMENTS IN THE DEPARTMENT OF POTOSI, BOLIVIA

Population Size Category	Towns	Population 1950	Towns	Population 1976
20,000 or more	Potosi	43,306	Potosi	77,334
			Llallagua	23,361
10,000-20,000			Villazon	12,536
			Siglo XX	10,766
			Tupiza	10,682
5,000-10,000	Tupiza	8,235	Uyuni	8,639
	Pulacayo	7,735	C.M. Catavi	7,593
	Uyuni	6,671	Uncia	7,396
	Llallagua	6,626		
	Villazon	6,175		
2,000- 5,000	Uncia	4,454	Atocha	4,677
			R. Tazna	3,171
			Chayanta	2,937
			Animas	2,694
			Colquechaca	2,686
			S. Barbara	2,556
			Siete Suyos	2,523
			Pulacayo	2,398
			Tatasi	2,380
			Telamayu	2,332
			Betanzos	2,205
			B. Retiro	2,052
1,000- 2,000	10 towns		11 towns	
500- 1,000	15 villages		29 villages	

Source: H. Evans, Urban Functions in Rural Development: The Case of Potosi Region of Bolivia, Washington: USAID, 1982.

1950 only the city of Potosi had more than 10,000 residents; by 1976 there were six cities in the region of that size or larger, and about 20 with more than 2,000 people compared to 7 a quarter of a century earlier. However, as Figure 4-1 indicates, more than half of the towns with more than 500 residents in 1950 lost population over the next 26 years. More extensive investigations later found that nearly all of the settlements that lost population were farming communities and nearly all that gained were mining centers. The explanation is clearly found in the economic characteristics of the region and economic policy of the government, which emphasized mining to the detriment of agriculture in investment allocations. Evans points out that the population growth of settlements in the Potosi region was closely related to the economic base of the area in which they were located.[3] The few farming settlements that grew were closely linked to larger centers of consumption, underlining the importance of demand and market outlets in stimulating and sustaining rural production. Mining towns such as Pulacayo, which lost over 70 percent of its population between 1950 and 1976, declined as profitable mineral deposits were gradually exhausted.

FUNCTIONAL ANALYSIS OF THE SETTLEMENT SYSTEM

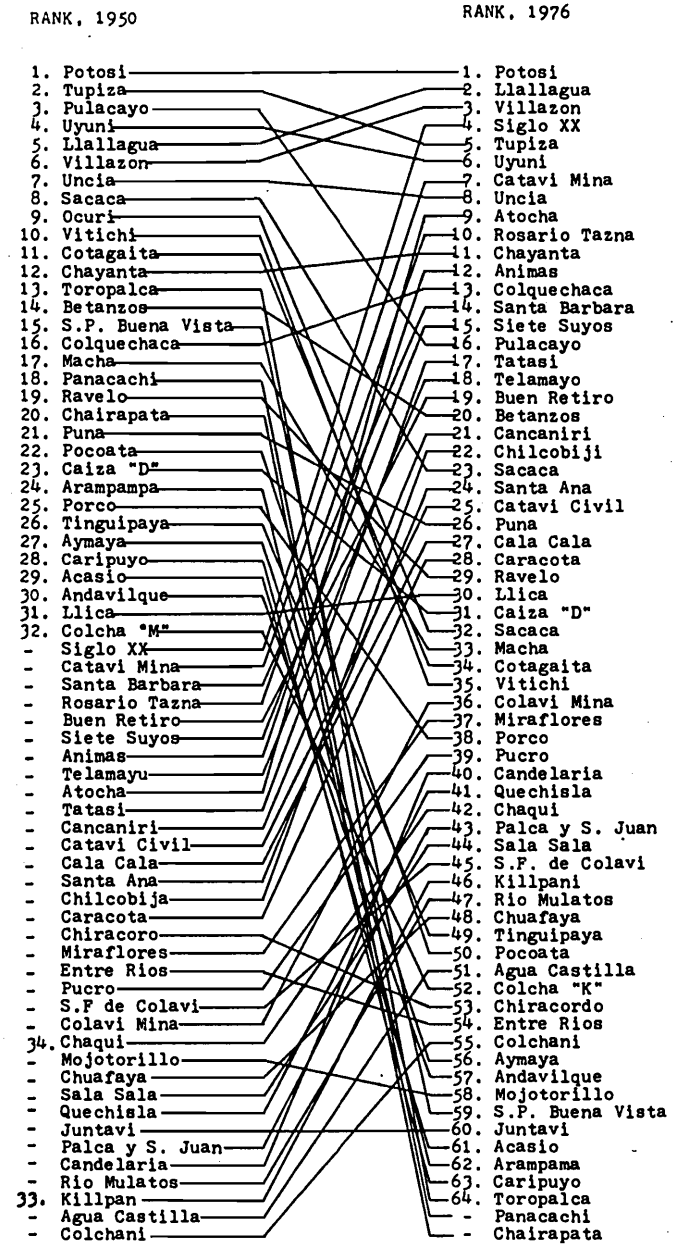
Although morphological and population size analyses provide some useful information about the settlement system in a region, they do not offer insights into the functional characteristics of communities or provide a satisfactory description of the regional settlement hierarchy. The UFRD approach uses a combination of methods to determine the functional characteristics of the settlement system, including: Guttman scales, manual scalograms, threshold analyses, weighted centrality indexes, and frequency distributions.

Scale Analyses

A Guttman scale is a means of analyzing the underlying characteristics of particular items. In regional analysis the items are functions--services, facilities, infrastructure, organizations and economic activities--which give settlements (cases) centrality in the spatial system. In order to construct a scale, the measures must be unidimensional, that is, measurement must be toward or away from a single underlying objective for each case. The scale must be ordinal--items can be divided into two portions, that is, "yes" or "no" or "present" or "absent". Moreover, the scale must be cumulative, so that items can be ordered by their degree of complexity, such that each higher order

Figure 4.1

POPULATION GROWTH AND RANK SIZE CHANGES OF SETTLEMENTS IN THE DEPARTMENT OF POTOSI, BOLIVIA



item is composed of lower order ones. In a perfectly hierarchical scale of settlements, for example, each settlement would be expected to possess all functions (items) of those of places of lower order (functional complexity), but would not be expected to possess those functions of places ranking higher in the scale. Each deviation from the "expected pattern" is considered an "error." That is, when functions are missing from a higher order settlement that are found in lower order ones, or when functions are present in lower order settlements that are not found in higher order ones, this constitutes a statistical error that requires further investigation for an adequate explanation. Statistical measures, based on analysis of errors, can also help determine the validity of the scale. A coefficient of scalability determines whether or not the scale is unidimensional and cumulative.[4]

Obviously, there are few regions in which settlements would be perfectly ordered in a hierarchical scale. Because of distance and other factors there are usually many "unexpectedly present" and "unexpectedly absent" functions in a settlement hierarchy. In both cases, other means of analysis must be employed to determine whether the presence or absence of functions in particular communities constitutes a problem or an opportunity for investment.

Guttman Scale is a relatively easy way of examining both the functional complexity of settlements and the distribution of functions among communities within a region. But as with all methods of analysis described here, it provides only rough approximations that must be cross-checked and further analyzed by other methods. Assuming that a settlement's "level of development" is reflected in the number and diversity of functions located within it, relative levels of development and hierarchy for all settlements in a region can be determined by the array of Guttman 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 people living in other areas.

As will be seen later, data need only be collected on the presence or absence of functions in settlements and can usually be gathered quickly through simple surveys. In some cases aerial photography can be used to determine the presence or absence of physical facilities or activities with distinguishable physical structures, as well as to determine locations and distances of facilities from population concentrations. Indeed, aerial photographs that clearly show the number of dwelling units in settlements can be used to approximate the number of people living in the community, as a check on or to substitute for census data.

The most important aspect of the scale analysis is that it gives planners and policy analysts the ability to process a great diversity of qualitative data concerning development when quantitative data are either not available or cannot be quickly and economically acquired. It is also useful in situations where more sophisticated statistical analysis cannot conveniently be applied. Scale methodologies discern detailed differences in quality among the units of analysis, such as settlements, administrative areas, districts or regions. But they also go beyond the capacity of such statistical techniques as factor analysis, which measure quantitative variances or differences among cases. Scales can delineate specific qualitative differences among settlements and the cumulative sequence of attributes or characteristics within them. As Voelkner points out, scale analysis can be used as a substitute for quantitative analysis, but ideally it is "complementary to quantitative analysis and vice-versa in measuring development. The strength of quantitative analysis lies in the measurement of efficiency and correlations between variables. It does poorly in identifying sequence and multiple interdependencies of development factors. The strength and weaknesses of scalogram analysis are the opposite."[5]

Scale analyses can be done in two ways--using a computerized statistical program or a manual method. Both were tested in the UFRD pilot projects in the Philippines and Bolivia. In the Bicol project, planners initially attempted to extend a statistical application of scale analysis that had been done earlier for municipalities in Camarines Sur Province to the rest of the Basin.[6] The approach used in Camarines Sur province clearly illustrates the procedure for applying Guttman scales in regional analysis. First, a survey identified existing institutions, services, facilities and establishments in town centers (poblacions) and other communities (barangays) in each municipality.[7] Among the information collected were the name, administrative level and administrative class of the place, the number of barangays, land area, population size, number of

dwelling units and population densities of each town center and barangay. In addition, information was gathered about the presence or absence of and the number of communities possessing the following functions:

1. Public utilities and facilities--including telephone company, telegraph office, post office, messenger service, radio station, TV station, printing press, newspaper or magazine publisher, police force, fire department, sewage system, electric utility, security agency, street lights, water supply, paved streets, paved sidewalks, national highway, and irrigation system.

2. Transportation services--including calesas (horse-drawn carts), tricycles, buses, jeepneys, taxis, motorboats, aircraft, trains, airports, train stations, bus terminals, or commercial ports.

3. Commercial establishments--including sari-sari (neighborhood) stores, groceries, department stores or bazaars, drugstores, gas stations, auto repair shops, bakeries, banks, hardware stores, lumber yeards, rice or corn mills, furniture shops, applicance stores, agrochemical stores, insurance or real estate offices, and factories.

4. Health facilities--including public and private hospitals or clinics, child health care centers, family planning clinics, and optical, dental or chest clinics, or rural health stations.

5. Recreational facilities--including theaters, cock-fighting pits, bowling alleys, basketball courts, tennis, volleyball and raquetball courts, nightclubs, bars, reading centers, recreation halls or centers, resort facilities, golf courts and dancing pavilions.

6. Extension services--agricultural, local government, family planning, plant industry, and national grain authority agents, social work, forestry, fishery or animal industry agents, welfare services and malaria control units.

7. Community organizations--school and church-related activities, civic groups, professional organizations, marketing, consumer or irrigation cooperatives, credit groups, compact farm groups, labor unions, women's clubs, cultural organizations and youth clubs.

8. Educational institutions--including kindergarten and nursery schools, primary, intermediate and secondary schools, vocational schools, public and private colleges and universities, technical and business schools.

9. Health services--physicians, nurses, licensed midwives, dentists, pharmacists, healers, herbalists, optometrists, opticians, faith healers, medical technologists, and health paraprofessionals.

10. Professional services--lawyers, engineers, accountants, architects, building contractors, surveyors, chemists, teachers, licensed electricians and plumbers and others.

11. Personal services--including barber shops, beauty parlors, tailor shops, dressmaker shops, shoe-repair shops, hotels and lodging places, cafeterias, restaurants, laundaries, funeral parlors, photo studios, sauna baths and others.

Once these data were collected for the 33 municipalities in Camarines Sur Province, the items or functions were coded as being either present or absent and scaled by the Guttman method. A computer program 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 functional complexity, and based on scale scores, were regrouped into scale steps (see Table 4-3). 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 (see Figure 4-2).

The analysis clearly identified Naga City and Iriga as the most functionally complex centers in the province, delineated their apparent "areas of influence" and pinpointed the satellite or supplementary centers 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 Camarines Sur 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 descriptive statistics and indexes of development in the regional profile concerning levels of development among municipalities--its most important deficiency was that the municipalities in the Philippines are administrative areas and not necessarily discrete settlements. A

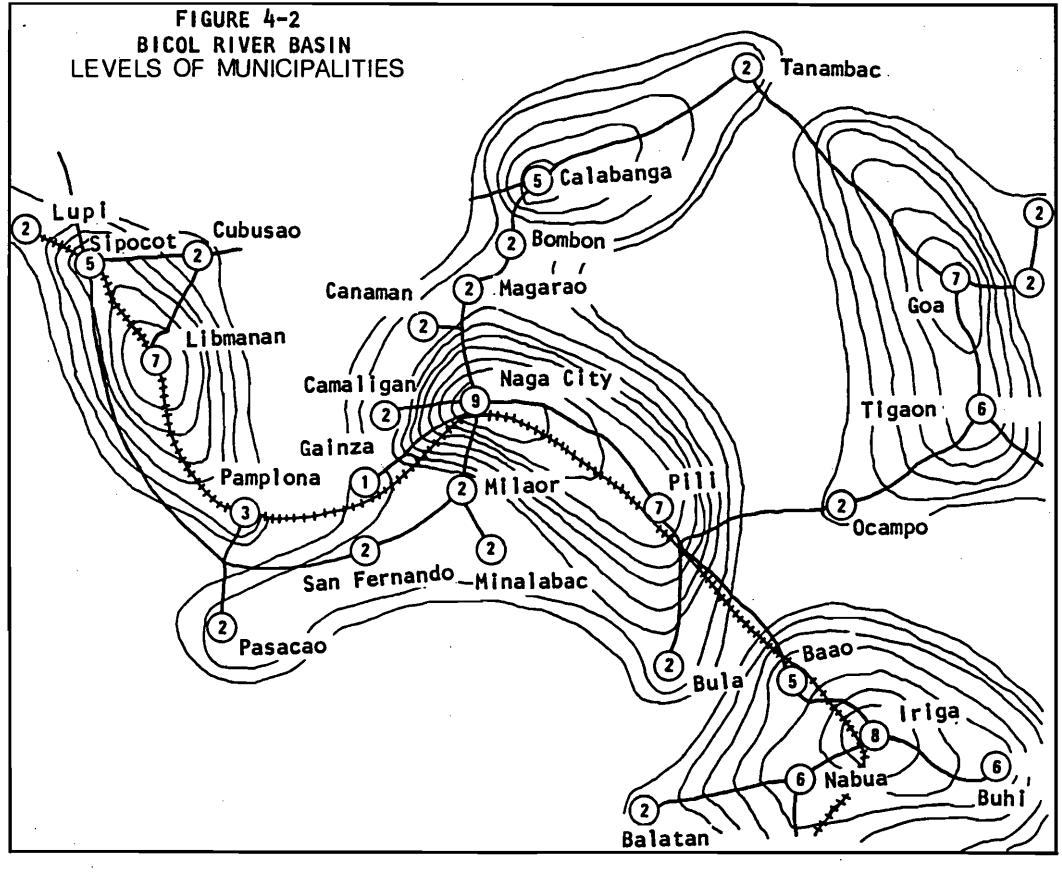
TABLE 4-3

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
28	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 Jose	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.

FIGURE 4-2
BICOL RIVER BASIN
LEVELS OF MUNICIPALITIES



second scale, of urbanized or "built-up areas" (poblacions) was done to rank settlements by functional complexity and delineate a hierarchy of central places. The "built-up areas" consisted of (1) poblacions and contiguous barangays with approximately the same land use characteristics as the poblacion, and (2) other barangays within the municipality with a population size of at least 50% of the poblacion.

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 could not be determined, population density criteria had to be eliminated. It was decided, instead, to test the Census definition of settlements: poblacions and other barangays with at least a population of 1,000 in which the occupation of the inhabitants is predominantly nonfarming or fishing and which have specified physical characteristics. 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 judgment. 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 settlements in Bicol.[8]

Scalograms

The manual version of the Guttman scale is primarily a graphic and nonstatistical device that arrays functions by their ubiquity (frequency of presence) and ranks settlements by functional complexity on a matrix chart. The Guttman scales calculated by a computer program present two major problems. First, some functions that are fairly widespread in rural villages but that are located in communities for reasons other than the settlements' threshold population size do not scale well and are often eliminated from the scale scores by the computer. Such facilities as farm equipment repair shops, vocational schools, rural banks, credit unions, and others that are of crucial importance for rural development, for example, did not scale in the program applied in the Bicol River Basin. Second, the computer output is often very difficult to understand, especially by policy-makers and technical officials who are not familiar with social science methodologies.

A graphic scale used successfully in India and Indonesia was adopted for the Bicol study and subsequently applied in the Potosi project in Bolivia. Both the data collection and calculation requirements for constructing a scalogram are minimal. The only information required is:

1. A list of all settlements in the region (hamlets, villages, market towns, small cities, larger urban centers);
2. The population size of each settlement;
3. A map pinpointing the location of the settlements; and,
4. An inventory showing the presence or absence of functions (services, organizations, facilities, infrastructure, economic activities) in each settlement.

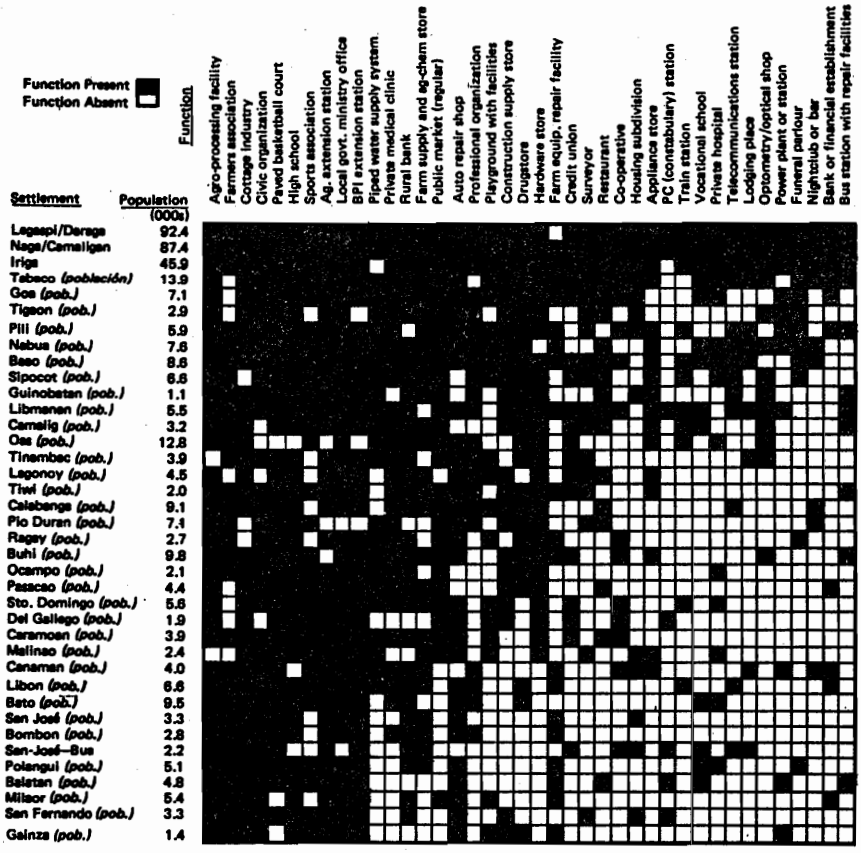
The procedure for constructing a scalogram is as follows:

1. On the left side of a worksheet, list settlements as rows in descending order of their population;
2. Across the top of the worksheet, list the functions found in the region in their descending order of ubiquity (frequency of presence);
3. 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;
4. Fill in with a dark color, an "X", or a "1" 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, or fill in a "0";
5. 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, or in decreasing order of presence of functions;
6. The scalogram is complete when no shifting of a settlement row or function column can reduce the number of blank cells in this pattern;
7. The final order of settlement rows identifies a ranking of settlements which can be interpreted as an ordinal centrality score.

The exercise results in a matrix such as that depicted in Figure 4-3, for the Bicol River Basin.

The number and types of functions that are included in the analysis will vary from region to

FIGURE 4-3
PORTION OF A SCALOGRAM FOR SETTLEMENTS IN THE BICOL RIVER BASIN



region depending on planners' judgments about which are most important for determining the centrality and hierarchy of settlements and for allocating investments among communities. In Bicol, planners included both "central functions" and other indicators. Sixty-four functions, listed in Table 4-4, were selected by analysts to reflect both levels of development and centrality.[9]

In Bolivia, two versions of the scalogram were prepared. The first included a complete inventory of information collected from a survey of towns, covering more than 120 functions in 112 settlements. This was a useful reference base, but included a large number of noncentral functions. In order to define the hierarchy of central places, a second scalogram was prepared. Only 58 functions that were considered to be the best indicators of functional complexity were included.[10] This scalogram is shown in Figure 4-4.

Scale analysis has a number of important uses in regional development planning. 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."[11] This observation was confirmed in the presentations at technical workshops in Bicol, 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."[12] 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:

1. 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;
2. The scalogram shows rough associations among services and facilities in specific locations and potential linkages among them;
3. The scalogram indicates the sequence in which settlements accumulate functions and the implications for sequencing complementary or catalytical investments;

TABLE 4-4

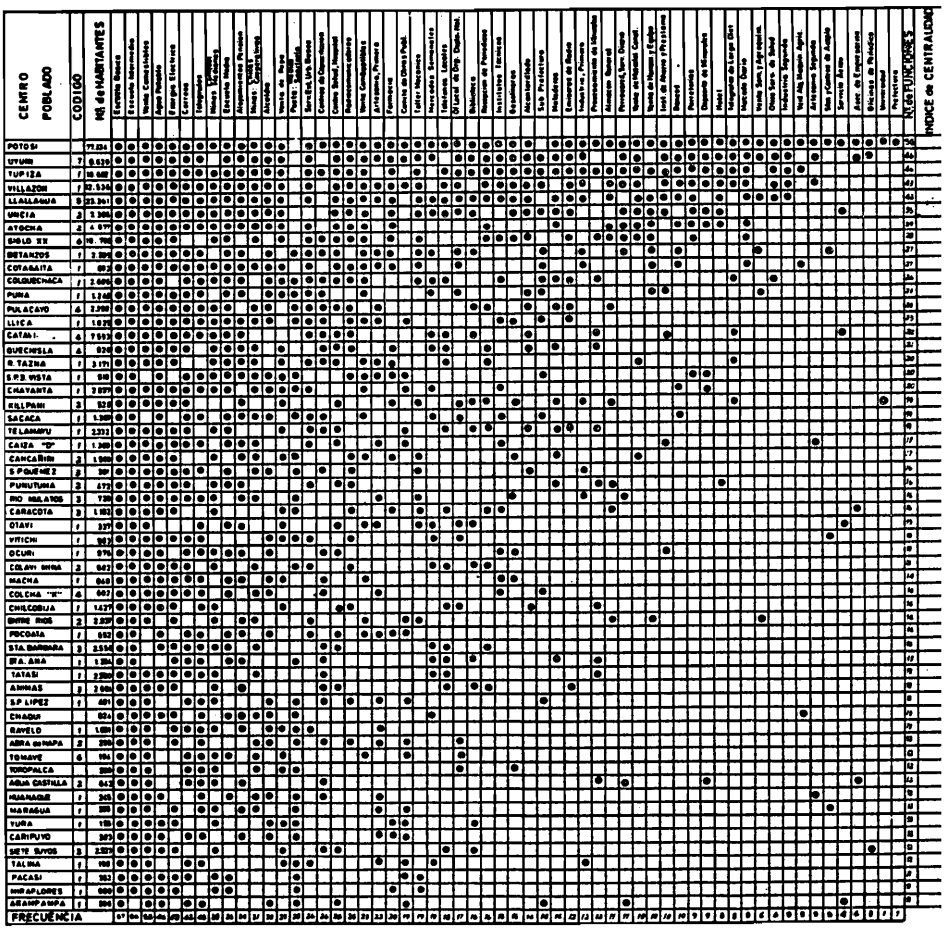
FUNCTIONS ANALYZED IN BICOL RIVER BASIN UFRD PROJECT

Category	Functions
Economic Activities	Shopping center or supermarket Public market Appliance store Farm supply or agro-chemicals store Banks and financial institutions other than rural banks Rural bank Manufacturing or processing plant other than cottage industry Cottage industry
Social Services and Facilities	Nursing school College Vocational school High school Private hospital Government hospital (operational) Private clinic Drugstore
Transport and Communications Services and Facilities	Airport Port Train station Bus station Newspaper publisher Radio station Telephone exchange Telecommunications office
Infrastructure and Maintenance Services	Functioning power plant Piped water system Hardware supply store Farm equipment repair shop Housing estate or subdivision Surveyor's office Construction supply store Auto repair shop

TABLE 4-4 (continued)

Category	Functions
Recreational Activities	Bowling alleys Gymnasium or auditorium Cinema with daily showings Nightclub Playground with facilities Cock-fighting pit Cinema with periodic showings Concrete-paved basketball court
Personal Services	Optometrist or optical shop Xerox copying services Photo studio Restaurant Cemetery Funeral parlor Hotel Lodging house
Community Organizations	Credit union or cooperative Other cooperative "Paluwagan" (welfare society) Labor union Professional organization Civic organization Sports association Farmers association
Extension and Protective Services	Security agency (private) Philippine Constabulary station Red Cross office Firetruck Bureau of Animal Industry agent Bureau of Agricultural Extension agent Bureau of Plant Industry agent Department of Local Government and Community Development office

FIGURE 4-4
SCALOGRAM OF SETTLEMENTS IN POTOSI, BOLIVIA



Source: Evans 1982.

4. By reading any column the ubiquity of a service or facility, and its distribution among settlements, can be easily seen;
5. The array of items in the scalogram, analyzed 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;
6. "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;
7. Unexpectedly present functions are also identified, and the reason for the appearance of services and facilities in those settlements can be determined;
8. 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; and,
9. The scalogram can be used to make decisions about appropriate "packages" of investments for settlements at different levels in the spatial hierarchy.[13]

Thus, a manual scalogram has definite advantages over the computarized 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. Systematic reporting schemes can be designed to obtain information about changes in services and facilities in settlements of a region.

Threshold Analysis

Another means of assessing the functional characteristics of settlements in a region is through an analysis of the population sizes required to support those services, facilities and infrastructures that already exist within an area. In the Bicol River Basin planners used Marshall's approach to threshold analysis.[14] Marshall explains 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 for analysis of rural regions using 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."

The planners in Bicol adapted a procedure which is illustrated in Table 4-5:

1. Construct a table with a rank listing of centers according to population, a corresponding list of population data and the presence (1) or absence (0) of every function in each of the centers listed;
2. Apply Marshall's rule and identify each function's population threshold; and
3. Apply Marshall's supplementary rule and disregard functions eliminated by this process.[15]

Another method--the Reed-Muench approach--can also be used to determine the approximate threshold level of functions.[16] This process calculates the median population for a function by comparing the proportion of settlements that have the function at different population levels, using the formula:

$$Th = \frac{100 \times Ps}{Ps \times Ag}$$

where: Ps = number of settlements below a certain population level having the function; and,
Ag = number of settlements above this population level not having the function.

The median can also be obtained by graphically plotting values of Ps and Ag for different population levels as depicted in Figure 4-5.

There are strong limitations on the use of these methods, however. They tend to underestimate the population needed to support a function by using only the population size of the settlements rather than that of their service areas. Moreover, current thresholds may not realistically reflect the potential for settlements of various sizes to support services and facilities in an unintegrated and poorly developed settlement system. Indeed, they may reflect location decisions based on criteria other than economic efficiency. These methods do, however, offer a quick way of getting rough estimates of population threshold sizes for currently available services and facilities and can provide useful information if cross-checked or supplemented by other types of analyses.

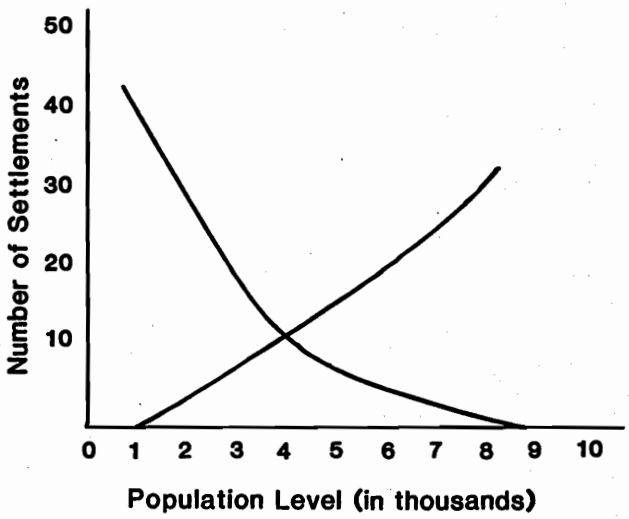
TABLE 4-5

CALCULATION OF THRESHOLD LEVELS FOR CENTRAL PLACE FUNCTIONS

Central Places in Descending Order of Rank	Population Size	Function 1	Function 2	Function 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	1

Figure 4-5

REED-MUENCH GRAPHIC METHOD
OF PLOTTING THRESHOLD LEVELS
OF FUNCTIONS



Weighted Centrality Indexes

Another exercise was used in both the Bicol River Basin and the the Potosi Region to obtain an indication of the centrality of settlements. This index measures functional complexity in terms not only of the number of functions in a place, but also their frequency of occurrence. Functions are assigned a weight in inverse proportion to the frequency with which they occur. Thus, a technical school or general hospital, which are found in only a few places, are weighted more heavily than an elementary school or health clinic, which are more widespread. The centrality index for a place is therefore the sum of the weights of the functions found there; the higher the index the greater its functional complexity.[17]

The procedure for calculating the weighted centrality index is as follows:[18]

1. Reproduce the Guttman scale in an inverted form with cases arranged vertically and items horizontally;
2. Total each row and column;
3. 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;

4. Add one block to the table and enter the weights computed;
5. Reproduce another table similar to that in step "1" displaying the weights calculated in step "3" and the total centrality values;
6. Sum the weights of each row to produce the indices of centrality.

Tables 4-6 and 4-7 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 center does contribute to its centrality.

TABLE 4-6

CALCULATING WEIGHTS OF FUNCTIONS

Places	Functions 1	2	3	4	5	6	7	8	9	10	Total
A	1	1	1	1	1	1	1	1	1	1	10
B	1	1	1	1	1	1	1	0	1	0	8
C	1	1	1	1	1	1	0	0	0	0	6
D	1	1	1	1	1	1	0	1	0	0	7
E	1	1	1	1	1	0	0	0	0	0	5
F	1	1	1	1	0	0	0	0	0	0	4
G	1	1	1	0	0	0	0	0	0	0	3
H	1	1	1	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 4-7

CALCULATING CENTRALITY INDEXES

Places	Functions 1	2	3	4	5	6		8	9	10	Total
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					149.1
E	12.5	12.5	12.5	16.6	20.0	25.0		50.0			74.1
F	12.5	12.5	12.5	16.6	20.0						54.1
G	12.5	12.5	12.5	16.6							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.

DISTRIBUTION OF FUNCTIONS AND DELINEATION OF SETTLEMENT HIERARCHIES

The information collected for the scalogram analysis can also be used to determine the distribution of functions among settlements in a region and to delineate a hierarchy of settlements based on functional complexity. The distribution analysis indicates not only the number of settlements that have a particular function, but also the frequency with which a function appears among settlements in the region. Together with a linkage analysis--which is described in Chapter Five--estimates can be made of the accessibility of functions for people living in different areas of the region. The distribution of functions for the Bicol River Basin is shown in Table 4-8.

The distribution of functions can also be used to determine, along with the scalogram analysis, the functional hierarchy of settlements. In the Philippines, for example, analysis suggested that the Bicol River Basin was a region in which the services and facilities that were needed for fulfilling basic human needs and generating economic development were not only inadequate but also highly concentrated in a few of the larger central places. Those places were not easily accessible to people living outside of their boundaries. The hierarchical distribution of settlements was strongly skewed and the spatial system was 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 percent of all functions appeared in less than 20 percent of the settlements. Most of the other functions that appeared in more than 20 percent of the settlements were either highly localized services or social organizations with little or no productive capacity. And even among the built-up areas functions were unevenly distributed. Nearly 60 percent of all central functions appeared in less than 20 percent of the built-up areas, with one-fifth of these places containing no functions at all.

Using the scalogram analysis, centrality indexes and functional distributions, together with their knowledge of most of the settlements in the Basin, planners were able to distinguish among four levels of settlements within the region. The four levels were determined by the following criteria:

Level I --all centers having at least 60 of the 64 facilities and services used in the scalogram, centrality and functional distribution analyses. At least half of these functions should be central services and facilities serving a wide area.

TABLE 4-8

DISTRIBUTION OF FUNCTIONS AMONG SETTLEMENTS IN BICOL RIVER BASIN

Range of Settlements with Functions	Number of Functions	Type of Functions (Percent 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%	2	High School (7.8) Agricultural Extension Station (6.1)	
2 - 4.9%	18	Photo Studio (4.8) Professional Organization (4.1) Plant Industries Extention Office (4.3) Private Medical Clinic (3.8) Farm Supply-Agro-Chemical Store (3.4) Regular Public Market (3.2) Farm Equipment Repair Shop (2.9) Rural Bank (2.8)	Ministry of Local Government Office (4.1) Animal Industries Extension Office (3.9) Auto Repair Shop (4.1) Cockfighting Pit (3.6) Construction Supply Store (3.4) Hardward Supply Store (3.1) Playground with Facilities (2.9) Housing Subdivision (2.8)

TABLE 4-8 (continued)

Range of Settlements with Functions	Number of Functions	Type of Functions (Percent of Settlements with Function)	
		Labor Union (2.3)	Cooperative Organization (2.2)
1 - 1.9%	19	Drugstore (1.8) Restaurant (1.8) Credit Union (1.8) Train Station (1.7) Appliance Store (1.6) Bus Station with Repair Facilities (1.5) Lodging Place (1.3) Telecommunications Station (1.1) College (1.1) Funeral Parlor (1.0)	Police Constabulary Station (1.8) Nightclub or Bar (1.7) Surveyor (1.7) Gymnasium/Auditorium (1.6) Private Hospital (1.5) Vocational School (1.3) Power Plant or Station (1.2) Bank or Financial Establishment (1.1) Optometry/Optical Shop (1.1)
Less than 1.0%	18	Telephone Exchange (0.9) Cinema with Daily Run (0.8) Operational Government Hospital (0.7) Shopping Center (0.6) Cemetery (0.6) Radio Station (0.4) Newspaper Publisher (0.3) Red Cross Office (0.2) Airport (0.1)	Xerox Copy Service (0.9) Paluwagen (Welfare Society (0.7) Fire Station with Trucks (0.7) Cinema with Less than Daily Run (0.7) Port or Pier (0.5) Nursing School (0.4) Security Agency (0.3) Hotel (0.3) Bowling Alley (0.2)

Level II --all centers at having at least 30 of the 64 functions; at least eleven of these should be central functions.

Level III--all settlements having at least 10 of the 64 facilities and services. At least two of these should be non-residentiary in nature.

Level IV --all places with less than 10 of the 64 facilities and services.

The hierarchy and the characteristics of its four levels is shown in Table 4-9 and Figure 4.6. Only two central places--the Naga-Camaligan and Legaspi-Daraga urban areas, which contained most of the functions found in the Basin--tended to serve as provincial centers and offered a wide range of services and facilities. These two places accounted for less than one percent of all communities and contained about 10 percent of the Bicol's population. Legaspi-Daraga had a centrality index of 422 and Naga-Camaligan an index of 383, the two highest in the region. At a second level were 11 settlements which as a group seemed to function as local service centers, with from 31 to 54 functions. These centers performed a few area-wide and a larger number of local commercial and administrative functions. Almost all had markets and were connected by the Manila highway or provincial roads to smaller places in their immediate hinterlands. Most had a few cottage industries, a moderate range of commercial and service activities; almost all had elementary and secondary schools, health clinics and administrative offices of the municipality. Their level of centrality ranged from 298 (Iriga) to 98 (Guinobatan). A third level of about 43 settlements, representing about 3 percent of all communities and about 10 percent of the Basin's population seemed to act as small rural service centers in which 10 to 28 functions appeared. About half of these communities had public markets, although the majority were no more than collection points for agricultural produce that was shipped to Naga or Legaspi for processing and sale. Most had general stores, small groceries and sari-sari stores. Very few of these settlements had cottage industries; some had shops that turned out abaca craft, candies and pastries. In a few there were warehouses, copra storehouses, and trading establishments, sawmills and furniture upholstery shops. Most had rice or corn mills and about half contained a rural bank. Their characteristic features were that most had rural extension services supplied by the national departments of agriculture, plant industry, animal industry and local government. Farmers associations, credit services and cooperatives were found in many and most had either elementary or secondary schools. About half had private health clinics or public health stations.19

TABLE 4-9

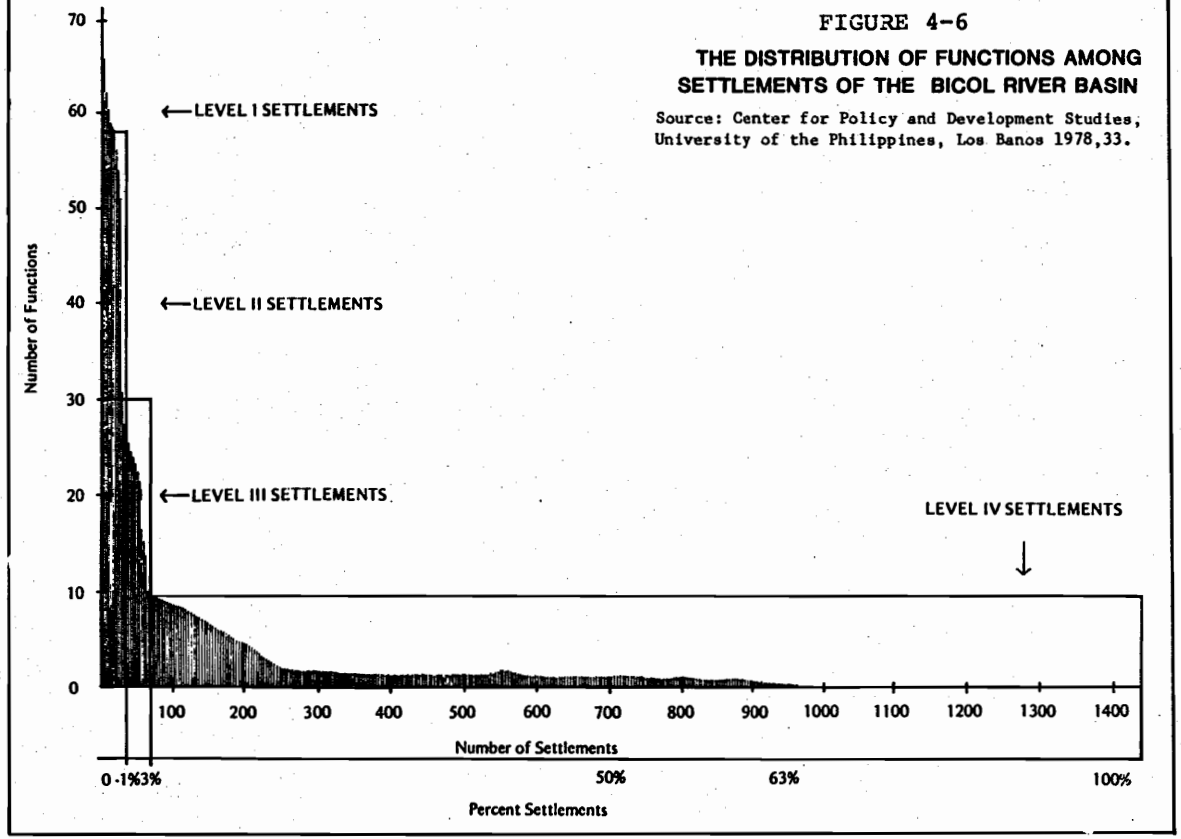
FUNCTIONAL COMPLEXITY OF LEVELS OF SETTLEMENTS IN BICOL RIVER BASIN.

Level of Hierarchy	Functional Character-istics	Number of Settlements	Settlements	Range of Functions	Percent of All Settlements	Percent of Basin Population	Average Popula-tion Size
I	Provincial Service Centers	2	Naga Camaligan	60-61	0.14	10.6	89,892
II	Local Service Centers	11	Iriga, Tabaco, Goa, Tigaon, Pili, Nabua, Baao, Guinobatan, Libmanan, Ligao	31-54	0.77	7.3	11,107
III	Rural Service Centers	43	37 Poplacions 6 Barangays	10-28	3.03	10.5	4,196
IV	Non-Central Places	1,363	2 Poblacions 1,361 Barangays	0- 9	96.06	71.6	922

FIGURE 4-6

THE DISTRIBUTION OF FUNCTIONS AMONG SETTLEMENTS OF THE BICOL RIVER BASIN

Source: Center for Policy and Development Studies, University of the Philippines, Los Banos 1978,33.



The overwhelming majority of settlements in the Bicol River Basin, however, were found to be non-central places. Over 1,300, or about 96 percent of the total--were villages of a few hundred or less families engaged in subsistence or near subsistence agriculture or working as tenants or on small family owned plots. All communities in this category had less than 9 functions; most contained only a few or none at all. Those that had a few functions usually only contained farmers associations, a chapel or primary school, a sari-sari store and sometimes an extension worker or small rice or corn mill. More than 70 percent of the Basin's population were found to be living in places that provided no central functions.

The scale analysis of the Bicol River Basin showed very little functional distinction among most settlements, except for the Level I communities and a few in Level II. The eleven settlements in Level II did not differ from each other significantly in the range of functions they provided nor did they differ greatly from many of the settlements found in Level III. In reality, then, there was little functional differentiation or specialization among most settlements in the Bicol River Basin, due primarily to the predominance of subsistence agricultural economy and the low levels of household income throughout the region.

A similar analysis done in the Department of Potosi in Bolivia yielded the results summarized in Table 4-10. At one end of the scale was the city of Potosi, which contained all but two of the 58 functions included in the scalogram: the office of a Sub-prefect which occurred only in provincial capitals, and a medical post which was usually located in villages and small towns. At the other end of the scale were the smallest villages with very few amenities, perhaps a junior school, piped drinking water or a small grocery store. Between these two extremes, there appeared to be two clear intervals, both of them at the upper end. The first fell between the city of Potosi with 56 functions and the second ranked Uyuni with 46 functions. The second interval was between sixth placed Uncia with 35 and seventh placed Atocha with 29. Further down the list no such obvious breaks occurred. But Evans suggests that this may indicate that there is only one city in the first tier of the hierarchy, the city of Potosi, followed by a group of five at the second level--Uyuni, Tupiza, Villazon, Llallagua and Uncia. The latter two were within five kilometers of each other and were therefore treated as a single urban area. Together they had 45 functions, which emphasizes the gap between the second and third group beginning with Atocha.[20]

TABLE 4-10

FUNCTIONAL CHARACTERISTICS OF SETTLEMENTS IN POTOSI, BOLIVIA

Level and Settlement Type	Number of Functions	Centrality Index	Number of Functions of Level i or Higher
I Regional center	56	675	6
City of Potosi			
II Sub-regional center	(min 35)	(min 200.0)	(min 10 max 18)
Uyuni	46	372.7	17
Tupiza	46	299.4	15
Villazon	43	294.6	16
Llallagua	42	253.3	11
Uncia	35	209.3	10
III Rural center	(min 20)	(min 100.0)	(min 10 max 38)
Atocha	28	149.2	14
Betanzos	27	155.0	16
Siglo XX	27	153.3	15
Cotagaita	26	131.5	13
Colquechaca	24	121.7	11
Catavi	23	126.7	10
Quechisla	23	101.2	11
Rosario Tazna	23	104.7	11
Puna	22	123.6	10
Llica	22	87.0	10
Killpani	20	100.0	12
IV Local center	(min 13)	(min 50.0)	(min 7 max 43)
Pulacayo	23	92.2	12
San Pedro de Buena Vista	19	79.4	12
Chayanta	19	75.4	9
Sacaca	18	79.6	11
Telamayu	18	71.8	10
San Pedro de Quemez	17	61.0	8
Tatasi	17	72.5	9
Cancaniri	17	68.2	10
Punutuma	17	71.9	10
Rio Mulatos	17	64.5	9
Caiza "D"	16	60.3	8
Caracota	16	95.3	9
Otavi	15	81.0	9
Colcha "K"	15	53.5	7
Vitichi	15	70.7	7
Ocuri	15	59.9	8
Chilcobija	15	65.5	7
Colavi Mina	15	52.2	7
Macha	15	52.8	9
Entre Rios	14	72.8	8
Pocoata	14	47.2	8
Animas	14	57.5	8
Santa Barbara	14	46.7	7
Huanaque	14	87.7	7
San Pablo de Lipez	13	45.6	9
Santa Ana	13	48.8	9

The scalogram, centrality and functional distribution analyses suggested that the hierarchy of settlements of Potosi consisted of five levels[21] (see Table 4-11). At the top was the regional center, the City of Potosi, with a population of about 77,000 and a centrality index of 675, the highest in the region. The city had almost a full range of the 58 functions, including several that appeared only once in the region: a university, the Prefecture office, editorial offices of a newspaper, a television station and regular air service.

At a second level were four towns with an average population of 12,500: the urban area of Llallagua/Unica in the north, Uyuni in the west, Tupiza in the south, and Villazon on the border with Argentina. Centrality indices ranged from 373 for Uyuni to 209 for Uncia. Treating Llallgua/Uncia as a single entity, this group of towns possessed a similar range of between 43 and 46 functions, typical of which were hospitals, daily markets, manufacturing industry, commercial banks, rail service, long distance telephone service, and depositories of the central Mining Bank, where independent mining concerns could sell their output to the government.

There was a wide gap in functional complexity between the second and third tiers of the hierarchy. The rural service centers consisted of only eleven settlements with a mean population of 3,200. These centers had centrality indices ranging from 87 to 149, and between 20 and 28 functions. At the fourth level were 26 places, having centrality indices of 45 to 95 and containing anywhere from 13 to 23 functions, most typically a post office, high school, doctor's clinic and clothing store. The remaining seventy settlements fell into the fifth category of villages or non-central places, having twelve functions or less, such as drinking water, electricity, or a food store, most of which served only the residents of the immediate vicinity.

The scalogram revealed a weak relationship between the size of the settlement, measured by population, and its functional complexity. Uyuni, for example, with barely a quarter of the 30,000 population of the Llalagua/Uncia urban area, had the same number of functions, while Llica and Cotagaita with around 1,000 inhabitants each, had more functions than Catavi, which had seven times the number of residents. Location provides part of the explanation: the distance of center to its nearest larger-sized neighbor influences the kinds of functions it can support. Thus, Uyuni had no competition for miles around, while Catavi was only a five-minute bus ride from Llallagua. Another explanation stems from the favored treatment of the mining centers, which were often equipped with basic infrastruc-

TABLE 4-11

FUNCTIONAL ATTRIBUTES OF SETTLEMENTS AT EACH LEVEL OF THE HIERARCHY, POTOSI, BOLIVIA

Level		Function Range	Index Range	Typical Functions	Average Population	Percent of Departmental Population
I	Regional Center	56	657	Prefecture university air service television station newspaper office	7,334	11.7
II	Sub-regional center	35-46	209-381	rail service long distance telephone daily market hospital manufacturing industry banks farm supply stores	1,252	9.5
III	Rural center	20-28	87-156	inter-urban bus service newspaper delivery radio communication weekly market health center pharmacy vehicle repair workshop gas station	3,238	5.4
IV	Local	13-23	46-92	post and telegraph office doctor's clinic high school clothes store	1,371	5.2
V	Villages (non-central places)	0-12	0-84	junior school grocery store drinking water	457	4.8

Source: H. Evans, Urban Functions in Rural Development: The Case of the Potosi Region in Bolivia, Washington: USAID, 1982.

ture, health and education services, subsidized provision stores and other facilities, usually financed by the semi-autonomous state mining corporation, COMIBOL, or occasionally by large private mining companies. A further factor is the low level of urbanization in the region. With the majority of Potosinos scattered in small villages and rural areas, the population size of a settlement was a poor guide to the number of rural people who used its services and facilities.[22]

In both the Bicol River Basin and the Department of Potosi, the UFRD project's settlement system analysis gave planners and policy-makers the first statistical profile of towns and villages within their regions. In some cases it documented for the first time general knowledge about settlements in those regions. In other cases it provided new information about the distribution of services and facilities, infrastructure, productive activities and local resources. In both regions, for the first time, planners had methods and techniques for identifying, collecting and organizing information about the settlement system, the distribution of functions among settlements and the settlement hierarchy. Although this information is useful in creating a profile of settlements within the region, a better understanding of the patterns of interaction among settlements is also needed to understand the dynamics of regional development or underdevelopment. This requires an analysis of spatial linkages, one method of which is described in the next chapter.

NOTES

1. See P. Haggett, A.D. Cliff and A. Frey, Location Analysis in Human Geography, New York: Wiley, 1977.

2. Republic of the Philippines, Census of Population and Housing, Manila: National Census and Statistics Office, 1974.

3. Hugh Evans, Urban Functions in Rural Development: The Case of the Potosi Region in Bolivia, (Washington: U.S. Agency for International Development, 1982), pp. 37-38.

4. H.E. Voelkner, Shortcut Methods to Assess Poverty and Basic Needs for Rural Regional Planning, Geneva: United Nations Research Institute for Social Development, 1978.

5. Ibid., p. 43.

6. Agapito M. Tria III, SSRU Municipal Inventory. Naga, The Philippines: Social Survey Research Unit, Bicol River Basin Development Program, 1974.

7. Bicol River Basin Development Program, Urban Functions in Rural Development: A Research Project in Spatial Analysis and Planning, Pili, The Philippines: BRBDP, 1978.

8. See Dennis A. Rondinelli, "Spatial Analysis for Regional Development: A Case Study in the Bicol River Basin of the Philippines," Resource Systems Theory and Methodology Series, No. 2, Tokyo: United Nations University Press, 1980.

9. Tria, op. cit., lists the functions surveyed.

10. Bicol River Basin Development Program, op. cit.

11. H. Benjamin Fisher, "Methods of Identification of Agro-Urban Centers at the Kapubaten and Provincial Levels," (Jakarta: Ford Foundation, 1975) mimeographed.

12. H.E. Voelkner, "The Structural Complexity Growth Model and Scalogram Analysis of Development and Human Ecosystems," unpublished paper, (Washington: World Bank, 1974), p. 16.

13. See Rondinelli, "Spatial Analysis for Regional Develop-ment." op. cit. for a more detailed description.

14. See John U. Marshall, The Location of Service Towns, Toronto: University of Toronto Press, 1969.

15. Junio M. Ragragio, "The Design for the Identification of the Hierarchy, Centrality and Threshold of the Central Place System in the Bicol River Basin," Project Discussion Paper, (College, Laguna: Center for Policy and Development Studies, University of the Philippines--Los Banos, 1977.

16. See Haggett, Cliff and Frey op. cit. for a more detailed explanation.

17. Evans, op. cit.
18. Ragragio, op. cit.
19. Dennis A. Rondinelli, "Applied Policy Analysis for Integrated Regional Development Planning in the Philippines," Third World Planning Review, Vol. i, No. 2 (Autumn 1979), pp. 150-178.
20. Evans, op. cit., pp. 39-45.
21. Ibid., pp. 45-48.
22. Ibid., pp. 77-88.

5
Spatial Linkage Analysis

A region is not only a system of functionally diversified settlements but also a network of social, economic, and physical interactions. The processes of interaction are shaped by linkages among settlements. They are the means through which people living in rural areas and small villages obtain access to services, facilities, infrastructure and economic activities located in towns and cities. Through these linkages rural people receive many of the inputs needed to increase agricultural productivity and market the goods they produce. Therefore, regional planners and policy-makers must be concerned about the effectiveness of these processes of interaction and the degree to which settlements are linked to each other in ways that provide a maximum amount of access to people living in all parts of the region.

THE ROLE OF LINKAGES IN REGIONAL DEVELOPMENT

Regional development occurs through the growth and diversification of settlements and the creation of new and stronger linkages among them.[1] In some cases the extension of physical linkages such as road, rail or river transport promotes growth and diversification in existing settlements; in others it stimulates the growth of new central places. New linkages usually promote greater interaction between settlements and their rural hinterlands. Moreover, the linkages that integrate a settlement system are themselves inextricably linked. Creating one new linkage can produce a "cascade effect," making other activities and linkages possible. Once a new set of linkages is introduced into a rural market system, for example, it can trigger a set of "circular and cumulative" changes that promote further growth and change. Simply improving transportation among villages often leads to reorganization and expansion of existing periodic markets. Displacement

of weak or unsuccessful markets and redistribution of commerce and trade can create entirely new markets and increase demands on the transportation system.[2] New physical linkages between urban centers and rural villages can change the flow of economic resources, the social pattern of interaction and the movement of people and goods. Closer interaction among villages, market towns, intermediate cities and major metropolitan centers can make it more convenient and less expensive to integrate technology at each level of the spatial hierarchy and to distribute more widely services that are needed for regional development.

In its manual on rural service center planning, ESCAP points out that analysis of urban and rural linkages can provide planners with important information about the following questions concerning regional development:[3]

-- What is the pattern of flows of agricultural products from rural areas to demand centers?
-- Which areas provide the raw materials for manufacturing activities?
-- To which centers do farmers go to obtain the agricultural inputs they need, such as fertilizers, farm implements, improved seed and credit?
-- What changes can be made in the road network to improve the marketing of rural products?
-- Does the regional resource base provide the potential to support additional production and processing activities?
-- What new activities can be supported? What linkages are needed to implement these activities?
-- What is the pattern of key communications linkages?
-- What are the daily, weekly and seasonal commuting patterns of off-farm labor?
-- What are the key bottlenecks in the existing linkage system?

A complete set of linkages can be found in more developed regions[4] (see Table 5-1). These include:

1. Physical Linkages. The spatial integration of communities results primarily from physical linkages through man-made or natural transportation networks. New roads, water channels and rail systems can reduce travel time, lower shipping costs, widen marketing, commuting and migration opportunities, allow greater access to non-agricultural employment, improve communications and extend areas of service delivery. Farm-to-market roads have promoted the creation of new markets in rural areas, increased interaction among

TABLE 5-1

MAJOR LINKAGES IN SPATIAL DEVELOPMENT

TYPE	ELEMENTS
Physical Linkages	Road Networks River and Water Transport Networks Railroad Networks Ecological Interdependencies
Economic Linkages	Market Patterns Raw Materials and Intermediate Goods Flows Capital Flows Production Linkages--Backward, Forward and Lateral Consumption and Shopping Patterns Income Flows Sectoral and Interregional Commodity Flows "Cross Linkages"
Population Movement Linkages	Mirgration--Temporary and Permanent Journey to Work
Technological Linkages	Technology Interdependencies Irrigation Systems Telecommunications Systems
Social Interaction Linkages	Visiting Patterns Kinship Patterns Rites, Rituals and Religious Activities Social Group Interaction
Service Delivery Linkages	Energy Flows and Networks Credit and Financial Networks Education, Training and Extension Linkages Health Service Delivery Systems Professional, Commercial and Technical Service Patterns Transport Service Systems
Political, Administrative, and Organizational Linkages	Structural Relationships Government Budgetary Flows Organizational Interdependencies Authority-Approval-Supervision Patterns Inter-jurisdictional Transaction Patterns Informal Political Decision Chains

villages, linked agricultural production areas to crop collection and distribution centers and made new crops economically viable. Those areas of a region without easy physical access to central places are usually characterized by low social mobility, localized and subsistence agriculture, and low levels of trade.

2. Economic Linkages. Economic interaction also promotes spatial integration. The most important linkages are market networks through which commodities, raw materials, and manufactured products flow among settlements; capital and income flows; and forward and backward production linkages among manufacturing and agricultural processing activities. The expansion of market linkages is a primary force in commercializing agriculture, diversifying production and expanding the spatial system of exchange.[5] Since the market town is the main channel through which rural people obtain basic goods and services in return for their agricultural products, the impact of vertical coordination of marketing systems can have widespread effects and provide substantial benefits to the farmer. It can increase farmers' bargaining powers by improving price information and market competitiveness, reduce transaction and physical distribution costs by standardizing marketing procedures and allowing farmers to use more efficient means of transporting their goods. Vertical linkages can also reduce losses and improve quality by establishing incentives for standardized grading, processing and packaging.[6]

The combination of increased transportation and marketing linkages within a region can encourage the growth of nested and integrated markets, expand patterns of exchange for agricultural commodities and ensure broader access for rural people to basic goods and services.[7]

3. Population Movement Linkages. Short-term and permanent migration is a ubiquitous characteristic of development and an important form of urban-rural linkage. Temporary migration and journey-to-work, more strongly than other forms of spatial interaction, depend on transportation and communication linkages between urban and rural areas, and on the location of industrial activities in intermediate cities and smaller towns. More permanent migration depends on a wider range of economic and social determinants, including the availability of jobs in towns and cities; wage, public service and educational opportunity differentials between cities and villages; and the distance, cost and convenience of moving. Rural people, given potential job opportunities and convenient means of travel, are more likely to migrate to a city where they have friends or kin.[8]

4. Technological Linkages. Developing regions need a variety of technologies, appropriate to different social, economic, technical and administrative capacities of communities of different sizes and stages of development. Technology--equipment, procedures and methods of production--must also be integrated spatially and functionally, since no single technological innovation will promote social and economic transformation in a region unless it is appropriate to local needs and conditions, and linked to both higher and lower levels of technology and related inputs. Spatial and organizational linkages are especially crucial for capital-intensive industrial technologies. To have an impact on development, capital technologies must be introduced into industries with strong backward and forward production linkages and in countries where there are strong connections between government scientific programs and private sector activities. As Parent points out, each branch of a major industry " . . . produces linkage effects which spread to other apparently quite unconnected industries," and the impact of the new technology in a leading industry will then depend " . . . on several factors including the importance of the originating industry in total industrial production and the number of its direct connections with other industries. If the supporting industries are missing, attempts to establish leading industries will fail."[9] Similarly, if elements of the spatial structure which allow industry to disperse geographically are missing, technological linkages and channels of innovation will not promote widespread growth.

5. Social Linkages. Market towns and intermediate cities do more than generate physical and economic activities, they are the focal points for a wide variety of social linkages among settlements and between central places and their rural hinterlands. Market centers perform many social roles in rural areas. The types and frequency of economic activities are often closely linked to social events. Traditional markets provide an important locus of social interaction; marketplaces are often used for games and dances; they contain a variety of social facilities--restaurants, bars, baths, churches, temples, and cinemas--attracting people from the villages not only to exchange goods and services but also to engage in recreation and to meet friends, acquaintances, and kin.[10] The growth of market towns in many countries has a profound effect on rural social interaction. Market centers provide a spatial focus for social interaction within a broad trading area. Because people make regular visits to the market throughout their lifetime, even the poorest farmers come to know

almost every other adult in the marketing area; marriage arrangements are often made from within the trading boundaries; credit and lending decisions are based on people's reputations formed through frequent market transactions; and the acceptance of common criteria of exchange, such as standard weights and measures, evolve from the need to maintain social harmony among disparate villages and groups within a trading area.[11] With market expansion and increasing commercialization of agriculture, periodic markets evolve into permanent places of exchange, daily markets displace smaller, infrequent exchange points, and diffuse social linkages promote increasing social and spatial integration. Widening market areas extend the spatial range of social interaction for marriage arrangements, steadily integrating smaller clans, communities and villages, promoting new kinship ties and visiting patterns, transforming social group and organizational relations.[12]

6. Service Delivery Linkages. Increasing the physical, economic and technological linkages among central places is critical to expanding service delivery networks in developing nations. Urban centers and rural areas must be closely linked in order to distribute social and commercial services more widely and to increase the access of rural residents to urban amenities. Nearly all services require the support of a minimum number of people concentrated in a limited geographical area, a "threshold population" of sufficient size and density to attract enough customers to earn profits for suppliers of commercial and professional services and to allow public services to reach the largest number of people at the lowest cost. Threshold levels for services vary widely. Because each service has a specific threshold, the types, degree of specialization and delivery range of services found in any given community depends on the size and density of its population, its occupational profile and income distribution, transportation access and economic diversification. All other things being equal, the "hierarchy" of services in a region is closely related to the hierarchy of central places. Larger population size and higher density create economies of scale that allow services to be offered at lower cost.

Services also have different "ranges of influence," the distance over which they can be extended or that people will travel to purchase or use them. The larger the area of influence and the more densely concentrated the users within that area, the more efficiently services can be provided, especially those requiring physical facilities or infrastructure for delivery such as water, sanitation, energy and health. The World Bank points out that per capita costs of

supplying water and sanitation services increases substantially in smaller communities: " . . . sector characteristics change markedly as one progresses from large urban centers, through medium sized cities, small towns and villages, to the dispersed population. The administrative structure becomes more diffuse, income levels decline, and per capita costs for equivalent levels of service tend to increase."[13] In areas with widely scattered populations and small central places there exists less institutional, financial and technological capability to deliver services efficiently.

Most developing regions require a hierarchy of services with a range of facilities appropriate to the needs and support capacity of different levels in the spatial system. Public health services, for instance, can usually be efficiently provided to widely scattered villages and hamlets only in the form of small clinics that offer basic preventive treatment, first aid, maternity care, and perhaps family planning information, staffed by a nurse or paramedic. Small hospitals with basic treatment and diagnostic facilities, and with either a visiting or part-time physician, a nurse or paramedic requires a larger service area and usually is found only in large market towns or small cities. A full services general hospital with a small staff of doctors and more extensive diagnostic and treatment equipment is most often found in intermediate cities or regional centers. Diversified, specialized medical centers with a staff of full-time physicians and technicians, containing more sophisticated diagnostic and treatment equipment, can usually only be supported by major metropolitan areas.

7. Political, Administrative and Organizational Linkages. Finally, spatial systems are integrated and transformed through a set of political and administrative linkages reflected in formal government structural relationships, flows of public budget resources, administrative authority, supervision and approval patterns, transactions among government jurisdictions, informal political influence, and interdependencies among spatially dispersed specialized organizations.

Linkages among settlements evolve because in nearly every developing nation government functions, services and resources are fragmented among organizations and jurisdictions. Linkages among government organizations not only extend services, facilities, and budget resources throughout the spatial system, but also act as channels for obtaining political support and authority to undertake activities that are essential to integrated development. As Uphoff and Esman conclude from their reivew of case studies of rural development in Asia, " . . . organization for rural development must be seen as a system of institutions

performing various functions in the rural sector . . . and effectiveness of linkages between and among institutions, horizontally with other organizations at the same level and especially vertically between local organizations and structures at the center of government which set policy and allocate resources [is] essential to the success of rural development."[14]

As urban centers grow and new central places emerge, political and administrative linkages change and functions are transformed within each center. The number of social functions performed by government tends to increase as communities grow. A variety of health, education, security, welfare and other services that are usually offered in rural areas and villages by extended families are provided by government in cities and metropolitan areas.

An analysis of these linkages can provide information with which planners and policy-makers can determine the degree to which settlements within the region are integrated, the degree to which people living in various parts of the region have access to town-based services and facilities, and the approximate service areas of central place settlements.

The linkage analysis methodologies used in UFRD may not address all of these issues directly; they are intended, instead, to provide a profile or overview of the system of linkages in a region that will lead planners to design more detailed studies. But the methods described here can provide planners and policy-makers with sufficient information about the nature and extent of linkages to begin refining their investment patterns to strengthen the network of linkages and to identify projects that are needed immediately to increase the interaction among strategic settlements and the access of rural people to central places.

The Urban Functions in Rural Development approach uses a number of methods to identify and assess the strength of linkages among settlements: market center studies, transport and physical access analyses, goods and services flow analyses, service area analyses, and social interaction studies.

MARKET CENTER STUDIES

The UFRD analyses of market centers and market linkages are heavily based on methodologies suggested by Bromley.[15] Bromley defines a market as a "public gathering of buyers and sellers of commodities meeting at an appointed or customary location at regular intervals ranging from daily to monthly."[16] A market center is a nucleated settlement with one or more markets each week. Its size and importance are related to the amount of market activity taking place there each time

the market meets. Markets can be divided into daily markets meeting every day of the week, and periodic markets meeting less frequently.

A wide variety of other commercial activities are usually associated with larger market places. As noted in Chapter One, most market places offer opportunities for small farmers to trade their produce, vegetables, grains, rice and other staples; for stock raisers to sell cattle, goats, sheep and dairy products; for gatherers to exchange firewood, lumber, charcoal, lime, and other uncultivated products; for fishermen to sell their catches; for artisans to sell or trade textiles, pottery, baskets, woven materials, iron, brick- or wood-work, household utensils and an enormous variety of households goods. Services located near the market place can reach large numbers of consumers more efficiently. Carpenters, masons, bakers, butchers, barbers, midwives, blacksmiths, tailors, seamstresses, stonecutters, traditional healers and herb vendors, and marriage brokers ply their trades in or near the markets along with mechanics, repairmen, doctors, druggists, agricultural suppliers, and others whose permanent shops or offices are located near the marketplace. Moreover, larger daily markets often support traveling vendors, storekeepers, agents, brokers, middlemen, and truckers, moneylenders, commission agents, warehouse owners and others who facilitate market trade.[17] Because people often come from many miles around to trade or participate in market centers, market trade patterns are important integrating linkages and indicators of the "service area" of a central place. In regions where market systems are well developed, the hierarchy of settlements often conforms quite closely to the hierarchy of market centers.

Market center analysis involves four major activities: (1) compiling a list of market centers and market days within the region; (2) mapping market centers and classifying them by size and periodicity; (3) measuring market activity; and (4) determining market centers' areas of influence.[18]

1. Compiling a list of market centers and market days. In countries where gazeteers or agricultural censuses have already compiled information on markets, their meeting days and types of activities and stalls, the data needed for regional market analysis can simply be derived from those reports and cross-checked or updated through sample field surveys. Where such information has not already been collected, the list of market centers must be complied through key informant interviews and field surveys. Field visits are usually needed to determine where market places are located, the days of the week on which they meet, their size and importance in terms of numbers of participants and the

volume and types of goods traded. In compiling lists of market centers through field surveys, Bromley suggests that planners attempt to produce as detailed a list of nucleated settlements and concentrations of commercial activities as possible. Attempts should be made to specify for each settlement: its population, location of "competing" settlements, information about the road network, administrative status, number and types of transportation services, and the presence or absence of the types of services, facilities, organizations, infrastructure and other functions that are described in the scalogram analysis.[19]

2. Mapping market centers and classifying them by size and periodicity. When a list is compiled it should be transferred to a map. Size classifications can be made using the number of stalls or amount of market fees collected by local authorities as rough indicators. The map should be coded by the day of the week and the number of times a week the market operates.

3. Measuring market activity. Bromley suggests a number of direct and indirect methods of measuring market activity.[20] Indirect measures include the levels of market taxes collected, the number of licenses issued, numbers of market stalls, the square footage of the market occupied by traders, the size of permanent market buildings and other data often collected by local or national governments. These may be incomplete or inaccurate, however, both because of the inefficiency of administrative procedures and because much marketing activity takes place outside of permanent market buildings, on sidewalks or roads surrounding the formal market place.

More direct measures attempt to estimate market turnover by counting numbers of traders and types of merchandise. Counting sheets can be used on which surveyors note the number of traders in and around the market place and the categories of goods they sell. The surveyors can use a checklist of categories of goods, including perishables such as fruits, vegetables, grains, root crops, preserves, flour, bread, sugar, salt, fats, meat, fish, eggs, milk, cheese, food and drink for ready consumption, fuel and animal fodder, and live domestic animals such as chickens. They should also count durables and services, such as textiles, clothing, footwear, metal, plastic and glass products, medicines, artisanal goods, tailor, cobbler or repair services, and other types of goods or services traded in the market place. The counts should be taken over a number of weeks to account for variations in market activity.

4. Determining market centers' areas of influence. Bromley points out that rough approximations can be made of a market's area of influence by examining administrative divisions, natural barriers, transport networks and services, and physical terrain features in the area around market centers to judge how far people are likely to travel to participate in the center's marketing activities.[21] Where registers are kept of ferry traffic, road toll collections or police checkpoint traffic, these may provide data that allow planners to construct traffic volume and flow patterns in and out of a market center. Bus companies or those that offer other forms of transportation to and from market places also provide information useful for estimating the service area of a market center.

A more detailed and precise estimate of market activity must rely on field surveys. Bromley suggests "quota sampling" questionnaires for rapid market activity analyses. He describes the method as follows:

> Quota samples are based on a count of stalls or traders taken earlier the same day, and involve interviewing a specific portion of all traders in each of the classificatory categories used in the count. For example, a 5% (one in 20) sample may imply interviewing 12 female vegetable sellers, two male vegetable sellers, five female clothing sellers, and 11 male clothing sellers.
>
> Interviewers then go out into the marketplace interviewing traders in each category until their quota of successful interviews is completed. 'Refusals' or 'idiotic responses' and other negative interviews are simply replaced by another interview so as to ensure that the target is achieved.
>
> Within each category interviewers are instructed to ensure a reasonably broad spatial distribution of cases, bearing in mind the overall distribution of traders in that category, and to avoid concentrating on specific types of traders within a category (e.g., old vegetable sellers, rather than interviewing a mixture of old and young roughly proportional to their distribution in the total population of vegetable sellers).[22]

The quota sample techniques can be used to gather information about the distance from which traders come to participate in market activities, their places of residence, supplementary occupations, working routes and stopover points, means of transportation, number and location of marketplaces in which they trade, and sources of the goods in which they trade.

The activity data can be mapped, and the influence or service-area of the market centers can be delineated

based on the distances from which participants come, the flows of goods into and out of the market place and the routes or networks of markets that traders use. The data can also be used to trace the linkages among settlements in a market center's network and the interactions among them in the market system.

A more detailed form of analysis can be used for periodic markets in rural areas, one that Bromley calls market movement surveys.[23] These are simultaneous counts and origin-destination surveys of vehicles and pedestrians going into each entrance of a market center during peak periods of a market day. The surveys can be done using volunteer high school students or paid young-adult assistants. Bromley suggests that detailed plans and arrangements be made over a two week period prior to the actual survey. They should be organized to achieve five major goals:[24]

a. To secure local collaboration from police, army detachments and, most important of all, from secondary schools or other potential sources of census-takers;
b. To map the perimeter of the market center, and all the roads and paths leading into the settlement;
c. To observe the flow of people into the market center on, and before, the major market day, in order to determine the starting and finishing times of pedestrian and vehicle flows into the market center;
d. To prepare a detailed plan of action, including timings of commencement and termination of work, dropping off the survey takers at their posts, serving refreshments, changing shifts, checking on efficiency, picking everyone up at the end of their jobs, and collecting the results; and
e. To hold one or more briefing sessions for the 6-100 people participating in the work.

Actual survey work usually begins prior to the time when significant numbers of people begin coming into the market center on market day. It continues until the flow begins to drop off significantly. Two pairs of surveyors are stationed at each entrance to the market center. One counts pedestrians, the other counts vehicles. Those counting vehicles must have the assistance of a policeman or soldier to control the flow of traffic.

Pedestrians (including people on bicycles, motorcycles and animal-pulled carts) are asked where they come from. Motor vehicles are classified by type--buses, trucks, cars, jeeps or others--and drivers are asked where the journey originated and where it will

end. Rough counts are made of passengers, and information is requested on the types and amounts of products and livestock carried into the market.

Market movement data can be used to estimate the linkages among settlements, and also the service area of market centers, the volume and flow of different types of goods traded, and the origins and destinations of market participants.

The market center studies carried out in the UFRD projects in the Philippines and Bolivia used different combinations of methods suggested by Bromley.

In the Bicol River Basin of the Philippines, a sample market center study was done of six large regular markets and six small periodic markets, which were considered by local planners to be the most important and most representative. A comprehensive market centers study was to be carried out later during a planned agricultural marketing study of the region. A survey of the six major market centers in Camarines Sur and Albay Provinces was conducted to trace the origin and destination of agricultural and manufactured commodities and to determine the service areas of these markets. Naga, Iriga, Goa, Legaspi, Tabaco and Ligao were selected as the leading market centers based on their strategic location, population size and their estimated volume of market activity.

The number of respondents was determined by proportional allocation--i.e., the population by type of commodity was first determined and the samples were taken by choosing every nth trader or producer. Using prepared questionnaires, one hundred traders and middlemen and fifty producers from each market center were interviewed. These respondents were drawn from the registered traders in the market.

The information that was gathered included: (a) source and destination of commodities; (b) type of buyer and seller; (c) place of sales and purchases; (d) type and cost of transport; (e) frequency of disposal and purchases; (f) packing and storage practices; (g) mode of payment; (h) problems encountered; and (i) other related information.

The commodities included were: (a) rice and palay; (b) corn; (c) sugar; (d) copra and coconut; (e) vegetables; (f) poultry and livestock; (g) fish; (h) manufactured goods; (i) agricultural and veterinary products; (j) farm implements; and (k) cottage industry products.

The six small markets, which operate once or twice a week, were studied to determine the degree to which they are linked to larger markets and to the rural areas in which they are located. The sample included three centers in Camarines Sur Province (Payatan, San Gabriel, and San Ramon) and three in Albay Province

(Pili, Paulba and Sinungtan). Interviewers sought information on the historical factors that brought the market into existence, the origin and destination of commodities traded in the market place, the linkages between these market centers and other periodic markets and between them and their rural hinterlands, marketing practices and conditions, marketing problems and potential solutions, and related information.

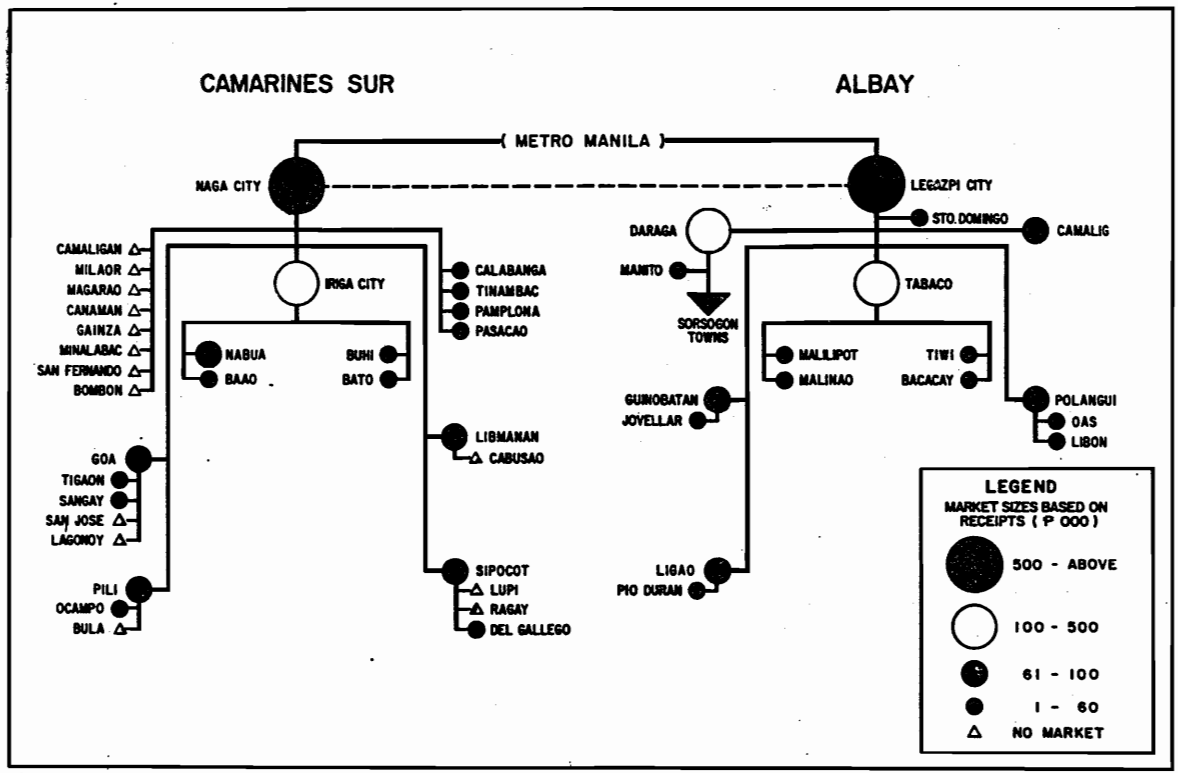
The sample surveys yielded a great deal of information not only about particular market centers but also about the nature of the marketing center system in the Basin. The Bicol planners found that:[25]

1. Markets in the Bicol River Basin were primarily local trading centers. The analysis of commodity flows in the six major regular markets showed that they functioned largely as local centers of trade. Nearly half of the commodity transactions in the Basin's largest market at Naga City were local; the remaining half were either with Manila or with periodic markets in the immediately surrounding area of the city. The same pattern of trade was characteristic of the second largest market, in Legaspi. Nearly 70 percent of the transactions occurring in the Tabaco market were among people who lived within a 5 km. radius of the town. For all six major markets, well over two-thirds of their transactions were among people living within a 10 km. area. Only about 12 percent of the transactions in Naga and Legaspi markets were with centers outside of the region, and nearly all were with the national capital, Manila. Figure 5-1 shows the degree to which the major markets in the Basin were linked to other market centers.

2. Market centers in the Basin had narrowly circumscribed service areas and provided limited access to people living outside of them. Planners found that the service areas of even the largest market centers in the Basin--Naga and Legaspi--did not encompass large portions of their provinces. They discovered that Naga's service area encompassed only 28 of the 37 municipalities in its province, while Legaspi's covered only 12 of the 17 municipalities in its province. Transactions between Naga and 13 of the 28 municipalities with which it had linkages were less than one percent of the total trading activity. Significant transactions between traders in the Legaspi market took place with those in only 10 of Albay's municipalities. Moreover, the trading linkages between Naga and Legaspi were minimal, accounting for only 3 percent of Naga's transactions and 2 percent of Legaspi's. The degree of interaction between the major markets in the Basin are depicted in Figure 5-2.

The service areas of the periodic markets, as might be expected, were even more constrained. Trans-

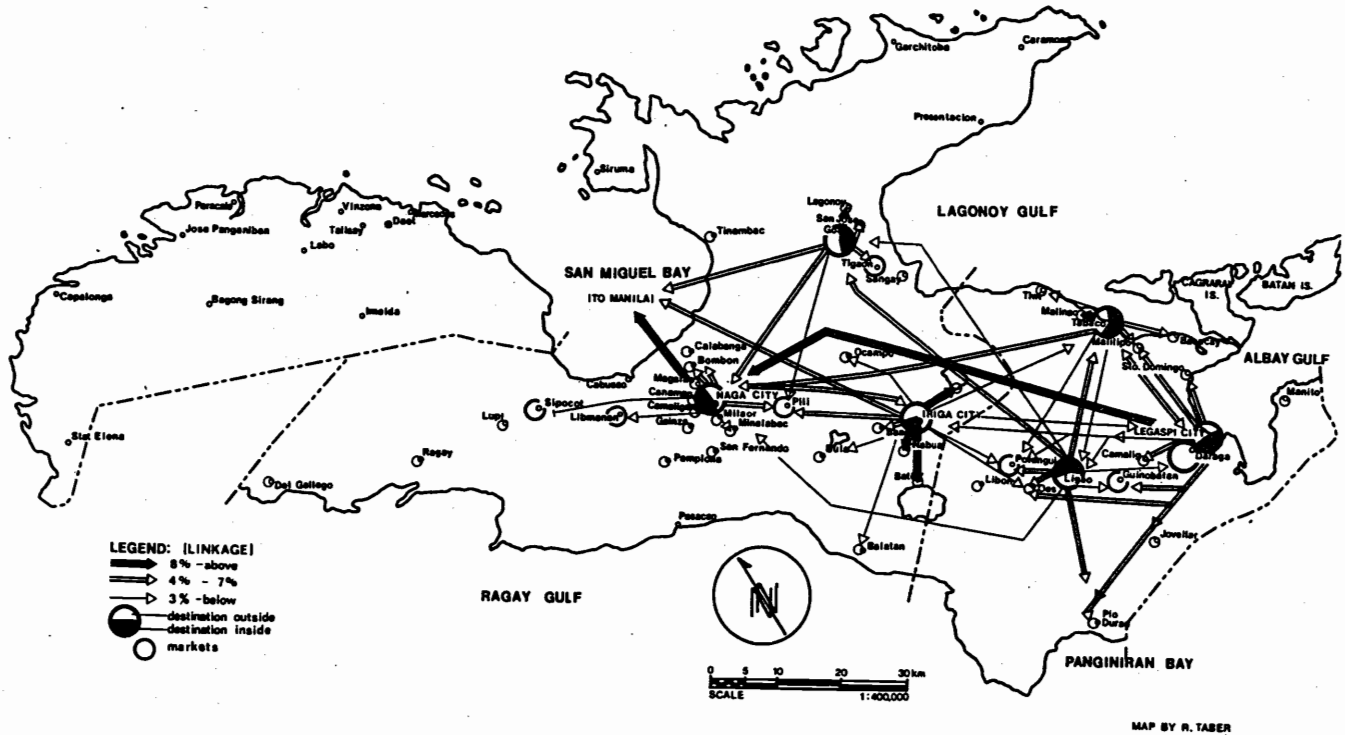
FIGURE 5-1
ORGANIZATIONAL LINKAGES AMONG SIX MAJOR MARKETS IN BICOL RIVER BASIN



Source: Center for Policy and Development Studies, University of the Philippines, Los Banos 1978,59.

FIGURE 5-2

LINKAGES AMONG SIX MAJOR MARKETS IN BICOL RIVER BASIN, PHILIPPINES



port service to them was infrequent. During the rainy season, the roads became impassable and the periodic markets became nearly inaccessible (see Figure 5-3). In two of the six periodic markets more than 90 percent of the participants travelled by foot. The trading areas of periodic markets were found to be 5 kilometers on average; while the average range of the larger markets was only about 14 kms. Naga obtained 73 percent of its agricultural commodities from with a 20 km. range and sold 73 percent of its goods within a 10 km. range (see Table 5-2).

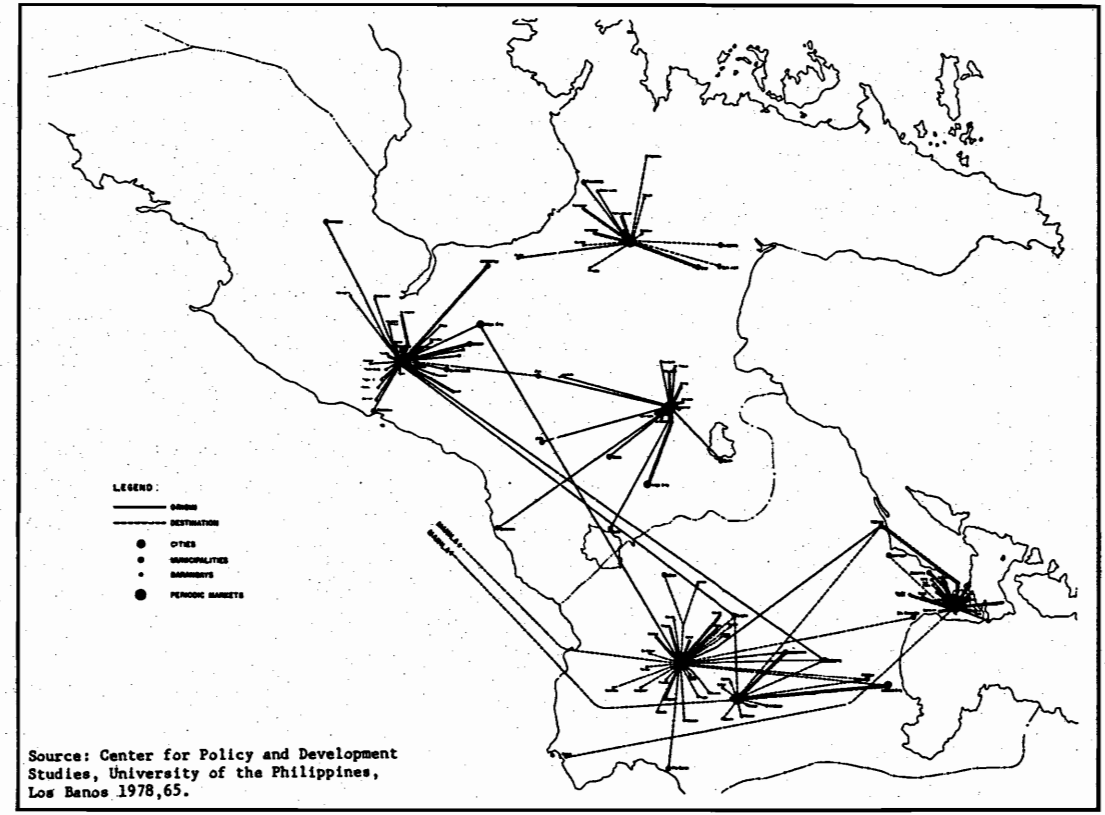
3. Market centers in the Basin were predominantly agricultural trading places. Planners found that except for Iriga, the major markets in the Basin traded more in agricultural than in manufactured goods. The most frequently traded goods were palay, rice, copra, coconut, fresh and dried fish, poultry and livestock. None of the major markets were specialized in any particular commodity. All manufactured or processed goods came from outside of the region; mostly from Manila. The processed goods most frequently found in the market included agricultural and veterinary products, groceries, small appliances, household utensils, personal wear, drugs and medicine. In these goods, the major markets in Bicol acted only as transfer points; the periodic markets traded predominantly in agricultural products grown in the immediately surrounding area and had few manufactured goods available.

From these market center studies planners in the Bicol River Basin were able to obtain, quickly and inexpensively, an initial profile of economic and trade linkages among settlements in the region and in-depth information about the functions and characteristics of a sample of market centers.

In the Department of Potosi in Bolivia, information about market functions and linkages was gathered as part of a general survey of settlements. Interviewers requested information about the existence of markets in the towns, the type of market, when it was established, and the frequency with which it operated. Key informants were asked to identify the principal products traded in the market; the distances from which principal products and participants came, where the town's inhabitants went to trade if no market existed in that town, and major marketing problems. Information about supporting services and facilities, transportation access to the market center from other towns and rural areas, and flows of goods from the market were determined through household and settlement surveys done in connection with the scalogram analysis.

The surveys found that in the Potosi region, where more than half the population was engaged in agricul-

FIGURE 5-3
TRADING LINKAGES OF SIX PERIODIC MARKETS IN BICOL RIVER BASIN



Source: Center for Policy and Development Studies, University of the Philippines, Los Banos 1978,65.

TABLE 5-2

TRADING DISTANCES OF SIX MAJOR MARKETS IN BICOL RIVER BASIN

Market Center	No. of Places	Sources of goods traded				No. of Places	Destination of goods traded			
		0-10 km.	11-20 km.	21-50 km.	51+ km.		0-10 km.	11-20 km.	21-50 km.	50+ km.
Agricultural										
Naga City	89	38.2	34.8	34.8	10.1	102	73.5	3.9	3.9	17.2
Legaspi City	110	44.5	11.8	24.5	19.1	110	58.2	3.6	16.4	4.2
Iriga City	46	65.2	26.1	8.7	--	62	61.3	11.3	16.1	7.3
Tabaco	111	74.8	4.5	2.7	18.0	112	71.4	12.0	1.8	12.2
Ligao	114	78.9	0.9	14.0	6.2	117	70.1	0	15.4	55.9
Gao	120	86.7	0.8	2.5	10.0	191	--	--	--	14.5
Manufactured										
Naga City	69	37.7	1.4	2.9	58.0	87	67.8	4.6	10.3	17.2
Legaspi City	60	11.7	10.0	5.0	73.3	96	61.5	30.2	3.1	4.2
Iriga City	16	32.9	14.8	16.2	36.1	438	48.9	25.8	18.0	7.3
Tabaco	64	28.1	3.0	25.0	43.8	82	54.9	28.0	4.9	12.2
Ligao	31	6.5	0	32.3	61.2	34	44.1	0	0	55.9
Gao	25	52.0	0	0	48.0	62	85.5	0	0	14.5

Source: UFRD Market Research, 1977

tural activities, market centers were extremely important as outlets for the sale or trade of surplus commodities and as sources of basic consumer goods and inputs for agricultural production.[26] The information collected in the surveys of settlements allowed planners to describe the basic structure of market interaction in the region. The studies found that the most important market centers were the larger towns in which other commercial and service activities were located. Smaller markets were usually located in rural service centers within areas of higher agricultural production.

The studies found that the largest settlement in the region--the City of Potosi, with five markets--played an important role in structuring the pattern of market interaction in that part of the Department in which the city was located. The strong volume of activity in Potosi, its relatively good access by road, and its interaction with a larger market in the city of Sucre, stimulated interaction with periodic markets in several nearby small towns as well--Betanzos, Puna, Otavi, and Ckullco--most of which were located in the main areas of agricultural production and accessible from the main road that ran through the Department.

The studies indicated that in the southern part of the region, daily markets were found mainly in centers of consumption--Tupiza, Villazon and Atocha--and that several mining centers had weekly markets. The more sparsely populated western part of the region had markets located mostly in mining towns. The lack of markets in the west and north, and the lack of roads connecting rural villages to them, created strong disincentives for farmers to increase production and encouraged them to make longer market trips to larger towns when they did engage in market trade.[27]

TRANSPORTATION LINKAGE STUDIES

Transporation linkages--roads, rail and water networks as well as transportation services--are among the most important means of connecting settlements within a region and of providing access for rural people to town-based services and facilities.

In its manual on rural service center planning, ESCAP suggests that the following types of transport information be collected:[28]

1. Density of road systems--number of kilometers of road per square kilometer of land in the region;
2. Access needs of rural population;
3. Quality of the road system--extent to which it provides access to services and markets in central place settlements;

4. Average distances among settlements within the region and of population to roads;
5. Classification of road hierarchies, including:[29]
   a. national roads--"serving international, intercity and interregional demands, requiring superior mobility and structural strength for long distance trips and heavy vehicles and therefore high engineering standards and bitumen or similar surfacing;"
   b. regional roads--"providing continuous access to designated centers as well as internal area (province and district) circulation, requiring all-weather constructed roads;"
   c. local roads--"connecting minor centers and farms to market and service centers, which are possibly suitable for labor-intensive construction and maintenance methods."
6. Modes of transport and their suitability--ranging from pedestrian travel, animal or animal pulled conveyences, bicycles, motorcycles, automobiles, trucks, buses, water-borne conveyences, rail and other means and the degree to which they facilitate existing and projected traffic needs;
7. Road conditions and levels of maintenance--roads can be classified as paved, deficient-paved, sealed gravel, unsealed gravel and earthen, or some other categorization that reflects road traffic and accessibility criteria;
8. Origin and destination of traffic, commodity and population flows and traffic volume flows.

Transport linkage studies played a prominent role in the regional planning projects in both Bicol and Potosi. In the Bicol River Basin planners compiled information on transportation linkages among municipalities by mode, on road networks and road conditions, and calculated interpoint distances among villages and between villages and town centers. In addition, information on road traffic volumes, commodity flows, means of transportation, and origins and destinations of vehicles had already been collected through a major transportation survey. Most of the data were mapped and provided a detailed profile of physical linkages among settlements within the Basin.

Transport studies showed that more than 70 percent of all roads in the Basin were of poor quality and needed upgrading. Only the national highway cutting through the center of the Basin, and a few provincial roads, were of all-weather construction and passable during the rainy season. Farm-to-market roads were few and poorly constructed. Many rural villages could only be reached by small boat or on foot. The inadequacy of regular transport linkages was 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 were on foot. The railroad provided limited service to points outside the Basin and the major centers were linked to Manila only by infrequent bus and air service.

Roads were used by 85 percent of the passengers taking trips within the Bicol River Basin and to transport over 80 percent of the agricultural commodities. But as physical linkages among communities, the roads provided rather poor service (see Table 5-3). Most of the rural population lived in settlements not easily accessible by road, and transport was difficult and expensive in most of the Basin. The costs of transporting commodities in interior rural areas was up to six times more than in areas connected by roads passable by motor vehicles. Farmers from rural areas had to walk for hours to the nearest road and carry their produce on their backs or on slow-moving carabao or horses. Even after they reached a provincial road, the waiting times for a jeepney or bus were long and the costs so high that marginal profits were sometimes completely wiped out. Rural farmers had to 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 had to wait as long as three or four hours. Because of the cost of transportation and difficulty of travelling, 85 percent of all trips taken within the Basin were among places within the same municipality and 99 percent were within the same province. Relatively little travel--for shopping, work, trade, social interaction, or any other purpose--took place among municipalities and there was little interaction on a regular basis between the Basin's two provinces.[30]

In Bolivia, information about transportation linkages could be obtained from secondary sources through national agencies engaged in transport planning and management. The study found that the Department of Potosi had a more extensive transport network in relation to its land area than other regions, although none of the roads in the department were paved. Given the

TABLE 5-3

POPULATION AND SETTLEMENTS SERVED BY ROADS AND OTHER MEANS OF TRANSPORTATION IN BICOL RIVER BASIN

	POPULATION SERVED[a]				SETTLEMENTS SERVED[b]			
	Albay % Albay population	Cam. Sur % Cam. Sur population	Total	% Basin population	Albay % Albay settlements	Cam. Sur % Cam. Sur settlements	Total	% Basin settlements
Road								
Concrete (MSR)	9	9	155,977	9	3	4	52	4
Asphalt (provincial road)	13	4	124,606	7	6	2	49	4
Gravel and earth (others)	46	35	677,751	40	48	39	600	42
Sub-total			958,334	56			701	49
Footpath[c]	30	42	629,942	37	39	41	580	41
Other Means								
Watercraft	-	7	71,827	4		11	104	7
Railway	2	3	39,966	3	3	2	34	2
Bicol River	-	(2)	(229,372)	(14)				
Total	100	100	1,700,069	100	100	100	1,419	100

[a]Population served by river transport not added since these settlements are also served by road and other means.
[b]BUA's or barangays are computed.
[c]The total population and settlements served by footpaths were computed by subtracting the population and settlements served by all types of road and other means from the Basin population and settlements for the two provinces.
Source: UFRD Research, 1977, based on BRBDP Transport Study, 1976, DPH and PEO of Camarines Sur and Albay.

mountainous terrain, travelling was slow and difficult, especially during the rainy season.

The national highway service classified roads into three categories: the supposedly all-weather basic network that connects departmental capital cities; the complementary network that links capital cities with larger towns; and the local network that includes all other roads.[31] In reality, none of these roads in Potosi was of all-weather construction. Roads in the basic network connected the city of Potosi with nearby departmental capitals and La Paz, but often the journey was long and slow. Several roads in Potosi were part of the complementary network although only the link between Potosi and Tupiza and Villazon to the south approached all-weather status. Local feeder roads reached most of the settlements with more than a few hundred residents, but except on flat terrain they were tortuous and rarely permitted vehicles to travel more than 15 kilometers an hour.

The transport linkage surveys in Potosi found that there was bus service only to cities and towns connected by roads in somewhat better condition. Buses ran a few times a week from Potosi to the second and third largest towns in the Department, but there was no regular service to the fourth largest town or smaller settlements. The main means of transport to towns and villages that were located off the main highway was by truck where there were local feeder roads, and by mules and llamas elsewhere. The rail system was built mainly to export minerals to seaports in Chile, Peru and Argentina and passenger service remained inferior even to road transport. The railroad offered connections between Potosi and other Bolivian cities only once or twice a week.[32]

The transport study made apparent the physical isolation of many parts of the region, and how few physical linkages existed among settlements within the region or between larger towns in the region and others in Bolivia.

SOCIAL INTERACTION LINKAGE STUDIES

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, intervillage marriages, and for recreation and ritual--social linkages reflect the degree to which people perceive a region as a coherent and unified unit of society. One means of finding out about the extent of social interaction among settlements in a region is to include questions about the purposes of journeys in origin and destination surveys. To obtain adequate information, however, the studies must be conducted

over a period of time and include weekends and holidays, when people are free to travel for social purposes.

Another means of obtaining a profile of social linkages in regions where much of the interaction is expected to take place among kin, is to study the spatial patterns of courtship and marriage. Under appropriate cultural conditions, the spatial patterns of spouse selection reveal a great deal about social interactions among communities both prior to and after marriage linkages are forged.

Such a study was considered to be an important indicator of social interaction in the Bicol River Basin, and the planners were able to map spouse selection patterns by compiling data in each municipal hall from a 10 percent sample of the marriage record files over a five year period. The records showed the residence of both the bride and the groom at the time of marriage. The study confirmed the findings of the market and transport linkage analyses that there was little linkage or interaction among municipalities in the Basin. Only an average of 19 percent of the marriages during the period studied were between people from different municipalities. Thus, more than 80 percent of the marriages occurred among men and women from the same locality; and of these only about 4 percent were among partners from different villages. Those marriages that were between spouses from different settlements tended to take place mostly in the municipalities around Naga City, the largest market center in the region.[33]

SOCIAL SERVICE LINKAGE STUDIES

Another means of determining both the degree of interaction that takes place among settlements and the service or influence area of central places is to study the origins of consumers or clients for important services, and especially for social services. Two studies were made of service linkages in the Bicol River Basin: one of the origin of students in secondary and post-secondary schools and the other of patients in clinics and hospitals.

The specific objectives of the studies were:

1. To determine the degree of centrality, if any, of schools and hospitals in the Basin;
2. To find out whether schools and hospitals were effective linkages between or among areas;
3. To identify the service areas of schools and hospitals; and

4. To determine what possible factors (spatial or non-spatial) create or maintain linkages.

A list of secondary and post-secondary schools was made from records of the Department of Education and Culture and samples of students were drawn from two educational levels: secondary schools; and post-secondary schools such as colleges, trade and agricultural schools, technical schools and vocational training institutions. A sample of the eight largest secondary schools and 29 post-secondary schools was used to draw a list of students from whose records information could be obtained about their permanent residence.

The origin of patients was determined from a 10 percent sample of those registered over a one-year period in the 43 hospitals in the region having more than 10 beds. Data were collected on the permanent residence of the patients and their types of ailment.

These studies confirmed that most of the education and health services were located in larger settlements and that their linkages to and accessibility from rural areas were weak. Two-thirds of all higher education facilities were located in Naga and Legaspi cities. About 60 percent of the students in the higher educational institutions came from outside of the town in which the facility was located, but the service areas were quite small and extended on average only about 37 kilometers. Analysts found a close relationship between the size of settlements and their centrality for higher education and health services. More than half of all larger schools in the Basin were found to be concentrated in the largest settlements--Naga, Legaspi, Daraga and Iriga. The studies of the service areas of hospitals found that less than one percent of the patients came from more than 36 kilometers from the facilities' location (see Tables 5-4 and 5-5).

Similar studies conducted in Potosi, Bolivia, found that although there were high schools in all larger and a few smaller towns, those in the smaller settlements did not offer a complete curriculum. A complete high school education was offered only in bigger cities and children from rural areas had to move from home in order to attend. It was found that in Potosi the size and degree of specialization of social service institutions determined the degree to which they served broad geographical areas. The largest higher education institution, the University of Tomas Frias, for example, had students from the entire country. But high schools and elementary schools tended to serve only the towns in which they were located.

Patients in need of specialized medical treatment had to go to La Paz or to one of the larger cities outside of the Department. The city of Potosi and the

TABLE 5-4

SERVICE AREAS AND LINKAGES OF SCHOOLS IN BICOL RIVER BASIN

School Location	No. of Schools	% of Students from Outside	Distribution of Origins					
			0-5%		5-10%		10% and above	
			No. of Places	Ave. % per Place	No. of Places	Ave. % per Place	No. of Places	Ave. % per place
Naga	9	58	205	1.9	30	6.2	7	17.9
Legaspi	7	69	82	2.1	12	6.7	6	14.6
Daraga	3	55	13	2.3	3	7.2	1	29.3
Guinobatan	2	54	16	2.5	7	7.3	3	16.2
Iriga	2	48	40	2.1	3	8.6	2	13.7
Tabaco	1	56	16	2.6	3	6.9	2	18.6
Pili	1	44	24	4.0	3	6.5	2	13.5
Sipocot	1	28	2	5.2	-	-	2	14.7
Polangui	1	42	-	-	3	8.3	1	16.7
Bato[b]	1	6	3	1.7	-	-	-	-
Goa	1	46	6	2.2	2	6.3	1	21.9
Nabua	1	11	1	3.4	1	6.8	-	-
Pasacao	1	51	9	2.8	-	-	1	13.9
Ragay[b]	1	4	1	3.4	-	-	-	-
Tiwi	1	25	-	-	-	-	1	25.0

[a]Only schools of higher education but not secondary schools, are included here. They include those that offer general, agricultural and trade, technical, and other higher specialized education.

[b]Ragay is a railroad town and is inaccessible to the rest of the Basin towns; the school in Bato with very low centrality is a small local college whose capacity is not even enough to fill local demand.

Source: UFRD Primary Research, 1977.

TABLE 5-5

SERVICE AREAS AND LINKAGES OF HOSPITALS IN BICOL RIVER BASIN

Hospital Location	No. of Hospitals	% of Patients from Outside	Distribution of Origins					
			0-5%		5-10%		10% and above	
			No. of Places	Ave. % per Place	No. of Places	Ave. % per Place	No. of Places	Ave. % per place
Legaspi	7	43	37	1.0	5	7	3	14
Tabaco	5	36	20	0.9	6	7	3	17
Naga	4	45	64	1.0	2	7	-	-
Polangui	4	33	18	1.0	2	6	4	19
Ligao	4	23	13	1.0	1	8	2	18
Daraga	3	40	35	0.5	2	6	2	37
Iriga	3	36	25	0.8	4	7	2	13
Libon	3	6	4	0.7	-	-	1	15
Pio Duran	2	26	9	0.6	2	6	2	11
Camalig	1	0	0	.0	0	0	0	0
Guinobatan	1	9	4	2.0	0	0	0	0
Malilipot	1	77	13	0.5	1	9	3	20
Oas	1	20	12	0.8	0	0	1	10
Baao	1	23	7	0.6	0	0	1	17
Cabusao	1	49	29	0.7	1	5	1	17
Libmanan	1	14	12	0.4	1	9	0	0
San Jose	1	21	3	1.0	0	0	1	16
Tinambac	1	2	1	1.0	0	0	0	0

larger towns in the Department had general hospitals that served mainly their own provinces; health centers were available in most larger and intermediate towns, and small clinics could be found in some villages, although few of them functioned effectively because of the lack of doctors, nurses, supplies and equipment. Often, because those social services at the lower end of the hierarchy were either missing of ineffective, rural people had to go to larger cities to obtain health and educational services or simply go without them.[34] In both Bicol and Potosi, the analyses of social service linkages provided a profile of the service areas of educational and health facilities located in central places and gave planners an overview of the accessibility of different parts of the region to those services.

POLITICAL, ADMINISTRATIVE AND ORGANIZATIONAL LINKAGE STUDIES

A related but somewhat different approach to determining the degree to which settlements in a region are integrated is to examine political, administrative and organizational linkages among them. These linkages are reflected in formal government structure, informal decision-making relationships, flows of budget resources from higher to lower levels of administration, transactions among political and administrative jurisdictions, and the degree of administrative decentralization that exists within a region.

In the Bicol River Basin various studies of government structure and decision-making patterns sought to describe and assess the authority, relationships and capabilities of government organizations located in settlements of the region and to determine rural residents' access to the services and facilities offered by public agencies.

Six studies were done using field observation, secondary data, case studies and structured interviews:[35]

1. A case study of the provision of government services in one area of the region, the municipality of Minalabac in Camarines Sur province, was used to obtain an in-depth profile of organizational structure and interaction within a municipal unit of government. The area contained both a town center and a rural hinterland. The municipality was located off the main highway and in an area that other studies indicated was relatively weakly linked to the rest of the regional economy. Interviews attempted to determine the availablility of educational, health, agricultural extension and general government services. The questions sought information on: (a) extent of use of services by the

respondents or other members of their households; (b) the cost and mode of transportation and the time required to obtain services; and (c) respondent's assessment of the quality of services available. Respondents were drawn from 25 barangays throughout the municipality.

2. Interviews with key personnel and data collected from secondary sources were used to study the extent to which agricultural extension services were available in the Bicol River Basin.

3. A study of rural health facilities was done in two municipalities--Minalabac and Malinao--using secondary data, interviews with key informants and field observation.

4. A study of local decision-making patterns was also done by interviewing key informants in the offices of provincial governors, city mayors, municipal mayors and barangay captains.

5. An in-depth case study of the conflict over the proposed transfer of the provincial capital in Camarines Sur from Naga City to the town of Pili provided information about formal and informal political interaction within the Basin.

6. A case study of locating an industrial estate in Bicol provided information about intergovernmental linkages, political decision-making and interaction between public and private decision-makers within the region.

These studies confirmed that formal government linkages among levels of administration in the Bicol were dominated by national ministries operating within the Basin and that formal structure was highly centralized. Most local officials were appointed by and responsible to national ministries. Municipal officials generally were not under the authority of the mayors, themselves holdover appointees under martial law, who had few resources to solve local problems. Most municipalities in the Basin were dependent on the national government for part of their revenues and most of their authority. Decisions were often made through personal relationships.

Studies of government structure and services in Bicol indicated that services provided by all levels were highly localized. Health, education, and other public institutions generally extended services only to populations living in the immediate vicinity of their sites or to the few who could afford to travel from rural barangays to obtain them in the larger cities. Even the post-secondary schools in the larger centers primarily served only the local area. Health, education and agricultural extension services were far below standards set by national ministries.[36]

In the Department of Potosi, Bolivia, it was decided to use a survey of the provision of basic infrastructure as a means of determining the degree to which government services reached towns and villages in the region. Infrastructure investment was the single most important activity in which government agencies were engaged in Potosi, and information about the distribution of infrastructure investments could provide a good indication of the degree to which settlements throughout the Department were linked into the governmental decision-making system.

Planners found that published statistics on connections to drinking water, sewerage and electricity were not disaggregated by towns and villages. Although these data were available on request, it was decided instead to use information collected in the survey of towns done for the scalograms. This was only a rough estimate, but it was more up to date than census data, and included in addition information on the provision of paved streets, street lighting and garbage collection. For each of the six aspects of physical infrastructure that were taken into account, communities were graded on a scale of 0 to 4, representing none to all, for example, of houses that were directly connected to drinking water, or of streets that were paved. Scores for the six categories were added together to arrive at a total for the community, and an average. Figures were summed for each of the four zones of the Department by simply calculating the average for all the communities in that zone. The city of Potosi was omitted from the calculation of the indices for the central area, since standards of provision there were so much higher than elsewhere and would distort the picture for the rest of the zone.[37]

Evans and his associates concluded from this analysis that the standard of provision of basic infrastructure was extremely low. The overall index for the entire Department (the city of Potosi excluded) was 1.15 on the scale of 0 to 4. Of the six elements considered, the provision of drinking water was furthest advanced, although this still represented only a small part of the total population. Next came electricity, paved roads, street lighting and garbage collection. Sewerage was rarely found outside the largest towns. The southern region emerged as best off--probably because infrastructure investments were made in mining towns by the national mining corporation, COMIBOL--but still with a low score of 1.65 (see Table 5-6).[38]

In brief, the spatial linkage analyses provide planners with abundant information about the degree to which people living in settlements of different sizes and functional characteristics and in different areas

TABLE 5-6

SUMMARY OF INFRASTRUCTURE INDICES FOR THE DEPARTMENT OF POTOSI

	Population of Survey Settlements	INFRASTRUCTURE							
		Water	Sewer	Garbage	Elec-tricity	Street Light	Paved Streets	Total	Average
North	72,071	2.33	0.33	0.30	1.48	0.63	1.00	6.07	1.01
Center*	26,812	1.61	0.07	0.10	1.85	1.22	1.07	5.93	0.99
South	51,482	2.93	0.73	1.32	2.86	1.73	1.32	9.89	1.65
West	18,157	2.38	0.05	0.48	1.19	0.67	1.05	5.81	0.97
Total	168,522	8.25	1.18	2.20	7.38	4.25	4.44	27.70	4.62
Average		2.06	0.29	0.51	1.85	1.06	1.11	6.92	1.15

*The central zone does not include the City of Potosi.

Source: Hugh Evans, Urban Functions in Rural Development: The case of the Potosi Region in Bolivia, Washington: USAID, 1983.

of the region are able to interact in economic and social activities. They help determine the degree to which services and facilities located in various settlements serve people living in rural areas and other towns. They can also indicate the service areas of important facilities located in towns and cities. The information derived from linkage analyses can be used in conjunction with other data to determine which parts of the region are not served by central places and where rural people have little or no access to important town-based functions.

NOTES

1. Dennis A. Rondinelli and Kenneth Ruddle, Urbanization and Rural Development: A Spatial Policy for Equitable Growth, New York: Praeger, 1978.

2. See R. Symanski and R. Bromley, "Market Development and the Ecological Complex," Professional Geographer, Vol. 26, No. 4 (1974): 328-388.

3. United Nations Economic and Social Commission for Asia and the Pacific, Guidelines for Rural Centre Planning, (New York: United Nations, 1979): p. 186.

4. For a detailed discussion see Rondinelli and Ruddle, op. cit., Chapter 7.

5. See E.A.J. Johnson, The Organization of Space in Developing Countries, Cambridge, Mass.: Harvard University Press, 1970; G.W. Skinner, "Marketing and Social Structure in Rural China," Part 1, Journal of Asian Studies, Vol. 24, No. 1 (November 1964), pp. 3-43.

6. See H.M. Riley and K.M. Harrison, "Vertical Coordination of Food Systems Servicing Large Urban Centres in Latin America," paper prepared for UN Food and Agriculture Organization, Conference on the Development of Food Marketing Systems for Large Urban Areas in Latin America, Rome: FAO, 1973.

7. See Carol A. Smith (ed.) Regional Analysis, Vols. I and II, New York: Academic Press, 1976.

8. U.S. Bureau of the Census, Planning for Internal Migration: A Review of Issues and Policies in Developing Countries, ISP-RD-4, Washington: US Government Printing Office, 1977.

9. Jean Parent, "The Problem of Transferring Techology from Branch to Branch and the Multiplier," in Organization for Economic Cooperation and Development, Choice and Adaptation of Technology in Developing Countries, (Paris: OECD, 1974), p. 208.

10. See D.R.F. Taylor, "The Role of the Smaller Place in Development: The Case of Kenya," in S. ElShakhs and R. Obudho (eds.) Urbanization, National Development and Regional Planning in Africa, (New York: Praeger, 1974), pp. 142-160; Ronald G. Knapp, "Marketing and Social Patterns in Rural Taiwan," Annals of the Association of American Geographers, Vol. 61, No. 1 (March 1971), pp. 131-155; G. William Skinner, "Marketing and Social Structure in Rural China, "Part 2, Journal of Asian Studies, Vol. 24, No. 2 (February 1965), pp. 195-228.

11. See Skinner, op. cit.; and Lawrence W. Crissman, "Marketing on the Chungua Plain, Taiwan," in W.E. Willmot (ed.), Economic Organization in Chinese Society, (Stanford: Stanford University Press, 1972), pp. 215-259.

12. Brian Schwimmer, "Periodic Markets and Urban Development in Southern Ghana," in Smith, op. cit., 123-146; Raymond J. Bromley, "Contemporary Market Periodicity in Highland Ecuador," Ibid, pp. 91-122.

13. World Bank, Village Water Supply, (Washington: World Bank, 1976), p. 29.

14. Norman T. Uphoff and Milton J. Esman, Local Organization for Rural Development: Analysis of the Asian Experience, (Ithaca: Cornell University Center for International Studies, 1974) p. xi; see also David K. Leonard, "Interorganizational Linkages for Decentralized Rural Development: Overcoming Administrative Weaknesses," in G.S. Cheema and Dennis A. Rondinelli (eds.), Decentralization and Development: Policy Implementation in Developing Countries, (Beverly Hills: Sage Publications, 1983), pp. 271-294.

15. Ray Bromley, "Market Centers in the Urban Functions in Rural Development Approach," Working Paper (Worcester, Mass: Clark University Settlement and Resource Systems Analysis and Management Project, 1983).

16. Ibid, p. 3.

17. See Ralph L. Beals, The Peasant Marketing System in Oaxaca, Mexico, Berkeley: University of California Press, 1975.

18. Bromley, "Marketing Centers in the UFRD Approach," op. cit. pp. 3-16.

19. Ibid., pp. 17-18.

20. Ibid., pp. 23-26.

21. Ibid., pp. 45-56.

22. Ibid., pp. 51-52.

23. Ibid., pp. 56-61.

24. Ibid., pp. 56-57.

25. Bicol River Basin Development Program, Urban Functions in Rural Development: A Research Project in Spatial Analysis and Planning, Pili, The Philippines: BRBDP, 1978.

26. Hugh Evans, Urban Functions in Rural Development: The Case of the Potosi Region in Bolivia, Washington: U.S. Agency for International Development, 1982.

27. See Dennis A. Rondinelli and Hugh Evans, "Integrated Regional Development Planning: Linking Urban Centers and Rural Areas in Bolivia," World Development, Vol. II, No. 1 (1983), pp. 31-54.

28. United Nations Economic Commission for Asia and the Pacific, op. cit., pp. 185-204.

29. Ibid., pp. 189-190.

30. Bicol River Basin Development Program, op. cit., pp. 99-100.

31. Evans, op. cit., pp. 51-52.

32. Idem.

33. Bicol River Basin Development Program, op. cit., pp. 72-73.
34. Ibid., pp. 74-78.
35. Ibid., pp. 89-98.
36. Ibid., pp. 97-98.
37. Evans, op. cit., pp. 58-61.
38. Ibid., pp. 47-49.

6
Applying Spatial Analysis in Regional Planning

The first three stages of Urban Functions in Rural Development are primarily concerned with data collection, organization and preliminary analysis. The three following phases focus on presenting, interpreting and applying the information gathered for the regional profile, settlement system and spatial linkage analyses. In phases four through six of the UFRD approach, the information is summarized in maps, charts, tables and other graphic presentations. The maps and data are analyzed together in order to determine the accessibility of settlements and functions for people living in various parts of the region. The analyses are then used to identify functional "gaps" in various services, facilities, infrastructure and productive activities, and to delineate the service areas of existing settlements. In some cases, regional planners are interested in identifying marginal or peripheral areas that do not have sufficient numbers of central places to serve their residents, where access to functions is weak or nonexistent, and where linkages among settlements are poorly developed. Combined with more detailed economic and technical studies, sectoral analyses, or "demand analyses," the information about the settlement system can be used to help develop regional investment strategies and to identify specific projects for particular settlements or areas.

The spatial information is mapped and interpreted to help regional planners deal with the following types of issues or questions:

1. Which settlements in the region are central places with "adequate" functions and service areas, and need only investments that maintain and strengthen their current comparative advantages?
2. Which settlements are functionally "deficient," or could serve a greater hinterland with strategic investments in services and

facilities that are currently absent but could be supported in the settlement, or by strengthening their linkages with higher or lower order settlements?

3. Which settlements lack important services and facilities or infrastructure but show little or no potential for economic growth and diversification and therefore should have low priority for investment?
4. Which centers have the potential for economic growth and diversification and could be "upgraded" to a higher level in the settlement hierarchy with a "package of projects" designed to add to their functional diversity?
5. Which settlements that do not now serve as central places might be upgraded with investments in new services and facilities?
6. How can existing non-central places that do not seem to have potential for growth and diversification be linked more strongly to existing or potential central place settlements?
7. How can the access of people now living in marginal or peripheral areas be increased so that they can be served by facilities, infrastructure or social and commercial activities that must be located in towns or cities?
8. How can the existing settlement system be used more effectively to distribute services, facilities and infrastructure more widely and to serve larger numbers of people?
9. How can the settlement system be changed to make it more articulated and integrated and to allow it to provide a physical base for more widespread economic development?
10. How can linkages among settlements be strengthened to promote development in strategic places spontaneously?

These are only some of the issues about which spatial analysis can provide information. It should be stressed again, however, that the analyses do not provide answers to these questions. The answers require careful judgment based on an intimate knowledge of the region and its people's needs and desires. The analyses provide information that allow planners and policy-makers to make better and more informed judgments. Moreover, the spatial analyses provide only some of the data needed to make informed judgments. They must be combined with other analyses, with information about potential needs and demands, with assessments of economic and political feasibility, and with appraisals of institutional capability to carry out programs and projects.

This chapter describes phases four through six of the UFRD approach: analytical mapping, accessibility analyses, and identification of functional and settlement service areas. From these studies functional "gaps" and unserved or marginal areas of the region can be identified. These analyses are used in turn to help planners add a locational dimension to the formulation of investment strategies and projects, phases of UFRD that will be described in more detail in Chapter 7.

ANALYTICAL MAPPING

Experiences with UFRD projects in the Philippines and Bolivia suggest that one of the most important tasks of regional planners is to present information and analyses in ways that are easy to understand and to visualize. This is especially important when they are dealing with policy-makers who may not be familiar with spatial analysis techniques, and with government officials and local leaders who may not be highly trained in statistical analysis and, indeed, may not even have a high level of formal education. Unless those who must make decisions can "see" the implications, it is highly unlikely that they will make use of spatial analyses. Moreover, if the studies are too complicated or the presentation of results too abstract, they may generate hostility among decision-makers rather than convince them of the importance of locational and spatial factors in regional planning and policy.

Roy and Patil,[1] in their manual on area development planning in India, suggest that two types of maps are essential:

1. Topographic maps that record physical features of a region--such as rivers, forests, roads, and terrain; and
2. Thematic maps that concentrate on a set of activities, characteristics or socio-economic features of the region such as population distribution, location of infrastructure, movements of goods and services, economic characteristics of settlements or other important factors that can be drawn or symbolized.

In addition to these, the UFRD approach makes use of other forms of graphic presentation, including tables, charts, graphs and diagrams. Obviously, the process of mapping and organizing information goes on throughout a UFRD project and is not all done at a single point in the process. In this sense, calling this activity a "stage" or "phase" of the UFRD approach is somewhat misleading. A number of graphic presentations are prepared in earlier phases of analysis--the regional profile tables, settlement system scalograms, and linkage analysis all require some sort of graphic,

statistical or diagrammatic presentation. Moreover, maps, charts, tables and graphs are prepared in subsequent stages of analysis as well--in accessibility analysis, delineation of service areas and formulation of investment strategies and programs. However, it is usually after the regional profile, settlement system and linkage analyses are completed that information can be analyzed in new ways and summarized most effectively on maps in order to prepare for its further analysis, interpretation and application.

There are a wide variety of graphic and statistical presentation methods that can be used to in regional planning. Dickinson, perhaps, most concisely summarizes and describes the range of techniques that can be used in the UFRD approach.[2] He notes that:

1. Statistical diagrams can be used to show the relationship between quantities when the presentation of spatial distribution is not important. Among the most effective statistical diagrams are:
   a. Line graphs
   b. Bar graphs
   c. Circular graphs
   d. Scatter graphs or scatter diagrams

Statistical diagrams can also be used to show the division of characteristics into components--usually in percentages or absolute numbers. Among the most effective statistical diagrams for showing parts or components of a whole are:

   a. Compound line charts
   b. Bar graphs
   c. Divided circle or "pie" charts
   d. Divided rectangles
   e. Triangular graphs

2. Statistical maps can be used to show the spatial distribution of social or economic characteristics, population, activities, resources or other features that exist at different levels or in different quantities in various parts of a region. When differences in degree or level are to be shown in a non-quantitative manner, various symbols, letters or levels of shading can be used at different locations on the map.

When it is important to show on the map quantities distributed among places, the following devices can be used:

   a. For showing the quantities distributed at specific points:
      1) Repeated unit symbols--such as a small drawing of a cow at each location representing 100 head of cattle raised in that place
      2) Proportional bars--representing different levels or amounts at each place

3) Squares, circles, spheres or cubes--with each symbol representing different amounts or proportions
4) Graduated range of symbols--such as circles of different sizes representing larger amounts or percentages
5) Repeated statistical diagrams

b. For showing the quantities distributed in an area:
1) Dots--with the density of dots representing the amount within the area
2) Shading--the darker the shading, the greater the amount or percentage
3) Proportional shading
4) Isolines--connecting areas with equal amounts or levels and forming areas within an area

c. For showing quantities distributed along a line--such as a road, river, or railroad--bands with proportional widths or graduated size indicating the level or amount.

The most effective type of map, table or chart to use depends on the types of data to be presented, the emphasis or focus that is desired, and the ability of the audience to comprehend the information. There are graphics that are more or less appropriate to different types of data: for example, population or commodity flow data along roads are most appropriately highlighted by proportional width bands along the line of flow. But other means might be used to highlight other data. Part of the planners' responsibility is to select those graphic techniques that are most likely to highlight the relevant implications of the data and that are most likely to be understood by those who must make decisions about the information presented.

In the Bicol River Basin, most of the forms of presentation listed earlier were used at one stage or another of the UFRD project. Information about the levels of development and accessibility of settlements was mapped together with information about the distribution of functions and the network of linkages. The maps were used to determine the "areas of influence" of various settlements, the service areas of selected functions, and the location of marginal or peripheral areas within the region where the population was poorly served by central places.

Moreover, the data were used to delineate subsystems of settlements and major economic areas within the Basin and to compare those to existing planning units. Transport and physical accessibility maps showed areas of the Basin that could 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 center 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 to show the distribution of services and facilities among settlements and that could be employed for comparison and evaluation after development plans were implemented. They also produced the first comprehensive map of barangay settlements in the Bicol River Basin that would be important in future development planning.[3]

In both the Bicol River Basin and the Department of Potosi in Bolivia, the base and analytical maps were important tools for organizing and interpreting the regional profile, settlement system and linkage analyses and in determining the accessibility of settlements and functions for rural residents.

ACCESSIBILITY AND SERVICE AREA ANALYSIS

A crucial feature of the UFRD approach is that is is designed to collect and analyze spatial and functional data to help planners make investment decisions that will promote economic growth with a high degree of social and geographic equity. That is, the UFRD approach is based on the premise that new investments in services, facilities, infrastructure and productive activities should be located in such a way as to promote equitable growth by increasing the access of the population living in rural hinterlands to the functions that are located in central-place settlements. Before such locational decisions can be made, however, it is necessary to know how accessible existing settlements and functions are to the population living within the settlement and to those living in immediately surrounding areas.

One dimension of accessibility is physical--the amount of time and the distance people must travel from the places where they live to the places where functions are located. In rural regions, especially, physical accessibility is a major factor determining which groups can participate in the activities located in towns and cities.

Obviously, however, it is not the only factor. Perhaps equally important are the disposable income and purchasing power of potential clients or customers, people's knowledge about the existence of facilities, their level of education, their skill in making use of

the facilities and services, and other social and political factors. But physical distance does play an important role in accessibility. It determines to a large degree the differential cost of a service or facility for people living at different distances from its site. People's knowledge of the existence or use of a service or facility is also determined in part by their physical access to it. And to some extent the effective demand for a service or facility is determined by the probability that people can have physical access to it. Living near a school, for example, makes people more aware of the existence of educational services. It lowers their cost of travel and increases the probability that they will be able to attend or to send their children.

Moreover, all things being equal, the closer people live to a service or facility, the greater their chances of being able to make use of it during the hours of the day when it is provided or made available, and the more likely that they will be able to get convenient transportation to it. Thus, although physical distance between the location of a function and its potential clients or customers does not in itself determine accessibility (e.g., a family may live next to a general hospital but not have an income high enough to pay for its services), the physical location of services and facilities does play an important role in determining the number of people who are likely to have access to them. Moreover, the comparison of locations of population and functions can provide a surrogate for, or an effective initial indicator of, accessibility that can be refined with information about income, knowledge, and effective demand. As with all other techniques of analysis employed in the UFRD approach, accessibility studies are most effectively used in conjunction with other methods to cross-check and refine them.

Several methods have been used to determine the service areas of functions, and in combination, that of settlements. Usually the service areas of settlements are composite indicators of the accessibility of major functions located within them. These methods include functional service area indexes, market area and commodity flow networks, service area cluster maps, and accessibility models.

Functional Service Area Index

Southall suggested the use of a functional service area index in the UFRD project in Upper Volta. The index determines accessibility of functions for people living in settlements or villages,[4] and in a sense, complements and extends the scalogram. It helps

show the relationship among functions in a settlement and the average access of the population to them. Southall suggests the following procedures:

1. Record the distance of each settlement to surrounding towns or villages and to other areas where there is a significant distribution of population;
2. Assume that on average the distance of the total population of one settlement from a service or function located in another settlement is the distance from each settlement's physical center. For very large cities, this assumption could be redefined.
3. On the basis of 1 and 2, calculate the distance of each settlement from each function and calculate the total population at each interval of distance from each function.
4. If all services are ranked and weighted, then the overall score of Service Access adequacy or inadequacy can be calculated for any settlement or any group or network of settlements.

For example, the accessibility of functions in a district or province for people living in Town A could be determined by measuring the distance of Town A to functions located in the district or province. Assume that people living in Town A were the following distances from these functions:

Town Hall	0 kms (one located in Town A)
Primary School	5 kms
Health Clinic	10 kms
Hospital	20 kms
Secondary School	20 kms

If it was very difficult for people to travel more than 15 kilometers from Town A because of poor roads or rough terrain, one could consider the population living in the town to be within the service areas of the town hall, primary school and health clinic functions, but not within the effective service areas of the hospital and secondary school functions.

Similarly the functional service areas for a region could be determined by calculating the proportion of population in the region at each distance interval from various functions:

	0 kms.	1-5 kms.	6-10 kms.	11-20 kms.	more than 20kms.
Town Hall	60%	30%	10%		
Primary School	30%	40%	30%		
Dispensary	20%	30%	30%	20%	
Hospital	10%	15%	20%	25%	30%
Secondary School	10%	15%	20%	25%	30%

The Service Access Index method can also be modified to use time required to reach a function rather than simply distance. Depending on the terrain and the availability of transportation, time interval measurements may be far more accurate indicators of accessibility than distance measures.

In any case, the adequacy of accessibility can be judged only be establishing desirable criteria for time or distance required to reach a function. If, for example, it is considered important that at least 50 percent of the population of an area should be within 5 kms. of a secondary school, then the accessibility of secondary schools for population living in the district or province described above would be considered inadquate. The implication would be that the feasibility of locating a secondary school in or nearer to settlements that were more accessible should be explored. If it is assumed that at least 50 percent of the population should be within 10 kms. of a town hall, the accessibility of that function in the previous example would be more than adequate.

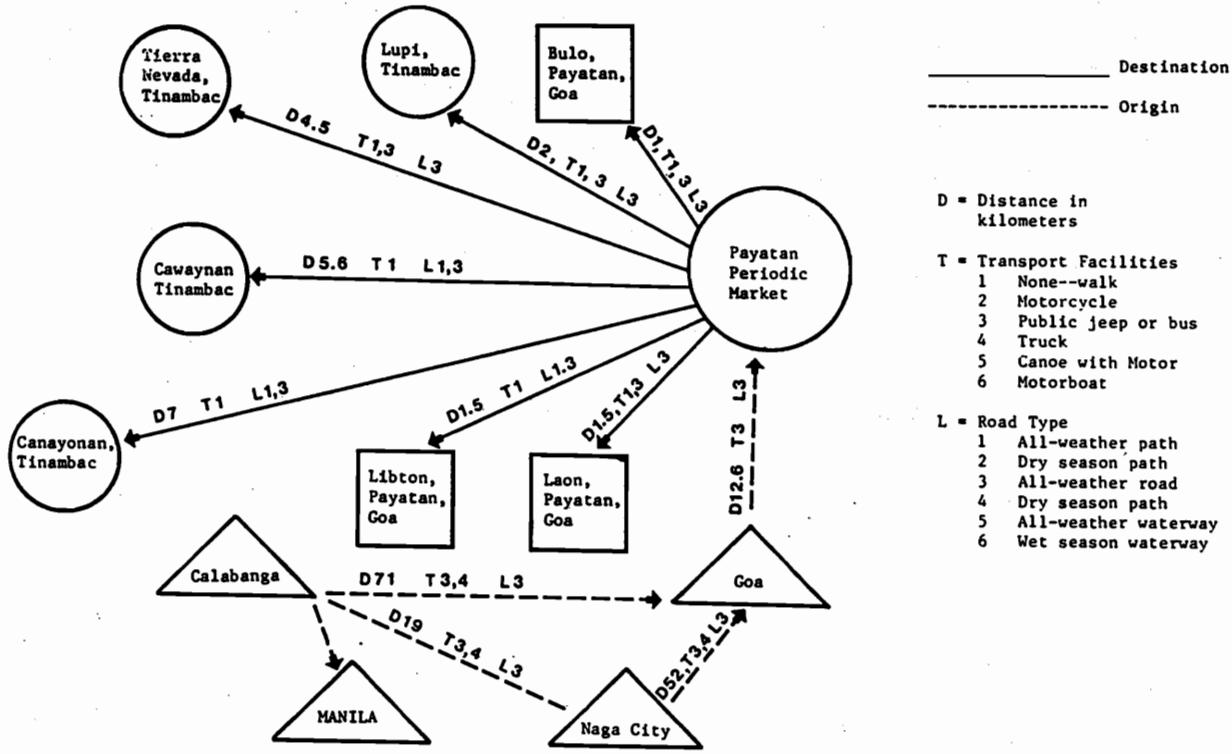
Market Area and Commodity Flow Networks

In those settlements that are market centers, the settlement's area of influence can often best be determined by tracing the flow of commodities into and out of the market and by mapping the distance from which buyers and sellers come to trade in the market place. The information gathered from the scalogram, market center and transport linkage studies can be used to trace the commodity flow networks of a settlement. Market area maps constructed from the combination of commodity flow networks can determine marginal or peripheral areas that have little or no access to organized market systems.

In the Bicol River Basin, for example, commodity flow networks were derived from major goods traded in regular and periodic markets through data gathered in the market center and from transportation linkage analyses. The flows were traced for each major commodity traded in each market. The distance from which goods came and were sold, the time and cost of transporting them and the type of transportation route were recorded during the market center studies. Flows were traced through intermediate as well as final markets.

For example, Figure 6-1 shows the origin and destination of salt water fish, through Payatan, one of the six periodic markets surveyed in the Bicol River Basin during the UFRD project. Since Payatan was a mountainous barangay located near the foot of Mt. Isarog, it had no direct access to the sea, and depended for its salt water fish supplies primarily on

FIGURE 6-1
ORIGIN AND DESTINATION OF SALT WATER FISH THROUGH PAYATAN PERIODIC MARKET, BICOL RIVER BASIN



markets in Calabanga. Fish were supplied through markets in Naga City and Goa. Some came directly to Goa from Calabanga, others from middle-men or wholesalers in Naga City.

Studies also found that Payatan served about 18 barangays in a 10 kilometer radius. Payatan was primarily a palay (unmilled rice) and rice trading point, obtaining its supplies from the barangays of Lupi, Tierra Nevada, Tinambac, Quinale, Cawaynan, Canayonan, Libtong and Laon, as well as Bulo, Maysalay, Tabgon and Balaynan. Palay and rice were sold primarily in the larger, regular markets in Goa, Tigaon and Naga. In addition, the market at Payatan traded in clothing, nearly all of it made in Manila and shipped in through Naga City and Goa; school supplies from the same sources; sugar from Pili and Goa, which was sold to traders in smaller barangays; canned and prepared foods from Manila, Naga and Goa; and dried fish. Moreover, the periodic market at Payatan served as a collection point for coconut, livestock and vegetables which were sent to the Goa market for further distribution.

Through the commodity flow networks, planners were able to show the market area of Payatan and the network of linkages through which traders distributed goods from the rural hinterlands, the networks through which processed and manufactured goods came into the area, and the barangays that had access to the market. They also identified the rural areas that were outside of the market area and in which people had little or no access to places where they could sell their goods or obtain the items traded in organized markets.[5]

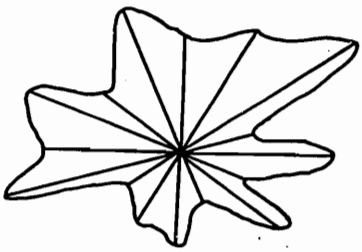
Service Area Clusters

Another technique of determining the service area of a settlement is by clustering the service areas of major functions located within it. The approach, described in more detail by R.S. Dick, requires a map of the service ranges of individual functions measured in any direction from a central place.[6] To construct the service area cluster (see Figure 6-2) for the settlement, the following steps are followed:

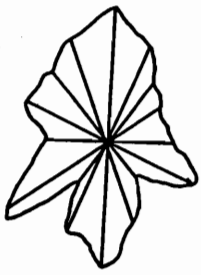
1. Measure the service range of the function outward from the center along sixteen radials corresponding to the sixteen principal compass directions (N, NNE, NE, ENE, etc.).
2. Index the separate radial directions clockwise from 1 to 16--labelling N as 1, NNE as 2, NE as 3, and so on.
3. Along the given radial i (i=1,2, ... 16) the actual ranges r_{ji} (j= 1,2, ..., n) are measured and the mean service range r_i

FIGURE 6-2

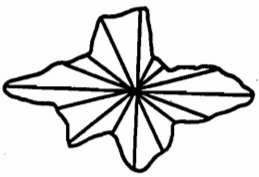
GRAPHIC ILLUSTRATION OF SETTLEMENT SERVICE AREA AS COMPOSITE OF FUNCTIONAL SERVICE AREAS



Function 1 Service Area



Function 2 Service Area



Function 3 Service Area

Settlement Service Area

$$\bar{r}_i = \frac{1}{n} \sum_{j=1}^{n} r_{ji}$$

is determined.

4. Deviations from the mean range are recorded, ignoring sign, and the mean deviation is calculated:

$$\bar{d}_i = \frac{1}{n} \sum_{j=1}^{n} \left| r_{ji} - \bar{r}_i \right|$$

5. The degree of correspondence of service area boundaries around a settlement is determined by a measure of relative variability of service range, defined by the following ratio expressed in percent:

$$V = \frac{(100D)}{R}$$

where:

D = average of the mean deviations ($\bar{d}_i$) recorded for each of the 16 radials drawn, i.e.,

$$D = \frac{(\Sigma \bar{d}_i)}{16}.$$

R = overall mean service range obtained as the mean of 16 separate r_i

Possible values for V range from zero percent--which indicates complete coincidence of all service boundaries--to higher values indicating varying degrees of discordance. Generally, the higher the value of V, the higher the degree of variability and the lower the degree of correspondence among the service areas of functions located within the settlement.

Dick notes that in many regions, the high degree of variation found in service areas for some functions is due to erratic government investment criteria or to the fact that service areas for some public facilities or infrastructure are mandated by law. In any case, when information is available about the service areas of functions, analyses of their correspondence can provide a good indication of the service area of settlements. As Smailes has pointed out, "the service areas of a variety of functions correspond sufficiently closely to

allow broad recognition of general or composite urban fields at a series of functional levels which accord with the more clearly defined ranks of the urban hierarchy."[7] Thus, this method can be used to cross check and refine the functional hierarchy defined by the scalogram analysis.

Through the use of a combination of time-distance analyses, linkage analyses, analytical mapping and service area clustering, planners in the Bicol River Basin were able to outline broadly not only the service areas of various functions, and of the major settlements, but also of functional subsystems of settlements within the region. Indeed, the analytical maps, linkage studies and accessibility and service area analyses confirmed earlier indications that the Bicol River Basin was not an integrated economic or physical region. Independent functional subsystems of settlements, instead, tended to cluster around the two urban centers of Naga and Legaspi, each primarily serving a small network of towns and villages in its immediately surrounding area and within its own province. Transport routes to the rest of each province converged at these two cities, which were also the largest markets in the Basin. Smaller market centers were usually linked to one or the other of these central markets. Most of the higher order services and facilities were concentrated in Naga and Legaspi.

However, the accessibility and service area studies showed that relatively little interaction occurred between the two provincial cities. The level of market trade between Naga and Legaspi was negligible. Travel volume was less than 230 person-trips per day, a low and insignificant volume for a region with 700,000 hectares of land and 1.7 million people. The service areas of major functions located within each center deteriorated rapidly with distance.

Iriga City, in the center of the Basin acted as another node for a smaller number of settlements and had a few linkages with Naga City but relatively little physical, economic or social interaction with Legaspi.

In Camarines Sur province, some local services were available to rural people living in the areas immediately surrounding Calabanga, Goa, Pili and Bato. In Albay Province the towns of Lagao, Polangui, Guinobatan and Tobaco provided services to nearby barangays. But accessibility to town-based services and facilities for much of the rest of the Basin was found to be weak. Large portions of the region were relatively inaccessible and had few central places of any significance.

The Manila South Road provided the most important physical linkage and means of access to services and facilities for people living outside of the major towns. People living only a few kilometers off of the

main road often had to travel long periods of time to get to towns and market centers. The cost of transporting goods to market for farmers who lived off the main roads was nearly six times that of farmers living along the Manila South Road or a connecting provincial road. The clustering of settlements by functional service areas and linkages in Bicol is depicted in Figure 6-3.[8] The white or blank areas on the map are places that generally have little or no access to towns and the functions located in them; these marginal and peripheral areas had the highest levels of poverty.

Accessibility Models

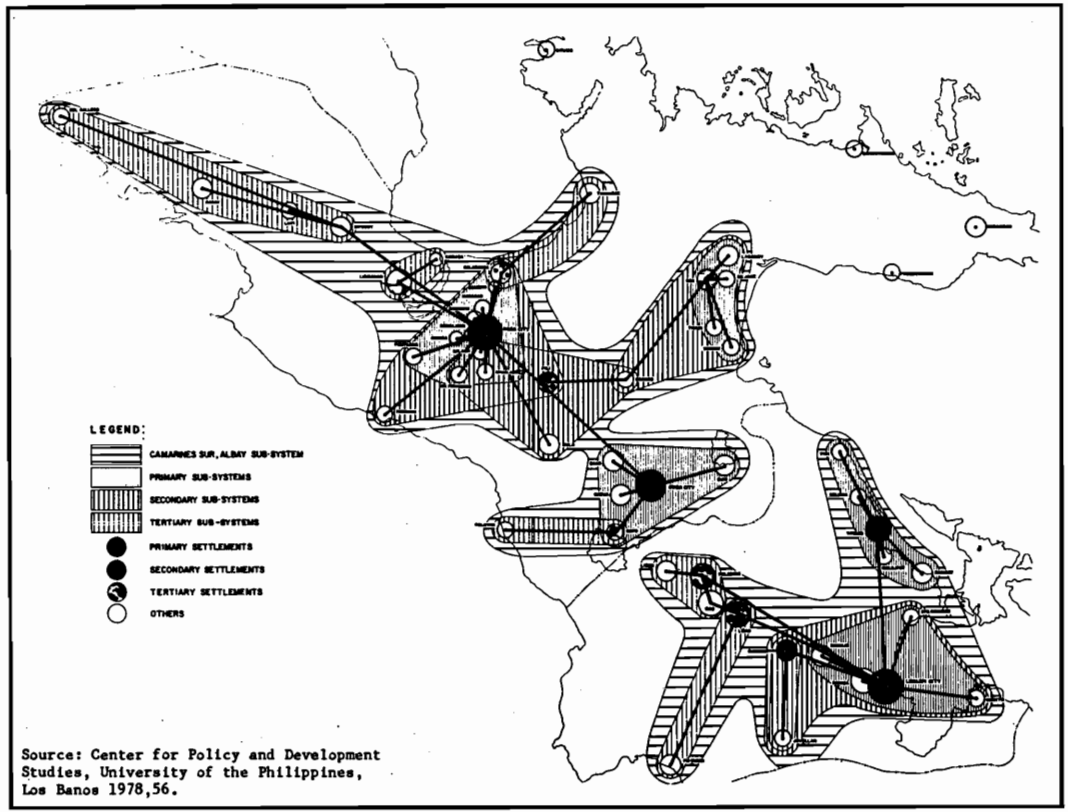
In the UFRD project in Potosi, Bolivia, an attempt was made to delineate more precisely the service areas of settlements and the accessibility of people living in various parts of the region to town-based services and facilities. A model was designed by John Dickey and Hugh Evans to measure the level of access of the population in different zones of the region to specific functions.[9] The model was later used to evaluate alternative investment strategies for improving physical access either by upgrading transportation to towns where functions already were located or by locating them in new places. The model was constructed in the following way (see Figure 6-4):

1. Identify zones and zone centroids: zones can be delineated on the basis of existing political boundaries, economic criteria, physical features or other standards, depending on the factors that are most important for planning in the region. A centroid is chosen for each zone. It should approximate the population center of that zone. To simplify the analysis, it is assumed that all trips to the zone are made to and from this centroid.

2. Identify transport links among centroids: information can be obtained from an appropriate government agency, from reliable maps or from the UFRD linkage analysis, on the transport network in each zone. Each major link is assigned a number. Those centroids not connected to the primary network are assigned links following the best path (a tertiary road or commonly used footpath or river) to that link. Also a "pseudo link" is created for each centroid to simulate the network for travel within the zone. A table is constructed to show the numbers and travel time of each link.

3. Compute interzonal travel times: a map can be used to compute zone-to-zone travel times. A table is then constructed to list the inter- and intra-zonal travel times. The total time for each link is added to find the zone-to-zone travel time.

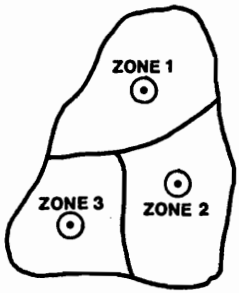
FIGURE 6-3
FUNCTIONALLY RELATED SETTLEMENT SUBSYSTEMS IN BICOL RIVER BASIN, PHILIPPINES



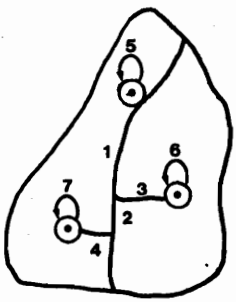
Source: Center for Policy and Development Studies, University of the Philippines, Los Banos 1978,56.

FIGURE 6-4

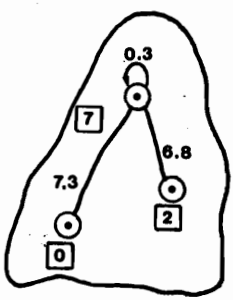
GRAPHIC ILLUSTRATION OF ACCESSIBILITY MODEL



a. Zone map with centroids



b. Transport links connecting centroids



c. Function travel convenience

(continued)

Figure 6-4 (Continued)

d. Zone to Zone Travel Times

From Zone	To Zone 1	2	3
1	0.3	6.8	7.3
2	7.0	0.5	4.0
3	7.4	3.9	0.4

e. Zonal Characteristics and Functions

Zone	Population	No. of Function A	No. of Function B
1	10,000	7	3
2	6,000	2	0
3	4,000	0	0

f. Function Travel Convenience Indices
(Numbers of Function/hours)

Zone	Function A	B
1	23.63	10.00
2	5.00	0.43
3	1.46	0.41

Figure 6-4 (Continued)

g. Zonal and Function Accessibility Indices Base Case (x 1000)

Zone	Functions A	Functions B	Total
1	7561	1500	9061
2	960	39	999
3	187	24	211
Total	8708	1563	10,271

h. Weighted Accessibility Indices Base Case (x 1000)

Zone	Functions A	Functions B	Total
1	2520	500	3020
2	960	39	999
3	94	12	116
Total	3574	551	4125

4. Develop indices of function travel convenience: the number of establishments or occurrences of functions in each zone is divided by the travel time to that zone. The resulting fractions for all zones are added. The formula for the calculation is as follows:

$$A_{ij} = \sum_{k=1}^{n} (N_{kj}/T_{ik})$$

where N_{kj} = the number of establishments of function j in zone k

T_{ik} = the travel time from zone i to zone k

5. Weight the functions by level of importance: it is assumed that all functions found in a zone are not of equal importance. Some play a more crucial role in the daily lives of residents or are more crucial than others in the development of the locality. One empirical indicator of the importance of a function is its annual average number of visit-hours (number of visits x hours of travel per visit). It is assumed that if people are willing to spend more time for more visits to a particular function it must be proportionately more valuable to them. A table is made to list the visit-hours weight of each function.

6. Develop population weights: assuming that the location of a function or linkage that reaches more people is better than one that reaches fewer, the accessibility index should reflect the population of the zone. A total individual access index, A_i, for each zone for all functions is:

$$A_i = \sum_{j=1}^{m} (A_{ij} \times W_j)$$

where W_j = weight assigned to function j

$= N_j \times T_j \times P_j$

and N_j = average number of visits by a household in time t, to the function j;

T_j = average travel time to function j;

P_j = proportion of the population that uses function j.

7. Calculate accessibility indices: finally, an accessibility index, $A(P)_i$, for each zone and each function can be calculated using the following formula:

$$A(P)_i = A_i \times P_i = \sum_{j=1}^{m} A_{ij} \times W_j \times P_i$$

Obviously, the statistical methods used in Potosi require a great deal more information than the graphic methods used in the Bicol River Basin. To use the accessibility model effectively, information must be collected on the population of each settlement and rural area of each zone; average speed along, and distances of all road links; and the number of establishments or occurences of each function in each zone. Such information could be collected at the same time that a scalogram survey is done, or independently at a later stage in the UFRD analysis.

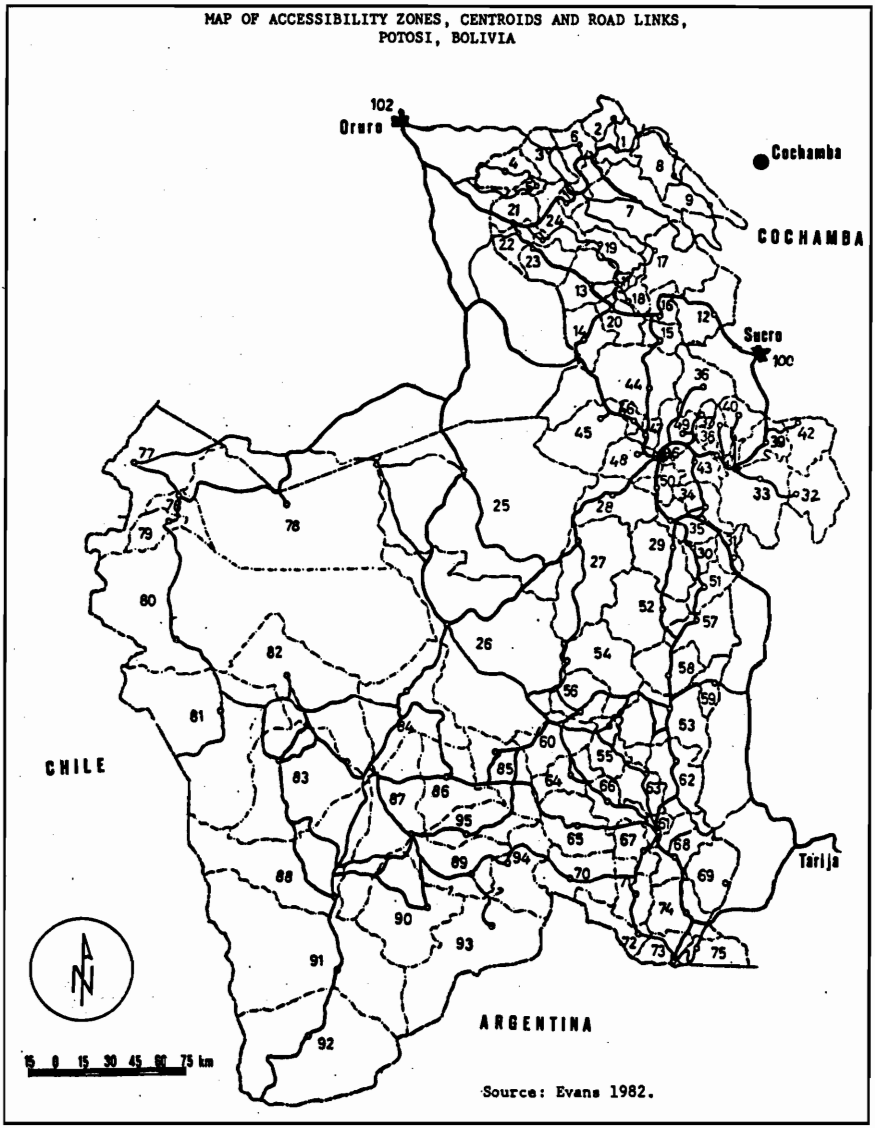
In Potosi, information on frequency of visits and travel times to functions was gathered through a survey of randomly selected households in 96 zones (see 6-5). Data were collected for 24 functions including health and education facilities, shops and stores, government offices and services for mining and agriculture.

The calculation of the average number of visits for different functions was handled in different ways. For schools and health facilities, for example, where the visit was made by only one individual, averages were based on observations for appropriate individual members of the household. For other functions, such as farm supply stores, processing plants, pharmacies, gas stations, post offices, or government offices, where the visit usually benefits the whole family, averages were based on the total number of visits made by all members of the household. For such functions as markets, clothing or grocery stores, where counts for all members of the household might exaggerate the number of trips, averages were based on the total number of visits made by all household members divided by the number of people in the family who made the trips.

Evans points out in his analysis of the results of the survey that schools were the most frequently visited function. The average travel time was about 15 minutes for primary and high schools and was slightly greater for middle schools.[10] The average travel time, however, masked the fact that children in some parts of the region had to travel up to two hours between home and school. The next most frequently visited function was grocery stores. In most zones these small family shops selling basic consumer goods were visited once or twice a week by people who had to travel an average of one-half hour. Families visited markets about three times a month and took an average of two hours to get to them. Stores selling cooking and heating fuel were visited about twice a month and it took an average

FIGURE 6-5

MAP OF ACCESSIBILITY ZONES, CENTROIDS AND ROAD LINKS, POTOSI, BOLIVIA



Source: Evans 1982.

of nearly two and a half hours to reach them. People in the region seldom had access to doctors or hospitals, both because they could not afford to visit them and because both functions were highly concentrated in only a few centers in the region. Farm-related services and facilities were among the least accessible functions primarily because they were located in so few places in the department. They were visited only once or twice a year and they required a four to five hour journey.[11] (See Table 6-1)

Evans further notes that using the methods of accessibility analysis applied in Potosi, the most important and accessible function turned out to be the market, followed by the grocery store, fuel store, pharmacy, primary and middle schools, and post offices. The indices show that health facilities and agricultural supply stores were among the least accessible functions in Potosi. But Evans emphasizes that the indices are based on current usage, and given the scarcity of functions in most settlements in the region they do not give an accurate estimate of the inherent worth of these functions, or provide good information on the potential demand for the functions if they were more accessible.[12]

The same data were used to examine the distance-decay relationships for each function--that is, the decline in the number of visits that people made to a function as the length of the journey increased. A slow decline in the relationship indicates that the function is not highly sensitive to distance; people are willing to travel long distances in order to obtain the good or service it offers. The observations are plotted on a graph with the number of visits and the length of journey as the two axes. Table 6-2 summarizes the cumulative percentages of visits over time for the ten most frequently used functions. As the table indicates, the distance-decay relationship declined most rapidly for grocery stores; 83 percent of the visits were to places within 15 minutes travel time. Seventy percent of the trips to high schools were within the same travel-time interval. Over seventy percent of the trips to post offices and doctors' clinics were less than one-half hour. The decline was slower for fuel stores, pharmacies, hospitals and markets. They reached their seventieth percentile after two hours. The slowest decline was for farm supplies, which reached that level only after five hours.

The analysis confirmed the preliminary conclusions of the linkage analyses. Evans points out that instead of visitng a doctor's office nearby, people often travelled to a hospital farther away to obtain better care. The farmers' persistence in visiting distant farm supply stores suggested that there could be

Table 6-1

WEIGHTED ACCESSIBILITY INDEXES FOR FUNCTIONS IN POTOSI, BOLIVIA

Function	Number of Observations	N_j	T_j	P_j	Weight
Market	179	32	2.15	1.00	68.8
Grocery store	100	73	0.54	1.00	39.4
Cooking and heating fuel store	151	24	1.39	1.00	33.4
Radiocommunication and t'phones	17	25	1.33	1.00	(20.0)
Pharmacy	141	5	2.03	1.00	10.1
Junior school	159	200	0.27	0.16	8.6
Banks	11	12	1.34	0.49	(7.9)
Junior-high school	82	196	0.29	0.13	7.4
Post and telegraph office	94	10	0.73	1.00	7.3
Mineral processing plant	6	44	1.22	0.13	(7.0)
Shoe and clothing store	180	2	3.04	1.00	6.1
Silo or farm produce storage	3	2	4.40	0.60	(5.3)
Mining Bank depository	8	12	3.24	0.13	(5.1)
High school	43	200	0.25	0.10	5.0
Training Center	6	200	0.30	0.08	(4.8)
Hospital or health center	224	3	1.56	1.00	4.7
Domestic appliance store	203	1	3.80	1.00	3.8
Farm produce processing plant	48	3	1.95	.060	3.5
Hardware store	65	1	3.32	1.00	3.3
Farm tools and equipment store	60	1	4.85	0.60	2.9
Seeds and fertilizer store	51	1	4.61	0.60	2.8
Prefect/mayor/civil registrar	133	2	1.03	1.00	2.1
Doctor's clinic or nurse's post	146	2	0.92	1.00	1.8
Police station or magistrate	84	4	0.35	1.00	1.4

N_j = average number of visits per year to function j

T_j = average time in hours of journeys to function j

P_j = proportion of the population that normally uses the function j

Weighting factor $W_j = N_j \times T_j \times P_j$

Figures in (parentheses) should be interpreted cautiously due to the limited number of observations.

Source: CORDEPO, Funciones Urbanas en el Desarrollo Rural: Resultados del Estudio en Potosi, Vol. 2, CORDEPO, Potosi, 1981; and Hugh Evans, Urban Functions in Rural Development: The Case of the Potosi Region in Bolivia, Washington: USAID, 1982.

Table 6-2

CUMULATIVE PERCENTAGES OF VISITS TO SELECTED FUNCTIONS BY TRAVEL TIME, POTOSI, BOLIVIA

Travel Time		High School	Post Office	Doctor's Clinic	Farm Supplies	Grocery Store	Pharmacy	Cooking Fuel	Market	Hospital	Farm Equipment
Hours	Minutes										
0	15	70.0	52.5	62.7		83.0	35.0	48.0	35.3	56.0	5.0
0	30	97.5	72.5	71.1	25.0	84.4	43.0	59.3	46.3	63.8	10.0
0	45		75.5						47.8		
1	00		78.5	73.1	30.5	88.4	55.0	63.3	55.7	65.8	13.0
1	30	100.0	82.8	76.5	35.5	92.4	65.0	70.1	64.5	69.8	20.0
2	00		92.8	81.5	43.5	94.0	74.0	83.1	74.2	74.8	41.0
3	00		98.1	94.9	58.5	96.8	85.0	90.1	83.8	86.4	60.0
4	00		98.3	98.9	65.5	98.0	89.3	95.1	89.7	89.4	66.0
5	00		98.7		67.0	98.6	91.6	95.4	90.4	93.4	69.0
6	00										75.0
7	00				80.5		94.3		94.6	97.8	83.0
8	00		100.0		85.0		96.3	97.3	96.6		88.0
9	00			100.0	90.0						
10	00										
12	00						97.5	99.1			
14	00										
16	00				100.0						
18	00										
20	00					100.0	100.0	100.0			
22	00										
24	00								100.0	100.0	
48	00										100.0

Source: CORDEPO, Funciones Urbanas en el Desarrollo Rural: Resultados del Estudio en Potosi, Vol. 1, CORDEPO, Potosi, 1981; and Hugh Evans, Urban Functions in Rural Development: The Case of the Potosi Region in Bolivia, Washington: USAID, 1982.

large potential demand for such functions if they were located in more accessible places throughout the region.[13]

The results of the accessbility study were used together with those of the scalogram and linkage analyses to delineate the service areas of functions and settlements and to refine the functional hierarchy of settlements derived from the scalogram. Although the accessibility model could have been used to determine the market areas of settlements in each level of the hierarchy, it was actually used only to delineate the rural areas of the region. These rural areas were to form what later would become the basic planning units for regional development.[14]

The rural areas were intitially delineated by preparing maps of the effective service areas of rural centers for each function normally found at the third tier of settlements in the scalogram. Weekly markets, health centers, and fuel and drug stores were representative functions. These maps were then superimposed on each other, in much the same way as is done in preparing service area cluster maps. In this way the service areas of different functions of a settlement could be compared. While the degree of variability was high, the effective market or functional economic areas of rural centers could be delineated in terms of those zones having effective service to the majority of functions. Where residents of a zone had access to functions in more than one center, the zone was assigned to the market area of that town providing the greatest accessibility.

The definition of an "effective service area" is always the subject of some debate. But in Potosi it was considered to be those areas having zones with a level of access at least 50 percent of the maximum observed in settlements located outside of the city of Potosi. Travel pattern data gathered from survey of households showed not only that the number of visits to a function tended to fall off with increasing journey time and distance, but also that the proportion of families making journeys also declined. Evans points out that it might be, for example, "that in the case of pharmacies, 90% of the families use such a facility when the travel time is less than half an hour, 75% when the journey is less than one hour, and 50% when it is less than three hours. If 'effective' service is defined in terms of observed use, say where at least 50% of families made use of the facility, then the effective area would include only those zones where the journey time is less than three hours,"[15] (See Table 6-3).

The region of Potosi was nearly always identified with the political-administrative boundaries of the Department, although the UFRD studies found that many

Table 6-3

SUB-REGIONAL CENTERS IN THE DEPARTMENT OF POTOSI, BOLIVIA

Sub-region		Rural Area	T_{max} (hrs)	km^2	Local area
NORTH					
Center:	Llallagua/	Llallagua/Uncia	5.54	3,300	Llallagua/Uncia Chayanta Entre Rios
		Colquechaca	2.28	2,700	Colquechaca Macha Pocoata
		None Corresponding			Ocuri Sacaca S.P.de Buena Vista
CENTRAL					
Center:	City of	City of Potosi	3.11	3,200	City of Potosi Caiza "D"
		Betanzos	1.99	1,600	Betanzos Colavi
		Puna	0.72	600	Puna
		None Corresponding			Punutuma Otavi Vitichi
SOUTH					
Center:	Tupiza	Tupiza	3.58	4,300	Tupiza
		Villazon	4.06	2,500	Villazon
		Atocha (part of)	5.27	5,300	Atocha Rosario Tanza
		Cotagaita	1.41	2,400	Costagaita
		None Corresponding			S.P.de Lipez
WEST					
Center:	Uyuni	Uyuni	3.24	8,000	Uyuni Pulcayo
		Llica	2.50	4,100	Llica Huanaque
		Atocha (part of)	5.27	5,300	Atocha
		None Corresponding			Colcha "K" S.P.de Quemez Rio Mulatos

T_{max} = estimated maximum travel time from any zone in the rural area to the rural center.

Source: Hugh Evans, Urban Functions in Rural Development: The Case of the Potosi Region in Bolivia, Washington: USAID, 1982.

areas on the periphery of the department were more closely tied economically to nearby regions and capitals of other departments. The city of Potosi did serve as a regional center for a number of functions, including higher education through the university and other technical training institutes; the communications media through newspapers and television, and as a unit of government administration. Most of the institutions representing region-wide functions were concentrated in the city of Potosi and did serve a good portion of the department.

The accessibility studies also allowed planners to discern quite clearly four subregional centers--Llallagua-Uncia-Siglo XX, the city of Potosi, Uyuni and Tupiza. Such functions as banks, savings and loan associations, legal services, wholesaling and import-export activities, and retail outlets for furniture and domestic appliances were concentrated in them and they served a wide surrounding area. These subcenters also contained some government offices and daily markets. Some had farm supply stores and hospitals. The maximum travel time from the periphery of the areas in which these sub-regional centers were located to the center itself was nearly the same in all four areas--about 10 hours--except for the western region where the terrain was much flatter and the roads in better condition, where it was about 4 hours.

The accessibility study also identified rural service centers providing basic, frequently-used household goods and services, and sometimes a gas station, vocational school or farm supply store. Some settlements, such as the City of Potosi, which are clearly regional or subregional centers, also functioned as rural service centers because they contained many of the establishments that provided goods or services primarily to rural households. This can be expected in areas of a region where service areas are hierarchical and "nested."

Finally, local centers were also identified as places that provided only the most basic goods and services and those that were most frequently used. The service areas of these centers were quite small and accessibility to them was very poor.[16]

IMPLICATIONS OF THE SPATIAL ANALYSES

In both the Department of Potosi and the Bicol River Basin, planners were able to describe and analyze the settlement structure, distribution of functions, service areas of settlements and accessibility of important functions and centers to rural populations more effectively after mapping and interpreting spatial information from the UFRD studies.

In Potosi, the studies made clear that the urbanization process in that part of Bolivia was only in its incipient stages. The settlement system through which development would have to proceed in the region was still unarticulated and unintegrated. Evans and his associates found that "the regional capital, the subregional centers and a number of lower level service centers have established themselves, although some of these, particularly the smaller settlements serving the farming communities are weak and in some cases show signs of decline."[17] In large parts of the region, especially in the north, there were few central places with adequate facilities and infrastructure to function as service centers for their rural areas, and from which rural people could obtain the inputs needed to increase agricultural production or their incomes.

The accessibility and service area studies confirmed that interaction among settlements in Potosi were only strong along the main roads from Potosi to Sucre and Villazon, and between Llallagua-Uncia and cities outside of the region. In much of the Department, physical access to even subregional centers was weak. Roads were in such bad condition that whatever services and facilities were located in rural and local centers were barely accessible to people living outside the settlements. "In sum, it is fair to say that by far the greater part of the region remains poorly integrated into the main urban-rural system," Evans concluded, "particularly the provinces of Ibanez, Bilbao and Charcas in the north, the periphery of Linares and Saavedra, even many communities in Frias and Quijarro in the middle and almost the whole of the west."[18]

From the analytical maps and accessibility studies planners delineated 18 functionally related areas that could be used for coherent sub-regional planning and for developing regional investment strategies and programs. (See Figure 6-6) The region was then divided into five major sub-regions encompassing these 18 planning units. Each had a settlement as the subregional center except the Southwest, where there was no town large and functionally diversified enough to perform that function. Each subregion encompassed from two to four provinces, each having a rural service center. Table 6-4 lists the subregions, the 18 planning units and the rural service centers in each unit.

The analytical maps and functional-settlement service area analyses also allowed planners in the Bicol River Basin to draw more definite conclusions about characteristics of the the spatial system. They found, for example, that the major services, facilities, infrastructure and productive activities in the region were heavily concentrated in Naga and Legaspi and that the lack of an articulated and integrated

FIGURE 6-6

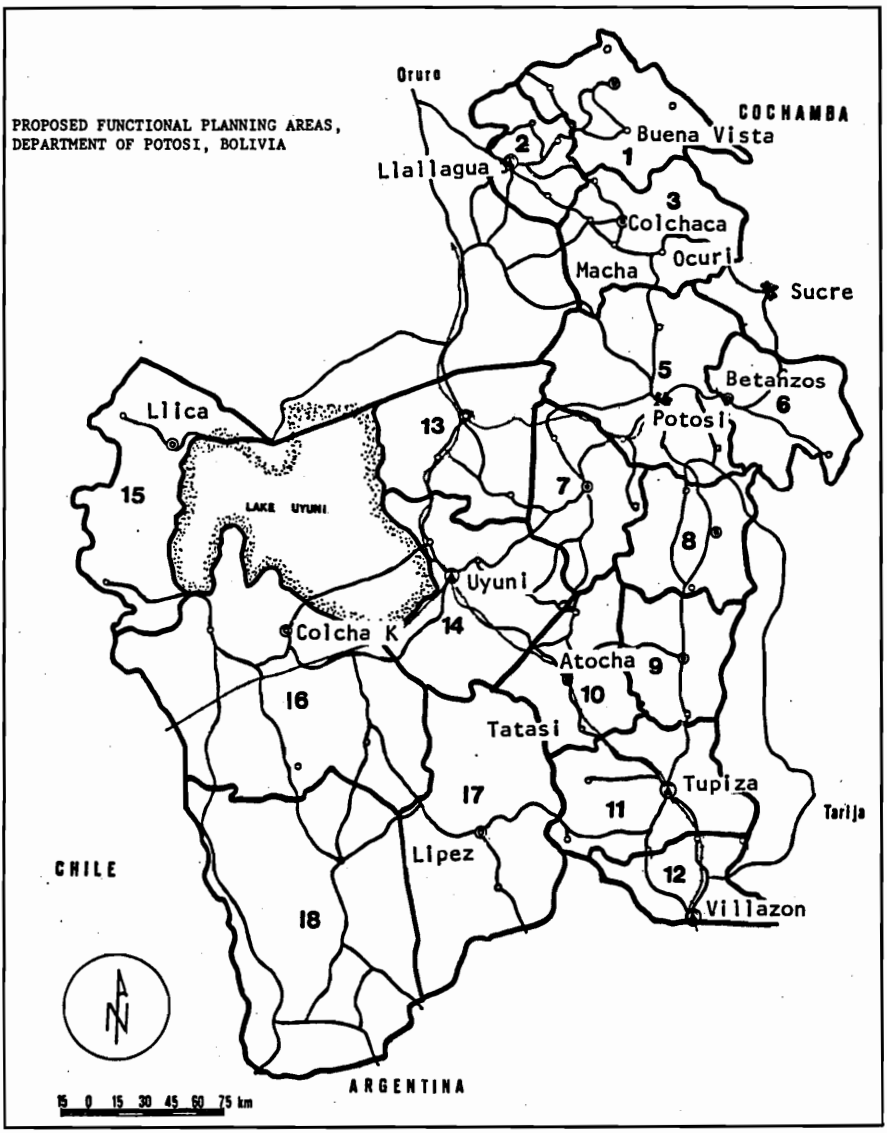

PROPOSED FUNCTIONAL PLANNING AREAS,
DEPARTMENT OF POTOSI, BOLIVIA
Oruro
COCHAMBA
Buena Vista
Llallagua
Colchaca
Ocuri
Macha
Sucre
Betanzos
Potosi
Llica
LAKE UYUNI
Uyuni
Colcha K
Atocha
Tatasi
Tupiza
Tarija
Lipez
CHILE
Villazon
ARGENTINA
1
2
3
5
6
7
8
9
10
11
12
13
14
15
16
17
18
15 0 15 30 45 60 75 km

Table 6-4

PROPOSED SUBREGIONAL PLANNING AREAS AND CENTERS
POTOSI, BOLIVIA

Sub-region	Sub-regional Center	Rural Area	Rural Center
North	Llallagua/Uncia		
		1. North of Potosi	Acasio
		2. Bustillos	Llalagua/Uncia
		3. Chayanta	Colquechaca
Central	City of Potosi		
		5. *Potosi	City of Potosi
		6. Betanzos	Betanzos
		7. Quijarro East	Punutuma
		8. Vitichi	Vitichi
South	Tupiza		
		9. Cotagaita	Cotagaita
		10. Atocha	Atocha
		11. Tupiza	Tupiza
		12. Villazon	Villazon
North-west	Uyuni		
		13. Rio Mulatos	Rio Mulatos
		14. Uyuni	Uyuni
		15. D. Campos	Llica
		16. Nor Lipez	Colcha "K"
South-west	None		
		17. S.P. de Lipez	S.P. de Lipez
		18. Sud Lipez	(to be determined)

*Rural are #4 was subsequently absorbed into rural area #5, Potosi.

Source: H. Evans, Urban Functions in Rural Development: The Case of the Potosi Region in Bolivia, Washington: USAID, 1982.

system of settlements within the region prevented a large percentage of the population living on the periphery and away from the Manila South Road from having access to the functions concentrated in the cities. They noted that "people in the Basin, therefore, have little choice but to go directly to these two cities even for basic services that should have been available in nearer places." They pointed out that "the dominance of existing urban centers has stunted the growth of other sub-regions of the Basin and has slowed down the growth of intermediate-and smaller-sized cities."

Moreover, as noted earlier, they were able to determine that the majority of the rural population was scattered in small barangays or villages with less than 300 households: "too small to support services or facilities of any developmental significance. Against this pattern of scattered, small communities, is the absence of enough central places, sufficiently dispersed to provide farmers with access to needed farm inputs and to markets where their produce can be sold at fair prices."[19]

The analytical maps and service area studies also confirmed earlier indications that linkages among rural settlements and between them and the larger central places in the region were extremely weak. The weaknesses were due to the fact that

1. Transport connections are poor between rural areas and periodic markets and regular markets; and between market towns and the two provincial capitals of Naga and Legaspi;
2. There is a lack of specialization and division of labor among settlements along with dependence upon Metro Manila for manufactured commodities; and,
3. Public service delivery linkages from town centers to rural barangays are intermittent, weak, unorganized and discouraged by poor access.[20]

They found that the few functions located within most smaller settlements of the Basin usually served only the populations of those settlements and rarely provided access to people living in surrounding areas.

Examining the plans of the Bicol River Basin Development Program (BRBDP), the UFRD staff concluded from the spatial analysis that adjustments would be needed in investment strategy in the future.

First, they suggested that BRBDP plans that were based on the assumption that the Basin was a cohesive economy be re-examined and that fundamental changes be made in planning strategy to integrate the Basin economically and spatially. They found that at least five subarea economies operated almost independently of each other. As the scalogram had indicated, Naga and

Legaspi cities and their immediate rural hinterlands formed two largely autonomous economic areas and a cluster of villages surrounding the smaller city of Iriga formed another. Smaller, primarily subsistence, agricultural trade areas were scattered in rural municipalities of the Basin operating at relatively low levels, in virtual isolation. They were centered 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 to none at all, were found in coastal and peripheral areas of the Basin.

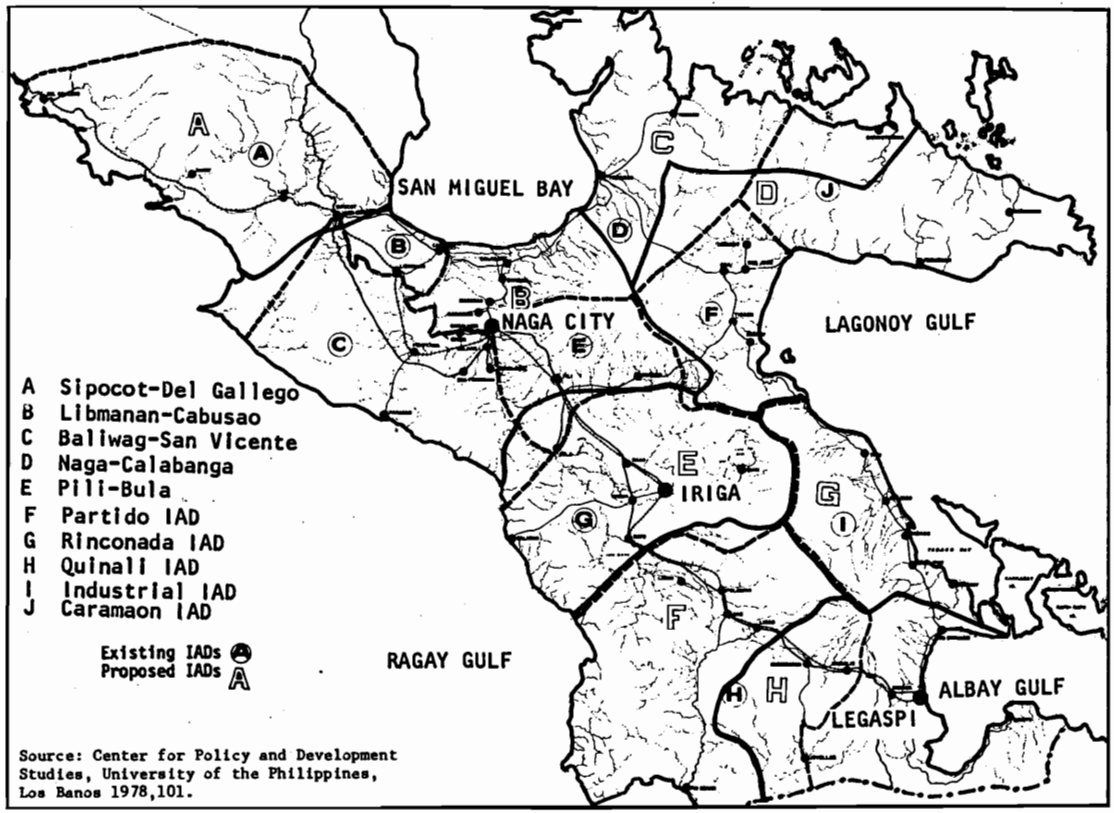
Second, the BRBDP's IAD boundaries, which were drawn on the basis of water resource and physical criteria, would be less useful for economic development planning later, since they took virtually no cognizance of economic and spatial subsystems in the Basin. In fact, they divided what seemed to be economically related clusters of communities. The staff suggested that more attention be given to how IAD development will integrate rural production areas with urban-centered marketing towns, and promote market center growth, spatial specialization and division of labor and exchange among settlements. The UFRD's settlement system analysis, analytical maps and linkage studies could be used to redraw IAD boundaries. (See Figure 6-7).

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 larger number of rural areas. The planners 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 was found to be an essential precondition for extending services to rural people, locating agro-processing facilities in rural areas and providing access to the services, facilities and productive activities that were 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 required the immediate attention of the BRBDP. Future investments in services, facilities and infrastructure would have to be located strategically in existing or incipient rural service centers to stimulate the growth of markets. Without a well-dispersed, integrated and easily accessible network of market centers in rural areas it would be unlikely that farmers could increase

FIGURE 6-7

PROPOSED CHANGES IN SUBREGIONAL PLANNING UNITS BASED ON SPATIAL ANALYSIS



Source: Center for Policy and Development Studies, University of the Philippines, Los Banos 1978,101.

production to the levels projected by the BRBDP. The BRBDP had, to this point, concentrated on planning for the provision of agricultural inputs to stimulate production, but had given little attention to marketing and distribution. Experience in the Philippines and other developing nations clearly showed that both must be done simultaneously. The UFRD study pinpointed the location of existing or incipient market centers and the analysis, supplemented by more intensive marketing studies, could be used to plan the location of investments that would stimulate rural market-center 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 to develop more detailed locational criteria for projects. Plans then had to 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 coordinating agricultural with industrial development projects.[21]

In sum, these spatial analyses can help planners understand locational implications in formulating investment strategy and in designing "packages of investments" and specific projects for individual settlements or particular areas of the region. It is to these issues that attention turns in the final four phases of the UFRD approach.

NOTES

1. Prodipto Roy and B.R. Patil, Manual for Block Level Planning, Delhi: The Macmillan Company of India, 1977.

2. G.C. Dickinson, Statistical Mapping and the Presentation of Statistics, 2nd Ed., London: Edward Arnold, 1973, especially Chapter 2.

3. Bicol River Basin Development Program, Urban Functions in Rural Development: A Research Project in Spatial Analysis and Planning, Pili, The Philippines: BRBDP, 1978.

4. Aiden Southall, "Urban Functions in Rural Development: Report on a Visit to Upper Volta," unpublished report, (Washington: U.S. Agency for International Development, 1978).

5. Center for Policy and Development Studies, University of the Philippines, Los Banos, Urban Functions in Rural Development, Bicol River Basin Development Program, Vol. III-B: Case Study of Six Periodic Markets in the Bicol River Basin, College, Laguna, CPDS, 1977.

6. Ross S. Dick, "Central Place Service Areas and Urban Fields: New Measures of Spatial Character," Queensland Geographical Journal, Vol. 5 (1979), pp. 65-78.

7. A.E. Smailes, The Geography of Towns, (London: Hutchinson, 1966), p. 145.

8. Center for Policy and Development Studies, op. cit.

9. Hugh Evans and John Dickey, "A Technique to Help Evaluate Function and Linkage Packages," unpublished paper, Potosi, Bolivia: Urban Functions in Rural Development Project, 1980.

10. Hugh Evans, Urban Functions in Rural Development: The Case of the Region in Bolivia, Vol. 1 (Washington: USAID, 1982), pp. 66-68.

11. Ibid. p. 68.

12. Idem.

13. Idem.

14. Ibid., p. 80.

15. Idem.

16. Ibid., pp. 81-86.

17. Ibid., p. 88.

18. Idem.

19. Bicol River Basin Development Program, op. cit. p. 99.

20. Idem.

21. See Dennis A. Rondinelli, "Spatial Analysis for Regional Development: A Case Study in the Bicol River Basin of the Philippines," Resource Systems Theory and Methodology Series, No. 2 (Tokyo: United Nations University, 1980), pp. 37-38.

7
Integrating Spatial Analysis in Regional Planning

The final phases of UFRD focus on integrating spatial analysis with sectoral, economic and technical planning. They are concerned with promoting the use of locational information and standards in the on-going processes of planning and decision-making that most directly affect the region's development. Phases seven through ten of UFRD include: formulating a broad spatial strategy for regional development; identifying possible programs and projects for various areas and settlements within the region; establishing monitoring and evaluation procedures to assure that programs and projects are implemented on schedule and to assess their impact on the regional settlement system; and integrating spatial analysis methods into institutionalized processes of regional planning and policy-making.

As explained in Chapter Two, the aim of doing spatial analyses is not necessarily to produce a comprehensive physical plan for the region, but rather to identify the spatial and locational factors that should be taken into account in future development decisions. Initially, the UFRD approach yields a detailed report on the settlement system and conclusions and recommendations for promoting integrated regional development. This is less a plan, however, than a set of policy recommendations. In later iterations, it is often more desirable to integrate the methods of spatial analysis described here into the general process of regional planning rather than to carry them out as separate activities. To the extent that they can be integrated with other forms of planning it will be more likely that physical and spatial factors will be considered seriously in program and project design. But in its intitial application the UFRD approach can make an important contribution to planning and policy-making by providing planners with the information needed to suggest a broad strategy for spatial development.

FRAMEWORK FOR STRATEGIC PLANNING

In its initial application, the UFRD approach can yield detailed information about the physical and spatial characteristics of the region and can be used to formulate a broad strategy for spatial development. That information can also help policy-makers to locate services, facilities, infrastructure and productive activities in places that provide greater access to larger numbers of people and that will allow greater spread effects to surrounding areas.

There are relatively few ways in which planners and policy-makers can intervene to create a more articulated and integrated settlement system in a region. They include:

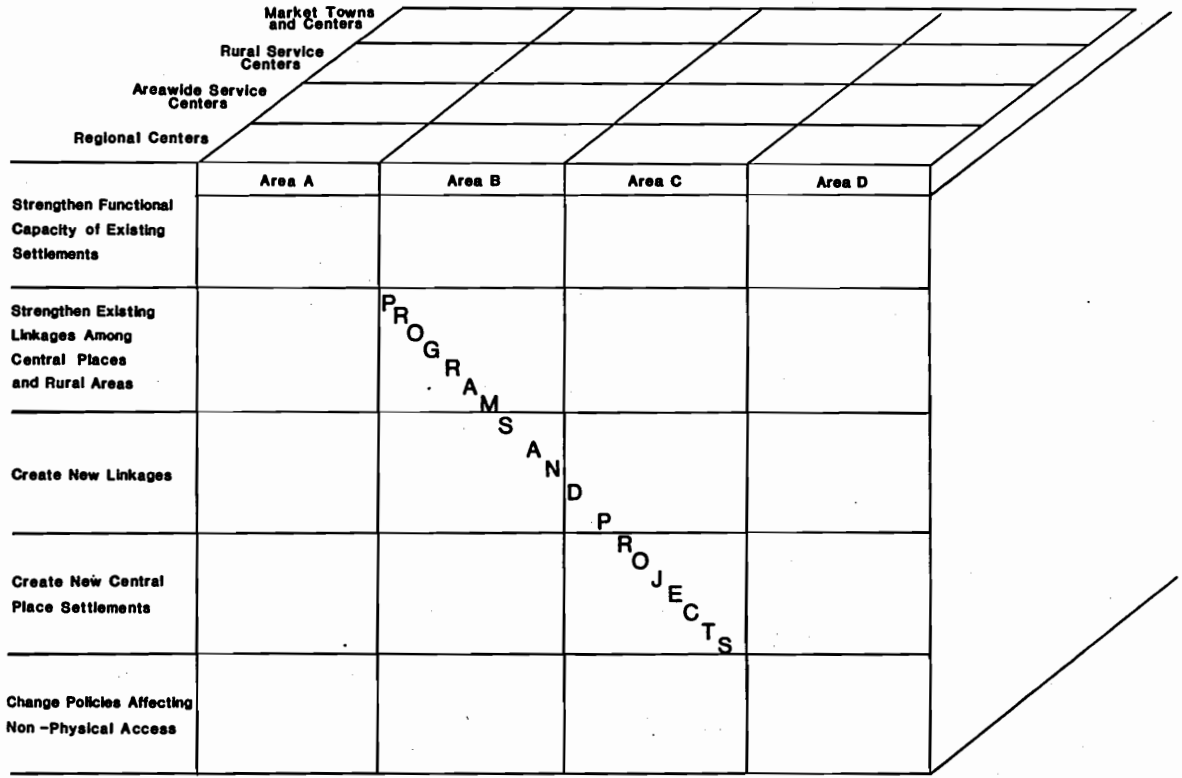
1. Strengthening the capacity of existing settlements to perform a wider range of functions by investing in higher order services and facilities or new types of functions in strategically located central places;
2. Strengthening existing linkages between central places where functions already exist in currently unserved or peripheral areas of the region;
3. Creating new settlements in unserved areas to act as central places for a specified range of functions;
4. Creating new linkages to reduce the travel time and cost of reaching places with appropriate functions from peripheral or unserved areas; and,
5. Enacting or changing regulations or policies affecting the operation of functions or linkages in ways that will increase the nonphysical access of people in various income groups to those functions.

These activities can be carried out on a region-wide basis or in various areas within the region in the currently existing settlements, that is, a regional urban center, intermediate-sized cities and towns, area-wide service centers, market towns, rural service centers or villages. Spatial development planning attempts to match activities that are best suited to the appropriate settlement in the appropriate areas. (See Figure 7-1.)

These strategies require a thorough understanding of the settlement system of a region as well as the historical and political reasons for its emergence in its current form, and the comparative strengths or weaknesses of areas within the region for future development. Effective regional planning and development also require an understanding of how alternative forms of economic, social, and political intervention affect, and are affected by, physical and spatial development. Just as there are relatively few alternatives for shaping physical and spatial development,

FIGURE 7-1

ALTERNATIVE APPROACHES TO SPATIAL DEVELOPMENT



there are a limited number of ways to intervene to change the pace and direction of regional economic development (See Figure 7-2). These, John Friedmann has identified as:[1]

1. Discovering or capturing new markets for goods and services produced in the region;
2. Finding new ways to produce goods more efficiently and economically through changes in production functions;
3. Producing new or improved products or services;
4. Building up or extending physical infrastructure directly relevant for productive activities;
5. Creating local savings and investment opportunities;
6. Developing human resources to increase labor supply and skills;
7. Developing local natural resources and improving the locational advantages of the region and areas within it to produce goods and services more effectively and efficiently; and,
8. Building the capacity of institutions to provide more and better information and to disseminate knowledge that is useful for planning, decision-making and production.

Within any given region, these activities can be promoted in a variety of sectors: agriculture, industry, commerce, social services or public works.

It is also clear that the pursuit of any of these sectoral strategies in a region is likely to have different impacts on different social, income or occupational groups. Any investment is likely to create different kinds of benefits and costs for different groups and to provide greater access to opportunities for people living in different areas of the region. Although there is no way of ensuring that any investment program will provide <u>equal</u> benefits to all groups in a region, packages or portfolios of projects and programs can be designed to ensure relatively <u>equitable</u> development by providing a combination of investments that benefit a wide range of groups--town dwellers, landowners, landless laborers, small scale entrepreneurs, farm tenants and others--living in different parts of the region.

Regional planners are most often concerned primarily, if not exclusively, with sectoral strategies. The impacts of those strategies on different groups and geographical areas within the region are rarely considered. Spatial analysis, along with social-impact studies, can add a physical and locational dimension that helps planners and policy-makers to calculate the potential impact of investment programs on beneficiaries while at the same time forging a coherent

FIGURE 7-2

SECTORAL STRATEGIES FOR ACHIEVING REGIONAL ECONOMIC GROWTH

Means [1] \ Sectors	Agriculture	Industry	Social Services	Infrastructure	Energy and Utilities	Health	Education	Commercial Enterprise	
Create new markets for existing goods									
Identify new ways to produce old products									
Produce new or improved goods and services		P	R	O	J	E	C	T	S
Create new organizations for production									
Build-up or extend physical infra-structure				A	N	D			
Create local savings and investment opportunities									
Develop human resources		P	R	O	G	R	A	M	S
Develop local natural resources									
Provide better information and knowledge									

[1] Adopted from John Friedmann, Urbanization, Planning and National Development, Beverly Hills: Sage Publications, 1973.

development policy for the entire region. (See Figure 7-3.)

All of this must usually be done, however, in an environment in which the capacity to formulate and implement detailed comprehensive development plans is extremely limited. Participants in regional planning and decision-making usually pursue their own interests. Action must be taken incrementally and with limited resources. Political factors often outweigh all others in resolving conflicts and disputes over proper courses of action. In most developing countries institutional dynamics make coordination and cooperation among the participants highly unlikely. Thus, planners must realize that however comprehensive and integrated their proposals may be, they are unlikely to be understood in their full complexity, agreed to entirely by other groups or implemented totally.[2]

Because of the difficulty of formulating and carrying out regional development plans comprehensively, investment plans and programs must be designed strategically and disaggregated by area so that projects can be made incrementally and sequentially. It is to this task that spatial analysis can make an important contribution.

FORMULATING SPATIAL INVESTMENT STRATEGIES

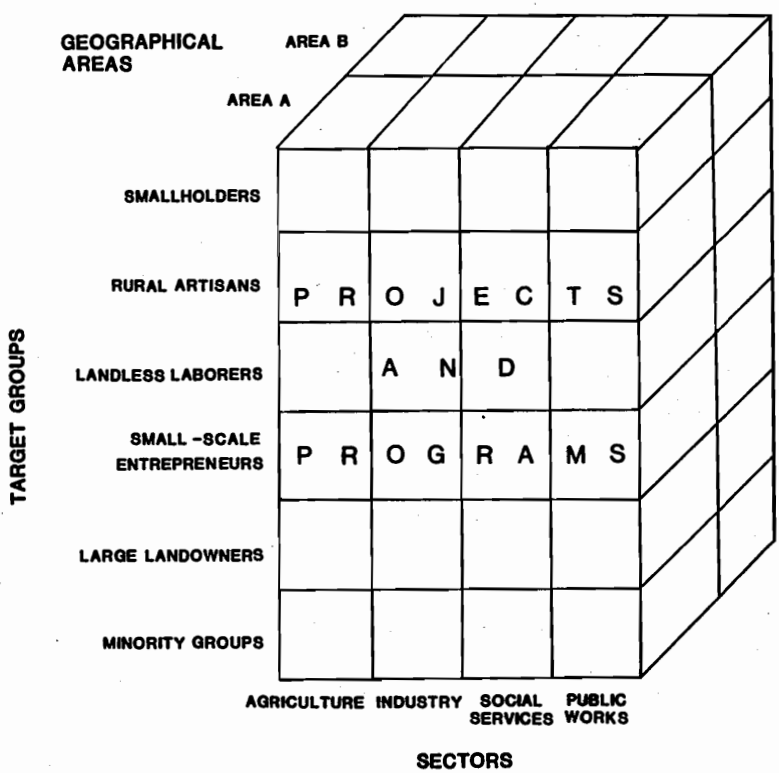
The findings of the Urban Functions in Rural Development studies were used in both the Bicol River Basin and the Department of Potosi to help formulate broad regional development strategies.

Spatial Strategy for Potosi

In Potosi, before the UFRD project began, the Departmental Development Corporation (CORDEPO) had already begun preparing a medium-term plan for the regional economy with investment programs for agriculture, mining, industry, transportation, tourism, infrastructure and other important sectors. The spatial and locational implications, however, had not been taken into consideration. The UFRD studies introduced a spatial dimension to regional planning and for the first time planners in CORDEPO began not only to identify sectoral investments but also to consider the most effective location for projects. As Evans points out: "This required a complex procedure for rationalizing and coordinating the projects proposed by each of the teams involved in global, sectoral and spatial planning. Prior to that, however, it was necessary to ensure that objectives and strategies, particularly those related to the global and spatial components of the plan, were consistent with one another."[3]

FIGURE 7-3

INTEGRATING SPATIAL, SECTORAL AND TARGET GROUP PLANNING



For the region, the plan sought to maximize the growth of the local economy in order to reduce the growing gap in income and wealth between Potosi and other regions of the country and to increase productivity and income within the Department to reduce the even wider gap in living conditions between urban and rural areas.

The economic and spatial analyses pointed to a number of common conclusions, which made the process of integrating the two much easier. First, both showed that despite the high level of mining activities in the region, the Department of Potosi was the most economically backward area of the country and was falling further behind each year. As noted earlier, it had the lowest per capita income of any department in Bolivia, the highest rate of infant mortality, and the slowest population growth. Mining was merely an enclave activity, valuable to the national economy as a source of foreign exchange, but of little benefit in increasing the incomes or living conditions of the local population. On the other hand, agriculture was the sector in which the majority of Potosi's population earned its living. It suffered from severe underinvestment and neglect by both national and local governments. As a result, the value of production was low and declining. Therefore, it was clear to CORDEPO's planners that more widespread and equitable development required substantial investment in agriculture and rural development.

Moreover, these analyses indicated that the distribution of health, education and other social services among settlements in the Department was closely related to the settlements' level of economic development and proportion of urban population. Incomes were higher in urban occupations such as manufacturing and commerce than in agriculture. Those living in towns had better access to a wider array of services, facilities, infrastructure and productive activities. With severe resource constraints, it was equally clear that such functions could be provided efficiently and economically only to towns, implying that a second component of development strategy had to be to locate services and facilities in such a way as to encourage people to concentrate in small and medium-sized settlements rather than disperse themselves widely over the rural landscape. Infrastructure and facilities would have to be provided to encourage farmers to live in clustered settlements.

In addition, the analyses revealed that with few exceptions the mining towns had been gaining while farming towns had been losing population. The scalogram analyses, however, showed that seven of the eleven third-tier settlements in the hierarchy (rural centers) and almost half of the fourth-tier (local centers) were

mining towns, although they represented a smaller proportion of the total number of towns and villages. The relatively higher level of infrastructure and social services found in mining towns was due to the fact that investment in farming towns had been largely ignored. Planners therefore saw the need to reduce this imbalance by increasing investment in social services and infrastructure in selected rural service centers that were accessible to the farming population.

Furthermore, as Evans pointed out, "it was evident from an examination of the distribution of other urban functions that there was a widespread lack of the infrastructure and services required for agricultural production, such as irrigation, storage facilities, farm supply stores for seeds, fertilizers, tools and equipment, as well as mills and other plants for processing farm produce. This once again reflected the low priority previously given to agriculture in the region."[4] It also reflected the weak demand for such facilities due to the low level of rural household income. Future development policy therefore would have to pay more attention to the provision of such infrastructure.

The studies of linkages and accessibility underlined the importance of rural roads in connecting small communities to towns and urban centers and in providing access for the rural population to the functions provided in them. Moreover, the studies found rural roads to be major factors in giving farmers access to markets for their surplus goods and in providing them with the incentives to increase output. High priority, therefore, had to be given in future investment plans to extending transportation access to rural areas and integrating outlying and poorly served rural communities.

Finally, both the economic and spatial analyses pointed out that if agriculture was to become the cornerstone of development in Potosi, investments would have to be made in related service and processing industries and in diversifying the economies of rural communities to provide employment and stimulate the demand for local farm produce. Analyses indicated that there would be strong potential demand for storage and packaging facilities, mills, slaughterhouses and other small labor-intensive food processing operations if agricultural development strategy was successful. Agricultural production would not be able to increase, however, without substantial investment in farm-related infrastructure and services such as irrigation works, production and marketing cooperatives, and agricultural credit. "The promotion of new industries related to agriculture in small and middle-sized settlements also served other goals of the plan," Evans noted. "The

prospect of better jobs, coupled with the policy of upgrading the provision of infrastructure and services in selected towns and villages, is designed to provide the incentives necessary to encourage the rural population to resettle in urban centers. The increased urbanization of the population is expected in turn to facilitate the diffusion of developmental impulses and to act as a catalyst in exposing farmers to more modern methods of production."[5]

The spatial implications of the strategy were clear. Action would have to be taken to strengthen the hierarchy of central places in the region, particularly the small-and intermediate-sized settlements that had few functions, and to improve the linkages between them and their surrounding communities in order to integrate isolated or peripheral areas into the regional economic system. Investments had to be made initially in facilities to support agricultural production and to meet the basic needs of the rural population. Planners began to choose the towns and villages that would act as rural and local service centers by three criteria: 1) the economic potential of the locality and its long-term prospects for continued growth and diversification; 2) the strength of the settlement's linkages with other towns and with the surrounding rural areas; and 3) the existing range of functions found in the settlement. Particular attention was given to the possibility of revitalizing traditional farming towns that had recently lost population.

Linkages would be improved by upgrading main roads between the larger towns in the region and building feeder roads to connect service centers to surrounding rural areas. This would both increase the access of the rural population to functions located in urban service centers and expand the potential market for manufacturing and commercial establishments located in them.

Strengthening the urban hierarchy also meant investing in new functions in settlements where they were missing and rationalizing the distribution of existing facilities to increase the access of rural population to them.

The strategy recognized the need to build on the productive potential and comparative advantages of each area within the region. The design of the "package of projects" for each area would thus begin by identifying the main economic activities of the area, and determining the infrastructure and services--such as credit, irrigation, technical assistance, storage and market facilities--needed to support those activities. Investments would also be made in education, health care and other social services to meet basic needs. Evans noted that "in Potosi, the concept of designing packages of

projects for specific areas, as opposed to the more conventional approach of individual projects in each sector, introduced a new perspective on the allocation of investments." In previous years, he pointed out, "the discussion had always been in terms of sectoral needs and priorities, now for the first time the distribution of resources in different parts of the Department was taken into account explicitly: planners and decision-makers were able to consider instead the options of giving priority to specific provinces or areas of the region."[6]

Spatial Strategy in the Bicol River Basin

As in Potosi, the Bicol River Basin Development Program had already formulated a number of regional development plans, all of which were sectoral or technical and none of which explicitly included spatial or locational factors. Although Integrated Area Development (IAD) units were created to identify projects for particular places in the region, these units were based on natural resources and not on the functional and economic characteristics of settlements. Indeed, some of the IAD boundaries had broken up functionally-related settlement sub-systems into two or three different planning units.

The BRBDP's comprehensive plan for the region sought to achieve six major goals:

1. To accelerate growth in the agricultural sector;
2. To stimulate investment in manufacturing and a tertiary industries;
3. To expand employment opportunities;
4. To distribute equitably income and wealth;
5. To improve social services; and,
6. To promote maximum popular participation in planning and implementation.[7]

Projects were classified sectorally under four major development categories: physical development, including water resources and transport; agricultural development; agribusiness and rural manufacturing; and health, nutrition and social services development.

The general problems of development were well known through extensive sectoral and technical studies prior to the formulation of the comprehensive plan. These problems included the region's physical isolation from Manila and other centers of national economic activity; a hostile physical environment with extensive flooding and salinity intrusion; inefficient agricultural production and marketing technology; capital scarcity for investment in appropriate physical infrastructure and services; rapid population growth and outmigration; high levels of ill-health in rural households, malnutrition

and poor environmental sanitation; inequitable land tenure arrangements; and ineffective delivery of government services.[8]

All of these problems were addressed to one degree or another in the BRBDP's development plans (See Figure 7-4). However, the plans did not have a strong locational or spatial dimension. Little attention was given to where projects would be located. But the UFRD study was done after the comprehensive plan had largely been formulated and was not completed until after the plan had been published. Thus, the UFRD study was seen primarily as a pilot project to test methods and techniques of spatial analyses and as a background study to provide information that would be used in future development plans and programs.

The planners who carried out the UFRD study in Bicol, nonetheless, derived from it the outlines for a spatial development strategy. As noted earlier, the UFRD studies indicated quite clearly that:

1. Services, facilities and infrastructure were heavily concentrated in a few of the largest settlements in the Basin and in those towns and villages along the Manila South Road.

2. Only a few settlements in the Bicol River Basin served as central places for other communities and rural areas. Naga City, Legaspi, Iriga and a few others were the only settlements that acted as area-wide service centers. The large majority of settlements--over 95 percent--were noncentral places. Their average population was about 300 households and most contained only very basic functions such as a small grocery stall or a few small shops.

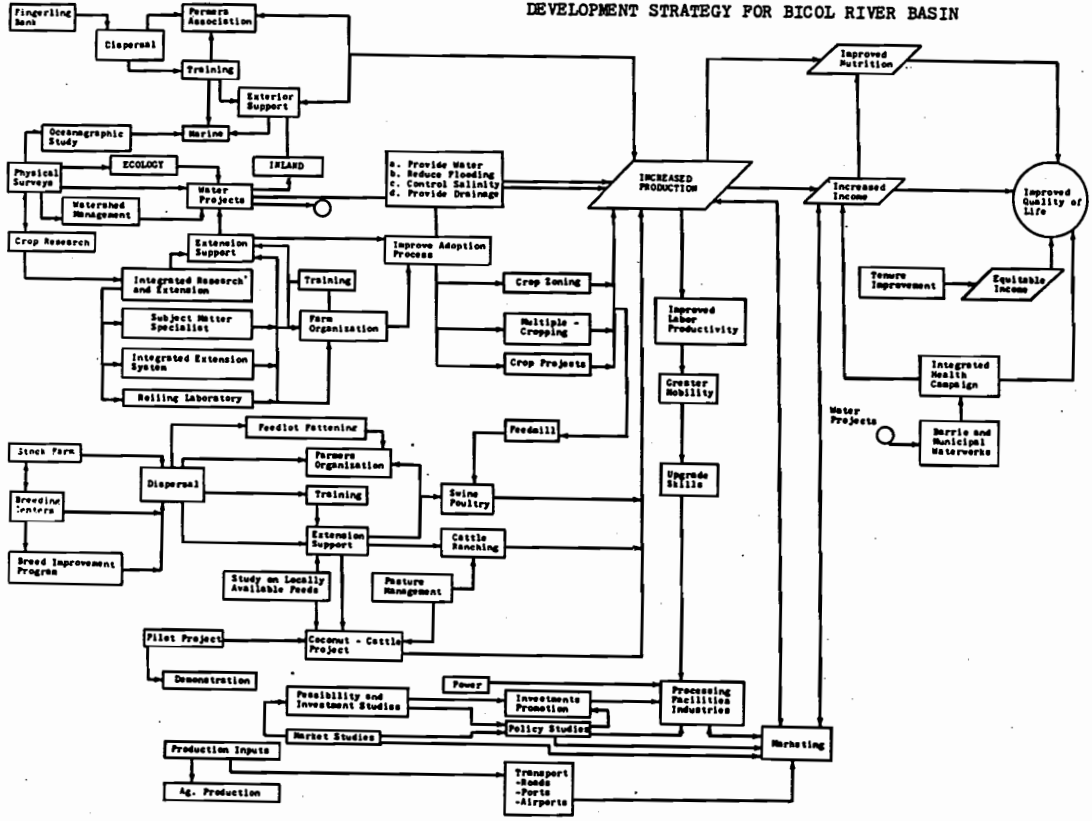
3. Linkages of all kinds among places in the Basin were extremely weak. Little social, physical or economic interaction took place between the two provinces of the Basin or among municipalities that were not connected by the Manila South Road. The functions located in the towns, therefore, served only the residents of the town and few nearby communities; access for rural people who lived off of the main highway was limited.

4. Large disparities in income and living conditions existed between the more urbanized centers of the Basin and the rural peripheral areas. Large gaps also existed in the services, facilities, infrastructure and productive activities between the few urban centers in the region and the large number of small villages and towns.

5. The settlement system of the Basin was neither well-articulated nor well-integrated. Rather, clusters of economically and functionally autonomous settlements existed around some of the larger towns in the Basin, which were neither integrated with each other nor with the rural areas surrounding them. Services and facilities could not be arranged in a hierarchical fashion to

FIGURE 7-4

DEVELOPMENT STRATEGY FOR BICOL RIVER BASIN



serve differing needs in the Basin, and those communities located off of the all-weather roads received very few services on a regular basis.[9]

The planners who carried out the UFRD studies identified a number of settlements within the Basin that could serve as central places at various hierarchical levels. They also delineated the functions they could perform if adequate investments were made in services, facilities and infrastructure (see Figure 7-5). These included:[10]

1. Rural Service Centers, which would contain services and facilities to assemble agricultural commodities for marketing, provide local periodic marketing functions, extend transport access to market towns and larger urban centers, accommodate small-scale agro-processing and handicrafts, distribute credit, market information and other technical inputs, mobilize savings, and provide basic health, recreation, education and administrative services;

2. Market Towns and Centers, which would provide an areawide 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 centers 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 could be found in rural service centers; and offer vocational and secondary education, health and child care services, and rural commercial services; and

3. Regional Centers that would be linked physically to each other and to urban centers outside the Basin by frequent and reliable transportation and all-weather roads; offer diversified commercial, financial, professional and administrative services; 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 agri-business and large-scale agricultural processing, and offer incentives for a variety of small-scale consumer goods industries, tool-making and repair workshops, machine shops and light durable goods industries. They could also offer higher educational opportunities and more specialized vocational training, and provide diversified and multi-purpose hospitals and health clinics.

The planners who conducted the spatial studies also argued that more equitable development in the Basin

FIGURE 7-5

SERVICES, FACILITIES AND INFRASTRUCTURE PROPOSED FOR EACH SETTLEMENT LEVEL, BICOL RIVER BASIN

General Functions	Rural Service Centers	Market Towns and Centers	Regional Urban Centers
Transport and Communications	-Surfaced, All-Weather Roads -Farm Access Roads -Bus Stop -Regular Bus or Jeepney Service to Rural Collection Points -Gas Station -Telegraph Service -Postal Service	-Asphalted, All-Weather Roads -Bus Terminal -Trucking or Bulk-Distributing Services -Regular Bus or Jeepney Service to Rural Service and Regional Urban Centers -Gas and Service Station -Auto Spare Parts Retail Store -Telegraph-Radiogram Service -Telephone Station -Postal Services	-Concrete Highway to Major Urban Centers -Bus Terminal with Major Repair Facilities -Auto & Machine Repair Shops -Vehicle and Machine Spare Part Shops -Regional and interregional Trucking and Bus Services -Gas and Service STations -Railroad, Port and Air Terminals -Telegraph, Telegram, Telex Services and Facilities -Telephone Exchanges linked to Major Urban Centers and Market Towns -Postal Distribution Centers
Marketing, Trade and Shopping	-Periodic Market Facilities -Farm Implements and Agricultural Supply Shop -Marketing Cooperative Outlet -Storage Facilities -General Store or Sari-Sari Stores -Milling Facilities	-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	-Diversified Daily Market -Distribution Outlets and Sales Offices for Farm Machines -Farm Supply Wholesalers -Cold Storage and Warehousing -Agricultural Commodity Brokers and Distriubters Outlets -Diversified Commercial Retail and Wholesale Establishments -Retail Outlets for Consumer Goods, Household Goods -Consumer Specialty Shops

(continued)

General Functions	Rural Service Centers	Market Towns and Centers	Regional Urban Centers
Industrial and Manufacturing	-Cottage Industry -Small Scale Craft Shops -Small Machine Repair Shops and Metal Shops	-Bulk Commodity Processing Facilities -Agricultural Processing Plants -Small Scale Consumer Goods Manufacturing Facilities -Small Machine, Implement and Metal Shops	-Agro-Industry and Agribusiness Facilities -Commodity Processing and Packaging -Rural Goods Production and Distribution Facilities -Small Tool and Implement Production Facilities
Finance	-Rural Bank -Credit Cooperative	-Commercial and Savings Bank Facilities -Rural Bank with Nonagricultural Loan Programs -Credit Cooperatives -Moneylenders and Pawnshops	-Development and Commercial Bank Branch -Savings and Loan Associations -Insurance and Financial Establishments -Urban and Rural Credit Coops -Brokerage Firms -Chambers of Commerce -Small Industry and Business Incentive Programs
Public Utilities	-Piped Water Supply Points -Small Water Filtration Facilities -Residential Electricity	-Electrical Energy Station -Residential Piped Water Supply -Residential and Commercial Area Drainage Systems	-Electric Supply Grid -Piped Water System -Sewerage and Drainage System -Waste Disposal System
Administration	-Municipal Service Office -Barangay Government Office -Police or PC Sub-station -Municipal Court Branch -Agricultural Extension Station	-Municipal or Barangay Govt. Office -IAD Team Headquarters Office -Police or PC Station -District Office of Agricultural Extension -Judicial Facilities -National Ministry Program District Offices	-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

General Functions	Rural Service Centers	Market Towns and Centers	Regional Urban Centers
Administration	-Municipal Service Office -Barangay Government Office -Police or PC Sub-station -Municipal Court Branch -Agricultural Extension Station	-Municipal or Barangay Govt. Office -IAD Team Headquarters Office -Police or PC Station -District Offices of Agricultural Extension -Judicial Facilities -National Ministry Program District Offices	-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
Recreation and Social	-Paved Basketball Court -Multi-purpose Community Center	-Paved Basketball Court -Small Gymnasium/Auditorium -Restaurants and Coffee Shops -Cinema -Playground with Facilities	-Paved Basketball courts -Parks and Plazas -Cinema with Daily Run -Hotel with Nightclubs -Restaurants -Gymnasium/Auditorium -Multipurpose Community Center -Diversified Social Activities
Education	-Primary Schools -Vocation 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 Programs -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

would require better physical linkages between rural areas and towns. Among the most important linkages were farm-to-market roads and all-weather arterials between market centers and larger cities. It was inconceivable, they contended, that the BRBDP would be able to attain its goals of increased agricultural production, economic diversification and equitable distribution of income and wealth without first improving transportation. Substantial portions of the northern and northwestern areas of the Basin and the peripheral areas of the southwestern coast were completely inaccessible by road.[11] In both the Bicol River Basin and the Department of Potosi, the spatial analyses allowed planners for the first time to assess the settlement system in the region and to derive from that assessment spatial and locational implications for regional development. The suggestions for broad strategies of spatial development, however, had to be integrated with sectoral and technical proposals for specific projects and programs.

FORMULATING INVESTMENT PROGRAMS AND PROJECTS

The UFRD analyses can be used not only to outline a broad spatial development strategy, but also to identify specific projects and programs needed to provide essential functions and to strengthen the settlement system's capacity to promote development.

As in strategy formulation, the spatial analyses must be used together with economic, sectoral, social and technical analyses to help planners and policy-makers form better judgments about the types of projects and programs that are needed and where they might be located. Often, the most important contribution that the UFRD analyses can make to the process is to raise further questions and lead planners to think in different ways about the allocation of investments and the design of projects. There are specific methods and techniques that can be used at this phase of the UFRD approach to help planners cope with spatial and locational issues, but again these must be used in conjunction with other forms of analysis and planning in order to be most useful. They include demand analysis, relative partitioning methods to find the most efficient location for new settlements, project "package" identification methods, distance-access-equity assessment methods and locational sensitivity analyses.

Demand Analyses--Household and Social Surveys

Much of the methodology used in the UFRD approach is "supply" oriented. It assesses the degree of articulation and integration in the settlement system by the distribution of functions within a region and assumes

that the continued survival of those functions is an indication of demand. A more direct method of ascertaining demand, of course, is by asking those people who live in the region and in various settlements throughout the region what types of functions they need and want.

In both Potosi and the Bicol River Basin household sample surveys were used to determine the location of functions and to obtain some indication of what types of services and facilities people desired. In Potosi, questions were included in the household surveys used to gather information for the scalogram, linkage and accessibility analyses about services and facilities that were needed in communities. The questions could be asked quickly and inexpensively during the functional inventory.

In the Bicol River Basin an extensive and systematic set of social surveys were carried out under the auspices of the Social Survey Research Unit (SSRU) of a local university--the Ataneo de Naga. The surveys included both large sample studies of households throughout the Basin and stratified and occupation group studies of households in specific municipalities. Studies were done of the problems and needs of rice farmers, fishpond owners, cooperative members, credit association members, those living on land consolidation projects, people living in areas where proposed projects were to be located, irrigation users, people living in flooded areas, the unemployed, local elite groups, and those suffering from particular types of health and nutritional problems.

Moreover, the SSRU surveys included large-scale household studies of people's needs and desires and baseline studies of living conditions. A sample of over 1,000 Basin farmers was questioned in the mid-1970s, for example, about the most significant problems with which they had to cope. The survey was one means of identifying projects that might be undertaken to deal with development problems. In decreasing order of frequency, people identified the following as their most important problems: threats to peace and order, flooding, lack of roads, unemployment, poor drinking water, ineffective community organizations, lack of transportation, lack of access to electricity, dirty and unsanitary surroundings, and high prices.[12] A sample of 3,240 household heads yielded a great deal of information about what factors people in Bicol thought were related to an improved quality of life. They indicated that the following were most important: to have a respectable job and an adequate income; to have a sturdy home, to have adequate food and drink and sufficient furnishings; to enjoy esteem and status in their community, and to participate in small group activities and community affairs.[13]

The surveys further indicated that people in Bicol region "have a market orientation and accept the idea that modern practices and increased production and income lead to a higher quality of life." The surveyors found that for Bicolanos, quality of life "tends first to revolve around the concept of job and income, second around the concept of adequate housing and food, and third around the concept of formal and informal group affiliation."[14]

The projects included in the Bicol River Basin Development Program's plans coincided with eight of the ten major concerns of the people revealed by the household surveys. Peace and order and social acceptance were considered goals that had to be pursued through community and national efforts and that might only indirectly result from economic development and social progress in the region.

In both Potosi and Bicol, household and social surveys were used to cross-check "supply-oriented" methods of analysis and to identify projects and programs that were needed and wanted by people living in those regions. In Bicol a substantial effort was made to include a wide range of group leaders in IAD planning units and in the BRBDP's planning and policy-making activities. Both the demand analyses and the continuing participation of a variety of occupational, geographic and economic interest groups allowed planners to attach priorities to project proposals and to assess the need and desire for functions in various locations within the region.

Partitioning Methods for the Location of New Centers

A relatively simple method of choosing preliminary sites for the location of a new settlement or for selecting settlements to be upgraded to higher order central places is available through relative partitioning. It involves the following procedures:[15]

1. Identify the largest and most functionally complex settlement in the area.
2. Search in all directions for other settlements inside or outside of the area (but not farther outside than the approximate diameter of the area).
3. Draw lines from the most important place to settlements of approximately equal importance identified in step 2, using transport routes if places are connected by reasonably direct links or, otherwise, straight lines.
4. Bisect each of these lines and construct perpendicular lines at these points of bisection.

5. The innermost area formed by the intersection of these perpendicular bisectors delineates the area that will be served from the most important centers with functions not offered by subsidiary centers, and other areas will be served from other central places.
6. Identify settlements of local importance performing some functions found in higher level centers within the area of this boundary.
7. Select subsidiary centers to become lower order service centers from among these places, so that they are distributed approximately uniformly over the boundary area.

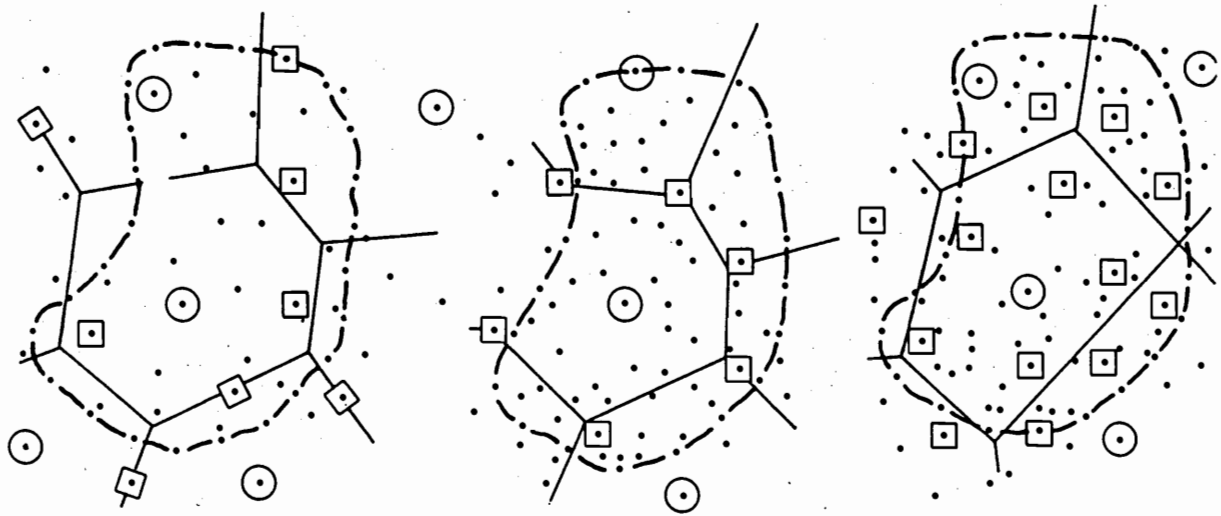
The selection of subsidiary centers can follow one of three models (See Figure 7-6): choose settlements at the edges of the boundaries between major centers, choose settlements at the corners of the boundaries between major centers or choose settlements on either side of the boundaries between major centers.[16] Partitioning methods should be used, however, only to obtain preliminary indications, based on physical distance, of where central places might be strengthened. Much more detailed studies must then be made of the settlements chosen through partitioning techniques to take into consideration topography, population distribution, transportation access and social interaction patterns as well as economic growth potential, and comparative advantage. Relative partitioning techniques, tested in area development planning in India, were introduced in the Potosi and Bicol projects, but were not used because in neither case had the planning agencies yet turned their attention to the creation of new settlements or the deliberate upgrading of existing settlements.

Use of Service Standards for Equitable Distribution of Functions

National ministries use service standards as a means of allocating investments in nearly all developing countries. Usually the criteria are based on the number of people each function should serve--for example, one health clinic or primary school for every three thousand people in an area. But there are a variety of standards that can be used to improve the distributional equity of functions when spatial factors are taken into consideration. Morrill and Symons define efficient location of a function as "one in which some societally predetermined level or volume of service is met at minimum total system cost of operation and travel. Alternatively, but similarly, an efficient pattern could be that which maximizes the volume of service within a predetermined budget constraint."[17] They point out that the concept of distributional equity could take three different forms:

FIGURE 7-6

SELECTION OF SUBSIDIARY SERVICE CENTERS USING RELATIVE PARTITIONING TECHNIQUES



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.

PLANNING MODEL C

In this model the subsidiary centres are located on either side of the boundaries between the major centres.

Block boundary

Major centres

Subsidiary centres

Source: S. Andrade, S. Banerji, H.B. Fisher, N.S. Saini G. Rushton and A. Sharma, A Graphical Approach to Settlement Planning for Integrated Area Development, New Delhi, Ford Foundation, n.d.

1. System equity--in which average travel times to facilities should be no more than a prescribed number of minutes or kilometers of distance. The average travel time criterion provides some degree of uniformity in choosing the location of functions, but does not address the issue of disparities within the range of travel times that constitute the average. Usually, level of access to a set of functions can be raised using this standard by providing a larger number of smaller facilities distributed more widely throughout an area. Although average travel time would be reduced, in some cases efficiency might decline and average costs could increase.
2. Minimum standard--in which no more than a socially acceptable small percentage of people are more than some critical distance from a good or service; for example, no more than 10 percent of the school age population will be more than 3 kilometers from an elementary school. Often, the only way that minimum standards can be reached effectively is to shift investment in services and facilities from more densely to less densely populated areas. Again, this may increase the access of more people who had previously been farther away than the minimum acceptable distance, but at an increased cost for those living in more densely populated areas and perhaps with a reduction in efficiency of operation. Where income is higher in more densely populated areas, however, the increased costs to richer people of providing greater access to poorer families may be a socially acceptable trade-off.
3. Range of Variability--in which the frequency distribution of time or distance required to travel to a set of functions is used as the basis for making location decisions and in which reduction of variability about the mean indicates a more equitable location pattern. The range of variability could be reduced for many functions simply by locating them in a regular system of central places, in a lattice-like pattern, over an area. If population density and income vary greatly throughout the area, the reduction in the range of variability might come at increased cost and reduced efficiency of operation.

Some combination of standards could be used, or different standards could be applied for different functions. Also, substitution of complementary services--

such as clinics with paramedic staff and referral services for physician-staffed health stations or hospitals--could increase access without shifting the locations of higher order services.[18]

Oberg has summarized concisely the strategies available to planners for locating services and facilities to attain different combinations of equity and efficiency goals:

1. If the major goal is urban system efficiency and the purpose is to provide access to as many people as possible, then functions should be located in as many of the largest central places as possible.

2. If regional equity is the main objective with the aim of giving people in as many different parts of the region as possible access to functions, then they should be located in a pattern of spatial dispersion, with priority given to central places away from existing supply points.

3. If sectoral efficiency is a major objective in order to increase competition among providers of services, then priority would be given to those lcations already having the functions;

4. If settlement system equity is the goal, that is, to increase the access of people who currently have little or no access to services and facilities, then the functions should be located in centers that have few or none of them.

5. If temporal efficiency in the settlement system is considered important, functions would be located in centers with growing populations in order to provide access to services in anticipation of actual need.[19]

Again, depending on local goals and objectives some combination of these standards, or different standards for different functions, can be used in identifying and formulating projects and programs for regional development.

Identification and Design of Project Portfolios

A process for identifying and selecting projects aimed at promoting development through a well-articulated and integrated settlement system emerged in the UFRD project in Potosi, Bolivia. Based on information obtained in the regional profile, settlement system, linkage and accessibility analyses, planners in Potosi--working through an iterative and lengthy process in interdisciplinary teams--were able to integrate spatial and sectoral criteria in preparing "packages" or "portfolios" of projects for various areas of the region. The process involved the following steps:[20]

1. The comparative economic advantages or potentially productive activities in each area of the region were identified. Information was derived from previous

economic and sectoral studies and from UFRD surveys of towns and market centers.

2. Using this information, and personal knowledge of the areas, planners proposed two or three key agricultural production or rural development projects, and estimated the potential outputs or impact of them.

3. Preliminary proposals were made for essential supporting activities, services or facilities, such as mills, agro-processing enterprises, or packing plants. These could be identified through a quick sketching of forward and backward linkages of the key projects.

4. Preliminary estimates of required inputs--such as irrigation facilities, extension agents, credit, or agricultural supplies--were made, based on knowledge of the area and information about existing facilities from the scalogram analysis.

5. The need for infrastructure directly related to the key projects--such as electricity, water, market facilities, or roads--was identified using the scalogram and linkage analyses.

6. Proposed locations for the key projects and supporting facilities and services were identified--again using the scalogram, linkage and accessibility studies as well as information from economic and technical studies.

7. A timetable, year-by-year, sequence of activities and schedule of related investments were made for each area. Each timetable started with "year 1" rather than any specific date, since it was not known when the project would be approved, funds could be obtained and the plans would be implemented.

8. The timetables were used to estimate the costs of the project portfolio or package over the first five years. The estimates included sources of funding, amounts required from each source, and investments needed from the private sector. Annual cost estimates were summed for each project by sector and each area.

An initial portfolio for the area "Norte de Potosi" is illustrated in Table 7-1. This somewhat physically isolated area, with great potential for agricultural development, had few roads to connect farm areas with markets or existing settlements with larger urban centers. Therefore, improving the road linking the area with markets in Llallagua, Siglo XX, and the Department of Cochabamba received high priority in the investment program, and the construction of feeder roads to connect Acasio--the settlement chosen to be the rural service center--to nearby communities was also proposed in the investment plan. Work would begin on building irrigation systems in the second year, along with construction of a potato packing plant. During the third year, it would be possible to provide farm supplies, technical assistance, credit and other inputs needed to increase

TABLE 7-1
PROPOSED PROJECT PORTFOLIO FOR NORTE DE POTOSI AREA
OF POTOSI, BOLIVIA

Project	Location	Organization	Years 1	2	3	4	5
Agriculture							
Irrigation	various	CORDEPO		———	———		
Extension service	various	IBTA			———	———	———
Credit	RC	BAB			———	———	———
Construction	various	CORDEPO		———	———		
Farm Supplies	RC	MACA/CORDEPO			———	———	———
Wheat	Arampampa	MACA/CORDEPO			———	———	———
Corn	Acasio/Aram	MACA/CORDEPO			———	———	———
Potatoes	Acasio/Aram	MACA/CORDEPO			———	———	———
Sheep raising	Sacaca	INFOL/MACA/CORD				———	———
Mining							
Machinery hire	various	CORDEPO/BAMIN			———	———	———
Industry							
Mill	RC	MinInd/CORDEPO		———			
Animal feed plant	RC	MinInd/CORDEPO			———		
Dried oca plant	RC	MinInd/CORDEPO			———		
Tourism							
Resource survey	various	IBT/CORDEPO			———		
Craft Workshop	San Pedro	IBT/CORDEPO			———	———	———
Transport & Comms.							
Highways	Uncia-Anzaldo	SENAC/CORDEPO	———	———			
Feeder roads	RC to LCs	ALDE/CORDEPO	———	———			
Telephones	RC	ENTEL	———				
Post Office	RC	MinTC		———			
Energy							
Grid extension	various	ENDE	———				
Local generators	RC & LCs	CORDEPO		———			
Education							
High schools	RC & LCs	MinEd/CORD			———	———	———
Training center	RC	MinEd			———	———	———
Literacy Program	various	MinEd			———	———	
Health							
Health center	RC	UnSan/CORD			———	———	———
Clinics	LCs	UnSan/CORD				———	———
Infrastructure							
Drinking water	RC & LCs	CORDEPO		———	———		
Sewerage	RC	CORDEPO			———		
Market	RC	CORDEPO		———			
Institutions							
Producers coop	various	IPTK/MACA		———	———	———	———
Marketing coop	RC	IPTK/MACA			———	———	———
Field office	RC	CORDEPO	———	———	———	———	———

RC = Rural center = Acasio;
LC = Local center = Arampampa, Sacaca, Toro Toro and S.P. de Buena Vista.

production of wheat, corn and potatoes, the major crops grown in the area. A plant was also needed to dehydrate oca, a local vegetable.

Because Acasio was only a small village, the project portfolio had to include investments in a wide range of functions that would allow it to act as a rural service and marketing center. These included a post and telegraph office; a high school; a health center staffed by doctors equipped with jeeps so that they could visit neighboring communities; a gas station and repair shop; and a market, agricultural supply store and warehousing facilities. Four nearby local centers were to receive drinking water systems, high schools, post offices, and small health clinics.[21]

In the Bicol River Basin a combination of partitioning techniques, physical distance analyses and information from the scalogram and linkage studies were used, along with the analytical maps, to delineate eight settlements that could serve as market centers. With appropriate facilities, these places could incorporate large unserved or marginal areas into the regional marketing system. Bicol planners chose the following places to be considered as sites for a market development investment package: 1) Sipocot in the western part of the Basin, 2) Naga City in the Center of Camarines Sur province, 3) Tinambac north of Naga; 4) Iriga City in the center of the Basin; 5) Goa in the eastern portion of the Caramoan peninsula; 6) Ligao in the upper part of the Basin; 7) Legaspi covering the northern, southern and western part of the Albay Gulf; and 8) Tabaco north of Legaspi. It was around these market centers that the planners proposed re-drawing IAD planning boundaries so that projects and programs would be oriented toward economic rather than flood-plain development. The market areas for each center would be the proposed IADs depicted in Figure 7 in Chapter Six.

The scalogram analysis served as a guide in formulating an investment package for the market centers, indicating which important functions were lacking and which might be improved or upgraded. As noted earlier the investment portfolios for market centers would consist of projects to construct or improve all-weather asphalt roads to connect them to rural service centers, telephone lines connecting the market centers to the larger urban centers within the Basin, permanent market facilities, warehousing and cold storage facilities, utilities, finance and credit services, and agricultural extension services.

In some of the market centers, general services would also be improved, including health clinics or small hospitals, vocational schools, and essential social services. These market centers would also be high-priority locations for the development of agro-

processing industries and related small-scale manufacturing.[22]

Incentives for private investment in these centers would be offered, based on the following criteria: 1) that it reinforce the central marketing and trading functions of the town; 2) that it contribute to agro-processing activities; 3) that it strengthen transport access from within its agricultural supply areas; 4) that it widen its non-agricultural commercial or service capacities, especially in finance, distribution and social services; or 5) that it contribute to increasing the administrative capacity of organizations located there to serve people living in the rural hinterlands.[23]

The accessibility model described in Chapter Six can also be used to do sensitivity analyses of proposed project packages. The procedure consists of assessing various combinations of functions that might be located in a zone to see how they affect time-distance relationships.

It should be noted, however, that final decisions about the package of projects proposed for an area must depend on a variety of analyses and the judgments of planners, decision-makers and representatives of local groups. No statistical technique will provide answers or even objectively "optimal" choices. They will merely provide information that can be used in the decision making process.

MONITORING, EVALUATION AND INSTITUTIONALIZATION OF SPATIAL ANALYSIS METHODS

The final stages of UFRD are concerned with creating an evaluation system for monitoring the implementation of projects and for determining the impact of development activities on spatial development. They are also concerned with finding the best ways of integrating spatial analysis into the overall process of regional planning and policy-making.

Monitoring and Evaluation

As noted earlier, the intent of the UFRD approach to spatial analysis is not to create a "one-shot" comprehensive plan for the region, but to test and apply methods of analysis that allow planners and policy-makers to assess the spatial and locational dimensions of regional development on a continuing basis.

One important task is to determine the degree of frequency with which various methods of analysis should be applied. The regional profile analysis, for example, should be up-dated periodically when new data become available from secondary sources. The ten-year interval

between national censuses is probably too long in most regions, and ways should be found of obtaining up-dated population, social and economic data on the region every four or five years.

Information systems can be established to allow planners to up-date the scalogram analysis annually or bi-annually. In some countries municipal officials are required to report annually on changes in the types of services and facilities located in their jurisdictions, and this information can be collected and used to revise the scalogram. Check-lists of functions for each major settlement could be distributed annually to key informants, such as the town clerk or high-school prinicpal, to fill-in information about the presence or absence of functions in order to update the scalogram.

Linkage and accessibility studies, which require far more elaborate surveys, might be done every five years or after major linkage investments--such as new highways or markets--are made in the region. If the region is divided into planning areas, as was done in Bicol and Potosi, a full-scale UFRD study might be done for some of the zones each year on a three-to-five-year rotating basis.

One means of monitoring and evaluating project portfolios for various areas within the region is to formulate and design them using what the U.S. Agency for International Development calls the "Logical Framework."[24] This framework organizes information about the project package into four major categories:

1. Project Goals--stated in the form of single, coherent objectives toward which progress can be verified in terms of time, quantity or quality. They provide the reason for the projects and identify the ends toward which they are directed.
2. Project Purpose--stated in a way that defines the terminal conditions of success. It expresses in quantitative or qualitative terms what will be created, accomplished or changed through the project in order to solve development problems.
3. Project Outputs--stated functionally by kind and magnitude so that progress toward them can be verified. They are the specific results that can be expected from the effective management of the inputs provided through the projects.
4. Project Inputs--stated as activities that will produce outputs. They are the goods, services, and other resources provided from various sources in order to produce the specific outputs identified earlier. (See Figure 7-7.)

FIGURE 7-7
PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK

Life of Project:
From FY_____ to FY_____
Total Funding:_____
Date Prepared:_____

Project Title & Number:_____

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
Program or Sector Goal: The broader objective to which this project contributes: (A-1)	Measures of Goal Achievement: (A-2)	(A-3)	Assumptions for achieving goal targets: (A-4)
Project Purpose: (B-1)	Conditions that will indicate purpose has been achieved: End-of-Project status. (B-2)	(B-3)	Assumptions for achieving purpose: (B-4)
Project Outputs: (C-1)	Magnitude of Outputs: (C-2)	(C-3)	Achieving outputs: (C-4)
Project Inputs: (D-1)	Implementation Target (Type and Quantity) (D-2)	(D-3)	Assumptions for providing inputs: (D-4)

For each of these categories, information is provided on objectively verifiably indicators, means of verification and important assumptions for achieving the goals, purposes, and outputs, and for providing the inputs.

The "Logical Framework" not only can help planners to design investment portfolios more carefully and systematically, but also to monitor the actual progress toward goals and purposes by measuring the inputs and outputs over time.

Institutionalizing Spatial Analysis in Regional Development Planning and Policy-Making

The final stage of the UFRD approach is to integrate spatial analysis into the on-going planning and decision-making processes of organizations involved in regional development. This must be done differently in every region, since the organizational structure, authority of regional planning agencies, scope of participation, institutional relationships and political structure usually differ substantially even among regions within the same country.

To some degree the methods are institutionalized through building the skills of planners during the initial UFRD project, and by making national, regional and local technical and economic planners, government officials and local group leaders familiar with the uses of spatial analyses in regional planning and investment programming.

As with the introduction of any innovation or change in established organizations and procedures, the integration of spatial analysis often requires a concerted initial effort and a long period of gestation.

It is important for spatial analysts to emphasize at the outset that the intent of this process is not to supplant, but to supplement, existing planning procedures. It is equally important to underline the fact that the UFRD approach is not intended to produce a comprehensive plan for the region, but only to add the spatial and locational dimensions to economic, technical and sectoral planning.

Indeed, the underlying assumptions of the UFRD approach are that in most regions the most effective form of planning is strategic and incremental. In few places are there the resources, skills and administrative capacity to formulate and implement long-range compehensive plans. The UFRD approach is designed to provide basic information quickly, to be adjunctive and indicative, and to raise critical questions about the settlement system and locational implications of development decisions which require more detailed studies to

answer effectively. It seeks to provide quickly marginally better information about the spatial dimensions of regional development so that locational factors can be considered in decisions that must be made rapidly and that cannot await time-consuming systematic research. The UFRD approach is most useful where planners seek to transform conditions gradually. Indeed, the approach is designed to promote a transformational approach to development.

Rondinelli and Ruddle have defined transformational development as a process that "seeks to increase incrementally the productivity of indigenous institutions and practices, reinforcing and building on those appropriate to local conditions and needs and adaptive to changing circumstances, gradually displacing those that are not."[25] The characteristics of transformational development include:

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 methods 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, adaptive and that provides for experimentation and adjustment as transformation takes place.

Development planning rarely begins with a clean slate. In every region existing problems and circumstances, which often evolved over centuries, establish the environment for change. Although it is almost a cliche to argue that development plans should be based on a thorough understanding of existing conditions and emerging needs, this basic principle is often lost in the urgency to formulate and implement projects and programs.

One of the recurrent lessons of development experience, however, is that the most pervasive changes can be attained by transforming existing resources. Local social and economic systems survive because they perform useful or necessary functions. They are usually adaptive mechanisms suited to cultural peculiarities that meet the needs of those who maintain them. Understanding their operations is crucial to designing effective plans and programs for promoting change. The use of existing resources and culturally embedded traditions, moreover, can be more effective and less costly than attempting wholesale substitution of "modern" but alien institutions and practices.

Building on existing resources, institutions and practices requires involving local people who will be affected by transformation and change in development planning and implementation. The information, experience and insights of local residents are essential in identifying local needs, the most effective channels of change, and the types of change that they will support. Only by involving local people in the process of planning and implementation can decisions be tailored to their needs and can their latent talents and skills be developed.

Transformational development also implies building on the comparative advantages of organizations and settlements and strengthening those functions they can perform most effectively and efficiently compared with other organizations and places. This requires assessing the advantages and deficiencies of existing settlements to determine their potential roles, the extent and nature of their linkages to other settlements and their complementarities.

A fundamental obstacle to investment in many rural regions is the lack of information on local conditions, which makes evaluation of location decisions difficult, uncertain, and risky. The ability of public and private decision-makers to act to meet the needs of a region depends on their ability to perceive correctly current problems and opportunities. Most regions lack organizations that collect, aggregate and analyze data on regional social, economic, and technological trends. In some cases a regional development agency can compile information already collected by other agencies and firms as the basis for analysis, or it can generate new data. Ultimately, however, successful planning for regional development must be tailored to the needs and constraints of individual communities.

A fundamental weakness of centralized national planning is its insensitivity to uniquely local problems and opportunities. Regions in developing nations often differ drastically in their resource bases, comparative advantages, levels of development and potential for

future growth, as do communities within regions. Not all regions or communities suffer the same deficiencies or require the same services and facilities to promote productive investment. The requirements for building intermediate cities differ from those for market towns and village service centers. Decisions concerning allocation of investment and location of urban services and facilities should be based on the types of analyses of rural hinterlands and of existing central places that are offered by UFRD.

Much of the transformation needed to increase the productivity of settlements in developing nations can be achieved through methods that are low in cost, adaptable to local conditions, and that generate "demonstration effects" that encourage communities to experiment with successful technologies, services and facilities. As spatial structure, traditional institutions and indigenous practices change, the least productive and adaptive are eventually displaced. Their roles and functions must be assumed by more appropriate successors. Examples of transformational displacement in developing nations are numerous and commonplace--day laborers and bullock ploughmen are replaced by mechanized tractors and tillers, ferrymen operating small barges at river crossings are rendered jobless by the construction of a bridge, charcoal makers are ousted from their livelihood by rural electrification, periodic markets disappear as new transport linkages between rural areas and larger towns increase access to more diversified daily markets, the economic base of whole cities deteriorates as new industrial technologies or competitive markets for their goods or services emerge.

Since displacement is inevitable as development occurs planners must attempt to mitigate its adverse impacts. But the lessons of history document the frustrations of attempting to preserve artificially unadaptive institutions. The fundamental role of development planning is to facilitate and promote processes of productive change, while attempting to anticipate and mitigate the adversities and traumas of transformation.

Yet governments can never be omnipotent in planning for development. Rarely, if ever, is it possible to anticipate accurately or to control comprehensively the consequences of change. Indeed, there are only limited actions that governments can take to promote economic growth, and these are confined to those identified at the beginning of this chapter. But few governments in developing nations have the resources even to undertake all of these activities. At best, government intervention can usually only establish the essential preconditions for change and attempt to manipulate strategic factors that obstruct development or set in motion chains of activities that are likely to accelerate

transformation. Among the most important preconditions that can be established by government agencies are: providing social overhead capital and physical infrastructure required for productive investment by public and private organizations, ensuring that at least minimum levels of health, education and other social services are available to a majority of the population, removing obstacles to increased productivity and exchange in economically lagging regions and among disadvantaged groups, and ensuring equitable and wide opportunities for individual advancement.

Beyond providing these preconditions governments can plan their own resource allocations and investments to encourage the growth of strategic points in the spatial hierarchy--rural service centers, market towns, intermediate cities and metropolitan areas--and to strengthen the linkages among them. Regional development agencies using the UFRD approach can assist provincial, district and local governments and private firms to locate services and facilities in ways that build the productive capacity of central places and strengthen linkages among them, by:

1. Helping to identify specific sites for establishing new plants or expanding existing enterprises to take maximum advantage of economies of agglomeration, scale, and proximity to supplementary and complementary economic and social activities;
2. Analyzing social overhead expenditures, public services and facilities needed to sustain proposed development projects and new private ventures and to adapt technological innovations to regional and local conditions;
3. Identifying and analyzing backward, forward and lateral linkages of existing economic activities and delineating opportunities for new investment in the production of goods currently imported to the region;
4. Monitoring the investment activities of local, provincial and national government agencies that construct infrastructure and develop utility, transportation and service facilities in the region;
5. Analyzing the impact of that infrastructure on regional and local comparative advantages and on production, marketing and transport costs for important sectors of the regional economy; and
6. Identifying major public and private capital investments that would yield high, immediate multiplier effects for the region's major economic activities and settlements, and recommending their inclusion in national and regional investment plans.[26]

Social, economic and technological changes play an important role in promoting regional development. Changes in transportation, technology, service delivery and economic linkages, it was noted earlier, vitally

affect the locational advantages of villages, market centers, and small and intermediate cities. Changes in agricultural, mining, and manufacturing production techniques have been significant in creating comparative advantages of some communities and destroying those of others. The ability of regional decision-makers to perceive opportunities and adopt technological innovation is critical to regional development.

Regional planning agencies can play an important role in helping to establish an environment for innovation, transformation and entrepreneurship by acting as an intermediary and channel of communication between organizations within rural regions and those outside--national ministries, private firms, financial institutions, universities, research groups and individual entrepreneurs--with resources that could be invested in regional activities. As an intermediary and promoter of innovation and entrepreneurship, a regional development agency can:

1. Transfer information concerning innovations in production technology, marketing, transportation, organization and processing techniques to public and private organizations within the region;

2. Identify public and private sources of capital for new ventures--by monitoring new national development programs, changes in interest rates, new sources of government grants and loans to industry, and by actively participating in the creation of cooperatives;

3. Promote regional agricultural goods and manufactured products locally and in markets outside the region--by assisting local entrepreneurs to pool resources for promotion, advertising, and marketing in intermediate cities and metropolitan areas;

4. Development agencies can also help improve the skills of regional entrepreneurs and public administrators by contracting for and conducting training, by conducting workshops and seminars through which successful entrepreneurs disseminate their experience to others, and by mobilizing teams of experts and practitioners within the region to evaluate potential projects and existing business and government operations.

Because the very purpose of development planning is to trigger a set of interrelated actions, which through multiplier and spread effects generate productive change, the planning process itself must be change-oriented. It has to remain flexible, incremental and adaptive. It must foster experimentation and adjust policies and programs to the consequences of previous investments.[27]

CONCLUSIONS

In summary, the applied methods of spatial analysis and planning described here are designed to help planners to:

1. Understand the comparative advantages and weaknesses of a region's economic, human and physical resources in the national space-economy;
2. Identify areas within the region that have greater and lesser developed resources and capacities to promote economic growth;
3. Determine the pattern of human settlement, the distribution of important services, facilities, infrastructure and productive organizations among settlements, and the degree to which settlements in the region serve people living in the rural areas surrounding them;
4. Identify the types and strengths of linkages among settlements, the degree of access they provide for rural residents to town-based functions, and the degree of interaction that takes place among them;
5. Determine those functions that are not well distributed within the region, those that are available only to people living in some areas of the region and the pattern of association among functions within particular areas of the region;
6. Identify areas in which people are not well served by central place settlements or which are weakly linked to towns and cities that contain the functions needed for economic development and social progress;
7. Determine, on the basis of the existing distribution of functions, how to locate new investments to fill crucial gaps, provide complementary services and facilities, or build potential comparative locational advantages; and,
8. Identify means of locating new investments in ways that increase the capacity of settlements to support and promote "spontaneous" economic growth without further government intervention or investment.

The spatial and locational dimensions of regional planning can be ignored, but only if governments are willing to accept the high costs of locating expensive services and facilities in places where they may not generate the intended benefits or where they will not produce the maximum spread effects. The methods of analysis suggested here can help regional planners to gather information rapidly to minimize those risks. They can help investors to locate services and facilities in places where they are more likely not only reach intended beneficiaries but also to increase the capacity of those places to serve a larger population. In so doing, they may not only be able to promote economic growth more rapidly but also to distribute the benefits more equitably.

NOTES

1. John Friedmann, Urbanization, Planning and National Development, (Beverly Hills: Sage Publications, 1973), pp. 115-116.

2. The argument is made in more detail in Dennis A. Rondinelli, Development Projects as Policy Experiments: An Adaptive Approach to Development Administration, London: Methuen, 1983.

3. Hugh Evans, Urban Functions in Rural Development: The Case of the Potosi Region in Bolivia, Part I (Washington: USAID, 1982), p. 90.

4. Ibid., p. 92.

5. Ibid., p. 95.

6. Ibid., p. 97.

7. Bicol River Basin Development Program, Ten-Year Develop- ment Plan, 1978-1987, Baras, Canaman, Philippines: BRBDP, 1977.

8. U.S. Agency for International Development, Philippines: Bicol Integrated Rural Development Project, 1977-1981, Project Paper, Manila: USAID, 1976, 1976.

9. Center for Policy and Development Studies, University of the Philippines--Los Banos, Urban Functions in Rural Development: A Research Project in Spatial Analysis and Planning, College, Laguna, Philippines; CPDs, 1978), pp. 99-102.

10. See Dennis A. Rondinelli, "Spatial Analysis for Regional Development: A Case Study in the Bicol River Basin of the Philippines," Resource Systems Theory and Methodology Series, No. 2 Tokyo: United Nations University, 1980.

11. Center for Policy and Development Studies, op. cit., pp. 102-104.

12. Frank Lynch, S.J., "Let My People Lead: Rationale and Outline of a People-Centered Assistance Program for the Bicol River Basin," Manila: Institute of Philippine Culture, 1976.

13. Robert C. Salazar and Frank Lynch, S.J., "The Perceived Quality of Bicol Life in the Early 1970s," Naga City: Social Science Research Unit, Ateneo de Naga University, 1974.

14. Frank Lynch, S.J., "Social Soundness Analysis of Bicol Integrated Rural Development Project," (Manila: U.S. Agency for International Development, 1976), p. 5.

15. C. Andrade, S. Banerji, H.B. Fisher, G. Rushton, N.S. Saini, and A. Sharma, A Geographical Approach to Settlement Planning for Intergrated Area Development, (New Delhi: Ford Foundation, no date), pp. 43-48.

16. See Prodipto Roy and B.R. Patil, Manual for Block Level Planning (New Delhi: The Macmillan company of India, 1977); pp. 28-29.

17. Richard L. Morrill and John Symons, "Efficiency and Equity Aspects of Optimum Location," Geographical Analysis, Vol. IX ((July 1977) pp. 215-225; quote at p. 26.

18. Ibid., pp. 223-224.

19. Sture Oberg, Methods of Describing Physical Access to Supply Points, Lund Series in Geography, No. 43 (Stockholm: Royal University of Lund, 1976).

20. The process is described in more detail in Evans, op. cit., pp. 98-106.

21. See Evans, op. cit., Part II, pp. 77-86.

22. Center for Policy and Development Studies, op. cit., pp. 104-105.

23. Ibid., p. 105.

24. U.S. Agency for International Development, Design and Evaluation of AID-Assisted Projects, Washington: USAID, 1980.

25. Dennis A. Rondinelli and Kenneth Ruddle, Urbanization and Rural Development: A Spatial Analysis for Equitable Growth, (New York: Praeger, 1978), p. 181.

26. See Dennis A. Rondinelli and Barclay G. Jones, "Decision-Making, Managerial Capacity and Development: An Entrepreneurial Approach to Planning," African Administrative Studies, No. 13 (1975), pp. 105-118.

27. See Rondinelli, Development Projects as Policy Experiments op. cit., Chapter 5.

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Index

Access, physical, 29, 30, 221, 241
  analysis of, 182-185, 191-204
Agriculture, 21, 51, 67, 221
Agropolitan development, 8-9
Association, spatial, 83-84

Ball, J.M., 25
Beals, R.L., 24, 175
Bendavid-Val, A., 22, 54, 97
Berry, B.J.L., 4, 5, 23, 48
Bicol River Basin(Philippines), 17,18, 19, 87, 90, 101-104, 125, 153-157, 161-162, 165, 169-170, 181-182, 190-191, 223-230, 231, 232, 239-240
  economic conditions in, 60-68, 82, 83-84, 91-94
  employment in, 72-78
  settlement system of, 109-117, 127-133
Bicol River Basin Development Program (BRBDP), 208, 224, 232
Bolivia, 2,3,10, 14, 15, 18, 19, 38
  See also Potosi
Bromley, R., 7, 22, 23, 148, 150, 151, 152, 175

Centrality, 34
  index of, 125-126
Central places, 2, 6, 21, 34, 177, 222, 224, 236
Cheema, G.S., 175
Cities, small-sized, 9, 16-18
Cliff, A.D., 138
Cohen, D., 44, 48
Concentration, measure of, 83-84
Conroy, M., 22, 25
Corwin, L., 24
Crissman, L.W., 174

Dannhaeuser, N., 11, 24
Darwent, D.F., 22
Data collection, 43-44, 51-59, 109-111
David, D.E., 25
"Decentralized territorial" approach to regional development, 8-12
Development index, 90-96
Dick, R., 212
Dickenson, G.C., 180, 212
Dickey, J., 191, 212
Distribution measures, 83-84, 127-137
Doherty, P.A., 25

Douglass, M., 9, 17, 23, 25

Ecuador, 2
Educational services, 30,93, 110, 197, 199, 220
Employment, 70-78, 82
Entrepreneurship, 248
Equity, 216, 233-236
Evaluation, 37, 240-243
Evans, H., 22, 25, 79, 94, 138, 139, 171, 175, 176, 191, 197, 202, 212, 218, 221, 250, 251

Factor analysis, 45
Fass, S., 22, 39, 48
Fisher, H.B., 6, 22, 23, 117, 250
Frey, A., 138
Friedmann, J.R., 9, 23, 53, 63, 97, 216, 250
Fuller, T.D., 24
Functions. See Urban functions

Ghana, 15
Gilbert, A., 20, 26
Glasser, E., 48
Grove, D., 22
Growth centers, 4, 8-9
Growth poles, 3-4, 20
Guatemala, 10, 14, 15
Guttman scale, 106-114, 121, 125

Haggett, P., 138
Hansen, N., 22, 23
Harrison, K.M., 174
Health services, 18, 30, 110, 166, 169, 220, 226
Hirst, M.A., 25
Ho, S., 24
Honduras, 14, 15, 16, 17
Household surveys, 230-232
Huszar, L. 22

India, 2,6,7,13,33, 115
Indonesia, 2,6, 115
Industry, 13, 20, 75-77, 83, 221
Innovations, 248
  agricultural, 8-9
  dissemination of, 9, 10
Institutional development, 5, 243-248
International Labor Organization (ILO), 27
"Investment packages," 37, 222, 230-240
Ivory Coast, 16

Johnson, E.A.J., 5, 13, 23, 24, 47, 174
Jones, B.G., 54, 97, 251

Kenya, 2
Knapp, R.G., 174
Korea, Republic of, 13

Leeds, A., 9, 24
Lindblom, C.E., 44, 48
Linkages
  administrative, 147-148, 169-173
  analysis of, 32, 141-173, 239, 241
  economic, 144, 185-187
  physical, 9, 10, 11, 18, 19, 30, 33, 142, 160-164, 222, 224
  political, 147-148, 169-173
  social, 145-146, 164-169
  technological, 145
Location, 58, 59
Location quotients, 84-87
"Logical Framework," 241-243
Lombardo, J.F., Jr., 25
Lynch, F., 250

Malawi, 2
Mali, 16
Maps, analytical, 179-182, 202, 205, 208
Market areas. See Service areas
Market centers, 8, 10, 14-15, 148-160, 209
Market movement surveys, 152-154, 185-187

Marshall, J.U., 121, 122, 138
McNulty, M., 25
Mexico, 14, 15
Migration, 15, 144
Misra, R.P., 22
Mix and share analysis, 70-78
Monitoring, 37, 240-243
Morrill, R.L., 233, 251

Nigeria, 16

Oberg, S., 236, 251
Obudho, R.A., 22
Onyemelukwe, J., 25

Papua New Guinea, 17, 19
Parent, J., 174
Parr, J.B., 22
Partitioning methods for new center location, 232-233
Patil, B.R., 7, 8, 23, 33, 48, 179, 212, 250
Peru, 2
Philippines, 2, 3, 11, 38, 117
  See also Bicol River Basin
Planning, 41, 214-218
Population
  analysis, 58, 59, 66, 79, 101-106
  threshold, 34, 212-124
Potosi (Bolivia), 87-90, 157-160, 162-164, 166-169, 171, 173, 197-204, 205, 218-223, 236-239
  settlement system of, 133-137
  socio-economic conditions in, 68-70, 79-82, 94-96
Poverty, in developing countries, 27-31, 63-70
Preston, D., 10, 24
Primacy index, 104-106

Ragragio, J.M., 138, 139
Reed-Muench functional threshold measure, 122-124
Region, concepts of, 50-59
Resource analysis, 32, 36, 49-97
Rice, E.B., 48
Richardson, H., 11, 22, 24
Riley, H.M. 174
Rondinelli, D.A., 7, 22, 23, 25, 47, 54, 56, 97, 138, 139, 174, 175, 212, 244, 250, 251
Roy, P., 7, 8, 33, 48, 179, 212, 250
Ruddle, K., 7, 22, 23, 47, 56, 97, 174, 244
Rushton, G., 6, 23, 250

Salazar, R.C., 250
Santos, M., 23
Scalograms, 45, 114-121, 127, 133, 135, 202, 208, 239, 240, 241
Schatzburg, M., 8, 23
Schwimmer, B., 175
Sectoral analysis, 42, 213, 216
Service area, 34, 149, 151, 154, 165-166, 181-191, 202, 208
Settlement systems, 2, 20
  analysis of, 32, 99-137
  functions of, 7, 12-20, 29-30, 106-121, 226-230
  hierarchy, 6, 35
  integration of, 5,7, 35, 224, 226
Shah, S.M., 22
Skinner, G.W., 174
Smith, C.A., 174
Social Survey Research Unit (SSRU), 231
Solomon Islands, 17
Southall, A., 23, 183, 184, 212
"Spatial closure," 9
"Spread effects" of economic growth, 1, 3, 4, 20
Sri Lanka, 117
Statistical measures, 60-70, 79-82
  mapping of, 180-181
Stohr, W., 9, 24, 26

Sundaram, K.V., 22
Swetnam, J. 24
Symanski, R., 174
Symons, J., 233, 251

Taiwan, 13
Tanzania, 15
Taylor, D.R.F., 26, 174
Thailand, 2, 13, 17, 117
Thomas, M.D., 22
Transformational development, 244-248
Transportation. See Linkages
Tria, A.M., 138
"Trickle down" of development benefits. See Spread effects
Todtling, H., 9, 24

United Nations Economic and Social Commission for Asia and the Pacific (ESCAP), 36, 51
United States Agency for International Development (USAID), 3, 27, 30, 32, 241
Upper Volta, 38, 39, 183
Urban functions, 34, 39, 110-111, 127-137, 205
Urban Functions in Rural Development (UFRD), 3, 38-46
  concepts in, 33-35
  history of, 27-32
  phases of, 36-38

Vanuatu, 17
Voelkner, H.E., 45, 48, 108, 109, 117, 138

Ward, M.W., 19, 25
Ward, R.G., 19, 25
World Bank, 13, 24, 27, 28, 31, 47
Wunsch, J., 15, 25

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