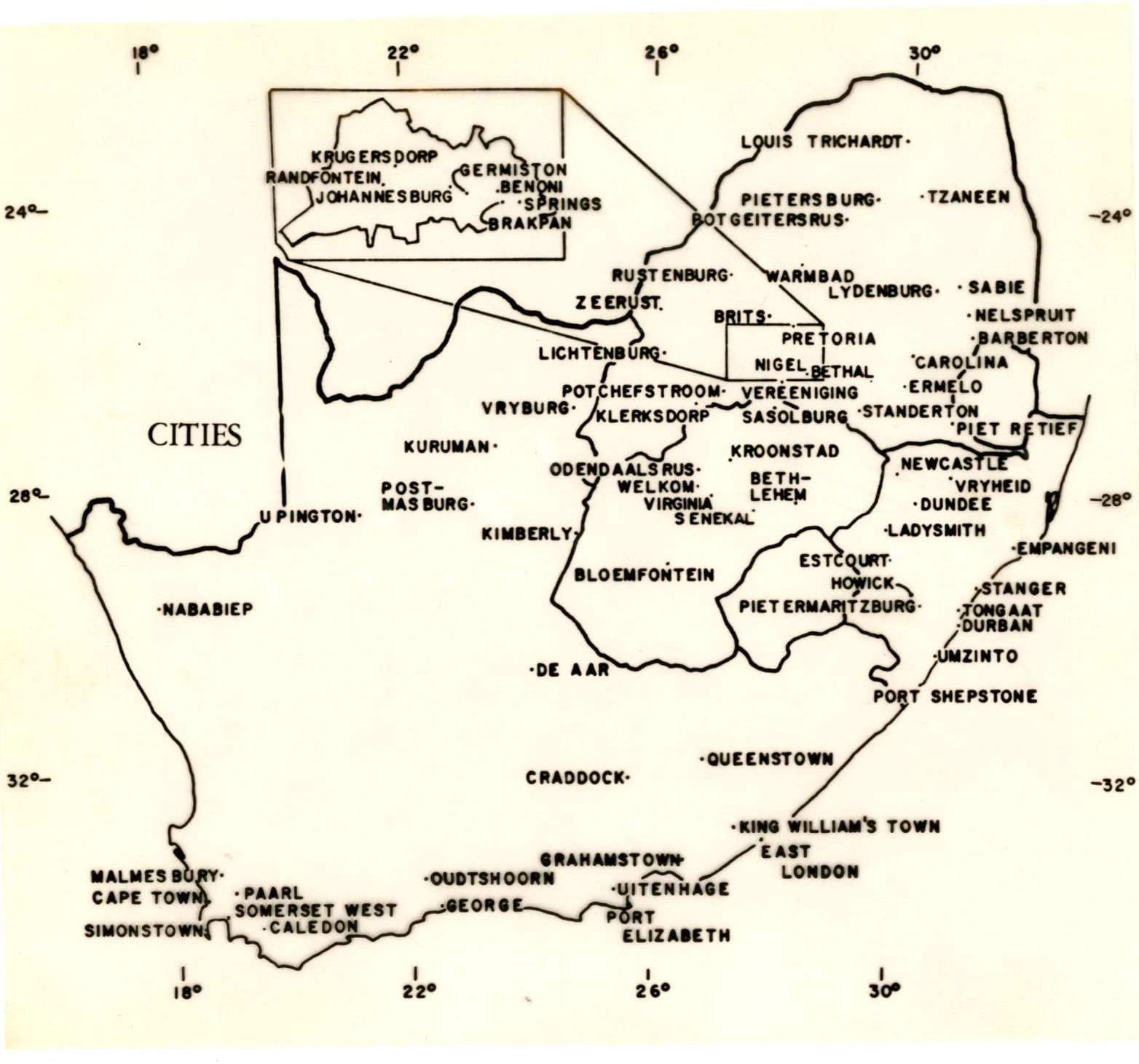
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UITENHAGE
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SIMONSTOWN
CALEDON

AN ANALYSIS OF URBAN DEVELOPMENT, SPECIALIZATION, AND FUNCTIONAL CLASSIFICATION OF SELECTED MAGISTERIAL DISTRICTS IN THE REPUBLIC OF SOUTH AFRICA

A Thesis

Presented to

the Faculty of the Department of Geography

East Carolina University

Geography Research Paper No. 14

In Partial Fulfillment

of the Requirements for the Degree

Master of Arts in Geography

by

Roger L. Payne

June 1972

AN ANALYSIS OF URBAN DEVELOPMENT, SPECIALIZATION, AND FUNCTIONAL CLASSIFICATION OF SELECTED MAGISTERIAL DISTRICTS IN THE REPUBLIC OF SOUTH AFRICA

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Roger L. Payne. AN ANALYSIS OF URBAN DEVELOPMENT, SPECIALIZATION, AND FUNCTIONAL CLASSIFICATION OF SELECTED MAGISTERIAL DISTRICTS OF THE REPUBLIC OF SOUTH AFRICA. (Under the direction of Ralph E. Birchard) Department of Geography,

The purpose of this study is to provide an analysis of the urban development, specialization, and functional classification which is an integral part of the urban system of the Republic of South Africa; that is a national or regional organization of cities which are functionally inter-related. The Europeans (British and Dutch) found an uninhabited area when they first arrived in South Africa. The resulting conflict of two European elements intensified the interior settlement of South Africa. The urban system gradually became crystalized with the discovery and exploitation of the vast mineral wealth of South Africa, the setting of transportation, and the recent development of manufacturing. The urban system as it exists today was established almost entirely by the European segment of the population. However, Bantu, the largest group of people in South Africa, provided a special element in the urban system as a source of cheap labor.

After an introductory note concerning the urban hierarchy, an analysis of the urban system is made. This makes possible a comparison to other economically advanced areas and brings out the peculiar nature of the urban system. Seven functions of the urban hierarchy are analyzed. They are: mining, manufacturing,

wholesale and retail trade, motor trade, other commerce (finance), transport, and services. The study employs two quantitative methods that objectively establish criteria for urban analysis. Firstly, the minimum requirements method identifies the boundary between basic and nonbasic economic activity and thereby establishes a point of reference which determines the viability of an urban area. The specialization index (an aspect of the minimum requirements method) measures the precise degree or level of specialization experienced by each magisterial district. The resulting specialization index indicates a high degree of specialization in large cities in South Africa due to the association of mining activity with highly populated areas.

The multifunctional classification, the second method, enables one to determine which magisterial districts are specialized in each function and to what degree. The relative importance of mining and manufacturing and their close association are indicated by applying this method. Also, the Bantu element of the population is found to create an abnormally high amount of service activity.

The location of the magisterial districts specialized in each of the seven functions studied is shown on maps. The main industrial areas of South Africa are: the Cape area, the Southern Coast (Port Elizabeth-East London), the Durban area, and the Witwatersrand. The spatial distribution of the industrial-urban system is analyzed by utilization and comparison of the above quantitative methods.

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First and foremost my deepest appreciation is extended to Dr. Ralph E. Birchard for his guidance, most helpful contributions, and untiring patience. As director, Dr. Birchard devoted unlimited time and effort to the completion of this study. His aid, advice, and contributions can be found in each and every aspect. Also, appreciation is extended to Mr. Louis A. Woods for his helpful contributions concerning quantitative aspects, as well as his critical overall comments.

Appreciation is extended also to Dr. James R. Wirth whose assistance and patience made possible all of the computer computations as well as the program necessary for the computer analysis. Thanks is also extended to Mr. Ronald A. Crowson without whose aid no map contained in this study would have been possible. The courtesy of Mr. H. A. Collins and the South African Embassy should not go unmentioned. Mr. H. A. Collins of the Information Division of the South African Embassy discussed important points on a number of occasions. Thanks should be extended to Dr. H. Daniel Stillwell for carographic advice, and to Dr. Robert E. Cramer, Dr. Ennis L. Chestang, and Dr. Blanche Watrous for critical reading and suggestions.

A very special kind of appreciation must be extended to Sara, my wife and typist. Without her never ending patience and devotion, none of this study would have been possible. It is with deepest gratitude that I extend thanks to all people who made this study possible.

June, 1971 Roger L. Payne

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"So geographers, in Afric maps
With savage pictures fill their gaps;
And o'er uninhabitable downs
Place elephants for want of towns."
...Jonathan Swift

Chapter I

Introduction

The African continent is developing rapidly in all respects. One of the most important aspects is economic, and this is directly related to urban systems. The Republic of South Africa has secured the position of the economic leader of Africa, and for this reason the industrial-urban system of South Africa merits analysis.

Objective

The purpose of this study is to provide an analysis of South Africa's industrial-urban system by delineating the basic employment of the economic structure as well as establishing definite functional types. For an analysis of the South African urban system, a unit of measurement is necessary. The magisterial district was chosen because this unit is the smallest division for which census data are available, and it affords a good cross-section of the economic structure of South Africa. In most instances the districts represent service areas which are valid representatives of the economic structure.

Problem

South Africa offers an advanced industrial-urban system to which various methods of urban geographic analysis may be applied.

South Africa has become established internationally as an industrial nation illustrating that there is a developed industrial-urban system. As one author puts it, "an industrial framework has already achieved certain pronounced peculiarities."[1] Most authorities agree that the initial phase of the development of the aspects associated with the industrial-urban system in South Africa has been completed. Therefore the existing urban system of South Africa merits the application of established methods in which are determined the total economic structure of South Africa's urban areas.

It has been established that a definite industrial-urban pattern exists in South Africa, and this pattern will be analyzed. Before an analysis can be made; however, it is necessary to highlight the historical developments that led to the settlement patterns. It should be noted that the presentation of the settlement factors does not serve as a mere formality as in most studies. Although settlement patterns have a very real influence upon present urban structure, the case in South Africa is somewhat magnified and the very peculiar nature of South Africa's settlement will shed some light upon the industrial-urban situation that exists today.

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[1]W. N. Mallows, "Some Comments on Urbanization in Southern Africa," The South African Geographical Journal, Vol. L, (1968), p. 3. The peculiarities referred to lie basically in the concept of South African ports relying upon the more developed Rand and adjacent area for their industrial base, whereas most world ports are industrially independent. This is the generally accepted theory of core-periphery development and dependence in South Africa.

Methodology

The data utilized in this study is that of industrial employment. The basic source of raw data is the Population Census of the Republic of South Africa.[1] It is not sufficient to simply indicate the use of these census materials. This is because of the unfamiliarity of their contents which is a direct result of South African government policies. The very terms "Magisterial District" and "Economic Region" merit an explanation. The most striking difference within the South African Census is that it divides the country into Economic Regions which are subdivided into Magisterial Districts.

The study is based on industrial employment, and the South African Census differs from United States Census materials. However, the South African Census is a reliable census[2] and the industrial categories are generally similar to industrial categories of United States census publications. The following quote explains the variations: "The industrial classification employed is based on

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[1]Two specific volumes were utilized. South African Bureau of Statistics, Population Census: Characteristics of the Population in Each Magisterial District and Economic Region, Occupation, Industry, and Type of Abode (Pretoria: Government Printer, Vol. VII, No. 2, 6 September, 1960); South African Bureau of Statistics, Urban and Rural Population of the Republic of South Africa, 1904-1960 (Pretoria: Government Printer, Report No. 02-02-01, 1960).

[2]It must be noted that in keeping with the governmental policy of Apartheid, the data in the Census Reports are presented in five separate tables: All races, Whites, Coloured, Asian, and Bantu. All races, however, was omitted for the industrial categories and each of the four races had to be summed.

the International Standard Classification of All Economic Activities with the necessary amendments and adaptations for South African conditions."[1] Ten industrial categories of the Census are as follows: agriculture, mining, manufacturing, construction, electricity, commerce, transport, services, unemployed and unspecified, and not economically active. It was necessary to omit certain categories since they do not conform to the needs of this study. Agriculture was omitted because the essence of this study is urban and the category entitled "Agriculture" deals with all aspects of non-urban activity such as forestry, hunting, and fishing as well as the raising of crops and animals. Construction and electricity were omitted because they are largely nonbasic functions with special characteristics. "Construction" tends to accentuate the new building activity of an urban area rather than giving insight into the urban economic base while "electricity" is generated in relation to demand. Two other categories were also dropped, partly because of irrelevancy and partly because they did not add to the urban economic base. In fact, the urban economic base would have been distorted with the addition of the latter of these two categories. "Unemployed and Unspecified" was omitted as a category because the total number in this category was slight; therefore, providing only marginal new information. "Not economically active" as a category was omitted because of the possibility of distortion of

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[1]South African Bureau of Statistics, Population Census, (6 September, 1960), Vol. VII, No. 2, p. vi.

the urban economic base.[1]

The remaining seven categories reflect the urban economic base.[2] However, a further explanation is necessary concerning three of the seven industrial categories. Wholesale and retail trade, motor trade, and other commerce are in fact subdivisions listed under the broad category entitled "commerce". Motor trade as a category includes all purchasing and selling of automobiles and other commercial vehicles as well as the retailing of parts and gasoline and lubricants.[3] Transport differs from motor trade in that transport refers to both public and private conveyance of passengers and goods except for those divisions of the South African Railways that are appropriately classified into other categories.[4] Other commerce as a category, includes banks, insurance, real estate, and other financial institutions.[5]

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[1]This category was extremely high in number, but this is because of the high number of subsistent Bantu as well as housewives and scholars.

[2]It must be understood that the expressed purpose of this study is urban and only urban.

[3]H. A. Collins, Information Counsellor-South African Embassy, Washington, D. C.: Letter; 21 October 1970.

[4]Ibid.

[5]Ibid. The description presented is to make clear any descrepencies between industrial categories. This study is not, however, a history of South African industry. An excellent description of industrial processes may be obtained from Gunnar Alexandersson, The Industrial Structure of American Cities (Lincoln: University of Nebraska Press, 1956).

The methods used in analyzing South Africa's urban system are widely accepted urban geographical methods. They have been tested by a number of urban geographers, and have been found to provide an accurate analysis of the economic structure. A number of methods have established that "excess" employment in any given urban area will represent the basic economic structure; that is, the part of the economy that renders urban areas viable by exporting goods and services. It is the expressed opinion of this study that the minimum requirements method[1] represents the best and most thorough technique for expressing the excess or basic employment of an urban area. An important aspect of the minimum requirements method is also utilized -- the specialization index. The specialization index relates the degree of diversification and specialization by utilizing the minimum percentages of each industrial category for each particular sample chosen. Also, the specialization index is invaluable in studying and analyzing the spatial distribution of specialized urban areas.

A second method (Nelson's multifunctional classification)[2] is used in classifying each sample area according to their functions. The second method is not redundant nor was it inten-

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[1]Edward L. Ullman and Michael F. Dacey, "The Minimum Requirements Approach to the Urban Economic Base", Papers and Proceedings of the Regional Science Association, Vol. VI, (1960), pp. 175-194.

[2]Howard J. Nelson, "A Service Classification of American Cities", Economic Geography, Vol. XXXI, No. 3, (July, 1955), pp. 189-210.

ded to be a check on the first. However, through comparison each method should readily compare with the other, i.e., the results of each should indicate the same structure and pattern. In utilizing Nelson's multifunctional classification as a second method, definite functional types are established. This does not detract from nor is it indifferent to the minimum requirements method of Ullman and Dacey. In fact, the comparison of these two methods will yield valuable data. When analyzed in conjunction, they will provide a clear and concise functional classification of South Africa's industrial-urban system as well as provide a total survey of the viability of the industrial-urban areas. Both methods will also provide interesting by-products, both quantitative and qualitative, that will be invaluable as aids in the analysis of the spatial distribution of functional types. The two methods mentioned above are quite obviously quantitative methods, and their quantitative nature is best described in their respective chapters.

Urban Pattern

Thus far this introduction has presented the actual nature of the study; in short, to introduce the analyses which will provide the results of the study. However, the introduction must also introduce the subject matter or urban system of South Africa. It would be impossible to begin a study of the urban system of the Republic of South Africa without first bringing attention to the world's foremost expert on the subject, R. J. Davies,[1] whose

[1]R. J. Davies is Professor of Geography at the University of Natal in Durban. He has published a number of articles concerning

work provides the basis for an introductory note concerning South Africa's urban system.

Central Places

Central places are the bases for development of an urban hierarchy and are the focal points of the service areas that they create. Based upon the premise of the central place as pioneered by Walter Christaller in his study of central places in southern Germany, a hierarchy of some nature may be established within every urban system. The above statement must be qualified. The central place system (although somewhat static)[1] in most cultures conforms to the theory developed by Walter Christaller.[2] The hierarchy develops not because different numbers of people congregate in different areas, but because each successfully larger place in the order performs added functions. The higher order places have a larger array of services. That is, the added functions will influence the smaller order areas, thereby increasing the range of services of the larger order areas. The result is a

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(Cont'd) South Africa as well as gathered field data for urban study. Davies is in the process of writing a series of publications through which the total urban structure of South Africa will be analyzed.

[1]The theoretical model developed by Christaller is static in that it does not recognize the time element. This is evidenced by the more heavily weighted settlement hierarchy of the eastern United States and eastern Brazil. Peter Haggett, Locational Analysis in Human Geography (New York: St. Martin's Press, 1966), p. 96. Based upon Haggett the urban hierarchy of South Africa would be more heavily weighted along the southern and southeastern coasts whereas the more recently settled interior (Rand) is still evolving within the urban hierarchy.

[2]Haggett, Locational Analysis, p. 51 and pp. 106-107.

hierarchy of focal points of service activities or a hierarchy of central places.

Urban Hierarchy

The existing urban hierarchy within any urban system is an important aspect of that urban system, but the urban hierarchy is not essential to the formulation and analysis of the economic structure or to the discovery of functional types of urban areas. It is necessary to discuss the urban hierarchy as a means of establishing a background for further analysis since the hierarchy is basic to uncovering the economic structure. For this reason the existing urban hierarchy of South Africa will be dealt with only by way of introduction as a basis for a more sophisticated study of the economic structure. The presentation of South Africa's urban hierarchy is based almost entirely on the hierarchy as developed by R. J. Davies.[1] Since the urban hierarchy is presented only by way of introduction, only the general methodology and end results will be necessary to establish the background.

Although Davies cites the classic work by Christaller, he relys more heavily upon the studies made by Berry and Garrison as can be evidenced by the use of the terms variate and attribute

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[1]R. J. Davies, "The South African Hierarchy", The South African Geographical Journal, Vol. XLIX, (December, 1967), pp. 9-12 and R. J. Davies and G. P. Cook, "Reappraisal of the South African Urban Hierarchy", The South African Geographical Journal, Vol. L, (1969), pp. 116-133.

functions.[1] The urban hierarchy is based upon twelve indices of central functions[2] which are divided into components of the variate or attribute functions. The method is further refined by assigning arbitrarily[3] weighted scores to each individual function. To find the centrality index, the weighted scores are merely summed.

The hierarchy itself is established by plotting on a graph the functional score in relationship to population. Davies then uses near neighbor analysis to establish eight separate orders of the hierarchy. Although a boundary between each of the eight orders had to be discerned, the establishment of these boundaries may be considered arbitrary in orders five to eight which quite naturally contain a great deal more urban places than the higher order places. It may even be stated that the urban hierarchy in South Africa is a quasi-continuum; that is, having easily discernable breaking points in the higher orders, but a continuum of places as the lower levels are approached.

The results of the established hierarchy are important, especially in the higher orders. When considering the hierarchy on the national level the results indicate the core-periphery

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[1]Variate functions are those of which more than one can occur in one area, and conversely attribute functions may occur only once in an urban area. Davies, "South African Urban Hierarchy", p. 10.

[2]Ibid.

[3]Davies states that the weighted score was derived after consultation with social scientists, government officials, and commercial institutions. Davies, "South African Urban Hierarchy", p. 11.

idea professed by many South African urban geographers, including Mallows.[1] Further, the cities of the fourth and fifth orders tend to be located within or contiguous to the Rand,[2] and the coastal Cape Province as well as the Durban areas.[3] This further establishes the core-periphery concept of South African urban places. It is also important to note that Davies associates the urban hierarchy of South Africa with the theoretical hierarchy established by Christaller. The three criteria which determine the spatial distribution as well as number and size of central places are: market, transport, and administrative functions.[4] According to these three criteria, central places arrange themselves in such a manner that k = 3, k = 4, k = 7 respectively.[5] Davies found that the urban hierarchy of South Africa had a very close resemblance to the k = 3 possibly indicating a lack of intense agriculture settlement.[6]

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[1]Mallows, "Urbanization in South Africa," p. 3.

[2]The Witwatersrand of the Southern Transvaal. This is the highly populated, highly industrialized mineral area of South Africa.

[3]Davies calls these urban areas Major Towns and Towns because as Davies relates, the common usage of terms such as village and other general urban terms did not develop in South Africa. Davies, "Urban Hierarchy", pp. 13-15.

[4]Brian J. L. Berry and Allen Pred, Central Place Studies: A Bibliography of Theory on Application (Philadelphia: Regional Science Research Institute, 1961), p. 16.

[5]k is a constant. The number of central places will increase by the constant value in each succeeding lower order of the hierarchy. Davies, "Urban Hierarchy", p. 17.

[6]Ibid., p. 18.

Davies followed up the above analysis later with a work in which he used more sophisticated methods. He increased the number of functions used to fifty-five.[1] The same process of computation was used and the same eight orders within the hierarchy were re-established.[2] The most important discovery made was that the increase in number of functions and the use of a more sophisticated method of classification did not change the previous urban hierarchy by any significant degree. Each order corresponded 75%[3] of the time with orders one, two and three corresponding 100%[4]. Also, the hierarchy remained more closely aligned with Christaller's k = 3 "market" function.

Davies' urban hierarchy of South Africa further demonstrates a set pattern of industrial-urban development. Also, the concept of core-periphery development is emphasized. The following chapter will deal with the development of settlement and a qualitative analysis of the core-periphery concept in providing a basis and background for the analysis of South Africa's economic structure of industrial-urban areas.

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[1] Davies, "Reappraisal", p. 118.

[2] Ibid.

[3] Order seven registered only 58% correspondence, but Davies suggests that a combination of orders seven and eight register a correspondence level of 92%. Davies, "Reappraisal", p. 120.

[4] Ibid.

Chapter II

Development of the Urban System and Relationship to the Settlement Pattern

The settlement pattern provides a basic background and understanding of today's industrial-urban arrangement in South Africa. This chapter examines the unusual method of settlement and therefore is most essential for an understanding of the urban system of South Africa. An account of settlement cannot be given without first introducing variables that have influenced the settlement patterns.

Physical Features

The Republic of South Africa extends from approximately 35° south latitude at Cape Agulhas (Africa's southernmost tip) to about 22° south latitude, with an area of about 472,359 square miles. The area is about five times the size of Texas. South Africa has about 2,000 miles of coastline, but there is no natural or even good harbor on the coastline. It should be noted that most of South Africa's river mouths are blocked by sandbars.

Physiography

South Africa contains three basic physical areas. A narrow coastal plain extends from the Cape Town area, where it is only about one mile wide, eastward then northeastward where it gradually widens to about sixty miles near the border of Mozambique.[1]

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[1]James Bryce, Impressions of South Africa (New York: The Century Company, 1900), p. 2.

The coastal plain quickly changes to a complex system of hills or low mountains usually ranging from 3,000 to 7,000 feet and thereby creating the second major region -- the Basuto Highland. From Cape Town the elevation increases in a northeasterly direction until heights of 10,000 and 11,000 feet are reached on the Highlands. The coastal side of these highlands is known as the Great Escarpment which runs virtually unbroken from Rhodesia to the Cunene River[1] (the border between Southwest Africa and Angola). In the Cape Province there is a system of coastal ranges paralleling the Great Escarpment, and here the coastal ranges are higher than the Great Escarpment. The third major area is one of plateaus. The Great Escarpment slopes rather gently to an interior plateau where the elevation varies from about 3,000-6,000 feet above sea level. This flat to gently rolling plateau may be divided into two parts. The prairie-like grassland area is known as the High Veld;[2] the Karroo[3] is a semi-arid, steppe area (Fig. 1.).

Drainage Pattern

A most important aspect of the physical geography and its relation to settlement and urban development is the drainage pat-

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[1] R. J. Harrison Church et al., Africa and the Islands (New York: John Wiley and Sons), p. 403. Actually from about Cape Town north to the Cunene River, the Great Escarpment is the edge of a plateau rather than a mountain range.

[2] A South African term referring to tableland or grassland.

[3] Originally from the Hottentot language, meaning dry or waterless.

PHYSICAL FEATURES

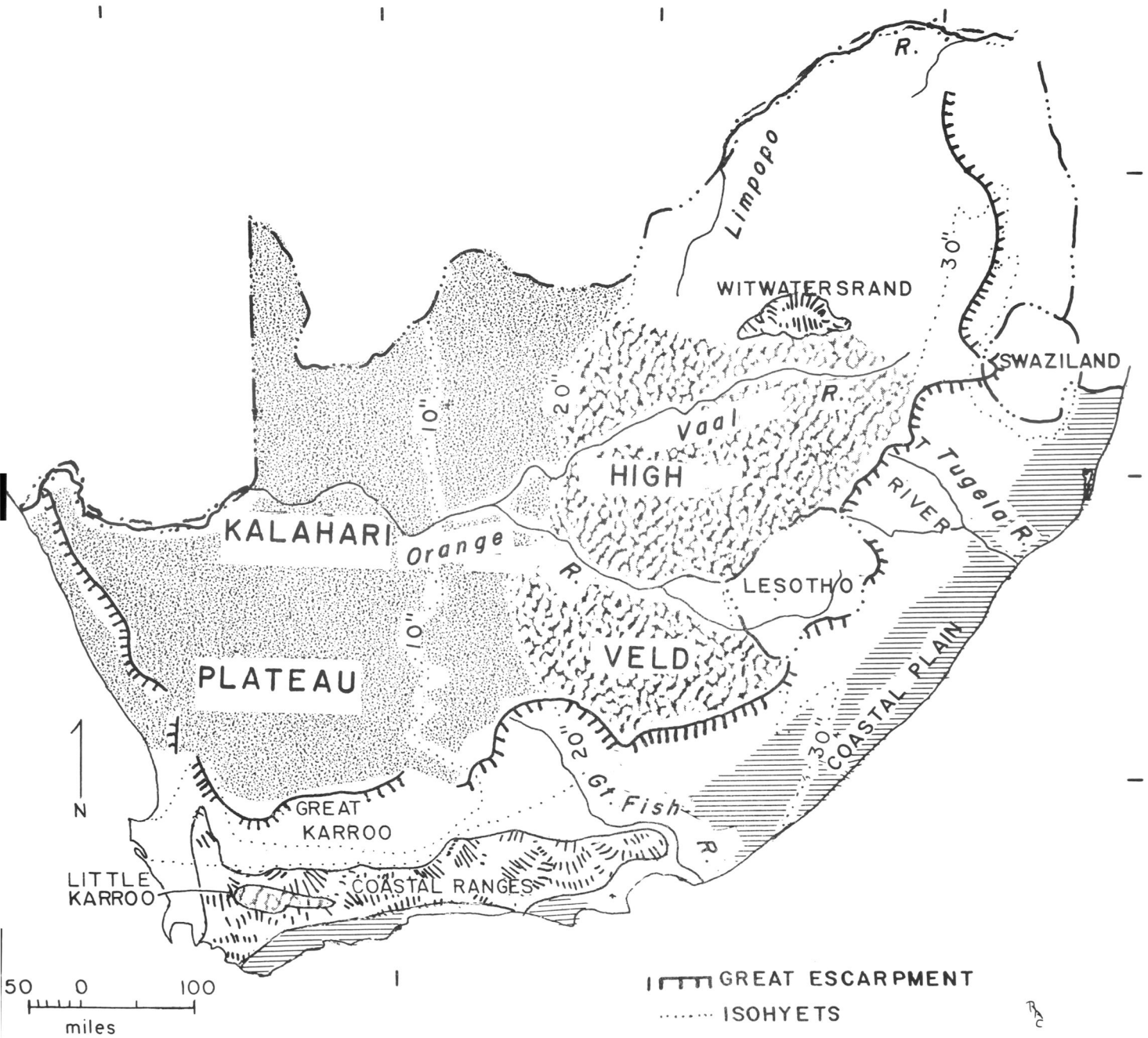

FIG. 1.

tern and the characteristics of South Africa's rivers. South Africa's rivers are not well suited for transport or for establishing an internal waterway system. None of the rivers are navigable because they are plagued by rapids and falls and the mouths are blocked by sandbars. Also, South Africa's rivers have erratic water flow; that is, they are either swollen or almost dry.

The drainage of South Africa may be divided into two major parts: the interior and the coastal. The interior plateau is drained by the Orange-Vaal system and the Limpopo system. The divide between these two drainage areas is the Witwatersrand.[1] The Orange-Vaal system rises close to the Indian Ocean but flows westward over 1,000 miles to the Atlantic Ocean, and has a drainage basin of over 300,000 square miles. The Limpopo drains the central and northern Transvaal. It flows almost 1,000 miles to the north, then northeast, then east through Mozambique into the Indian Ocean. The coastal area is drained by many short swift-flowing streams which tumble over the escarpment to the sea.

Climate

The twenty-inch isohyet is of considerable importance because it generally indicates the limit to which economically sound rain agriculture is practiced, and this was important to the early settlement of South Africa. Another factor regarding early settlement is the influence of the twenty-inch isohyet on grazing.

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[1]The term means "ridge of white water". (Fig. 1).

Less than twenty inches of precipitation necessitates more land for grazing to support each animal.[1] It should be noted that 64.7% of South Africa has an annual precipitation of less than twenty inches.[2] The eastern section of South Africa has the highest rainfall; winds blow from the Indian Ocean and create an orographic effect against the Great Escarpment. The west has a dry climate primarily because of the continental origin of the dry winds that blow over the area and because of the cold Benguela Current immediately off the coast of Southwest Africa.[3]

Early Southern Africa

A most important aspect, in fact a key to South Africa's settlement, is the settlement conditions which existed during the fifteenth century. Some European explorers had landed on South Africa's coast (1498), but only for provisions and stores. No main wave of Bantu had migrated south of the Limpopo River which is the present boundary of South Africa. Both European and Bantu

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[1]William A. Hance has suggested that in South Africa the thirty inch isohyet assumes the basic characteristics of the twenty inch isohyet because of the great amount of evaporation. It should be noted that 89.8% of the country has annual rainfall at less than thirty inches. William A. Hance, The Geography of Modern Africa (New York: Columbia University Press, 1964), p. 543.

[2]John W. Wellington, Southern Africa: A Geographical Study Vol. 1 (Cambridge: At the University Press, 1955), chart, p. 239.

[3]The Benguela Current is paramount in creating the extremely dry Namib desert which is limited to the extreme southwest area of Southwest Africa.

(South Africa's major ethnic elements) arrived at opposite borders of what is now South Africa at approximately the same time. This means that neither of these groups is able to lay claim to South Africa as a whole.

Hottentots and Bushmen

Pre-European-Bantu South Africa was not totally uninhabited. Originally Bushmen[1] had inhabited much of South Africa, but had become more localized with the appearance of the Hottentot.[2] The more culturally advanced Hottentots drove the Bushmen into the more arid, less desirable Southwest Africa. Therefore, it was the Hottentot who inhabited South Africa when the European first established permanent quarters at the Cape of Good Hope, and it was the Hottentot who retreated southward before the migrating Bantu from the north.

Cape Coloured

When the Europeans first attempted to settle at the Cape in 1652 (Cape of Good Hope), their numerical inferiority made it

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[1]The Bushmen is a primitive hunter and gatherer today occupying the arid regions bordering between the Kalahari plateau and the Namib desert in Southwest Africa. The pure Bushmen number less than 100,000. He is not Negroid, but instead has features which do not place him in one of the three major races. Most anthropogeographers agree that the Bushmen is an ancient mixture or the remnant of an ancient race.

[2]The term Hottentot is thought to be derived from the Dutch Hüttentut, meaning stutterer and so applied because of the "clicks" in the Hottentot language. John W. Wellington, South Africa: A Geographical Study, Vol. II (Cambridge: At the University Press, 1955), Footnote, p. 234.

essential to establish and maintain friendly relations with the Hottentots. The inevitable result was a mixed group of people referred to as the Cape Coloured. Miscegination became quite common when slaves were brought to the Cape Colony, primarily from East Africa and the holdings of the Dutch East India Company[1] in the East Indies. Although marriage between races was outlawed in 1665, miscegination continued. Today the Cape Coloured element is most important in the southwestern Cape Province, especially, in and near Cape Town. The Cape Coloureds have historically been farmers and the urban Coloureds were primarily artisans. However, the middle class status of the Cape Coloureds has been lowered somewhat in recent years.

Bantu[2] Migrations

The Bantu began migrating southward probably from the Lake Victoria area in East Africa at some early date in history. The reasons may be many[3], but there seems to be one paramount reason: population pressure from other groups of people or population

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[1] The Dutch East India Company was the owner of the Cape Colony. The Company had established the colony in 1652 as a half-way port-of-call between the East Indies and the Netherlands.

[2] The term Bantu means people and simply indicates a linguistic difference, but usually refers to a broad division of the Negro race inhabiting East and Southern Africa.

[3] One author hypothesizes that the introduction of forest crops was a definite factor in the southern expansion of the Bantu.

pressure from within.[1] It is thought that the Bantu first appeared at the Zambesi River around 5,000 B.C. Migrations increased from East Africa, and the population pressure became greater causing more southward migrations. By the first century A.D. these southern migrations had peopled almost the entire area between the Zambesi and the Limpopo Rivers. By the ninth century A.D. the Bantu had migrated into areas south of the Limpopo River or what is now the present day areas of the northern and eastern Republic of South Africa. At some time between 1300 A.D. and 1500 A.D., a vanguard of the Bantu had reached as far south as today's province of Natal situated in the southeastern portion of South Africa.[2]

It should be noted that all of the Bantu migrations were channeled into the eastern area of South Africa primarily because it is well-watered and afforded better grazing for the pastoral Bantu. It can also be noticed that the migrations, although in waves, took an average of 5,000 to 7,000 years.[3]

Although the majority of migrations into South Africa had

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[1]B. W. Hodder and D. R. Harris, eds., Africa in Transition: Geographical Essays (London: Methuen and Company, Ltd., 1967), p. 299.

[2]Gwendolyn M. Carter, ed., Five African States: Responses to Diversity (Ithaca, New York: Cornell University Press, 1963), p. 472.

[3]An important point concerning the Bantu and Bantu migrations is the contact with Arabic peoples. The contact is certain, but the date of contact is not. Some authors hypothesize ca. the eighth century A.D. The contact most likely occurred three to four centuries before this. The contact led to the Arab slave trade which accounts for another important catalyst of the Bantu migrations.

ended by the late sixteenth century, some groups continued their migrations into South Africa until the late eighteenth century. After the migrations into South Africa had been completed another type of migration began. This was the chaotic inner migration of the eighteenth century created by the development of military native states of which the Zulu was the most prominent. During the early part of the eighteenth century, whole tribes were displaced or re-aligned because of warring factions.[1] Immediately following the period of inter-tribal warring came the struggle of the Zulu against the Dutch element of the Cape Colony. Both periods were extremely chaotic, and the implications are still being felt in South Africa today.

European Settlement[2]

It is the European settlement that has been responsible for the establishment of South Africa's present industrial-urban areas. The European settlement must be presented in three phases.

The Cape Colony

This phase of settlement includes both the period of Dutch settlement of the Cape Colony, and that of the British. Prior to

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[1]Monica Cole, South Africa (New York: E. P. Dutton and Co., Inc., 1961), p. 92.

[2]European settlement in South Africa is very complex. In only a few areas in Africa other than South Africa was settlement seriously attempted. Not only was there the conflict of Bantu and European, but also the conflict of two groups of Europeans. Even in British East Africa where settlement was attempted, there was an absence of two opposing European groups.

the British acquisition of the Cape, the Dutch East India Company governed the colony. It did so with a policy of non-immigration at first which was not profitable. Later a new policy of immigration, primarily from the Netherlands, tended to increase migration activities to the interior. A part of the new immigration was made up of French Huguenots (French Protestants).[1] The French Huguenots were settled in three separate places although the entire party of French Huguenots numbered only 150. The purpose of this action was to obtain complete assimilation. The assimilation was successful because after a short time only French surnames indicated any previous French settlement. It is this first initial interior migration that established the passes and trails used by the later migrations to the interior. The first migrations created an isolated, rural, pastoral group (the Boers or Dutch Farmers) of people that later played an important part in the interior development of South Africa. The Dutch East India Company, which was waning, had no choice but to keep extending frontier boundaries to restrain the migrating people within the jurisdiction of the colony. These extensions were not very successful, because the frontier people did not consider themselves under the jurisdiction of the colony. By the end of the eighteenth century, the Cape Colony had become rather densely

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[1] In the 1680's Cardinal Richilieu of France had revoked the Edict of Nantes (ending religious tolerance), and the French Protestants immediately fled to Holland. From Holland some of the French Protestants migrated to South Africa.

settled from the Orange River to the Great Fish River.[1] As the colony became settled, more migration continued into the interior. They were out of the jurisdiction of the colony.

The British element had a profound influence upon the settlement of South Africa. With the defeat of Napoleon in Europe, Great Britain acquired the Cape Colony.[2] The establishment of the British in South Africa was bitterly resented by the Dutch who considered the British as foreign invaders. Also, the British had a great deal more capital with which to operate the colony. The new British government immediately extended control over the frontier Dutch, who had previously been isolated and under the nominal jurisdiction of the Cape Colony.

During the first years of British Rule (1800-1820) immigration by the British increased considerably, and thereby heavily populated the colony. A new type of settlement began under the auspices of the British government in the Cape Colony. Many settlers became established on the frontier to act as a buffer against the Bantu thereby reducing the cost of garrisoning troops. As a result, there was a deviation from the earlier haphazard isolated type of settlement and settlements were made in close proximity. This pattern resulted in many small urban

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[1]It is at the Great Fish River that the main migrating European element first came into contact with the main element of the Bantu.

[2]Napoleon had conquered the Netherlands and had established the Netherlands Republic causing the Dutch monarch to take refuge in Great Britain. The Dutch Cape Colony elected to remain loyal to the newly established Netherlands Republic. With Napoleon's defeat, the Cape Colony became British.

centers in the southeastern Cape today.

The high rate of British immigration placed the British in the majority in the Cape Colony. They attempted to Anglicize all aspects of daily activity in the colony by establishing the English language as the official language. Anglicization and the new settlement policies, which were aimed at controlling the Dutch element, increased the bitterness and tension between the British and Dutch until only a catalyst was needed to produce some sort of reaction.

The Great Trek[1]

Differences between the Dutch and British had developed to such a degree that either rebellion or migration were inevitable. It was probably a wise decision that the Dutch chose the latter. With migration the Dutch had to deal with the less formidable Bantu. It should be noted that the various routes of each "trek" that occurred were not haphazard, but were fully planned and had been checked by scouting.

The decision to migrate to the interior came after a series of events. The British had developed a policy of liberation and toleration to the Bantu, Anglicization increased, and the policy of free land grants was ended. Finally, the freeing of slaves[2]

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[1]Trek refers to more than a journey. A trek is total movement, never intending to return to the point of origin.

[2]The freeing of the slaves caused formidable economic problems. Generally speaking, the slaves after acquiring their freedom were landless and lacked any source of capital. The solution sought by the newly freed slaves was to migrate to the cities to find work, but instead many became vagrants because of the lack of jobs.

coupled with a series of droughts[1] initiated the Great Trek to the interior of South Africa. During a period of four years (1836-1840) over 10,000 people trekked into the interior.[2] The Great Trek was made up of a number of groups which settled different parts of the interior.[3]

The Great Trek resulted in the settling of the present areas of the Orange Free State, and the Transvaal. The Dutch element that settled these areas was rural and did not care for outside intervention. Also, the major parties of the Great Trek demonstrated their desire for isolation by establishing four republics north of the Vaal River (Transvaal).[4] Later, these four republics evolved into what is now the Transvaal Province of the Republic of South Africa; until the defeat of the Boers in 1902 it was known as the South African Republic. The South African Republic was by nature an agrarian society with no desire for any outside contact, but a role of isolation could not exist indefinitely.

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[1]Sheila Patterson, The Last Trek: A Study of the Boer People and the Afrikaner Nation (London: Routledge and Kegan Paul, Ltd., 1957), pp. 192-193.

[2]Eric A. Walker, A History of South Africa (London: Longman's Green, and Company, 1935), p. 207.

[3]One group split from the main stream and attempted to settle in Natal because it was not a British colony. The result was a long period of conflict with the Zulu ending in the demise of the Zulu militaristic state. The area was not inhabited long by the Dutch because they were forced to trek to the interior again when the British annexed Natal.

[4]Utrect, Lydenburg, Zoutpansberg, and Potchefstroom.

Diamonds and Gold

The third phase of South Africa's settlement began in 1867 with the discovery of diamonds. During this phase of settlement activities were more rapid than during the two previous periods; because mining towns developed out of chaos. Nevertheless, there was laid a basis for industrial development.

By 1869 a diamond rush to the northern Cape Province and western Orange Free State had begun. People from all over southern Africa and the world streamed to the diamond fields. The mining towns developed in a haphazard manner; and construction consisted mainly of tents and structures built from corrugated metal. Living conditions in the mining towns were rather primitive and crowded. After the initial fever of the strike, many of the diamond towns developed into regional and local service centers. Kimberly became the largest in population.

Within five years of the first diamond strikes, more people had settled in the area than in thirty years of trekking to the interior. The people came in waves: first the miners, then the Bantu seeking work and then the financiers and shopkeepers. Most importantly is that the discovery of diamonds, and later other minerals, destroyed completely the rural isolation enjoyed by the Afrikaaner Dutch. The rural agrarian society had an incipient urban society imposed upon it.

Gold had been discovered in the eastern Transvaal near Swaziland in 1873, but the quantity was small. In 1885 the richest gold deposits in the world were discovered in the

Witwatersrand of which Johannesburg[1] today is the focal point. The reaction resembled that of the diamond strikes, but the magnitude was many times greater. By 1890 there were over 100,000 English-speaking people in Johannesburg alone. The gold strikes ended any vestiges of isolation or agrarian society. The financially failing South African Republic of the Transvaal became wealthy and a base for industrial development was laid.

Transportation

It is important to note that South Africa was settled before an efficient means of transportation had been established. The Great Trek had been completed by 1850 and the initial phases of the diamond strikes all took place without the railroad. Prior to the 1860's the railroad did not exist in South Africa.[2] This means that South Africa was settled entirely by people in wagons drawn by oxen and had it not been for the Great Trek or the discovery of diamonds and gold, the settlement of the interior no doubt would have taken much longer.

Settlement by inland waterways was impossible in South Africa because of a lack of navigable rivers or lakes. It is entirely possible that the interior would have developed commercially much sooner had access to the interior been easier. The lack of trans-

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[1]Before the gold strikes Johannesburg was a small village of 100 inhabitants, and it was 300 miles from the nearest railroad. Hedley A. Chilvers, The Seven Wonders of Southern Africa (Johannesburg: Administration of the South African Railways and Harbours, 1929), p. 44.

[2]The railroad was pioneered in the United States and Europe in the 1840's.

portation connections to the coastal cities can account for the degree of political and social isolation attained by the Dutch prior to the diamond strikes.

Railroads

There was a lack of railroad development in South Africa prior to the mineral strikes because there was no excess of commodities to export. It was not feasable to develop a fast efficient means of transport because the agricultural supplies were grown near the coastal market areas. This means that each port city had its own hinterland. Therefore, there was no reason to connect the port cities with transportation routes. More importantly, the lack of an excess of any profitable commodities in the interior indicated an advanced subsistent type agriculture.

Although the railroad had been introduced a few years before 1867 (the year diamonds were discovered) financial failings necessitated the complete governmental control of railways. With the diamond discoveries in the northern Cape Colony, the railroad immediately began to transport supplies to, and diamonds from, the diggings. However, it was not until the discovery of gold in 1885 in what is now the southern Transvaal that South Africa's rail development began in earnest. Traffic was increased on the existing Cape line and two less important lines from Port Elizabeth and East London were developed. The Cape line passed through the Orange Free State to the gold fields and developed a

rail system in the Orange Free State. Also, competition began with the development of a rail line from Durban to the gold fields.[1] The rail line from Johannesburg to Lourenço Marques in Mozambique was successfully completed because of special sanctions given to it by the South African Republic. The rail lines mentioned above became the main trunk lines of South Africa's railway network. A period of very intense competition existed until the outbreak of the Boer War.[2] The Cape and Natal lines suffered greatly because of the rates charged by the South African Republic of the Transvaal government.[3]

After the Boer War (1902) there was no longer any one sided competition[4] because the two Boer[5] republics became Crown Colonies. The high value of commodities brought from the Rand[6] allowed the rail lines to subsidize the improvement and penetration of railways into agricultural regions thereby improving South

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[1]The Durban line was shorter and not subject to the political restrictions of the Orange Free State.

[2]The Boer War was basically a result of Dutch resentment of British interference in the affairs of the South African Republic.

[3]Cole, South Africa, p. 482.

[4]Prior to the Boer War (1902) the two British Colonies (Cape and Natal) had to compete with a railroad from Johannesburg to Lourenço Marques which was subsidized by the South African Republic.

[5]Boer is a term referring to the Dutch element of South Africa's rural population. It literally means farmer.

[6]Short term for Witwatersrand located in the southern Transvaal.

Africa's agricultural output and market relations.[1] Increased railway development resulted in nodal development which was most pronounced in the central Rand. The lines branching out from the Rand railway node created more interaction between markets.

Ports

South Africa's ports are all man-made, and South Africa's coast affords no natural protection or natural harbours. It should be noted that the establishment of South Africa's ports as modern manufacturing and trade centers is directly related to the extraction of mineral deposits in the interior which is consistent with the core-periphery theory of development. In many instances the ports act as thoroughfares or as intermediaries for the Rand interior-industrial region.

Road and Air Transport

The highway as a means of transport has not been developed in South Africa until recently. Even today the development of motor transport is retarded because of the high degree of emphasis historically placed on rail development, and because of government ownership of all transportation systems. Motor transport never developed to a great degree in South Africa because the very existance of the railway depended soley upon the carriage of great quantities of valuable commodities.[2] For

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[1]Hodder, Africa in Transition, p. 340.

[2]Cole, South Africa, p. 493.

this reason the South African government has restricted motor trade, and has allowed it to develop only to augment the railway, that is to haul products (mostly agicultural) from areas that are too small or areas that are uneconomical to serve by rail. It is true that the majority of South Africa's industrialized society has created markets for finished products. The problem of supplying South Africa's markets with finished products could best be solved by the more mobile and versatile truck, and the railway at this time would most probably not be damaged.

It is perhaps too early to realize the impact of air transport in South Africa. It is increasing and becoming a necessity because of the vast distances between South Africa's industrial base and the industrial bases of Europe and the United States. Even so South Africa has only one international airport situated approximately half-way between Johannesburg and Pretoria.

Industrialization

Most authorities agree that South Africa's industrial revolution occurred between 1930 and 1950.[1] During the period of industrialization South Africa also became an urbanized society. The urbanization might be construed as a second Great Trek because the Dutch[2] and Bantu have migrated to the city.

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[1]Jan H. Hofmeyer, South Africa (London: Ernest Benn Limited, 1931), p. 231.

[2]The Dutch made up the rural segment of European population.

South Africa's industrialization has tended to follow two main patterns. The interior industrial centers are either based upon mining or located in service centers which draw upon mining. Along the coast the manufacturing is located in the larger urban areas because of port facilities and an abundance of labor and capital.[1] Again this is in keeping with the core-periphery theory of development.[2]

Bantu Homelands

A paradox exists today in South Africa. The Bantu are migrating to the city, yet the government is advocating the policy of Bantu Homelands. The Bantu are asked, in fact compelled to return to designated Bantu Homelands which are based upon the tribal structure. The paradox lies in the fact that the urban Bantu is becoming detribalized while tribalism is being emphasized in the Bantu Homelands.[3] The Bantu Homeland concept

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[1]This does not include the government policy of "border industries". Border industries are those industries re-located on the predominantly non-urban borders of Bantu Homelands, areas designated as original homelands of the Bantu, to tap cheap Bantu labor. Border industries may be found on the international border of Lesotho for the same reason.

[2]T.J.D. Fair, "Core-Periphery Concept and Population Growth in South Africa, 1911-1960", The South African Geographical Journal Vol. XLVII, 1965, pp. 59-71.

[3]The Bantu Homeland, also referred to as the native reserve, is in keeping with the South African government's policy of apartheid or separate development. Each Bantu Homeland eventually should receive near total autonomy with the exception of international affairs.

is an elaborate scheme which extends spatially in a horseshoe pattern from Natal through the Transvaal to the border of Botswana.[1]

The first and most successful Bantu Homeland is the Transkei which is situated in the eastern Cape Province. A certain degree of autonomy has evolved, but the Transkei must let South Africa manage all external affairs and many internal affairs.

The Bantu Homelands, and the urban Bantu are important elements in South Africa's economic structure. The Bantu provide both cheap industrial labor and a large portion of the Bantu are of a subsistence nature. The subsistent Bantu play a major role in determining South Africa's industrial-urban economic structure because the subsistent Bantu make up an abnormally high part of the total labor force.

Summary

The physical features presented a problem to the early South African settlers. Expansion to the interior was impeded by the complex coastal ranges. After crossing the coastal ranges, their rainshadow or the great and little Karroos, are encountered. Penetrating still further inland, the most formidable barrier of all is encountered: that of the Great Escarpment which rims all

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[1]Peter Scott, "The Bantu Areas of South Africa", Geographical Review (Record), Vol. LXVII, No. 3, (July, 1957), p. 432.

of South Africa except to the north.[1] After attaining the interior region mobility is relatively simple because the interior plateau is flat; however, semi-arid conditions impeded the movement on the interior plateau because of a lack of water and vast distances.

Once the Dutch had reached the interior they did not become farmers, but instead became pastoralists. There are many reasons for the conversion. The interior plateau was too dry for agricultural practices; at least agricultural practices familiar to the Boers. Also, agriculture did not develop in the interior of South Africa because inland water routes for the transport of agricultural commodities did not exist. Also, the lack of markets and the scarcity of capital were factors.[2] All of these reasons discouraged agricultural development, and encouraged a rural pastoral isolated society. The pastoral and agricultural activities developed on the family level, and there did not develop a sound agricultural base of agricultural centers. The family farm was the basic unit of development and not the village. In fact the agricultural base in South Africa was not created until the demand of urban centers created them.[3] It was the discovery of minerals that destroyed the existing rural society and

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[1]Many times the voortrekkers had to dismantle their wagons in order to mount the escarpment.

[2]N. C. Pollock and Swanzi Agnew, An Historical Geography of South Africa (London: Longman's Green, and Company, Ltd., 1963), pp. xiv-xv.

[3]R. J. Davies, "The South African Urban Hierarchy", p. 8.

replaced it with an industrial society based upon minerals.

The core-periphery theory exists because of the isolation of the interior. The southern Transvaal-Rand regions developed rapidly into a highly urbanized and highly industrialized area; the coastal area developed gradually over a period of two centuries. The core-periphery theory is emphasized by the urban-industrial void between the coast and the Rand. This is a direct result of the isolation of the early rural settlers and the discovery of minerals in the southern Transvaal.

It is known that interaction in geographic space takes place along transportation routes or that interaction occurs thereby creating a need for transportation routes. Therefore, it is the transportation route that channels the interaction between the Rand and the coastal area. The main instrument that focuses this interaction is the railway. The railway is the only modern, well developed means of transportation in South Africa. The by-product of mineral exploitation was industrialization and it is this that gave rise to urbanization. It is now possible to study in detail South Africa's urban-industrial economic structure using this background provided as a basis for reference.

Chapter III

URBAN SPECIALIZATION, DIVERSITY, AND ECONOMIC BASE OF THE MAGISTERIAL DISTRICTS

It is apparent that South Africa is an anomaly on the African continent in that it has become highly industrialized in the past forty years. South Africa's industrialization has led to rapid urbanization which has had far reaching effects. The task of this study is to provide a classification of South Africa's urban areas, many of which are the result of, or are directly related to rapid industrialization and urbanization.

Definition of Economic Base

South Africa's urban areas are economically viable. The basic economic activity refers to all activities that bring money into a city and is the basis of a city's viability. On the other hand, nonbasic activity is that which is associated with the internal economic structure and is dependent upon the basic components. The basic-nonbasic concept of the economic structure of cities is not sufficiently precise for classification of cities.

Methodology

A number of methods have been devised for the study of a city's economic structure. More than one method has been developed because of the subjectivity in establishing the set of criteria for basic economic activity. The following methods are the most accepted for determining a city's economic structure.

Alexandersson's Method[1]

Alexandersson's method was simply to determine the city-forming (basic) activities by determining the city-serving (non-basic) activities and establishing a ratio. Alexandersson found what he determined to be the boundary between city-serving and city-forming activities, and he labeled this ratio or boundary the *k* value. Alexandersson states: "the *k* value represents that ratio necessary to supply a city's own population with goods and services of the type which are produced in every normal city."[2] Alexandersson's *k* value is further based on a national standard in the United States. The *k* value is a percentage located in the fifth percentile of each industrial category used. The fifth percentile was chosen as the bare minimum of city-forming activities, and was tested along with the first percentile in actual city structures.[3] After testing, Alexandersson arrived at the fifth percentile for the minimum city-forming activity. Further, the *k* value is a constant, but does vary because of regional differences in the United States, differences between urban and rural areas, and because of the influence of sporadic activities.[4]

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[1] Alexandersson, *Industrial Structure of American Cities*.

[2] *Ibid.*, p. 17.

[3] *Ibid.*, pp. 17-18.

[4] *Ibid.*, p. 20. Sporadic refers specifically to city-forming activities, whereas ubiquitous activities are both city-forming and city-serving.

Morrissett's Method[1]

Morrissett essentially elaborated upon the classification method established by Alexandersson. The summation of the k values is interpreted to represent that percentage of a city's labor force that must be employed to make a city economically viable.[2] Morrissett increased the size of the population categories[3] and found that the k value did increase with city size, but the larger the size the greater the increase of the k value. Consequently, functions that were sporadic in small cities became ubiquitous in large ones.[4] An important difference between Morrissett's and Alexandersson's study is that Morrissett defined the difference between ubiquitous and sporadic activities in a quantitative manner. If a city's k value is less than one-fourth the national percentage in the same industrial category, the industry is ubiquitous.[5] By establishing the quantitative definition, Morrissett is able to characterize each of his population classes and cities as either sporadic or ubiquitous

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[1]Irving Morrissett, "The Economic Structure of American Cities," Papers and Proceedings of the Regional Science Association, IV., 1958, pp. 239-256.

[2]Ibid., p. 241.

[3]Morrissett also divides his study into the northeast and southwest (because the industrial structure of these two "regions" differs greatly), but both categories have the same population classes.

[4]Morrissett, "Economic Structure of American Cities,"p. 245.

[5]Ibid.

in each of the various industrial categories. The k value is also put to use to indicate the diversification of a city by employment-ratios.

Method by Ullman and Dacey[1]

Ullman and Dacey use raw employment figures which are converted to percentages of the labor force employed in a given number of functional categories. The minimum percent of the labor force employed in each category is a quantitative statement of the minimum percentage required to maintain an urban area economically or to make an urban area economically viable. The minimum percentage is used rather than a percentile (as used by Alexandersson and Morrissett) because it more accurately represents the internal economy[2] of an urban area.[3] Also, fewer areas were omitted (except where unavoidable) because the economic base would be distorted. The core of the minimum requirements method, as in any classification system, is the theme that the minimum requirements should represent the nonbasic economic activity, while all employment greater than the minimum re-

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[1]Ullman and Dacey, "The Minimum Requirements Approach to the Urban Economic Base", pp. 175-194. This is the most recent and most objective method to determine an urban area's economic base.

[2]This is synonomous with nonbasic economic activity, city services and Alexandersson's city-serving functions.

[3]Also, as stated by Ullman and Dacey, when the second lowest minimum was calculated the increase was consistent. Ullman and Dacey, "Minimum Requirement", p. 179.

quirement[1] should represent the basic economic activity. The fact that the basic-nonbasic ratio is easily obtained by this method should not detract from the other assets of the method which will be discussed later.

The purpose of the above discussion is twofold. Primarily, the discussion introduces and provides a background and basis for the purpose and nature of this study. Secondly, the discussion can provide insight into the literature of urban geography.

Method Employed

It is the purpose of this study to apply the minimum requirements method to a classification of the industrial-urban areas of the Republic of South Africa. South Africa's anomalous situation on the African continent is directly related to its peculiar development and its physical geography, both of which were paramount in the rapid industrialization of South Africa. It is felt that the industrial structure of South Africa merits a sophisticated method of analyzing the urban areas which is the result of industrialization. For this reason the minimum requirements method was chosen to analyze South Africa's urban economic base.

Selection of Sample Urban Areas

A lack of industrial employment data for each individual city necessitates a classification based upon magisterial districts. This should not be interpreted as a disadvantage or as detracting from the validity of the findings. Although con-

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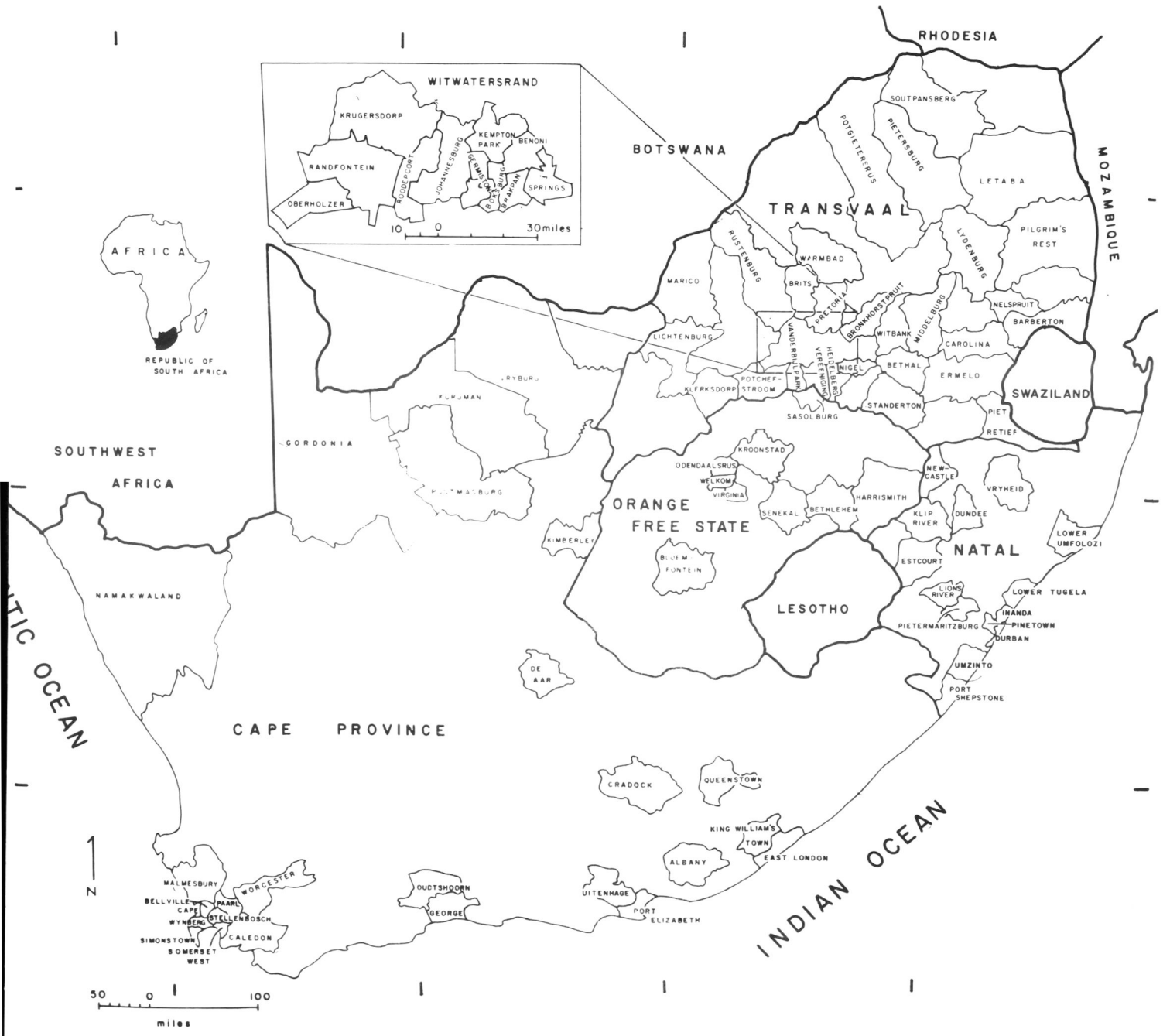
[1]Termed by Ullman and Dacey the "excess employment".

BASE MAP OF THE REPUBLIC OF SOUTH AFRICA



taining rural population, most of the magisterial districts used have more urban than rural population. The study, based on the magisterial districts, yields results for cities, their urban areas, and their immediate service areas.[1]

These magisterial districts are subdivisions of sixty-seven Economic Regions. The sixty-seven Economic Regions are further sub-divided into three-hundred and one Magisterial Districts.[2] In an urban study only those urban magisterial districts are desired. A number of methods were tested to arrive at those districts that would best illustrate South Africa's urban economic base. The criterion established to delimit the magisterial districts was that each district must have a labor force of at least 7,500[3]. Any number lying between 5,000 and 10,000 would be valid; therefore, 7,500 was selected. Also, 7,500 was utilized because a natural break occurred at this level. Based upon the above criterion, there are eighty-eight magisterial districts which are analyzed according to their functions

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[1]This problem is by no means unique. There are many instances where industrial employment data is not available or complete and county data must be used. In the example of South Africa, it is suggested that the magisterial district is a more refined measurement than the county; or perhaps even than the United States township level.

[2]South African Bureau of Statitics, Population Census, (September, 1960), Vol. VII, No. 2, p. xiii.

[3]This figure was arrived at by subtracting those employed in agriculture as well as those not economically active. By subtracting these two categories a number was derived which better served as a criterion for an industrial classification as a great number of South Africa's Bantu are listed in these two categories.

TABLE 1. Labor Force & Population of Magisterial Districts[1]

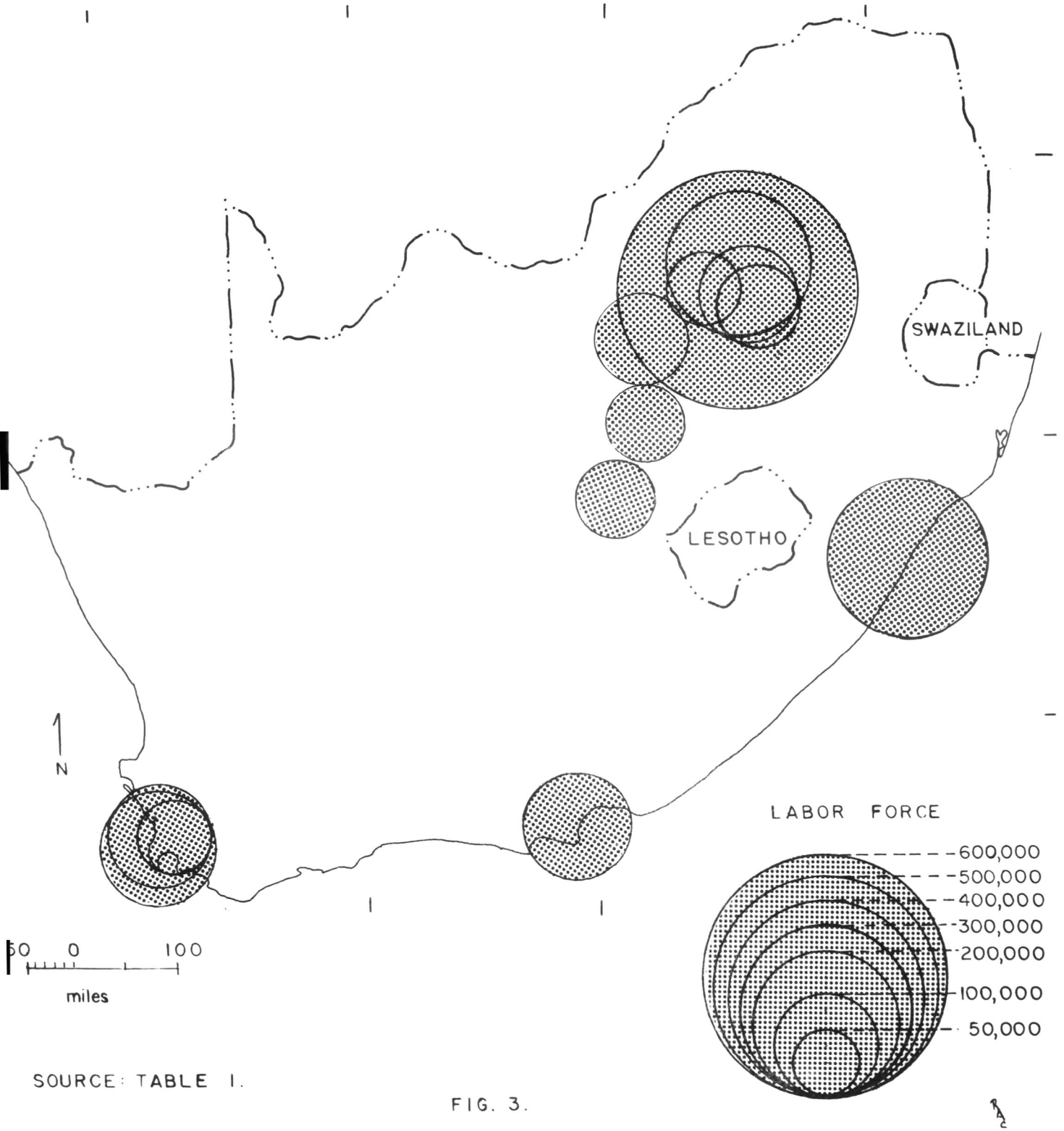
District	Labor Force	Population
Johannesburg	542,294	1,137,806
Durban	263,606	607,864
Pretoria	208,620	454,222
Wynberg	135,884	342,298
Port Elizabeth	120,801	306,512
Cape	114,852	254,471
Germiston	107,986	143,769
Klerksdorp	90,875	159,143
Springs	82,198	141,943
Welkom	70,531	102,731
Bellville	65,898	181,324
Roodepoort	65,840	121,185
Bloemfontein	64,830	168,444
Benoni	59,150	136,683
Vereeniging	58,598	161,198
Krugersdorp	56,521	114,457
East London	56,004	173,668
Pietermaritzburg	54,929	171,308
Brakpan	42,468	78,324
Randfontein	41,251	80,498
Oberholzer	41,124	63,334
Boksburg	40,003	75,049
Rustenburg	38,315	115,045
Kimberly	33,918	88,671
Witbank	32,212	90,246
Virginia	30,950	47,121
Pietersburg	25,619	243,213
Pinetown	23,648	74,762
Kempton Park	23,401	51,020
Paarl	22,293	66,549
Nigel	22,192	49,574
Inanda	21,767	82,999
Potchefstroom	21,491	82,841
Uitenhage	21,232	69,213
Bethal	20,865	75,427
Newcastle	20,815	52,623
Kroonstad	20,787	78,625
Sasolburg	20,252	39,854
Odendaalsrus	19,612	38,012
Vanderbijlpark	19,463	52,743
Soutpansburg	19,407	154,865
Vryheid	18,971	74,186
Worcester	18,157	68,236
Middleberg	17,922	88,809

TABLE 1. Continued

District	Labor Force	Population
Letaba	17,150	184,613
Ermelo	17,001	83,987
Stellenbosch	16,550	54,423
Klip River	16,394	81,163
Queenstown	15,725	65,707
Lydenburg	15,634	129,385
Potgeitersrus	15,279	174,142
Standerton	15,266	73,950
Nelspruit	15,205	56,840
Lower Tugela	15,103	93,964
Umzinto	14,549	114,290
Bethlehem	14,488	59,829
Heidelberg	14,311	24,127
Port Shepstone	14,171	83,756
Dundee	14,085	39,433
Namakwaland	13,777	43,825
Lichtenburg	13,736	68,790
Barberton	13,531	85,151
Albany	13,521	59,273
Pilgrim's Rest	13,324	116,530
Somerset West	13,222	19,921
Gordonia	13,168	72,728
Vryburg	12,943	83,894
King William's Town	12,653	92,046
Estcourt	12,632	62,205
Harrismith	12,086	73,255
Postmasburg	11,566	30,972
Simonstown	11,349	29,118
Lower Umfolozi	10,715	69,249
Kuruman	10,476	51,332
Bronkhorstspruit	10,117	36,147
Oudtshoorn	9,910	43,441
George	9,760	38,676
Malmesbury	9,734	43,632
Piet Retief	9,711	63,616
Caledon	9,617	35,725
De Aar	9,524	17,165
Carolina	8,827	32,401
Brits	8,650	68,187
Marico	8,595	69,179
Lion's River	8,370	35,104
Senekal	7,959	40,234
Craddock	7,857	35,804
Warmbad	7,808	69,239

[1]The figures in this table represent an adjusted labor force which was obtained by subtracting those individuals employed in agriculture and those individuals economically inactive from the total labor force in each magisterial district.

EMPLOYED URBAN LABOR FORCE BY DISTRICTS — 1960



SOURCE: TABLE 1.

FIG. 3.

and their levels of diversity and specialization.[1] (Fig. 3.)

Minimum Requirements Established

The basis of the classification must state the method by which the minima are determined. The classification can then be tested with individual samples. The procedure for establishing the excess employment for each magisterial district follows. After determining this excess employment, a district's economic structure may be identified.

Population Categories

The population categories for the magisterial districts had to be chosen before the minima could be identified. Total population of each of the eighty-eight magisterial districts was the criterion used to determine the population classes. An immediate

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[1] Contained within these eighty-eight magisterial districts are notable urban exceptions; however, it must be remembered that these exceptions do meet the 7,500 labor force requirement. Forty-five districts have a higher rural population than urban. This figure is actually lower than expected because of the size of most districts. It should be remembered that a magisterial district could be compared to a township in the United States. Thirteen districts have less than 10,000 (a standard guideline) labor force. Twenty-three districts do not have cities of 10,000 population. However, this is misleading because contained within these districts are many cities and some have populations near 10,000. At any rate the study is concerned with the urban economic base of magisterial districts. There were also sixteen districts containing over 10,000 population that were dropped because they did not meet the 7,500 labor force criterion. It should be noted that these urban exceptions were expected because of the nature and make up of the magisterial districts. All districts have a population of at least 15,000. Strand, Cape; Glencoe, Natal; Alberton, Transvaal; and Messina, Transvaal are districts that meet the criterion but these districts simply do not have any data listed in the industrial census report.

problem arose; by what method would the population classes be determined? No previous study of urban classification provided an acceptable method of classification. It was recognized that arbitrarily assigning population classes may or may not present a true representation of those districts utilized. It was decided to use a well accepted statistical method for determining the population classes. The advantages were twofold: (1) a scientific method of selection would be utilized and (2) anyone wishing to check the classification could do so. The method used divides the total array into groups based on one-half the standard deviation (σ).[1]

The exact class interval obtained was 48,192; which is used as a guide for the class interval. In this regard a class interval of 50,000 was established. As the population increased it became apparent that the interval would have to increase also because certain categories had no districts listed. For this reason the class interval for the first four lowest population classes is 50,000; the interval for the fifth class is 100,000; the interval for the sixth class is 300,000; and the interval for

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[1]Allen Wallis and Harry V. Roberts, Statistics, A New Approach (New York: The Free Press of Glencoe, 1964), p. 175.

$$\sigma = \frac{\sum(x-\bar{x})^2}{n}$$ variance (this removes all negative signs);

$$\sigma = \sqrt{\frac{\sum(x-\bar{x})^2}{n}}$$ standard deviation

Hereafter, SD = σ (standard deviation).

the seventh class is 500,000. In each instance of population increase the class interval also increased by multiples of 50,000.[1]

Minima Computed

The percentage of the labor force in each of the seven industrial categories was then calculated for each district within each population class.[2] The minimum or lowest percentage in each category for each population class was entered into table 2. One or more districts from each population class afforded the minimum for each industrial category. As an example, for districts with a total population of 615,000 to 1,214,000 the minimum percentage for manufacturing is 9.724 which is the actual percentage of Johannesburg.[3] Likewise for the population class of 65,000 to 114,999 the minimum percentage for transport is 0.353 which is the actual percentage of a district in this population class. The minimum percentage for services in the same population class is 3.377. This figure represents the actual percentage of another district in the same population class. The seven minima

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[1] It should be noted that the population classes begin at 15,000 because the lowest population number is 17,165 (De Aar). Also, there are 31 districts in class 1,34 in class 2, 10 in class 3, 6 in class 4, 3 in class 5, 3 in class 6, and 1 (Johannesburg) in class 7.

[2] These percentages were obtained from the computation for the diversity index made by use of the IBM 360, Computer Center, East Carolina University.

[3] Johannesburg is the only district in this class; therefore, each of the percentages are the minima.

in each class were then summed to produce a total percentage in each class. The summation or total percentage represents the nonbasic or internal economic activity of a district within each class. The remaining percentage represents the basic economic activity.

TABLE 2. Minimum Requirements (Percentages) in South African Magisterial Districts

Size Classes	Population in Thousands						
	7	6	5	4	3	2	1
Industry Types	615 to 1,215	315 to 615	215 to 315	165 to 215	115 to 165	65 to 115	15 to 65
Mining	3.344	0.019	0.039	0.075	0.413	0.030	0.007
Manufacturing	9.724	6.806	0.567	0.522	0.237	0.250	0.271
Wholesale and Retail Trade	6.436	3.375	0.806	1.071	0.542	0.719	0.680
Motor Trade	0.921	0.662	0.189	0.181	0.088	0.167	0.212
Other Commerce	2.276	1.428	0.120	0.057	0.031	0.059	0.077
Transport	1.926	2.246	0.430	0.328	0.248	0.353	0.367
Services	15.193	10.900	3.595	2.611	2.433	3.377	2.589
Total	39.828	25.436	5.746	3.845	3.992	4.955	4.203

From Table 2 it can be immediately noticed that the percentage totals do not conform to the general format of Ullman and Dacey. Classes one[1] through five are extremely low percentages. From class five to class six, there is a very large difference, and although classes six and seven are more representative of the format of Ullman and Dacey, they are still somewhat low. This may indicate

[1]For reference the population classes will be numbered one through seven beginning with the smallest population.

a youthful stage of industrial development in South Africa. Of particular interest is the fact that classes three and four decrease their total percentages, and in fact the minima for classes three and four are smaller than the total minima for classes one and two.

The very peculiar arrangement of total minimum percentages indicates a functional relationship. Through the method of least squares,[1] a regression line was fitted to the data plotted on a graph. The purpose of this straight line regression[2] is to approximate the relationship between the data; that is, to obtain the value for any individual urban area when the value for another is known.

Is there a discrepancy in the minimum requirements method itself? Most probably the discrepancy lies in the anomalous situation of South Africa. Primarily, it should be noted that South Africa has become industrialized and urban in the last four decades. Secondly, there is an unique racial situation in South Africa. The industrialization and urbanization seems to have taken place at a much too rapid pace for the previously pastoral and agricultural Bantu. In fact, the largely subsistent nature of the Bantu is considered to be the basic reason for South

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[1] The minimum of the sum of the squares of the difference between each individual datum. S. Gregory, Statistical Methods and the Geographer (London: Longmans, 1969), p. 208.

[2] $Y = a + bX$ is the formula for a straight line.

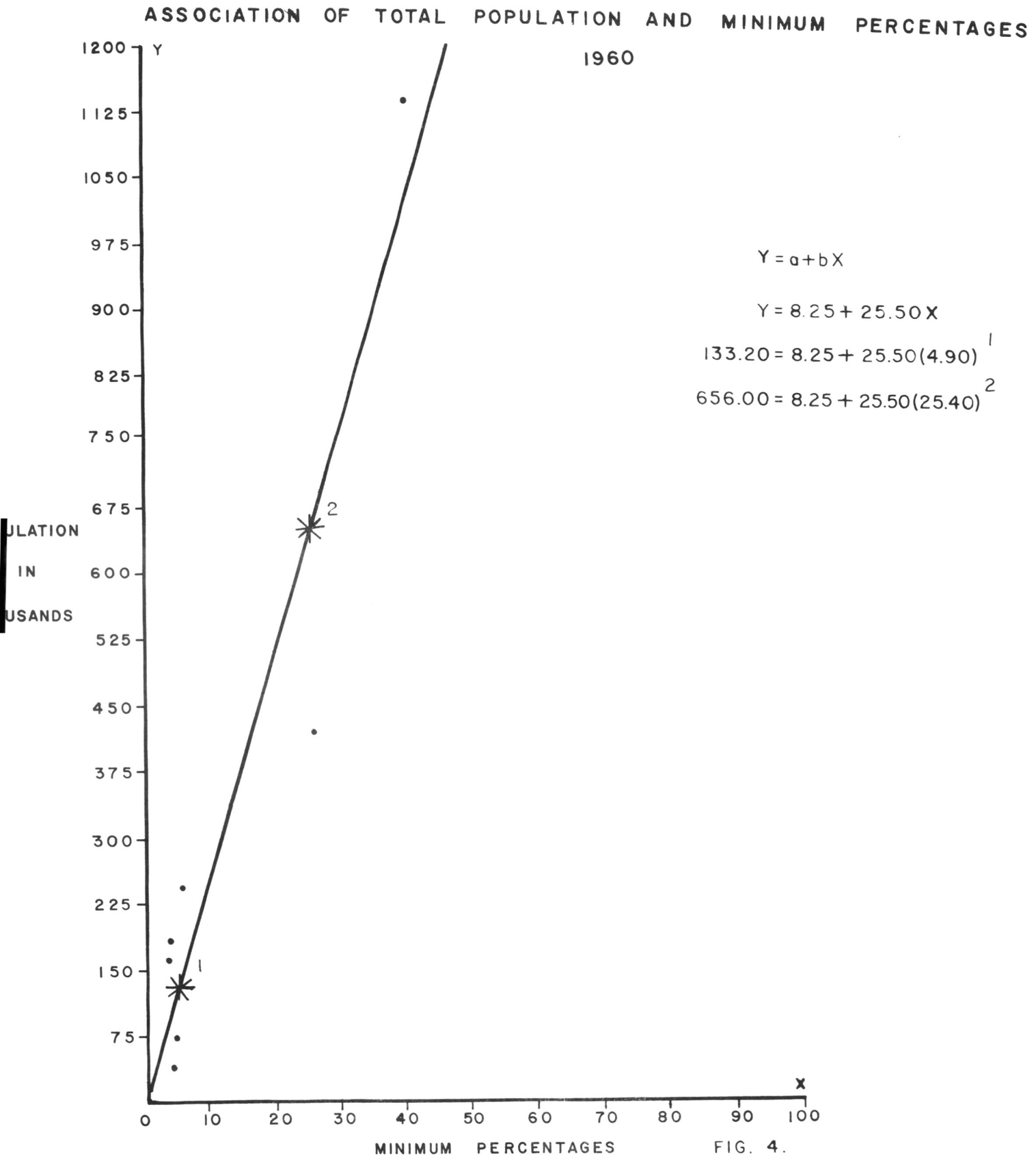
ASSOCIATION OF TOTAL POPULATION AND MINIMUM PERCENTAGES
1960
Y
1200
1125
1050
975
900
825
750
675
600
525
450
375
300
225
150
75
ULATION
IN
USANDS
Y = a+bX
Y = 8.25 + 25.50X
133.20 = 8.25 + 25.50(4.90) 1
656.00 = 8.25 + 25.50(25.40) 2
1
2
X
0
10
20
30
40
50
60
70
80
90
100
MINIMUM PERCENTAGES

FIG. 4.

Africa's low minimum percentages.[1] Almost any of the eighty-eight selected districts picked at random will yield a high number in either agriculture or not economically active or both.[2] As can readily be discerned the subsistent Bantu population plays a large part in the urban economic base. Also, it must be remembered that the study is based upon magisterial districts which cover more square miles than does one city.[3] The above statement applies even to highly urbanized areas (with the exception of ten districts which are highly urbanized and contain no rural areas). The fact that a larger number of square miles is involved is not so important itself, but it does indicate that the urban area of a particular district, in almost every instance,

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[1] The minimum percentages were calculated using the total labor force including agriculture and not economically active. A great majority of Bantu are found in the category not economically active. The advantage of using the total labor force is to give a true representation of the urban economic base as well as to indicate the role of the subsistent nature of South Africa's labor force.

[2]

District (Bantu Only)	Total labor Force	Agriculture	Not Econ. Active
Nelspruit	87,788	18,415	57,515
Benoni (highly industrialized)	89,237	2,123	45,061
Vryburg	67,494	10,104	47,755
Soutpansberg	163,341	24,031	122,866

[3]

District	Square Miles	
	Rural	Urban
Namakwaland	18421	97
Rustenburg	3677	39
Witbank	1077	44
Bloemfontein	1879	165

contains more than one urban place.[1] This is quite obviously true of the more populous districts.[2] It is true, however; that only one city is the focal point in each district and very rarely is there more than one city with over 10,000 population. Also, the number of districts in each population class is always less than the number used by Ullman and Dacey,[3] although they randomly chose cities in the lower categories to equal the number of cities used in their second highest population class.[4] It was discovered by Ullman and Dacey that the minimum dropped slightly with the addition of more cities. It can be discerned that the above reasons (with special emphasis upon the Bantu subsistent factor) are responsible for the anomalous industrial employment situation of South Africa's urban system.[5]

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[1]All places having a population of 500 or more are considered urban. South African Bureau of Statistics, Urban and Rural Population Report No. 02-02-01.

[2]

District	No. of Urban Places
Wynberg	9 (with over 20,000 urban in areas less than 500)
Namakwaland	9
Pretoria	28
Bloemfontein	21

[3]South Africa's population is less than one-tenth that of the United States.

[4]The largest class (over 1,000,000) had a total of only fourteen cities.

[5]The anomaly is expressed by the fact that with the increase in district size the size of the minima do not increase as expected. Instead they decrease to a certain point which may be a result of the small number contained in the three classes in question.

Case Studies Utilizing the Minimum Requirements Method

To further illustrate the minimum requirements method in South Africa, and to apply the absolute minima in Table 2 to individual economic bases, four individual districts were selected. These four districts were chosen as representative examples from their respective population classes.[1] It should be noted that a case study analysis shows the relative importance of each function for each individual district.

Nelspruit

Nelspruit (Table 3) represents an average district in the eastern Transvaal (Fig. 2). There is a slight increase in each industrial category from per cent of employment to per cent of excess employment with the exception of motor trade, other commerce, transport and services. In each of the four categories the decrease is very slight indicating only about one one-hundreth of a percentage point difference. Manufacturing is expected to be high because of the location near the Witwatersrand, but it is the lowest figure because the other case studies are manufacturing districts. Also, wholesale and retail trade is expectedly high since in South Africa these two activities are included together and retail trade has a high percentage. Services are as high as they are in almost every district because this category includes employment of domestics

[1]An exception to the above method is Benoni. This district was picked because an example of the Witwatersrand, South Africa's intensely industrialized area was necessary.

TABLE 3. Nelspruit (Total Population-56,840)

	Employment		Minimum Requirements		% of Excess of Basic Employment		
Ind. Types	No.	%	No.	%	No.	Total	Excess
Mining	719	5.867	3	0.007	716	5.860	6.117
Mfg.	2669	21.779	84	0.271	2586	21.508	22.452
Wholesale & Retail Trade	2147	17.519	522	0.680	1625	16.839	17.578
Motor Trade	478	3.900	163	0.212	315	3.688	3.850
Other Comm.	194	1.583	64	0.077	130	1.506	1.572
Transport	829	6.765	282	0.367	547	6.398	6.679
Services	5219	42.587	1989	2.589	3230	39.998	41.753
Total	12255	100.000	3107	4.203	9148	95.797	100.001

TABLE 4. Benoni (Total Population-136,683)

	Employment		Minimum Requirements		% of Excess of Basic Employment		
Ind. Types	No.	%	No.	%	No.	Total	Excess
Mining	11847	24.026	664	0.413	11183	23.613	24.595
Mfg.	16447	33.355	308	0.237	16139	33.118	34.495
Wholesale & Retail Trade	4268	8.656	631	0.542	3637	8.114	8.451
Motor Trade	846	1.716	103	0.088	743	1.628	1.696
Other Comm.	780	1.582	36	0.031	744	1.551	1.615
Transport	1702	3.452	289	0.248	1413	3.204	3.337
Services	13419	27.214	2834	2.433	10585	24.781	25.811
Total	49309	100.001	4865	3.992	44444	96.009	100.000

which absorb a great volume of the large Bantu labor force.

Benoni

The Witwatersrand is the location of the large discovery of gold in South Africa in 1887. The presence of gold became a basis for rapid industrialization and urbanization. Benoni (Table 4) is a district situated in the vast Witwatersrand conurbation (Fig. 2). Benoni, as expected, demonstrates a high degree of specialization in both mining and manufacturing.[1] All other categories are comparatively low with the exception of services and again this largely is a result of the large number of employed domestics. Wholesale and retail trade are rather low, probably as a result of wholesale rather than retail trade. The close proximity of Johannesburg suggests that much of the wholesale and retail trade is provided by Johannesburg.

Bellville

Bellville (Table 5) is a district of over 100,000 population, located on the Cape Peninsula (Fig. 2). This more populous district is highest in manufacturing, the most basic of economic activities, and (although there is a decrease from percentage employed) there is a rather high excess percentage in wholesale and retail trade. The population size is also high enough to illustrate a high excess percentage in the transport category, and services are consistently high. Other commerce,

[1] Benoni is specialized, but not to the extent as other Witwatersrand conurbation districts such as Springs and Boksburg.

TABLE 5. Bellville (Total Population-181,324)

Ind. Types	Employment No.	Employment %	Minimum Requirements No.	Minimum Requirements %	% of Excess of Basic Employment No.	% of Excess of Basic Employment Total	% of Excess of Basic Employment Excess
Mining	715	1.412	130	0.075	583	1.337	1.405
Mfg.	15939	31.572	913	0.522	15026	31.050	32.631
Wholesale & Retail Trade	6625	13.123	1873	1.071	4752	12.052	12.666
Motor Trade	994	1.969	334	0.181	660	1.788	1.879
Other Comm.	3277	6.491	105	0.057	3172	6.434	6.762
Transport	8284	16.409	574	0.328	7710	16.081	16.900
Services	14652	29.023	4817	2.611	9835	26.412	27.757
Total	50484	99.999	8746	4.845	41738	95.154	100.000

TABLE 6. Durban (Total Population-607,864)

Ind. Types	Employment No.	Employment %	Minimum Requirements No.	Minimum Requirements %	% of Excess of Basic Employment No.	% of Excess of Basic Employment Total	% of Excess of Basic Employment Excess
Mining	1240	.576	66	0.019	1174	.557	.747
Mfg.	63595	29.526	36849	6.806	26746	22.720	30.470
Wholesale & Retail Trade	30595	14.275	18274	3.375	12471	10.900	14.618
Motor Trade	4288	1.991	2264	0.662	2024	1.329	1.782
Other Comm.	9137	4.242	7732	1.428	1405	2.814	3.774
Transport	21952	10.192	12161	2.246	9791	7.946	10.657
Services	84427	39.198	37663	10.900	47164	28.298	37.951
Total	215384	100.000	114609	25.436	100755	74.564	99.999

which primarily refers to bank and financial institutions, indicates an impressive figure which again can, most likely, be attributed to the higher population.

Durban

Durban (Table 6) is an exceptional case study (Fig. 2). Manufacturing is high, as expected, and so are services and transport. The wholesale and retail trade figure (14.618) for Durban is the second highest figure in the wholesale and retail trade category, but could possibly be higher for a district as high in population as Durban. The fact that wholesale and retail trade appear as one category is not sufficient to explain the retained percentage. The most probable explanation is that Durban, although handling a large volume of tonnage, is a through port and probably handles a more specialized cargo. Much of the materials received by Durban are transhipped to Johannesburg and the Witwatersrand.[1] This may indicate a more subdued wholesale aspect of the highly populated district.

Comparison

Mining hardly registers in Bellville or Durban, but is very high in Benoni where there is an association of mining and manu-

[1]This is in keeping with the core-periphery theory of South African urban development. South Africa's ports have not developed independently of the Witwatersrand because of their dependence upon the well-developed manufacturing in the Witwatersrand. Unlike other world ports, the major ports of South Africa have developed only ancillary (to the Rand) industry.

facturing. Nelspruit has the smallest figure for manufacturing, but even this is high because of Nelspruit's proximity to the Rand. Each of the other districts represents a South African manufacturing area. Wholesale and retail trade tends to be representative with the major exception in Benoni which is a direct result of dependence upon Johannesburg. Other commerce is highest in Bellville. This can be attributed to the fact that the city of Cape Town is divided into four districts which tend to isolate certain functions, in this case other commerce (banking and finance).

The case studies presented indicate that the economic structure of individual districts can be examined in detail by the application of the minimum requirements method. Also, a comparison of these individual districts have confirmed general expectations.

Index of Specialization[1]

The minimum requirement was also utilized to compute a specialization index for each individual district.[2] The purpose of the specialization index is to measure the degree of specialization: the higher the figure, the more specialized the district; the lower the figure, the more diversified a district's

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[1]The index of specialization is the same as the index of diversity established by Ullman and Dacey, but as can readily be seen, index of specialization is more indicative of this study.

[2]The following index of specialization was programmed through Fortran IV, and processed at the Computer Center, East Carolina University.

activities. The formula for computing the specialization index is as follows:

$$D = \sum_i \left[\frac{(P_i - M_i)^2}{M_i}\right] \Big/ \left[\frac{\sum_i P_i - \sum_i M_i^2}{\sum_i M_i}\right] \quad 1$$

To find the specialization index the excess employment $(P_i - M_i)$ in each of the seven industrial sectors (i) for each district was squared, and then divided by the minimum requirement (M_i). The results were then summed $(\sum)$. This was divided by the summation of each sector of excess employment $(\sum_i P_i - \sum_i M_i)$ squared, which is divided by the summation of each sector of minimum requirements.[2]

Analysis

Although Ullman and Dacey developed a diversity index based upon fourteen metropolitan areas of 300,000 or more, it was felt that a specialization index based upon the entire sample used in this study was necessary to illustrate South Africa's urban specialization (Table 7). A larger number of districts (in this case the sample area) will yield a greater difference between the diversified and specialized districts. Table 7 reveals extremely

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[1] D = Diversity
i = Each of the seven industrial categories
P_i = Percentage of the total labor force employed in each industrial sector
M_i = Minimum requirement in each industrial sector
$\sum_i$ = Summation of all seven industrial sectors
After Ullman and Dacey, The Urban Economic Base, p. 189.

[2] Ibid.

TABLE 7. Index of Specialization for Magisterial Districts in South Africa (adjusted labor force of 7,500 or more)

District	Pop. Rank	Index	District	Pop. Rank	Index
Lydenburg	20	446.449			
Oberholzer	59	440.351	Vanderbijlpark	66	8.789
Virginia	70	426.639	Johannesburg	1	6.635
			Pietermaritzburg	12	6.329
Bronkhorstspruit	79	396.245	Nelspruit	63	5.489
Welkom	26	388.549	Lower Umfoloze	49	5.477
Kuruman	67	362.924	Kempton Park	68	5.412
Klerksdorp	15	361.479	Vereeniging	14	5.339
Odendaalsrue	78	354.875	Umzinto	25	5.236
Postmasburg	84	323.290	Paarl	56	4.483
Randfontein	39	319.927	Lower Tugela	27	4.304
Namakwaland	71	303.627	King William's Town	28	4.162
Nigel	69	285.248	Inanda	36	3.808
			Somerset West	87	3.626
Brakpan	41	257.312	Uitenhage	51	3.444
Vryheid	45	251.514	Bellville	9	3.307
Rustenburg	23	248.180	Port Elizabeth	5	3.231
Krugersdorp	24	247.460	Wynberg	4	2.609
Springs	18	235.408	Cape	6	2.575
Warmbad	50	229.088	Estcourt	60	2.553
Witbank	29	225.541	Stellenbosch	64	2.552
Sasolberg	75	217.152	Piet Retief	58	2.476
Soutpansberg	16	174.398	Durban	2	2.331
Letaba	8	167.091	Worcester	54	2.293
Barberton	32	164.123	Port Shepstone	35	2.287
Rooderpoort	21	156.700	Potchefstroom	37	2.187
Middleberg	30	153.030	Gordonia	48	2.178
Newcastle	65	152.290	George	77	2.149
Heidelberg	86	147.297	Pinetown	44	2.132
			Lion's River	82	2.024
Boksburg	43	112.703	East London	11	1.839
Marico	52	104.907	De Aar	88	1.814
Pietersburg	7	99.054	Pretoria	3	1.728
Bethal	42	76.849	Malmesbury	72	1.540
Pilgrim's Rest	22	49.176	Brits	55	1.431
Benoni	19	41.312	Craddock	80	1.419
Potgeitersrus	10	40.928	Simonstown	85	1.364
Ermelo	33	31.832	Bloemfontein	13	1.353
Standerton	46	29.600	Oudtshoorn	73	1.322
Carolina	83	22.711	Kroonstad	40	1.195
Kimberly	31	21.804	Caledon	81	1.185
Germiston	17	20.977	Senekal	74	1.148
Dundee	76	19.276	Harrismith	47	1.134
Klip River	38	18.515	Queenstown	57	1.125
Lichtenburg	53	15.465	Bethlehem	61	1.056
Vryburg	34	14.395	Albany	62	1.038

high degrees of specialization, because of South Africa's specialization in mining and manufacturing.[1] In most of the districts yielding indices with a specialization level over 100, the prime factors are mining and/or manufacturing. A few examples will serve as a guide. Most of the Witwatersrand districts such as Oberholzer, Odendaalsrus, Randfontein, Brakpan, Krugersdorp, and Springs can be considered highly specialized in either mining or manufacturing or both; Johannesburg, Vereeniging, and Kempton Park represent comparatively diversified districts (Fig. 3). This is probably because of the distribution of mineral deposits and the higher degree of wholesale and retail trade as well as services in the more diversified districts. Other districts not found in the Witwatersrand are highly specialized primarily as a result of mining. These districts are to be found in the northern Cape Province where a variety of minerals are found. The three best examples are Kuruman, Postmasburg, and Namakwaland. Kimberly does not appear highly specialized although it is a mining center. This is mainly because it was the first mining center in the area after the discovery of diamonds in 1867, and it has gradually been diversified and become a regional center. The coal mining districts of Vryheid and Newcastle in Natal must be noted because of their high degree of special-

[1] It should also be noted that anything above 4.000 in the sample area used by Ullman and Dacey was specialized; however, because of the extreme specialization of many South African districts, the comparative figures indicating diversity and specialization in South Africa are much higher.

ization. The remaining extremely highly specialized districts such as Letaba, Barberton, and Marico can most likely be attributed to services extended to large Bantu populations. Attention should be called to the fact that each borders a source of Bantu labor.[1] As expected, the larger ports of South Africa, such as the districts of the Cape peninsula, Durban, Port Elizabeth, and East London, are relatively diversified districts. This is not to say that manufacturing does not exist, but wholesale and retail trade, banking and financial institutions, and transport are comparatively well developed.

The most diversified districts in South Africa seem to be those districts that might be labelled as centers: either local, regional, national, or international such as Queenstown, Bloemfontein, Pretoria,[2] and Durban respectively.

Distribution

Merely stating a specialization index does not give one a very good idea of the total overview. To firmly establish what has been stated, specialization and diversity types were mapped showing the general distribution in South Africa of specialized to diversified magisterial district (Fig. 5).

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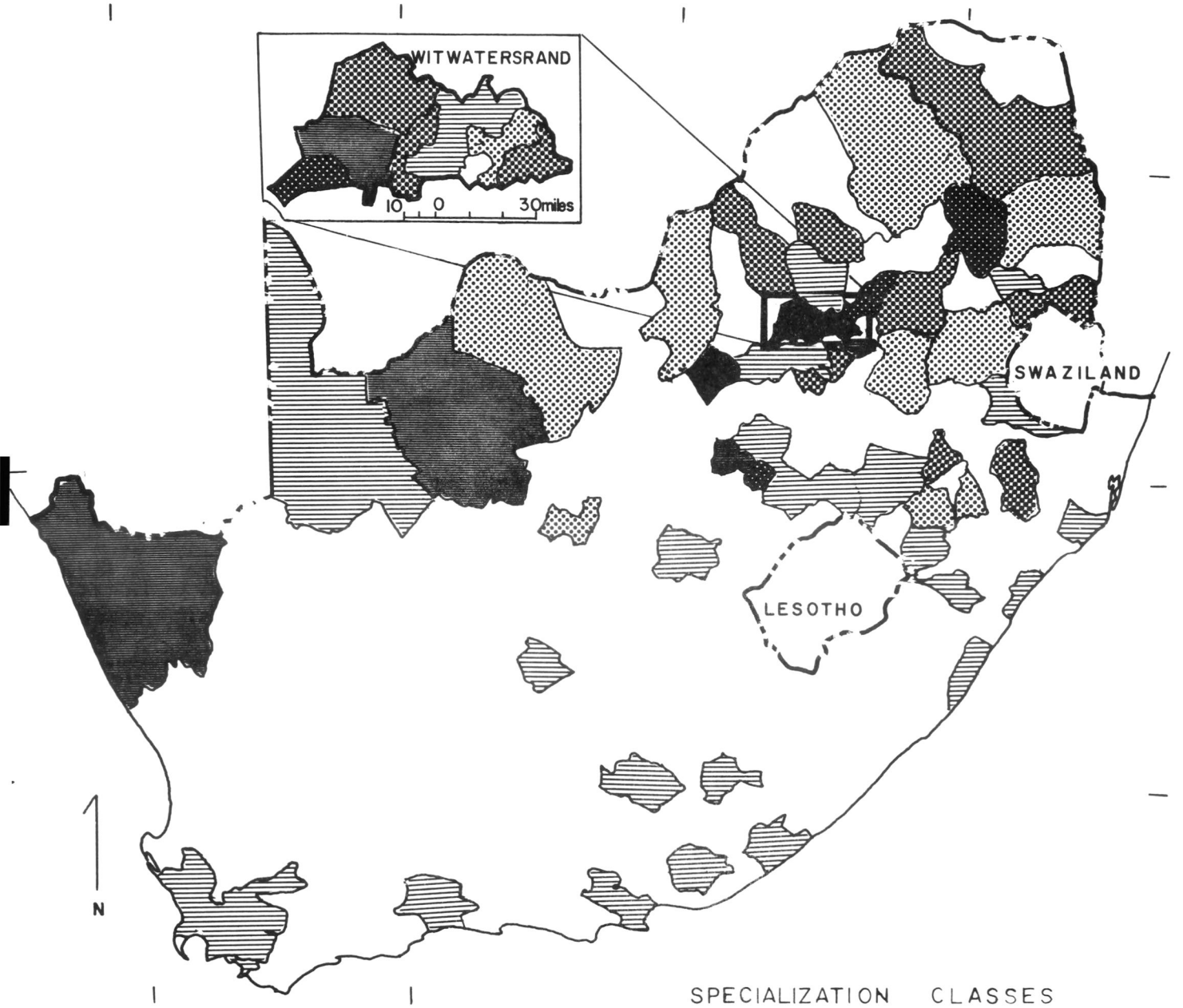
[1]Mozambique, Swaziland, and Botswana, respectively.

[2]It is peculiar that Pretoria as well as the Cape and Bloemfontein would be as diversified because of their governmental services. Perhaps it is the division among the three centers that indicates the diversity of these districts.

SPECIALIZATION CLASSES OF ECONOMIC ACTIVITY BY MAGISTERIAL DISTRICTS 1960



SOURCE: TABLE 7.

FIG. 5.

Again, it was evident that a random selection of mapping classes was not sufficient, and again one-half of the standard deviation (p. 47) was used as a guide for establishing the class interval to be mapped. The result of one-half of the standard deviation was 133.040. Therefore, 130.000 seemed to be the likely interval to use, but this had to be adjusted. To accomodate a great many diverse districts the first class interval is 10.000.[1] It is obvious (Table 7) that the guide for establishing the class interval (130.000) had to be modified to accommodate the more diverse districts since over one-half of the districts display an index less than 10.000. Also, a natural break occurs at the point 10.000. The second through the fifth districts conform to 130.000.

The distribution map of diversity and specialization easily indicates at a glance the distribution of mining and manufacturing as well as indicating market or trade center areas. The highly specialized areas are basically found in the Rand, central Orange Free State, and northern Cape Province where mining is located. It must be noted that the diversity is based upon the entire eighty-eight districts which include population centers of 15,000 to over 1,000,000. This can account for the extremely high specialization indices indicated in Table 7.

Correlation

There is an observation made in urban geography that states

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[1]The first class interval was of necessity arbitrarily chosen.

that as city size increases specialization decreases because a city can support more activities. Therefore, there should be an inverse relationship between size (population) and the degree of specialization. This observation was tested against the eighty-eight sample industrial districts of South Africa used in this study. The method employed was the Personian Correlation. The above method employs the following formula to test the significance of the relationship of values, in this case total population to the diversity index:

$$r = \frac{N(\sum XY) - (\sum X)(\sum Y)}{\sqrt{[N\sum X^2 - (\sum X)^2][N\sum Y - (\sum Y)^2]}} \quad [1]$$

The above formula yields an answer or coefficient located at some point between -1.00 and +1.00 indicating either a negative or positive relationship. The value of 0 indicates no apparent linear relationship between the X and Y values. It is the 0 value that is of importance in South Africa because the above formula yielded a relationship so close to 0 that the difference is negligible.[2] Again an anomalous situation is indicated in South Africa. It would seem that there is little or no linear relationship between total population and specialization. This was suspected before the test from a simple comparison of the rank in population with

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[1] N = 88 (the total number of districts employed)
X = each diversity index
Y = total population of each district

[2] The actual value is -.136.

the index of specialization (Table 7). There are two reasons why the weak relationship or non-relationship exists. It must be remembered that the correlation is based upon magisterial districts which in many instances have a large area.[1] The magisterial district is not city-like in structure; therefore, it cannot be expected to behave as does a city. High degrees of specialization in certain urban areas in South Africa are counteracted by a very high intensity level in the industrial categories of mining and manufacturing in those highly populated urban areas of the Rand as well as Odendaalsrus, Virginia,and Welkom in the central Orange Free State.[2] The above is a deviation from the norm in that most highly populated metropolitan areas that are high in manufacturing and wholesale and retail trade do not have a great concentration in mining. Also, the other manufacturing districts of South Africa such as the Cape area (Bellville, Paarl, Somerset West, Stellenbosch, Wynberg, and Cape Town), Port Elizabeth, East London, and Durban have low

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[1]This is the only method available. To use the main urban area or focal point of each magisterial district would be erroneous. This would dismiss the population of other urban places within the district who are part of the active labor force which contributes to the diversity index. To use merely the urban population would dismiss those rural people actively employed in the seven industrial categories employed in obtaining the specialization index.

[2]Fourteen of the twenty-eight districts having an index of diversity over 100 are highly populated industrial areas located in the Rand, adjacent to the Rand or in the center of the Orange Free State.

diversity indices. Even those districts of the Rand, not heavily associated with mining (Johannesburg, Vanderbijlpark, Vereeniging, and Kempton Park), have relatively low specialization indices. It must be assumed then that a great concentration of mining in highly populated areas creates the difference in specialization, and the exception to the observation that highly populated areas are by nature diverse. Conversely, many small urban areas having a small population are quite diversified partly because of their historical development and partly because of isolation.

The minimum requirements method has provided a basis for determining the basic or excess economic activity in each of the eighty-eight industrialized magisterial districts, and the specialization index indicates the degree of specialization present in each of these districts. The above two methods indicate the individual urban economic situation of South Africa's most industrialized magisterial districts.

Chapter IV

URBAN FUNCTIONAL CLASSIFICATION OF THE MAGISTERIAL DISTRICTS

The previous chapter has indicated the method by which a classification of each magisterial district may be indicated by discovering excess employment. The excess employment represents the economic base and viability of each urban district. To further categorize and refine this urban study, a second classification is used to illustrate, in tabular form, the major function or functions of each urban district; i.e., to actually name and indicate each of the major urban functions in each of the eighty-eight districts. This classification also provides a valuable aid in the analysis of the spatial distribution of functional types in South Africa's urban system.

When considering the economic structure of cities, a multitude of criteria are useful and each represents some facet of the economic structure.[1] However, there is one set of criteria that has been used most extensively and seems to provide the best overall view of a city's economic structure. The most useful criteria, as established in the previous chapter, is employment in urban areas.

Use of employment as a method of understanding a city's economic structure has led to the classification of cities

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[1] Payrolls, income and expenditure, value added by manufacturing, dollar sales volume, and physical production are some other criteria cited in Raymond E. Murphy, The American City: An Urban Geography (New York: McGraw-Hill Book Company, 1966), pp. 101-102.

according to employment by function. It is a generally accepted fact that all cities are multifunctional, meaning that each city is engaged in at least some activity in more than one economic function. Because classifications can be subjective in nature, there have been a vast array of functional classifications, differing in degree. As a basis of understanding it is worth reviewing the most familiar functional classification systems.[1] It will not be necessary to give details and particulars about each, but a simple explanation of the most important classifications will suffice.

Functional Classifications

As previously stated; there are a number of different and related functional classifications in the literature of urban geography but the classic functional classifications by Harris and Nelson are examined here.[2]

Harris' Classification

The earliest functional classification was made by Chauncy D. Harris in 1943.[3] Harris developed an empirical analysis of

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[1] It serves no purpose to cite other various classifications or simply list the names of those who have made functional classifications. A list may be obtained from any text on urban geography.

[2] It should be noted that Alexandersson also made a functional classification of cities in the United States by establishing quantitative boundaries that indicated functional types. The classification was based upon "chief city-forming" industries (basic in basic-nonbasic terminology) or those industries that make a city economically viable. Alexandersson, Economic Structure of American Cities.

[3] Chauncy D. Harris, "A functional Classification of Cities in the United States," Geographical Review, Vol. XXXIII, (1943), p. 86-89.

cities in the United States using employment as well as occupational data from the Census of Manufacturing, Census of Business, and the Census of Population respectively. The most important aspect of Harris' system was that, although recognizing that cities were multifunctional, Harris based his classification scheme upon each city's dominant function or as Harris puts it, "the activity of greatest importance in each city".[1] In addition, Harris found that he had to vary his percentage for determining each functional type because some functional types have a higher or lower percentage than others. As an example: the 60 percentile was the critical value used for manufacturing types whereas the 20 percentile was used for wholesaling types.[2] This is because of the very nature of the types, i.e., a city may be in the 35 percentile of wholesaling and be extremely specialized in wholesaling, while 35 percentile in manufacturing is not especially intense. As a result, Harris established criteria for nine functional types (two degrees of manufacturing) which he used as bases for making his functional classification.

Nelson's Classification

Howard J. Nelson recognized that cities were multifunctional and classified them on the basis of more than one function.[3]

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[1]Harris, "Functional Classification of Cities in the United States," p. 86.

[2]Ibid., p. 87.

[3]Howard J. Nelson, "A Service Classification of American Cities," Economic Geography, Vol. XXXI, p. 189-210.

The purpose of Nelson's classification was to develop a standard statistical method for classifying cities. Nelson based his entire functional classification upon percentages of labor force as obtained from the Census of Population. The arithmetic mean for each economic group used by Nelson was computed from his population classes, and in two-thirds of the categories Nelson found that the percentages increased as the city size increased.[1] Nelson selected the standard deviation as the basis of his statistical analysis and calculated the standard deviation (SD) for each functional group. Then he discovered a degree of specialization by adding the standard deviation in succession. The city was specialized if it was one standard deviation above the mean and relatively more specialized if it was two or three standard deviations above the mean. In this manner there could be a multifunctional classification in that a city could rank one or more standard deviations above the mean in more than one function. According to Nelson, all cities that do not have percentages enough to fit into even the first standard deviation are put into a category labeled "diversified".[2]

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[1] Ibid., pp. 191-193.

[2] The diversified category signified no specialization based on the standard deviation.

Method Employed

Nelson's functional classification method was chosen to classify the eighty-eight industrial districts so that individual functional types could be identified. As Nelson states "a study of this sort is perhaps more useful as a reference tool than as an end in itself."[1] There are a number of reasons for choosing Nelson's method. Nelson's method eliminates the problem of choosing the dominant function of an urban area which is a task in itself. The point at which one function is or is not important in any given urban area does not have to be subjectively discerned because it is determined quantitatively. As indicated Nelson's method is multifunctional which more truly reflects the actual condition of most urban areas including those of South Africa. Also, Nelson's method yields a quantitative statement which absolutely establishes a base by which urban areas can be identified according to their functions. The quantitative statement is expressed by the standard deviation from the mean[2] and is easily understood by others. The standard deviation also allows for differences in degree of functional types. One urban area may be mildly specialized in manufacturing while another may be very high in manufacturing. A simple statement or presentation of labor force percentages does not always indicate the difference in degree, but

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[1]Nelson, "Service Classification of American Cities," p. 203.

[2]Refer to page 47.

the use of the standard deviation is an excellent method for discerning the degree.

The degree of specialization is a key to the nature of each district that is classified. The degree indicates how specialized a district is in a given industrial category. The degree of specialization is determined by adding the standard deviation (SD) to the mean ($\bar{x}$) of all the percentages (88) in a given industrial category. Thus, the mean plus the standard deviation yields a degree level of two, and this procedure is carried to the extent necessary to include each percentage in each industrial category. This provides the necessary degree factor which differentiates between those districts heavily specialized in a particular function and those districts less specialized (but specialized none-the-less) in the same function.[1]

Functional Types of Magisterial Districts

The functional types and degree of specialization in each function are shown in Table 8. It should be noted that a great number of districts are labeled as "low percentages" (Fig. 6).[2] These low percentage districts are those having no percentages in any of the seven industrial categories high enough to meet the requirements of one standard deviation above the mean. The

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[1] Nelson in his classification of American cities had need of three standard deviations to indicate the degree of specialization although he does indicate rare occasions in which a fourth standard deviation is necessary.

[2] It should also be noted that over one-half of these low percentage districts have functional types that exist between the mean and the first standard deviation.

LOW PERCENTAGE DISTRICTS (DIVERSIFIED) – 1960

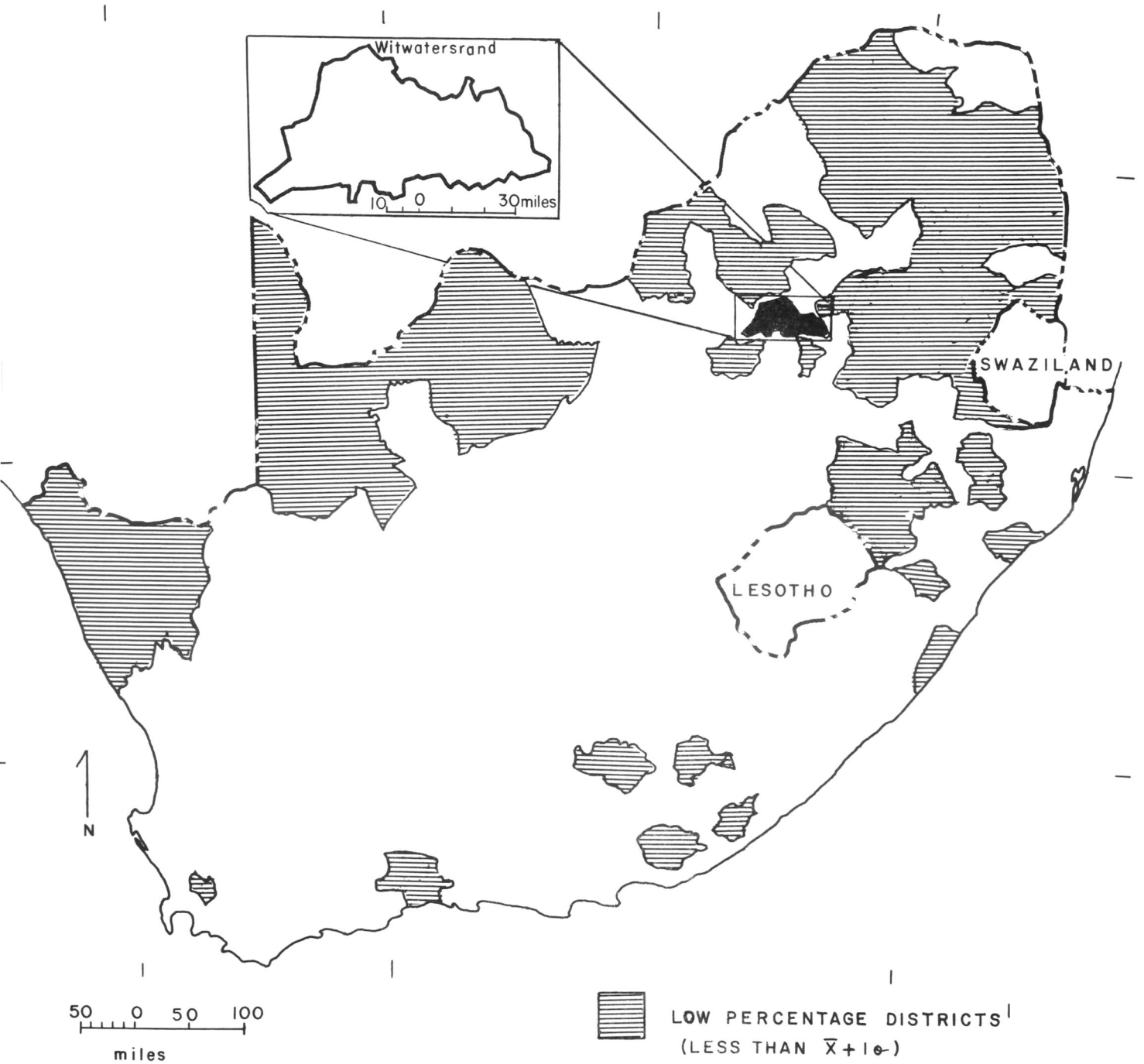


FIG. 6.

[1]PERCENTAGES ARE TOO LOW TO INDICATE FUNCTIONAL TYPES.
SOURCE: TABLE 9.

low percentage districts are the same as the diversified grouping in Nelson's classification. It is true that some of these districts are the smaller diversified districts of the south and east Cape Province as well as those in Natal and the northern and eastern Transvaal, but some highly specialized districts such as the mining district of Namakwaland and Kuruman of the northern Cape Province are also included within this "functional" or "non-functional" category.

TABLE 8. Functional Degree of Functional Types

	Mining	Manufac-turing	Wholesale & Retail Trade	Motor Trade	Other Commerce	Trans-port	Ser-vices
$\bar{x}$	7.304	4.390	2.139	.448	.396	1.409	8.130
σ(SD)	12.247	4.528	1.292	.201	.473	1.158	3.362
$\bar{x}$+1SD	19.551	8.918	3.431	.649	.869	2.567	11.492
$\bar{x}$+2SD	31.798	13.446	4.723	.850	1.342	3.725	14.854
$\bar{x}$+3SD	44.045	17.974	6.015	1.051	1.815	4.883	18.216

Nelson's classification does not contradict the diversity index of the previous chapter. On the contrary, the index is substantiated by Nelson's classification. Again falling into the low percentage category merely indicates that the districts in question do not have enough employment in any given category to indicate a functional type. For this reason the highly populated mining centers of the Rand cause the two previously mentioned mining districts of Namakwaland and Kuruman of the northern Cape Province not to appear as specialized in mining (Fig. 7).

TABLE 9. Multifunctional Classification (subscripts indicate degree as computed by the standard deviation)

Key: MI - Mining (14) OC - Other Commerce (10)
M - Manufacturing (15) T - Transport (13)
WR - Wholesale & Retail Trade (12) S - Services (13)
MT - Motor Trade (15) LP - Low Percentage (45)
( ) Functions between the mean and 1SD

District		Functional Types
Bellville	(M MT)	$WR_1OC_2T_2$
Cape		$M_1WR_3MT_1OC_3T_1S_1$
Simonstown	(MT)	$WR_1OC_2T_1S_3$
Wynberg	(S)	$M_1WR_2OC_2MT_1T_1$
Paarl	(WR MT OC S)	M_1
Somerset West	(OC)	$M_1WR_1MT_1S_1$
Stellenbosch	(M WR MT OC S)	LP
Worcester	(M WR MT OC)	T_1
Malmesbury	(WR OC)	MT_2
Caledon	(WR S)	MT_1
George	(M WR MT S)	LP
Oudtschoorn	(WR MT S)	LP
Port Elizabeth	(OC S)	$M_1WR_1MT_1T_1$
Uitenhage	(WR S)	M_1T_1
Albany	(S)	LP
Craddock	(T S)	LP
De Aar	(WR OC)	T_3S_1
Namakwaland	(MI MT)	LP
Gordonia	(WR T)	LP

TABLE 9. Continued

District		Functional Types
Kuruman	(MI)	LP
Postmasburg		MI_1
Vryburg		LP
Kimberly	(OC)	$WR_1MT_1T_1S_1$
East London	(M OC S)	$WR_1MT_1T_1$
King William's Town		LP
Queenstown	(WR MT S)	Lp
Durban		$M_1WR_2MT_1OC_2T_1S_1$
Pinetown	(M WR OC)	S_1
Port Shepstone		LP
Umzinto		LP
Inanda	(M WR)	LP
Lower Tugela		LP
Pietermaritzburg		LP
Estcourt		LP
Klip River	(T)	LP
Lion's River	(S)	Lp
Dundee		LP
Newcastle	(MI)	LP
Vryheid	(MI)	LP
Lower Umfolozi	(M)	LP
Johannesburg	(T)	$M_1WR_3MT_2OC_3S_2$
Benoni	(MI WR MT OC S)	M_1

TABLE 9. Continued

District		Functional Types
Boksburg	(WR MT OC S)	$MI_1M_1T_1$
Brakpan	(M WR MT OC T S)	MI_2
Germiston		$M_2WR_1MT_1OC_1T_1S_1$
Kempton Park	(WR MT OC S)	M_3T_2
Springs	(M WR MT OC)	MI_2
Krugersdorp	(M WR OC)	MI_1
Oberholzer		MI_3
Randfontein		MI_2
Roodepoort	(M WR MT T S)	MI_1OC_1
Pretoria	(M WR T)	$MT_1OC_2S_2$
Vanderbijlpark	(OC)	M_3
Vereeniging	(WR MT OC S)	M_2
Klerksdorp	(WR MT)	MI_2
Lichtenberg	(WR)	MT_1
Potchefstroom	(MT S)	LP
Brits		LP
Marico		LP
Rustenburg	(MI)	LP
Pietersburg		LP
Potgeitersrus		LP
Soutpansburg		LP
Warmbad		LP

TABLE 9. Continued

District		Functional Types
Bronkhorstspruit		LP
Middlebug		LP
Witnank	(MI T)	LP
Bethal		LP
Heidelberg		LP
Nigel	(MT)	MI_1
Standerton	(S)	LP
Carolina	(T)	LP
Ermelo	(S)	LP
Piet Retief		LP
Barberton		LP
Letaba		LP
Lydenberg		LP
Nelspruit	(WR MT)	LP
Pilgrim's Rest		LP
Bloemfontein		$WR_1MT_2OC_1T_3S_2$
Odendaalsrus	(MT)	MI_2
Virginia		MI_3
Welkom	(WR MT OC)	MI_3
Kroonstad	(WR T)	MT_1S_1
Senekal		S_1
Sasolberg		MI_1M_1
Bethlehem	(WR T)	MT_1S_1
Harrismith	(S)	LP

However, they are very much specialized as indicated by their specialization index. On the other hand a large number of special functions in a specific district does not mean that it is specialized but that it is diversified. In most instances the larger cities of South Africa possess a large number of functional types, but have a low specialization index. This is in keeping with the theory that a large city's source of diversification lies in its ability to provide a large number of specialties. Nelson's classification then aids in putting South Africa's anomalous situation into proper perspective. Those highly populated areas in the Rand and central Orange Free State have a high degree of specialization when viewed through both Nelson's and Ullman and Dacey's classification. With the exception of the existance of mining they possess the same functional structure as those large South African urban places with low indices of specialization which indicates diversity or no specialization.

Distribution of Functional Types

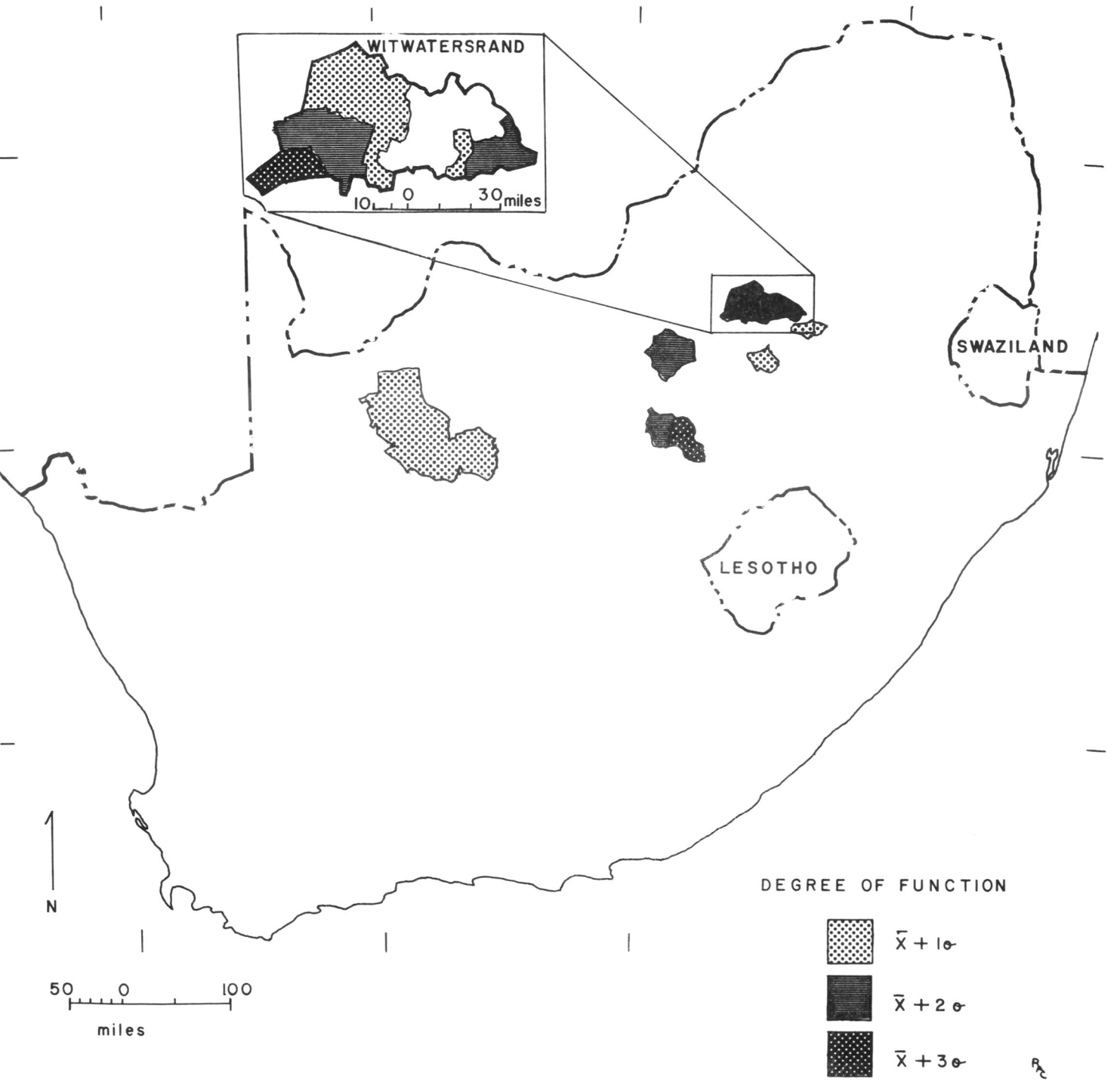
The following discussion indicates the distribution of functional types in a qualitative manner. The distribution gives insight to the anomalous industrial situation of South Africa, and provides the necessary relationship among industrial types.

Mining

South Africa has a large number of mineral deposits especially in the area situated in the northern Cape Province stretching through the central Orange Free State into the Rand and continuing into the northern Transvaal. Also the two coal mining districts of Newcastle and Vryheid in Natal are highly specialized. Although many of South Africa's magisterial districts are highly specialized in mining, the more densely populated districts which have a high percentage of the labor force employed in mining, are factors that influence the distribution of functional types. As indicated the mining activities of the Witwatersrand[1] and the central Orange Free State overshadow (with the exception of Postmasburg) South Africa's other specialized mining districts. The low percentage districts of Namakwaland, Kuruman, Vryheid, and Newcastle fall between the mean and one standard deviation in mining; thus a lower specialization in mining is indicated based on relatively lower employment figures. It should be noted that the highest concentration of mining is located in the three districts of the central Orange Free State (Fig. 7). This indicates a higher con-

[1]The Witwatersrand has developed into a densely populated, highly developed industrial area because of its mineral wealth. Prior to the discovery of gold in 1883, Johannesburg was nothing more than a crossroad. The Witwatersrand's unusual development is based upon mineral wealth; therefore, the association of mineral wealth and large numbers of people account for the Witwatersrand having a high specialization in mining.

MINING DISTRICTS – 1960



SOURCE: TABLE 9.

FIG. 7.

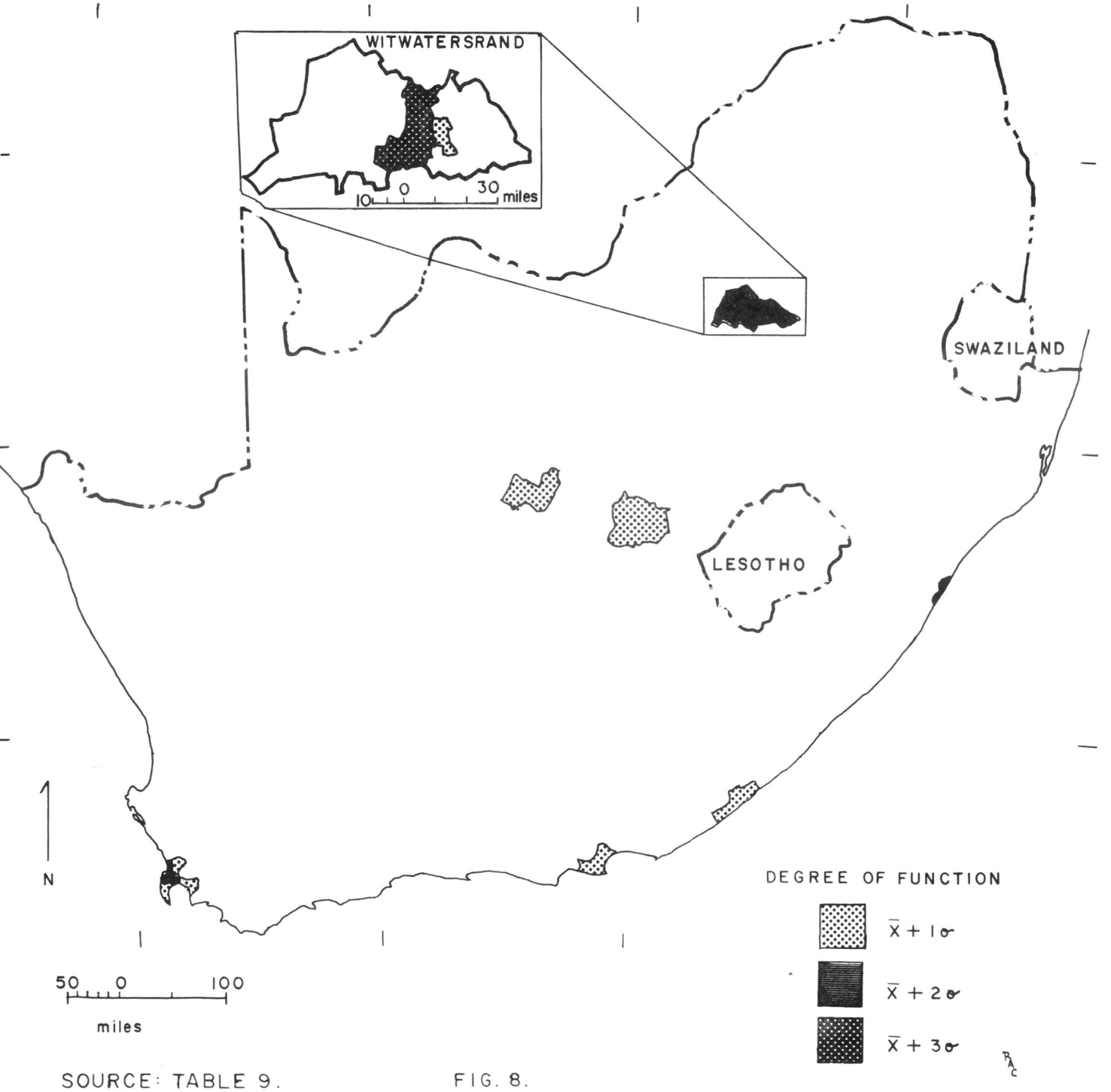
centration of mining than the Witwatersrand because these central Orange Free State districts have over fifty percent of the labor force employed in mining. Again it can be readily discerned that the association of mining with highly urbanized populated areas helps account for the anomalous urban situation in South Africa.

Manufacturing

Manufacturing is the most representative of all of the city-forming functions. As expected, districts specialized in manufacturing occur only in the five major manufacturing areas of South Africa (Fig. 8). The majority of districts located in the Cape area, southern coast (Port Elizabeth-East London), Durban area, central Orange Free State, and the Rand have manufacturing functions, and these districts constitute the major industrial areas of South Africa (Fig. 8).

The distribution of manufacturing districts conforms to an expected pattern in that they are congruent to the highly populated regional, national, and international service centers. This is in keeping with the theory illustrated by Alexandersson that manufacturing is the strongest basic urban activity. East London curiously is not indicated on the manufacturing map. This can most probably be attributed to the slightly less metropolitan nature of the East London area, as well as the high degree of mechanized manufacturing. It should also be noted that East London does possess some specialization in manufacturing because it is indicated at a level between the mean and one standard

MANUFACTURING DISTRICTS — 1960



SOURCE: TABLE 9.

FIG. 8.

deviation. It is also interesting to note that the three mining districts of the central Orange Free State do not record percentages high enough to be classified as specialized in manufacturing which can be attributed to the high intensity (3SD) in mining. The most interesting aspect of the distribution of manufacturing districts occurs in or adjacent to the Rand (Figs. 6&7). The entire western and eastern areas of the Rand are highly specialized in mining while the central districts (although engaged in mining) do not manifest mining as their functional type. Conversely, the western and eastern districts of the Rand are not sufficiently high in manufacturing[1] to register whereas the central districts indicate high specialization in manufacturing. This suggests a certain amount of complementarity by function or a working relationship between mining and manufacturing in the Rand. Also, the contiguous districts of Vanderbijlpark and Vereeniging should be noted for their specialization in manufacturing. These are highly industrialized outlyers of the Rand. Both Districts have a manufacturing level of at least 2SD with Vanderbijlpark (3SD) being the most specialized. Sasolberg in the northern Orange Free State is industrialized probably as a result of mining. Sasolberg has 1SD in each category (M and MI), and is situated adjacent to Vereeniging and Vanderbijlpark.

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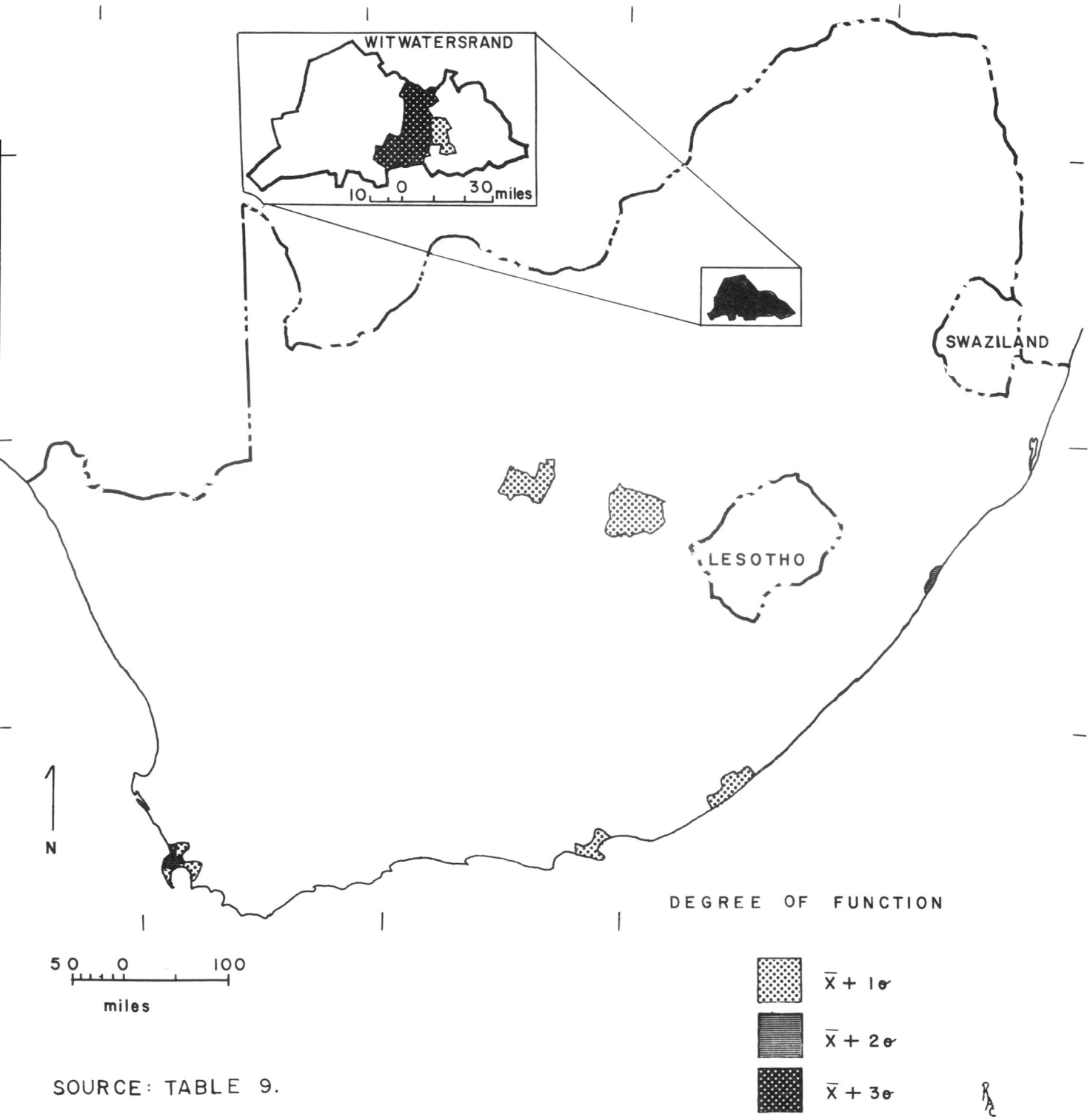
[1]The eastern Rand is not entirely without specialization in manufacturing in that the districts of Springs and Brakpan manifest a level of specialization between the mean and one standard deviation.

Wholesale and Retail Trade

It is impossible to identify the difference in occurance of wholesale and retail trade because the data for each is grouped together in the census. For this reason, only the larger regional and national centers are indicated as being specialized in this function (Fig. 9). However, twenty-seven districts fall between the mean and one standard deviation indicating the relatively ubiquitous nature of the retail aspect of "Wholesale and retail trade."

As stated, wholesale and retail trade cannot reveal their individual nature, but according to the availability of data the results are as expected with large service centers being represented in this category. Bloemfontein indicates 1SD in wholesale and retail trade which is probably due to its regional relationship to the Orange Free State. Kimberly's position may be explained historically. Kimberly was the first large mining center because of its development with the discovery of diamonds in 1867. The fact that it was the first urban area in the center of the diamond fields can account for its development as a trade center. The trade functions of Kimberly may also be attributed to its early establishment as a railway center which was a direct result of the diamond discovery. The distribution of wholesale and retail trade in the Rand conforms to the previously developed idea of distribution of functions (Fig. 9). Only Johannesburg and adjacent Germiston

WHOLESALE AND RETAIL TRADE DISTRICTS — 1960



SOURCE: TABLE 9.

FIG. 9.

are high enough to register, but all of the other Rand districts lie between the mean and one standard deviation. It should be remembered that these districts (Johannesburg and Germiston) did not register as mining centers. Obviously, Johannesburg (3SD) is the overwhelmining wholesale and retail trade center for the Rand, South Africa, and most probably of all southern Africa.

Motor Trade

Motor trade is quite similar to wholesale and retail trade in that it is a component of commerce.[1] The same general distribution pattern is prevalent in motor trade as in wholesale and retail trade (Fig. 10). The major difference occurs in the degree attained. Motor trade in the Cape occurs in more districts indicating a larger distribution. The districts of Malmesbury and Caledon appear for the first time, and the advent of these two districts quite naturally lowers the intensity of motor trade in the Cape district. The Rand remains essentially the same except the intensity in Johannesburg is lowered. Kimberly's intensity remains the same, but Bloemfontein increases intensity by 1SD. Also, Pretoria, Kroonstad, and Bethlehem appear as motor trade centers. Most important is the appearance of East London in the southeastern Cape Province. This can be attributed to the automobile assembly plants es-

[1]Many districts in the more urban manufacturing areas of South Africa display specialization in "motor trade" between the mean and one standard deviation.

MOTOR TRADE DISTRICTS – 1960

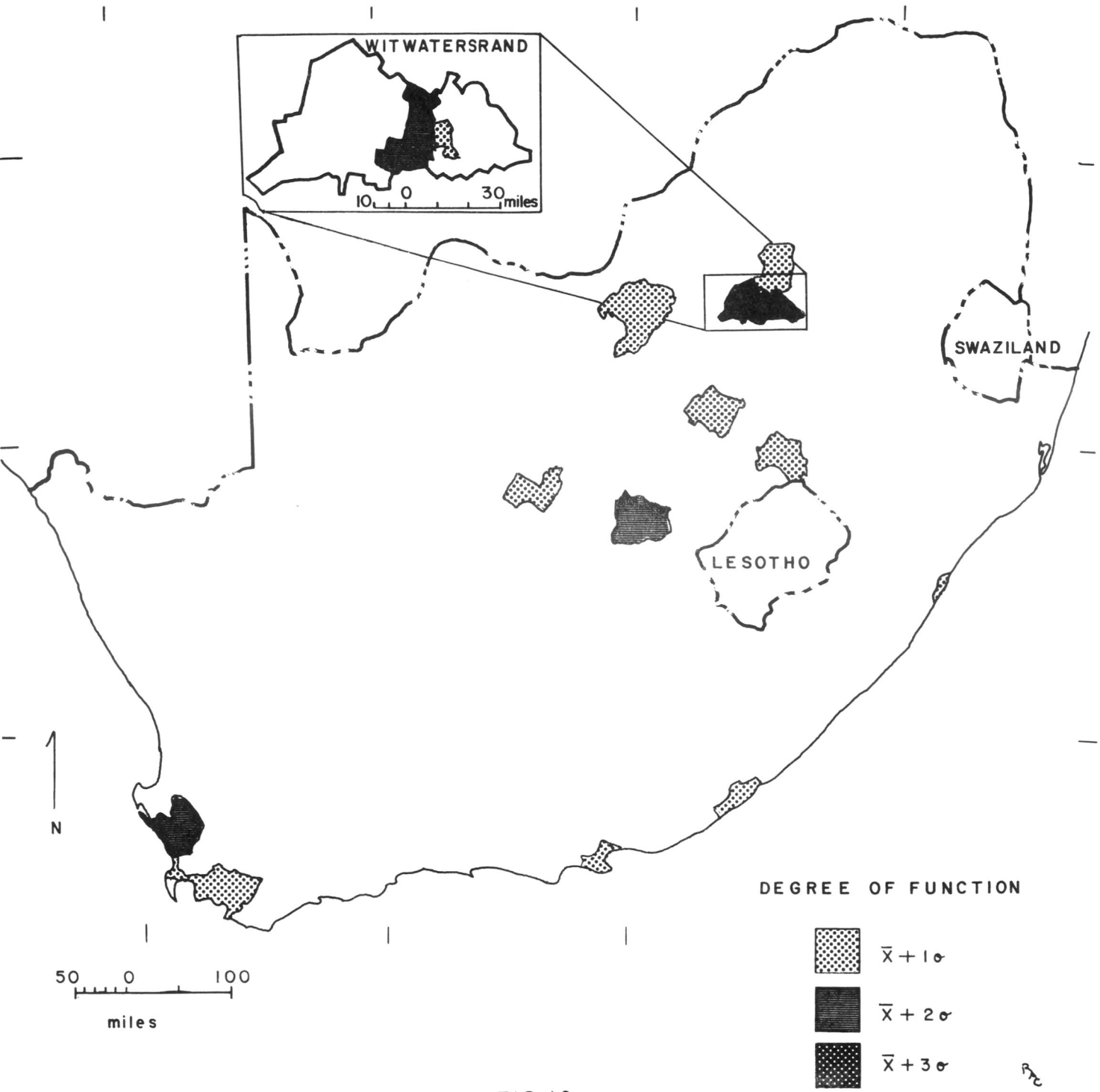


FIG. 10.

SOURCE: TABLE 9.

tablished by foreign manufacturers.

Other Commerce

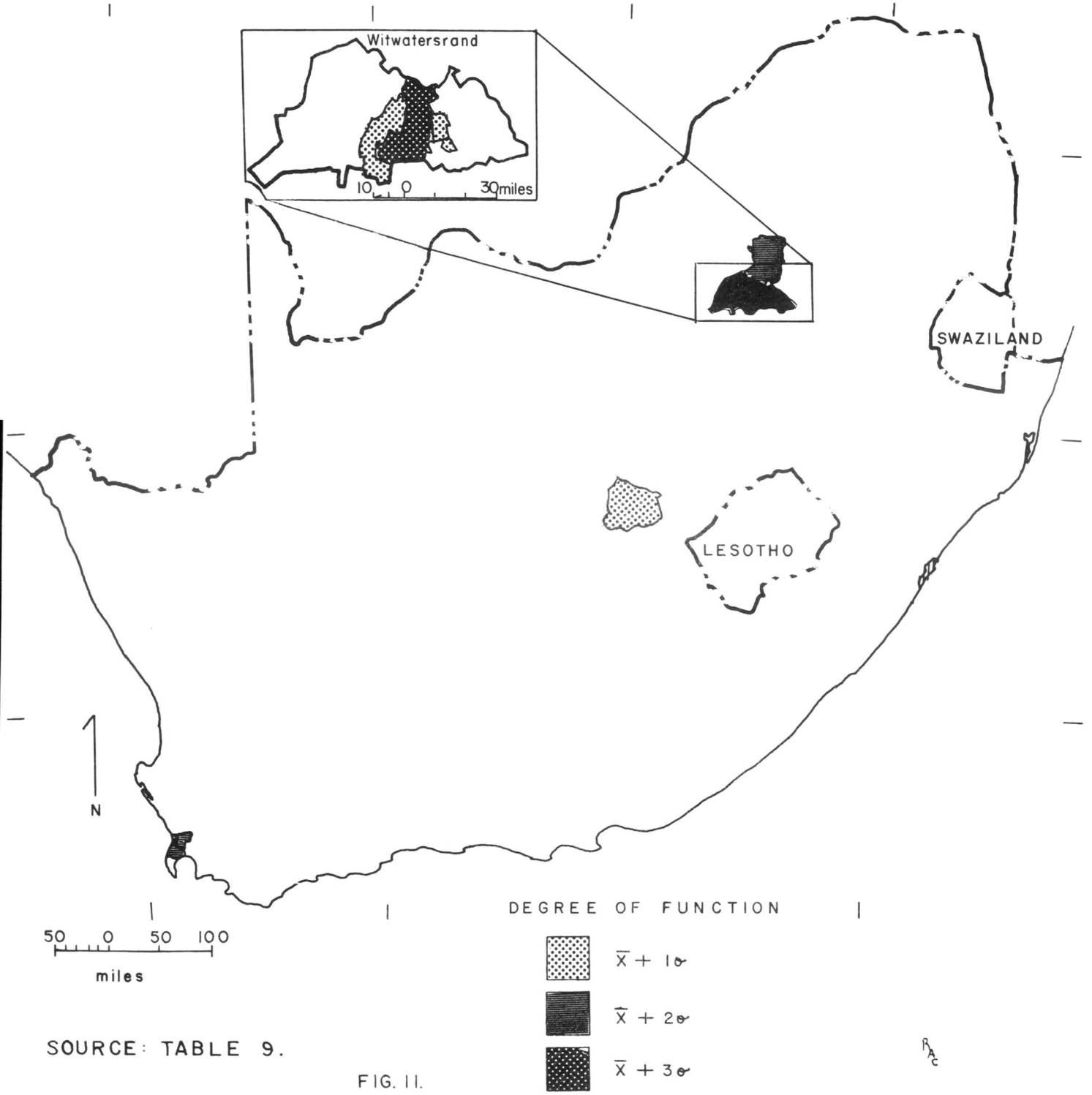
Other commerce is the category that refers primarily to banks and other financial institutions which indicates the more refined nature of commerce.[1] One might expect this category to occur only in those areas containing a large concentration of urban population. In South Africa this basically holds true (Fig. 11). The four districts of the Cape Peninsula and those districts adjacent to it boast degrees in this function of 2SD and 3SD. Durban is also high in this functional class. Bloemfontein, Pretoria, and the central Rand are high in this category with Johannesburg quite naturally having the highest intensity with a degree of 3SD.

Transport

Transport is a highly concentrated industry (Fig. 12). In the Cape Province only the district of Stellenbosch is highly specialized enough to register as a transport district. The central Orange Free State does not register in the industrial category transport, and in the Transvaal only Kempton Park in the Rand has a high enough percentage to register as a transport center. Bloemfontein and De Aar also

[1] The districts that occur within the major urban manufacturing areas but are not populated enough to be categorized as specialized in "other commerce" usually are found between the mean and one standard deviation. This also holds true for regional centers such as Kimberly.

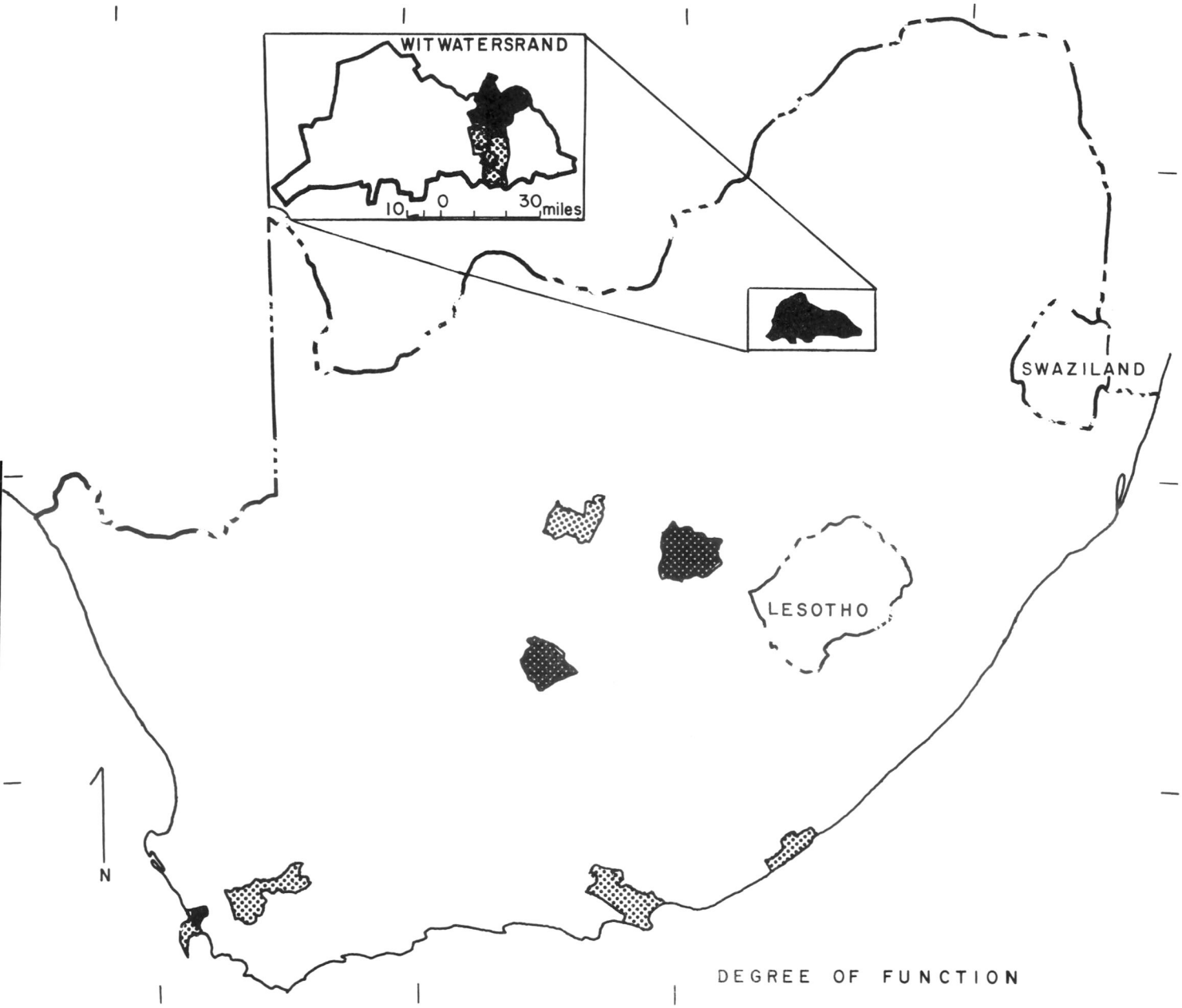
OTHER COMMERCE DISTRICTS — 1960



SOURCE: TABLE 9.

FIG. 11.

TRANSPORT DISTRICTS — 1960



SOURCE: TABLE 9.

FIG. 12.

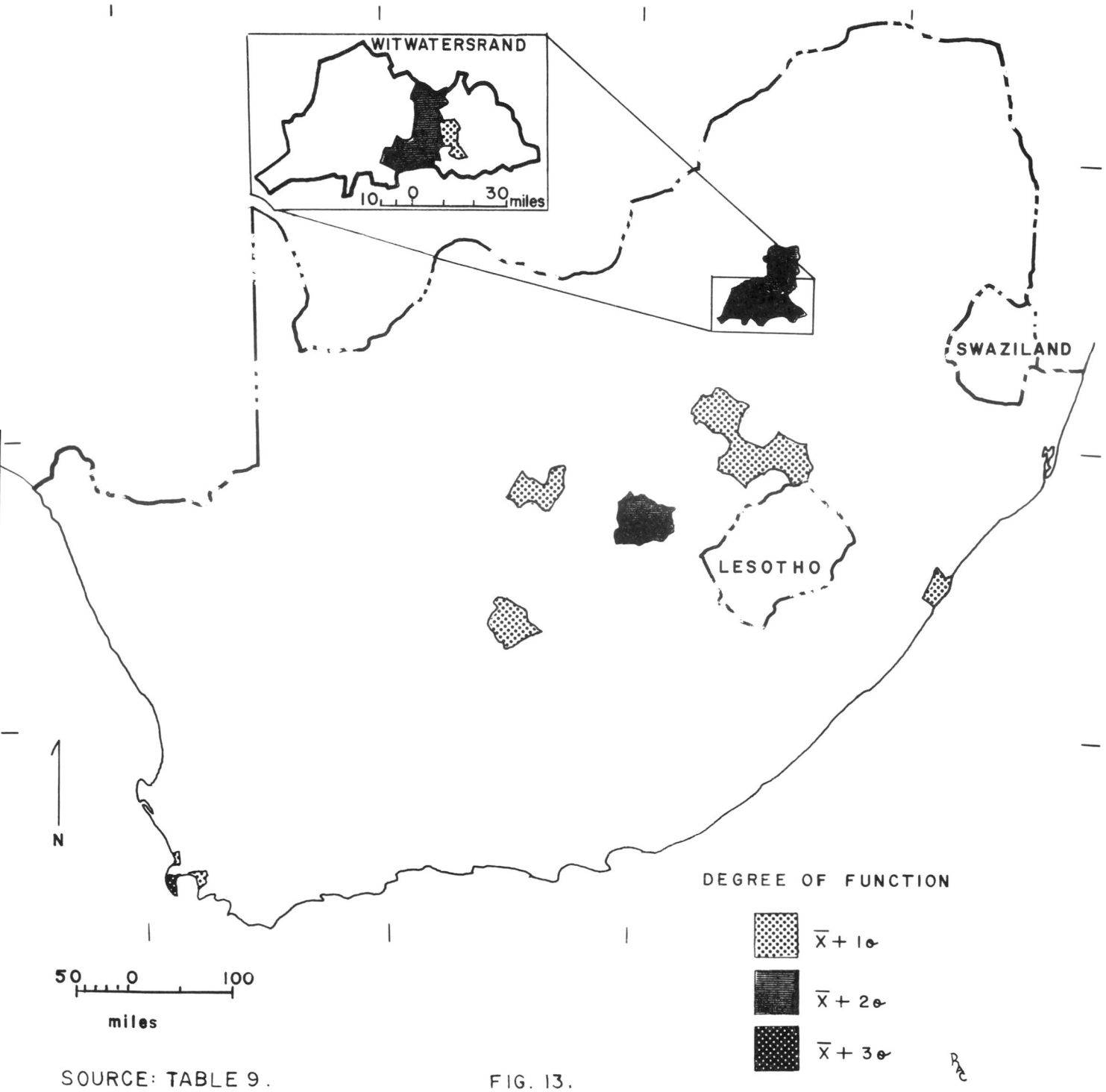
have a high concentration in transport. Much of the specialization in transport can be attributed to historical developments, especially in the case of De Aar. De Aar occupied the site of the junction of the Cape Province's three main rail lines (Cape Town, Port Elizabeth, and East London) as they developed toward the diamond and gold fields of the interior and as the junction for southwest Africa. Today De Aar remains 3SD above the mean in Transport.

Services

Services as an industrial category in South Africa is an anomaly within an anomalous situation. Services are represented by abnormally high percentages throughout South Africa.[1] These high percentages are largely the result of the large numbers of Bantu employed as "domestics" in nearly every district (Fig. 13). Quite surprisingly those districts bordering native states, although high in service percentages, were not high enough to be classified as service centers. Three districts in the Cape area adhere to the above components with the Cape district functioning as focal point because of its cultural, educational, and governmental (legislative capital) dominance. Durban as well as Kimberly are service centers. Also, Bloemfontein as capital of the Orange Free State and seat of South Africa's Supreme Court

[1]Services include government, business, recreation, educational, medical and research activities. However, the most important aspect is the employment of a large number of domestics.

SERVICES DISTRICTS — 1960



SOURCE: TABLE 9.

FIG. 13.

functions as a service center. The central Rand, as expected, is high in services with Johannesburg as the focal point with "spill over" into Germiston and Potchefstroom. Kroonstad and Senekal in the Orange Free State appear as 1 SD above the mean in services which is probably a result of services extended to established native reserves of homelands.

Davies' Presentation of Nelson's Method

Since the mechanics and analysis of South Africa's eighty-eight most industrialized magisterial districts have been completed, an analysis of the economic structure of South Africa's cities has been made by R. J. Davies.[1] At this point it is appropriate to present a synopsis of the article.

Each successive article by Davies builds upon the last. The most significant contribution of his latest article is an elaborate table containing size classes, rank-order in the urban hierarchy, activity ratio class,[2] Alexandersson's classification, Nelson's classification, and the dominant function of each city (unadjusted).[3]

Data and Methods

Davies states that his data are derived from unpublished

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[1] R. J. Davies, "The Economic Structure of South African Cities", The South African Geographical Journal, Vol. LI, (1969), pp. 19-38.

[2] This is the labor force (economically active) expressed as a percentage of the total population and divided into classes.

[3] No attempt was made to assign quantitative boundaries as Harris did, but this merely indicates the industrial category with the highest percentages.

materials and materials gathered over a period of time from the field.[1] His data were compiled for 318 urban places with a minimum of 2,000 persons.[2] Metropolitan areas were used for the larger cities and most importantly those cities in the western and eastern Witwatersrand were grouped into the two divisions "West Rand" and"East Rand". Also, the intensive mining districts of the central Orange Free State were grouped together as the O. F. S. Goldfields. Davies then codifies the existing urban hierarchy as established by himself at an earlier date, and he divides the ratio of the economically active labor force to the total population into "activity ratio" classes. Davies uses seven industrial categories (condensed from sixty-four)[3] which are the same as those appearing in the published census material (Census Report, Vol. VII, No. 2, 1960). Davies accomplishes two analyses of the economic structure by using both Alexandersson's and Nelson's method.[4] Davies mentions the spatial distributions

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[1]Davies, "Economic Structure of South African Cities", p. 19.

[2]Davies does not indicate the reason 2,000 population was used as a cut-off point. The South African Census Bureau uses a population of 500 as a definition for an urban place.

[3]Unpublished census material. Davies, "Economic Structure of South African Cities", p. 19.

[4]An application of Pownall's method is (L. L. Pownall, "Functions of New Zealand Towns", The Annals of the Association of American Geographers, Vol. XLIII, No. 2, pp. 232-250) made. This method is based upon deviations from the national mean in each industrial category. This classification, although yielding a multifunctional classification, is subject to all the evils of classification based upon national averages.

only in passing, and he indicates that the spatial distribution will be dealt with in more detail in later publications, but there is a basis for comparison in Nelson's functional classification.

Comparison

One might think that the above mentioned publications would detract from this study. On the contrary, Davies' findings provide a most welcome basis for comparison. Although Nelson's method is used both in this study and by Davies, different sets of data are used to arrive at the same theoretical goal, i.e., the analysis of South Africa's industrial-urban structure.[1] Therefore, a comparative base is established through two quite different sets of data.

It should be pointed out that Davies uses the two categories; construction and electricity whereas this study does not. In addition, Davies uses the category commerce whereas this study divides commerce into three separate categories which provide a more finite analysis. These differences must account for some of the descrepencies in the comparison. Table 9 provides a comparison between the data of this study and the data of Davies' study. It must be remembered that Davies' study is being compared to this study; therefore, only those sample areas that

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[1]The sample areas of necessity are different. It was totally impossible to obtain unpublished census materials as Davies did; therefore, only the published South African Census could be used.

TABLE 10. A Comparison of Nelson's Classification

Key: Symbols used in this study:
MI - Mining
M - Manufacturing
WR - Wholesale & Retail Trade
MT - Motor Trade
OC - Other Commerce
T - Transport
S - Services
LP - Low Percentages

Symbols used in Davies' Study:
MI - Mining
M - Manufacturing
CN - Construction
E - Electrictiy
C - Commerce
T - Transport
S - Services
LP - Low Percentage (originally blank, but for clarity changed to LP)

( ) = the category with the highest percentages in both classifications.
--- = regional divisions as categorized in this study.

District	Functional Types	City	Davies' Functional Types
Bellville	$WR_1OC_2T_2(M)$		
Cape	$M_1WR_3MT_1OC_3T_1S_1(S)$		
Simonstown	$WR_1OC_1T_1S_3(S)$	Cape Town Metropolitan area	$C_1(M)$
Wynberg	$M_1WR_2MT_1OC_2T_1(S)$		
Paarl	$M_1(M)$	Paarl	$M_2(M)$
Somerset West	M WR MT S (M)	Somerset West	LP(M)
Stellenbosch	LP(S)	Stellenbosch	$S_2(S)$
Worcester	$T_1(S)$	Worcester	$M_1(M)$
Malmesbury	$MT_2(S)$	Malmesbury	$CN_1(S)$
Caledon	$MT_1(S)$	Caledon	$C_2(C)$
George	LP(S)	George	LP(M)
Oudtshoorn	LP(S)	Oudtshoorn	$S_1(S)$
Port Elizabeth	$M_1WR_1MT_1T_1(M)$	Port Elizabeth	$M_1(M)$
Uitenhage	$M_1T_1(M)$	Uitenhage	$M_1(M)$

TABLE 10. Continued

District	Functional Type	City	Func. Types
Albany	LP(S)	Grahamstown	S_2(S)
Craddock	LP(S)	Craddock	LP(S)
De Aar	T_3S_1(S)	De Aar	T_2(T)
East London	$WR_1MT_1T_1$(S)	East London	LP(M)
King William's Town	LP(S)	King Wm's Town	M_1(M)
Queenstown	LP(S)	Queenstown	LP(S)
Namakwaland	LP(MI)	Nababiep	MI_3(MI)
Gordonia	LP(S)	Upington	T_1(C)
Kuruman	LP(MI)	Kuruman	LP(S)
Postmasburg	MI_1(MI)	Postmasburg	MI_2T_2(T)
Vryburg	LP(S)	Vryburg	C_1(C)
Kimberly	$WR_1MT_1T_1S_1$(S)	Kimberly	MI_1(S)
Durban	$M_1WR_2MT_2OC_1T_1S_1$(S)	Durban Metropolitan Area	LP(M)
Pinetown	S_1(S)		
Port Shepstone	LP(S)	Port Shepstone	T_1S_1(S)
Umzinto	LP(S)	Umzinto	C_1(S)
Inanda	LP(M)	Tongaat	M_1(M)
Lower Tugela	LP(S)	Stanger	CN_1(M)
Lower Umfolozi	LP(M)	Empangeni	M_1(M)

TABLE 10. Continued

District	Functional Type	City	Func. Type
Pietermaritzburg	LP(S)	Pietermaritzburg	S_1(S)
Estcourt	LP(S)	Estcourt	M_1(M)
Klip River	LP(S)	Ladysmith	T_1(M)
Lion's River	LP(S)	Howick & Howick W.	M_2(M)
Dundee	LP(S)	Dundee	S_1(S)
Newcastle	LP(MI)	Newcastle	MI_1(M)
Vryheid	LP(MI)	Vryheid	LP(S)
Johannesburg	$M_1WR_3MT_2OC_3S_2$(S)	Johannesburg	C_1(C)
Germiston	$M_2WR_1MT_1OC_1T_1S_1$(M)	Germiston	MI_1M_1(M)
Benoni	M_1(M)	East Rand	MI_3(MI)
Boksburg	$MI_1M_1T_1$(MI)		
Brakpan	MI_1(MI)		
Kempton Park	M_3T_2(M)		
Springs	MI_2(MI)		
Krugersdorp	MI_1(MI)	West Rand	MI_3(MI)
Oberholzer	MI_3(MI)		
Randfontein	MI_2(MI)		
Roodepoort	MI_1OC_1(MI)		
Pretoria	$MT_1OC_2S_2$(S)	Pretoria	S_3(S)

TABLE 10. Continued

District	Functional Type	City	Func. Type
Vanderbijlpark	M_3(M)	Vanderbijlpark	M_3(M)
Vereeniging	M_2(M)	Vereeniging	M_2(M)
Klerksdorp	MI_2(MI)	Klerksdorp	MI_2(MI)
Lichtenburg	MT_1(S)	Lichtenburg	C_1(C)
Potchefstroom	LP(S)	Potchefstroom	S_2(S)
Brits	LP(S)	Brits	C_2(C)
Marico	LP(S)	Zeerust	LP(S)
Rustenburg	LP(MI)	Rustenburg	C_1(C)
Pietersburg	LP(S)	Pietersburg	LP(S)
Potgeitersrus	LP(S)	Potgeitersrus	C_1(S)
Soutpansburg	LP(S)	Louis Trichardt	MI_3(MI)
Warmbad	LP(S)	Not Listed	
Bronkhorstpruit	LP(MI)	Bronkhorstpruit	LP(S)
Middleburg	LP(S)	Middleburg	S_1(S)
Witbank	LP(MI)	Witbank	LP(M)
Bethal	LP(S)	Bethal	C_1(C)
Heidelberg	LP(MI)	Heidelberg	CN_1S_1(S)
Nigel	MI_1(MI)	Nigel	MI_3(MI)
Standerton	LP(S)	Standerton	LP(M)

TABLE 10. Continued

District	Functional Type	City	Func. Type
Carolina	LP(S)	Carolina	$CN_1(S)$
Ermelo	LP(S)	Ermelo	LP(S)
Piet Retief	LP(S)	Piet Retief	LP(S)
Barberton	LP(MI)	Barberton	$S_1(S)$
Letaba	LP(S)	Tzaneen	LP(S)
Lydenburg	LP(MI)	Lydenburg	$S_1(S)$
Nelspruit	LP(S)	Nelspruit	$C_1(C)$
Pilgrim's Rest	LP(M)	Sabie	$S_1(S)$
Bloemfontein	$WR_1MT_2OC_1T_3S_2(S)$	Bloemfontein	$C_1T_1(C)$
Odendaalsrus	$MI_2(MI)$	O.F.S. Goldfields	$MI_3(MI)$
Virginia	$MI_3(MI)$		
Welkom	$MI_3(MI)$		
Kroonstad	$MT_1S_1(S)$	Kroonstad	LP(S)
Senekal	$S_1(S)$	Senekal	LP(M)
Sasolburg	$MI_1M_1(MI)$	Sasolburg	$M_3(M)$
Bethlehem	$MT_1S_1(S)$	Bethlehem	$T_1(S)$
Harrismith	LP(S)	Harrismith	LP(M)

make up the universe of this study are compared. For added comparison the category of each district having the highest percentage is indicated in parentheses. It will also be noticed that in some districts it was necessary to list the names of the largest city because these districts do not bear the same name as their largest city. The comparison can in no way be exact because Davies uses all cities having 2,000 population or more; however, with the exception of the larger metropolitan areas, many districts have more than one city with a population of 2,000 or more. This means that Davies may have used data for many towns in a particular district separately, whereas this study used the data from each district as a unit. The comparison is made between the district and the largest city (Davies), but in most cases the names are the same. The comparison is best made with the largest city because the largest city will always be the focal point of the magisterial district. In fact, this was the basis for the formation of the magisterial district as a local political unit. Also, in a few instances certain districts[1] are not comparable to Davies' study because they are tabulated as being part of the metropolitan area of the parent city. It should also be noted that Davies combines most

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[1] Cape Town
Bellville
Simonstown
Wynberg
Durban
Pinetown

of the Witwatersrand districts into two metropolitan areas, and the same is done for three districts in the central Orange Free State.[1]

Cape Area

The immediate Cape area (Table 10) compares rather favorably with the most notable exception being Somerset West. Quite probably the reason lies in a more evenly distributed labor force throughout the district rather than concentrated in the central city or focal point. The four districts that make up the metropolitan area of Cape Town are most heavily concentrated in other commerce (banking and finance) which would, in Davies' classification, be indicated as commerce. The low percentage districts (employment is too low to indicate specialization) show up as being most heavily concentrated in either manufacturing or services. This is expected because manufacturing is the most prevalent city-forming industry, and services are abnormally high in South Africa.[2]

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[1]

West Rand	East Rand	O.F.S. Goldfields
Krugersdorp	Benoni	Odendaalsrus
Oberholzer	Boksburg	Virginia
Randfontein	Brakpan	Welkom
Roodepoort	Kempton Park	
	Springs	

[2]As stated before the high emphasis upon domestic service in South Africa accounts for the high percentages (20-30%) for most urban areas in services. This is also noted by Davies.

Southern Coast

The southern coast of the Cape Province with Port Elizabeth as the focal point (Table 10), and the hinterland of Port Elizabeth compare almost exactly. East London and its hinterland (Table 10) differ somewhat in comparison. The two central places in the hinterland could compare, but East London itself is quite different. Davies' classifies East London as a low percentage city, but the district of East London indicates specialization. East London is specialized in manufacturing in that it lies between the mean and one standard deviation and East London's highest percentage according to Davies is manufacturing. In this respect there is a comparison.

Northern Cape Province

The districts of the northern Cape Province (Table 10) compare as closely as can be expected considering the large amount of area. Here again a closer comparison is realized when the percentages between the mean and one standard deviation are recorded. For example, the district of Gordonia is highest in services, but the focal point (Upington) is identified as transportation in Davies' classification, yet the district registers transport as being between the mean and one standard deviation. The whole of the district of Kuruman is highest in mining, but the city is identified as service dominated. The largest discrepency is Kimberly. Davies indicates Kimberly correctly as a mining center but the district registers in

other categories primarily because it has become a regional center.

Durban Area

Durban's (Table 10) national prominence is not indicated by Davies' method, but both classifications do recognize the manufacturing base of the Durban area. The remainder of coastal Natal (Table 10) compares very well in both classifications. Also, Pietermaritzburg and the other districts of the interior of Natal (Table 10) compare favorably. Again the main difference is between manufacturing and services which is to be expected. A major discrepency occurs in the district of Klip River; however, the comparison is more favorable when the function (transport) between the mean and one standard deviation is realized. Lion's River is high in services but the towns of Howick and Howick West are highly specialized in manufacturing.

Witwatersrand

Johannesburg (Table 10) is most specialized in other commerce (banking and finance), and both the west and east Rand districts are extremely high in mining and manufacturing. Davies' study indicates the same specialization in both areas whereas this study recognizes a slightly higher specialization in mining in the West Rand districts. The districts adjacent to the Rand (Table 10) compare in a similar manner to those within the Rand. Pretoria, as expected, is high in services and Vanderbijlpark, Vereeniging, and Klerksdorp compare exactly.

Northern and Eastern Transvaal

The northwestern Transvaal districts (Table 10) compare favorably with the exception of Rustenburg, but the two districts of northern Transvaal (Table 10) do not correlate. Soutpansberg as a large district is highest in services but registers as mining, and Potgietersrus although highest in services registers in commerce according to Davies. The districts of the eastern Transvaal also are comparable, but it must be remembered that the districts only roughly resemble cities. As an example, Pilgrim's Rest is highest in manufacturing, but the largest city in this district registers as being specialized in services; Graskop, the second largest city, is highest in manufacturing. Although the largest city is best for comparison, the other urban areas of a district can at times give a clue to the classification of the district.

Orange Free State

The Orange Free State is comparable, especially the three districts that comprise the O. F. S. Goldfields. The other Orange Free State districts are comparable except that Senekal and Harrismith are identified as high in services but Davies indicates that they are high in manufacturing.

Summary and Comparison

The above comparison has indicated that the study made by Davies using Nelson's classification (with a few exceptions) compares as close as can be expected to the utilization of

Nelson's method in this study. This re-enforces the findings of this study and through comparison provides a degree of clarity of the difference between magisterial district and city. One might state that the most important conclusion lies in the fact that a functional classification of the central city with its service area will, generally speaking, yield the same functional types.

Chapter V

Summary and Conclusion

The first part of this chapter will provide a summary of this study. The second part of this chapter will state, discuss, and relate the conclusions that are the end result of all research and writing associated with the study. The purpose of this chapter is to provide a synthesis of all components of this study by demonstrating the existing interrelationships.

Summary

The nature of this study is urban, and the core of the study was the classification of South Africa's urban-industrial areas by two quantitative methods so as to analyze the industrial system. Through the results of these two classifications the nature of the economic structure of South Africa's urban areas was discovered.

The urban system is discussed in order to provide the basis for studying the economic structure of South Africa's urban areas. Central places and the urban hierarchy, are the basic components of any urban system. Central places are related to the term "focal point" because it is the urban focal point which was the basic factor in the formation of the political unit (magisterial district) used in this study.

The general reference to central places or focal points provides an introduction to the urban hierarchy in South Africa. South Africa's urban hierarchy, as presented in this study, can

be considered with accuracy. The synopsis of the urban hierarchy is based upon two studies by R. J. Davies who is considered to be one of the leading experts on urban South Africa. Two important deductions can be made from the urban hierarchy as established by Davies; (1) South Africa's urban system is a quasi-continuum of cities and (2) the urban hierarchy, when compared to the theoretical models established by Christaller, is the market model. There are a number of definite breaks in the hierarchy in the upper orders but a continuum is the rule in the lower orders. The comparison to Christaller's model indicates a market oriented hierarchy, but there is a deviation in population indicating South Africa's lack of intense agricultural settlement.

The urban hierarchy is not sufficient to establish how South Africa's urban system has evolved. A number of variables and factors must be considered. Chapter II considers the general physical and cultural geographical factors.

One important physical factor lies in the fact that South Africa lacks natural or even good harbors. All of South Africa's harbors are man made, and there are no navigable rivers in the interior of the country. All of the rivers are plagued by rapids, falls, sandbars, and a discontinuous volume of water. The coastal plain area of South Africa is almost non-existent and the interior was virtually inaccessible because of the Great Escarpment which rims South Africa (except in the western Cape Province). Once the interior was penetrated, the lack of water

and vastness of the interior plateau became natural enemies. It is the lack of an inland water route system and the barrier of the Great Escarpment that impeded settlement to the interior. Once the interior was reached the vastness and arid nature seemed best suited to pastoralism and a subsistent type of agriculture. It should be noted that the primary factors involved in the type of activity established can be related to the attitudes of the settlers (perception of one's environment). The settlers were migrating inland to escape authority, and the interior was not suited to the agricultural practices to which these early settlers were accustomed. Two important results stemmed from the blend of the nature of the interior and the perception of the interior by its settlers: (1) isolation and (2) the lack of a sound agricultural society. Isolation developed because the basic unit of production became the family unit. Farming villages did not develop because both the abundance of land and the grassland veld were well suited to pastoralism. It is important to note that a subsistent type of agriculture developed on the family level. This meant that no sound commercial agricultural base capable of producing surplus products existed when industrialization began. It was the industrialization that created a need for sophisticated agriculture. The agricultural society did not develop past the family level primarily because of a lack of markets. Also, as previously stated there was no inland water routes to establish interaction even if there had been markets. Railroads did not develop in South Africa until

the 1860's, and only poorly developed wagon trails existed as roads.

The Bantu are the largest group in South Africa and they are a major influence upon the urban system. The Bantu migrations and settlement, as well as the subsistent nature of the Bantu, plays an important role in defining the economic structure of South Africa's urban areas. The European settlement patterns of South Africa are discussed in a more detailed manner because it is the European element that is directly responsible for today's urban system in South Africa. In 1910 the two British colonies of the Cape and Natal combined with the former "Boer Republics" of the Orange Free State and the South African Republic (Transvaal) to form the Union of South Africa. The Union broke all colonial ties with Great Britain although South Africa remained in the British Commonwealth. The Union created a need for industrialization in South Africa. It should be noted that the interior was largely settled as a result of friction and disagreement between the Dutch and British elements of the Cape Colony.

South Africa's highly urban and highly industrialized society can be attributed to the discovery of minerals in the interior. Diamonds and especially gold enticed thousands of people of all types and varieties to settle in the interior primarily in the vicinity of the Witwatersrand in the southern Transvaal. It is the discovery of minerals in the late nineteenth century that laid the foundations for South Africa's industrial revolution.

It is also the close association of minerals, industrialization, and high density of population that accounts for a number of deviations in South Africa's urban system.

The economic structure of South Africa's urban areas has been defined by discovering the basic or excess employment through the utilization of the minimum requirements method. This method indicates the required minimum percentage of the labor force in a given industrial type that is necessary to make an urban area viable. The most important aspect of this classification is the index of specialization. Through quantitative analysis it has been possible to determine the level of specialization obtained by each magisterial district utilized in this study. It is the results of the index of specialization that lead to the basic realization of the anomalous situation occupied by South Africa's urban areas.

Functional types identified on the basis of employment indicates the true industrial structure of urban areas. To further classify the urban system of South Africa, Howard Nelson's multifunctional classification system was utilized. It was necessary to establish actual functional types as well as the degree of the function in order to analyze the distribution of the functions of urban areas. The functional classification and the index of specialization compared favorably. The functional classification indicated the main functions and their levels of specialization; the index of specialization indicated the exact degree of specialization.

Since the initial research and calculations were made, R.J. Davies has continued his research into South Africa's urban system by utilizing Howard Nelson's multifunctional classification. Davies utilized data for individual cities while this study utilized data for magisterial districts, which can be considered politically superimposed boundaries of generalized service areas, therefore, the studies can be considered as complementary. As a result this study welcomed the chance for comparison, and in most instances the comparison was favorable, thereby indicating a common result through different means.

Conclusions

The conclusions established in this study are a result of both quantitative and qualitative analysis. South Africa became urbanized as a result of industrialization and the main area of industrialization was based upon the exploitation of some of the richest mineral deposits in the world.

Urbanization

The urbanization began in the late nineteenth century after the discovery of diamonds and gold. The European was the first to become urbanized in South Africa. Today, a paradox exists in South Africa. The Bantu are migrating to the cities in search of high paying jobs while the South African government is attempting the relocation of the Bantu in "Bantu Homelands". The Bantu who have become urbanized make up an important part of the employment in each of the industrial categories. Also, the

large subsistent element of the Bantu is a part of the total labor force, and this causes some deviations from the norm. The abnormally high employment in services can be attributed to Bantu who are employed as domestics.

Urban Economic Base

The Bantu who are categorized as employed in agriculture or not economically active indicate an anomalous situation in South Africa. The anomaly occurs when the minima from each population category are summed. It was known that the Bantu did play a significant role in the economic base, but it was not known exactly how significant. The establishment of the minima for each category in each population class defines the significance. The high number of subsistent Bantu significantly lowers the minimum percentages in each industrial sector with the exception of the two categories that contain the four largest cities. In these two categories the subsistent Bantu is either non-existent or not large enough to distort the minimum percentages.

Specialized Districts

The specialization of each of the eighty-eight most industrial districts was discovered in this study. By using all eighty-eight districts to determine the specialization index a great range occurred. This was expected because of the great difference between many of the districts. The first clue to South Africa's anomalous situation may be found in the analysis of the index of specialization of the districts. Using the

specialization indices provided by Ullman and Dacey as a basis for measurement, it may be readily seen that the larger manufacturing and trade areas in the United States are diverse. This holds true for South Africa's coastal manufacturing urban areas, but the highly populated manufacturing areas of the interior (with the exception of Vereeniging, Vanderbijlpark, Kempton Park and Johannesburg)[1] indicate a high degree of specialization. This relates to an association of minerals, manufacturing, and dense population. This association accounts for the anomalous urban situation in South Africa. It also is responsible for South Africa's deviation from the observation that as city size increases specialization decreases; therefore, there is no linear correlation between specialization and population. Again it must be realized that the mineral situation in South Africa can account for these deviations.

Nelson's multifunctional classification also supports this conclusion. The large coastal areas are represented by manufacturing as well as at least one of the three aspects of commerce as used in this study. The districts of the interior (Rand) indicate specialties in mining, but it should be noted that the functions of manufacturing and at least one of the three sectors of commerce appear between the mean and one standard deviation for these districts. This in-

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[1]These districts lack a heavy concentration in mining. Johannesburg is specialized in each category and thereby indicates diversification and international prominence.

dicates a normal specialization in a number of functions which is typical for large urban centers. The specialization obviously occurs from the category of mining. It is the large numbers employed in mining that keeps the other functions between the mean and one standard deviation. The high employment in mining concentrated in highly populated urban areas creates a mask that disguises the otherwise diverse nature of these urban areas by suppressing the other functions typical of large urban areas. It may be stated that the association of mining with the highly industrialized, and to highly populated areas of the Rand and adjacent area account for the deviation from observations that highly populated areas are diverse. This is indicated by the specialization index and the multifunctional classification based upon the standard deviation. The comparison of this study to R. J. Davies' study yields very similar results although the data is entirely different. Davies' study divides the Rand into two cities and two other areas consisting of contiguous urban areas. Davies also discovers the specialization in mining, but he does not indicate functional types that occur between the mean and one standard deviation. Since the comparison between this study and the study made by Davies is generally close, one important conclusion may be developed. A functional classification of the central city will generally yield the same functional types or same functional

pattern as the central city and its service area.[1] This may only be taken as a general statement and is subject to other variables.

Core-Periphery Concept

The above conclusion tends to confirm a generally accepted theory that applies to urban-industrial development and the present urban-industrial situation in South Africa. It may readily be seen that the two major manufacturing areas and the two major population areas of South Africa are the coastal area (extending from Cape Town to Durban), and the interior which refers to the Rand and adjacent area of the southern Transvaal. There is a lack of a high degree of manufacturing and intense population anywhere else in South Africa especially in those areas lying between the south-southeastern coasts and the Rand.

Again minerals are the basic factor in the somewhat extraordinary situation of South Africa's urban system. The discovery of minerals was by far the main impetus to settlement in the Rand and led to the industrialization and high population there. The Great Trek and colonialization also contributed. Prior to the industrialization in the interior, the port cities were not highly industrialized because there were no available markets, and capital and raw materials were not readily accessible. Contrary to normal growth the industrialization of the Rand also prompted industrialization of the coastal area. It

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[1]Focal point, parent city, or whatever name best suits the situation.

should be remembered that the industrial revolution in South Africa did not begin until the early 1930's. South Africa's ports, unlike other world ports, did not develop industrially on their own but growth depended largely upon the interior Rand.

It must be concluded then that the Rand commands a great deal of economic control in South Africa with the prosperity and development associated with mineral development. The high concentration of employment in minerals is indicated by the specialization index and functional classification based upon the standard deviation.

Selected Bibliography

Books

Alexandersson, Gunnar. The Industrial Structure of American Cities. Lincoln, Nebraska: University of Nebraska Press, 1956.

Berry, Brian J.L. and Fred, Allen, Central Place Studies: A Bibliography of Theory and Applications. Philadelphia: Regional Science Research Institute, 1961.

Bryce, James. Impressions of South Africa. New York: The Century Company, 1900.

Carter, Gwendolyn M., ed. Five African States: Responses to Diversity. Ithaca, New York: Cornell University Press, 1963.

Chilvers, Hedley A. The Seven Wonders of Southern Africa. Johannesburg: Administration of the South African Railways and Harbours, 1919.

Church, R. J. Harrison, et al. Africa and the Islands. New York: John Wiley and Sons, 1967.

Cole, Monica. South Africa. New York: E.P. Dutton and Company, Inc., 1961.

Gregory, S. Statistical Methods and the Geographer. London: Longmans, 1969.

Haggett, Peter. Locational Analysis in Human Geography. New York: St. Martin's Press, 1964.

Hance, William A. The Geography of Modern Africa. New York: Columbia University Press, 1964.

Hodder, B.W. and Harris, D.R. eds. Africa in Transition: Geographical Essays. London: Methuen and Company, Ltd., 1967.

Hofmeyer, Jan H. South Africa. London: Ernest Benn Limited, 1931.

Murphy, Raymonds E. The American City: An Urban Geography. New York: McGraw-Hill Book Company, 1966.

Patterson, Sheila. The Last Trek: A Study of the Boer People and the Afrikaner Nation. London: Routledge and Kegan Paul Ltd., 1957.

Pollock, N.C. and Agnew, Swanzi. An Historical Geography of South Africa. London: Longman, Greene, and Company, Ltd., 1963.

Wallis, W. Allen and Roberts, Harry V. Statistics: A New Approach. New York: The Free Press of Glencoe, 1964.

Walker, Eric A. A History of South Africa. London: Longman's Greene, and Company, 1935.

Wellington, John H. Southern Africa: A Geographical Study. Vol. I, Physical Geography. Cambridge: At the University Press, 1955.

Wellington, John H. Southern Africa: A Geographical Study, Vol. II, Economic and Human Geography. Cambridge: At the University Press, 1955.

Journals

Davies, R.J. "The Economic Structure of South African Cities." The South African Geographical Journal. LI(1969), 19-38.

Davies, R.J. "The South African Urban Hierarchy." The South African Geographical Journal. XLIX (December, 1967), 9-21.

Davies, R.J. and Cook, G.P. "Reappraisal of the South African Urban Hierarchy." The South African Geographical Journal. L (1968), 116-133.

Fair, T.J.D. "The Core-Periphery Concept and Population Growth in South Africa, 1911-1960". The South African Geographical Journal.XLVII (1965), 59-71.

Harris, Chauncy D. "Functional Classification of Cities in the United States." Geographical Review, XXXIII (1943), 86-99.

Mallows, E.W.N. "Some Comments on Urbanization in South Africa." The South African Geographical Journal. L (1963).

Morrissett, Irving, "The Economic Structure of American Cities." Papers and Proceedings of the Regional Science Association. IV (1958), 239-256.

Nelson, Howard J. "A Service Classification of American Cities." Economic Geography. XXXI (3 July, 1955), 189-210.

Pownall, L.L. "Functional Classification of New Zealand Towns." Annals of the Association of American Geography. XLIII, 14 (December, 1953), 232-250.

Scott, Peter. "The Bantu Areas of South Africa." Geographical Review. (Record. LXVII, 3 July, 1957), 432.

Ullman, Edward L. and Dacey, Michael F. "The Minimum Requirements Approach to the Urban Economic Base." Papers and Proceedings of the Regional Science Association. VI (1960), 155-194.

Census Publications

South African Bureau of Statistics. Population Census: Characteristics of the Population in Each Magisterial District and Economic Region, Occupation, Industry and Type of Abode. Pretoria: Government Printer, VII, 22 (6 September, 1960).

South African Bureau of Statistics. Urban and Rural Population of the Republic of South Africa, 1904-1960. Pretoria: Government Printer, Report No. 02-02-01.

Correspondence

Collins, H.A., Information Counsellor. Letter: 21 October 1970, the nature of the industrial categories motor trade, other commerce, and transport. Washington, D.C.; South African Embassy.