

Economic and Environmental Evaluation of Development Alternatives for Beaufort County, S. C.

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with

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PART 1

Introduction

Nature of the Problem

Economic development has been a major goal of many rural counties in the southern United States in the years since World War II. With few exceptions, these rural counties, faced with mechanization of agriculture and decline in farm employment, have welcomed almost any type of new industry. Although some of the new industry has caused noticeable pollution, southern communities have often overlooked environmental problems in their search for a new economic base.

In the late 1960's, however, a noticeable shift in emphasis began to occur in the search for new industry. The acquisition of industry began to be viewed as a mixed blessing. While many communities continued to search for industry to replace agriculture as the foundation of their economy, more and more local leaders began to demand that new industry take special precautions to avoid excessive pollution of the environment. No longer was just any new industry considered desirable; the new industry must not cause any appreciable damage to the natural environment. This change in emphasis has created frustrations on the part of industrial development organizations and heated controversy in many local communities. Perhaps in no area has the conflict between industrial development and environmental quality been more dramatic than in Beaufort County, South Carolina.

In 1969 it was announced that the Badische Anilin and Soda Fabrik Company (generally designated by its initials, BASF) had acquired a site and was planning to construct a major chemical manufacturing facility at Victoria Bluff on the Colleton River in the southern part of Beaufort County, South Carolina. The site is in a sparsely-settled, undeveloped part of the county and is approximately equidistant (by existing highways) from Beaufort, South Carolina, and Savannah, Georgia (about 30 miles). It is however, only about four straight-line miles from the nearest point on Hilton Head Island and eight to ten miles from the portions of that island which have been developed very substantially as recreation-residential areas, a major attraction of which is the subtropical sea-island environment.

The developers of Hilton Head Island, the fishermen of the Port Royal Sound estuary (of which the Colleton River is a part) and a number of other groups and individuals who were interested in preventing pollution and in preserving natural environmental and ecological systems protested the construction of the proposed industrial plant unless and until they could be assured that it would be constructed

and operated in such a way, and under adequate government regulation and supervision, as to prevent any appreciable impairment of the existing economic and environmental attributes of surrounding and nearby areas.

In response to these protests and to requests for an impartial and systematic study of the possible effects of substantial industrial development of the Port Royal Sound area, and especially of developing Port Victoria as proposed, the Governor of South Carolina on January 21, 1970, issued the following directive to Mr. Clair P. Guess, Jr., Executive Director of the South Carolina Water Resources Commission:

"It has become necessary, in my opinion, to conduct a comprehensive study of the environmental conditions as they exist in the coastal area of the State. This, of course, would be far-reaching and necessitate a considerable amount of time and expense. Because of the proposed industry at Victoria Bluff, I feel that the first step would be that you and the staff complement of the Water Resources Commission should collect and evaluate base line environmental quality information relating to the development of this type of industry. You should utilize the interdisciplinary inputs and facilities of the agencies of the State, such Federal assistance as may be available, and, if necessary, employment of a private consultant firm.

This first effort should commence immediately."

Pursuant to this directive, Mr. Guess created an over-all committee to plan and coordinate the various physical, biological and socio-economic studies which would be made by specific study groups, which were designated by the over-all committee.

In January 1971, the BASF Company announced that it had cancelled plans to construct a plant at Victoria Bluff. Undoubtedly, the protest from conservation-oriented groups in the Hilton Head area, and the resulting delay in the ability of BASF to implement its construction plans, was a significant factor in the company's decision to cancel its original decision.* Yet the decline of agricultural employment in Beaufort County and the inherent uncertainty of the economic activities in the County dependent upon military spending required that community leaders seek new additions to the local economic base or face economic decline or stagnation. It is quite logical for them to look to manufacturing for this additional economic base. This report will deal with the socio-economic aspects of various types of possible industrial development in Beaufort

*The media has reported that both environmental and cost factors forced the BASF Company to cancel its construction plans.

County and some possible environmental repercussions of each type of development. The purpose of the report is to assist Beaufort County citizens and other interested persons in evaluating alternatives for the economic development which almost every resident of the area thinks is needed.

Problem Definition and Objectives

The central problem of this study is to determine the economic and environmental consequences of various types of industrial development in Beaufort County. Consequently, our analysis centers on the question: "What type of industrial development in Beaufort County will provide the greatest economic benefit to local people, and what will be some of the environmental consequences of that development?" This question must be studied within the context of the existing socio-economic conditions in Beaufort County and the viable alternatives for resource development in the area.

In accordance with such a definition of the problem, we have established four specific objectives for this study:

- 1) To examine the existing economic base and the socio-economic characteristics of the population of Beaufort County relative to the state and the nation.
- 2) To identify possible types of industrial development for Beaufort County and to estimate the magnitude and geographic distribution of the direct and indirect economic and environmental effects of each of the various types of development.
- 3) To estimate the effects that various types of development in Beaufort County will have on local and State government revenues and expenditures in both the near and more distant future.
- 4) To ascertain and evaluate the willingness of members of various social and economic groups to sacrifice pecuniary income in order to protect the environment of Beaufort County against the encroachment of industries which have a potential for environmental pollution.

Plan of the Report

The basic plan of this report follows the strategy implicit in the objectives set forward above. We will first describe in some detail the existing socio-economic conditions of Beaufort County, noting the distribution of the population by income groups, recent demographic trends and the current structure of the County's economy. In Part III, we will outline the development alternatives for Beaufort County and, using the framework of an input-output model, evaluate the economic and environmental impact of each of these alternatives. Objective four will be attacked in Part IV, where we will eval-

uate the results of a household survey in Beaufort County concerning attitudes toward environmental quality. Finally, in Part V, we will summarize our findings and attempt to identify and evaluate the alternatives for the economic future of Beaufort County.

Basic Concepts and Methodology

The basic premise underlying this study is found in the export base theory of economic development. The essential element of export base theory is that the impetus for regional growth stems from sales made by the region to buyers located outside the region [3]. Such sales bring in "outside money" to support markets for and jobs in local enterprises. These sales include both tangible goods, such as agricultural and industrial products, and intangibles, such as recreation sold to tourists. Although export base theory has been thoroughly critiqued [3] and must be used with a degree of caution, it has found wide acceptance as a planning tool and the basic premises are to be found in almost all regional economic projections [10, 20].

Following export base theory, we are assuming the autonomous factor giving rise to economic growth in Beaufort County is external sales (i.e., sales to buyers located outside the county). Each dollar of external sales generates more than one dollar of income in the county if that dollar (or some portion of it) is spent locally to purchase supplies and/or labor. If the worker spends a part of his paycheck locally, the local merchant also realizes income from the original dollar of external sales. Thus, a dollar of external sales may turn over several times before it gradually "leaks" out of the county through purchases made from external suppliers. The number of times a dollar turns over locally before leaking out is called the local multiplier. This local multiplier varies for different types of enterprises since some activities make extensive use of local inputs and other activities generate purchases of only small quantities of supplies locally. In the Beaufort County input-output model developed for this study, we have assumed external sales to constitute the "final demand" for locally-produced products and have calculated local export-base multipliers for each alternative type of economic development.

Sources of Data

Data used in this study have been obtained from three sources: 1) published and unpublished data collected by various Federal and State agencies; 2) a survey of a random sample of households in Beaufort County taken in the summer of 1970; and 3) a sample survey of business and industrial firms in Beaufort County conducted in the autumn of 1970. We will discuss in some detail the two surveys which were used to obtain primary information.

Household Survey

The household survey consisted of a stratified sample of 162 households, or approximately 1.2 percent of the households in Beaufort County. This sample was selected from a preliminary list of 650 households drawn from the personal property tax rolls in the office of the county treasurer using a systematic procedure based on a random starting point. These 650 households were classified according to the amount of personal property taxes paid in 1969, and a prime sample of 300 households was then chosen using a random procedure within each tax-level category. The original goal was to survey the entire prime sample of 300 households, using random selections from the remaining 350 households when substitutions were deemed necessary. During the course of the survey, however, an unauthorized reproduction and distribution of copies of the survey questionnaire created a possibility of bias*; hence the survey was terminated with only 162 valid interviews having been conducted. The survey was conducted by six local enumerators trained by personnel from Clemson University and working under the supervision of a field director. A copy of the questionnaire is presented in the Appendix.

Business and Industry Survey

The business and industry survey was designed primarily to obtain information on the geographic patterns of sales and purchases by Beaufort County business and industrial firms. An attempt was made to compile as complete a list as possible of such firms, using local telephone directories and the South Carolina State Industrial Directory. All firms on the list were mailed the questionnaire shown in the Appendix. Ninety-three usable questionnaires were returned representing all the principal sectors of the Beaufort County economy. No claim can be made, however, that the returned questionnaires represent a random sample, and it is difficult to assess the biases which may be inherent in the returned questionnaires. Nevertheless, the returned questionnaires appear to represent a cross-section of the local economy, and data obtained from them have been used to construct the technical co-efficients matrix of an input-output model for Beaufort County.

*The survey was made before the BASF Company announced the cancellation of its construction plans and while an atmosphere of distrust and suspicion was prevalent among several groups in the County.

PART II

The Economy of Beaufort County

Introduction

This section is concerned primarily with Objective 1 as defined in the preceding chapter. It describes in some detail the existing socio-economic conditions in Beaufort County as a background against which various types of economic development alternatives can be evaluated.

CHARACTERISTICS OF POPULATION

Population Trends

The 1970 Census of Population placed the population of Beaufort County at 51,136, up from 44,187 in 1960. This growth amounted to a 15.7 percent increase in the decade of the sixties, as compared to a 5.9 percent growth over the same period in the State of South Carolina [22]. As evidenced by the data presented in Table 1, there was a rather dramatic shift from a rural to urban setting for the Beaufort County population in the 1960-1970 period. In 1960, only 14.3 percent of the population was classified as urban; in 1970, slightly more than one-half (50.2 percent) was urban. Part of this shift was due to a 49.8 percent increase in the population of the city of Beaufort over the time period, but part of the shift was also due to annexation on the part of the town of Port Royal.

TABLE 1. Rural-Urban Distribution of Population, Beaufort County, South Carolina, 1960 and 1970

Year	Total Population	Total Urban	Total Rural	Percent Urban	Percent Rural
1960 ^{a/}	44,187	6,298	37,889	14.3	85.7
1970 ^{b/}	51,136	25,657	25,479	50.2	49.8

SOURCE: ^{a/} U. S. Bureau of the Census, *1960 Census of Population*, U. S. Department of Commerce, Washington, D. C.

^{b/} U. S. Bureau of the Census, *1970 Census of Population, South Carolina*, Advance Report.

Table 2 reveals the relative growth or decline in population in each of the five census divisions of Beaufort County over the decade of the sixties. About 30 percent of the total population growth of the county in the 1960-1970 period occurred in the Bluffton Division, an area including both the Hilton Head resort community and possible industrial sites at Port Victoria. Much of this growth in the Bluffton Division is undoubtedly due to the development of Hilton Head Island since 1960. The other growth center of the county is the Beaufort Division, which includes the city of Beaufort. All other census divisions had either stable or declining populations during the decade of the sixties.

TABLE 2. Population of County Subdivisions, Beaufort County, South Carolina, 1970 and 1960

County Subdivision	Year		Percent change 1960-1970
	1970	1960	
Beaufort Division	22,382	16,686	34.1
Bluffton Division	5,252	3,135	67.5
Port Royal Division	15,254	15,025	1.5
St. Helena Division	5,718	6,048	- 5.5
Sheldon Division	2,530	3,293	-23.2
Total	51,136	44,187	15.7

SOURCE: Same as Table 1.

The 1960's saw not only a shift from rural to urban residence in Beaufort County but also a decline in the relative importance of nonwhites in the population. The 1970 Census reported that 34 percent (17,272 persons) in Beaufort County were nonwhite, whereas in 1960, 39 percent (17,104 persons) in the County were nonwhite. For South Carolina as a whole, 31 percent of the population was reported to be nonwhite in 1970 as compared to 35 percent in 1960. Thus, changes in the racial makeup of the Beaufort County population closely approximate the state-wide trend in the decade of the 1960's [22].

Education

In 1968-1969, there were 10,339 students* enrolled in public schools in Beaufort County [15]. Six public high schools enrolled 4,845 students, or an average of 808 students per school, while the 14 public elementary schools had a total enrollment of 5,494 students, or an average of 392 students per school. About 55 percent of the total public school enrollment in the County in 1968-1969 was nonwhite.

It is difficult to estimate the current level of educational attainment of the population of Beaufort County. The most recent concrete data are from the 1960 Census and show that only 14 percent of the population of the County 25 years old or older had completed the 12th grade [22]. This compares to slightly more than 30 percent of the 1960 state population 25 years old or older who had completed the 12th grade. Although educational levels in Beaufort County had undoubtedly improved considerably since 1960, it appears likely that the 1970 Census will show that educational attainment in the County still lags behind that of the State as a whole.

Tax Structure

In South Carolina, the principal source of local government revenue is the property tax. In 1969, personal and real property in Beaufort County was valued at \$18,165,100, or \$355 per capita. The value of all personal and real property in South Carolina as a whole amounted to \$481 per capita in 1969; hence, the local tax base in Beaufort County on a per capita basis is less than 75 percent of the property tax base statewide [18]. Although many of the

*Based on ten-day average attendance.

taxes collected by the State of South Carolina are shared with county governments, the relatively low property tax base in Beaufort County poses significant problems for the operation of county and local government.

One of the major expenditures of county government in South Carolina is in the support of the public school system (although the counties do in fact pay less of such costs than the state government). In 1969-1970, Beaufort County spent \$1,650,816 of locally-collected county money for school purposes, an average of \$155 per pupil [19]. The statewide average expenditure per pupil from locally-collected taxes was \$214. The presence of sizeable military installations in Beaufort County, however, made the local school system eligible for assistance from the Federal Government under Public Laws 815 and 874 (hereafter called Impacted Area Funds), and in 1969 Beaufort County received \$631,568 in Impacted Area Funds [19]. Given these funds and shared revenue from the State, per pupil expenditures in Beaufort County in 1969-1970 totaled \$530 as compared to an average of \$457 statewide.

Some insight into the tax structure in Beaufort County and the potential revenue problems facing the county school administrators can be gained by comparing Beaufort County to Pickens County. Table 3 provides some relevant data for such a comparison. In 1970, Beaufort and Pickens Counties had roughly the same population.*

TABLE 3. Comparison of Expenditures Per Pupil and County Per Capita School Taxation, Beaufort and Pickens Counties, South Carolina, 1960 and 1969

Political Entity	Expenditures Per Pupil ¹		County Per Capita Taxes for Schools ²	
	1960-1961	1969-1970	1960	1969a
Beaufort County	\$191.10	\$530.70	\$14.74	\$32.73
Pickens County	191.33	415.23	23.85	38.00

^{1/}Computed by dividing taxes collected during tax year commencing December 1, 1968, by 1960 population plus 9/10 of the increase between 1960 and 1970.

SOURCE: ^{1/} State Superintendent of Education, *Annual Report*, South Carolina Department of Education, Columbia, 1960-61 and 1969-70.

^{2/} South Carolina Tax Commission, *Annual Report to the Governor and General Assembly*, Columbia, 1960 and 1969; U. S. Bureau of the Census, *Census of Population*, U. S. Department of Commerce, Washington, D. C., 1960 and 1970 (advanced).

Beaufort has a military complex which results in additional population without an appreciable increase in the tax base; Pickens has Clemson University, which also increases the population and county costs without adding appreciably to the tax base. In 1960, both Beaufort and Pickens were spending approxi-

*In 1970, Beaufort County's population was 51,136 as compared to 58,956 in Pickens County [22].

mately the same per pupil for public education, although per capita taxation for school purposes in Beaufort County in 1960 was only about 62 percent of the per capita school taxation in Pickens County. By 1969-1970, Beaufort County had increased per pupil school expenditures to \$530 as compared to \$415 in Pickens County. Even if Impacted Area Funds are not considered, Beaufort County was still spending \$56 more per pupil in 1969-1970 than was Pickens County. Yet Table 3 shows that per capita taxation for school operations in Beaufort County still lagged behind Pickens County in 1969 by about six dollars per person. If Beaufort County were not receiving Impacted Area Funds, per capita school taxation in the County would need to be raised by 38 percent in order for Beaufort to match the per pupil expenditure of Pickens County in 1969-1970 (assuming the county, not the state, paid the difference). By contrast, if Pickens County residents were to pay taxes high enough to offset the property taxes paid by manufacturing firms in the county, per capita taxes in Pickens in 1969 would also need to be raised by about 38 percent. Thus industrial development is doing for Pickens County, financially, what the Federal Impacted Area Funds are doing for Beaufort County.

Employment and Income

Employment

The average work force in Beaufort County in 1969 amounted to 13,200 persons, as compared with 12,700 in 1968 [16, p. 15]. The rate of unemployment decreased from 1968 to 1969, moving from 5.9 to 4.5 percent. The rate of unemployment in Beaufort County in 1969 was almost one-half a percentage point higher than that for the State. The distribution of employment in the County in 1969 is shown in Table 4. Less than 7 percent of the non-agricultural employment in Beaufort County was in manufacturing, whereas more than 33 percent of the nonagricultural employment was in government.

Table 5 presents data on the age distribution of the Beaufort County population 14 years old or older as determined by the household survey. It is this part of the population that is normally considered the potential labor force. In 1970, there were 36,900 persons in the county 14 years or older, almost 50 percent of whom were over 40 years old. The productivity of the older half of the potential labor force can be expected to decline as its members advance in age; thus a large proportion of the potential work force in the over-40 group will not normally be attractive to industries which must train local workers.

The household survey also revealed that approximately 12,000 persons would be interested in seeking industrial employment should such become available in the Port Victoria area of Beaufort County. Al-

TABLE 4. Work Force Estimates, Beaufort County, South Carolina, 1968 and 1969

Item	Annual average		Absolute Change
	1968	1969	
Civilian work force	12,700	13,200	500
Unemployment	750	600	150
Percent of work force	5.9	4.5	
Employment	11,950	12,600	650
Nonagricultural employment	10,800	11,550	750
Wage and salary workers, except domestics	8,850	9,500	650
Manufacturing	650	800	150
Food and kindred products	300	350	50
Other manufacturing	350	450	100
Contract construction	1,000	900	-100
Transportation, communication and utilities	300	300	0
Wholesale and retail trade ..	1,400	1,400	0
Finance, insurance, real estate	600	700	100
Service	1,200	1,300	100
Government	3,600	4,000	400
Other manufacturing	100	100	0
Self-employed, unpaid family workers and domestics	1,950	2,050	100
Agricultural employment	1,150	1,050	-100

SOURCE: South Carolina Employment Security Commission, *South Carolina's Manpower in Industry*, Research and Statistics Section, Columbia, May 1970.

TABLE 5. Estimated Potential Labor Force, by Age, Beaufort County, South Carolina, Summer 1970

Age	Number	Percent of Total
14-29	12,000	33
30-39	6,600	18
40-49	7,700	21
50-65	7,800	21
66 and over	2,800	7
Total	36,900	100

SOURCE: Household Survey of Beaufort County, Department of Agricultural Economics and Rural Sociology, Clemson University, Clemson, S. C., Summer 1970.

most one-half of these 12,000 persons was currently employed in the County, or in surrounding counties. Nevertheless, it appears that there is ample potential labor supply in Beaufort County for new industrial enterprises and that perhaps as many as 3,000 to 6,000 workers (depending on age requirements) could be hired without disrupting the existing labor market.

Income

On the basis of the household survey, we estimate that total personal income in Beaufort County in 1970 from all sources was approximately \$132 million. Given that there were approximately 13,500 households in the county, average income per household was \$9,800. Per capita income for 1970 is estimated at \$2,500, which is 67 percent of the 1969 U. S. average of \$3,676 (no figure for 1970 was

available at the time of this writing). In 1969, per capita income in the state of South Carolina was estimated at \$2,580, so that, given errors in estimates, we can conclude that average income per capita in Beaufort County was roughly equal to the State average [26, p. 326].

Average income figures may be only partially meaningful, however, since they may reflect a population with both extremely high and extremely low incomes. The household survey revealed that 57 percent of the households had incomes below \$6,000. On the extremes, 6 percent of the households had incomes above \$21,000 for the year, and 12 percent had incomes below \$3,000 in 1970. In contrast, only 39 percent of the households in the Charleston area were found to have had incomes below \$6,000 and only 1.5 percent had incomes above \$21,000 in 1968 [4, p. 12].

One of the reasons for the relatively low income of residents of Beaufort County is the prevailing low wage rates. Average annual pay per employee in each of several economic sectors has been computed and is shown in Table 6, along with comparable State and national data. In most sectors, pay in Beaufort County is low relative to both the State and the nation. Average annual pay of \$3,817 in manufacturing is much lower than the national figure of \$7,372. Wide divergence is also found in the food, construction and transportation sectors. All but one of the pay averages for Beaufort County are below the national figures for the same sectors, but the differentials are not as marked as in those mentioned above. These wage differentials could be due to one or more of several factors, among which could be low productivity, lower educational attainment of workers, labor supply and demand relationships, differences in kind of construction, or the effect of unionization.

MAJOR COMPONENTS OF THE ECONOMIC BASE

In Part I it was noted that the export base component of an area's economy consists of those industries producing goods or services for sale to customers living outside the area. On the basis of this criterion, we can identify the major components of the Beaufort County economic base as military activities, tourism and recreation, agriculture, forestry and fisheries, and manufacturing. Table 7 shows estimates of the magnitude of each of these activities in the County in 1970.

Military Facilities

As shown in Table 7, military activity was one of the most important influences on the Beaufort County economy in 1970, accounting for nearly one-half of all sales in the county. The military sector of the County's economy is comprised of the Parris Island Marine Base and the Laurel Bay Marine Air

TABLE 6. Average Annual Pay Per FICA-Covered Employee by Sector, Beaufort County, South Carolina and USA, 1969

Beaufort County as % of U.S.	Industry Group	Beaufort County	South Carolina	USA
64	Ag., Forestry and Fisheries	\$2,635	\$3,702	\$4,146
42	Food and Kindred Products	2,766	4,845	6,528
59	Construction	4,421	5,191	7,453
52	All Manufacturing	3,817	5,407	7,372
56	Transportation	4,305	6,455	7,625
71	Eating and Drinking Places	1,889	2,100	2,666
77	Hotels and Lodging Places	2,473	2,345	3,213
84	Gasoline Service Stations	2,869	2,950	3,406
73	Other Wholesale and Retail Trade	4,148	4,632	5,675
66	Financial Services	4,965	6,231	7,492
102	Real Estate	4,849	4,082	4,772
58	Other Business and Professional Services	2,862	3,733	4,958
60	All Covered Employment	\$3,796	\$4,986	\$6,277

SOURCE: Computed from U. S. Bureau of the Census, *County Business Patterns, 1969*, U. S. Department of Commerce, Washington, D. C., 1970.

TABLE 7. Estimated Magnitude of Major Components of the Economic Base of Beaufort County, South Carolina, 1970

Direct Expenditures Activity	(External Sales)	Total Sales	% of Estimated Gross Sales ^b
Military	\$ 84,661,000 ^{c/}	\$187,700,000	46
Tourism and Recreation	11,950,000 ^{d/}	25,844,000	6
Agriculture, Forestry and Fisheries ..	7,333,000 ^{e/}	19,467,000	5
Manufacturing	5,345,000 ^{f/}	12,961,000	3
Totals	111,628,000	245,972,000	60

- a/ Based on multipliers derived from input-output matrix in Part III.
- b/ Gross sales for Beaufort County were calculated by applying the ratio of personal income to gross sales for the Charleston area [see 5] and were estimated at \$408,999,000.
- c/ Based on data supplied by the Office of the Assistant Secretary of Defense. The local sales multiplier for military activities is relatively high in Beaufort County because almost all local military expenditures are to households in the form of wages and salaries.
- d/ Based on [9]
- e/ Based on [6] and [27]
- f/ Based on average output per worker in South Carolina in [23]

Station. Direct military spending in the County is primarily directed into payrolls totaling almost \$83 million in 1970. In addition, more than \$1.5 million was spent by the military in the County in 1970 for construction activities. The payroll expenditures are distributed throughout the local economy in the form of payments for retail items and services, and its impact is felt in almost all sectors of the Beaufort economy.

There appears to be no plan to significantly alter military operations in Beaufort County. Even a partial reduction in base operations, however, could have adverse effects on the local economy via the

negative multiplier principle resulting directly from a decrease in dollars flowing into the County from Federal sources.

*Tourism and Recreation**

With its subtropical climate and relatively unspoiled estuarine environment, Beaufort County has developed since 1960 a major tourism and recreation industry. The industry is now the second most important component of the County's economic base, accounting for about 6 percent of all gross sales in the County. There are three major sectors which are directly involved in tourism and recreation activities—hotels and lodging places, eating and drinking places, and gasoline service stations [see 1, p. 27]. Yet tourism and recreation activities also have indirect impacts on many other sectors of the local economy, particularly households which supply labor and wholesale and retail trade establishments. The rapid growth of tourism and recreation activities in Beaufort County since 1960 has been, in large part, tied to the development of the Hilton Head resort complex, and it is argued that continued development of this sector might be adversely affected by the development of heavy manufacturing enterprises in the County.

Agriculture, Forestry and Fisheries

Agriculture, forestry and fisheries activities constitute the traditional base of the Beaufort County economy. Yet all of the sectors have been in decline in recent years, and in 1970 they accounted for only about 5 percent of total sales in the County. In 1960, more than 9,500 persons were engaged in agriculture in Beaufort County [22]. By 1969, the number had declined to 1,050 [16]. From 1959 to 1964, the number of farms in the County declined by about 20 percent [24], and this declining trend is probably still operative. The decline in agricultural employment and number of farms would appear to indicate that farm operations have become heavily mechanized, thus releasing human resources to seek other forms of employment. But even though the number of people engaged in farming operations has been decreasing, Beaufort County continues to have a viable agricultural economy, ranking 26th (among 46 counties) in the State in total cash receipts from farming and second in cash receipts from vegetable crops [27].

Although highly visible and colorful, the fishing industry in Beaufort County is relatively small. In 1963, there were an estimated 223 full-time job equivalents available in the industry [6, p. 10], although probably many more than 223 persons were employed in these positions on a part-time basis. The principal types of fishing activities center on shrimp, crabs and oysters. Available studies indicate that

*"Tourism and recreation" is defined as an industry serving transients, as opposed to a retirement industry which attracts permanent residents.

there is little potential for substantial growth in the shrimp fisheries on the Carolina coast, but some prospects exist for expansion of crab and oyster operations [6].

Manufacturing

Table 7 shows that the direct and indirect effects of manufacturing currently account for only about 3 percent of all sales in Beaufort County. Earlier, in Table 4, we noted that less than 7 percent of the nonagricultural employment in the County is in manufacturing activities. Current manufacturing operations in the County are geared largely to apparel, food processing and other light industry with traditionally low wages. Growth of manufacturing in the County in the decade of the sixties was slow. The average county in South Carolina gained 1,135 new manufacturing jobs from 1963 to 1967, while Beaufort County gained only 200 jobs [16].

Summary

The preceding description of the current state of the Beaufort County economy presents a picture of a county with a decline in its traditional economic base and in need of a new base to sustain population and community services. Although population has been growing and per capita and average family income in Beaufort County do not appear to be low by regional standards, the County's economy is heavily dependent on military spending. Reductions in military operations in the County would probably have profound effects on local economic activity and the operation of such vital services as public education. The only major component of the current economic base which exhibits growth prospects is the tourism and recreation sector. Although the quality of the resident labor force in terms of educational attainment appears to be relatively low, there is ample local labor available for substantial industrial development. Beaufort County needs economic growth of some sort which will use that labor supply and provide an increased tax base to cushion possible future reductions in the level of military operations in the County.

PART III

Development Alternatives For Beaufort County

Introduction

In the previous chapter we described the existing economic conditions in Beaufort County, noting the decline of the traditional economic base in agriculture, forestry and fisheries and the need to develop a new base. In this chapter, we turn to consideration of some development alternatives for Beaufort County. Particularly, we will focus our attention on the assessment of the economic and environmental impacts which might be expected under seven representative types of development: 1) food and kindred products industry, 2) textiles and apparel in-

dustry (representing light industry), 3) lumber and wood products manufacturing, 4) chemicals manufacturing (representing heavy industry), 5) tourism and recreation, 6) retirement community development, and 7) military activities.*

Tools of Analysis

The basic tool of analysis employed in this chapter is the economic-ecologic linkages model developed by E. A. Laurent and J. C. Hite. We will only briefly sketch the basic elements of this model in this report. The reader who desires a more detailed account of the model and its development should consult the work of Laurent and Hite [7].

There are two essential elements of the economic-ecologic linkages model used in this study: 1) the inverse of an input-output matrix of the area economy, and 2) a matrix showing the inflow from the environment associated with one dollar of gross output in the input-output matrix. The system quantified by the model can be visualized as in Figure 1. Resources are taken from the environment and processed through technology in the economic system, then discharged into the environment in the form of residuals (some of which are classed as pollutants).

The Laurent-Hite model simplifies the system by ignoring the ecologic processes represented by the box in the lower right-hand corner of Figure 1 and by concentrating instead on the inputs to and outputs from the environment to the economic system. Further simplification is achieved by concentrating on only a few of the most critical environmental linkages (e.g., BOD**, SO₂***, particulates**** and solid waste outputs). No attempt is made to analyze the ecologic consequences of these linkages as they are best examined by professional engineers and scientists.

The Beaufort Input-Output Matrix

In order to use the Laurent-Hite model it was necessary to construct an input-output matrix of the Beaufort County economy. Input-output matrices are difficult to construct not only because it is expensive to collect all the data needed via a survey, but also because many firms cannot provide the

*We do not wish to imply that Beaufort County has locational advantages for these specific types of developments. Further studies of comparative costs and markets would be necessary before we could determine if Beaufort County could compete favorably with other areas for these types of activities.

**BOD means Biochemical Oxygen Demand, a common measure of water pollution due to biologically degradable organic wastes.

***SO₂ is sulfur dioxide, a common and important type of air pollutant.

****Particulates are inert materials such as cinders and dust which are common air pollutants.

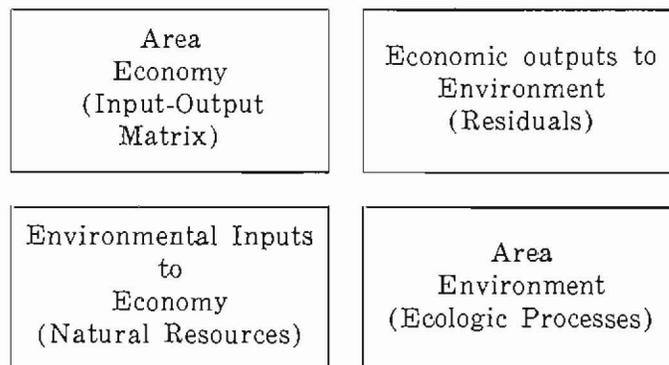


Figure 1. Generalized Economic-Ecologic Linkages Model

necessary information due to limitations of their accounting systems. As a result, construction from ordinary data of a full-scale input-output model for Beaufort County was deemed impractical, given the limitations of time and funds imposed on this study. However, several successful efforts have been made by researchers in simulating the input-output structures of local economies [see 8, 14]. The availability of a relatively recent (1968) input-output model of the Charleston metropolitan region provided an opportunity to simulate a Beaufort County matrix by recalibrating the Charleston model to account for Beaufort County sales patterns [5].* A detailed description of input-output models and the simulation techniques is included in the Appendix.

In simulating the Beaufort County input-output model, we have omitted the transactions matrix and moved immediately to the construction of the technical or direct coefficients. This move was necessitated by the difficulty of obtaining accurate data on the gross output of each business and industrial firm in the county. Consequently, Appendix Table 3 shows the simulated interindustry and Inter-regional transactions on a per dollar basis, given the structure of the Beaufort County economy in 1970. The raw data for simulating this table were obtained from the survey of Beaufort County business and industrial firms described in Part 1. Appendix Table 4 shows the inverse of the matrix in Appendix Table 3.

The Environmental Linkages Matrix

The second element of the Laurent-Hite model, the environmental linkages matrix, was developed for Beaufort County by recalibrating the environmental linkages matrix constructed for the Charleston area [7]. Adjustments were made in the matrix to eliminate those sectors of the economy which appear in the Charleston area but are not present in Beaufort and to account for differences in the mix of firms which make up sectors which are common to the two areas. The matrix is representative of the 1968 level

*The Charleston metropolitan region as defined in [5] is northeast of, and immediately adjacent to, Beaufort County.

of waste treatment characterizing the Charleston area and, for most sectors of the economy, it represents a relatively low level of treatment. This matrix can be found in the Appendix. It is quite likely that any new developments in the Beaufort area would be required to install waste treatment facilities representing a somewhat higher level of residuals removal, and, consequently, the estimate of pollution levels in the following discussion can probably be considered to have an upward bias.

Note on Interpretation of Model's Estimates

One of the chief limitations of the Laurent-Hite model is that it combines rather large groups of industries into a single sectors. For example, "Food and Kindred Products" includes bakeries, dairy processing plants, seafood canneries, etc. The waste output of a bakery is considerably different from the waste output of an ice-cream plant, but the model does not distinguish different types of operations within a particular sector. By the same token, the waste output of a textile dyeing plant is usually far more significant than the waste output of an apparel operation such as a shirt factory. Given this limitation, the estimates produced by the model must be interpreted as *averages* for the sectors and they should not be applied to a specific type of operation without adjustments based on further information.*

Types of Development and Projected Impacts

The seven representative types of economic development in Beaufort County were analyzed with regard to the local impact on 9 different variables. The results of this analysis are summarized in Table 8. All analysis is developed on the basis of 100 jobs, with the exception of analysis of the impact of re-

*For a more complete discussion of the limitations of the model, see [5].

TABLE 8. Projected Effects of 100 "Export" Jobs in Seven Types of Economic Activities on the Beaufort County (South Carolina) Economy, 1969^a

Type of Impact	Given 100 "Export" Workers in:							
	Food and Kindred Products	Textiles and Apparel	Lumber and Wood Products	Chemicals	Tourism and Recreation	Retirement Community ^b	Military Base	
Total Sales (\$)	1,030,800	1,895,900	2,003,100	2,157,700	2,309,500	870,300	911,000	
Total Personal Income Generated (\$)	679,400	1,147,200	982,800	1,288,600	1,493,600	670,600	382,000	
Total Number of Jobs Created	111	119	114	118	126	15	109	
Local, County Taxes Paid (\$)	5,100	71,200	11,800	27,000	12,500	4,900	2,800 ^c	
State Taxes Paid (\$)	65,900	113,800	138,400	94,800	151,400	29,200	79,100	
Particulate Matter (lbs/year)	2,900	4,700	1,552,200	4,100	19,200	3,800	2,100	
SO ₂ (lbs/year)	4,600	3,500	3,500	3,900	17,300	2,700	1,500	
Five-Day BOD (lbs/year)	335,100	470,200	1,736,000	249,300	131,100	139,300	78,400	
Solid Waste (cu yds/year)	3,500	6,900	156,300	5,400	7,600	5,100	2,900	

^aSince these projections are based on the Charleston Input-Output Model which was developed in late 1968, these projections are for the year 1969.

^bThis category represents 100 new residents of the retirement community.

^cThis figure is based on Impacted Area Funds.

SOURCE: Computed from tables in the Appendix.

tirement developments, which is developed on the basis of 100 new residents. Data which support the figures in Table 8 can be found in tables presented in the Appendix.

Food and Kindred Products

Given the existing vegetable agriculture and commercial fishing industries of Beaufort County, the development of food processing activities in the County would appear to be a definite possibility for future growth. Table 8 shows that 100 new jobs in this industry could be expected to generate, directly and indirectly, around \$1 million in increased local sales and \$679,000 in increased personal income. With the local multiplier principle operative, these 100 new jobs would also stimulate 11 additional new jobs in related areas of the local economy, for a total of 111 new jobs. Local taxes generated would amount to \$5,100 per year. State taxes resulting from 100 new jobs in food processing would amount to \$65,900 per year.

Yet not all the impacts of 100 new jobs in food processing would be positive. Table 8 shows that such development would generate 335,100 pounds of BOD, 4,600 pounds of SO₂, 2,900 pounds of particulate matter and 3,500 cubic yards of solid waste per year.**

*The figures in Table 8 were derived in the following manner. First, output per 100 workers in each of the seven types of development was calculated (see Appendix Table 6). Then a new matrix representing the product of the environmental linkages matrix (Appendix Table 5) and the inverse of the Beaufort County input-output matrix (Appendix Table 4) was constructed. The appropriate columns of this new matrix were then multiplied by the respective total output figures.

**Economists are not really qualified to make judgments as to the severity of the amount of waste which is discharged. Hence, the reader is cautioned that data on waste discharges are presented only for purposes of comparison.

Textiles and Apparel

The textiles and apparel industry already has some start in Beaufort County. It is an industry which traditionally has been labor-oriented and able to make use of relatively low-skilled workers. Table 8 shows that 100 new jobs in the textiles and apparel industry in Beaufort County would generate, directly or indirectly, almost \$2 million annually in increased local sales and slightly more than \$1.1 million in increased personal income. These 100 new textiles and apparel jobs would result in a total of 119 new jobs in the County. These jobs would also produce \$71,200 in annual local taxes per year. State taxes generated would amount to \$113,800 per year.

As noted above, textiles and apparel may have very different effects upon the environment, depending on the type of operations. On the average, 100 new jobs in the textiles and apparel industry would produce 470,200 pounds of BOD, 3,500 pounds of SO₂, 4,700 pounds of particulate matter and 6,900 cubic yards of solid waste per year.

Lumber and Wood Products

Lumber and wood products manufacturing, including pulp and paper operations, is traditionally resource-oriented and tends to locate in areas with a plentiful supply of timber and water. Both of these resources are abundant in the Beaufort County area. Table 8 shows that 100 new workers in the lumber and wood products industry in Beaufort County could be expected, directly and indirectly, to increase local sales by about \$2 million and personal income by more than \$980,000 per year. These 100 workers in the lumber and wood products industry would generate a total of 114 new jobs in the County. Table 8 also shows that these 100 new jobs would produce \$11,800 in local tax revenue and \$138,400 in state tax revenue annually.

The lumber and wood products industry has significant environmental impacts. Table 8 indicates that 100 new jobs in the industry will result in 1,736,000 pounds of BOD, 3,500 pounds of SO₂, 1,552,200 pounds of particulates and 156,300 cubic yards of solid waste per year.

Chemicals

Although currently there is only a small chemical manufacturing operation in Beaufort County, the BASF controversy arose out of the announced plans of a chemical manufacturing firm to locate in the County. Table 8 shows that 100 new workers in the chemical industry would generate, directly and indirectly, approximately \$2.1 million in increased sales and \$1.3 million in increased personal income in the County. These 100 new jobs would result in a total of 118 new jobs in the County. They would also generate around \$27,000 in local and county taxes and \$94,800 in state taxes per year.

The category of chemical manufacturing is a

broad one, encompassing everything from fertilizer operations to organic dyes. Consequently, the environmental repercussions of 100 new chemical jobs are highly sensitive to the type of operation. In general, however, 100 new chemical workers in Beaufort County could be expected to result in increases of about 249,300 pounds of BOD, 3,900 pounds of SO₂, 4,100 pounds of particulates and 5,400 cubic yards of solid waste per year.

Tourism and Recreation

We noted in Part II that tourism and recreation activities have recently become an important component of the economic base of Beaufort County. Further growth of this industry is not only possible but probable if environmental conditions continue to be favorable. Table 8 shows that each 100 new jobs in tourism and recreation activities would stimulate, directly and indirectly, about \$2.3 million annually in increased local sales and \$1.5 million in increased personal income in Beaufort County. These 100 new jobs would also stimulate 26 additional jobs in related industries in the County, so that for every gain of 100 jobs in tourism and recreation, Beaufort County realizes a total increase of 126 jobs. Tourism and recreation activities also generate tax revenue. For each 100 new jobs, local and county governments will realize approximately \$12,500 in increased revenue and State government will realize approximately \$151,400 per year.

Generally, tourism and recreation is considered to be a "clean" type of development, i.e., it generates very little environmental pollution. However, Table 8 shows that this may be a misconception. Each 100 new jobs in tourism and recreation activities can be expected to produce 131,100 pounds of BOD, 17,300 pounds of SO₂, 19,200 pounds of particulate matter and 7,600 cubic yards of solid waste per year. These relatively high residual outputs result from the large amount of waste generated by hotels and lodging places and eating and drinking places, and by the large amount of gaseous wastes resulting from automobile traffic. Moreover, the indirect effects of tourism and recreation activities are largely felt locally, which means that most of the pollution is felt locally rather than being exported (as would be the case with industries which purchased most of their inputs outside the County).

Retirement Community Development

Development of real estate for retirement communities has been proceeding at a rather rapid rate in Beaufort County in recent years. Substantial developments have materialized on both Hilton Head Island and Fripp Island. Although the real estate for such development will be eventually exhausted, retirement community development is likely to continue in Beaufort County for several years. To the extent that this development brings in money from

outside the County, it is an export activity and a legitimate part of the economic base of the County. Since development of retirement communities is more often thought of in terms of new residents, the estimates shown here are based on 100 new residents rather than 100 new jobs. The initial assumption is that each lot sale potentially secures an average of three new residents.*

Table 8 shows that 100 new residents in retirement community developments in Beaufort County stimulate an increase, directly and indirectly, in annual sales in the County of almost \$900,000 and in annual personal income of more than \$670,000. Approximately 15 new jobs, spread across several sectors of the local economy, are needed to service these new residents. Under present assessment and millage rates, these 100 new residents can be expected to generate \$4,900 in local and county taxes and \$29,200 in state taxes annually.

In the main, retirement communities generate only household waste; consequently, the environmental repercussions of such developments are minor. Each 100 new residents could be expected to produce an increase of about 139,300 pounds of BOD, 2,700 pounds of SO₂, 3,800 pounds of particulate matter and 5,100 cubic yards of solid waste per year.

Military Activities

Military activities represent one of the most important components of the economic base of Beaufort County. Such activity is almost inherently unstable, being highly sensitive to political conditions. The estimates in Table 8, therefore, can be interpreted as indicators of the positive impacts of growth in military operations in Beaufort County or, conversely, as a measure of the negative impacts of reductions in military activities in the County. One hundred new jobs in military activities is taken to represent a total of 100 civilian and military personnel (including recruits) stationed in the County.

Table 8 shows that 100 military-related personnel account, directly and indirectly, for around \$911,000 in annual sales and almost \$400,000 in personal income in Beaufort County. These 100 military-related jobs generate a total of 109 jobs in the County. Since the military does not pay taxes, no local tax revenue is generated directly by military activities, but areas with military bases commonly receive Impacted Area Funds in lieu of taxes. Table 8 shows that these Impacted Area Funds amount to about \$2,800 per year for each 100 military-related jobs in the County. Military activities do stimulate sales which produce State taxes, however, and 100 military-related jobs account for about \$79,100 in State tax revenue annually.

There are environmental linkages associated with military activities, just as with all other types of human endeavor. Table 8 shows that each 100 military-related jobs in Beaufort County account for 78,400 pounds of BOD, 1,500 pounds of SO₂, 2,100 pounds of particulate matter and 2,900 cubic yards of solid waste per year.

Comparison of Impacts

Although we have examined in Table 8 the impacts of each of the seven types of development on nine economic and ecological variables, we can simplify our comparisons between the seven types of development by concentrating on a few key variables. In Section II, we noted that Beaufort County needs new jobs and an increased tax base. Table 8 shows that tourism and recreation activities will produce more jobs per 100 new jobs in the industry than any of the other six types of developments. In terms of total contributions (i.e., local and state taxes added together), tourism and recreation activities also show up fairly well, as they represent the second most important industry in regard to tax impact. They are surpassed only by the textiles and apparel industry in tax payments. Textiles and apparel, chemicals and lumber and wood products manufacturing follow closely in importance of economic impact. Table 8 shows that between the four above-mentioned development alternatives and the remaining three—military, food and kindred products manufacturing and retirement community development—a relatively wide gap in economic impact exists. This is especially true of the amount of local and state tax contributions. Food and kindred products and military activities generate approximately the same amount of jobs and tax payments. Retirement community developments generate not only the least amount of jobs of the seven types of economic development but also make the smallest contributions to local and state taxes.

With regard to ecologic impacts, air and water pollution are probably of greatest interest. While BOD is a measure of only one type of water pollution (and perhaps not the most serious type), we may note that lumber and wood products industries appear to offer the most serious threat to water quality of any of the seven types of developments under analysis. Textiles and apparel and food and kindred products manufacturing are also relatively serious threats to water quality, however. Lumber and wood products industry also produce large quantities of air pollutants in the form of particulates, and tourism and recreation activities produce sizeable quantities of both SO₂ and particulates. Military and retirement community development is consistently low, however, in terms of detrimental ecologic impacts. The projected ecologic impact of chemical manufacturing lies somewhere between the

*This assumption is based on a telephone conversation with Mr. Fred Hack, President of the Hilton Head Company.

extremes of relatively minor and relatively severe pollution threats.

Summary

The analysis of seven types of economic development for Beaufort County presented in this chapter shows that four of the seven types of development examined—tourism and recreation, textiles and apparel, chemical and lumber and wood products industries—would each have beneficial effects upon the local economy of approximately the same magnitude. Yet their development is shown to have some severe environmental disadvantages, at least under conditions of current technology and recent levels of waste treatment. Other types of development of comparable size, such as food processing and military activities and retirement community developments, have less serious environmental consequences, but they also produce fewer economic benefits. Thus, a classic dilemma emerges for Beaufort County: It can opt for economic benefits in the form of development of industries such as tourism and recreation, textiles and apparel, chemical or lumber and wood products and risk environmental pollution, or it can opt for industries with low potential for environmental damage, but also with relatively weak economic benefits. In a very real way, trade-offs between environmental quality and pecuniary economic benefits seem to be necessary in Beaufort County. An assessment of the best course of action for the future of Beaufort County requires, therefore, analysis of the values which local residents place on environmental quality and their willingness to trade greater or lesser quantities of that environmental quality for monetary income. In the next section, we will turn to such an analysis.

PART IV

Attitudes Toward Environmental Quality

Introduction

The first part of this chapter will introduce a conceptual framework within which the demand for and value of environmental goods may be examined. The remaining sections will describe an experiment which was conducted in Beaufort County, South Carolina, in the summer of 1970. This experiment was an attempt to apply the theory to an actual empirical investigation of public attitudes toward environmental goods.

*Willingness-to-Pay as a Measure of the Value of Environmental Goods**

There are no markets, as we commonly define the terms, for environmental goods such as clean air and clean water. We do not go out and purchase so many units of water quality and air quality as we do pounds of hamburger, quarts of milk, and numerous other items.

However, we do know from experience that such environmental goods are desired by the public and that the public is willing to make some sacrifice to obtain these goods. For example, consider the expense in both time and money incurred by inland residents in making vacation trips to the costal areas.

If it were possible to measure the amount of this sacrifice, then we would have some measure of the value the public places on such environmental goods. By the same token, we would also have a measure of the damages which would result if these same environmental goods were denied to society as a result of pollution.

Let us begin the analysis by defining two categories of goods: 1) "marketable" consumption goods for which organized markets exist and price or value can be readily determined; and 2) "nonmarketable" environmental goods for which no organized markets exist and price or value cannot be readily determined.

Given the two categories of goods, we define our measure of the value of a specified amount of environmental goods as the amount of marketable goods which individuals are willing to give up in order to obtain these environmental goods.

In essence, we are postulating a trade-off situation in which marketable consumption goods are traded for environmental goods. Given that the value of a specified amount of marketable goods can be expressed in dollar terms, it is thus possible to define the value of a specified amount of environmental goods in the same terms.

At any point in time, there exists a fixed stock of natural resources, such as clean water and clean air, even in the absence of human polluting activities. For example, at any given point in time under any given atmospheric or hydrologic conditions, only so much clean water and clean air are available for use in a geographic area. There exist competing demands for the use of these resources. On the one hand, individuals want to consume clean water and clean air as environmental goods, e.g., to support basic life processes. In competition with this demand is a demand to use these resources in the production of marketable goods. Because of the nature of most productive processes, the water and air resources used in the production of these latter goods are altered in form through the introduction of materials we call pollutants. Consequently, the use of water and air to produce these marketable goods reduces the quantity of clean water and clean air available for consumption as environmental goods unless the water and air are treated in some way to remove or reduce the polluting materials before such resources are put back into the environment. Because this treatment requires installation of additional

*This section draws heavily from Hite and Laurent [4].

equipment and processes, it increases the monetary costs of producing these marketable goods and reduces the quantity of such goods offered at any given budget level. Hence, the preservation of clean water and clean air as environmental goods reduces the quantity of marketable goods available to individuals with a given budget of total expendable money available. The implication of such reasoning is that additional environmental goods can be obtained only by giving up some marketable goods, and additional marketable goods can only be obtained by giving up some environmental goods.

Empirical Application of the Theory

A household survey was conducted in Beaufort County, South Carolina, during the summer of 1970.* Part of the questionnaire which was administered to the sample households was concerned with respondent attitudes toward environmental goods such as clean water and clear air and the values placed on different levels of purity of water and air.

Analysis of Responses to Two Questions

The analysis which follows is based upon the responses to questions on water and air quality, respectively, which were included in the survey.

The theoretical foundation for these two questions is a variant of the trade-off analysis presented above. In these questions, respondents were asked

what percentage of their total income they would be willing to give up (i.e., how much consumption of all other goods they would be willing to forego) in order to obtain water and air of a specified quality.

Willingness-to-Pay for Water Quality

In one question, respondents were confronted with the following situation:

Assume that the only way you could have clean water in the Beaufort area streams would be for individual citizens such as yourself to go together and pay for it in the form of taxes, or by some other method. For the present, forget about who might be to blame for the pollution.

They were then asked what percentage of their total income they would be willing to give up in order to have (buy) water of each of four qualities: (1) clean enough to have no unnatural smell associated with it; (2) clean enough to fish out of safely; (3) clean enough to swim in safely; and (4) for fresh water, safe to drink with standard treatment. These descriptive criteria were, of necessity, of a non-technical nature; however, comparable technical criteria do exist for each quality level described above. Table 9 shows the correspondence between the nontechnical and technical criteria for each water quality level.

*See Part 1 of this report for a description of this survey.

TABLE 9. Non-technical and Comparable Technical Specifications of Four Levels of Water Quality

<i>Quality Level</i>	<i>Non-technical Specification</i>	<i>Technical Criteria</i>
Water Quality I	Safe to drink	DO \geq 5ppm; Coliform \leq 200/100m ℓ
Water Quality II	Clean enough to swim safely	DO \geq 5ppm; Coliform \leq 20/100m ℓ
Water Quality III	Clean enough to fish safely	DO \geq 4ppm
Water Quality IV	No unnatural smell	DO \geq 3ppm

SOURCE: South Carolina Pollution Control Authority, *Water Classification Standards System for the State of South Carolina*, Columbia, December 1967.

STATISTICAL ANALYSIS OF RESPONSES

Appropriate statistical tests were employed to analyze the responses.* The tests were conducted in an attempt to ascertain what factor or factors weigh most heavily in an individual's subjective evaluation of the value of the present state of the environment of Beaufort County. Specifically the relationship between the reported figure which indicated willingness-to-pay and each of several variables—income, area of residence, and water quality—was examined.

The levels of willingness-to-pay and income were obtained directly from the survey questionnaire. Area of residence was determined from the Beau-

fort County property tax rolls, which report personal property by township districts. Except in the case of one township, these townships can be classified into one of two geographic areas or zones of residence. These zones were the part of Beaufort County north of Port Royal Sound and the part south of Port Royal Sound. All respondents were classified into one of these two zones depending on the township designation of the location of the respective personal property. In the case of the one township that did not have a geographic break along Port Royal Sound, respondents were located on a map of Beaufort County and classified according to their relative location with regard to the Sound.

*Specifically analysis-of-variance and least-squares-regression techniques were utilized. See [2].

Statistically significant relationships were found

to exist between willingness-to-pay and each of the following variables—income, zone of residence, and water quality level I (i.e., fresh water safe to drink with standard treatment). In fact, the tests revealed that the odds were only 1 in 20 that random chance would have shown the relationships. Thus, we can be reasonably certain that a significant relationship did exist between willingness-to-pay and each of these variables.

The tests revealed a direct relationship between income and expressed willingness-to-pay. There was an obvious difference in direction of influence of the zone of residence variables as between respondents located north and south of Port Royal Sound. In relation to the total area, the relationship between residence location south of the Sound and willingness-to-pay was a positive one; for residence location north of the Sound, the relationship was a negative one. These relationships can be interpreted as follows: residents who lived south of the Sound appeared to value the environment more highly than residents who lived north of the Sound.*

The relationship between water quality level I, the

*It should be remembered that both the proposed BASF plant site and the Hilton Head Island resort community are included in the residence zone designated "south of Port Royal Sound."

highest water quality level designated on the questionnaire, and willingness-to-pay was a positive one. The relationships between each of the other three water quality levels and willingness-to-pay were not significant. Thus, it can be surmised that the primary concern of respondents in regards to water quality was to have a supply of safe drinking water. They evidently believed that if water were kept this pure all lower quality levels would be taken care of automatically.

Willingness-To-Pay For Air Quality

A question, similar to the one on water quality, was asked in regard to air quality. Again, the respondent was confronted with a hypothetical market situation in which, this time, he and his fellow citizens were asked what percentage of their total income they would be willing to give up in order to have (buy) air of each of four qualities: (1) there is no possible threat to health; (2) it does not discolor paint, draperies, and other items; (3) there is no artificial haze in the sky; and (4) there is no noticeable smell as a result of air pollution. Again, comparable technical criteria exist for the descriptive criteria presented in the questionnaire. Table 10 shows the correspondence between the non-technical and technical criteria.

TABLE 10. Non-technical and Comparable Technical Specifications of Four Levels of Air Quality

<i>Quality Level</i>	<i>Non-technical Specifications</i>	<i>Technical Criteria</i>
Air Quality I	No possible threat to health	Particulates $\leq 80 \mu\text{g}/\text{m}^3$ $\text{SO}_2 \leq 0.04 \text{ ppm}$
Air Quality II	No soiling of materials	Particulates 60—180 $\mu\text{g}/\text{m}^3$; $\text{SO}_2 \leq 0.09 \text{ ppm}$
Air Quality III	No perceptible haze or smog	Particulates $\leq 150 \mu\text{g}/\text{m}^3$; $\text{SO}_2 \leq 0.10 \text{ ppm}$
Air Quality IV	No perceptible odor	$\text{SO}_2 \leq 0.06 \text{ ppm}^a$

^aParticulates are not normally associated with odor.

SOURCE: National Air Pollution Control Administration, *Air Quality Criteria for Particulate Matter*, Publication No. AP-49, U. S. Public Health Service, Washington, D. C., 1969; and National Air Pollution Control Administration, *Air Quality Criteria for Sulfur Oxides*, Publication No. AP-50, U. S. Public Health Service, Washington, D. C., 1969.

STATISTICAL ANALYSIS OF RESPONSES

As in the water quality analysis, appropriate statistical tests were used in analyzing the responses.* The analysis was again directed toward examining the relationship between expressed willingness-to-pay and each of several variables—income, zone of residence, and quality level.**

The statistical tests yielded results similar to those of the water quality analysis. Significant relationships

were found to exist between willingness-to-pay and each of four variables—income, both zones of residence, and air quality level I (i.e., air engendering no threat to health at all). As with the water quality analysis, the tests indicated that the odds were only 1 in 20 that random chance would have shown the relationships. Thus, we can place the same amount of confidence in these relationships as we did in the relationships discussed in the water quality analysis.

Income and expressed willingness-to-pay were found to be directly related, i.e., as income varied so did willingness-to-pay. As with the water quality analysis, there was an obvious difference in direction of influence of the zone of residence variables

*See the preceding explanatory footnote for the type of tests which were administered.

**With the exception of the quality variables and the willingness-to-pay variable, all terms are defined as they were for the water quality analysis. The two exceptions relate to air quality and willingness-to-pay for the same respectively.

as between respondents located north and south of Port Royal Sound. The relationship between residence location south of the Sound and willingness-to-pay was a positive one; the relationship between residence location north of the Sound and willingness-to-pay was a negative one.

In regard to the quality of air, the relationship between air quality level I and expressed willingness-to-pay was a positive one. The relationships between each of the other three air quality levels and willingness-to-pay were not significant. Thus, it can be surmised that the primary concern of respondents in regard to air quality is to protect their health from any and all danger. As with water quality, respondents evidently believed that maintenance of air free from threats to health would insure that all lower air quality levels would be taken care of automatically.

Aggregate Totals

The sample data were "blown up" and thus ex-

panded to the total population of the county. The aggregate sums for water and air quality are shown in Tables 11 and 12 respectively.

In Table 11 the columns are arranged, left-to-right, in ascending order of purity by engineering or technical standards. That is, technically speaking, "safe drinking water" represents the highest quality level and "avoid unpleasant smell" represents the lowest. Examining the column totals, however, we see that the respondent households indicated a different ordering. They rated "safe drinking water" as the most valuable quality level. Next in importance was "clean enough to fish safely," followed by "avoid unpleasant smell" and "clean enough to swim safely" in that order. We note that the difference in totals for these last two categories is minor indeed when compared with the difference in totals for drinking and fishing purposes and the difference between these two totals and the totals for odor and swimming.

TABLE 11. Willingness-to-Pay in Aggregate Sums for Four Alternative Levels of Water Quality by Household Income Class, Beaufort County, South Carolina, 1970

Household Income Class	Amount to:			
	Avoid Unpleasant Smell	Clean Enough to Fish Safely	Clean Enough to Swim Safely	Safe Drinking Water
Under \$3,000	\$ 13,750	\$ 18,750	\$ 13,750	\$ 32,750
3,000- 5,999	60,000	69,410	76,910	163,330
6,000- 8,999	206,250	253,160	221,910	466,330
9,000-11,999	356,250	290,910	367,500	585,660
12,000-14,999	264,410	258,750	264,410	478,160
15,000-17,999	343,750	343,750	357,500	619,160
18,000-20,999	130,000	130,000	130,000	390,000
\$21,000 and over	682,500	1,032,500	595,000	1,226,910
Totals	\$2,056,910	\$2,397,230	\$2,026,980	\$3,962,300
Per Household	\$ 38	\$ 45	\$ 38	\$ 75

SOURCE: Calculated from Household Survey of Beaufort County, Department of Agricultural Economics and Rural Sociology, Clemson University, Clemson, S. C., Summer 1970.

TABLE 12. Willingness-to-Pay in Aggregate Sums for Four Alternative Levels of Air Quality by Household Income Class, Beaufort County, South Carolina, 1970

Household Income Class	Amount to:			
	Avoid Perceptible Odor	Avoid Haze or Smog	Avoid Soiling of Materials	Insure no Threat to Health
Under \$3,000	\$ 18,750	\$ 13,750	\$ 13,750	\$ 46,750
3,000- 5,999	67,500	37,500	41,250	138,750
6,000- 8,999	156,250	162,500	150,000	860,660
9,000-11,999	389,410	369,250	166,250	853,160
12,000-14,999	374,080	227,830	205,330	385,330
15,000-17,999	343,750	357,500	357,500	632,500
18,000-20,999	177,910	145,410	161,660	405,410
\$21,000 and over	673,750	761,250	708,750	1,422,080
Totals	\$2,201,400	\$2,074,990	\$1,804,490	\$4,744,640
Per Household	\$ 42	\$ 39	\$ 34	\$ 90

SOURCE: Calculated from Household Survey of Beaufort County, Department of Agricultural Economics and Rural Sociology, Clemson University, Clemson, S. C., Summer 1970.

Table 12 shows willingness-to-pay, in aggregate sums, for four levels of air quality. The tabular ordering of these quality levels represents increasing technical standards as we move from left to right. From an examination of the totals, we can see that the respondent ordering of air quality was different from the technical one. However, this difference was not as evident as that found in the water analysis. By far, "insure no threat to health" rated the highest priority, but the differences in totals among the other three air quality levels were not appreciable.

Possible Sources of Bias in Data

What kind or kinds of bias might we find in the responses to the questions on water and air quality? Several possible sources of bias will be discussed in this section.

It cannot be denied that some respondents, upon being asked the questions, did not take the questions seriously. After all, the questions did force the respondent to place himself in a situation in which he was forced to purchase clean water and clean air or go without these all together.

Moreover, the distinction between what respondents would be willing to pay and what they would actually have to pay should be made. We can surmise that respondents tend to over-estimate the value of environmental goods in the former case and under-estimate in the latter. So long as the respondent is not forced to make an actual payment for these goods and yet is assured of their provision by some regulatory agency, it is to his advantage to over-estimate their value. The higher the value he places on these goods, the more he believes will be provided. However, if he thinks he may be forced to come across with an actual payment, he has a tendency to under-estimate the value in the hope that he can obtain the maximum amount at the minimum price.

The questions on water and air quality asked for expressed willingness-to-pay. Thus, the responses may have over-estimated the value of environmental goods. Conceptually, however, this over-estimation presents few serious problems, provided respondents consistently over-estimate these values.

The figures in both tables were put on a per household basis.* These per household figures are average figures in the sense that they represent what each household in the county, on the average, is willing to pay for each of the water quality and air quality levels.

There exist statistical procedures whereby we can make inferences for the entire population from the estimates our sample of households gives us. We calculate a confidence interval or range for our estimates of per household willingness-to-pay. We can

choose any degree of confidence that we desire, but for present purposes we will say that the procedure which leads us to say that the true population value lies within the interval which is calculated will result in our making 95 correct statements out of 100, on the average.* Table 13 shows the intervals which were calculated for the water quality data. Table 14 shows the same for the air quality data.

TABLE 13. Ninety-five Percent Confidence Intervals on Per Household Willingness-to-Pay for Water Quality by Quality Level, Beaufort County, South Carolina, 1970

<i>Quality Level</i>	<i>Confidence Interval in Dollars</i>
Water Quality Level I	\$ 61-89
Water Quality Level II	31-46
Water Quality Level III	40-50
Water Quality Level IV	34-42

SOURCE: Calculated from Household Survey of Beaufort County, Department of Agricultural Economics and Rural Sociology, Clemson University, Clemson, S. C., Summer 1970.

TABLE 14. Ninety-five Percent Confidence Intervals on Per Household Willingness-to-Pay for Air Quality by Quality Level, Beaufort County, South Carolina, 1970

<i>Quality Level</i>	<i>Confidence Interval in Dollars</i>
Air Quality Level I	\$ 68-112
Air Quality Level II	27- 41
Air Quality Level III	31- 47
Air Quality Level IV	37- 47

SOURCE: Calculated from Household Survey of Beaufort County, Department of Agricultural Economics and Rural Sociology, Clemson University, Clemson, S. C., Summer 1970.

From a cursory examination of both tables we can see that no calculated confidence interval or range includes the value zero. Thus 95 times out of 100, we can expect to be correct when we say that residents of Beaufort County do value the environment and/or are willing to pay something to maintain or enhance it.

Previously in the analysis, we mentioned that residents who lived south of Port Royal Sound appeared to value the environment more highly than did residents who lived north of the Sound. It should be remembered that the household survey was made before the BASF Company announced the cancellation of its construction plans and while an atmosphere of distrust and suspicion was prevalent among several groups in the County. Consequently, it is entirely possible that this situation itself would accentuate the differential in willingness to pay as among residents living north and south of the Sound. Therefore, we may not have a true reading of these atti-

*In statistical terminology, we are calculating a 95 percent confidence interval.

*See last row in each column in both tables.

tudes because of the controversy which was raging in the County at the time the survey was conducted. However, some might argue that the reading of these attitudes is free of such bias because the controversy generates discussion and thought among the residents. It makes them relatively more aware of the "problems" associated with the environment. Their responses, in turn, would reflect their true attitudes.

Summary

One of the main purposes of the household survey was to ascertain attitudes of residents toward the environment of Beaufort County. We have made a somewhat comprehensive analysis of these attitudes in regard to clean water and clean air. One final note of caution in interpreting the estimates of willingness-to-pay reported in this chapter may be in order. As noted earlier, our estimates are based on the response of the interviewee to a hypothetical situation which he may not have understood fully. Moreover, given each interviewee's personal assessment of possible uses of the estimates derived from his response, he may either have inflated his answer above his true willingness-to-pay (on the judgment that he would not, in fact, be forced to pay at all), or he may have deflated his answer (on the judgment that he would possibly have had to actually pay the amount he suggested).

While conceding that estimates are subject to considerable reservation, they show that residents of Beaufort County are willing to make rather sizeable sacrifices in income in order to preserve a high quality environment.

PART V

Summary and Conclusions

Introduction

In the preceding four parts we have noted the existing economic conditions in Beaufort County, analyzed the economic and ecologic impacts of seven different types of activities which might be developed to expand the economic base of the County, and attempted to measure the willingness of the local population to trade off environmental quality for pecuniary income. In this final chapter, we will review our findings and discuss some of the conclusions the findings seem to justify.

Review of Findings

Although all of the analyses which we report are subject to limitations imposed by certain assumptions which we were required to make and by the quality of the data we were able to obtain, the following points now seem rather clear:

1. Beaufort County's traditional economic base of agriculture, forestry and fisheries has been

releasing human resources at a rapid rate. These traditional activities are not likely to disappear from the County's economy, but they can no longer be depended upon to support a growing population and the public services which such a population will require. Military activities have largely replaced agriculture, forestry and fisheries in the County's economic base, but the level of local military operations is politically sensitive and likely to be unstable. Beaufort County must seek activities to form a new and expanding economic base if the County is to grow and prosper in the years ahead. These activities must provide both increased jobs and increased tax revenues.

2. To a large extent, economic development in Beaufort County will require trade-offs between environmental quality and pecuniary benefits (e.g., jobs, income, taxes, etc.). Of the seven types of economic development which were examined in Part III, four (tourism and recreation, textiles and apparel, chemicals and lumber and wood products activities) appear to offer the greatest pecuniary returns, but under current technology, such industries will also create a threat of considerable environmental damage. Light industry (such as food processing) and military and retirement community developments pose less environmental threats, but also produce fewer pecuniary benefits.
3. The residents of Beaufort County appear to place a rather high value on environmental quality, especially clean air and clean water, and are willing to make rather sizeable sacrifices in income in order to preserve a high quality environment. There is considerable variation in attitude toward such sacrifices between various income groups and between persons living north and south of Port Royal Sound. Those living south of the Sound indicated a greater willingness to sacrifice income for environmental quality than those living north of the Sound.

The Options for the Economic Future of Beaufort County

Given the findings reported in this study and summarized above, we can identify at least three distinct options for the economic future of Beaufort County:

1. Beaufort County can choose to risk local environmental quality and opt for the development of economic activities which generate relatively high monetary benefits. The pay-offs from such an option in terms of income, jobs and tax revenue would probably be sig-

nificant, and the actual damage to the environment might be very slight. But this sort of development, especially that of heavy industry, carries with it the potential for serious pollution problems and, at best, such development carries a risk of at least periodic episodes of air and water pollution.

2. Another option for Beaufort County lies at the opposite extreme to Option #1. The County may choose to do nothing toward attracting activities for a new economic base. If military activities remain at about 1970 levels, such an option may mean that the County will suffer little in the way of population decline or severe economic hardship. But if the military activities in the County are decreased considerably, there would probably be an eventually significant population decline. In addition, a decrease in military activities in the County would result in a curtailment of Impacted Area Funds, necessitating either a substantial increase in the local tax levy or a deterioration in local government services.
3. The third option for Beaufort County involves pursuit of a middle course. The development of light industry such as food processing might be encouraged, as well as further development of retirement-type communities in the County. While these activities will not produce as large a pecuniary payoff in terms of income, jobs and tax monies as those development activities referred to in Option #1, they will, if developed at sufficient scale, provide the economic base needed to sustain a stable or modestly growing population and a level of public services approaching the State average. Although light industry and retirement communities do account for some measure of environmental degradation, the effect on the environment is relatively minor. In fact, if military operations in the County were reduced concurrently with development of such activities, it is quite possible there would be no net reduction at all in environmental quality.

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