A-231

The Feasibility Of Manufacturing Machine Shop Products In Southwest Georgia

Prepared For

INDUSTRIAL DEVELOPMENT DEPARTMENT

SOUTHWEST GEORGIA PLANNING & DEVELOPMENT COMMISSION

GEORGIA INSTITUTE OF TECHNOLOGY

Engineering Experiment Station
Economic Development Laboratory
Atlanta, Georgia 30332

Project A-2310

THE FEASIBILITY OF MANUFACTURING MACHINE SHOP PRODUCTS IN SOUTHWEST GEORGIA

Prepared for

The Southwest Georgia
Planning and Development Commission

Under Partial Funding Provided by
The Coastal Plains Regional Commission

by

Harvey Diamond
Project Director

and

James C. Muller
Research Engineer

GEORGIA INSTITUTE OF TECHNOLOGY
Engineering Experiment Station
Economic Development Laboratory
Business Development Division
Atlanta, Georgia 30332
January 1980

Table of Contents

APPENDICES (cont'd) Page

Map

Tables

Tables (cont'd) Page

Figures

Summary

Since World War II, the rate of economic development and industrialization in the five southeastern states of Alabama, Florida, Georgia, South Carolina, and Tennessee has far exceeded the national average. Unfortunately, certain essential support operations, such as metalworking, have not kept pace with manufacturing in the Southeast. A metalworking service which appears to have particularly high potential for success as a new venture is machine shop products. Albany, Georgia, centrally located in the region, offers many advantages for a jobbing machine shop.

There is a large and expanding market in the United States for machined metal products. Machine shop job work more than doubled in dollar volume in five years, rising to $3.26 billion in 1977. A tremendous potential market also exists among the 19% of the metalworking establishments in the U. S. which perform their own machine shop work. The largest consumers of job shop services are the transportation industries, miscellaneous machinery manufacturers, and primary metal producers.

In the five-state Southeast, metalworking industries consume an estimated $234 million worth of machined metal products annually, and an additional $54 million worth is purchased by nonmetalworking firms.

A survey of southeastern companies revealed that 72% of the firms using outside metalworking services purchased machine shop products; 54% of this volume was fabricated in job shops in the Southeast. Although southeastern plants are estimated to consume 7.2% of the national output of job work, employment in the five-state nonelectrical machinery, n.e.c., industry, of which jobbing machine shops constitute the major segment, is only 5.2% of the U. S. total. Calculating on a per employee basis, the annual production of machine shop job work should be increased by approximately $65 million for an ideal internal supply/demand balance for the area.

Based on its proximity to the actual and potential market, Albany, in southwest Georgia, appears well located for a machine job shop to profitably serve the five-state Southeast. Raw materials can be supplied by approximately 200 metal service centers, 100 ferrous foundries, and 75 nonferrous foundries in the Southeast. Trained labor is readily available, and machine shop courses are

offered at the Albany Area Vocational-Technical School. Among companies in the miscellaneous nonelectrical machinery industry in the five states, those in Georgia have the highest labor productivity and the second lowest wage rates. Transportation services are provided by two railroads, one major airline, and 31 motor carriers (21 with terminals in Albany). Ample electric power, natural gas, coal, fuel oil, LP gas, and water are available. Essentially level plant sites of various sizes, adjoining both rail and highway and served by public utilities, are available, both in the city and in surrounding areas. Revenue bond financing is offered to well-rated industrial concerns.

Two jobbing machine shop models are presented: one using standard machine tools and the other equipped with CNC tools. Both are typically sized, with 13 to 16 production workers. Total land, building, and improvement costs are estimated at $203,600. Highlights of both models are tabulated below.

	Standard Tool Shop	CNC Tool Shop
Fixed Assets	$417,560	$567,050
Start-up/Working Capital	200,600	300,300
Total Investment	$618,250	$867,350
Direct Labor	13 persons	16 persons
Indirect Labor	4 persons	5 persons
Administrative Labor	3 persons	6 persons
Total Labor Costs	$283,958	$398,728
Number of Shifts	1	2
Before-Tax Profit	$ 61,755 (4th yr.)	$142,440 (4th yr.)
Profit/Sales Ratio	8.2%	12.3%
Average Annual Sales	$754,000	$1,160,000
Break-Even Point	74.7% of average prod.	67.9% of average prod.

The profitmaking potential of the CNC-equipped shop appears to be very strong. This is due principally to the multi-shift possibility offered by the flexibility of CNC in permitting machine loading to be divided between jobs. The higher costs of starting and operating a CNC shop, however, make it advisable to perform a detailed marketing analysis prior to choosing this alternative to determine how much work suitable for the CNC centers can be obtained.

INTRODUCTION

Background

Since World War II, the rate of economic development and industrialization in the Southeast has far exceeded the national average. This is true for nearly all major economic indicators, such as employment, population, and personal income, but especially for manufacturing, where much of the expanded activity is due to company relocation and the opening of branch operations.

United States Department of Commerce data indicate that for the 1966-1975 period, as the number of manufacturing establishments in the United States increased by 2.1%, in the five southeastern states of Alabama, Florida, Georgia, South Carolina, and Tennessee, the number of plants increased by 12.8%. In 1975, manufacturing establishments in the five-state Southeast represented 12.6% of the United States total.

Certain support operations, critical to production, have not kept pace with manufacturing in the Southeast. One of these essential industries upon which the future growth of manufacturing heavily depends is metalworking. Although value or volume statistics by area for various metalworking categories are not available for comparison, employment data by state can be quantified. Regional employment in metal heat treating is 3.6% of the national total; machine shop work, 3.5%; metal plating, 6.7%; metal casting, 9.3%; and metal forming, 4.9%. These are the types of support facilities that must be expanded to assure full manufacturing growth potential in the Southeast.

Objective and Procedure

Realizing that the need for additional metalworking facilities is prevalent throughout the Southeast, the Southwest Georgia Area Planning and Development Commission asked the Business Development Division of Georgia Tech to ascertain which metalworking support services hold the greatest potential for success in the Southeast based on market considerations and other preliminary findings. The two most promising services were found to be machine shop products and metal stampings.

This report assesses the economic feasibility of locating a machine shop jobbing facility in Southwest Georgia to serve the ever-growing manufacturing

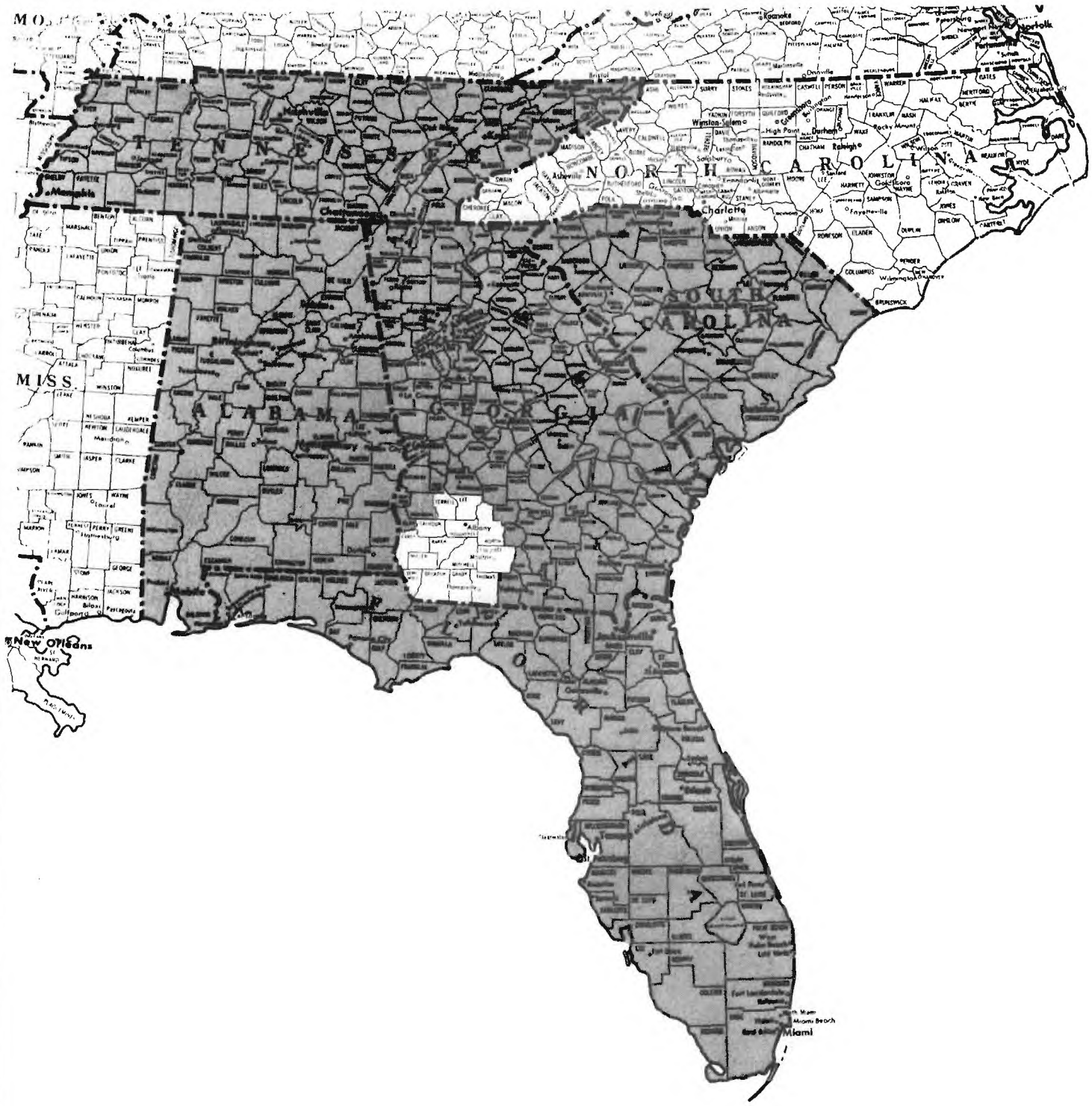
sector of the Southeast. It will be used by the Southwest Georgia Area Planning and Development Commission as a tool to attract potential investors to the area. (See Map 1.)

The study is divided into two major sections. The first qualifies and quantifies the market for machine shop products in the Southeast and enumerates and discusses the elements of production and distribution required to assure a sucessful machine shop jobbing operation in Southwest Georgia, as represented by Albany, Georgia.

The second section is a comprehensive analysis and presentation of a model jobbing machine shop that could be located in Albany. Included is a detailed schedule of capital costs outlining the costs of land, building, infrastructure, equipment, and working capital plus a detailed cost/profit schedule to incorporate all significant costs incurred in the operation of two ideally sized plants. These costs are tailored to reflect the business conditions in Albany, Georgia.

Map 1

SOUTHEASTERN STUDY AREA AND FOURTEEN-COUNTY
SOUTHWEST GEORGIA PLANNING AND DEVELOPMENT COMMISSION AREA



MACHINE SHOP JOB WORK

Industry

Machine shop job work has a five-digit classification (SIC 35995),[1] and as such has very few annual statistics available. Because these products constitute the major segment of Machinery, Except Electrical, N.E.C.[2] (SIC 3599) grouping, however, it can be assumed that data pertaining to the four-digit industry would be representative of machine shop operations.

Production of nonelectrical machinery, n.e.c., is well suited to small to medium plants. In 1972, out of a total of 16,284 plants, 15,863 employed fewer than 50 workers each; their output was valued at $2,572 million, or 70% of the entire value of shipments for the industry.

Increased labor productivity, through industrial automation and the greater use of capital machinery, has been prevalent in the nonelectrical machinery, n.e.c., industry. Value of shipments per production worker climbed from $16,200 in 1958 to $18,800 in 1963, to $22,000 in 1967, and to $28,800 in 1972. Preliminary data for the just completed Census of Manufactures indicate a further advance to $44,600 per production worker in 1977.

This increased labor productivity has been accompanied by a steady decrease in the average number of employees in the nonelectrical machinery, n.e.c., industry. Although the number of plants has grown slightly, industry employment has not varied in the last ten years. Consequently, the average number of employees per plant has declined from 15.4 to 11.2. (See Table 1.)

A machine shop doing job work may be described as a shop where specialty machinery building and repair work is done. Jobbing machine shops are equipped to do a great variety of work. The bulk of this work includes special machine building, tool and die making, and general repair work; it may include production work for industries that are behind on their production schedules.

---

[1] Standard Industrial Classification (SIC), a system of grouping industries according to their primary activities which was developed by the U. S. Office of Management and Budget. The industry definitions become progressively narrower with successive additions of numerical digits. The groupings used in this report are from the Standard Industrial Classification Manual, 1972.

[2] N.E.C. = not elsewhere classified.

Table 1

NUMBER OF PLANTS AND EMPLOYEES
IN THE NONELECTRICAL MACHINERY, N.E.C.
INDUSTRY IN THE U.S., 1967 TO 1976

Year	Number of Plants	Number of Employees	Average Number of Employees per Plant
1967	14,093	217,476	15.4
1968	14,343	211,245	14.7
1969	14,816	217,196	14.6
1970	15,137	218,911	14.5
1971	14,609	190,478	13.0
1972	14,483	198,563	13,7
1973	15,250	229,719	15.1
1974	16,619	208,330	12.5
1975	16,595	200,185	12.1
1976	17,067	191,799	11.2

Source: U. S. Department of Commerce, Bureau of the Census, County Business Patterns.

Most machine shops concentrate on selling their services to manufacturing plants, and this was the area of concentration in this market study. However, a machine shop may also serve the farmer by doing repair work and building small tools, the auto repairman by reworking and repairing automotive components, and the domestic consumer by doing miscellaneous sharpening and repair work.

National Market

There is a large and expanding market in the United States for machined metal products. Used to some extent by virtually every manufacturing industry, machine shop job work has more than doubled in dollar volume in five years.

Preliminary Census of Manufactures data for 1977 place product shipments for machine shop job work at $3.26 billion, a figure more than triple the $1.08 billion worth shipped in 1967. Should this current growth rate continue, machine shop shipments by 1983 should approach $5 billion worth annually. (See Table 2.)

Table 2

LINEAR REGRESSION TREND
FOR MACHINE SHOP JOB WORK
IN THE U.S.

Year	y	x	xy	x^2
1967	1,080	-5	- 5,400	25
1968	1,244	-4	- 4,976	16
1969	1,303	-3	- 3,909	9
1970	1,619	-2	- 3,238	4
1971	1,582	-1	- 1,582	1
1972	1,426	0	0	0
1973	1,932	1	1,932	1
1974	3,027	2	6,054	4
1975	3,193	3	9,579	9
1976	3,437	4	13,748	16
1977	3,262	5	16,310	25
	23,105		28,518	110

$y = a + bx$ where:

$$a = \frac{\Sigma y}{n} = \frac{23,105}{11} = 2,100$$

$$b = \frac{\Sigma xy}{\Sigma x^2} = \frac{28,518}{110} = 259$$

1983→ $y = 2,100 + 259(11) = 4,949$

These numbers, however, represent only a portion of the potential market for machine shop job work. Census data for 1972 (latest available) indicate that 18,800 or 19.1% of the total number of metalworking establishments in the United States (SICs 33-37) employ production workers for machine shop work. This percentage is down from 21.6% in 1967 and 22% in 1963. Since during the same period both the number of machine job shops and their total output have increased, it would appear that there is a slow transition for machined metal work from an in-plant or captive operation to a job shop end-product.

Quantitatively, this in-plant production is of sizable volume, with these 18,800 companies employing 569,200 production workers to do machine shop work. Since this figure is more than ten times the number of production people in machine job shops that produced $1.4 billion in shipments in 1972, conceivably the need for metal machined products is tremendous.

Machine shop job work, although utilized in many areas of manufacturing, is consumed in greatest volume by the transportation industries, followed by miscellaneous machinery manufacturers and primary metal producers.

In 1974, the United States Department of Commerce published Input- Output Structure of the U. S. Economy: 1967. In a series of tables, the study delineates the interrelationships between 367 industries, services, and activities and presents definitive input-output flow data for the numerous industries listed. An analysis of these tables reveals that 45 industries other than transportation purchase more than $10 million worth of machined products annually, while an additional 96 industries consume between $1 million and $10 million worth.

More than 29% of the national machine shop job work is used in the transportation industries, with almost 46% consumed by the ten industries purchasing the largest volumes. On the assumption that the utilization percentages in 1977 are similar to those in 1967, the dollar value of the principal machine job shop markets and all others can be calculated. These values are shown in Table 3.

For the next decade, any changes in demand for machine shop job work should be closely correlated with the growth experience of the industries and markets that purchase large quantities of these items. Table 4 shows the recent growth of these industries.

Southeastern Market

The market for machine shop job work in the southeastern states of Alabama, Florida, Georgia, South Carolina, and Tennessee can be approximated by extrapolating the national figures. On the assumption that machine shop products end-use in the study area is identical to the national end-use, and that machine shop job work consumption can be calculated on a per employee basis, the volume estimates in Table 5 appear to be valid. In addition to the five-state metalworking market of $234 million, an estimated $54 million worth of machine shop job work is purchased in the area annually by nonmetalworking industries such as food, chemicals, paper, plastics, and construction.

Table 3

MACHINE SHOP JOB WORK CONSUMED IN THE U.S., BY INDUSTRY, 1977

SIC	Industry	Volume (in millions of dollars)
331	Blast furnaces, steel works and rolling and finishing mills	103.2
332	Iron and steel foundries	75.2
3369	Nonferrous castings	33.5
3441	Fabricated structural metal	61.5
345	Screw machine products, bolts, nuts, rivets and washers	65.1
3469	Metal stampings, n.e.c.	39.8
3519	Internal combustion engines, n.e.c.	79.6
352	Farm and garden machinery and equipment	38.1
3531	Construction machinery and equipment	32.6
3544-5	Dies, jigs, fixtures, and cutting tools	42.5
3573-4	Electronic computing equipment, calculating and accounting machines	62.4
359	Miscellaneous machinery, except electrical	223.5
3662	Radio and television communication equipment	39.7
3713	Truck and bus bodies	379.2
3721	Aircraft	246.1
3724	Aircraft engines and engine parts	196.4
3728	Aircraft parts and auxiliary equipment, n.e.c.	132.2
	All other metalworking markets	1,058.1
	Nonmetalworking markets	352.9
	Total	3,261.6

Table 4

VALUE OF SHIPMENTS OF SELECTED
METALWORKING INDUSTRIES
(in millions of dollars)

SIC	1972	1973	1974	1975	1976	% Increase 1972-1976
3312	22,211	28,033	38,200	32,523	36,831	65.8
3321	4,034	5,090	6,065	6,079	6,952	72.3
3441	3,306	3,619	4,075	4,640	4,645	40.5
3452	1,988	2,331	2,879	2,462	2,840	42.8
3519	3,353	4,106	5,095	5,191	6,138	83.1
3573	6,108	7,085	8,668	8,442	10,134	65.9
3599	3,363	4,172	4,872	4,965	5,110	51.9
3713	1,440	1,523	1,398	1,640	2,269	57.6
3721	7,538	9,486	10,364	10,880	11,723	55.5
3724	3,069	3,687	4,026	4,488	4,928	60.6
3728	3,437	4,074	4,457	4,842	5,102	48.4

It would appear from these figures that the metalworking industries command the bulk of the southeastern market for job shop machine products. These products come, by and large, from outside the area. Census data indicate that in 1972 only 4.4% of the job shop machine products shipped nationally were fabricated in plants located in the five-state area.

Survey Results

The questionnaire responses to the mail survey which helped motivate this study give credence to these data and enable the following observations to be made:

1. Of the 198 companies using outside metalworking services, 143, or 72%, purchased machine shop products totaling $28.9 million.

2. Approximately half of this volume (54%) was fabricated in plants in the Southeast.

3. Although only 55, or 38% of the users, were metalworking companies, as a group they purchased $21.5 million worth, or 74% of the machine shop products

Table 5

MACHINE SHOP JOB WORK CONSUMED IN
FIVE SOUTHEASTERN STATES BY INDUSTRY, 1977

SIC	Industry	Volume (in thousands of dollars)
331	Blast furnaces, steel works and rolling and finishing mills	3,693
332	Iron and steel foundries	6,901
3369	Nonferrous castings	878
3441	Fabricated structural metal	9,066
345	Screw machine products, bolts, nuts, rivets and washers	1,470
3469	Metal stampings, n.e.c.	2,001
3519	Internal combustion engines, n.e.c.	2,421
352	Farm and garden machinery and equipment	2,036
3531	Construction machinery and equipment	1,127
3544-5	Dies, jigs, fixtures, and cutting tools	4,358
3573-4	Electronic computing equipment, calculating and accounting machines	4,321
359	Miscellaneous machinery, except electrical	12,807
3662	Radio and television communication equipment	2,380
3713	Truck and bus bodies	26,958
3721	Aircraft	20,942
3724	Aircraft engines and engine parts	7,462
3728	Aircraft parts and auxiliary equipment, n.e.c.	4,495
	All other metalworking markets	66,910
	Nonmetalworking markets	54,236
	Total	234,462

bought. On the average, in the Southeast, nonmetalworking machine job shop purchases were $85,000 per annum; those for metalworking companies approximated $390,000 per annum.

4. Nonmetalworking firms bought $5.5 million worth of machine shop job work from southeastern suppliers (74% of their total purchases), but more than half (53%) of the metalworking company purchases came from outside the five-state area. A complete listing of machined products users by SIC, volume, and origin of purchases is given in Appendix 1.

These data would indicate that machine shop products are purchased in the Southeast by many different types of companies, with the metalworking firms buying the greatest volumes. These larger volumes, more frequently than not, are produced in plants outside the study area.

The number of potential customers for machine shop job work in the Southeast is substantial. Table 6 gives a breakdown by number of establishments with 20 or more employees in the five states that are classified in the industries consuming large volumes of machine shop products.

The total number of metalworking plants in the Southeast has been increasing steadily. Table 7 shows the changes in the number of plants with 20 or more employees in the five-state Southeast as compared with all other sections of the United States for 1967, 1970, 1973, and 1976.

Demand vs. Production

An imbalance exists between machine shop job work demand and production in the Southeast. Although southeastern plants are estimated to consume 7.2% of the national output of job work, Census data for 1977 place employment in the southeastern nonelectrical machinery, n.e.c., industries at 5.2% of the United States total. If once again, calculations are made on a per employee basis, the annual production of machine shop job work should be increased by approximately $65 million for an ideal internal supply/demand balance for the area.

Table 6

NUMBER OF SOUTHEASTERN COMPANIES WITH 20 OR MORE EMPLOYEES IN INDUSTRIES CONSUMING LARGE VOLUMES OF MACHINE SHOP PRODUCTS

SIC	Alabama	Florida	Georgia	South Carolina	Tennessee
331	17	9	13	7	11
332	36	4	10	1	18
336	5	10	4	6	8
3441	39	31	19	24	36
345	5	7	3	2	8
3469	4	6	7	2	12
3519	1	2	-	3	-
352	6	6	21	3	5
3531	3	4	2	2	8
3544-5	11	17	14	6	21
3573-4	-	9	2	1	3
359	24	32	16	7	30
3662	4	27	2	5	4
3713	2	7	4	-	7
3721	2	5	4	2	-
3724	-	5	1	-	1
3728	2	11	2	1	2
Totals	161	192	125	72	174

Five-State Total = 724

Source: Dun and Bradstreet Metalworking Directory, 1976.

Table 7

NUMBER OF METALWORKING COMPANIES
IN THE U.S., 1967, 1970, 1973, 1976

Year	Five-State Southeast	Other States	U.S. Total	S.E. as % of U.S.
1967	1,847	34,527	36,374	5.1
1970	2,238	39,403	41,641	5.4
1973	2,309	33,053	35,362	6.5
1976	2,685	36,551	39,236	6.8

Source: Dun and Bradstreet Metalworking Directory, 1967-8, 1970, 1973, 1976.

ADVANTAGES OF AN ALBANY, GEORGIA, LOCATION

Based on its proximity to the actual and potential market, Albany, Georgia, in the southwestern part of the state, appears well located for a machine job shop from which to profitably service the machined product needs of industry in the five-state Southeast.

To fully assess the suitability of such a location, it is necessary to examine existing economic conditions in the area that are pertinent to a continuing market and to ascertain the availability of factors relevant to achieving a successful fabricating enterprise.

Various economic elements reflect the region's probability for future growth. Although not as important to machine job-shop production as the changes shown in Table 4, certain economic activities present an overview of the commercial and industrial potential of the area. With this in mind, percentage growth comparisons between the Southeast and the United States for several essential economic elements were compiled and are given in Table 8. These figures, plus the detailed data shown in Appendices 2 through 10, strongly emphasize the growth differences between the Southeast and the United States as a whole.

This dynamic southeastern economic growth cannot be guaranteed to continue; however, these statistics do indicate that for the near term at least, for any expansion that does occur, the Southeast should exceed the national average.

In addition to the market aspect, in selecting a location for a machine job-shop facility, prime consideration should be given to the availability of specific factors of production and distribution such as raw materials, labor, power and fuels, transportation facilities, and plant sites. Southwest Georgia, and Albany in particular, can satisfy these criteria.

Raw Materials

Census data show that the bulk of the identifiable raw materials of metal consumed by the nonelectrical machinery, n.e.c. (SIC 3599) industries can be categorized as mill shapes for forms, ferrous castings, or nonferrous castings. These materials are all readily available for sale to a plant in Albany.

Table 8

RELATIVE GROWTH OF THE SOUTHEAST [1/]
COMPARED WITH THE U.S., 1950-1977

Activity	Period	Percent Increase	
		Southeast	U.S.
Population	1950-1977	64	42
Nonagricultural Employment	1950-1978	184	90
Manufacturing Employment	1950-1978	111	33
Construction Employment	1950-1978	216	81
Value Added by Manufacture	1950-1976	845	470
New Plant Expenditures	1951-1976	748	421
Electrical Power Capacity	1950-1977	1,251	736
Total Personal Income	1950-1977	890	599
Per Capita Personal Income	1950-1977	486	370

[1/]Alabama, Florida, Georgia, South Carolina, and Tennessee.

The Dun and Bradstreet Metalworking Directory identifies metal distributors and producers of mill shapes and castings in the five-state study area. These firms are shown by type and state in Table 9.

Labor Availability

An assessment of available labor in all Georgia counties is published on a quarterly basis by the Georgia Department of Labor, Employment Security Agency. The most recent issue, May 1979, places recruitable labor for a seven-county southwest Georgia area in a commuting radius of 35 miles of Albany, Georgia, at more than 9,700 persons, of whom more than 93% are experienced workers.

A machine shop job-work producer that is locating or relocating in Albany, Georgia, need not suffer from a lack of trained production workers. The Albany Area Vocational-Technical School in Albany, where technical courses in machine shop are given, is available to service the manpower training requirements of a new industry in that area of the state. Through area vocational-technical schools, Quick Start, a totally state-supported program, is designed to screen and train workers for specific, clearly defined jobs in a particular plant. This

Table 9

NUMBER OF METAL SERVICE CENTERS
AND FOUNDRIES IN THE SOUTHEAST, 1978

State	Metal Service Centers	Ferrous Foundries	Nonferrous Foundries
Alabama	37	51	24
Florida	71	12	27
Georgia	55	18	11
South Carolina	17	2	3
Tennessee	39	18	8
Total	219	101	73

Source: Dun and Bradstreet, Inc., Dun and Bradstreet Metalworking Directory, 1978, New York.

training assures a supply of production employees who know their work and plant requirements before they are hired. The manufacturer benefits by a lower labor turnover rate and higher initial productivity.

The Georgia labor force provides a prospective machine shop jobber a favorable combination of low wage rates and high productivity. The 1977 Census of Manufactures shows that among companies in SIC 3599 in the five southeastern states, those in Georgia have the highest labor productivity and the second lowest wage rates. (See Table 10.)

Availability of Transportation

A machine shop producing job work in Albany, Georgia, can ship to all points in the five-state Southeast in minimal time. Albany is located on U. S. Highways 19 and 82, and on State Routes 3, 50, 62, 91, 133, 234, and 257. Its wide streets channel traffic through the city smoothly and swiftly. The railroads serving the area are the Seaboard Coast Line and Southern Railway System, which owns Central of Georgia and Georgia Northern. Republic Airlines provides Albany with jet service.

Table 10

AVERAGE HOURLY EARNINGS AND
LABOR PRODUCTIVITY FOR SIC 3599 IN THE SOUTHEAST, 1977

State	Average Hourly Earnings	Labor Productivity*
Alabama	$ 5.44	$ 2.60
Florida	5.52	2.47
Georgia	5.42	2.76
South Carolina	5.23	2.56
Tennessee	5.50	2.54
United States Average	5.57	2.59

*Value added by manufacture per dollar of production worker payroll.

Source: U. S. Department of Commerce, Bureau of the Census, Census of Manufactures, 1977.

Centrally situated in the five-state study area, Albany shippers are within 600 miles of all major cities in the Southeast. Highway distances to selected southeastern areas are as follows:

City	Miles	City	Miles
Atlanta, Georgia	170	Memphis, Tennessee	499
Birmingham, Alabama	243	Miami, Florida	542
Columbia, South Carolina	312	Mobile, Alabama	301
Jacksonville, Florida	195	Savannah, Georgia	216
Macon, Georgia	110	Tampa, Florida	312

Thirty-one motor carriers serve the area with more than 100 in and out schedules daily. Twenty-one have terminals in Albany. Anticipated delivery times to various cities in the Southeast are shown in Table 11.

Power, Fuels, and Water

Electricity. Within the Albany city limits, the city is the prime wholesale distributor of electricity. Georgia Power Company furnishes electric power service to the rest of the Albany area through a network of 115,000-volt transmission lines. Through this interconnected system, the Georgia Power

Company is capable of providing sufficient power to supply large industrial requirements. Nearest plants are a 5,400-KW hydroelectric plant just north of Albany and a 340,000-KW steam-electric plant (Plant Mitchell) some ten miles south of the city.

Table 11

DELIVERY TIMES BY MOTOR FREIGHT FROM
ALBANY, GEORGIA, TO CITIES IN THE SOUTHEAST

City	Delivery Time (number of days)	
	Truckload	Less-Than-Truckload
Atlanta, Georgia	Overnight	Overnight
Birmingham, Alabama	First day	Second or third day
Charleston, South Carolina	Second day	Third day
Columbia, South Carolina	Overnight	Second day
Jacksonville, Florida	First day	Second day
Knoxville, Tennessee	Second day	Third to fourth day
Memphis, Tennessee	Second day	Third to fourth day
Miami, Florida	Second day	Third day
Montgomery, Alabama	First day	Second or third day
Savannah, Georgia	Second day	Third day
Tampa, Florida	First day	Second day

All facilities of the Georgia Power Company, including generation, transmission, and distribution, conform to the highest standards in the industry, and reliability of service is exceptional. Industrial power rates for all classes of service are among the lowest in the Southeast, and the company is willing to negotiate for any size or type of power load in this area.

Natural Gas. The City of Albany purchases natural gas from the South Georgia Natural Gas Company, connecting with the company's 12-inch high-pressure main near the city limits. South Georgia Natural Gas Company receives its supply from connection with a high-pressure main of Southern Natural Gas Company near Opelika, Alabama. BTU content is 1,050.

Coal. Coal in Albany is available through Atlanta brokers (2 X 0 nut and slack coal from Tennessee and Kentucky mines). Coal rated at 13,100 BTU per

pound with about 7.0% ash content is delivered in carloads. Another coal with 12,500 BTU content and about 7.0% ash is also available. The price of coal is based on market and quantity, and delivered price will be given on request.

Fuel Oil. No. 2 fuel oil with a BTU content of 138,000 per gallon is available. Minimum delivery is 7,000 gallons.

LP Gas. LP gas is available through local distributors or, in large quantities, direct from suppliers. Purchases of 5,000 gallons or more can be made through a pipeline terminal within the county.

Water. Water for industrial use in Albany is supplied from a city-owned and operated system of 21 artesian wells; they range in depth from 700 feet to 1,027 feet and in output from 1,000 to 1,650 gallons per minute. The present capacity of the city's water system is 30 million gallons per day. The city has five 500,000-gallon elevated storage tanks and one 1-million-gallon tank, as well as a storage reservoir with a capacity of 1,290,000 gallons. The city is in a position to increase this capacity as required. Over 283 miles of mains are present in Albany, ranging in size from 2 to 14 inches. Pressure of 40 to 60 pounds is maintained in city lines. The city water is slightly chlorinated and fluoridated.

Taxes

As in other areas of the U. S., a producer of machine shop job work in Albany, Georgia, would be subject to a variety of taxes. Although one or two of the tax rates may be lower in other cities, when the total of all applicable taxes is considered, it is believed that an Albany location offers an opportunity for substantial tax savings. For Albany, Georgia, taxes would be as follows:

State Corporate Income Tax - 6.0% of net income

Local Corporate Income Tax - none

State Sales or Use Tax - 3%

Local Sales or Use Tax - 1% local option tax in Albany and Dougherty County

Property or Ad Valorem Taxes (include city, county, school district, etc.) - 41.585 mills at 40% evaluation or $16.63 per $1,000 at full market value

Availability of Plant Sites

Practically level plant sites varying from one acre to large tracts of several hundred acres are available at reasonable cost either inside or outside the Albany city limits. They adjoin both railroad and highway, and several are located on the Flint River. Most of these sites are presently served by public utilities, including natural gas. Where public utilities are not already installed, arrangements can be made with the city and county governments for their extension. Complete data, including aerial photographs, topography, size, water, sewerage, and other pertinent information, are available upon request. Personal inspection is invited. Both the Seaboard Coast Line Railway and the Southern Railway have modern, complete, well-located industrial parks in Albany. Excellent sites also are available in a privately owned industrial park for both rail and nonrail users.

The Albany-Dougherty Payroll Development Authority, a nonprofit industrial corporation, will issue tax-free revenue bonds for the purchase of land and the erection of buildings for well-rated industrial concerns on an attractive 10-15-20-25-year lease or lease amortization basis. In lieu of taxes during the amortization period, a company will be expected to pay an agreed amount to the city and county.

Building costs are very low in the Albany area, ranging in price from $8 to $14 per square foot, based on the size of the building and the type of material used. However, in view of the fact that building costs, nationwide, have been escalating, the jobbing machine shop depicted in this study will be based on a building cost of $17 per square foot.

Climate

One amenity not always available to industry but present in Albany, Georgia, is favorable weather conditions.

The climate in Albany provides many advantages for industry and cuts overhead in many ways. The superb year-round climate of the area is a major attraction, providing lower construction and maintenance costs, no work stoppage due to weather, and more pleasant working and living conditions. It also contributes to higher employee efficiency and lower operational costs. In addition, absenteeism and personal hazards due to winter ills are practically eliminated.

The moderate year-round climate is favorable to human comfort and efficient industrial operations. Although there are many hot days during the summer, they are tempered by the breezes from the Gulf of Mexico. The nights throughout the summer are cool, and heat prostration is practically unknown. Extremes of temperature in Albany are rare. The yearly average is 67.70°, with a summer average of 81.90° and a winter average of 52.90°. Albany's favorable humidity removes from its summer heat the depressing and dangerous effects of the hot weather in many localities. The highest daily humidity, 89%, usually occurs about the time of the lowest temperature, or about 7 a.m. for the entire year. The lowest, 44%, usually occurs about the time of the highest daily temperature, or about 2 p.m. The yearly average rainfall is 50.31 inches and is fairly evenly distributed. Winters are short and mild and snow a rarity. Ice is usually thin and forms only a few times each winter. Only light heating systems are needed for industrial buildings, making heating bills negligible.

It should be iterated that although this chapter refers specifically to an Albany location, any city in Southwest Georgia, such as Bainbridge, Moultrie, or Thomasville, also would be representative of the area.

JOBBING MACHINE SHOP MODELS

Owing to the nature of machine shop job work, there is no set manufacturing unit. Two jobs seldom are exactly alike. The cost of each and every job must be computed individually, and the size-of-work limitations dictated by the capacities of available machines must be taken into consideration. Oftentimes, the total requirements of the job cannot be fulfilled; in this case, certain operations, e.g., electroplating, heat treating, will have to be subcontracted.

The typical jobbing machine shop has about 15 employees. A shop can be as small as an owner and one helper; relatively few are larger than 100 employees. The reason jobbing machine shops are not large is not because they do not grow, but because they tend to grow out of this classification and become manufacturing plants with their own proprietary products. In economic terms, jobbing machine shops do not generally provide increasing economies of scale.

The level of management and supervision increases proportionately to the number of production workers and amount of equipment employed. The sales and quoting functions of the business require significant skill and experience; therefore, these functions are not likely to be delegated below the level of the principal owners. Extensive shop supervision is necessary if production is to be carried out in an orderly and efficient manner. Supervision is required to the extent that the shop foreman actually collects all the tools, fixtures, gauges, materials, and the latest blueprints and delivers them personally to the worker.

The nature of the work and the machinery does not permit the jobbing machine shop to operate more than one shift. It is not feasible for a new shift to pick up where the previous one left off nor is it feasible to break down the setup of the previous shift to clear the machines for new work. This being the case, there is little incentive for a job shop to grow large and there is less incentive for anyone to consider starting up a shop that is larger than the basic economic size.

It is for the reasons stated above that the shops modeled in this study are typically sized. They are large enough to generate significant earnings and yet are small enough to be manageable. Also, they do not require inordinately large amounts of capital investment or start-up working capital. It is felt that the large market demand for machine shop job work identified in the market segment of the report should provide a strong incentive for both individual and institutional

investors to consider establishing a shop in southwest Georgia but does not provide incentive for establishing a shop larger than the normal.

A jobbing machine shop usually stocks only a small amount of the raw materials that will be required. It would not be economically feasible to stock all the various materials that may be used. Permanent stockage is limited to common hot and cold rolled steel shapes, aluminum jig plate, some sheet metal, and fasteners. Special materials are ordered upon receipt of the job. For this reason, arrangements should be made with a metal service center to supply materials on short notice. A complete listing of metal service centers in the area is available in the directory entitled Metal Service Centers in the Southeast, published by the Georgia Tech Engineering Experiment Station.

The shop should be situated on level and well-drained acreage located near a main highway or thoroughfare (a rail siding is unimportant). It should have electric power and natural gas service (availability of a municipal water and sewer system is desirable but not necessary). To provide for future expansion, the site should contain at least two acres. It is estimated that an industrial location of this description with municipal water and sewer service in the Albany, Georgia, area can be purchased for $15,000 per acre or a site cost of $30,000.

The plant will comprise two adjacent structures: a shop building and an office. The shop will be a prefabricated metal building 80 feet square with a 16-foot clearance under the bar joist. The cost of this building is estimated at $17 per square foot, which includes sprinkler system, loading docks, heating system, air conditioning system, lighting, and industrial wiring for machine tools. The total cost of this building is $108,800.

The office building will be a single-story concrete block structure with facing brick; it will be 40 feet square with a 9 1/2-foot clearance under the suspended ceiling. The cost of the building is estimated at $27 per square foot, including plumbing, wiring, lighting, heating, air conditioning, and all finish work. The total cost of the office building is $43,200.

Approximately 7,200 square feet of paving will be required around the buildings for driveways and a parking lot. The cost of this paving is estimated at $3 per square foot. Therefore, paving cost is $21,600.

Summarizing all the component costs gives a total building and improvements cost of $173,600. The costs of the services of professional engineers and

architects are computed in the above building costs. An optimum plant design which provides the greatest economy in the investment of funds and provides sufficient detail for the construction of these buildings is beyond the scope of this study.

This shop building is admittedly a substantial investment, causing the investor to weigh alternatives other than purchasing a building. However, consider that buildings and property are perhaps the easiest of capital assets to finance on a long-term basis. Furthermore, buildings and property generally will appreciate in value, providing the opportunity for obtaining additional financing of business growth by remortgaging when the collateral value of the property and building exceeds the balance of the original mortgage. As long as sufficient cash is generated by the operations to both support the operations and make the mortgage payments, the decision should be to buy the building. Should it appear unlikely that the operation will generate sufficient cash to make mortgage payments on a suitable structure to house the operation within the foreseeable future, then perhaps the plans for establishing the operation should be dropped.

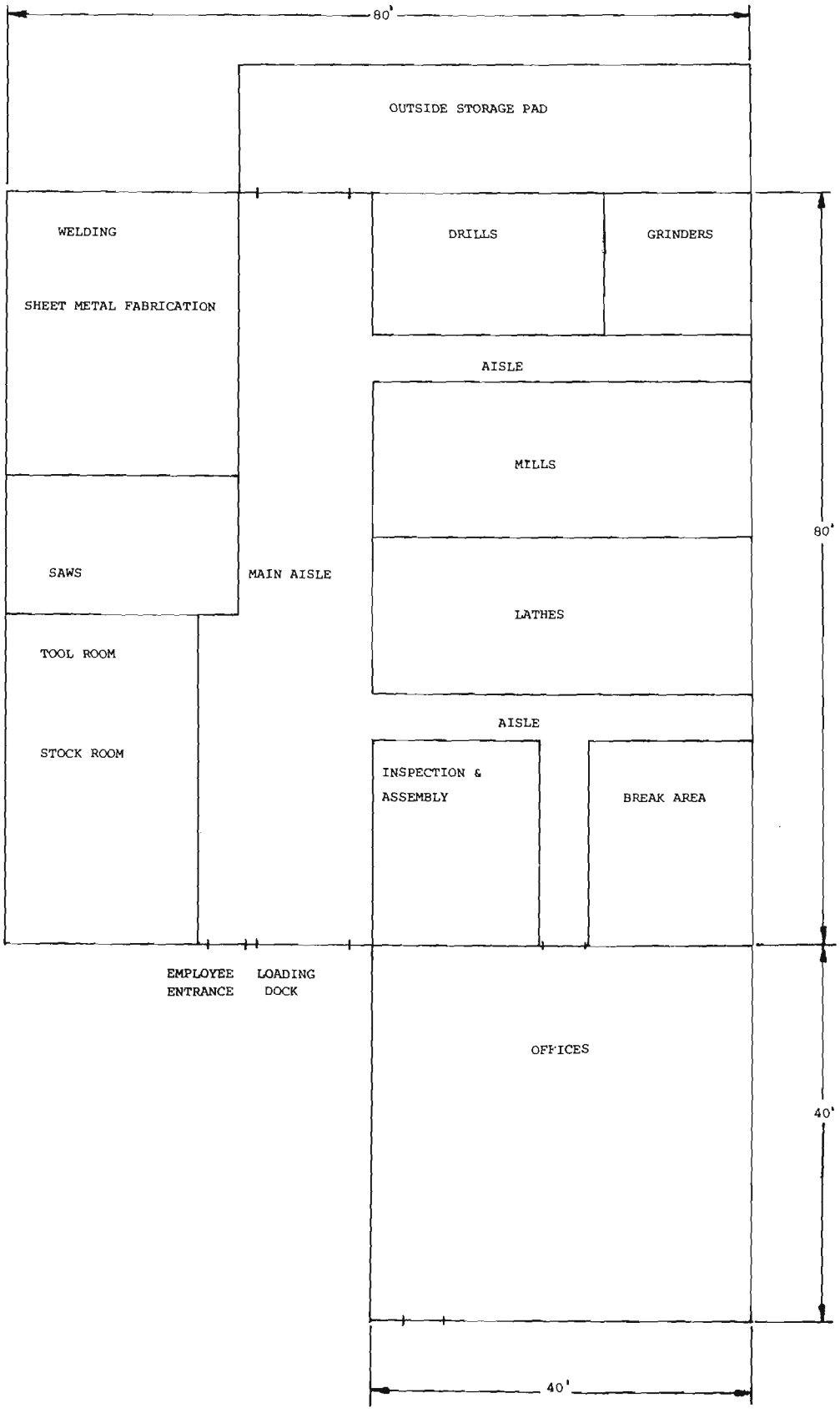
A process or function type of plant layout is recommended for a jobbing machine shop because the manufacturing process is intermittent. An intermittent process is one that produces product items when and as ordered, in small lots, and to the customer's specifications. The advantages of this type of plant layout are:

- o Lower investment through better machine utilization
- o Adaptability to a variety of products and to frequent changes in sequence of operations
- o Ease of accommodation to intermittent demand
- o Greater incentive for individual workers to raise the level of their performance
- o Easier to maintain continuity of production in the event of machine breakdown, shortages of material, and absent workers

A suggested plant layout is shown in Figure 1. This particular layout has some very advantageous features. It facilitates the easy movement of people and materials in that all areas are accessible from aisleways. This is important because moving people and materials through work areas is disruptive, damaging and dangerous. The wide main aisle provides for easy movement of large workpieces and machinery. The largest mill and lathe and the radial drill should be located

Figure 1

SUGGESTED JOB SHOP PLANT LAYOUT



adjacent to the main aisle because these machines will obviously be processing the largest workpieces. An overhead monorail crane running the length of the main aisle could be installed if desired but is not costed in the model. The assembly and storage areas are located next to the loading dock to facilitate in and out movement of raw material and product. The sheet metal fabrication and welding area is purposely located in the far corner of the building, all to itself, to minimize exposure to smoke and noise for the rest of the plant. There is a concrete pad to the rear of the plant, accessible from a wide overhead door, which is handy for storage of overflow raw materials; welding fabrication, weather permitting; and the collection of all manner of miscellaneous junk so charactistic of jobbing shops. The office building is separate from the shop building, but provides good visibility of the loading dock and the employee entrance. The offices are adjacent to the break area and the assembly and inspection area. This is most convenient for monitoring people and production.

The operations usually performed in a machine shop are listed below, together with the machine tools or equipment generally used to perform these operations.

- o Cut stock with power hacksaw, horizontal cutoff saw, foot shear, oxyacetylene torch
- o Turn to shape or mill to size with lathe, milling machine, contour saw, surface grinder, hand brake, roll former
- o Drill, bore, ream, and tap holes with drill press, radial drill, lathe
- o Join parts with oxyacetylene welder, heli-arc or stick welder, fasteners

The selection of specific machine tools and equipment is based primarily on the parameters of size and/or weight of the workpiece. It is equally unwise to equip a shop with light equipment and forsake a large quantity of profitable heavy work as it would be to equip a shop with mammoth machine tools when the bulk of the prevailing work is relatively light work. To achieve maximum flexibility in handling a wide variety of workpiece dimensions, the machine tools included in the modeled jobbing machine shop are prudently sized. The machines selected have the capacity to handle cylindrical shapes 16 inches in diameter up to 8 feet long and castings and similar parts up to 2,000 cubic inches in volume.

A secondary consideration in the selection of machine tools is the degree of automation necessary and/or justifiable. This consideration will be a point of departure in the modeling exercise. The first shop modeled will be equipped with

standard machine tools only. A second shop model will be developed for a shop with several CNC machine tools.

Until recently NC has been impractical for one-of-a-kind work in job shops. The microprocessor is changing this. It provides compact, reliable, inexpensive circuitry to convert the more rigid NC system into a flexible, programmable CNC system. Many of the microprocessor controls involve manual data input (MDI), storing part-programs in semiconductor memory rather than tape; in fact, many MDI machines do not seem like NC to the operator, even though they are. Some machines have systems designed for conversational programming. The operator programs the machine by punching out the answers to questions that appear on the screen. On some, the operator can watch a phantom tool point go through the motions as a final check before the real tool ever cuts into the metal. This is a system that can be used effectively to make one part.

It is highly innovative that two models are presented, because although historical data are readily available for the jobbing machine shop with standard machine tools, they are not available for jobbing machine shops with CNC machines. Guidance for justification of CNC machines provided by the CNC suppliers was used to rework the standard model to produce the CNC-equipped shop model. Appendix 11 is a listing of 44 points which should be considered in the justification of CNC machines. These considerations were analyzed and documented in a University of Michigan study for the Carlton Machine Tool Company. Also used but not included was a bulletin entitled How to Justify NC Machines by the Industrial Control Products Department of the General Electric Company.

The purpose of these models is not to show the superiority of one scheme over the other, but to present alternative courses for those wishing to avail themselves of the business opportunities revealed in the market study. The apparent greater profitability of the CNC-equipped shop must be weighed against the increased capital investment required, the greater working capital requirements, the heavier start-up losses, and the increased overhead cost. Additionally, a very detailed marketing analysis should be made to determine the exact nature of the available work, realizing that a high percentage of production work favors the CNC-equipped shop. The models can evaluate many of the variables so that a decision can be made after a hard look has been taken at a given situation with its particular set of circumstances.

The potential output of the models is shown in the form of financial statements. These constitute a familiar format for the businessman or financier, one that readily points out the requirements of the venture and the downstream results. An item by item explanation of the workings of each model is given in the form of extensive notes to the financial statements. Economic summaries of the behavior of both models are presented below, and are followed by the financial statements.

Economic Summary: Shop with Standard Machine Tools

Investment. The total investment required for the jobbing machine shop with standard tools is $618,250, of which $417,650 is for fixed assets and $200,600 is for start-up/working capital. The entire fixed asset investment is to be financed by a first mortgage. The start-up/working capital requirements are to be provided by equity contributions of $148,000 and a short-term loan secured by assignment of accounts receivable. The maximum draw on the loan is scheduled at $52,600, and this loan is scheduled to be reduced to a zero balance during the third year of operation.

Profitability. The modeled shop appears to have reached a steady state by the fourth year of operation, at which time the before-tax profit at average production is $61,755. This equates to a profit ratio of 8.2% as compared to sales. This is approximately 2% higher than the average jobbing machine shop in the same asset-size category. Conceivably, this increased profitability is due to the fact that the lower than average Georgia wage rates, utility rates, etc. were used in the modeling.

The modeled shop is not typical in that it has a monthly mortgage payment of $6,854; most shops do not have all new equipment and a spacious new building. However, this is offset by the fact that on the average about 8% of a shop's sales revenue goes to company officers who may or may not be active in the management of the company and no such provision is made in the model. An examination of the fourth-year balance sheet shows that the company is unusually solvent. In an actual case, the short-term notes probably would not have been reduced to a zero balance, thus providing cash for various purposes, e.g., officers' compensation or stock dividends. In the case of the modeled shop, as much as $139,000 would have been raised for these purposes during the four-year period without appreciably endangering the solvency of the business. However,

the overall profitability of the company would have been diminished by 1 or 2 percentage points at this same level of productivity.

The break-even point for the shop is at 74.7% of average production, which equates to $563,166 in sales. (See Break-even Chart, Figure 2.) For every percentage point of average production over break-even, $2,403 goes to the bottom line. For instance, assuming that sales rise to 110% of average production, a volume which can probably be produced with only a small amount of overtime, then an annual profit of as much as $85,785 can be realized.

Profitability can be viewed in many different ways. Looking at one figure or ratio out of context can be misleading; this is why an interim schedule of pro forma statements is provided. The long-term prospects of the modeled shop appear bright in that operating and promotional benefits can be reaped from operating out of a new facility and stability is provided by the long-term financing and the healthy equity contribution.

Economic Summary: Shop with CNC Machine Tools

Investment. The total investment required for the jobbing machine shop with CNC tools is $867,350, of which $567,050 is for fixed assets and $300,300 is for start-up/working capital. The entire fixed asset investment is to be financed by a first mortgage. The start-up/working capital requirements are to be provided by equity contributions of $219,500 and a short-term loan secured by assignment of accounts receivable. The maximum draw on the loan is scheduled at $80,800, and this loan is scheduled to be reduced to a zero balance during the third year of operation.

Profitability. The modeled shop appears to have reached a steady state by the fourth year of operation, at which time the before-tax profit at average production is $142,440. This equates to a profit ratio of 12.3% as compared to sales. This significant increase in profitability is directly attributable to the CNC centers. The multi-shift possibility offered by the flexibility of CNC in permitting machine loading to be divided between jobs contributes more than any of the other benefits of CNC to the profitability increase exhibited by the model.

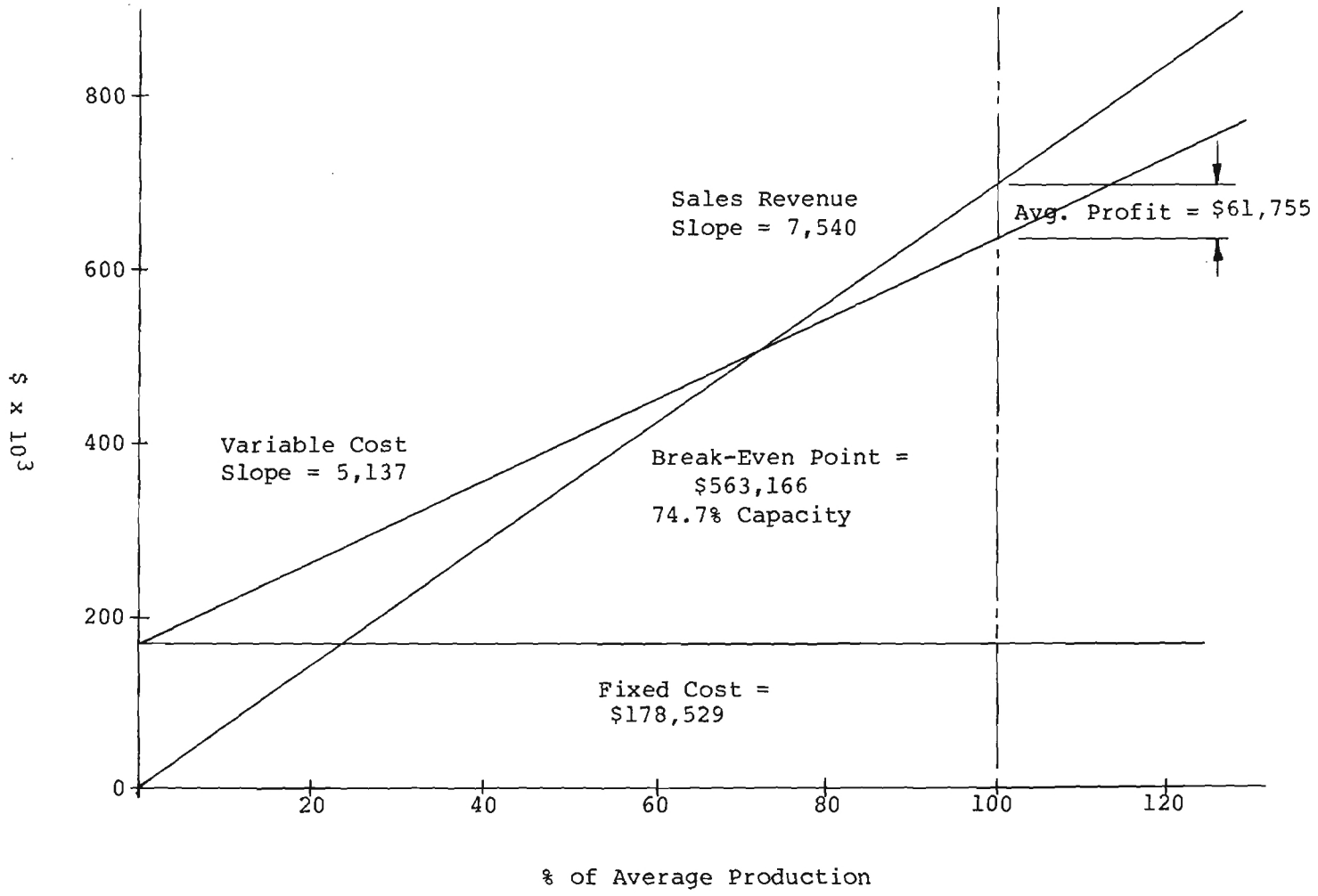


Figure 2

BREAK-EVEN CHART: JOBBING MACHINE SHOP
WITH STANDARD MACHINE TOOLS

During the four years of operation, the shop has generated $280,000 in excess cash. Another $80,000 or so could be raised by borrowing against the accounts receivable balance. These funds could be used to buy additional equipment or they could be paid out as dividends to stockholders. The latter disbursement, of course, would be subject to tax considerations, a determination of the future prospects of the business, and any loan covenants imposed by the mortgager.

The break-even point for the shop is at 68% of average production, which equates to $787,411 in sales. (See Break-even Chart, Figure 3.) For every percentage point of average production over break-even, $4,434 goes to the bottom line. If an additional amount of work suitable for production on the CNC machines can be acquired, then perhaps a third shift could be added. CNC machines are designed for continuous operation; many manual machines are not. The additional shift will bring in an estimated $140,000 in before-tax profits.

The profitmaking possibilities of the CNC-equipped shop appear to be very strong. Just how high the profits will be depends on how much work suitable for the CNC centers can be obtained. In an event, the two CNC machines are well supported with one designer/programmer each, which avoids the common mistake that shops make when they attempt to operate CNC machines without proper support. Also, the addition of a second shop foreman reduces the span-of-control from 15 workers to 12 on the first shift and to six on the second shift. Should the additional workloads imposed by the volume of production put a strain on any of the support functions, i.e., bookkeeping, shipping, and receiving, the operation can well support additional fixed costs.

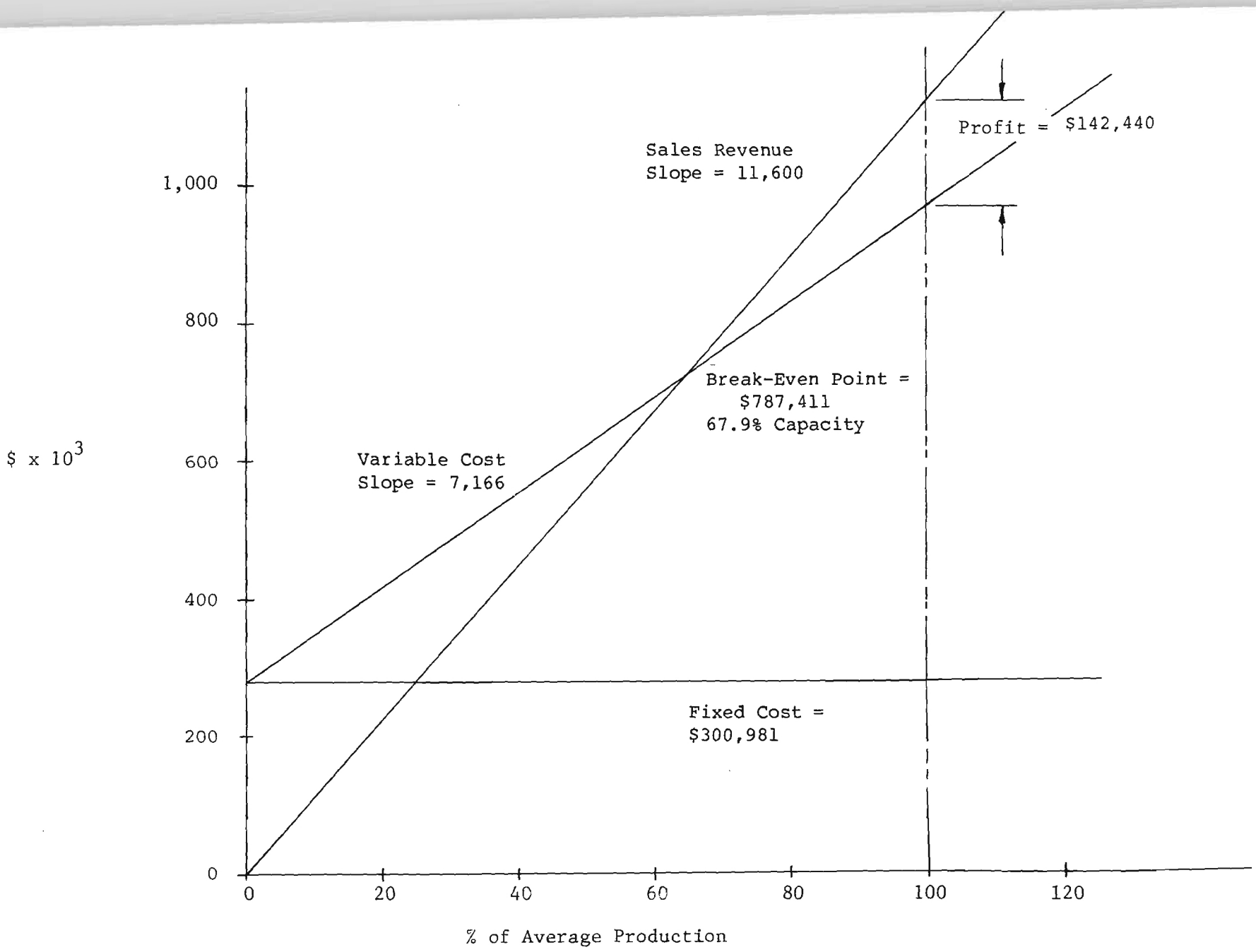


Figure 3

BREAK-EVEN CHART: JOBBING MACHINE SHOP
WITH CNC MACHINE TOOLS

PRO FORMA INCOME STATEMENT
JOBBING MACHINE SHOP WITH STANDARD MACHINE TOOLS

(in dollars)

	1st Year						
	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	2nd Year	3rd Year	4th Year
Sales (1)	47,125	94,250	141,375	188,500	754,000	754,000	754,000
Raw Materials (2)	9,425	18,850	28,275	37,700	150,800	150,800	150,800
Direct Labor (3)	25,717	34,290	42,862	51,434	205,735	205,735	205,735
Manufacturing Overhead (4)	23,595	24,276	24,957	25,638	102,136	101,721	101,306
Cost of Goods Sold	58,738	77,416	96,094	114,772	458,671	458,256	457,841
Gross Profit	-11,613	16,834	45,281	73,728	295,329	295,744	296,159
Administrative Expense (5)	10,925	10,925	10,925	10,925	43,700	43,700	43,700
Selling Expense (6)	7,540	15,080	22,620	30,160	120,640	120,640	120,640
Services (7)	13,000	2,000	2,000	2,000	8,000	8,000	8,000
Total Operating Expenses	31,465	28,005	35,545	43,085	172,340	172,340	172,340
Operating Income	-43,078	-11,171	9,736	30,643	122,989	123,404	123,819
Interest (8)	18,368	18,902	19,432	19,955	74,366	65,198	62,064
Profit Before Taxes	-61,445	-30,073	-9,695	10,688	48,623	58,205	61,755
Income Taxes (9)	0	0	0	0	0	0	0
Net Income	-61,445	-30,073	-9,695	10,688	48,623	58,205	61,755
Tax Credit (10)	71,259	85,694	90,347	85,217	61,878	33,939	4,297

PRO FORMA CASH FLOW
JOBBING MACHINE SHOP WITH STANDARD MACHINE TOOLS

(in dollars)

	1st Year						
	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	2nd Year	3rd Year	4th Year
Sources							
Collections (11)	29,595	76,720	123,845	170,970	754,000	754,000	754,000
Borrowing (12)	13,150	13,150	13,150	13,150	-20,000	-32,600	0
Paid-in Capital (13)	0	10,000	20,000	0	0	0	0
Total Sources	42,745	99,870	156,995	184,120	734,000	721,400	754,000
Uses							
Payroll (14)	45,273	53,845	62,417	70,990	283,958	283,958	283,958
Purchases (15)	14,268	26,676	36,128	42,861	178,110	178,110	178,110
Utilities	2,308	2,308	2,308	2,308	9,232	9,232	9,232
Selling Expense	7,540	15,080	22,620	30,160	120,640	120,640	120,640
Interest	18,368	18,902	19,432	19,955	74,366	65,198	62,064
Mortgage Retmt. (16)	2,851	2,973	3,102	3,235	14,397	17,045	20,179
Services	13,000	2,000	2,000	2,000	8,000	8,000	8,000
Taxes	1,710	1,685	1,659	1,633	6,115	5,700	5,285
Total Uses	105,318	123,469	149,665	173,142	694,818	687,883	687,468
Cash Surplus	-62,573	-23,600	7,329	10,978	39,182	33,517	66,532

PRO FORMA BALANCE SHEET
JOBBING MACHINE SHOP WITH STANDARD MACHINE TOOLS

(in dollars)

		1st Year						
	Start	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	2nd Year	3rd Year	4th Year
Assets								
Cash (17)	110,000	47,427	23,827	31,156	42,134	81,316	114,833	181,365
Receivables (18)	0	17,531	35,061	52,592	70,122	70,122	70,122	70,122
Raw Materials Inv. (19)	3,000	9,425	14,138	18,850	18,850	18,850	18,850	18,850
Supplies Inv. (19)	5,000	5,707	6,060	6,414	6,414	6,414	6,414	6,414
Current Assets	118,000	80,089	79,086	109,011	137,520	176,702	210,219	276,750
Property (20)	417,650	417,650	417,650	417,650	417,650	417,650	417,650	417,650
Depreciation	0	6,239	12,478	18,717	24,956	49,912	74,868	99,824
Net Property	417,650	411,411	405,172	398,933	392,694	367,738	342,782	317,826
Total Assets	535,650	491,500	484,258	507,944	530,214	544,440	553,001	594,576
Liabilities								
Payables (21)	0	6,996	9,649	12,983	14,650	14,650	14,650	14,650
Notes (22)	0	13,150	26,300	39,450	52,600	32,600	0	0
C.M.L.T.D. (23)	12,161	11,544	12,042	12,561	13,102	15,512	18,364	21,741
Current Liabilities	12,161	31,690	47,991	64,994	80,352	62,761	33,014	36,391
L.T.D. (24)	405,489	403,255	399,784	396,164	392,387	375,581	355,684	332,128
Total Liabilities	417,650	434,945	447,776	461,157	472,739	438,342	388,697	368,518
Equity (25)								
Paid-in Capital	118,000	118,000	128,000	148,000	148,000	148,000	148,000	148,000
Retained Earnings	0	-61,445	-91,518	-101,213	-90,525	-41,902	16,303	78,058
Net Worth	118,000	56,555	36,482	46,787	57,475	106,098	164,303	226,058
Liabilities + Net Worth	535,650	491,500	484,258	507,944	530,214	544,440	553,001	594,576

NOTES TO FINANCIAL STATEMENTS
JOBBING MACHINE SHOP
WITH STANDARD MACHINE TOOLS

1. Sales - The sales figure is net sales, i.e., gross sales less amount paid to subcontractors.

   Shop production is figured from Census of Manufactures data on the average productivity of production workers employed in SIC 3599. See Appendix 12 for graphical presentation of these data. An annual figure of $58,000 per worker is used in this model. Thirteen workers are employed; therefore, the average annual production of the shop is 13 x $58,000 = $754,000. It is assumed that the shop will reach sales capacity in one year and that the sales growth will be approximately linear.

2. Raw Material - Historical data and conversations with knowledgeable individuals currently in the industry indicate that raw material cost is anywhere from 19% to 21% of sales; 20% was used in the model.

3. Direct Labor - Direct labor manning is shown in the table below. Wages are based on statewide weighted average figures for the particular job title; source is "1979 Albany and Southwest Georgia Area Wage and Fringe Benefits," compiled by the Georgia Department of Industry and Trade. A 15% labor fringe factor is included in the statement figures to account for payroll taxes, hospitalization, holidays, etc. It is anticipated that the labor force will be built up over a period of one year. Inefficiencies of a new labor force are accounted for by applying a learning curve factor over the first year; i.e., 50%, 75%, 90%, 100% efficiencies during the first, second, third, and fourth quarters, respectively.

Job Title	No. Reqd.	$/Hr.	Annual
Machinist	6	7.35	$ 88,200
Machine Operator	5	4.80	48,000
Tradesman	2	6.00	24,000
Subtotal	13		$160,200
Labor Fringe @ 15%			24,030
Total			$184,230

4. Manufacturing Overhead - Includes indirect labor, utilities, depreciation, supplies, and property taxes.

a. Indirect Labor

Job Title	No. Reqd.	$/Hr.	Annual
Shop Foreman	1	-	$21,000
Shipping/Receiving Clerk	1	4.51	9,020
Driver	1	5.05	10,100
Janitor/Porter	1	4.30	8,600
Subtotal	4		$48,720
Labor Fringe @ 15%			7,308
Total			$56,028

b. Utilities - All rates calculated from Albany, Georgia, Water, Gas and Light Commission Ratebook.

1. Electricity - Average monthly usage estimated at 16,000 KWH; average demand estimated at 78 KW.

Average monthly electric bill	$694.38

2. Natural Gas - Monthly usage during four winter months estimated at 500 CCF, which equates to $145.92.

Average monthly gas bill	48.64

3. Water and Sewer - Monthly usage estimated at 10,000 gallons.

Average monthly water bill	9.82
Average monthly sewer bill	6.45

4. Garbage Pickup	9.67
Total Average Monthly Utilities	$768.96

c. Depreciation - Straight-line depreciation is used.

Description	Estimated Price	Life (years)	Annual Depreciation
Land	$ 30,000	-	-
Buildings	173,600	20	$ 8,680
Machine Tools	189,850	15	12,657
Misc. Durable Tools	9,500	10	950
Furniture & Fixtures	6,700	10	670
Truck	8,000	4	2,000
Total	$417,650		$24,957

d. Supplies - A fixed usage of $4,000 per annum plus a variable usage of 1.5% of sales.

e. Property Taxes are 41.585 mills at 40% evaluation or $16.63 per $1,000 at full value.

5. Administrative Expense

Job Title	No. Reqd.	$/Hr.	Annual
Manager	1	-	$28,000
Sales Engineer	1	-	commission
Bookkeeper	1	$5.00	10,000
Subtotal	3		$38,000
Labor Fringe @ 15%			5,700
Total			$43,700

6. Selling Expense - 16% of sales to account for freight out, commissions paid, travel, telephone, etc.

7. Services - Aggregate amount paid for legal, financial, and technical consultants. (Insurance premiums are also included in this amount.) $13,000 is estimated during start-up in the first quarter and $2,000 per quarter thereafter.

8. Interest - Interest paid on mortgages and short-term notes. Estimated interest rates at the time of this writing were 17% and 20%, respectively.

9. Taxes - Total income tax rate assumed to be 48%.

10. Tax Credit - A 10% investment tax credit is applied and credits resulting from losses are carried forward at their full amount. Significant employment tax credits are also possible but not included in this model.

11. Collections - A collection policy of net 30 days will be assumed. The model will be a little more lenient than this to allow for slow payers (approximately 34 days).

12. Borrowing - A line of credit secured by the receivables account will provide funds up to 75% of the receivables account value at an annual interest rate of 20%.

13. Paid-in Capital - Any equity injections to the business. None projected.

14. Payroll - Total of direct labor, indirect labor, administrative labor, and labor fringes.

15. Purchases - Actual payment for raw materials and nondurable supplies during the period.

16. Mortgage Retirement - Amount paid to reduce the mortgage balance as dictated by the terms explained in note 24.

17. Cash - The cash level should be allowed to fluctuate between 60% and 80% of the monthly sales level. The cash level of the model is sometimes excessive because no alternative investments are provided. This amount would be paid out to stockholders or invested in an actual situation.

18. Receivables - Refer back to Collections, note 11. This is the residual amount of sales less collections (approximately 30 days).

19. Raw Material Inventory and Supplies Inventory - These are appropriate amounts of inventory to support current and imminent operations. No value from direct labor or manufacturing overhead which would be in the work-in-process is carried in inventory in this model. Also, no finished goods inventory is carried.

20. Property (Fixed Assets)

Land	$ 30,000
Buildings & Improvements	173,600
Equipment (see Appendix 13)	214,050
Total	$417,650

21. Payables - Refer back to Purchases, note 15. This is the residual amount of invoiced raw materials and supplies less payments thereon (approximately 30 days).

22. Notes - Refer back to Borrowing, note 12. This is the outstanding balance of short-term funds borrowed.

23. Current Materials of Long-Term Debt - This is the amount of mortgage retirement due within the next year period.

24. Long-Term Debt - Two mortgages are assumed: one for the building and one for the equipment. It is assumed that the initial funds needed for start-up and working capital will come from equity contributions and short-term borrowing.

a. Building Mortgage - $203,600 for 15 years at 17% interest; monthly payment of $3,133.41 includes interest and principal.

b. Equipment Mortgage - $214,050 for 10 years at 17% interest; monthly payment of $3,720.14 includes interest and principal.

25. Equity - This is the stockholders' total equity contribution to the company.

PRO FORMA INCOME STATEMENT
JOBBING MACHINE SHOP WITH CNC MACHINE TOOLS

(in dollars)

	1st Year						
	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	2nd Year	3rd Year	4th Year
Sales (1)	72,500	145,000	217,500	290,000	1,160,000	1,160,000	1,160,000
Raw Materials (2)	14,500	29,000	43,500	58,000	232,000	232,000	232,000
Direct Labor (3)	27,169	36,225	45,281	54,338	217,350	217,350	217,350
Manufacturing Overhead (4)	35,094	36,507	44,656	46,070	183,696	183,111	182,527
Cost of Goods Sold	76,763	101,732	133,438	158,407	633,046	632,461	631,877
Gross Profit	-4,263	43,268	84,062	131,593	526,954	527,539	528,123
Administrative Expense (5)	18,113	18,113	25,300	25,300	101,200	101,200	101,200
Selling Expense (6)	11,600	23,200	34,800	46,400	185,600	185,600	185,600
Services (7)	25,000	4,000	4,000	4,000	16,000	16,000	16,000
Total Operating Expenses	54,713	45,313	64,100	75,700	302,800	302,800	302,800
Operating Income	-58,975	-2,045	19,962	55,893	224,154	224,739	225,323
Interest (8)	25,049	25,873	26,689	27,497	97,787	87,623	82,883
Profit Before Taxes	-84,024	-27,918	-6,727	28,395	126,367	137,116	142,440
Income Taxes (9)	0	0	0	0	0	26,435	68,371
Net Income	-84,024	-27,918	-6,727	28,395	126,367	110,681	74,069
Tax Credit (10)	97,037	110,437	113,667	100,037	39,380	0	0

PRO FORMA CASH FLOW
JOBBING MACHINE SHOP WITH CNC MACHINE TOOLS

(in dollars)

	1st Year						
	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	2nd Year	3rd Year	4th Year
Sources							
Collections (11)	45,530	118,030	190,530	263,030	1,160,000	1,160,000	1,160,000
Borrowing (12)	20,200	20,200	20,200	20,200	-50,000	-30,800	0
Paid-in Capital (13)	0	0	35,000	0	0	0	0
Total Sources	65,730	138,230	245,730	283,230	1,110,000	1,129,200	1,160,000
Uses							
Payroll (14)	59,288	68,345	90,626	99,682	398,728	398,728	398,728
Purchases (15)	23,418	42,264	56,577	67,176	279,200	279,200	279,200
Utilities	2,533	2,533	3,231	3,231	12,924	12,924	12,924
Selling Expense	11,600	23,200	34,800	46,400	185,600	185,600	185,600
Interest	25,049	25,873	26,689	27,497	97,787	87,623	82,883
Mortgage Retmt. (16)	4,311	4,497	4,691	4,893	21,774	25,778	30,519
Services	25,000	4,000	4,000	4,000	16,000	16,000	16,000
Taxes	2,321	2,284	2,248	2,211	8,262	34,113	75,464
Total Uses	153,520	172,996	222,862	255,091	1,020,275	1,039,966	1,081,318
Cash Surplus	-87,790	-34,766	22,868	28,139	89,725	89,234	78,682

PRO FORMA BALANCE SHEET
JOBBING MACHINE SHOP WITH CNC MACHINE TOOLS
(in dollars)

		1st Year						
	Start	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	2nd Year	3rd Year	4th Year
Assets								
Cash (17)	175,000	87,210	52,443	75,311	103,450	193,175	282,410	361,092
Receivables (18)	0	26,970	53,940	80,910	107,880	107,880	107,880	107,880
Raw Materials Inv. (19)	3,000	14,500	21,750	29,000	29,000	29,000	29,000	29,000
Supplies Inv. (19)	6,500	7,950	8,675	9,400	9,400	9,400	9,400	9,400
Current Assets	184,500	136,630	136,808	194,621	249,730	339,455	428,690	507,372
Property (20)	567,050	567,050	567,050	567,050	567,050	567,050	567,050	567,050
Depreciation	0	8,783	17,566	26,349	35,132	70,264	105,396	140,528
Net Property	567,050	558,267	549,484	540,701	531,918	496,786	461,654	426,522
Total Assets	751,550	694,897	686,292	735,322	781,648	836,241	890,344	933,894
Liabilities								
Payables (21)	0	11,482	15,093	20,340	22,964	22,964	22,964	22,964
Notes (22)	0	20,200	40,400	60,600	80,800	30,800	0	0
C.M.L.T.D. (23)	18,392	17,459	18,212	18,997	19,816	23,460	27,774	32,881
Current Liabilities	18,392	49,142	73,705	99,937	123,580	77,224	50,738	55,846
L.T.D. (24)	548,658	545,279	540,030	534,554	528,842	503,424	473,332	437,706
Total Liabilities	567,050	594,421	613,735	634,491	652,422	580,648	524,070	493,551
Equity (25)								
Paid-in Capital	184,500	184,500	184,500	219,500	219,500	219,500	219,500	219,500
Retained Earnings	0	-84,024	-111,943	-118,670	-90,275	36,093	146,774	220,843
Net Worth	184,500	100,476	72,557	100,830	129,225	255,593	366,274	440,343
Liabilities + Net Worth	751,500	694,897	686,292	735,322	781,648	836,241	890,344	933,894

NOTES TO FINANCIAL STATEMENTS
JOBBING MACHINE SHOP
WITH CNC MACHINE TOOLS

1. Sales - The sales figure is net sales, i.e., gross sales less amount paid to subcontractors.

   Shop production is again figured with Census of Manufactures data as the basis except that the productivity of workers operating CNC machine tools is increased 100%. When all the cost advantages of CNC related to productivity are taken into account, the result is that machine tools equipped with CNC can produce two to four times as much as the same machine tools without CNC. Additionally, a second shift operation of the CNC machine tools and supporting equipment is started, beginning in the third quarter of operation. CNC machine tools are designed for continuous operation and to permit easy machine loading and unloading rather than to produce economical lot sizes; most manual machines do not provide this flexibility. This important aspect of CNC machines permits multi-shift operation.

   The production average is figured as follows: 16 workers at $58,000 per year, plus a CNC bonus of four times $58,000 equals $1,160,000 per year. It is assumed that the production capacity will be reached in one year and that the sales growth will be approximately linear.

2. Raw Material - A factor of 20% was used in the standard model, but 22% is used in the CNC model. The reason is not that materials are more expensive in this case, but that the general nature of a CNC operation results in there being less gross margin.

3. Direct Labor - Direct labor manning is shown in the table below. Wages are based on statewide weighted average figures for the particular job title; source is "1979 Albany and Southwest Georgia Area Wage and Fringe Benefits," compiled by the Georgia Department of Industry and Trade. A 15% labor fringe is included in the statement figures to account for payroll taxes, hospitalization, holidays, etc. It is anticipated that the labor force will be built up over a period of one year. Inefficiencies of a new labor force are accounted for by applying a learning curve factor over the first year; i.e., 50%, 75%, 90%, 100% efficiencies during the first, second, third, and fourth quarters, respectively.

Job Title	No. Reqd.	$/Hr.	Annual
Machinist	6	7.35	$ 88,200
Machine Operator	8	4.80	76,800
Tradesman	2	6.00	24,000
Subtotal	16		$189,000
Labor Fringe @ 15%			28,350
Total			$217,350

4. Manufacturing Overhead - Includes indirect labor, utilities, depreciation, supplies, and property taxes.

a. Indirect Labor

Job Title	No. Reqd.	$/Hr.	Annual
Shift Foreman	2	-	$42,000
Shipping/Receiving Clerk	1	4.51	9,020
Driver	1	5.05	10,100
Janitor/Porter	1	4.30	8,600
Subtotal	5		$69,720
Labor Fringe @ 15%			10,458
Total			$80,178

b. Utilities - All rates calculated from the Albany, Georgia, Water, Gas and Light Commission Ratebook.

I. One-Shift Operation

Electricity - Average monthly usage estimated at 20,000 KWH; average demand estimated at 88 KW.	
Average monthly electric bill	$769.88
Natural Gas - Monthly usage during four winter months estimated at 500 CCF, which equates to $145.92.	
Average monthly gas bill	48.64
Water and Sewer - Monthly usage estimated at 10,000 gallons.	
Average monthly water bill	9.82
Average monthly sewer bill	6.45
Garbage Pickup	9.67
Total Average Monthly Utilities	$844.44

II. Two-Shift Operation

Electricity - Average monthly usage estimated at 32,000 KWH; average demand estimated at 88 KW.

Average monthly electric bill	$ 913.88

Natural Gas - Monthly usage during four winter months estimated at 1,500 CCF, which equates to $395.92.

Average monthly gas bill	131.97

Water and Sewer - Monthly usage estimated at 16,000 gallons.

Average monthly water bill	12.34
Average monthly sewer bill	9.03
Garbage Pickup	9.67
Total Average Monthly Utilities	$1,076.89

c. Depreciation - Straight-line depreciation is used.

Description	Estimated Price	Life	Depreciation
Land	$ 30,000	-	-
Buildings	173,600	20	$ 8,680
Machine Tools	332,750	15	22,283
Misc. Durable Tools	15,000	10	1,500
Furniture & Fixtures	7,700	10	770
Truck	8,000	4	2,000
Total	$567,050		$35,133

d. Supplies - A fixed usage of $6,000 per annum plus a variable usage of 2% of sales.

e. Property Taxes are 41.585 mills at 40% evaluation or $16.63 per $1,000 at full value.

5. Administrative Expense

Job Title	No. Reqd.	$/Hr.	Annual
Manager	1	-	$ 28,000
Sales Engineer	2	-	Commission
Designer/Programmer	2	-	50,000
Bookkeeper	1	5.00	10,000
Subtotal	6		$ 88,000
Labor Fringe @ 15%			13,200
Total			$101,200

6. Selling Expense - 16% of sales to account for freight out, commissions paid, travel, telephone, etc.

7. Services - Aggregate amount paid for legal, financial, and technical consultants. (Insurance premiums are also included in this amount.) $25,000 is estimated during start-up in the first quarter and $4,000 per quarter thereafter.

8. Interest - Interest paid on mortgages and short-term notes. Estimated interest rates at the time of this writing were 17% and 20%, respectively.

9. Taxes - Total income tax rate assumed to be 48%.

10. Tax Credit - A 10% investment tax credit is applied and credits resulting from losses are carried forward at their full amount. Significant employment tax credits are also possible but not included in this model.

11. Collections - A collection policy of net 30 days will be assumed. The model will be a little more lenient than this to allow for slow payers (approximately 34 days).

12. Borrowing - A line of credit secured by the receivables account will provide funds up to 75% of the receivables account value at an annual interest rate of 20%.

13. Paid-in Capital - Any equity injections to the business. None projected.

14. Payroll - Total of direct labor, indirect labor, administrative labor, and labor fringes.

15. Purchases - Actual payout for raw materials and nondurable supplies during the period.

16. Mortgage Retirement - Amount paid to reduce the mortgage balance as dictated by the terms explained in note 24.

17. Cash - The cash level should be allowed to fluctuate between 60% and 80% of the monthly sales level. The cash level of the model is sometimes excessive because no alternative investments are provided. This amount would be paid out to stockholders or invested in an actual situation.

18. Receivables - Refer back to Collections, note 11. This is the residual amount of sales less collections (approximately 30 days).

19. Raw Material Inventory and Supplies Inventory - These are appropriate amounts of inventory to support current and imminent operations. No value from direct labor or manufacturing overhead which would be in the work-in-process is carried in inventory in this model. Also, no finished goods inventory is carried.

20. Property (Fixed Assets)

Land	$ 30,000
Buildings and Improvements	173,600
Equipment (see Appendix 14)	363,450
Total	$567,050

21. Payables - Refer back to Purchases, note 15. This is the residual amount of invoiced raw materials and supplies less payments thereon (approximately 30 days).

22. Notes - Refer back to Borrowing, note 12. This is the outstanding balance of short-term funds borrowed.

23. Current Materials of Long-Term Debt - This is the amount of mortgage retirement due within the next year period.

24. Long-Term Debt - Two mortgages are assumed: one for the building and one for the equipment. It is assumed that the initial funds needed for start-up and working capital will come from equity contributions and short-term borrowing.

a. Building Mortgage - $203,600 for 15 years at 17% interest; monthly payment of $3,133.41 includes interest and principal.

b. Equipment Mortgage - $363,450 for 10 years at 17% interest; monthly payment of $6,316.68 includes interest and principal.

25. Equity - This is the stockholders' total equity contribution to the company during the period modeled.

APPENDICES

Appendix 1

MACHINED PRODUCTS USERS
BY SIC, VOLUME AND ORIGIN OF PURCHASES

SIC	No. of Companies	Volume of Purchases (in thousands of dollars) Total	Southeast	S.E. as % of Total Purchases
109	1	100	90	90.30
201	5	75	58	77.33
202	2	35	35	100.00
204	2	22	11	50.00
205	2	5	5	100.00
206	3	46	1	2.17
208	1	6	6	100.00
209	1	15	15	100.00
221	1	51	51	100.00
222	1	80	8	10.00
223	1	25	25	100.00
225	1	3	3	100.00
226	2	64	61	95.31
227	1	50	50	100.00
228	1	100	100	100.00
229	1	4	4	100.00
241	1	20	20	100.00
242	2	179	179	100.00
243	2	35	35	100.00
244	1	20	20	100.00
249	1	5	5	100.00
251	1	10	10	100.00
261	2	220	200	90.91
262	2	275	270	98.18
263	3	440	190	43.18
264	3	205	116	56.59
266	1	15	15	100.00
281	4	576	572	99.31
282	6	1,110	1,083	97.57
285	1	3	3	100.00
286	1	50	50	100.00
287	2	50	50	100.00
289	1	30	30	100.00
295	1	15	15	100.00
301	2	21	17	80.95
302	1	8	0	0.00
306	2	66	66	100.00
307	2	160	40	25.00
322	1	3	3	100.00
324	1	50	50	100.00
325	2	65	65	100.00
326	1	5	5	100.00
327	1	1	1	100.00
328	1	20	20	100.00
329	5	2,260	1,180	52.21

(Continued)

Appendix 1 (Cont'd)

SIC	No. of Companies	Volume of Purchases (in thousands of dollars) Total	Southeast	S.E. as % of Total Purchases
331	1	50	25	50.00
335	1	71	0	0.00
336	2	58	56	96.55
341	1	100	100	100.00
342	3	240	204	85.00
344	5	2,135	1,114	52.18
346	3	68	32	47.06
348	1	100	50	50.00
349	3	1,625	1,005	61.85
352	1	1,003	1,000	100.00
353	5	450	293	65.11
355	1	15	15	100.00
356	5	679	479	70.54
358	3	280	181	64.64
359	1	5	5	100.00
362	3	260	195	75.00
363	1	40	20	50.00
366	4	255	225	88.24
367	3	5,016	1,012	20.18
371	6	4,418	3,334	75.46
372	2	4,600	765	16.63
382	2	60	60	100.00
387	1	80	72	90.00
394	2	55	5	50.00
399	1	10	5	50.00
	143	28,949	15,625	53.97

Appendix 2

POPULATION GROWTH IN THE FIVE-STATE AREA, 1950-1977
(in thousands)

State	1950	1960	1970	1977*
Alabama	3,062	3,267	3,444	3,667
Florida	2,771	4,952	6,789	8,371
Georgia	3,445	3,943	4,590	4,981
South Carolina	2,117	2,383	2,591	2,808
Tennessee	3,292	3,567	3,924	4,270
Total	14,687	18,111	21,338	24,097
United States	151,326	179,323	203,212	214,726
Five-State % of U. S.	9.7	10.1	10.5	11.2

* Estimated.

Source: U. S. Department of Commerce, Bureau of the Census, Current Population Reports, Series P-25, No. 373, and Series P-25, No. 642.

Appendix 3

NONAGRICULTURAL EMPLOYMENT, 1950-1978
(in thousands)

State	1950	1960	1970	1978
Alabama	619.6	776.4	1,010.4	1,361.3
Florida	704.4	1,320.6	2,069.9	3,241.7
Georgia	806.6	1,051.1	1,531.7	2,027.0
South Carolina	461.4	582.5	819.8	1,153.2
Tennessee	759.3	925.5	1,309.8	1,747.9
Total	3,351.3	4,656.1	6,741.6	9,531.1
United States	45,222	54,234	70,593	85,763
Five-State % of U. S.	7.4	8.6	9.5	11.1

Source: U. S. Department of Labor, Bureau of Labor Statistics, Employment and Earnings, States and Areas, 1939-78.

Appendix 4

MANUFACTURING EMPLOYMENT, 1950-1978
(in thousands)

State	1950	1960	1970	1978
Alabama	216.1	237.0	323.8	367.5
Florida	102.3	206.7	321.6	442.5
Georgia	286.5	340.8	465.6	514.6
South Carolina	210.4	244.8	340.0	394.7
Tennessee	249.9	315.6	464.6	526.0
Total	1,065.2	1,344.9	1,915.6	2,245.3
United States	15,241	16,796	19,349	20,332
Five-State % of U. S.	7.0	8.0	9.9	11.0

Source: U. S. Department of Labor, Bureau of Labor Statistics, Employment and Earnings Statistics for States and Areas, 1919-1978.

Appendix 5

CONSTRUCTION EMPLOYMENT, 1950-1978
(in thousands)

State	1950	1960	1970	1978
Alabama	28.2	43.2	49.2	78.8
Florida	66.8	121.8	171.8	215.4
Georgia	40.3	55.3	77.8	99.3
South Carolina	24.3	34.6	51.5	65.6
Tennessee	46.2	46.8	63.1	91.1
Total	206.0	301.7	413.4	650.2
United States	2,333	2,885	2,951	4,212
Five-State % of U. S.	8.8	10.5	14.0	15.4

Source: U. S. Department of Labor, Bureau of Labor Statistics, Employment and Earnings Statistics for States and Areas, 1919-1978.

Appendix 6

VALUE ADDED BY MANUFACTURE, 1950-1976
(in millions of dollars)

State	1950	1960	1970	1976
Alabama	1,040	1,958	4,339	7,716
Florida	449	1,797	4,560	8,280
Georgia	1,236	2,497	5,483	11,092
South Carolina	858	1,719	3,767	7,164
Tennessee	1,174	2,586	6,297	10,724
Total	4,757	10,557	24,446	44,976
United States	89,750	163,999	299,409	511,471
Five-State % of U. S.	5.3	6.4	8.2	8.8

Source: U. S. Department of Commerce, Bureau of the Census, Annual Survey of Manufactures, 1950-1976.

Appendix 7

EXPENDITURES FOR NEW MANUFACTURING PLANTS AND EQUIPMENT, 1951-1976
(in millions of dollars)

State	1951	1960	1970	1976
Alabama	97	202	417	1,152
Florida	76	153	378	867
Georgia	115	173	453	853
South Carolina	131	144	371	868
Tennessee	114	217	508	781
Total	533	889	2,127	4,521
United States	7,782	10,070	22,090	40,553
Five-State % of U. S.	6.8	8.8	9.6	11.1

Source: U. S. Department of Commerce, Bureau of the Census, Annual Survey of Manufactures, 1951-1976.

Appendix 8

INSTALLED CAPACITY OF ELECTRIC UTILITIES, 1950-1977
(in thousands of kilowatts)

State	1950	1960	1970	1977
Alabama	1,690	4,700	10,172	17,602
Florida	999	3,992	13,868	27,583
Georgia	1,156	2,236	6,739	14,614
South Carolina	847	2,249	4,558	11,576
Tennessee	1,670	7,521	9,753	14,622
Total	6,362	20,698	45,070	85,997
United States	68,919	174,352	360,327	576,246
Five-State % of U. S.	9.2	11.9	12.5	14.9

Source: U. S. Department of Commerce, Bureau of the Census, Statistical Abstract of the United States, 1978.

Appendix 9

TOTAL PERSONAL INCOME, 1950-1977
(in millions of dollars)

State	1950	1960	1970	1977
Alabama	2,691	4,876	9,715	20,875
Florida	3,599	9,746	24,300	56,603
Georgia	3,574	6,489	15,186	30,298
South Carolina	1,886	3,298	7,576	16,210
Tennessee	3,295	5,521	12,049	24,940
Total	15,045	29,931	68,776	148,926
United States	227,228	398,725	797,081	1,589,893
Five-State % of U. S.	6.6	7.5	8.6	9.4

Source: U. S. Department of Commerce, Survey of Current Business.

Appendix 10

PER CAPITA PERSONAL INCOME, 1950-1977

State	1950	1960	1970	1977
Alabama	$ 880	$ 1,488	$ 2,876	$ 5,633
Florida	1,281	1,950	3,664	6,697
Georgia	1,034	1,639	3,354	6,002
South Carolina	893	1,377	2,933	5,639
Tennessee	994	1,543	3,075	5,801
Five-State Average	$ 1,016	$ 1,599	$ 3,180	$ 5,957
U. S. Average	$ 1,496	$ 2,215	$ 3,933	$ 7,026
Five State % of U. S.	67.9	72.2	80.9	84.7

Source: U. S. Department of Commerce, Survey of Current Business.

Appendix 11

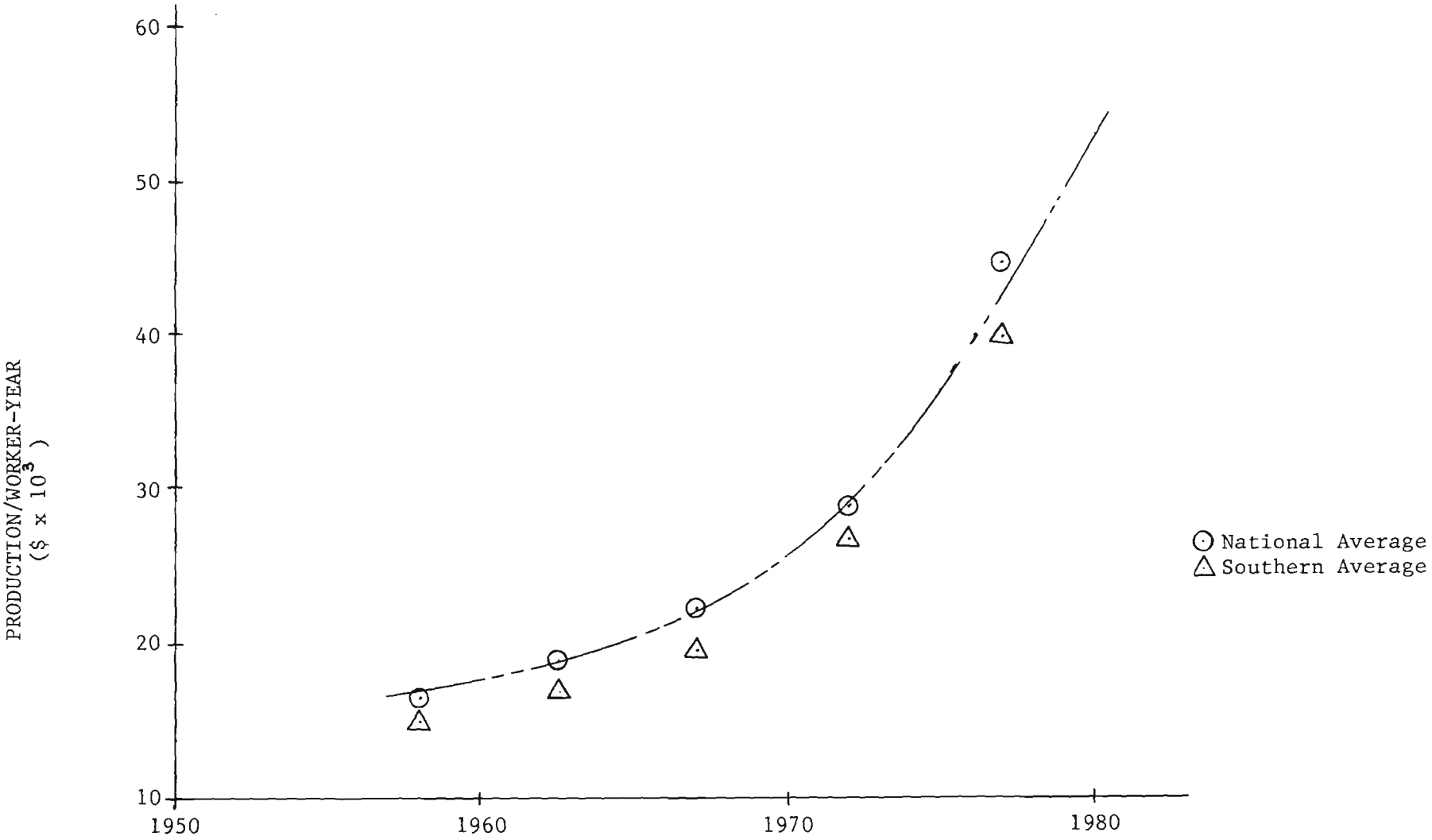
THE FORTY-FOUR POINTS

Considerations for Justifying CNC Machine Usage

Items to Be Analyzed	Anticipated Savings from NC Machine
1. Improved accuracy.	5% of direct labor cost.
2. Reduced cutting tool adjustment--by use of tool offsets.	5% of direct labor cost.
3. Reduced cutting tool change time--change only when dull.	20% of tool allowance.
4. Reduced cutting tool cost--throw-away carbides--more standard tools--fewer specials.	25% of tool cost.
5. Longer tool life due to optimum cutting speeds and feeds.	30% of tool cost.
6. Savings in purchasing--fewer tools --less paper.	5% of tool cost.
7. Improved tool life due to improved machine performance.	20% increased tool life.
8. Reduced cutting tool storage--simpler tooling.	50% of tool crib area.
9. Savings in tool maintenance--cutter grinding.	20% of cutter grinding costs.
10. Less tool room load due to less tooling required.	25% less tool room required.
11. Lower fixture cost--less needed.	75% of durable fixture cost.
12. Less tool engineering time.	30% of tool-process engineering cost.
13. Advantage of family of parts concept.	20% of tool-process engineering cost.
14. Savings from less tool engineering--tool engineering records--tool drawings--process sheets, etc. (printing costs).	40% of printing costs.
15. Machine maintenance savings due to improved and simpler designs.	25% of machine repair--labor.
16. Fewer machine repair parts required.	25% of machine repair--material.

Items to Be Analyzed	Anticipated Savings from NC Machine
17. Less inspection due to improved machine-process repeatability.	30% of inspection costs.
18. NC inspection more accurate than manual methods.	Actual inspection time can be reduced as much as 80%.
19. Reduced setup time.	80% of setup cost.
20. Reduced setup scrap.	30% of scrap costs.
21. Reduced scrap due to tool change or adjustment.	20% of scrap costs.
22. More running time--80% to 85% versus 40% to 60%.	10% of total burden.
23. Control of cycle in hands of management--can be fixed.	10% of increased production
24. Savings in setting and maintaining standards.	50% of cost of standards.
25. Power consumption more level due to continuous running.	5% of power cost.
26. Reduction of inventory.	5% of dollar value of inventory.
27. Savings from storage of less productive material.	20% of stores area.
28. Less inventory--less material handling.	5% of material-handling cost.
29. Floor space savings due to need for fewer machines.	Actual space saved.
30. Savings in supervision.	Actual number saved.
31. Lower fringe costs due to more productive time.	25% reduction in fringe costs.
32. Ability to produce samples with production runs.	50% of sample cost.
33. Availability of samples.	A useful sales tool.
34. Opportunity for foreman to concentrate on use of people rather than machines.	Improved total operation.

Items to Be Analyzed	Anticipated Savings from NC Machine
35. Reduction of direct labor.	Actual savings based on pieces per week--not cycle time.
36. Flexibility of scheduling.	Improved customer service.
37. Savings in scheduling.	Improved flexibility.
38. Ability to handle engineering changes.	Simple program change.
39. Ability to handle variable raw material.	Fewer raw material rejections.
40. Ability to produce more complex parts.	Machine capability simplifies tooling.
41. Product engineering has more design flexibility.	Can take advantage of NC capability.
42. Ability to handle future designs without extensive tooling.	Program changes only will handle many new designs.
43. Reduced costs and improved estimating accuracy.	Estimates can be made by dry run of tapes.
44. Skills built into tape programs retained through personnel changes.	Tool and process engineering improved by 15%.



Appendix 12

WORKER PRODUCTIVITY IN SIC 3599

Source: U. S. Census of Manufactures

Appendix 13

EQUIPMENT LIST
JOBBING MACHINE SHOP WITH STANDARD MACHINE TOOLS

Description	Example		Cost
Machine Tools & Major Equipment*			
Cutoff Saw	DoAll C-4	$ 4,200	
Contour Saw	DoAll 2012-2A	11,100	
Lathe	DoAll LM-1340	10,100	
	DoAll LM-1340	10,100	
	DoAll LMG-1680	20,300	
Mill	Ex-Cell-O 602	10,800	
	Ex-Cell-O 602	10,800	
	DoAll FVH-205	31,500	
Drill Press	DoAll D-151000	1,300	
	DoAll D-151000	1,300	
	DoAll D-25150	4,000	
Radial Drill	Carlton OA 4 ft.	22,000	
Surface Grinder	Okamoto Accugar 124N	27,000	
Tool Grinder	DoAll Model 8	8,500	
Misc. Grinder	DoAll D 3015	250	
	DoAll 500	600	
	Baldor 1216 W	1,200	
Foot Shear	Wysong 16 ga. x 4 ft.	2,500	
Hand Brake	Marathon 16 ga. x 4 ft.	1,100	
Roll Former	Pexto 22 ga. x 3 ft.	600	
Oxyacetylene Unit	Linde	300	
Arc/Heli-Arc Welder	Miller	2,000	
Arbor Press	DoAll #3403R	1,000	
Jib Crane	DoAll #F2000	500	
Elevating Table	DoAll #LT2000	700	
Air Compressor	Le Roi	2,000	
Measuring & Gauging Tools		4,100	
Total - Machine Tools & Major Equipment			$189,850
Misc. Durable Tools			9,500
Furniture and Fixtures			6,700
Truck			8,000
Total Equipment			$214,050

*Cost of machine tools includes electrical equipment and all basic accessories.

Appendix 14

EQUIPMENT LIST
JOBBING MACHINE SHOP WITH CNC MACHINE TOOLS

Description	Example	Cost	
Machine Tools & Major Equipment			
Cutoff Saw	DoAll C-4	$ 4,200	
Contour Saw	DoAll 2012-2A	11,100	
Lathe	DoAll LM-1340	10,100	
	DoAll LM-1340	10,100	
	Mazak M-4 Turning Center	105,000	
Mill	Ex-Cell-O 602	10,800	
	Ex-Cell-O 602	10,800	
	Mazak V-5 Machining Center	89,000	
Drill Press	DoAll D-151000	1,300	
	DoAll D-151000	1,300	
	DoAll D-25150	4,000	
Radial Drill	Carlton OA 4 ft.	22,000	
Surface Grinder	Okamoto Accugar 124N	27,000	
Tool Grinder	DoAll Model 8	8,500	
Misc. Grinder	DoAll D3015	250	
	DoAll 500	600	
	Baldor 1216 W	1,200	
Foot Shear	Wysong 16 ga. x 4 ft.	2,500	
Hand Brake	Marathon 16 ga. x 4 ft.	1,100	
Roll Former	Pexto 22 ga. x 3 ft.	600	
Oxyacetylene Unit	Linde	300	
Arc/Heli-Arc Welder	Miller	2,000	
Arbor Press	DoAll #3403R	1,000	
Jib Crane	DoAll #F2000	500	
Elevating Table	DoAll #LT2000	700	
Air Compressor	Le Roi	2,000	
Measuring & Gauging Tools		4,800	
Total - Machine Tools & Major Equipment			$332,750
Misc. Durable Tools			15,000
Furniture and Fixtures			7,700
Truck			8,000
Total Equipment			$363,450