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TECHNOLOGY UTILIZATION IN A NON-URBAN REGION: A MEASUREMENT OF THE IMPACT OF THE TECHNOLOGY USE STUDIES CENTER

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C. Henry Gold

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CHAPTER I

TECHNOLOGY AND ECONOMIC DEVELOPMENT

Economic development is most often defined as continuing increases in real income per person. The literature on economic development reveals many views on the prime sources of economic development of a nation, or a region.[1] In recent years a great deal of literature has evolved regarding technology and economic growth. The purpose of this chapter is to examine briefly the role of technology in the economic development process and to indicate the nature of the TUSC program of Technology Transfer.

The Role of Technology

Technology is considered by many economists as the foremost contributor to the development process. Thus, Hagen, although not accepting an economic theory of what causes the development process to begin, observes that

> In the broad sweep of history the answer is clear: Entry upon economic growth is a result of the accelerating cumulation of scientific and technical knowledge.[2]

The relationships in economic analysis between inputs and outputs are described by a production function. A production

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[1] Differing rates of economic development among regions have been attributed to, among other things, economic factors, religion, race, cultural factors, personality, and geography and climate. For discussions of these arguments see Everett E. Hagen, On The Theory of Social Change (Homewood, Illinois: The Dorsey Press, Inc. 1962); Charles P. Kindleberger, Economic Development, (2d ed., New York: McGraw-Hill Book Company, 1965); and David C. McClelland, The Achieving Society (Princeton, New Jersey: D. Van Nostrand Company, Inc., 1961).

[2] Everett E. Hagen, On The Theory of Social Change (Homewood, Illinois: The Dorsey Press, Inc., 1962), p. 12.

function relating aggregate output to factor inputs can be expressed as

$$(1)\quad Y = Y(K,L,R,t)$$

where

Y = Aggregate output
K = Capital
L = Land
R = Labor
t = Time

The equation (1) indicates that total output in the economy depends upon the inputs of Capital, Land, Labor, and Time. Time appears in the production function to allow for technical change. A simplified production function is illustrated graphically in Figure 1.1. Assume that there are only two variable inputs, capital and labor (with technology and land fixed). Total output Y is measured on lines of equal output such as Y_1, Y_2, Y_3, and Y_4. Greater amounts of output are represented by higher lines of equal output. Thus, output Y_4 is greater than Y_3; Y_3 is greater than Y_2; and Y_2 is greater than Y_1. Every point on the Y_1 line indicates various combinations of labor and capital inputs which can be used to produce Y_1 output. The same proposition holds true for the other lines of equal output. In producing any given level of output, labor and capital can be substituted for each other in the production process. Economic growth is represented in the diagram as the line OY. The line OY is termed an expansion path and indicates the growth in output for the economy as quantities of resource inputs are increased.[3]

The effect of a change in technology is depicted in Figure 1.2. A technological innovation is shown in the diagram as a shift of

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[3]The nature of the expansion path depends upon aggregate costs and prices of resource inputs. The expansion path goes through points of least-cost resource combinations for each possible level of costs.

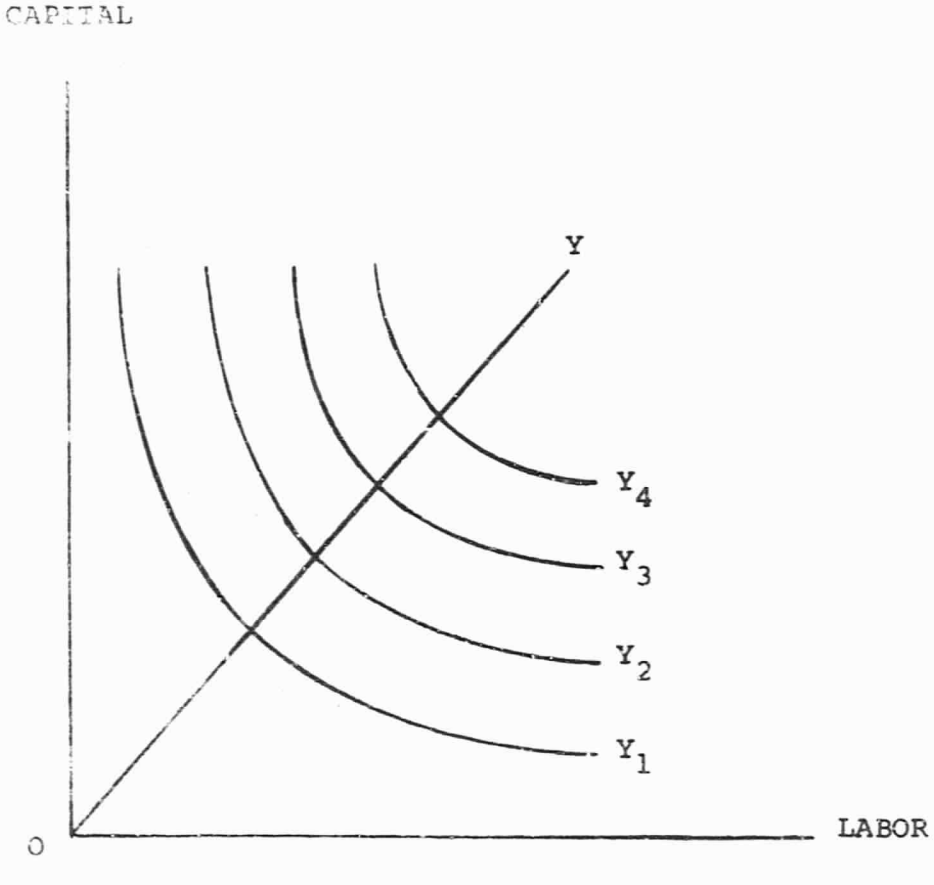

Figure 1.1. A Simplified Production Function.

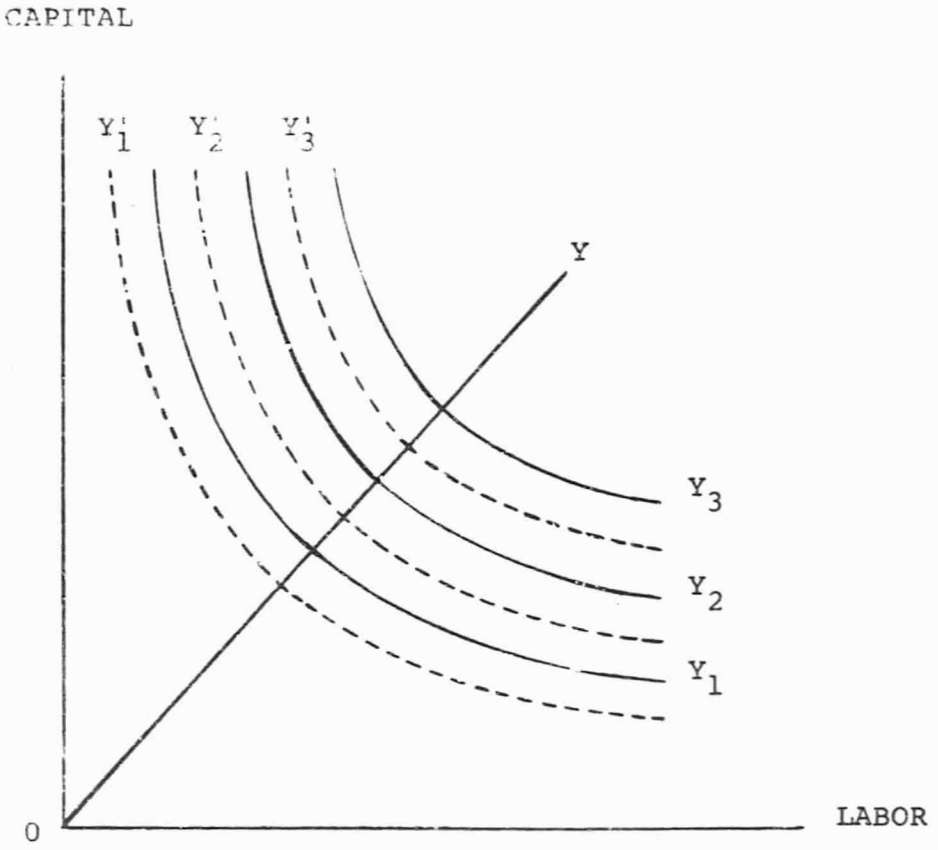

Figure 1.2. Effect of a Change in Technology.

all the lines of equal output in toward the origin.[4] Thus Y_1 shifts to Y_1', Y_2 to Y_2', and Y_3 to Y_3'. These shifts toward the origin of the lines of equal output indicate that any given level of output can now be produced with fewer inputs of capital and labor.

Growth in total output over time is therefore explained by growth in factor inputs and shifts in the production function. Several recent American studies have been concerned with measuring the relative contribution of capital and technology to an explanation of increases in real output per man-hour over time.[5] These studies suggest that technology has been responsible for some 80-90 percent of the growth in output per man-hour over time. The remaining 10-20 percent growth is attributed to capital.[6]

Technical change in these studies is usually accounted for by making output a function of time as well as resource inputs. Any shift in the production function is then related to a change in technology. It should be observed that a shift in the production function may not be due entirely to a change in the technique of production. Thus, this so-called technical progress is a result

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[4] As shown in the diagram, the technological change is neutral. That is, at existing factor prices after the technical change, factor inputs are used in the same proportions as before the change in technology. The innovation may of course not be neutral and instead be either labor saving or capital saving.

[5] No attempt is made here to review and access each of these studies. The technically-inclined reader (from an economic standpoint) is referred to the selected bibliography on technology and economic growth appearing in Appendix A.

[6] A recent study calls this conclusion into question. See D.W. Jorgenson and Z. Griliches "The Explanation of Productivity Change," Review of Economic Studies Vol. XXXIV (July 1967), pp. 249-283. These authors contend that estimates of production functions contained in most of the previous studies are subject to errors of measurement. Their hypothesis is that once errors in the data have been corrected, growth in total output is largely accounted for by growth in total inputs. Using corrected U. S. data for the period 1945-65 they found that growth of inputs explained 96.7 percent of the growth in output. The remaining 3.3 percent is explained by "technology" or shifts in the production function.

of many factors such as improved education and skills of the labor force, improved management, external economies, and many others. The term technical change thus represents a catch-all phrase for the many factors which could account for a shifting production function over time. For this reason, these shifts have been called, among other things, technical change, the residual, advance of knowledge, and measure of our ignorance.

A shifting production function then has been identified by many scholars as the most important explanation for economic growth. One writer thus concludes:

> The present paper offers evidence to support the view that technological change is of overriding importance in bringing about increased labor productivity over time and that there is a need for economists to shift emphasis from the theory of capital to the theory of technical progress, as an explanation of the growth in aggregate output.[7]

Although this statement is perhaps too strong, it is clear that technology is extremely important in the process of economic growth. Given that this premise is correct, the current explosion in new knowledge makes it even more imperative that the lag between discovery of new knowledge and its use in the economic system be shortened. Reducing this time span contributes to the national objective of a more rapid rate of economic growth. It also serves to eliminate regional imbalances in the economy if such programs are aimed at lagging regions. The following chapters are concerned with an experimental program of technology transfer sponsored by the National Aeronautics and Space Administration. This portion of the NASA program has been primarily limited to a 17-county region in Southeastern Oklahoma illustrated in Figure 1.3. Although two additional counties were added to the primary project area in 1968, they will not be included in the following analyses.

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[7] Benton F. Massell, "Capital Formation and Technological Change," The Review of Economics and Statistics, Vol. XLII (February 1960), p. 188.

FIGURE 1.3

THE TECHNOLOGY USE STUDIES CENTER
PRIMARY PROJECT AREA

Nature of the TUSC Program of Technology Transfer

The objectives of the NASA-sponsored Technology Utilization Program are:

> To increase the return of the national investment in aerospace research and development by encouraging additional uses of the knowledge gained in those programs.
>
> To shorten the time gap between the discovery of new knowledge and its effective use in the marketplace.
>
> To aid in the movement of new knowledge across industry, disciplinary, and regional boundaries.
>
> To contribute to the knowledge of better means of transferring new knowledge from its points of origin to its points of potential use.[8]

Specific TUSC responsibilities and mechanisms for a program of technology transfer will not be discussed here since these have been described elsewhere.[9] The purpose here is to indicate how TUSC functions as an intermediary in the technology transfer system. This is illustrated in a highly simplified diagram such as in Figure 1.4. Thus, TUSC can be viewed as a link between small industry and a system of information generation. It was evident from the beginning of the TUSC experiment that most TUSC clients would fall in the category of small business. Table 1 indicates that in 1963, 79 percent of the total number of manufacturing establishments in the 17-county region had fewer than 20 employees.

The upper portion of Figure 1.4 depicting research, formal education, large industry, and documentation may be described as a rather self-contained system of information generation and exchange. Small firms do not generally have ready access to this wealth of

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[8] National Aeronautics and Space Administration, The Technology Utilization Program, 1967, p. 4.

[9] For specifics of the TUSC program see Lee B. Zink, Technology Utilization in a Non-Urban Region: The First Four Years of an Experiment (Durant, Oklahoma: Technology Use Studies Center, Southeastern State College, 1968).

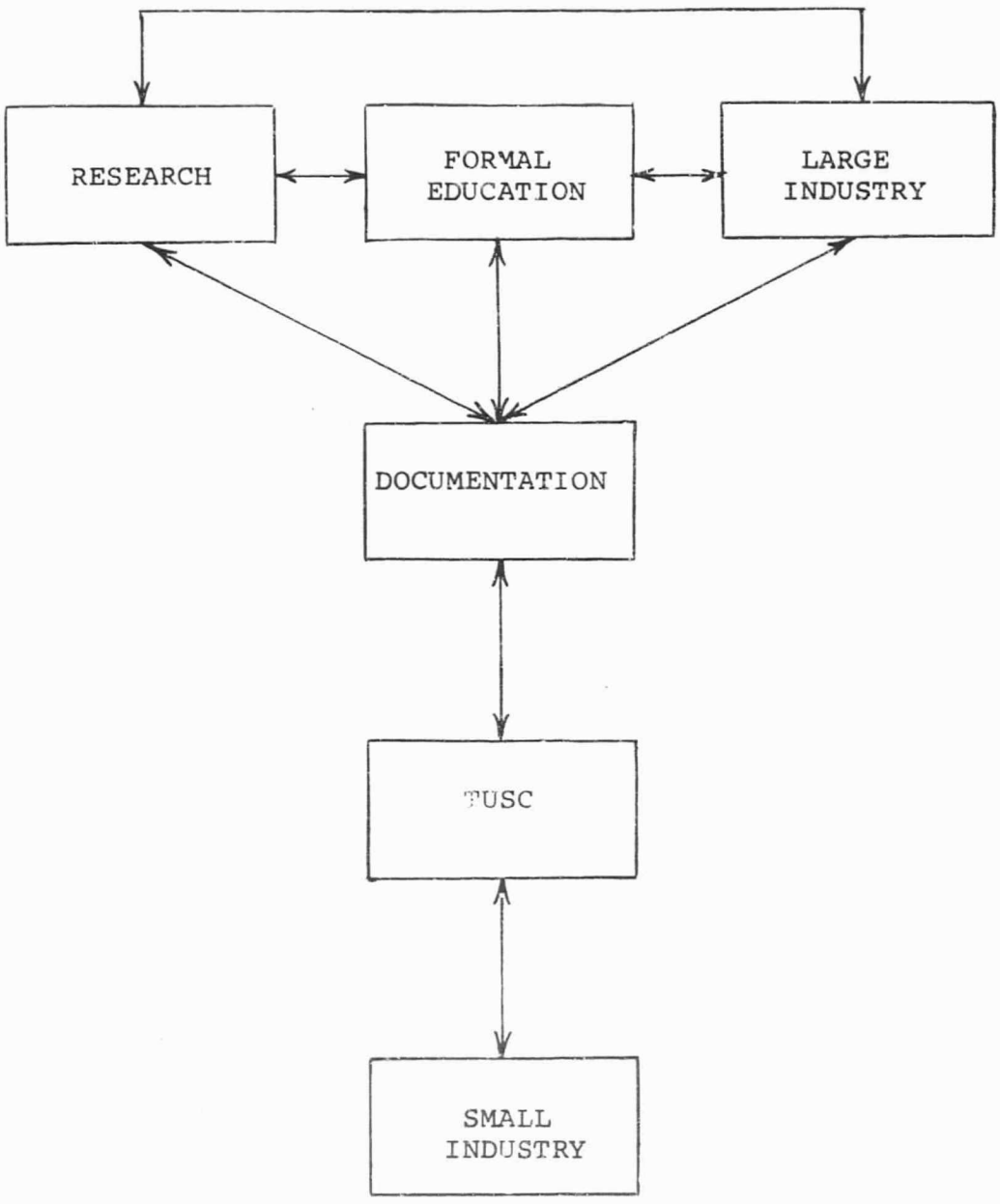

Figure 1.4. A Simplified System of Technology Transfer.

TABLE 1

MANUFACTURING ESTABLISHMENTS BY EMPLOYMENT SIZE CLASS, TUSC PRIMARY PROJECT AREA, 1963

Employment Size Class	Total Establishments
1-19 Employees	183
20-99 Employees	35
100-249 Employees	10
250 Employees and Over	3
Total	231

Source: U. S. Bureau of the Census, Census of Manufacturers: 1963, Vol. III, Area Statistics (Washington, D. C.: U. S. Government Printing Office, 1966).

newly-generated knowledge. The TUSC experiment was therefore geared from its inception to the task of serving primarily small firms in a non-urban region. Specific instances of TUSC impact upon this region are described in the following chapters.

CHAPTER II

THE TUSC REGION--SOCIO-ECONOMIC BACKGROUND

The purpose of this chapter is to sketch the socio-economic background of the 17-county TUSC region prior to 1964. Three principal measures of economic growth--income, employment, and population--are considered. Primarily due to the availability of data, the discussion focuses mainly upon employment trends over the 1940-1960 decades. An understanding of the economic forces which have been at play in the region in recent years should add to an understanding of the challenges facing the TUSC program of technology transfer.

Income

Most of the primary TUSC area comprises a portion of a large segment of Oklahoma (some 20 counties concentrated in Eastern and Southeastern Oklahoma) characterized as a low-income region. Table 2 indicates that only four counties in the TUSC area had a 1959 median family income greater than the generally recognized poverty level of $3,000. Median family incomes in the 17-county region ranged from $1,987 in Pushmataha County to $4,387 in Carter County. The comparable State and United States 1959 medians were $4,620 and $5,660, respectively.

Table 3 presents the ranks of the 17 counties among the 77 Oklahoma counties in terms of 1959 median family income. Carter was the highest ranking county among the 17, occupying 19th place in the state. At the other end of the scale is Pushmataha County with a rank of 76. Excluding Carter County, the remaining 16 counties rank from 51st to 76th among the 77 Oklahoma counties. Thus, economic activity in the TUSC region has not been a potent generator of income for the average family unit.

TABLE 2

MEDIAN FAMILY INCOME, 17-COUNTY
TUSC REGION, 1959

Atoka	$2,217
Bryan	2,802
Carter	4,387
Choctaw	2,239
Coal	2,349
Haskell	2,247
Johnston	2,439
Latimer	2,618
LeFlore	2,648
Love	2,876
McCurtain	2,455
McIntosh	2,066
Marshall	3,202
Murray	3,348
Pittsburg	3,212
Pushmataha	1,987
Sequoyah	2,492
State	4,620
United States	5,660

Source: W. N. Peach and Richard W. Poole, in association with Lee B. Zink, Larkin B. Warner, and Robert L. Sandmeyer, Human and Material Resources of (17 Counties), A Profile for Growth and Development (Durant, Oklahoma: Technology Use Studies Center, Southeastern State College, 1965).

TABLE 3

RANK OF 17 TUSC COUNTIES BY 1959
MEDIAN FAMILY INCOME

	County Rank (77 Counties)
Carter	19
Murray	51
Pittsburg	55
Marshall	56
Love	60
Bryan	61
LeFlore	64
Latimer	65
Sequoyah	66
McCurtain	67
Johnston	68
Coal	71
Haskell	72
Choctaw	73
Atoka	74
McIntosh	75
Pushmataha	76

Source: John J. Klein, Richard H. Leftwich, Richard W. Poole, and Rudolph W. Trenton, The Oklahoma Economy (Stillwater, Oklahoma: The Publishing and Printing Department, Oklahoma State University, 1963).

Employment Trends

Employment trends in the region indicate that significant adjustments in the economy have occurred. Table 4 shows that while the state of Oklahoma expanded employment by 24 percent and the United States' employment grew by 46 percent, employment in the TUSC counties decreased by 22 percent over the 1940-1960 period. Total employment was only 76,452 in 1960 as compared with 92,664 in 1950 and 98,216 in 1940--a decrease of 21,764 over the 20-year span. In the TUSC region only two counties, Carter and Pittsburg, increased employment over the two decades following 1940. Only Carter County managed an increase over both the 1940-1950 and 1950-1960 periods.

The heaviest losses were, as Table 5 shows, concentrated in the agricultural sector. Agricultural employment decreased from 51,237 in 1940 to 11,761 in 1960 within the region. No other sector of the region's economy has been able to offset this dramatic exodus from agriculture.

Data recently published by the Commerce Department provides a convenient technique for analyzing differing regional growth rates.[1] The national growth rate is used as a norm or standard for comparison. It should be understood that the national growth rate is used as the standard of reference with no attempt being made to explain the causes of national growth. The question of relative growth rates involves two distinct growth elements:

> First, does the region have a rapid or a slow-growth <u>industrial mix</u> or distribution of industries; and, second, does it have an increasing or a decreasing <u>regional share</u> in this industrial distribution. Regarding

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[1] U. S. Department of Commerce, <u>Growth Patterns in Employment by County, 1940-1950 and 1950-1960</u> (Washington, D. C.: U. S. Government Printing Office, 1965). For an application of the technique to regions in the United States, see Lowell D. Ashby, "The Geographical Redistribution of Employment: An Examination of the Elements of Change," <u>Survey of Current Business</u>, Vol. 44 (October 1964), pp. 13-20. The presentation of the technique in this chapter follows Mr. Ashby's article.

TABLE 4

PERCENT CHANGE IN EMPLOYMENT BY COUNTY, TUSC PRIMARY PROJECT AREA, 1940-1950, 1950-1960, AND 1940-1960

County	Total Employment 1940	1950	1960	Percent Change in Employment 1940-1950	1950-1960	1940-1960
Atoka	4,547	3,946	2,471	-13.2	-37.4	-45.7
Bryan	9,474	8,566	7,795	- 9.6	- 9.0	-17.7
Carter	11,415	12,039	12,790	5.5	6.2	12.0
Choctaw	6,633	5,724	4,269	-13.7	-25.4	-35.6
Coal	3,141	2,438	1,516	-22.4	-37.8	-51.7
Haskell	3,548	3,732	2,316	5.2	-37.9	-34.7
Johnston	3,559	2,822	2,362	-20.7	-16.3	-33.6
Latimer	2,496	2,494	1,873	- 0.1	-24.9	-25.0
LeFlore	9,523	9,054	7,509	- 5.0	-17.1	-21.2
Love	2.642	2,361	1,846	-10.6	-21.8	-30.1
McCurtain	10,207	8,370	6,478	-18.0	-22.6	-36.5
McIntosh	5,558	4,719	2,987	-15.1	-36.7	-46.3
Marshall	2,866	2,515	2,356	-12.2	- 6.3	-17.8
Murray	3,381	3,261	3,257	- 3.5	- 0.1	- 3.7
Pittsburg	9,966	12,235	10,189	22.8	-16.7	2.2
Pushmataha	4,339	3,484	2,237	-19.7	-35.8	-48.4
Sequoyah	4,916	4,904	4,201	- 0.2	-14.3	-14.5
17-County Total	98,216	92,664	76,452	- 5.6	-17.5	-22.2
State	658,739	767,058	818,107	16.4	6.7	24.2
United States	45,375,815	57,474,912	66,372,649	26.7	15.5	46.3

Source: U. S. Department of Commerce, Growth Patterns in Employment by County, 1940-1950 and 1950-1960, Volume 6, Southwest.

TABLE 5

EMPLOYMENT BY INDUSTRY, TUSC PRIMARY PROJECT AREA,
1940-1950 AND 1950-1960

	Employment		
	1940	1950	1960
Agriculture	51,237	32,591	11,761
Forestry & fisheries	70	153	244
Mining	2,576	4,032	3,535
Contract construction	2,873	5,702	6,133
Food & kindred products mfg.	873	1,218	1,688
Textile mill products mfg.	13	24	48
Apparel mfg.	37	450	1,363
Lumber, wood products, furniture mfg.	4,167	3,810	3,669
Printing & publishing mfg.	331	407	622
Chemicals & allied products mfg.	80	149	94
Electrical & other machinery mfg.	90	154	283
Motor vehicle & equipment mfg.	6	18	17
Other transportation equipment mfg.	6	63	121
Other & miscellaneous mfg.	365	941	1,631
Railroads & railway express	1,331	1,598	650
Trucking & warehousing	727	934	859
Other transportation	421	831	943
Communications	424	906	781
Utilities & sanitary services	513	1,017	1,110
Wholesale trade	1,555	1,829	1,907
Food & dairy products stores	2,859	3,131	2,736
Eating & drinking places	1,667	2,557	2,636
Other retail trade	5,936	7,362	8,660
Finance, insurance & real estate	1,184	1,374	1,597
Hotels & personal services	2,459	2,686	2,713
Private households	3,169	2,103	2,594
Business & repair services	1,572	2,022	1,833
Entertainment, recreation services	591	631	468
Medical, professional services	7,088	7,383	9,153
Public administration	2,589	4,451	4,179
Armed forces	0	200	238
Industry not reported	1,407	1,937	2,186
TOTAL	98,216	92,664	76,452

Source: Same as Table 4.

> the first point--the rate of growth of a particular national industry is characterized as rapid if it exceeds and slow if it falls short of the growth rate of all national industries combined over the same period. As for the second point--the rate of growth of a region within a particular industry is characterized as rapid if it exceeds and slow if it falls short of the growth rate of that industry nationally.[2]

Tables 6 and 7 show employment and components of change in each of 32 industries for the TUSC 17-county region from 1940-1950 and 1950-1960.[3] To illustrate the technique, consider the apparel manufacturing industry (line 7). Columns F, G, and H in Table 7 illustrate the components of change over the 1950-1960 period. Considering only this decade, the following information is required:

	Employment 1950	Employment 1960	Percent Change 1950-1960
United States, total employment	57,474,912	66,372,649	15.481
United States, apparel mfg.	1,003,921	1,159,163	8.952
17-County, apparel mfg.	450	1,363	202.889

Column F of Table 7 shows 69 employees. This represents the increase that would have occurred from 1950-1960 in apparel manufacturing in the 17 counties if that industry had increased at the all-industry national growth rate. It is computed by multiplying apparel manufacturing employment in the 17 counties in 1950 (450) by the national all-industry growth rate (0.15481).

The figure in Column G indicates that in the decade of the 1950's apparel manufacturing was a national slow-growth industry. Its national employment increase was at a lesser rate than the

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[2] Ibid., p. xi.

[3] For an analysis of the components of employment change in Oklahoma as well as the 17-county TUSC region see Harold Warren, Employment Changes by Industry in Oklahoma from 1940-1960 (Durant, Oklahoma: Technology Use Studies Center, Southeastern State College, Bulletin 5, 1967).

TABLE 6

COMPONENTS OF EMPLOYMENT CHANGE BY INDUSTRY,
TUSC PRIMARY PROJECT AREA, 1940-1950

	1940 - 1950			
	National Growth (A)	Industrial Mix (B)	Regional Share (C)	Total (D)
Agriculture	13,662	-22,858	-9,448	-18,644
Forestry & fisheries	19	-6	73	86
Mining	687	-651	1,423	1,459
Contract construction	765	1,163	900	2,828
Food & kindred products mfg.	235	9	101	345
Textile mill products mfg.	4	-3	11	12
Apparel mfg.	9	2	402	413
Lumber, wood products, furniture mfg.	1,111	0	-1,470	-359
Printing & publishing mfg.	88	29	-40	77
Chemicals & allied products mfg.	22	17	31	70
Electrical & other machinery mfg.	23	61	-21	63
Motor vehicle & equipment mfg.	2	1	8	11
Other transportation equipment mfg.	2	2	53	57
Other & miscellaneous mfg.	98	22	456	576
Railroads & railway express	355	-59	-27	269
Trucking & warehousing	194	90	-75	209
Other transportation	112	137	162	411
Communications	112	228	142	482
Utilities & sanitary services	137	89	277	503
Wholesale trade	415	577	-718	274
Food & dairy products stores	763	-324	-168	271
Eating & drinking places	443	408	39	890
Other retail trade	1,583	715	-872	1,426
Finance, insurance & real estate	314	47	-173	188
Hotels & personal services	655	-407	-23	225
Private households	846	-1,792	-120	-1,066
Business & repair services	420	389	-361	448
Entertainment, recreation services	160	-12	-104	44
Medical, professional services	1,892	1,233	-2,826	299
Public administration	692	1,106	66	1,864
Armed forces	0	0	200	200
Industry not reported	376	-65	219	530
TOTAL	26,196	-19,852	-11,883	-5,539

Total net relative change (E) -31,735

Source: Same as Table 4.

TABLE 7

COMPONENTS OF EMPLOYMENT CHANGE BY INDUSTRY,
TUSC PRIMARY PROJECT AREA, 1950-1960

	1950 - 1960			
	National Growth (F)	Industrial Mix (G)	Regional Share (H)	Total (I)
Agriculture	5,047	-17,533	-8,292	-20,828
Forestry & fisheries	23	-62	132	93
Mining	625	-1,824	701	-498
Contract construction	883	-291	-161	431
Food & kindred products mfg.	188	164	119	471
Textile mill products mfg.	4	-8	28	24
Apparel mfg.	69	-30	874	913
Lumber, wood products, furniture mfg.	589	-984	255	-140
Printing & publishing mfg.	65	73	78	216
Chemicals & allied products mfg.	21	21	-[illegible]	-58
Electrical & other machinery mfg.	24	47	58	129
Motor vehicle & equipment mfg.	1	-2	-1	-2
Oth transportation equipment mfg.	7	57	-6	58
Other & miscellaneous mfg.	146	30	513	689
Railroads & railway express	247	-760	-433	-946
Trucking & warehousing	146	132	-353	-75
Other transportation	130	-107	90	113
Communications	143	0	-268	-125
Utilities & sanitary services	157	-9	-55	93
Wholesale trade	284	-72	-136	76
Food & dairy products stores	486	-547	-333	-394
Eating & drinking places	397	-231	-86	80
Other retail trade	1,141	140	18	1,299
Finance, insurance & real estate	214	342	-328	228
Hotels & personal services	415	-299	-88	28
Private households	325	30	134	489
Business & repair services	313	145	-647	-189
Entertainment, recreation services	96	-89	-170	-163
Medical, professional services	1,145	3,138	-2,511	1,772
Public administration	687	529	-1,491	-275
Armed Forces	30	110	-100	40
Industry not reported	300	3,760	-3,809	251
TOTAL	14,348	-14,150	-16,368	-16,200

Total net relative change (J) -30,548

Source: Same as Table 4.

national all-industry growth rate. To calculate Column G, subtract the national all-industry rate from the national apparel manufacturing rate and apply the result to the 17-county 1950 base employment figure in apparel manufacturing. That is, multiply (0.08952 - 0.15481) by 450; the resulting industrial mix component is then -30 employees.

The regional-share component of change over the 1950-1960 decade is shown in Column H. To calculate Column H, subtract the national apparel manufacturing rate from the 17-county apparel manufacturing rate and apply the result to the 1950 employment base for the 17-county apparel manufacturing. Thus, multiply (2.02889 - 0.08952) by 450 to get 874 employees for the 17-county regional-share component of change. This represents a correction for the fact that apparel manufacturing employment expanded more rapidly in the 1950's in the 17 counties than in the nation as a whole.

The total change for the 1950's decade, which represents the actual employment change during the decade, is then shown in Column I as the algebraic sum of Columns F, G, and H.

In summary, the employment change in apparel manufacturing in the 17 counties would have been 69 had it grown at the national all-industry growth rate. But after correcting for the fact that apparel manufacturing was a national slow-growth industry (-30) and for the fact that the 17-county's performance was above the average region in this industry (874), the actual employment change is 913. Thus, in the apparel manufacturing line of Table 7 are the following entries:

Column F, change related to national growth 69

Column G, change related to industrial mix. . . . . -30

Column H, change related to regional share. 874

Column I, total change (algebraic sum of F, G, and H) 913

The overall growth in total employment for the TUSC region during the 1950's is shown at the bottom of Table 7 in the "Total" line. These figures represent the algebraic sums of the corresponding column entries for the separate industries. Thus, for the 17 counties the following entries are observed:

Column F, change related to national growth 14,348

Column G, change related to industrial mix. . . . . -14,180

Column H, change related to regional share. . . . . -16,368

Column I, total change (algebraic sum of F, G, and H) . . . . . -16,200

The figure in the bracket below the "Total" line indicates the total net relative change in the decade. It is derived by algebraically adding the totals of Columns G and H and indicates that the observed change in the 17-county region fell short of the national employment growth norm by 30,548 workers over the 1950-1960 period.

It is evident from Table 7 that the TUSC region had a heavy concentration of employment in slow-growth industries (industries indicating a negative industrial-mix component) in the decade of the 1950's. The concentration of employment in 1950 was such that about 60 percent of total employment was distributed among industries that were in the slow-growth category during the following decade. The bulk of this employment distribution, slightly over 35 percent, was in agriculture. The 1940 employment distribution indicates that some 67 percent was in the 1940-1950 decade slow-growth category. Again agriculture accounted for the major concentration with 52 percent total employment in 1940.

Examination of the regional-share component of change indicates that on balance the 17-county's industries grew less rapidly than the comparable national industries. In 1950, 77 percent of total employment was distributed among industries that were to experience less rapid growth in the region than those industries did nationally. This compares with an employment distribution in 1940 of 86 percent

in regional industries that grew less rapidly from 1940-1950 than the corresponding national industries. Agriculture was again the most heavily concentrated industry in both 1940 and 1950.

The unfavorable industrial-mix component in the TUSC region stems primarily from the region's historical agricultural orientation. At the national level, agriculture was a declining industry for both the 1940-1950 and the 1950-1960 decades. Thus, the larger the employment base in this industry in a region, the larger the negative industrial-mix share.

The behavior of the agricultural sector in the 17 counties also helps explain the predominately negative regional-share effects over the two decades under consideration. Generally, the percentage decrease in a county's agricultural employment exceeds the national average. Thus, the continuing migratory stream from agriculture has been taking place more rapidly in the TUSC region than in the nation as a whole. This results in a negative regional-share component in agriculture which indicates the region now has a smaller share of the total national employment in this industry. For most TUSC counties, the negative regional-share element in agriculture was sufficient to offset any gains made in other industries so that the total regional-share component of change is usually negative.

The more rapid adjustment in agriculture does, however, tend to reduce the region's unfavorable industrial mix. As indicated in Tables 6 and 7 the TUSC region has, on balance, a slow-growth distribution of employment among industries which results in predominately negative industrial-mix components. As people leave agricultural employment, the region's industrial structure becomes more like that of the nation, and the industrial mix thereby becomes less unfavorable. An examination of Tables 6 and 7 illustrates this point. Note that the 17-counties' industrial-mix component moved from -19,852 in the 1940-1950 period to -14,180 in the following decade. Although the region still had an unfavorable (negative) industrial-mix component, it was less unfavorable over

the latter period since the uniqueness--relatively large agricultural employment--causing the unfavorable industrial-mix had decreased.

Changes in an area's regional-share component are often related to the region's relative competitive position vis-a-vis other regions. This is sometimes referred to as a region's input-output access. On the input side, access to raw materials, labor, and other resource inputs affect the area's competitive position. On the output, or selling side, competitive position may be related to a region's access to markets. This input-output consideration represents a netting out of the relative advantages and disadvantages in terms of economic activity engaged in by the region.

The regional-share component of change represents the dynamic aspects of a region's growth or decline and are thus more important in the long run. Because some regions gain, over time, a relative advantage vis-a-vis other regions in their input-output access, they show region-share gains. A region with a differential advantage in terms of input-output access enjoys an increasing regional share of economic activity and changes the composition of its industrial mix. The ideal long-run growth situation to maximize employment gains for a region is to experience share gains in rapid-growth sectors and share losses in slow-growth sectors.

The 17-county regional-share performance was below that of the average region for both decades following 1940. From a -11,883 employees over the 1940-1950 period, Tables 6 and 7 indicate a weakening of relative competitive position as the regional-share component slipped to -16,368 employees in the 1950's. Thus, an erosion of the region's competitive position has occurred from 1940-1960 as huge employment losses in the agricultural sector have failed to be offset by employment gains in other industries. The failure of other sectors to show more rapid employment growth is presumably due to competitive disadvantages associated with the region's input-output access.

Population

Declining job opportunities have had severe consequences for the population of the TUSC region. The population of the 17-county region has declined dramatically over the 1940-1960 period. Table 8 indicates that from a 1940 figure of 427,493 the region's population fell to 272,731 in 1960. This represents a 36.2 percent decrease in population over the 20-year span. These figures are in stark contrast to state and national trends.

Confronted with declining job opportunities in the region, Table 9 shows that a significant portion of the population has chosen to migrate to other areas. Examination of these data by age-groups indicates that the bulk of the net migration loss over the 1950-1960 period is concentrated in the economically productive younger groups.[4] It should be observed that the net migration figure represents the loss of population due to numbers of persons migrating into and out of a county and does not correspond to the loss during the period.

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[4]See Gladys K. Bowles and James D. Tarver, Net Migration of the Population, 1950-60 by Age, Sex, and Color, Part 5 (Washington, D. C.: U. S. Government Printing Office).

TABLE 8

POPULATION, 17-COUNTY TUSC REGION,
1940, 1950, AND 1960

County	1940	1950	1960
Atoka	18,702	14,269	10,352
Bryan	38,138	28,999	24,252
Carter	43,292	36,455	39,044
Choctaw	28,358	20,405	15,637
Coal	12,811	8,056	5,546
Haskell	17,324	13,313	9,121
Johnston	15,960	10,608	8,517
Latimer	12,380	9,690	7,738
LeFlore	45,866	35,276	29,106
Love	11,433	7,721	5,862
McCurtain	41,318	31,588	25,851
McIntosh	24,097	17,829	12,371
Marshall	12,384	8,177	7,263
Murray	13,841	10,775	10,622
Pittsburg	48,985	41,031	34,360
Pushmataha	19,466	12,001	9,088
Sequoyah	23,128	19,773	18,001
Total	427,493	325,966	272,731

Source: W. N. Peach and Richard W. Poole, in association with Lee B. Zink, Larkin B. Warner, and Robert L. Sandmeyer, Human and Material Resources of (17 counties), A Profile for Growth and Development (Durant, Oklahoma: Technology Use Studies Center, Southeastern State College, 1965).

TABLE 9

NET MIGRATION OF THE POPULATION BY COUNTY,
17-COUNTY TUSC REGION, 1950-1960

County	Total Net Migration,[1] 1950-1960
Atoka	-5,288
Bryan	-7,039
Carter	-3,512
Choctaw	-6,213
Coal	-2,995
Haskell	-5,408
Johnston	-2,770
Latimer	-2,605
LeFlore	-9,715
Love	-2,428
McCurtain	-6,541
McIntosh	-6,994
Marshall	-1,542
Murray	-1,052
Pittsburg	-11,178
Pushmataha	-3,804
Sequoyah	-4,276
State	-218,436

[1]Represents the loss of population due to numbers of persons migrating into and out of a county.

Source: Gladys K. Bowles and James D. Tarver, Net Migration of the Population, 1950-60 by Age, Sex, and Color, Part 5 (Washington, D. C.: U. S. Government Printing Office).

CHAPTER III

QUANTITATIVE MEASURES OF GENERAL IMPACT WITHIN THE TUSC PRIMARY AREA

Economic activity within the TUSC region over the 1962-1967 span is the subject of this chapter. Significant changes have apparently occurred during this time period. From data that are available, the indications are that economic growth has begun, or is about to begin, in many counties in the TUSC region. More definitive statements must await the mass of data that will become available as a result of the 1970 U. S. Census material.

Again, general measures of economic growth are used in this chapter. Due to the dearth of current data at the county level, employment and population are concentrated upon. Many agencies, groups, and individuals have been concerned with quickening the pace of development in the TUSC region. Thus, changes in the region may be attributed to many sources. To measure the impact of TUSC on the region requires holding all other factors constant while examining the TUSC program. Unfortunately, in the social sciences, this poses a problem because other factors do not in fact remain constant. The posture here is that TUSC has played a part in bringing about many of the changes in the region. Specific instances indicating the nature of the TUSC contribution are contained in Chapters IV and V.

Employment

According to recent estimates by the Oklahoma Employment Security Commission, the employment experience of the 1940's and 1950's has apparently reversed itself. Unfortunately, data are not available to indicate changes in the employment situation by industry groups. Thus, only the total employment picture can be presented.

Table 10 indicates that total employment in the TUSC region climbed from 60,605 in 1962 to 70,155 in 1967.[1] After a slight decline in 1964, employment growth has been steadily upward from 1965 to 1967.

Relative to the state, Table 11 shows that employment growth in the TUSC region has been substantial in recent years. Over both the 1962-1964 and 1965-1967 periods, employment growth in the 17-county TUSC region was at a greater rate than the state-wide average. The relative gain was greater from 1965-1967 than in the 1962-1964 period. More significantly, only four counties indicate employment decreases in the 1965-1967 period whereas eight counties show decreased employment from 1962-1964.

Although employment by industry groups is not available for non-census years, Table 12 gives some indication of recent developments in manufacturing. The data in Table 12 refer to only new manufacturing establishments and thus do not include expansion of existing facilities. It is evident that since 1965 steady growth in both new jobs and investment has occurred in the TUSC region. The primary thrust of the TUSC effort has been in the manufacturing sector.

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[1] In Chapter II the 1960 total employment figure for the 17-county region was shown as 76,452. These figures then indicate a decrease in employment of nearly 16,000 from 1960 to 1962. This decline is considerably overstated because three counties are not included in Table 10 (see footnote 1, Table 10) and differences in methodology exist between data sources. It is estimated that the omitted counties in Table 10 would account for an additional 9,000 workers. Thus, the data would reflect a decline in employment from 1960 to 1962 of about 7,000.

This decline is probably overstated, however, due to differences in data sources. The Oklahoma Employment Security Commission estimates are based upon place of work whereas the 1960 census figures are based upon place of residence. If commuting to place of work outside the region is significant, then large differences in employment figures result. It is believed that the number of persons commuting to work outside the TUSC region is substantial. Although no data are available to access the quantitative importance of commuting, it is known that persons in the region do commute to Ft. Smith, Arkansas; Paris, Texas; Denison-Sherman, Texas; and Oklahoma City, Oklahoma to work. Although other differences in methodology exist between the data sources, the commuting factor probably explains a great portion of the suspected discrepancy.

TABLE 10

TOTAL EMPLOYMENT, TUSC
PILOT PROJECT AREA,[1] 1962-1967

County	1962	1963	1964	1965	1966	1967
Atoka	2,460	2,380	2,390	2,530	2,670	2,660
Bryan	5,990	6,030	6,150	6,440	6,980	6,970
Carter	12,475	12,875	12,450	12,675	12,700	13,350
Coal	1,590	1,560	1,570	1,660	1,640	1,620
Haskell	2,180	2,190	2,190	2,340	2,380	2,330
Johnston	1,890	1,910	1,830	1,980	2,090	2,150
Latimer	2,470	2,570	2,440	2,630	2,580	2,560
LeFlore	5,650	5,540	5,570	6,230	6,930	6,810
Love	1,630	1,800	1,910	2,010	2,100	2,110
McCurtain	5,570	5,590	5,660	6,060	6,480	6,180
Marshall	2,230	2,150	2,160	2,210	2,260	2,240
Murray	2,840	2,950	2,980	3,270	3,190	3,030
Pittsburg	10,250	10,550	10,500	11,275	12,650	14,275
Sequoyah	3,380	3,790	3,590	3,790	3,710	3,870
Total	60,605	61,885	61,390	65,100	68,360	70,155
State	870,900	873,800	872,600	890,800	919,600	943,800

Source: Oklahoma Employment Security Commission, Handbook of Labor Force Data (Oklahoma City, Oklahoma: Oklahoma Employment Security Commission), appropriate years.

[1]Choctaw, McIntosh, and Pushmataha Counties are excluded because data are not available for these counties.

TABLE 11

PERCENT CHANGE IN EMPLOYMENT,
TUSC PRIMARY PROJECT AREA,[1]
1962-1964 AND 1965-1967

County	1962-1964	1965-1967
Atoka	-2.8	5.1
Bryan	2.7	8.2
Carter	-0.2	5.3
Coal	-1.3	-2.4
Haskell	0.5	-0.4
Johnston	-3.2	8.6
Latimer	-1.2	-2.7
LeFlore	-1.4	9.3
Love	17.2	5.0
McCurtain	-1.6	2.0
Marshall	-3.1	1.4
Murray	4.9	-7.3
Pittsburg	2.4	26.6
Sequoyah	6.2	2.1
Total	1.3	7.8
State	0.2	5.9

Source: Derived from Table 10.

[1]Choctaw, McIntosh, and Pushmataha Counties are excluded because data are not available for these counties.

TABLE 12

NEW JOBS AND INVESTMENT IN
NEW MANUFACTURING ESTABLISHMENTS,
TUSC PRIMARY PROJECT AREA,
1963-1968

Year	New Jobs	Total Investment
1963	80	$ 274,000
1964	33	1,120,000[1]
1965	149	636,000
1966	272	628,500[2]
1967	502	24,160,000
1968	1,165	30,815,000[3]

Source: Research and Planning Division, Oklahoma Industrial Development and Parks Department.

[1]Total investment not available for one new plant employing 20 people.

[2]Total investment not available for two new plants employing 29 people.

[3]Total investment not available for one new plant employing 100 people.

A most significant recent development in the TUSC region was announcement that Ardmore has been selected as the site for a new $75 million Uniroyal tire plant. It is anticipated that the new tire manufacturing plant in Carter County will employ 1,300 workers with an annual payroll of some $10 million. Construction of the new facility is to begin in 1969. TUSC was not directly involved in the effort to locate the new facility in the region. Although the TUSC program has not been directly devoted to such industry-locating efforts, it is hoped that new industry in the region is one of the TUSC by-products. One of the original thoughts on the TUSC-generated profile data series was that the information could be used by industry seekers to help put together relevant data on the region to present to industrial prospects.[2] It was reported to TUSC that the profile data volume on Carter County was used as an input in the prospectus for presentation to Uniroyal officials.[3]

This new $75-million facility will have a substantial impact upon the Southeastern Oklahoma economy. The economic structure of a region can be classified according to the type of economic activity engaged in by the region. Two types, basic activity and service activity, have been used extensively in regional economic analysis. Basic activities are those which produce goods and services for the non-local market. Service activities in the region produce goods and services for the local market. This division identifies key economic activities upon which the regional economy depends. Basic activity, according to this "export-base" theory of regional growth, tends to initiate growth and determine its extent. Growth in the basic export activity tends to result in an expansion of service activities within the region through a multiplier process

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[2]The first major project of TUSC involved gathering extensive economic profile data on the primary study area. This effort culminated in the publication and dissemination of a volume for each of the original 17 counties containing various economic, governmental, demographic, and business data. This TUSC activity has been described in more detail elsewhere. See Lee B. Zink, Technology Utilization in a Non-Urban Region: The First Four Years of an Experiment (Durant, Oklahoma: Technology Use Studies Center, Southeastern State College, 1968).

[3]Reported to TUSC by Jess Craig, Director of the Ardmore Development Authority.

similar to the investment and foreign trade multipliers used in aggregate economic models. The multiplier process refers to the change in economic activity which is a result of a change in investment. According to this theory, the economic impact of a new investment in a region is a multiple expansion in the region's income and employment.

Consider the new proposed Uniroyal facility as an example to illustrate the multiplier process. It was indicated above that 1,300 new jobs are estimated to result from the initial new investment. The employment multiplier for the region has been estimated to be 3.71.[4] This means that for every job created by this basic activity, 3.71 additional jobs will be required in the service sector. Therefore, the employment-multiplier effect would be 4,823 (3.71 x 1,300). Ultimately, then, the new investment would generate some 4,823 new jobs. This multiplier process assumes current full employment in the service sector thus implying that new workers are necessary to provide the additional services required. It can be expected that the full employment-multiplier effect will not be realized due to something less than full utilization of existing capacity being prevalent in the region.

The income multiplier for the region has been estimated to be 3.33.[5] An income multiplier of 3.33 means that with no leakages the addition to total income in the region will be 3.33 times the initial annual new income created. Thus, ultimately, $33.3 million (3.33 x $10 million) new income for the region would be generated if the full income-multiplier effect is realized. The full effect, however, will not be realized due to leakages in the respending of income stream. These leakages involve, among other things, respending some of the newly-created income outside, rather than inside the region.

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[4]Charles H. Little, A Method to Determine Effects of New Investment on a Community (Stillwater, Oklahoma: Oklahoma State University Experiment Station, 1966).

[5]Ibid.

Population

Accompanying the recent growth in employment within the TUSC region has been a significant change in the population trend. The dramatic decline in population during the 1940's and 1950's has apparently been arrested. Table 13 illustrates that declines in recent years have been comparatively small. In 1967 the region's total population increased by over 2,400. Expanding job opportunities in the region have evidently helped slow down the out-migration of the region's work force.

TABLE 13

POPULATION TRENDS, TUSC PRIMARY PROJECT AREA, 1961-1967

County	1961	1962	1963	1964	1965	1966	1967
Atoka	10,224	10,118	10,020	9,949	9,640	9,540	9,524
Bryan	24,297	24,292	24,231	24,130	23,573	23,463	23,572
Carter	39,983	40,751	40,048	40,057	39,295	39,219	39,500
Choctaw	15,492	15,388	15,307	15,220	14,819	14,713	14,757
Coal	5,438	5,339	5,277	5,213	5,057	5,024	5,042
Haskell	8,997	8,903	8,834	8,738	8,490	8,436	8,459
Johnston	8,516	8,496	8,480	8,419	8,208	8,137	8,173
Latimer	7,741	7,738	7,734	7,670	7,473	7,425	7,443
LeFlore	29,154	29,153	28,513	28,612	28,147	28,195	28,366
Love	5,818	5,781	5,613	5,508	5,330	5,288	5,314
McCurtain	25,942	26,016	25,011	25,167	24,747	24,780	25,053
McIntosh	12,204	12,055	11,505	11,385	11,102	11,024	11,046
Marshall	7,341	7,387	7,373	7,330	7,155	7,102	7,138
Murray	10,745	10,865	10,875	10,845	10,604	10,551	10,594
Pittsburg	34,330	34,321	34,201	34,20[illegible]	33,872	35,345	36,520
Pushmataha	9,035	8,954	8,929	8,893	8,696	8,643	8,680
Sequoyah	18,255	18,484	18,509	18,495	18,140	18,111	18,218
Total	273,512	274,041	270,460	269,836	264,348	264,996	267,399

Source: Richard W. Poole and James D. Tarver, Oklahoma Population Trends (Stillwater, Oklahoma: Oklahoma State University Press, 1968).

CHAPTER IV

SELECTED CASE STUDIES INDICATIVE OF IMPACT

Any attempts to project the impact TUSC has had in the past five years must include consideration of the nature and the types of clientele served. This chapter includes selected case studies that are representative of the TUSC clientele. The cases themselves reflect the inherent potential such firms and organizations have for promoting economic growth in Southeastern Oklahoma or other similar regions.

In the previous chapters, quantitative examples were given which are indicative of the impact resulting from new plants and expanded operations of existing firms located in the area served by TUSC. Collectively, the examples in both Chapters III and IV reflect the emergence of a new, progressive attitude in the region. Perhaps TUSC's greatest impact has been to aid in the creation of an attitude that change can occur or is needed.

The cases presented in this chapter are comprehensive in order that the reader have a complete understanding of the types of clientele served. TUSC personnel interviewed clients to obtain the in-depth responses to questions contained in an interview and observation guide. The guide was used to achieve uniformity. But for minor modifications, the guide was used in the doctoral study of the TUSC Director. A copy of the guide is contained in Appendix B. The six cases presented here represent firms located within the TUSC primary area.

Case 1

Nature of the Business

A sole-proprietorship organization, this firm has been operated by its present owner and his wife for less than five years. Its principal products include concrete blocks and a line of baydite blocks. The principal challenge confronting the present owners at the outset was the need to develop a line of products that met architectural specifications for major construction.

The physical facilities of the firm include a four-acre plot that is adjacent to a railroad siding and near the heart of the community's industrial area. The main building housing production, warehouse, and office activities is divided among the categories as follows: 2,400 square feet for production; 2,740 square feet for interior warehousing; and 560 square feet for offices. In addition, there are two 8' X 42' kilns and 1½ acres of external storage space.

Production facilities, most of which have been obtained by the present owner, are modern and efficient. A multiple-use Columbia Block Machine is the major piece of equipment. An elevator, conveyor system with overhead bins, and mixers provide a constant and properly-mixed supply of raw materials. Other major production facilities include off-bearer racks, two fork-lift trucks, a straddle unloader, a dump truck, and a delivery truck.

Raw materials of limestone and sand are obtained locally. The only raw material that is received from other than nearby sources is a light-weight aggregate that is obtained by rail from Dallas.

Company personnel number seven, including the owner and his wife who serves as secretary and bookkeeper. The owner serves as manager, warehouseman, and salesman. Other employees include a foreman who mixes materials and supervises the production activities, and three operators who run the machinery. The remaining employee is a truckman who drives the company trucks and unloaders.

The employees are nonunion. Fringe benefits provided them include paid vacations, a bonus plan, and workmen's compensation insurance.

The market area served by the company is within a 50-mile radius of its location. Customers are now industry-wide since the firm manufactures a product that meets architectural specifications for major construction.

Sales for 1969 are expected to exceed the $100,000 total that was achieved in 1968. Average monthly assets include $8,350 in accounts receivable; $5,000 in raw materials; and $20,000 in work-in-process and finished-goods inventories. Liabilities average $6,000 in short-term obligations and $35,000 in long-term commitments. The block machine cost $17,000. The owner's equity is approximately $100,000.

Perhaps the most distinctive characteristic of the organization's objective is that sales have more than doubled during the past two years. The 1968 sales goal was achieved in early November.

Characteristics of the Owner

A native of the community in which the firm is located, the owner-manager was the seventh child in a family of nine children. He now has four living sisters and three living brothers. This individual began working at a very early age and remembers picking cotton when he was seven. The owner-manager is in his early forties. He completed the 10th grade in high school and is motivated by his lack of formal education. His wife is a high school graduate.

After leaving high school, the owner-manager worked as a brick and stone mason and as a contractor. At one time, he and a brother co-owned a dry cleaning establishment. Although it proved to be a profitable venture, he leased his interest and withdrew because he did not like inside work. During the six-year lease period, his original investment of $3,000 increased three times. After the lease expired, he sold his interest. It was through his work as a stone mason that he became acquainted with the previous owner of the concrete block firm. When the original owner was ready to retire, this individual was able to purchase the establishment.

The owner-manager has memberships in the Chamber of Commerce, a service club, a fraternal order, and is also active in his church.

Finance

Beginning capital for this venture amounted to $3,000. The owner had $1,000 in cash, and he obtained an additional $2,000 from the sale of a real estate plot that he had acquired years earlier.

During the owner's first year, the firm operated on a hand-to-mouth basis. In fact, he did not withdraw any money from the firm for over a year. That made it necessary that he and his family live on savings during the formative period. Presently, the owner-manager is paid a fixed salary just as are all other employees.

Capital for expansion has been acquired from two sources--retained earnings and bank loans. The firm still maintains an earning-retention policy that foreseeably will provide future capital requirements.

Fiscal management is achieved through the use of the double entry system of accounting. A cement salesman assisted the owner's wife in setting up the accounting system and at the present time, the owner's wife is enrolled in an accounting course. Recently, a Certified Public Accountant (CPA) was hired to assist the firm in managing its fiscal affairs.

Other than fire and casualty insurance and the required workmen's compensation insurance, the firm has no other types of insurance. The owner-manager confessed to the interviewers that he frankly had not thought about the need for public or product liability insurance. The external storage area, which covers 1½ acres with finished blocks stacked on skids, is not fenced.

Technical Information Interests

The categories of Searches Requested, Abstracts Provided, Reports Ordered, and NASA Tech Briefs Provided do not apply in this case. It is under the category of Other Technical Information Provided that the Technology Use Studies Center has been involved in this case.

TUSC personnel provided professional counsel to the owner-manager at the time he was seeking to improve his product to meet established architectural specifications. In addition, TUSC provided

assistance to the owner-manager in making detailed production and marketing projections that involved both the firm's capacity and the market's demands. The owner-manager reported that the projections have proved to be quite accurate. They were within five percent of the production output and sales received during the past two years. TUSC personnel also aided in the development of the firm's end-of-period financial statements.

Production

Production and quality control are achieved through the use of the semi-automatic block machine. Periodic random tests are made to insure that the blocks are of a consistent and standard quality. Finished blocks are placed in the drying kilns for a period of 48 hours. Afterwards, the blocks are removed to external storage areas where they are left to cure in atmospheric conditions for at least 28 days.

Raw materials used in this firm's production are purchased in carload lots. That practice enables the company to enjoy the lowest prices available in the industry.

Warehousing of raw materials is not complicated because most of the materials are not seriously affected by weather. Only cements are stored in specially prepared humidity-controlled bins.

Inventory control is not too difficult because the firm's products are highly standardized, and the product line is limited. Visual inspection and the production and marketing projections are used in maintaining control of inventory.

Both rail and truck transportation are used by this company. At this time, the firm is in need of a front-end loading machine which is used in loading and unloading rail cars. Most deliveries of finished blocks are made by truck.

Marketing Organization

The owner-manager personally handles most of the sales. Of course, his wife also accepts telephone orders. His experiences as

a brick and stone mason have proved very helpful because he knows personally most of his customers.

Advertising and sales promotion efforts of this firm are limited. Occasionally radio and newspaper advertisements have been used. The yellow-page listing in the telephone directory has proved to be a good promotional method for this company. The owner-manager recognizes that more advertising will be needed as the firm's market area grows. At this time, his personal acquaintance with the market is, he believes, sufficient; and therefore extensive promotion is not needed.

Credit sales on open accounts are routine for this company. Again, the owner-manager's personal acquaintance with the firm's clientele has proved helpful in that regard.

The pricing policy followed by this company involves a combination of three basic price policies. They are to "follow the leader," to consider "cost plus," and to use "a chain of discounts."

Location

From a geographical standpoint, this company's location is good because it is near a primary source of most of its raw materials. It is at the center of its market area. The availability of both rail and truck transportation makes the firm's location readily accessible.

The property owned by the firm has approximately 1½ acres remaining for expansion as additional space is needed.

Expansion

A systematic rate of growth is desired by this firm. Present facilities are more than adequate to meet the needs of the existing market. Plans for long-range continuity of the business have not been formulated. Actually, the owner-manager stressed that his main concern at the present time is to insure the firm's existence on more than a day-to-day or hand-to-mouth level of operation. Until he is confident that such a level of operation has been achieved, little time and attention can or will be given to long-range plans of expansion or continuity.

Case 2

Nature of the Business

This business is a corporation that is presently engaged in the design and fabrication of telemetry and communications equipment. It is also involved in metal fabrication, electroplating, and the development of printed circuitry.

The buildings used by the corporation are at four separate locations. Approximately 40,000 square feet of floor space are contained in the brick and stone buildings. Office space occupies 5,000 square feet while the remaining space is alloacted to production and storage areas.

The overall plant facilities encompass two separate categories of operation which are defined by their functions. These categories are production and testing, with each constituting a rather complete facility within itself. The operation of each of these facilities requires considerable knowledge and expertise in a variety of scientific and technical disciplines. Equipment within the two facilities is valued at $562,000. Heavy machine-type equipment includes milling machines, a variety of lathes, and electroplating apparatus. Smaller equipment, used primarily in printed-circuit manufacturing consists of cameras, etching devices, and painting equipment. Additional materials necessary to the operation of the latter are chemicals and chemical handling and storage equipment.

The testing facility is, of necessity, quite extensive. Due to the close-tolerance work demanded by most of the company's contracts, a complete test and evaluation capability is necessary. An exacting comprehensive quality control program is a must. A variety of electronic test and control equipment is therefore an integral part of the operation.

The number of employees varies according to the work load, but the number usually averages 200. The company presently shows an employee distribution by department as follows: 18 research and development, and purchasing; 17 engineering; 15 quality control;

6 maintenance; 9 material control and security; 46 machine shop; 24 chemographics and plating; and 65 labor and electronics production. The employees are nonunion. The annual payroll is $1,250,000.

Several fringe benefits are enjoyed by the employees. The corporation pays for a major medical and surgical insurance policy for company personnel. At their option, the employees may pay the group-rate premiums for coverage of their dependents. A $2,000 company-paid term life insurance policy is also provided each employee. Administrative and professional personnel receive a two-week paid vacation annually. Other personnel receive a one-week paid vacation after one year of service; and after two years, they are entitled to an annual two-week paid vacation.

The company bids on contracts of numerous government agencies and approximately 20 subcontractors. The market area includes the entire United States and even some international areas.

Annual sales of the corporation range from $3.5 to $4 million. Accounts receivable average $220,000 per month, and the monthly raw-materials inventory is $175,000. Work in process is approximately $250,000 per month. Tangible fixed assets are valued at $495,000. Intangible assets are valued at $450,000. Short-term liabilities amount to $510,000 and long-term liabilities to $520,000. Owner's equity is reported to be $280,000, and there is a reported surplus of $55,000.

The long-range goal of this organization is to continue to grow and thereby benefit the economy and living conditions in the community in which the business is located.

Characteristics of the Owner

The president and general manager owns 51 percent of the stock of this corporation. He is a native of Kentucky and was an only child. He was introduced to the "world of work" at a young age. While still a school boy, he worked part-time in a machine shop. It was in the machine shop that he obtained a basic understanding and life-long interest in the field of mechanical technology. He

attended Columbia University where he earned the Bachelor of Science Degree in Mechanical Engineering.

His first professional engineering position, in 1949, dealt with quality control. By 1955, he had worked his way through a middle-management position and was named to a professional administrative management position. Founding the current corporation provided the president and general manager with his first opportunity to acquire controlling interest in a firm.

He has memberships in two professional societies relating to his field of endeavor. He is an active member of the Chamber of Commerce and Rotary Club in the community in which his plant is located. Personal affiliations also include the Masonic Lodge and membership on the governing board of his church. He is a member of the planning commission in the community, and he has received wide recognition and an award for exceptional accomplishments as a businessman. The award came from a federal agency.

Finance

The Industrial Develor nt Corporation of the community in which the plant is located assisted this individual in initial planning, developing, and financing of the operation. The beginning capital was $13,000. The local industrial group furnished a $125,000 package with the cooperation of the following state and Federal agencies: Area Redevelopment Administration, $19,500; Industrial Development Authority, $38,000; and Economic Development Administration, $350,000. There is a working-capital guarantee of loans by local banks. This support from state and Federal agencies, together with excellent cooperation of local banks, has allowed the company to grow from a small job shop four years ago to its present size.

The fiscal management appears to be quite sound. The company's accounting records are kept by the company comptroller who is a CPA. An annual audit of the firm's records is conducted by a reliable Oklahoma City CPA service.

Compensation to the president and general manager is in the form of a $30,000 annual salary. The vice-president receives $17,500 annually. The president has a $150,000 life-insurance policy payable to the company at his death. All buildings and machinery are covered by insurance.

Technical Information Interests

The technical information interests of this company have been quite varied, and a great volume of documentation has been provided to them by TUSC over the past five years. Several categories of information stand out from the volume of material provided this client. Such subjects as circuit design, solid-state devices, plating, etching, radio equipment, soldering, and brazing account for a major portion of the subject material. A total of 14 searches, many Tech Briefs, magazine articles, etc., have been provided. The total amount of information is shown in the following list:

Searches Requested

32	Permanent Ink for Stamping Electric Parts
113	State-of-the-Art Search on Cavity Circuits
114	State-of-the-Art Search on Electro-plating
115	State-of-the-Art Search on UHF/SHF Solid State Circuits
132	Information on Building Single Sideboard Transmission and Receiving Equipment, Especially for Marine Radio Gear
A-11	Design and Fabrication of Cavities for UHF/SHF Circuits
A-13	Design of UHF/SHF Solid State Circuits
A-14	Solid State VHF Circuits
A-15	Sample and Hold Circuits
A-21	Automatic Phase Control
A-37	Triangulator Wave Generator
A-60	Transmittors
A-66	Strip Lines (Design and Fabrication)
A-68	Induction Welding and/or Dip Brazing

Abstracts Provided

113	10 Abstracts
A-13	35 Abstracts
A-60	73 Abstracts
132	29 Abstracts
115	6 Abstracts

Abstracts Provided (Continued)

114	11 Abstracts
A-21	27 Abstracts
A-68	1 Abstract
A-37	5 Abstracts
32	2 Abstracts
A-11	15 Abstracts
A-14	26 Abstracts

Reports Ordered

A-68	N67-12705	Induction Brazing
132	A65-21117	An Assessment of Aircraft SSB
	A65-12127	An Experimental SSB-FM System
	A65-36523	Automatic Checkout of Single Sideboard Radio Sets
	A65-12123	Distortion of SSB Transmission Due to AM-PM Conversion
	A66-25510	A High-Power VHF Overlay Transistor for Single-Sideboard Applications
	N65-22343	SSB and VHF Crystal Filters
	N66-19574	Design, Development, and Fabrication of the High-Frequency Single-Sideboard Transceiver
	N65-16297	SSB and VHF Crystal Filters
	N65-28529	SSB and VHF Crystal Filters
	N65-10712	Crystal Units for Single Sideboard Application
	N67-16040	Calibrator - Single Sideboard Adaptor
A-66	N65-18193	Design Techniques for Varactor Frequency Multipliers
	N64-31919	Varactor Frequency Modulation of the Supported Drift Tube Klystron
A-13	N64-25994	Solid-State RF Generator
	N65-20913	Development of a C-Bond Solid-State Generator
	N65-11028	Solid-State RF Generator
A-15	N65-14023	Millimeter and Submillimeter Component Development
A-37	N65-35714	Triangular-Waveform Generator
A-70	N65-35645	Study of Fabrication Microelectronic Assemblies for Frequency and Time Control Systems

NASA Tech Briefs Provided

B66-10366	Hollow Spherical Rotors Fabricated by Electroplating
B66-10415	Electroplating Eliminates Gas Leakage in Brazed Areas
B66-10703	Silver Plating Technique Seals Leaks in Thin Wall Tubing Joints
B67-10124	Silver Plating Ensures Reliable Diffusion Bonding of Dissimilar Metals
B67-10053	Solid-State Time-to-Pulse-Height Converter Developed

Other Technical Information Provided

TR-753 UHF Telemetry Conversion Study
NASA CR-577 Biological Controls Systems--A Critical Review and Evaluation
SP 7011 (27)
TUSC Fact Brief on Lasers
IAR 1-1455 Punched-Tape Read-In Circuit Improvements for Numerical Control
NASA 741 Microelectronics in Space Research
"How to Photograph Cavities," Research/Development, July 1967, pp. 28-29.
FA-66-266 Foreign Market Surveys now available to U. S. Exporters from Clearinghouse
FA-65-227 Electronics
FA-65-285 Electronics

Articles from:
Modern Plastics, January 1967, p. 282 and December 1966, p. 222.
Materials in Design Engineering, January 1967, p. 42 and May 1966.

Production

Production control at present is manual rather than computerized. Quality control is maintained in accordance with mil-Q-9858A, as required by most of the company's military contracts. Procurement is handled through a purchasing agent. Component parts are purchased when contracts are received, and parts are expensed out if not used in a few months. This procedure together with immediate shipment of the product upon completion virtually eliminates the need for warehouse facilities as well as extensive inventory control. A commercial truckline is used in most outshipping, and air freight is used occasionally.

Marketing

The marketing organization is made up of one sales representative, one contract liaison man in Washington, D. C., and two manufacturing representatives. The president and general manager personally heads up the sales organization. There is no advertising expense since all sales are to the Federal government or to government contractors. Through the sales representative and

contract man, the manager maintains direct contacts with government agencies. This accounts for a major portion of the firm's contracts. Liaison on the part of engineering personnel and manufacturing representatives accounts for the remainder of the contracts.

Collection of accounts does not constitute a problem. About 85 percent of all the work is done under defense contracts. The Department of Defense policy of payment of balance within 30 days frees the firm of most collection efforts. Since the company began business in 1964, they have encountered only $500 in bad debts. The firm's pricing policy is based on a 10 percent profit on the total cost of the contract before taxes.

Location

Though it is located in the TUSC primary area of Southeastern Oklahoma, less than 10 percent of the company's raw materials come from Oklahoma. The remaining 90 percent comes from Ohio, the East Coast, and the West Coast areas. Transportation of raw materials is primarily by truck.

The company leases all of its floor space. They presently have a 20-year lease with 5-year renewal options. The space presently under lease will accomodate 450 employees.

Expansion

The firm's short-range expansion plans for their facility go no further than contract requirements. Their long-range plans which cover a period of six months to two years are to construct a new building of approximately 100,000 square feet to house the entire operations.

Short-range product-line expansion plans are the design and manufacture of military communications and telemetry equipment. Long-range plans are to design and build avionic instrumentation equipment for commercial aircraft.

Short-range market plans are for 80 to 85 percent Department of Defense contracts; the remainder for other prime contractors. Plans for long-range continuity of the business are to increase

In addition to continuing normal job-shop and subcontractor functions, the owner is presently continuing work on his incinerator. He is attempting to improve the prototype unit which he presently has in the company shop. The immediate objectives are to "de-bug" the prototype and begin marketing procedures as soon as possible.

Characteristics of the Owner

The owner of the firm is a native of the town in which the firm is presently located. One of five children, three boys and two girls, he attended elementary and high school in the community until he dropped out in the third year of high school. The apparent reason for his dropping out was the divorce of his parents. However, he has attended several trade schools in the field of welding; and while in the army, he attended electronics school.

He has considerable experience in welding and metal-fabrication, having performed such duties in several plants in Dallas, Houston, and Oklahoma City. Since returning to his home community, his experience has consisted of machine work and welding. Much of the welding was related to pressure vessel construction. In addition, he has gained substantial knowledge and experience in a variety of fields relating to the incinerator project. Knowledge and experience in the fields of high temperature metals, coatings, thermal insulators, electrodes, waste disposal, and filtering systems have been gained through the use of TUSC provided data--trial and error research and consultant advice.

The owner is a respected member of his community and a member of the Masonic Lodge. He is also a member of professional societies related to the fields of mechanical engineering, metalworking, and welding.

Finance

The company was first established by a $1,500 loan from a local bank. The loan was repaid in 90 days. Since the company has

employment to 500 in the current plant within five years and to expand the number of operating plants.

Case 3

Nature of Business

This company can best be described as a single proprietorship job-shop. The owner-manager is responsible for sales, contracts, production, and shipping. The firm is basically a welding shop, though it is involved quite often in subcontracting for an oil field equipment firm. The subcontract work consists of welding pressure vessels for the oil industry.

The company is also involved in one other activity. Through his work with pressure vessels, the owner conceived the idea of an electrically-fired incinerator employing a large pressure vessel. He had spent much time and effort in research and development and had made considerable progress on the incinerator when he was first contacted by TUSC.

At the time of first contact with TUSC, the physical facility consisted of a metal building with 4,800 square feet of concrete floor space and about 144 square feet of office space. The plant is located near a city of approximately 25,000 population on a U. S. highway. The production facility contains an inventory of welding machines, metal cutting band saws, a metal abrasive cutter, and related hand tools. At present, the firm employs two welders. It is a nonunion company with no fringe benefits.

The owner estimates that the number of customers he serves in his home community is 180. The annual sales of the welding shop now are estimated at $100,000 per year with $40,000 accounts receivable. The present raw material stock is valued at $600. Total assets of the company are approximately $116,000 with short-term liabilities of only $850. Long-term liabilities consist of a 3-year, $3,000 note and a note for $15,600 on the owner's home. He has an equity of $8,000 in his home and a small amount of cash in a checking account.

been operating in leased buildings, there has been no opportunity to expand operations. Therefore, the owner has done little planning toward capitalization for an expansion.

Fiscal management of the company is typically that of a small job-shop. Billing and bookwork is done by a certified public accountant. The owner has no fixed salary. Money is taken from company accounts as needed. The company presently has no major earnings retention. The only retention consists of a small savings account of approximately $100. The owner carries a $100,000 personal insurance policy, home liability and a home owners policy; but there is no liability on the company.

Technical Information Interests

The technical information interests of the company are closely related to the owner's electrically-fired incinerator project. It is doubtful if he would have ever established more than an occasional basic information contact with TUSC had he not become involved in the development of a more efficient method of waste disposal. The incinerator project began with pressure vessels and electrical power, subjects with which he had considerable experience. However, his basic "cut and try" research soon indicated to him that a variety of technical disciplines would be involved in the project. In view of this, his technical information interests increased, partially through counseling from outside sources, to include high temperature materials, waste disposal, insulators, electrical connectors, electrodes, plasma jet technology, and other related subjects. The following list of search requests and reports ordered depicts generic and specific subjects comprising his technical information interests:

Searches Requested

47 High Temperature Paint, High Temperature Electrical Insulators
48 State-of-the-Art on Aluminum Brazing
61 How to Measure Room Temperature to 3800^{o}F
63 Information on Types of Metal or Metals that will Withstand 3000^{o}F Heat and Higher

Searches Requested (Continued)

79	Information on Human Waste Disposal and Filtering Systems for Human Waste Disposals
58	What Type of Electrodes Will Withstand a 4000°F to 8000°F Without Excessive Amount of Burn Off
59 & 60	Both were engineering problems and could not be handled in this office
46	Better Insulators for Electrical Connections
49	Equipment to Purify Vapor Produced by Burning Waste
101	Separation of Liquids from Solids in Human Waste
178	Plasma Jet Technology

Abstracts Provided

47	107 Abstracts
48	18 Abstracts
61	5 Abstracts
79	16 Abstracts
46	21 Abstracts
49	10 Abstracts
101	9 Abstracts
178	6 Abstracts

Reports Ordered

47	N63-10103	High Temperature Materials Program
	N64-33121	Research on Low Density Thermal Insulations Materials for Use Above
	N65-23763	Properties of Refractory and Ablative Materials to 5000°F
	A64-23549	Materials at High Temperatures
	A64-19760	High Temperature Vacuum Furnace for Diffusion Studies
	A63-25215	Requirements for High Temperature Materials for Space Vehicles
	A64-11487	The System AI_2SiO_5 at High Temperature and Pressures
	N66-23153	Thermal Properties of High-Temperature Materials
46	N64-15533	Research on Low Density Thermal Insulation Materials for Use Above 3000°F
	N65-19855	Conference on Electrical Insulation
	N65-34502	Thermophysical Properties of Six Charring Abstracts from 140° to 700°K and Two Chars from 800°K to 3000°K
	N66-19973	Bibliography on the High Temperature Chemistry and Physics of Materials in the Condensed State, Volume 1965, Number 4, October, November, December, 1965.
	N66-13608	High Temperature Materials Program

Reports Ordered (Continued)

46	A65-18497	Mechanical Properties of Pyrolytic Graphite
49	N67-11019	Fundamentals of Air Purification
	N66-18800	Protection Against Fire Hazards in the Design of Filtered Ventilation Systems of Radioactive and Toxic Process Buildings
	AD 638 293	Gaseous Contaminant by Adsorption
	N66-31872	Development of U-Foam Air Filters
	N66-25488	The Use of Incinerators for Treatment of Combustible Wastes
101	N67-17717	Recovery of Clostrida from Human Feces, Development of a Method
	N64-21554	Combustion of Human Waste and Product Recovery
	N63-11482	Growth of Chlorella on Products from the Incineration of Human Wastes
	N64-19556	Gross Chemical Changes of Human Waste Undergoing Thermal Decomposition
178	N65-10563	Temperature Measurements on a Plasma Jet
	N65-33410	Contributions to the Study of the Plasma Jet
	N64-29926	The Evaluation of High Temperature Materials Systems with an Arc-Plasma-Jet
	N65-27610	The Plasma Jet Flame-A Versatile Aid in Metal Processing
	N65-15233	Thermal Characteristics of a High and Low Mass Flux Argon Plasma Jet
	N65-14216	The Plasma Jet

NASA Tech Briefs Provided

101	TB 66-10319	Fiber Length and Orientation Prevent Migration in Fluid Filters
	TB 65-10394	Centrifugal Device Separates Liquid from Gas
	TB 66-10008	Automatic Fluid Separator Supplies Own Driving Power
178	TB 67-10024	Plasma Jet Electrode Has Longer Operating Life

Other Technical Information Provided

48 "Aluminum Structures Joined by Fluxless Brazing," Design Engineering, March 1965, pp. 122-123.
Aluminum Data Book, Reynolds Metal Co., 1961, pp. 7, 57, 172, 175-177.
"Solid State Bonding," Welding Aluminum, 1966, pp. 115-120.
Aluminum in Modern Architecture, 1956, pp. 101-105.
"New Bi-Metallic Brazing Process Meets Aerospace's Special Requirements," The Welding Journal, pp. 10, 511.

58 "Three Ways to Protect Graphite Against High Temperature," Materials in Design Engineering, June 1966, pp. 93-95.
"Properties of Materials in a Heat Environment," Materials in Design Engineering, December 1965, pp. 113-134.
63 "Melting Point of Metals and Ceramics"
178 NASA SP-5033, Plasma Jet Technology
CR-813, NASA Contributions to the Use of Plasma Jet Technology in Chemical Processing

Production

The nature of the basic operation of the company is welding and metal fabrication. There is no organized manufacturing or assembly line and no specific product. There is no organized effort at quality control or manufacturing control other than that exercised by the owner. He does exercise strong personal control over all work performed. In view of his extensive experience in the field, work leaving the shop reflects a high degree of quality.

An additional operation is the incinerator project, with which he spends as much time as possible. Since he personally handles that project, he is directly in control of the quality of the work. It is in relation to that project that he has obtained two registered patents. Both patents relate to a pressure vessel incinerator. The patents apply to the method of firing the incinerator. One is for the electrically-fired incinerator; the other involves the use of a plasma jet.

Procurement of raw materials is generally on an "as needed" basis and on a small scale. The raw materials used in the prototype include a special grade of high-temperature steel obtained from an Oklahoma steel sales outlet. No formal procurement procedures are used. Since there is, as yet, no volume production, there is no warehousing, inventory control, or transportation utilized.

Marketing

Since the basic operation of the company is primarily job-shopping and subcontracting on a small scale, there are no formal sales, marketing, advertising, and crediting procedures. These functions are performed by the owner either through visits to a prospective customer or at the plant in the case of local customers.

There are likewise no such procedures yet established for the incinerator project since it is still in a prototype stage. The owner does feel that the potential market is wide open since no equipment of that nature is presently in existence. He has not at this time established a price for the incinerator units.

Location

The present location of the client is near a town of approximately 25,000 which is currently enjoying a high rate of industrial growth. The only raw materials presently required are conventional welding and machine supplies, which are available in or near his home community, and the special steel for his incinerator project which he obtains from another area of Oklahoma. He is leasing his building and has no plans of expansion at this time.

Expansion

The incinerator project is not advanced to the point that the company can begin serious thought of expansion. The product line at present is vague. However, if proved feasible, it might consist of a variety of incinerators ranging from home-size models to a large truck-mounted unit. The market for such a product is wide open.

Plans for long-time continuity of the business are rather undefined. It appears quite obvious that if the company continues to operate as a welding and machine job-shop, moderate to fast growth could occur because of the increased industrial growth of the community. However, long-term continuity of the company, if based on the incinerator project, is undetermined. Plans were laid for development and marketing of the incinerator. At the outset of these plans, a partnership was formed with one partner doing strictly promotional work to secure the much-needed capital for the development and marketing. At that point, considerable liaison on the part of TUSC and NASA officials located potential sources of the capital needed. The use of that available capital could have speeded the development of the incinerator and placed

a product on the market. However, a personality conflict and differences over methods of stock sales thwarted the possibility of immediate success via that route. The development is still proceeding at a considerably reduced rate through the efforts of the owner of the company who hol the patents. He still has definite plans to place an electrically-fired incinerator on the market at some future date.

Case 4

This case is unique in that it does not involve a specific company. The client is an individual who has working contacts with numerous companies. He has no product as such since he is primarily a developer of ideas and is thus an inventor/innovator. Once he has worked on an idea sufficiently to prove the feasibility of converting it to a finished product, he immediately sells it to a company with production capability. By operating in this manner, he has no employees and no responsibilities such as accounts receivable, production control, quality control, etc., which are to be found in a production facility. His annual sales average $20,000 a year, and he indicates he has no short or long-term liabilities. He operates from his farm home in a small community near U. S. Highway 69-75 in Southeastern Oklahoma. He usually works with, or sells to, six or eight Oklahoma and Texas companies a year. His personal objectives are to seek, find, and develop opportunities for the economic enhancement of this area.

Characteristics of the Owner

The client is a native of Bryan County, Oklahoma, and is the only son of his parents. He has one sister. He was a second generation student of Southeastern. However, he transferred to Oklahoma State University where he obtained Bachelor of Science and Master of Education degrees.

He holds a Master of Business Administration from Stanford University and also completed two semesters of work at the University of Mexico where he developed a bilingual capability. His work

experience includes engineering duties with Bechtel Construction Company and plant engineering for Gulf Oil Corporation. The type of work involved in those assignments included engineering and other technical duties relating to the design and building of sugar refineries, oil refineries, and fertilizer plants. He has been self-employed in the design-engineering business. Much of his experience was gained at company sites located in Latin American countries. He has had experience in performing or providing input for feasibility studies and other management services. His professional affiliations are with the Oklahoma Society of Professional Engineers and the National Society of Professional Engineers. He chose not to divulge his total financial affairs for this case study.

Technical Information Interests

It is difficult to identify any exact parameters of this client's technical information interests. His interests range from the petroleum industry to the food industry and include such technical subjects as laser design and operation, metal coating, and semipermeable membranes. This is clearly shown by the following list of varied search requests and document dissemination:

Searches Requested

93 Removal of Hydrogen
136 What Is The State-of-the-Art on Semipermeable Membranes Pertaining to Liquids?
153 What Is the Best System for Metal Coating?
1. Vacuum
2. Electroplating
3. Flame Spraying
182 State-of-the-Art on Lasers
194 Information on Offshore Drilling
198 What Are the Raw Materials a Fiberglass Producer Would Look For?
201 Fiberglass General Information
205 Lasers for Stress Analysis
258 Infrared Radiation Measurement

Searches Requested (Continued)

274 Where Can I Purchase Electric Motors with the Following Specifications:
1. 12 Volts
2. 1/40 Horsepower
3. 6 RPM
4. 120 Inch-Pounds of Torque

Abstracts Provided

93	25 Abstracts
136	22 Abstracts
153	21 Abstracts
182	29 Abstracts
198	4 Abstracts
201	7 Abstracts
205	8 Abstracts
258	5 Abstracts

Reports Ordered

136	N65-19054	The Electrical Properties of Semipermeable Membranes
153	N67-31570	An Improved Spatterproof Vacuum Evaporation Source
	N67-28463	Problems in the Production of Thin Films
	N66-38738	Some Methods of Depositing Metals on Plastics
	N65-17003	Electroplating Explosive Devices
	N67-32299	Coatings of High-Melting Compounds on Graphite
	N66-32216	Adhesion and Thermal Properties of Refractory Coatings-Metal Substrate Systems
	N65-28278	Plastic for Flame Spraying and Their Characteristics
198	N67-11122	Methods and Applications of Fiberglass Production

NASA Tech Brief Provided

93	B66-10340	Device Removes Hydrogen Gas from Enclosed Spaces

Other Technical Information Provided

136 Industrial Research, August 1967, pp. 34-35
153 Welding Journal, December 1964, pp. 12-13
"Prefinished Metals," Materials in Design Engineering, March 1967, pp. 97-108
"Clean, Fast Vacuum Brazing Joins Diverse Materials," Materials Engineering, December 1967, pp. 76-78

"Metallurgy of Flame Sprayed Nickel Aluminide Coatings," Welding Journal, February 1966, pp. 66s-69s
"Turbines Don Coats for Wear," The Iron Age, March 28, 1968, pp. 72-73
194 23 Articles from Oil and Gas Journal
198 Articles from McGraw-Hill
201 "Mill Creek Area," Economic Geology, Southeastern State College Library
258 Article from McGraw-Hill
274 Article from Sweet's

Production and Marketing

Since there is no product involved in the operations of this client, other than his own ideas, he handles all marketing himself by approaching potential buyers of his ideas. He holds several patents relating to oil field equipment and plant design. TUSC does not have available the specific descriptions of these innovations. The long-term continuity plans of the client are apparently to continue his "brainstorming" of new ideas which might benefit this area.

Case 5

Nature of the Business

This client is a recently-formed company which is engaged in the research and development of a new product. The product under development is an electronic educational and training aid. At the present time, the physical facilities are meager due to budget constraints imposed by the cost of research and development. Office and laboratory space are located in a 16 ft. by 40 ft. building in the downtown area of the client's hometown.

There are no production or warehouse facilities at this time, though planning is presently underway. The staff consists of the owner/managers and one laboratory assistant. There are no union ties and no fringe benefits yet. Since the product is not yet being produced in volume, there is no customer list. However, spot surveys have indicated the market will be nationwide. The inventory

which includes raw materials, work in process, and a working-demonstration system is valued at $6,000.

The financial structure is not yet developed to the point that all items can be categorized. It can be stated that the client and his family maintain a controlling interest. He disposed of 40 percent of the stock in order to finance himself during the one-year development time. He has been frugal in his family and personal activity and has exercised sound judgment in applying available resources toward the development of the product. Typical of his economy-minded approach was his choice of a combined shop-laboratory-office in an extremely cramped area. He has also been very selective in expending funds on expert assistance where he felt his capabilities were limited. His organizational objectives are to develop the product and sell it to a major corporation which has a national marketing ability.

Characteristics of the Owner

The owner of this company is the older of two brothers reared in a small Oklahoma community. He earned an electrical engineering degree from the University of Oklahoma in 1957 and has since done considerable graduate work in electrical engineering at the University of New Mexico. His first work experience was in the Air Force as an electronics instructor. Following his military duty, he was employed by Sylvania Corporation as a design engineer. From there, he moved to King Radio Corporation, a producer of avionics equipment and material. His most recent experience consisted of three years as Chief Engineer for Oklahoma Aerotronics, Inc. He conceived the idea of a teaching aid while with Oklahoma Aerotronics and eventually quit to devote full time to his invention.

Finance

The beginning capital was $20,000. This venture capital came from personal savings of the owner and his family, supplemented by funds from an outside source who showed considerable interest in

the invention. In return for the funds, this investor obtained 40 percent of the company stock. At this time, there are no plans for capitalization of expansion. The client plans to sell the equity when demand increases the value of the stock. The owner personally keeps the accounting records and did not disclose his own compensation.

Technical Information Interests

The area of interest of this client is quite narrowly defined. Since the product under development is essentially a responder, the prime interest of the owner is in the field of frequency and time-control systems. The following is a list of detailed information in the form of NASA documents and other TUSC data on the subject of frequency synthesizers supplied to the client during the past two years:

Searches Requested

188	State-of-the-Art in Student Responders in Machine Teaching
A-42	Solid State Variable Frequency Oscillators
A-70	Frequency Synthesizers with Digital Control

Abstracts Provided

188	22 Abstracts
A-42	1 Abstract
A-70	21 Abstracts

Reports Ordered

132	N66-39699	Comparison of Spectra of Single Sideboard and Phase Modulated Signals
A-21	N65-20337	Oscillator Frequency Regulation by Means of an Automatic Phase Control Circuit with a Blocking Capacitor in Its Feedback Loop
A-42	N65-10092	Frequency Fluctuations of an Oscillator When Automatic Frequency Stabilization Circuits Are Used
A-70	N64-29505	Airborne Range and Orbit Determination System, Vehicle Master Oscillator and Frequency Synthesizer
	A64-18290	Digital Frequency Synthesizer

A65-35124	Phase-Shift Frequency Synthesizers
A65-28278	Frequency Synthesizers
A66-11927	A 28,000 Channel Frequency Synthesizer in 10 Cubic Inches
N65-10735	Frequency Synthesizing Techniques Permitting Direct Control and Rapid Switching
N66-12519	Research and Development Investigation of a Precision Digital Frequency Synthesizer for SSB

Production

Production to date consists of only one complete demonstration model of the system. The client is currently engaged in planning which he expects to result in efficient production techniques.

Marketing

The demonstration model has been shown to civilian and military education officials who have indicated a considerable interest in the system. However, the client does not plan to market the device himself. His plans are to sell it to a large corporation which can effectively market the product on a nationwide scale. He has been approached with an offer by a large firm. He did not refuse the offer; but at this time, he feels he cannot accept it. He feels the system needs a little more development. This addi-

assistance he needs to refine the product further. Some of the more urgent assistance which he needs is in the completion of production drawings. The drawings are required so that bids can be taken and an exact cost figure established. In view of his expressed intention of selling to a large firm, it would appear, that at the most, his plans for long-term continuity would not exceed retention of some stock in the product line.

Case 6

Nature of the Business

This corporation, presently involved directly in only one product line, has consistently been one of TUSC's most prolific users. Though the major part of this case study reflects the company's position in relation to its present product, the technical information interests profile is indicative of several other product lines in which the client company is now indirectly involved or with which it has been concerned in the past. In the case of the present product and in many of the others, there is considerable evidence of TUSC impact.

The corporation is closely held by 13 stockholders. The major product line consists of electrically powered, two-wheeled vehicles. The president of the company stated that they were primarily designed to be used as one-man golf carts. However, he indicates that they lend themselves to many other applications, such as transportation in large manufacturing plants or short distance commuting.

The manufacturing operation, which is handled by the Stromberg-Carlson Division of General Dynamics, is located separately from the client company's home facility. That enables the client to utilize the home facility for product development, marketing, and research. The facility consists of a metal building with 5,000 square feet of floor space, 2,500 square feet of concrete slab outside storage space, and 1,000 square feet of office space.

The company has three full-time and two part-time employees. They are nonunion and have no fringe benefits other than workmen's compensation.

At the present time, the company has 25 dealer-distributers and is actively recruiting more. The market area includes the entire United States, and plans are under way to initiate an export sales program. The projected annual sales are in excess of $1,000,000. There are no accounts receivable because all sales are cash. Raw material commitments to the manufacturer on the short run amount to $20,000. One hundred and seventy-five units, representing $30,000, are now in various stages of production. Finished goods on hand consist of only eight units. Since units are shipped upon completion, there will seldom be a large inventory on hand.

The company has approximately $6,000 invested in equipment for development. This equipment consists of welding machines, drills, bending machines, and other machinery required to fabricate the product. Short-term liabilities of the company are $1,500 in accounts payable. There are no long-term liabilities. The owner's equity is $50,000 with the owner-president and his brother holding 40 percent of the stock.

This company exemplifies the marketing concept in its organizational objectives. The owner began his present product line with an idea developed from an investigation of market demand. That is characteristic of his approach to previous product lines. In the case of the electrically powered two-wheeled cart, he sought to develop a unit which would use existing power sources that are available at a low cost. It was in his search for and analysis of available power sources that TUSC provided assistance on this project. Two concepts which are basic to the product line are price and power source. The owner plans to pattern the operations of his firm after the automotive industry wherever possible. Ultimately, he wants to produce both two- and four-wheeled vehicles.

Characteristics of the Owner

The developer of this firm, and present majority stockholder, grew up in Southern Oklahoma. He is the oldest of four children. His father is an attorney. He credits the availability of legal advice as being most instrumental in his firm's growth and development. His goal has been to remain in Southern Oklahoma. He felt he had to create something of his own in order to have the opportunity he wanted. He has a basic philosophy that stresses the need for doing what one enjoys. He stressed that he never liked being told what to do.

The client attended the University of Oklahoma for three years. His father's interest in the petroleum industry and the possibility of a lucrative salary caused him to choose geology as his major field of study. However, he stated that he was never really interested in that field. By his own admission, he was a poor student and eventually dropped from college to enter the automobile business which he wanted to learn. He offered to work for nothing to learn the automobile business.

He subsequently started work for an automobile dealer at $125 per month and 6 percent commission on units sold. At the age of 21, he started his own used-car operations. Now at the age of 38, he is still self-employed.

From auto sales, he gravitated to the coin-operated laundry business. It was this venture which actually launched his career as a product developer-innovator-entrepreneur. While in the laundry business, he developed a line of allied products sold in the coin-operated laundry industry. He later became a dealer-distributor of the laundry products he had developed.

Following his endeavors in the development of laundry products, he developed his first, and to date his largest, significant product line. This was the coin-operated car wash. He sold the patent rights to the car wash in 1963. During the first eight months after opening his first car wash (MAGIC-WAND), his firm realized $3 million in sales.

Other product lines, to which the client has devoted time and some on which he holds patent rights, are trailer hitches; photographic devices; plastics; concrete panels; and inflatable structures. Some of these product lines have been sold, some dropped for various reasons, and the remainder held in abeyance. At this time, the latter are receiving little attention due to his concentrated efforts at developing the electric cart.

The client has concentrated his memberships and affiliations in organizations that are business related. He was formerly active in the Junior Chamber of Commerce where he served on the Board of Directors. He has an active political interest and has coordinated three local campaigns. He is currently a member of the Board of Directors of the ten-county Southern Oklahoma Development Association (SODA). He is a member of the SODA Trust and a director of the Chamber of Commerce in his home community. He is very much interested in civic drives, industrial development, and related governmental programs.

Finance

The capital with which this client began his business career was $200 which he invested in the used-car business. In the venture he is presently pursuing, the initial capital consisted of a $50,000 stock investment. He estimates that the present net worth is in the area of $225,000. Capitalization for expansion is acquired through retained earnings and stock sales to a small group of investors. He wants the firm to reach a point where expanded stock sales to the general public are possible.

All accounting records of the company are maintained by a public accounting firm. The public accountant is a former representative of the Internal Revenue Service. The client indicates that he was instrumental in the accountant's decision to operate his own firm. He stated that he urged the accountant to do so. The client's knowledge of fiscal management was gained while he was in the automobile business. He studied the practices of lending agencies to learn what they sought in a loan. Indicative of his

deliberate and well-planned approach to founding a successful business is his method of establishing a good credit rating. He borrowed money from a bank, paid interest, and repaid the loan without ever using the money.

The present endeavor is the first one in which he has been paid a fixed salary. In previous ventures, he simply withdrew funds as he needed them. The firm is presently operating under a 100 percent profit or earnings retention policy.

Insurance coverage consists of $225,000. Personal insurance on the owner is a $190,000 term-insurance policy. The balance is in a product liability insurance.

Technical Information Interests

The technical information interests of this client are extremely diversified as indicated by the variety of product lines in which he has become actively engaged. Diversification is further indicated by the broad field of subjects shown in the list below of searches requested and reports ordered. However, the client was quick to point out that from a standpoint of the TUSC service provided to fulfill his technical information needs that a product list and search list do not tell the full story. He stated that the TUSC Field Specialists themselves, whom he considers as sources of additional information, were of significant assistance to him. He feels that in some ways the contact with a TUSC Field Specialist outweighed material provided from the data bank. He stated that the specialists were not only helpful in providing information but also assisted in analysis of the information and aided in its application.

Searches Requested

5	Equipment for Photographic Surveillance
35	Methods of Washing Aircraft
57	Information on a Cold Process to Make Plastic Parts
81	What Is the Present State-of-the-Art in Mixing Lightweight Concrete
83	Information on Inflatable Building and Equipment Used to Inflate Buildings

95	What Is the State-of-the-Art of Steam Drying Concrete Products
102	Methods of Using Air to Dry Carpets
137	Power Cell to Propel Golf Carts
177	Dry Cell Batteries

Abstracts Provided

5	21 Abstracts
35	1 Abstract
81	4 Abstracts
83	3 Abstracts
95	2 Abstracts
102	7 Abstracts
137	7 Abstracts
177	6 Abstracts

Pertaining to previous searches: 20 Abstracts

Reports Ordered

83	N66-24210	Analysis and Measurement of Materials with Low-Energy Radiation
35	N66-29387	An Expansion of the E. V. System
	N65-11143	Comparison of Solvents for Cleaning Metal Surfaces
83	N62-15166	The Application of Inflatable Structures to the Ground Effect Machine
81	N63-20454	Capabilities in Concrete Research
	N65-22292	The Strength of Portland-Cement Concrete as Affected by Air, Water, and Cement Content
	N66-12552	Dynamic Behavior of Concrete
	N66-21225	Comparison of the Ultimate Food Carrying Capacity of Laterally Restrained/Unrestrained, Cement Mortar Model Beams and Two-Way Panels

NASA Tech Briefs Provided

83	B67-10023	Tests Show That Aluminum Welds Are Improved by Bead Removal
	B67-10018	Technique Cuts Time and Cost of Bending Jacketed Piping
	B66-10111	Storage - Stable Foamable Polyurethane Is Activated by Heat

Other Technical Information Provided

Portland Cement Association, Research Department Bulletin:
81 158 Durability Studies of Exposed Aggregate Panels
183 An Improved Procedure for Proportioning Mixes of Structural Lightweight Concrete
195 Improved Method of Testing Tensile Bond Strength of Masonry Mortars
196 The Nature of Concrete
197 Pore Structure

Portland Cement Association, Development Department Bulletin:
95 D13 Effect of Variations in Curing and Drying on the Physical Properties of Concrete Masonry Units
D62 Optimum Steam Curing Procedure in Precasting Plants
D62A Supplement to D62
D75 Prestress Loss as Affected by Type of Curing

Fast Announcements:
95 66-302 Nuclear Technology--New Government R & D Reports Available from Clearinghouse

Technical Translation:
5 F-337 Steroscopic Filming of Rapid Processes by Two Independently Operating Moving Picture Cameras
F-377 Photographic Recording of High-Speed Processes

Magazines:
35 "What Does Pennsalt Know About Maintenance Cleaning," American Aviation, September 1966
"Suppliers' Literature," Materials in Design Engineering, July 1965, pp. 47-49
"Suppliers' Literature," Materials in Design Engineering, February 1967, p. 140
"Suppliers' Literature," Materials in Design Engineering, August 1965, p. 39
57 "Low Cost Neoprene Dip Moldings and Coatings," Materials in Design Engineering, June 1965, pp. 93-94
"Fluidized Bed Coating, Part II," Modern Plastics, September 1966, pp. 150-154
"Fluidized Bed Coating, Part I," Modern Plastics, August 1966, pp. 111-116, 120
Cope's Plastics Book, pp. 260-261

Production

A major portion of the duties involving production control do not directly concern the client. By transferring production to another nearby firm, the client has been able to realize an operation of $500,000 on the basis of a $50,000 investment. At the same

time, he has no production and quality control problems to worry him or detract from his efforts at continued research and marketing. He does maintain a final procurement right, though that too is handled by the firm which is actually manufacturing the product. This firm also manages the warehousing and the transportation which is by truck. It is presently causing some problems due to a lack of a long lead-time which is characteristic of small companies. That problem is not insurmountable, and conditions should improve with growth.

The product line is protected by three patents owned by the company. In addition, the owner personally holds several other patents including the coin-operated car wash and a patent pending on a trailer hitch.

Marketing

The client-company shoulders all the marketing and product development responsibilities. Continuous product development is anticipated to maintain a competitive advantage. The owner personally handles the marketing and development operations. There are dealers operating in 25 states, and negotiations are presently underway which will involve two foreign dealers.

The client considers television to be the one acceptable medium of advertising. Yet, he cannot justify the use of television advertisements because costs are too prohibitive. He is presently using dealer/product promotion ads in the Specialty Selling Magazine. Sales brochures and sales letters are being used. The client and his secretary have done the art work involved in the promotional literature. A Dallas printing firm was contracted to do four color brochures.

The company sells on a strict cash basis. As a result, there are no credit and collection functions necessary within the company. The reason the company can operate on a "cash and carry" basis is that there is no direct competition for the firm's products. There are definite plans for continued updating of the

product to maintain this favorable position. The pricing policy is based on a target return on the investment of 25 percent on gross sales.

Location

The client company is located in a town of approximately 25,000 population. It has good access to major cities via U. S. highways. The town is presently experiencing considerable growth and has recently been chosen as the site of a major industry and several smaller ones. The market in the company's home area should be good due to a climate favorable to recreation. It should allow an excellent chance to do test marketing and to develop product innovations. Since transportation is by truck, load times on raw material and product shipment are sometimes problematical; but they do not constitute a major obstacle.

The property on which the firm is located belongs to the client himself. He has sufficient room for expansion should the necessity arise.

At this time, there are plans to expand. In fact, the client hopes that the present product line will grow to the point that the corporation can soon sell stock on the open market.

Generalizations From Case Studies

There were obviously several factors which contributed to the growth and success of the TUSC clients described in this chapter. Government agencies, local attitudes, and the entrepreneural ability of the owners, were only a few of the contributing factors. Based on the information shown in these cases, there is a strong evidence of TUSC impact. However, there has been no effort in this chapter to quantify the impact. The cases stand on their own merits. Profiles of the clients and lists of service and information dissemination provide the evidence of TUSC-client relations.

The cases, ranging from the individual inventor/innovator described in Case 4 to the small manufacturer in Case 2, represent the clientele TUSC has served during the past five years. They are

also representative of small firms throughout Oklahoma and the United States. They would seem to be the type of firms for which the State Technical Services Act of 1965 was designed. In fact, TUSC itself may well be considered as having been a pilot project for the STS effort by its pioneering of the operational procedures necessary to extend a helping hand to firms such as those shown in this study.

Several characteristics common virtually to all these firms may be seen. Especially obvious are the features found in the larger companies that are lacking in the TUSC client companies. Among the missing features are: (1) research capability, (2) ready, effective access to current scientific and technical information, and (3) ability to apply new technology in its raw form. These features are covered in more detail in Chapter IX, "Ancillary Understandings."

Chapter V discusses other instances within the primary area in which TUSC impact is indicated. Much of the activity covered in Chapter V resulted in productive contacts with individuals and firms such as the ones described in this chapter.

CHAPTER V

OTHER IMPACT INSIDE THE PRIMARY AREA

Assistance to Chamber of Commerce and Community Industrial Development Officials

During the five-year existence of TUSC, economic data service has been made available to all interested individuals and agencies within the primary area. Chapter IV detailed selected examples of TUSC services to specific clients, representing both firms and individual entrepreneurs. These services fell primarily, although not entirely, in the area of technical assistance. This chapter deals with the TUSC services that represent a broader framework of TUSC assistance. The regional user of this type assistance is usually either a community leader or an agency involved in community and area industrial development. Chamber of Commerce managers and Economic Development District directors fall into this category. The TUSC material-supporting service to these area clients consisted primarily of the county profile data, TUSC bulletings, and the TUSC Four Year Report. Other supplementary material, referrals, and specific direct counseling were also employed in some cases.

Exact quantification of TUSC impact in the case of the area user is difficult if not impossible. The reason is that in the wholesale dissemination of data the information content is so widely diffused that a major portion of it is not directly traceable. It is not simply a case of specific knowledge transfer. It may be more accurately described as a general educational process. However, there is considerable evidence of an impact. In an attempt to identify impact, TUSC approached the initial users directly. In some cases, we were fortunate enough to identify secondary users

through the contacts with the initial recipients of the TUSC data service. The methods used in the survey are described in the following paragraphs.

Questionnaires (Appendices C and D) were completed by individuals and organizations within the primary area. The recipients were persons and agencies involved in industrial development who had received TUSC data. Chambers of Commerce representatives, utility companies personnel, and employees of local, state, and Federal government agencies were all included. Responses to the questionnaires indicate that Southeastern Oklahoma is realizing an accelerated rate of industrial growth. Compilations of responses cannot be considered as absolute fact; because, undoubtedly, respondents of necessity had to estimate the number of firms that have been organized in their communities during each of the past five years. It is significant, however, that the responses reflect growth. In this area which, since the 1930's has experienced a continuous out-migration of people, any indication of even a slight upward movement in business and/or industrial activity would appear significant.

Though some use of other TUSC data is indicated, the county data appears to have been quite useful in providing industrial prospects with up-to-date information concerning the statistics so necessary to establishing or expanding an industrial operation. Without the statistics of current manpower, educational facilities, natural resources, and other related data readily available, a community has little chance of attracting the interest of prospective businesses that are seeking new plant locations. The following statements indicate that many primary-area users of the profile data books relied on them in providing important statistics to industrial prospects:

> ...has been useful in gathering data asked by industrial prospects. First time to my knowledge that such information has been pulled together into a central source.

> TUSC data and TUSC research were especially helpful in locating Polaris activated carbon plant facilities in Coalgate.

> We believe the ideas available from this source, and no other within hundreds of miles, offer the greatest potential for development of all of Southeast Oklahoma and, possibly, the Southwest.
>
> Used county profile in compiling community data fact sheet for Oklahoma Industrial Development and Parks Department. Submitted data to several industrial prospects during the year.
>
> ...in helping the area keep their community data updated and readily available is one of the key factors in site location. Research; quality, factual feasibility studies; and research and development will become more important each year.

In view of the many times the profile data have been presented to industrial prospects, it appears obvious that significant impact has occurred.

Impact in the case of users other than industrial prospects is much harder to identify. It is in these cases that broad diffusion of information occurs. Though some of these are secondary users, whose applications of TUSC data can be identified, most of them use the materials in varied ways thereby eliminating any chances of tracing them. Once the information has been incorporated into a study, dissertation, or news article, assessment of the impact is impossible. The following statements portray some of the various applications of TUSC profile data:

> Extremely useful fact source for preparation of news stories.
>
> Used materials for news articles and presentation to groups along with other data sources.
>
> Helped to determine course offerings for the new area schools to be located in Southeast Oklahoma.
>
> Preparation of the SODA District OEDP background reference, statistics, etc.
>
> ...in planning OSU Extension Programs in conjunction with the county OEDP.

> We used the data in documenting requests for financial assistance by communities to EDA.
>
> ...obtain information for Federal Grant requirements.

Many of these statements point to the application of TUSC data in areas far beyond the originally intended uses. It appears that the users in the category described in this chapter are innovative in their applications of the profile data.

The profile data have served an additional purpose by providing an entry for the dissemination of technical materials and assistance in the primary area. The value of the profile data in serving the needs of Chambers of Commerce and other community officials has impressed them to the point that, in many cases, they are the best publicity channel TUSC has in the area. Their assistance and recommendations are necessary in establishing a rapport with the members of the business community who may need technical assistance. Establishing and operating a technical field service program in the primary area is a slow painful process at best. Without the support of some of the centers of influence in a community, "getting a foot in the door" for field service activity is even more difficult. The community officials, who are pleased with the information provided them, are quite willing to provide testimony to TUSC's capabilities and good intentions. In some cases they have actively solicited and directed industrial clients to use TUSC.

Chapter III showed that there has been significant, new industrial activity and growth during the five years of TUSC's operation. The survey of community leaders shows that they used TUSC profile data and, in some cases, technical information in the early stages of their industrial recruiting. In virtually all these cases, TUSC is listed as an excellent source of expertise which would be locally available. One Chamber official said that whether a firm located in his city or not, the firm would use TUSC services if it located anywhere in Southeastern Oklahoma.

The information derived from the survey questionnaire indicates that TUSC has had an impact on the primary area through both the profile data and the technical services extended to community officials. It seems that the identifiable impact shown in relation to the probable overall impact may be compared with an iceberg viewed from the surface. There is much more beneath the surface than is visible above. In the dissemination of knowledge, a major portion is hidden from view by a process of diffusion.

TUSC Assistance to Economic Development Districts

TUSC has provided economic and technical assistance on many occasions to the two economic development district organizations in the primary area. They are the Kiamichi Economic Development District of Oklahoma (KEDDO) and the Southern Oklahoma Development Association (SODA).

Assistance to KEDDO

Dr. Lee Zink, former TUSC Director, was instrumental in generating support in the region for organizing KEDDO and assisted in obtaining a director for the new development district. During the formative stages of KEDDO, the entire economic data file at TUSC was made available to Mr. Wesley Watkins, Executive Director of KEDDO, to assist him in preparation of the KEDDO Overall Economic Development Program (OEDP). Harold Warren, TUSC Regional Economist, provided assistance to KEDDO through compiling and analyzing data that went into the OEDP. The primary data source for the writing of the Kiamichi OEDP was the TUSC county profile series. In the foreword to the Kiamichi OEDP, Mr. Watkins singled out Dr. Zink and Mr. Warren to express a special appreciation for the major contribution TUSC made to KEDDO. The counties included in the KEDDO district are shown on the map in Figure 5.1.

FIGURE 5.1

KIAMICHI ECONOMIC DEVELOPMENT DISTRICT OF OKLAHOMA

Assistance to SODA

The TUSC staff attended the first organizational meetings of SODA and provided the SODA organizers with a set of the profile data books which were used in developing the SODA program. SODA has regularly called on TUSC for both profile data and technical material.

The most significant single instance of assistance to SODA was in the preparation of a preliminary feasibility study by the TUSC staff for a SODA client-company. Mr. Jim Gigoux, Executive Director of SODA, referred the company to TUSC for data service and assistance relating to the feasibility of producing activated carbon in the TUSC region.

The firm, with headquarters in Chicago, had discovered that the Oklahoma scrub hardwood made a grade of activated carbon far superior to most softwood activated carbon which dominates the present market. They knew of the extensive efforts aimed at clearing scrub timber for grazing land and could see possibilities of a cooperative effort of mutual benefit to landowners and a carbon producer.

The company involved was at the time seeking to secure funding for a proposed activated-carbon plant in a local community. In that endeavor they needed an economic feasibility study within a week from the time TUSC was contacted. The TUSC response to the request was that a complete feasibility study was not a possibility due to the time constraint imposed by the company. It was indicated, however, that a reply to the request could be made but that the resulting study would at most be only preliminary.

The study, referred to by SODA and the client firm as a feasibility study, was completed by TUSC in one week. It was described by TUSC as a Preliminary Economic-Market Feasibility Study for Production of Activated Carbon in the area of Southeastern Oklahoma designated by the client firm. The TUSC approach was to examine in as much depth as possible in seven days the ramifications of the market as identified by the client and other TUSC-selected sources. The TUSC sources included included a survey of several major cities

using activated carbon as a primary ingredient in water purification processes. Raw material resources and costs were investigated in the field by personal contacts with loggers and haulers. Economic data involving labor supply, the need for employment, and the impact in the plant area were obtained primarily from previously developed material in the TUSC economic data library. The impact of land clearance was determined by in-the-field visitation with landowners.

The study, consisting of 45 pages of summarized data, tables, charts, and map of the area, was delivered to a representative of the client-company seven days after the project was started. SODA and the client-company were both quite impressed with the report. The chief executive of the Chicago-based parent company visited TUSC personally to express his appreciation. Statements such as the following were received from SODA, the client firm, and others involved in industrial development in Oklahoma:

> "...were referred to TUSC, for a feasibility study, by SODA which resulted in the decision to construct a plant . . . ."

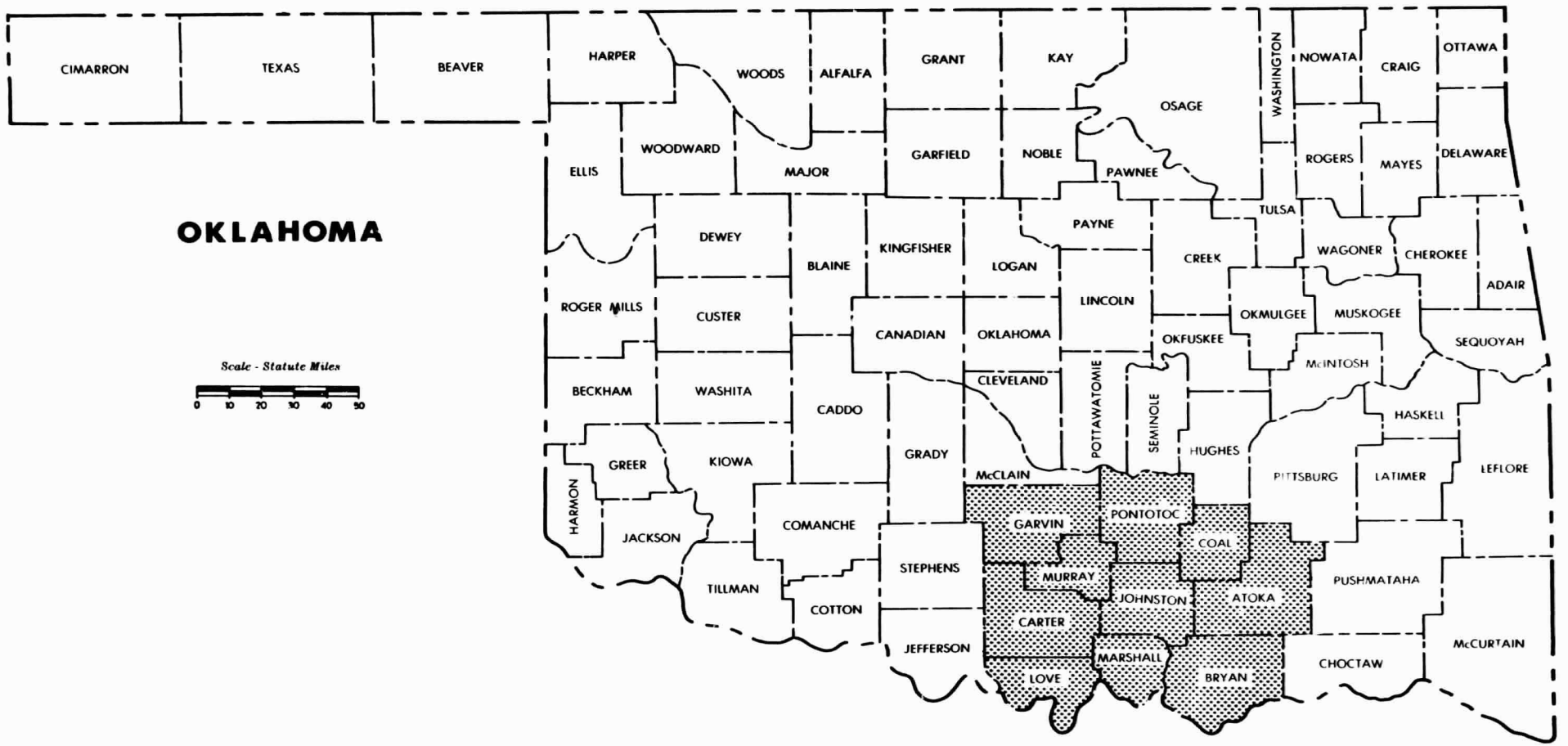
> "TUSC recently made a feasibility study for the location of an activated carbon plant in this area. As a result, the company plans to start construction on a $1.2 million plant in the very near future. The technical library provided by TUSC is most helpful."

One community leader, when asked the question, "Do you know if TUSC data were used in decisions to expand?", referring to the carbon plant, said, "Definitely, over and beyond the 'call of duty'." This person has long been a user of TUSC. His reference is to the fact that TUSC stretched its capability well beyond the usual TUSC service when the need arose. We feel that this case, referred to TUSC by SODA, definitely represents an impact of TUSC service. It is doubtful they would have received the financing to allow the construction of a plant in the area without the preliminary feasibility study.

The counties included in the SODA district are shown in Figure 5.2.

FIGURE 5.2

SOUTHERN OKLAHOMA DEVELOPMENT ASSOCIATION



Ozarks Regional Commission

TUSC has been of assistance on several occasions to the Ozarks Regional Commission.

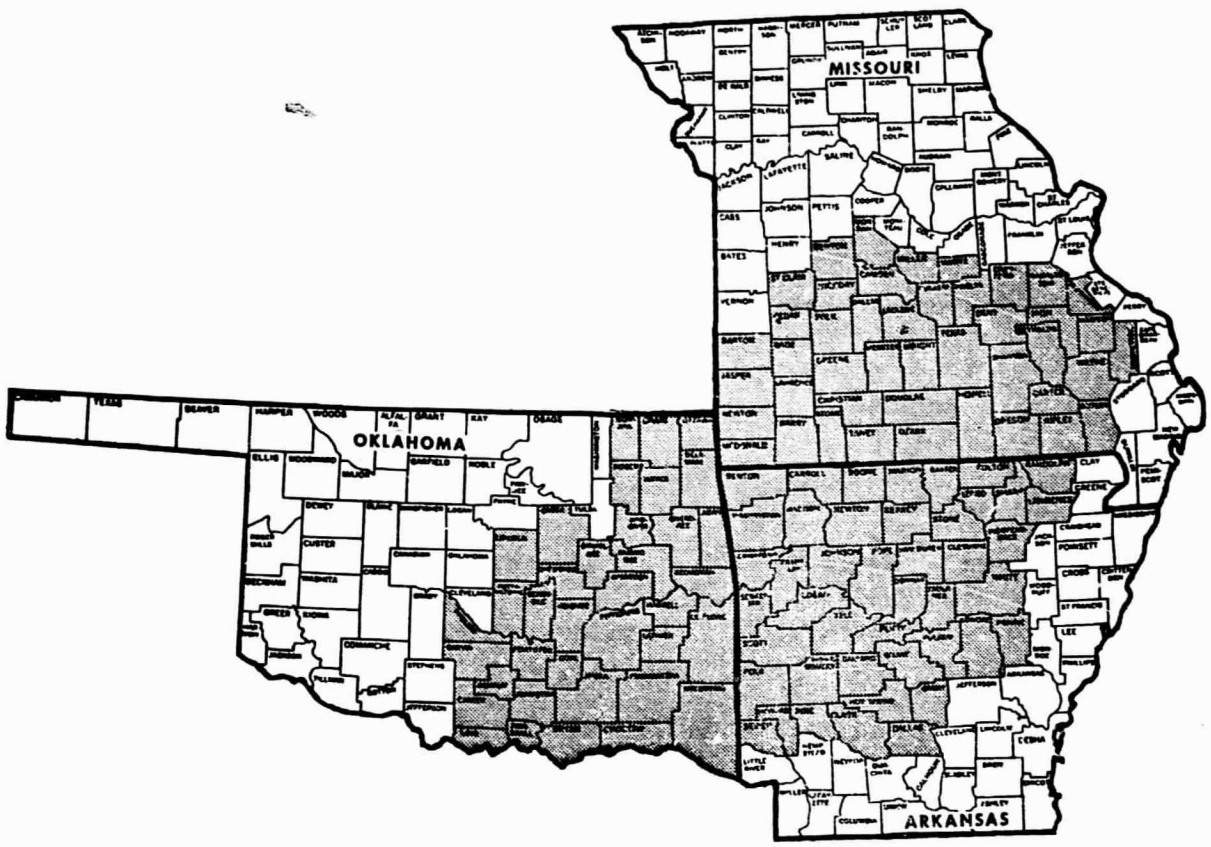
The Ozarks Region includes 37 Oklahoma counties which are shown on the map, Figure 5.3. These counties are all east of a line running generally northeasterly from Love County on the Red River through McLain County south of Oklahoma City and through Creek County west of Tulsa to Nowata County north of Tulsa on to the Kansas line. Only Tulsa and Oklahoma Counties are omitted from this area. The entire TUSC primary area falls within the Ozarks Region.

From the early planning stages of Ozarka, the TUSC service has been made available to the Commission. The profile data were sent to Ozarka officials in Washington and to the states involved. Mr. William McCandless, Federal Co-Chairman of the Ozarks Regional Commission, stated in a letter to Dr. Zink of TUSC in October 1966 that he was aware of TUSC and its service even before Ozarka and that he was very happy to have the information provided.

During the period TUSC has served Ozarka, a major portion of the information provided has been economic data. For the TUSC primary area, this material was obviously quite valuable to Ozarka, as evidenced by Mr. McCandless' enthusiasm. There is no other single source of complete economic data found outside the TUSC county profiles. The profile data saved Ozarka officials considerable time and expense which would have been necessary had they gathered the data themselves.

FIGURE 5.3

OZARKS ECONOMIC DEVELOPMENT REGION



Designation by Secretary John T. Connor, with concurrence of the States, in accordance with the provisions of the "Public Works and Economic Development Act of 1965," (PL 89-136).

CHAPTER VI

TUSC IMPACT OUTSIDE THE PRIMARY AREA

Technical Information Services Involving Special Experiments

Service to a Large Firm

The primary TUSC mission, from the start, has been oriented toward assistance to small firms. However, in a series of special experiments during 1967, TUSC did serve some large firms. The experiment in serving large firms was related to a special experiment in providing service by mail and phone. One such firm involved in the experiments was a corporation located in Tulsa. The firm employs approximately 500 personnel in the development, manufacture, and marketing of digital-tape systems and related equipment. Their engineering and production staff number over 300 of their employees. The firm is widely known for its line of oscillographs, servo mechanisms, telemetry equipment, and other testing and control instruments.

TUSC representatives made a presentation to the firm's engineering group at their Tulsa plant in August 1967. The presentation was followed by a lively question and answer period. However, it was two months before TUSC received the first technical request. The request was extremely broad, covering numerous general categories, with very little specific subject areas on which to base a search. Since TUSC was not prepared to furnish the thousands of documents which would have resulted from the extremely general requests, it was necessary to explain again the TUSC technique of responding to specific problems.

Once the communication problem was overcome by the more in-depth explanation of the service, later requests were more specific. Though no great volume of assistance has been extended to the firm, several information searches have been performed. It was difficult to obtain meaningful feedbacks from the firm for some time, possibly due to the security measures involved in the application of the information. Their personnel did mention, however, that one circuit outlined in a Tech Brief they had received would be used in the manufacture of a tape recorder they plan to market.

During the course of performing this study, the president of the firm was interviewed for the purpose of evaluating more fully the impact of the experiment. His evaluation of the TUSC service was quite favorable. He pointed out that there was no other place he could go in Oklahoma to obtain the information he needed to stay abreast of the developments in his field. He felt that TUSC had been very helpful. He was very impressed with the Tech Briefs, and he placed much emphasis on their use as a tool in cross fertilization of ideas. He felt that his research group got many valuable ideas from the Tech Briefs. Such a favorable response to the Tech Briefs is not common among TUSC clients. However, it is probable that the sophistication of the average TUSC client is not sufficient to cope with the technical level of most Tech Briefs. This particular client apparently was capable of obtaining valuable data from the Tech Briefs.

There has obviously been an impact resulting from the contacts with this client organization. However, their needs are considerably different from those of most TUSC clients. The types of service needed by this firm fall into two separate categories. Their personnel can use some Standard Interest Profile (SIP) dissemination in selected categories, but the strong need is for problem-oriented search services over a wide range of categories.

Serving Firms by Mail and Telephone

The project to serve client firms by mail and telephone was initiated with the Tulsa meeting in 1967, in which contact was

first established with the previously described large firm. This project came about in an effort to determine whether or not this type of service would be an effective supplement to the intensive face-to-face type field service rendered in the TUSC primary area.

The reasoning in the initiation of the mail and telephone experiment was that an extended face-to-face dialogue would not be required when dealing with firms having an engineering capability. TUSC staff members felt that the engineering personnel of the larger firms could frame questions and interpret abstracts without extensive aid from TUSC field personnel.

The initial meeting was attended by 20 persons who represented 14 of the 50 firms invited. The TUSC program and its operation was explained. The persons who attended were encouraged to avail themselves of the TUSC service. The apparent high interest among those attending caused the TUSC staff to be quite optimistic.

The optimism was not rewarded in the several weeks immediately following the meeting since responses were practically nonexistent. However, in retrospect, two years later it appears that this may have been one of the more successful and productive approaches to the dissemination of technology. At this time, TUSC is still getting search requests from persons who learned of our services at the Tulsa meeting in January 1967. Of even greater significance is the fact that TUSC is receiving requests from acquaintances of persons who attended the meeting. These new clients include golfing partners of those who were at the Tulsa meeting and other persons who have heard TUSC mentioned at trade association meetings. It appears the Tulsa meeting brought TUSC to the attention of persons with a technical level of development sufficient to enable them to understand the value of such a service.

The use of the TUSC services by persons who discovered TUSC directly and indirectly during the course of that experiment indicates an obvious impact. In view of the slow beginning, it is probable that the introductory meetings in such efforts should be more comprehensive. The establishment of such a service demands an intensive, personal, educational interchange, even with persons of advanced technical abilities, to insure anything approaching

immediate responses. The educational process required in providing technical knowledge to an engineering-staff member is not as intense as that needed when dealing with a small job-shop owner. However, the Tulsa experiment has shown that education in the use and application of the services provided by such centers is necessary.

Technology Utilization Seminars

TUSC conducted technology utilization seminars in five cities within and near the TUSC primary area. Three of these were cities in Oklahoma. The other two were directly adjacent to, and have considerable economic influence upon, the primary area. The purpose of these seminars was to encourage the use of new technology by the industrial community. The cities, general characteristics, location, attendance at seminars, and possible impact in the form of new clients are described in the following paragraphs.

TU Seminar at McAlester, Oklahoma

This TUSC TU seminar was jointly sponsored by the Associated Industries of Oklahoma, Inc., and the McAlester Chamber of Commerce. It was held in February 1967 at McAlester. One of the two largest towns in the 17-county area, McAlester has approximately 20,000 population. It is located 90 miles south of Tulsa and 120 miles southeast of Oklahoma City. It is served by U. S. Highways 69 and 270 and is linked to U. S. Highway 75 toward Tulsa by the Indian Nation Turnpike. A large Naval Ammunition Depot with some associated contractor facilities is located six miles south of the city. To the north a few miles is located Lake Eufaula, one of Oklahoma's largest lakes. A major portion of McAlester's industry is oriented toward or dependent upon the Naval Depot. There are some recreation-oriented industries around the lake.

The attendance at the seminar was considered small in view of the size of the city. The response from the crowd of about 45 persons who attended was good. However, many of those in

attendance were already familiar with TUSC services. No new clients could be directly attributed to the McAlester Seminar.

TU Seminar at Ardmore, Oklahoma

The TU Seminar at Ardmore was somewhat more successful than the previous one held at McAlester. Ardmore, the only other city of over 20,000 in the original primary area, probably has a stronger industrial posture than McAlester. Located on Interstate 35 and U. S. Highway 70, approximately half way between Oklahoma City and the Dallas-Fort Worth area, Ardmore enjoys excellent avenues of transportation. It has a large airpark housing the American Flyers Flying School and the Ardmore Plant of the Stromberg-Carlson Division of General Dynamics, Incorporated. Also located at the airpark are numerous small industrial firms, most of them subsidiaries of larger firms. These are primarily engaged in contracting or subcontracting government projects. Since the time of the seminar, Ardmore has been selected as the sight of a $75 million tire plant. The Ardmore area also has some recreation industry due to its location close to Platt National Park, the Arbuckle Mountains, and Lakes Murray and Texoma.

The attendance at Ardmore was not significantly larger than at the one at McAlester. However, among the 42 persons who did attend there were several who had not heard of TUSC. Since information searches resulting in three new active clients can be traced to the Ardmore seminar, TUSC can claim a degree of success from it. However, this seminar did not prove to be as effective as the "door knocking" approach to recruiting clients.

TU Seminar at Tulsa, Oklahoma

From a standpoint of the number of information requests in relation to attendance at the seminar, this was the most successful of the five seminars. Only about 20 persons representing 14 firms attended, though 50 invitations were sent out. However, ten of these firms have used TUSC since the seminar and are

considered TUSC clients. One company has requested six information searches and has stated that TUSC assistance contributed significantly to projects in which the company is involved.

The area in which this seminar was held differs from the others primarily in size and industrial climate. Located in Northeastern Oklahoma, Tulsa with a population of about 310,000 is heavily industrialized. There are several large corporations involved in a variety of industrial fields. Some of these are vitally involved in the fields of aviation and aerospace. There are many small and medium industrial establishments which occupy a sort of satellite existence as subcontractors for the large corporations. That group was the target of the TUSC Tulsa Seminar. As in the other seminars, the group in attendance was, as a whole, responsive. The high percentage of those invited who did not attend casts doubt on the effectiveness of the seminar approach as compared to individual canvassing.

TU Seminar at Sherman, Texas

This seminar, conducted at Grayson County Junior College in Texas, was directed at the Sherman-Denison area. Since both cities are within 25 miles of TUSC, this seminar might well be considered to be of a local nature. The sphere of influence of these cities from a standpoint of trade and employment actually encompasses the TUSC location.

The seminar attracted about 25 persons and resulted in several information requests in the following weeks. Since that time, however, information requests from this area have been referred to the Technology Application Center because Sherman and Denison are not physically located within the TUSC primary area.

TU Seminar at Fort Smith, Arkansas

Fort Smith, Arkansas, situated on the Oklahoma-Arkansas line which comprises the eastern boundary of the TUSC primary area, was the site of a TU Seminar in June 1967. The seminar

was jointly sponsored by TUSC and the Fort Smith Chamber of Commerce. Some 175 invitations were sent out; only 13 persons representing seven firms attended. Even though the persons who did attend were receptive and some subsequent information requests have occurred, the seminar could not be considered very successful. This experience appears to provide additional evidence that the seminar approach is not really very effective.

Service to Educational Institutions

> To speed the use of knowledge: a cooperative effort of the University of Oklahoma, Oklahoma State University, and Southeastern State College.

The preceding statement, printed on the TUSC letterhead, recognized Oklahoma's university and college system as a channel through which the knowledge accumulated by government research and development efforts may flow to the user. Actually, the educational institutions themselves are more users than disseminators. However, the material they use becomes diffused and eventually reaches many other users through textbooks, studies, and products resulting from various research projects.

Part C of the TUSC Work Statement provides for TUSC service to be made available to other colleges and universities than the three listed on the letterhead. Faculty and research staff personnel at five educational institutions in Oklahoma and many out-of-state schools, have made use of TUSC information during the five years. With the exception of Southeastern, all are outside the primary area. The information has varied from the use of the profile data books as a pattern for their own studies by institutions in other states to considerable amounts of technical data to such schools as the University of Tulsa and Oklahoma State University.

During five years of providing service to these educational institutions, several types of users have been identified. The most easily described of these users are: (1) persons involved in research who use the data in much the same manner as an industrial firm's research department would, (2) persons specifically involved

in curriculum development, (3) persons who use it for current awareness, and (4) students who use it for reference in preparing term papers. One other type of user not so easily defined might be called a "one-shot" user. Persons in this category usually apply TUSC material to some sort of special project. (See Table 14 for a selected list of users.)

Application of the data for research and curriculum development has potential for long-range diffusion of new knowledge. The awareness-type user may be described as that person who puts just a little more effort into staying abreast of new developments than the average faculty member. Through him, the information may not appear immediately in print; but it will be disseminated through his lectures and his classroom handouts. In most schools, this type of person is the one who is also apt to become involved in outside projects, such as short-term consulting, in which he also passes the information to secondary users.

The student user who applies TUSC supplied information to his term papers, studies, and thesis is a prime prospect as a future client of TUSC once he graduates and joins the "work-a-day" world as an employee of an industrial establishment or in a business of his own. In many cases, his first contact with TUSC is by referral of the faculty member who is an awareness-type user.

The "one-shot" user generally requests data or format details relating to the economic profiles. He may, in some cases, fall into one of the four categories described, such as a graduate student preparing a thesis or a researcher. However, he is more often a staff member engaged in the preparation of support material to use in requesting a grant from a Federal or a private source. It is usually impossible to obtain evidence of impact in these cases because many of the "one-shot" users obtain TUSC data from another individual or a library to which the profile data books were furnished. Though exact quantification cannot be made, the following statements indicate that there has been an impact in the case of that type of user too: "Abstracts were used in a study that resulted in a grant proposal" and "Useful as guide for Profile Studies of Missouri Planning Region."

TABLE 14

USE OF TUSC MATERIAL BY SELECTED EDUCATIONAL INSTITUTIONS

User	Type of Material			Type of Use				
	Technical	Economic	Other	Research	Curriculum	Awareness	Student Papers	Special Programs
University of Oklahoma	X	X	X	X	X			
Oklahoma State University	X	X	X	X	X	X	X	X
University of Tulsa	X			X				
University of Arkansas		X				X	X	X
University of Delaware			X					X
Idaho State University			X					X
University of Georgia			X					X
Oklahoma City University			X					X
University of New York		X						X
North Carolina State University			X					X
Texas A. & M. University	X			X				
Southwestern State College (Okla.)	X		X		X			X
Murray State College (Okla.)		X	X		X			X
Eastern Oklahoma State College		X	X					X
Poteau Community College (Okla.)		X						X
Grayson County Junior College(Tex.)	X						X	
Southeastern State College (Okla.)	X	X	X	X	X	X	X	X
Oklahoma School for the Deaf	X			X			X	
Eufaula, Oklahoma High School	X	X			X	X		
Wilburton, Oklahoma High School		X					X	
Durant, Oklahoma High School		X					X	X
Smithville, Oklahoma High School		X					X	X
Western Oaks Junior High (Okla.)	X					X		
Eagle Lake, Texas High School	X						X	

The TUSC experience indicates that by channeling new knowledge through educational institutions a wider audience can be reached than by individual contact as in a field service operation. The long-run impact will be great. However, the time lag from data bank to application is much longer; and it is impossible to determine application and any resulting impact in most cases.

Since the prime effort of TUSC is directed toward the immediate need for transfer of technology to business and industry, the service to educational facilities is offered on a request only basis. TUSC has done very little active promotion of data service among the various institutions. In spite of this, it is clear there has been significant impact. This impact is in the form of improved curriculum; more knowledgeable instructors; greater research potential; and, most important to future efforts in technology transfer, creation of an awareness of a new method of obtaining current knowledge among tomorrow's business and industrial personnel. In view of the slow and tedious process of a one-to-one ratio of transfer through field service, this new awareness on the part of today's students is most certainly a valuable result of TUSC service to educational institutions.

State Technical Services Program

TUSC Involvement in STS Planning

TUSC became involved in State Technical Services (STS) even before the STS Act became law. Early in 1965, the Secretary of Commerce requested the Governor of Oklahoma to assign delegates to the National Conference on State Science and Technology. Of the three delegates assigned, one was the Assistant Technical Director of TUSC. Representatives of two other Regional Dissemination Centers, Aerospace Research Applications Center (ARAC) and Center for Application of Sciences and Technology (CAST), also attended.

The TUSC representative saw the similarity between the TUSC mission and the stated mission of STS. He proceeded to point to

this at the conference and reported the similarity in his summary of conference proceedings. From that initial contribution at the National Conference, TUSC has endeavored to be of assistance in any way possible through liaison with STS on any level from national down to state and local.

Once the STS Act was passed and the program became a reality, planning was initiated at the state level. Once again, TUSC was involved. This time, Dr. Richard W. Poole of Oklahoma State University, TUSC Consultant and former Associate Director, was named by the Governor to head the Planning Committee for the Oklahoma STS Program. Dr. Lee B. Zink, TUSC Director, and Dr. Nelson Peach of Oklahoma University, TUSC Consultant and former Associate Director, were members of the committee. The first planning meeting was held at Oklahoma City University, and TUSC hosted the second meeting at Southeastern State College. The first meeting consisted primarily of outlining planning procedures and forming planning subcommittees. The second meeting, held December 14, 1965, at Southeastern was actually a working meeting at which Dr. Richard L. Lesher, Director of NASA's Technology Utilization Program, was present to speak on their program. Dr. Lesher and Dr. Zink held a question-and-answer period which provided significant contributions to the Planning Committee's formulation of an Oklahoma STS operation.

In addition to Dr. Zink, five other members of the Oklahoma STS Planning Committee were involved with TUSC as advisory board members, consultants, or staff members. TUSC Staff Members, A. M. Moore and Dr. Alvin White, though not on the STS Planning Committee, provided valuable input into the meeting by drawing on their experiences in the TUSC operation.

The present status and direction of Oklahoma STS in its approach to field service provide sound evidence that TUSC did have significant impact on Oklahoma STS through participation in the original state planning operation.

TUSC Effect on STS Operations

One of the most significant accomplishments of TUSC concerns the role it has played in developing effective field service techniques. TUSC field service techniques have been employed both locally in the Oklahoma STS Program and in the STS programs of other states.

One of the major reasons that Southeastern State College chose to participate in the Oklahoma STS Program was the realization by Southeastern officials that the STS program required the talents and expertise TUSC had developed. Having worked with and having closely followed the implementation of the Oklahoma STS Program, they were quite convinced that the entire STS program would grow to be primarily a field service operation.

As the Oklahoma STS Program moved from the planning stage to operational status in 1966, Southeastern employed one full-time STS representative to establish an STS field service program in 12 counties adjacent to the TUSC primary area. This person was housed in the TUSC facility and was to function part-time as a field specialist with secondary duties of information handling and coordination between TUSC and other STS agencies.

Since the person placed in this position had a background as an information specialist rather than field services, the TUSC field services techniques and procedures were adopted virtually "en toto." In view of the field service accomplishments by the Southeastern STS office as related to the other six participating institutions in Oklahoma, these techniques and procedures were most effective. Fifteen cases were cited by the Oklahoma STS administering agency in its 1968 Annual Report as prime examples of significant benefits of STS field service to Oklahoma users. Nine of these cases were technology transfers effected by the Southeastern STS office field service operation.

Though difficult to quantify, there is sufficient hard evidence to show that TUSC has, indeed, contributed significantly to the development of an effective STS field service program

in Oklahoma. Had TUSC experience not been available, it is doubtful if Southeastern would have participated in the STS program, thus depriving Oklahoma STS of one of its strongest participating agencies and depriving many Oklahoma businesses and individuals of the field service assistance they have received during the two years of the Southeastern STS field service program.

In addition to an effect on Oklahoma STS field service, TUSC has had some effect on STS field service programs in other states. STS programs are in varying stages of planning, implementation, and operation in most all states and territories. During the past year, there has been increased emphasis on field services. Though a few states have some experience in technical field services, most of them are still searching for efficient methods of carrying out a field service operation. Several of them have shown interest in TUSC techniques and procedures. From favorable comments received, it appears they have found that TUSC techniques show considerable promise in their STS activities.

The comments from STS officials in other states indicate that they learned of TUSC through mailed copies of the Four Year Report or directly from TUSC and Southeastern STS representatives at regional and national meetings. The one item which seems to interest STS officials considerably is the TUSC Four Year Report.[1] Since it shows various approaches to technical service as well as reporting and evaluation procedures, it may be responsible for the favorable response that has been received from STS officials in these other states. The response indicates that many of the states are adopting some of the TUSC techniques and procedures.

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[1]Tusc four year report by Lee B. Zink, Technology Utilization in a Non-Urban Region: The First Four Years of an Experiment (Durant, Oklahoma: Technology Use Studies Center, Southeastern State College, 1968).

The following statements are sufficient testimony that TUSC has had an effect on STS programs in several states:

> We have just received your activities report on your first four years of experience. This report is not only useful to anyone in this area of technology transfer, but, what is more unusual, it is highly interesting as well.--Mr. David L. Jones, Hawaii STS.
>
> I appreciate very much receiving your report on your first four years' operation. I could put to use an additional half dozen copies if they are available.--Mr. David B. Knoll, Illinois STS.
>
> I find your report to be of considerable interest, particularly the transfer projects and the use of seminars as a transfer mechanism.--Mr. W. L. Turner, North Carolina STS.
>
> I am presently initiating a field liaison service, and the information on your field activities is extremely beneficial in the structuring of my program.--Mr. F. Philip, Maine STS.

For some time members of the TUSC staff have viewed the field services operation as a pilot program for future programs of broader scope. The response from other states requesting information on the TUSC field services operation supports this opinion. Many of the states are using the Four Year Report as a guideline in designing their own programs as if the TUSC effort were indeed a pilot project.

TUSC as a Source of Information for Oklahoma STS

TUSC has provided scientific and technical information to Oklahoma STS since the very beginning of the Oklahoma STS program. The field service program operated by Southeastern State College has utilized TUSC as a source of technical information almost exclusively during the past three years. Oklahoma State University, the administering agency for STS in Oklahoma, and other participating agencies have also used TUSC material to complement their own local capability. There is little doubt that TUSC has been extremely beneficial to the Oklahoma STS program. As shown in the

following examples, TUSC information has contributed directly to the solution of problems encountered by Oklahoma STS:

Information Supplied to Oklahoma State University STS Office

Case 5: Annual Oklahoma State Technical Services Report, FY 1968.

Client: Oil Field Equipment Manufacturer.

Question or Problem: Client requested help in developing and improving a venturi guage.

Solution: TUSC information in the form of five technical reports was provided to the OSU STS office. The information was subsequently supplied to the client by the OSU STS agent. The information supplied consisted of the following IAA and STAR reports: A65-11185, A65-27457, A66-15519, N65-23 23, and N64-28959.

Information Supplied to Southeastern State College STS Office

Case 6: Oklahoma Annual State Technical Services Report, FY 1968.

Client: Individual Electronics Engineer, involved in the development of an educational television system.

Question or Problem: The client had encountered difficulty in the form of video interference resulting from arcing of alternating current relays. He requested assistance from STS which in turn directed an information search request to TUSC.

Solution: A search of TUSC files produced only one document relating to alternating current noise suppression. However, the client reported to the STS field specialist that the document, Semi-Conductor Switches for Aerospace Alternating Current Power Applications, was very useful and contributed directly to the solution of his problem. In this case, TUSC supplied to STS information which was available only from NASA.

Case 9: Annual Oklahoma State Technical Services Report, FY 1968.

Client: Owner and operator of chiropractic clinic with a large investment in elaborate x-ray equipment.

Question or Problem: Client had heard of the computer enhancement of x-rays through a civic club showing of the NASA TU film. He requested information on the enhancement technique from the Southeastern STS office.

Solution: TUSC obtained the backup package which was forwarded to the client. An STS representative states that the client is presently attempting to apply the techniques by obtaining cooperation from other doctors, clinics, and computer firms in his area. Chances for success appear good because of the organizational talents of the client and the area involved which includes Tulsa and two of Oklahoma's other larger cities, Muskogee and Okmulgee. In this case, the only source was TUSC and the NASA system.

Case 16: Southeastern Oklahoma STS Monthly Report, November 1968.

Client: Small metal forming industry, Southeastern Oklahoma.

Question: Client needed information on plastic finishing of metal for corrosion protection.

Solution: TUSC provided several documents from the NASA files which covered the subject thoroughly, thus providing Oklahoma STS with material not readily available anywhere else in Oklahoma.

Information Supplied to Southwestern State College STS Office

Case (This case occurred before STS began assigning numbers to cases.) It was directed to TUSC in 1967 from Southwestern State College through the Southeastern STS office.

Client: Small industry in Western Oklahoma. Product was not stated.

Question or Problem: Client wanted information on self-adhering foamed system plastics.

Solution: A search of TUSC files produced document abstracts specifically relating to the subject. Client ordered one document, AD 452046, Heat Foamable Resin System for Producing Foam to Adhere to Various Materials Including Metals. He indicated to the Southwestern STS office that the document answered his question.

Oklahoma Aeronautics Commission

The Oklahoma Aeronautics Commission's (OAC) name appears frequently in the TUSC files. Mr. Keith Lutz, the Executive Secretary of the Commission, exhibited a great interest in the aviation personnel training study conducted by TUSC/SSC in 1966. He was the TUSC authority for aviation data on Oklahoma. When the study was complete, the Commission used it for leverage in furthering other projects in their field of interest.

TUSC participated in a conference called by the Commission for the purpose of examining aerospace education in the public schools of the state. Considerable interchange of ideas between TUSC and the Commission regarding the curriculum needs of the schools took place during the ensuing months.

The Governor of the state appointed an advisory committee to make recommendations for the improvement of public school aerospace education. The 20-member committee includes the five members of the Aeronautics Commission and a TUSC Industrial Specialist. Plans are being formulated for concrete action which will put Oklahoma public schools at the top of the list in providing for the best in curriculum materials and qualified teachers whose teaching will reflect the rapid advancement being made in technical fields. Senate Bill 86, which provides $50,000 for initiating the program, is presently before the Oklahoma legislature.

Assistance provided the Commission includes four compilations of both general and specific information from the TUSC data bank covering developments which may affect air vehicles in the next decade.

The TUSC-OAC relations as described above indicate significant TUSC impact on the OAC and, consequently, on the entire Oklahoma aviation industry. This impact is especially important in view of the total involvement of Oklahoma and Oklahomans in the aviation/aerospace field. Oklahoma is one of the leading states in aviation-related industry and activity. A large percentage of Oklahomans depend either directly or indirectly upon the industry

for a living. Such a significant impact on one of Oklahoma's prime industries is an accomplishment of which TUSC can be proud.

TUSC relations with the OAC in the area of updated curriculum, though not at this time far enough advanced to identify a definite impact, show promise of being very productive. Currently the OAC has funded and scheduled a two-week Aerospace Education Workshop to be conducted at Oklahoma State University during the period of July 7-25, 1969. The workshop is designed to orient teachers to the progress and implications for teaching in an aerospace age and includes several field trips. Among the sites chosen for field trips are two NASA centers, Marshall Space Flight Center and Kennedy Space Center, Federal Aviation Agency facilities, airlines, aircraft manufacturers, and military air facilities. The Southeastern State College aviation education facility is also included in this tour. Since TUSC has provided technical assistance to OAC and one TUSC staff member is on the Governor's committee for improvement of public school aerospace education, TUSC should have a considerable long range impact on the future of the Oklahoma aviation industry.

CHAPTER VII

IMPACT ON SOUTHEASTERN STATE COLLEGE

The one individual who most appropriately can articulate the impact the Technology Use Studies Center has had on Southeastern State College is its President, Dr. Leon Hibbs. In this chapter, Dr. Hibbs' concepts and understandings of TUSC's impact on the College are presented.

There has been no attempt to provide one direct quotation after another. Rather, President Hibbs' comments during two lengthy sessions of open-end questioning are reported in the style of the writers who have prepared the entire report. That was done in order to maintain a logical consistency in the content and thereby to present a cohesive report.

Increased Student Aid Funds

As is true in most state-supported colleges and universities, Southeastern State College receives most of its student aid funds from the State of Oklahoma and the Federal Government. However, since the establishment of the Technology Use Studies Center, there has been increasing support of the student financial aid programs from private sources. Undoubtedly, the direct involvement of TUSC personnel with the business community in Southeastern Oklahoma has been significant in this development.

New Programs

As far as it can be ascertained, it would not have been possible for Southeastern State College to have its degree program in professional aviation had it not been for the extensive work done by TUSC and for the information it provided. Successful

implementation of the baccalaureate degree program required an initial feasibility plus other information that supported the desirability of the program. Personnel from TUSC were involved in each facet of justifying the program.

The continued presence of the Technology Use Studies Center on the campus has helped justify other new programs of study. TUSC personnel also participated in the research and planning that demonstrated the need for them. The industrial education department of the college has realized considerable growth as a result. Students can now earn two-year associate degrees in any of the following: automotive, drafting-design, electronics, or machine tools. A four-year baccalaureate-degree option is available to the students who major in automotive. Each of these programs of study is directly related to the industrial potential and the economic needs of Southeastern Oklahoma.

The College Budget and Increased State Funds

It would be unrealistic to say that state appropriations to Southeastern State College have been increased because of the activities of the Technology Use Studies Center. However, indirectly TUSC may have aided the administration in justifying its requests for increases in state appropriations. At such meetings of the State Board of Regents for Higher Education or the State Board of Regents for Oklahoma colleges, inevitably, there have been questions regarding TUSC. Typical questions have included: "How is the program coming along?"; "What impact is the program having?"; or "Is there anything that we can do to help make the programs more successful?" Perhaps TUSC has caused the members of both boards to recognize more fully that the College can do sophisticated and scholarly work and has thereby helped justify the increases in state appropriations to the College.

The Service Function Strengthened

The field activity performed by the staff of the Technology Use Studies Center has done much to enhance the image of

Southeastern State College. More than any other branch of the college community, TUSC exemplifies the concept of service that the institution seeks to fulfill.

Through extensive travel in the primary 17-county area of Southeastern Oklahoma and in other areas as well, the TUSC staff make frequent appearances before Chambers of Commerce, civic clubs, and other organi.ations. Such appearances result in good public relations for the Center and for the College. Through their work with individuals and firms, the staff builds longlasting goodwill. As representatives of the college community, the personnel are able to respond directly to varied questions about the College. In that way, the staff serves as a liaison between the College and its publics. Hence, one of the impacts of the Center has been a by-product of its basic objective of transferring technology. That is, the Center has served as an effective public relations and service arm of the College.

The Center as a Source of Student Employment

Hourly rates paid student employees of the Technology Use Studies Center are the highest on the campus. Consequently, employment in TUSC has an intangible level of prestige as well as enabling the students to finance on their own a large percentage of the total expenses of attending Southeastern State College. Of course, the Center has been able to attract some of the most capable students as part-time employees.

In many ways, the student employees are symbiotic in their relationships to the organization and the College. As students, their experiences in TUSC certainly have enriched their higher education. They are aware of the very latest in the developments in technology as well as the language of technology. Their experience thus better prepares these new graduates for living in a rapidly changing environment.

Members of the Professional Staff Serve as Instructors

During the five years the Center has been in operation, four members of the professional staff have taught at least one course in the College. Three of the staff taught courses in economics and one taught courses in business administration.

As a result of their teaching, interest in economics has increased and the administration has been able to justify the addition of a full-time instructor in economics.

The presence of the professional staff on the campus strengthens the academic community and the environment for continuing intellectual discourse and dialogue among the representatives of the various disciplines. The College is thereby better able to attract and hold faculty members because of the opportunities they have to work with more than only one or two colleagues in their own disciplines.

Attitudes of Students and Faculty

The attitudes of the students and the faculty probably demonstrate the greatest impact TUSC has had on the College. Students and faculty seem to recognize that the NASA-sponsored Center is something that is truly "Space Age" in its orientation and capabilities. Even if they do not know for sure what it is that TUSC is organized to accomplish, they are quite proud that it is part of Southeastern State College. They have developed a new sense of pride in their institution, and they seem to recognize that the rule of convention no longer has to be followed in the region.

There are many students on the campus who use the services of the Center frequently as they prepare oral reports or term papers. Students majoring in aviation have more-or-less adopted the Center as a place where they are welcome; where in the conference room their professional fraternity, Alpha Eta Rho (AHP), can hold its regular meetings; and where they can have access to the latest in NASA technology and the current technical periodicals. Students majoring in science and mathematics have found the Center to be an excellent source of information because they are able to delve into

subjects much more deeply than they can in their textbooks or in books from the College library. Because of TUSC's presence on campus, the students have ready access to the same extensive NASA literature that is concentrated in a manner than can be found in only seven other institutions of learning in the entire 50 states.

The greatest impact of the Center on the faculty of the College has been on those in mathematics and the physical sciences. Other faculty assisted by TUSC include those in industrial education and in professional aviation as was mentioned previously. The faculty members know what types of materials are available, and at this point they are beginning to have a basic understanding what a valuable asset it is to have the Center on the campus as an integral part of the college community. With increasing frequency, faculty members are using TUSC data in their classes rather than the five- or six-year old data found in their textbooks. Through TUSC they have the resources to bring the very latest materials to their students.

The very healthy attitudinal relationship among the students, the faculty, and the Technology Use Studies Center personnel has proved to be a major asset of the total program of Southeastern State College.

CHAPTER VIII

COOPERATION WITH OTHER AGENCIES AND ORGANIZATIONS

This chapter ties closely with Chapters V and VI by identifying TUSC impact both within and outside the primary area. However, it differs from them in type and depth of involvement. TUSC liaison with the several organizations and agencies mentioned here varies considerably. With some, such as the Southwest Grain Growers Association, it consisted of a one-time contact. With others, it has been occasional liaison. On the other hand, the involvement with such agencies as the Oklahoma Peanut Commission resulted in a TUSC staff member being appointed to a committee designated by that agency. TUSC involvement and indicated impact are described in the remainder of this chapter.

Bureau of Indian Affairs

TUSC assistance to the Bureau of Indian Affairs (BIA) has consisted primarily of providing copies of the economic profile data to local and national offices of BIA. The profile data have been used to some degree in a variety of Bureau studies and operations. According to one Bureau official, it was quite helpful in their attempt to locate and record the location of various families and tribal groups.

Economic Development Administration

A major part of TUSC involvement with the Economic Development Administration (EDA) is described in Chapter V and relates to the two EDA districts which fall within the TUSC primary area. There has been some TUSC assistance provided to other EDA agencies

and officials. In most cases, the assistance consisted of providing profile data books or their formats to EDA representatives involved in profile data studies of their own. In this manner, TUSC has had some impact through the use of TUSC guidelines and techniques in the profile studies of other EDA regions.

Federal Aviation Administration

TUSC involvement with the Federal Aviation Administration (FAA) has consisted of limited liaison. Most of the contact with FAA came during the time TUSC was involved in assisting Southeastern State College in the organization of its professional aviation program. TUSC still receives some FAA publications and has occasion to contact them in reference to activity involving the Oklahoma Aeronautics Commission.

Oklahoma Governor's Office

TUSC relations with the Governor's office at the present time consist of occasional dissemination of economic or technical data. Since the present Governor is very much concerned with recruitment of new industry, most questions are in some way related to his industrial recruiting program. One recent package of information was on the fiberglass industry.

Earlier in the history of TUSC, there was considerable active liaison and cooperation between TUSC and the Governor's office, primarily involving the initiation of the Oklahoma STS program and some EDA programs. During the planning of the Oklahoma STS program, TUSC and the Governor's office had close productive liaison.

Oklahoma Industrial Development and Parks Department

TUSC relations with the Oklahoma Industrial Development and Parks Department have been varied and primarily on the order of liaison. There have been isolated cases of technical assistance and one case of providing a TUSC staff member to work directly with the Industrial Development and Parks Department. The one

occurred in 1965 when Mr. Stuart Bumgardner of the TUSC staff spent several days with them. The assistance in this case involved the development of the Ozarks Region. The TUSC profile data were very useful in defining the characteristics of and delineating the Ozarks Region. This particular case also involved the Governor's office and several other state agencies.

Oklahoma Peanut Commission

The Oklahoma Peanut Commission came into operation in 1965. The commission members are nominated by the peanut growers and appointed by the Governor of Oklahoma. Peanut grower assessments on members provide all funding requirements.

The commission felt a need for outside help in locating competent research organizations and in contracting for research. An Industrial Specialist from the TUSC staff was invited to become a member of the Technical Advisory Committee. The Industrial Specialist accepted the responsibility and is Chairman of the Technical Advisory Committee.

The Committee has provided a vehicle for bringing aerospace technology to the attention of a segment of agriculture. At the same time, some problems in agriculture, which perhaps only aerospace technology can solve, were brought to the attention of the aerospace community.

The effects of TUSC's relations with the Oklahoma Peanut Commission can best be summed up by quoting from a letter dated January 4, 1968, from the Oklahoma Peanut Commission to the Director of TUSC:

> The broad spectrum of the information in your files has brought new disciplines into the efforts to solve technical problems in the peanut processing industry. We feel that the more scientists who know about our problems, the more likely we are to find a solution. The Center has provided a means of exposing our problems to the aerospace industry. We believe there is a place for the technology generated in aerospace to be applied to agriculture problems. The Center has been an excellent vehicle to expose these problems to aerospace industries.

Small Business Administration

TUSC involvement with the Small Business Administration (SBA) falls into three categories: (1) cooperative efforts in presentation of short courses, (2) liaison between SBA and potential SBA clients, and (3) limited direct technical assistance to SBA.

The training courses were held at Idabel and Durant in March 1966. The Idabel course was oriented toward record keeping for small businesses and consisted of six weekly sessions. Enrollment totaled about 100 persons. The Durant course consisted of four weekly sessions in a non-computerized management game called MANTRAP. A total of 20 persons enrolled in this course. These two cases of joint TUSC-SBA effort evidently had considerable impact by bringing busiress and industrial clients up to date on current management and record-keeping techniques.

Liaison occurs between TUSC and SBA when a TUSC client or potential client is found to have problems falling within the scope of SBA. This usually involves the need of an SBA loan. In a case such as this, TUSC acts as a switching device or referral agency by bringing SBA and the client together. This is considered a necessary function of field service operations with small businesses. TUSC finds that in addition to a need for new technical knowledge, the average small business or industrial establishment has a need for financial help and quite often also needs trained personnel. The SBA liaison helps TUSC fill the second of these needs. Liaison with agencies training technical personnel helps meet the third need.

The direct TUSC assistance to SBA consists of occasional technical information dissemination to SBA clients within the Southwest SBA Region through Mr. Bruce Gipson of SBA. Mr. Gipson approached TUSC concerning the possibility of drawing on the TUSC data bank for technical information. Though he does not call on TUSC for information often, when he does, TUSC attempts to fill his needs. He has stated that the TUSC material has been of significant value to him and his clients.

Southwest Grain Growers Association

TUSC realized that if one branch of the agricultural community could benefit by the new technology available from the data bank, possibly others would also be interested. A TUSC staff member thus contacted the Southwest Grain Growers Association in an effort to develop a dialogue. They appeared to be receptive to the TUSC offer and indicated that they did have problems which might be solved by TUSC data. However, to this date, there has been no effort on their part to obtain TUSC service.

Manpower Development Training

TUSC has on several occasions had liaison contact with Manpower Development Training programs. In the course of TUSC field work, three problems are frequently encountered: lack of technical expertise, lack of financing, and a shortage of trained personnel. These were mentioned in the description of the Center's relations with the SBA. The third of these problems, lack of trained personnel, has been met in several cases by referring the client to a manpower training facility where he can possibly obtain trained personnel. This type of service, though not involving specific transfer of information, has proved very beneficial to some TUSC clients.

CHAPTER IX

ANCILLARY UNDERSTANDINGS

In just five years, personnel of the Technology Use Studies Center have become well known and apparently well regarded in the area as sources of information that is couched in the language of the user. A number of businessmen in the area have grown to rely on the inputs of the TUSC staff to assist them with product-development ideas. That they are willing to share confidential information with TUSC personnel is indicative of their apparent regard and respect for the staff. Such loyalty must have been earned and obviously must be carefully guarded. In many ways, the TUSC staff has served as a "sounding board" for new ideas, many of which, had they been implemented, quite likely could have been major burdens and perhaps resulted in failure of the small firms involved.

TUSC personnel have been the ready ally of the "would be" entrepreneurs at a time when unscrupulous individuals might have taken undue advantage of them. Many of the TUSC clients have not had extensive formal education; and consequently, they are not readily familiar with the ins and outs of contract negotiations, applications for patent rights, and other business entanglements. The presence of the TUSC staff as an information resource and as counselors to such small firms certainly has proved effective in protecting the best interests of the firms involved. Of course, the "pay-off" for such services will be the economic development of the region that will result from the growth of area firms.

Because of the presence of the TUSC staff in the region, owners and managers of area firms seem more inclined to be

progressive as they seek new goals, new areas of endeavor, and new technological methods of operation. Apparently, the businessmen in the area are becoming more progressive because they know in TUSC there is a source of assistance that will help them find the answers to their problems. TUSC serves as a primary source of information or as a center of influence for obtaining needed information.

The activity in which TUSC has been engaged during the past five years has led the TUSC staff to certain understandings which are considered essential to the effective operation of such library and field-service programs. The ancillary understandings contained in this study may prove useful to the State Technical Services Program which is specifically aimed at assisting the type of client TUSC has served. The TUSC staff has maintained close liaison with several STS agencies, SBA technology utilization offices, and related agencies. The staff has, in a sense, considered the TUSC experiment a pilot project for STS. In view of this, an effort has been made to view the ancillary understandings in terms of the future needs of such agencies as might be involved in technology utilization programs.

The ancillary understandings are shown in five categories. Four are specific and narrowly defined, and one is general. The specific categories are: (1) the client who is the recipient of technical service, (2) the operational procedures for extending technical assistance, (3) the staff necessary to provide the technical service, and (4) library facilities and information/data backup to support a technical assistance program. The general category discusses comprehensive understandings relating to the overall feasibility, necessity, and requirements of an effective technical service and information dissemination program.

Recipients of Technical Assistance

One of the basic concerns of TUSC, much like that of a business firm, has been the market for its services. One of the first discoveries made by TUSC was related to the size of most firms

comprising the business and industrial community of the TUSC primary area. Two other descriptive factors soon revealed were the organizational characteristics and level of sophistication of potential clients. After five years of operation, these three factors still reflect the characteristics of an average TUSC client. Based on this understanding, it appears these factors may well apply to the potential market of STS, SBA, and other related technical-assistance agencies. The three factors by which TUSC has learned to identify its market are described in the following paragraphs.

Size of Client Firms

The most obvious of the ancillary understandings relating to clients is the size of the client firms. The size of the firms comprising the TUSC clientele has been found to be quite small, even by SBA standards. Most of them have less than 20 employees, with many falling into the job-shop category with only one or two employees. TUSC has found that companies of this size usually need assistance.

Organizational Characteristics

The organizational characteristics of a firm seem to be a very effective indicator in regard to that firm's need of technical assistance.

Several characteristics common to virtually all TUSC client firms have been determined. Especially obvious are the features found in large companies that are lacking in the TUSC client companies. Among the missing features are the following: (1) research capability; (2) ready, effective access to current scientific and technical information; and (3) ability to apply new technology in its raw form. TUSC has discovered that firms lacking one or all of these characteristics need the technical assistance to maintain their position in relation to the growth of large industry. In the TUSC primary area, even the larger

firms, of which there are only a few, lack a complete research capability. Other variations from the usual industrial firm organizational structure, such as lack of quality control and production control capabilities, are also used by TUSC to define the potential recipients of technical service.

Level of Sophistication

The third factor by which TUSC identifies clientele is the level of sophistication of a given firm. TUSC has found that the firms with a higher level of sophistication, such as those subcontracting from a larger firm or one managed by an engineer, technical person, or recent college graduate, are not in as dire need of assistance as firms lacking such contact with a large modern firm or the recent exposure to technical education. However, the more sophisticated person is usually quicker to use the services offered. The less sophisticated requires more encouraging and in many cases a basic interpretation of material provided. Many of the TUSC clients have only a grade school education which demands the more basic approach.

Operational Procedures

Ancillary understandings regarding the operational procedures of a technical assistance program are the result of considerable trial and error. The only extensive program of this nature from which to draw was the agricultural extension program. One of the first revelations to TUSC was that the TUSC effort, which might be described as technical extension, differed in many ways from the agricultural program. The lack of effectiveness of seminars to transfer technology to small industry is a good example of a technique employed by agricultural extension which shows little or no promise in technical extension.

Other understandings pertaining to types of assistance needed by TUSC clientele, planning of technology transfer activities, procedures for introducing service to clients, and methods of providing the service to an established client are covered in this section.

Types of Assistance Needed by TUSC Clients

An early TUSC discovery in regard to the needs of small industry was that most require far more than technical information. They also need financial and personnel-procurement assistance. The latter needs point to the necessity for an effective liaison between technical assistance agencies such as TUSC, SBA, and EDA as well as sources of trained personnel such as technical schools and manpower training facilities.

TUSC has found that through such liaison a package of assistance can be made readily available to a small business. Technical, financial, and personnel-procurement help can be provided to him on request.

Planning of Activities

The important points TUSC has learned about planning of activities relate to locating of potential clients, selection of introductory material, and continuity of service to established contacts. One of the best tools for pin-pointing of possible clients has proved to be the yellow pages of phone books covering the market area. In many cases, the firms are too small to be listed in other publications such as the manufacturing or service directories. The yellow pages together with these directories and the TUSC economic data books have proved to be of considerable value in planning and outlining field activity.

Introductory Procedures

Understandings concerning the basic introductory procedures in providing technical service to the TUSC primary area are among the most important lessons learned by TUSC. In the initial approach to a prospective client, it appears essential that the prime objective be the establishment of a strong rapport. Unless the prospect views the industrial specialist as a friend, there is little chance he will be receptive to services offered. Since many of the small firms in the market area have for some time led

an existence barely above the survival level, they are sometimes suspicious of outsiders and government-sponsored programs. This calls for considerable tact on the part of the industrial specialist making the contact.

TUSC finds that the technical information used in the introductory procedures must be as basic and uncomplicated as possible. A deluge of highly-sophisticated documents appears to be a very quick way to dampen the enthusiasm of a prospective client for a technical assistance program. Simple Tech Briefs, Special Publications, and magazine articles seem to be the best types of material to use in introducing a prospect to a technical assistance program.

Service Procedures to an Established Client

Two primary procedures that TUSC has found essential in serving established clients are encouraging the client to locate and relay his problems to TUSC and tailoring the responses to his problems in such a manner that he can understand the response. Though a client may still need outside help in identifying problems, he can be coached to identify many of them and simply address a specific question to the information center. However, TUSC has found that if the material is not specifically tailored to his needs by some preliminary interpretation in terms of his problem, there is little chance he will be able to use it. This is especially true in the case of the very small, unsophisticated firms. Technical data with no basic interpretation is not applicable in its raw form.

Technical Services Staff

A very important factor in a program of information dissemination and technical assistance is the operational staff. The staff, consisting of field specialist, information specialist, and consultant-type personnel, determine the succes of such a program. TUSC has found that the three are practically inseparable. Absence of any one of the three significantly lessens the overall capability.

Field Specialist

The typical TUSC client has been described as a very small firm with little modern technical sophistication. This firm cannot effectively communicate with a library or data bank, nor can it assimilate raw technical data as does the larger sophisticated firm. This lack of ability to maintain effective communication with technical information resources points to the importance of the field industrial specialist. TUSC has found the field specialist to be the most valuable link in the technology transfer process where the small unsophisticated firm is concerned. There might be a variety of sources of information on a particular subject, but there is still only one effective channel through which a given item of information can flow to the small firm. That channel is the field specialist who has person-to-person contact with the client.

The field industrial specialist is the client's "unwritten guidebook" for technical projects. He provides the client with information pertinent to the problem at hand in a language and/or on a technical level which the client can understand. He may have drawn on a variety of sources for the information he provides the client. Quite naturally, the field specialist may not be well versed in a particular subject area. Therefore, through the use of the data bank, open literature, reference material, and counseling by an expert, he essentially takes a "crash course" in the subject so that he may capably relay the necessary information to the client in terms the client can understand. The chart in Figure 9.1 shows the position of the field industrial specialist in relation to TUSC resources and the small unsophisticated client.

The preceding paragraphs have shown the field industrial specialist's function in relation to the information resource and the typical TUSC user. In this position, he is, first and foremost, a friend. Unless he has a close rapport with a prospective client, there is little chance of establishing the working relationship necessary to effect technology transfer. In addition to

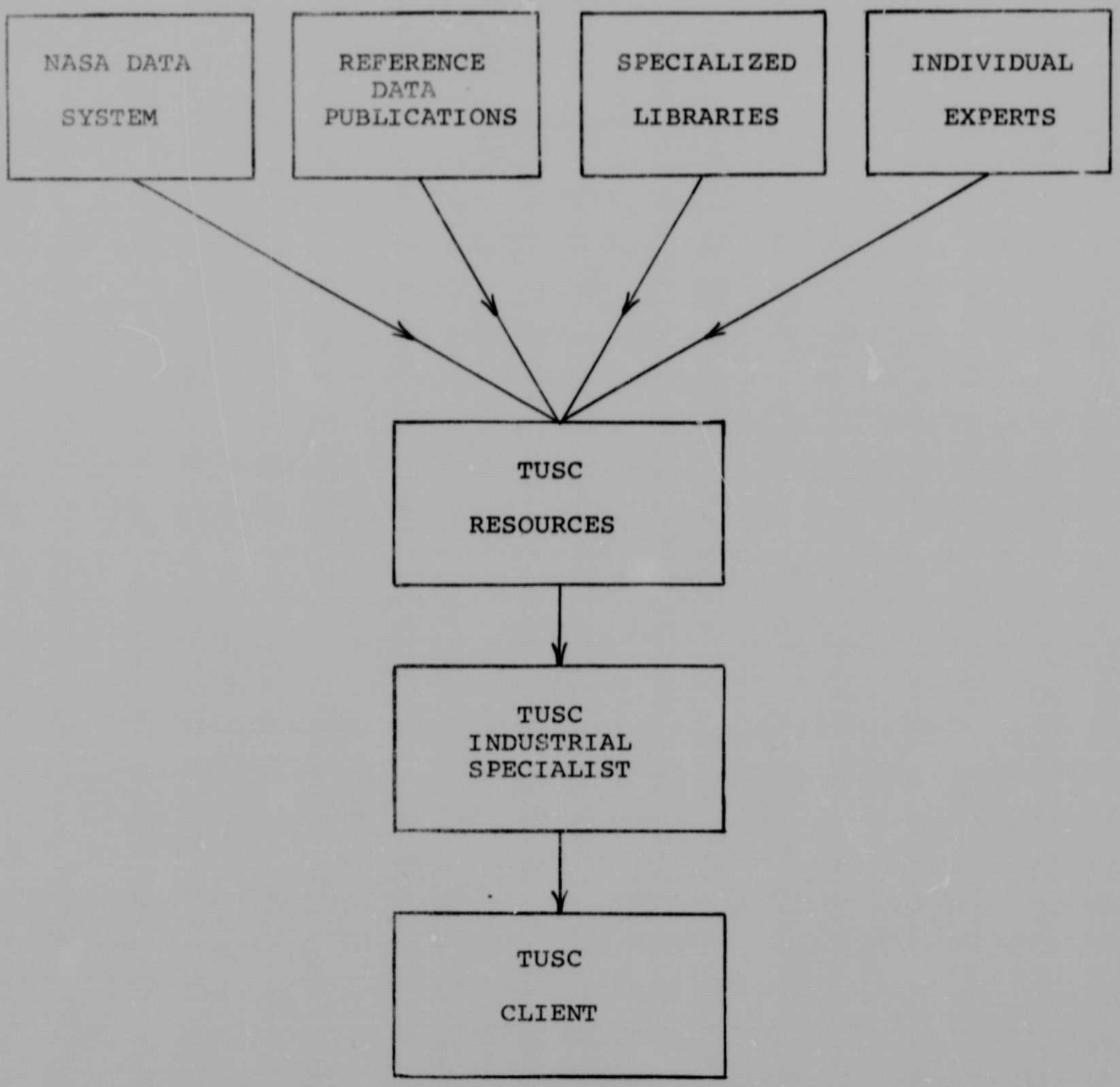

Figure 9.1 Relationship of TUSC Industrial Specialist to TUSC Resources and Client.

being a friend, the field specialist is also a salesman, coordinator, counselor, and an analyst.

One basic understanding gained from the TUSC five-year experiment is that there is no ideal field specialist. No one person can meet all the qualifications completely. Likewise, no particular field of study seems to provide the best qualified field specialist. Through understandings growing from the five-year experiment, TUSC has been able to define several attributes which are desirable in a field specialist. Among these attributes are the following:

(1) Salesmanship--The field specialist, in order to establish contacts with potential clients, must have strong sales ability. The unsophisticated client who has the greatest need for new technology is also apt to be the one who is most skeptical of a "something for nothing" approach--especially if it originates in or issues from a government agency. Salesmanship is a must in overcoming this initial obstacle.

(2) Technical interests--The field specialist must have the widest possible interest in scientific and technical subjects, a sort of "jack of all trades and master of none." In concurrence with the above mentioned cliche, he does not necessarily have to be an engineer or a specialist in a given technical field. In fact, if he is a specialist in a given field, he must not let that prejudice him against other fields.

(3) Communicative ability--The field specialist must be able to communicate effectively at all levels of technical sophistication. First, he must never "talk down" to a client by exceeding the technical level of the client. On the other hand, the field specialist must be able to communicate with those persons on a higher technical level, such as data bank specialists and clients who may have a high degree of technical orientation.

(4) Tact and diplomacy--The field specialist must be tactful and diplomatic when dealing with a client. This is especially important when dealing with proprietary matters such as patent applications and the firm's financial dealings.

(5) Understanding of basic objectives--The field specialist must understand his mission, its objectives, and the methods by which the mission can be carried out. In TU programs such as those of TUSC, STS, and SBA, the objective of providing new technology to technically-needy firms is best done on a problem-oriented basis. In view of this, the field specialist must be open-minded and look for problems the client himself may not see. He must remain problem oriented rather than endeavoring to create a complete industry from scratch. Creation of new industry is of course desirable, but it is probably well beyond the range of capabilities of the field specialist. There is such little chance of one individual creating an entire new industry that efforts in that direction may be a waste of valuable resources which could be applied to problem solutions in existing industry through the use of new technology available to him. Should the field specialist encounter technology which, with further research and development, might be economically feasible, he should seek to communicate this to teams engaged in such efforts.

(6) Knowledge of information resources--The field specialist should learn the mechanics of information systems and maintain a current awareness of all sources of technical information. He should be able to function as an interpreter, analyst, and catalyst between the source of information and the client.

Information Specialist

One basic understanding of TUSC, which differs from most other dissemination centers, concerns the information specialist. In an operation where a majority of the users are small firms, the persons engaged in retrieving material from the data bank need not be computer-trained professional information specialists. On the contrary, TUSC has found that college students trained in basic information retrieval theory produce more accurate results through hand-search methods than can be obtained by computer searches.

Consultants and Analysts

One of the best secondary tools which TUSC has found to support its information dissemination and technical service program is the use, on a limited basis, of consultants and analysts. There are cases in which the field specialist and information facility alone cannot reach a satisfactory answer to questions or problems. In these cases, TUSC finds that a list of specialists located at colleges and universities is essential. Usually, in conjunction with efforts already made by the field specialist, the consultant can reach a quick solution.

Library Facilities and Other Information Support

The base on which any information dissemination and technical assistance program is built is its information resources. Ancillary understandings in this area relate to the type of material, methods of retrieval, and referral capability. They are all essential to the operation of a successful program.

Content of Library

One of the first things TUSC discovered was that the extremely-technical research and development material contained in the NASA system is not easily assimilated by small industry. It can be used and is very helpful when supported by less technical open literature and some basic interpretation. TUSC has found that in many cases the open literature alone can solve problems occurring in small industry. Based on this finding, it appears that an extensive open-literature file should be maintained in conjunction with the government research data.

Methods of Search and Retrieval

Search and retrieval, as mentioned previously, have been found more effective when manual techniques are employed. For this reason, TUSC always applies manual search techniques first

and uses computer facilities only infrequently. On occasion, computer searches have been proved feasible in the case of a few of the larger firms in the primary area. One search technique which TUSC has learned may save time is to view the question or problem in terms of what type material would most nearly provide an answer. This allows quick use of encyclopedias and open literature to solve the problem without the expense of an extensive search.

Referral Capability

A supporting resource which TUSC has found essential is a comprehensive referral capability. There are cases in which the NASA data and open literature do not produce an effective answer. When this occurs, rather than calling a consultant immediately, TUSC attempts to locate a specialized source of expertise on the subject at hand.

General Ancillary Understandings

Relation to Other Agencies

Relation to other agencies has already been mentioned in this chapter. However, one overall understanding is that effective liaison with a variety of other agencies as described in Chapters VI and VIII is considered essential to a complete package service for assistance to industry.

Economics Program

The TUSC profile data volumes have been mentioned several times in previous chapters. These TUSC publications have been significant for implementation of the broader TUSC mission of technology transfer. In the embryo stage of the experiment, they provided TUSC planners with a tool for initiating the basic

mission. Besides giving staff members valuable information about the region, the volumes also served in many cases as "door openers."

Through use of the profile information, individuals in the region became aware of and developed an interest in problems of economic growth. Activities by the economics staff during the TUSC experiment have also contributed to a better understanding of the process of economic growth in the region. The effectiveness of the TUSC technology transfer program has been enhanced because the organization has been able to respond to a broader range of problems as a result of the economics portion of the TUSC endeavor.

CHAPTER X

PROJECTIONS FOR THE FUTURE

As a sponsored agency of the Technology Utilization Division of the National Aeronautics and Space Administration, the Technology Use Studies Center has with this report concluded its first experiment. That experiment was to learn if "space-age" technology could be transferred to business and industry in an underdeveloped economic region and thereby to promote the kinds of economic activity that would enable the region to produce a standard of living for a majority of its citizens that is above that of welfare or mere subsistence levels.

In such an underdeveloped area, all efforts at promoting growth must have begun at the most basic levels. In the past five years, TUSC has endeavored, through a carefully developed series of county economic profiles and through a continuous field-service effort, to bridge the wide gaps that would enable the region to utilize ultra-modern technology in catching up and perhaps exceeding the mean of the nation's economic productivity. As was seen in Chapter IX, "Ancillary Understandings," efforts have been made to work with the causes of economic development rather than the effects of economic underdevelopment.

Through NASA's help in sponsoring TUSC, Southeastern State College has been able to achieve an expanded sphere of influence in the progressive development of the region. More and more people and organizations are looking to the College for assistance and leadership. This report has shown the impact TUSC has had in that regard.

Long-term needs of the area seem to justify the continuation of the Center as a NASA-sponsored agency. In many ways the Center

is just becoming "of-age." Again, it was reported in Chapter IX that the preparation of this impact study has enabled the staff to solidify fundamental and basic concepts about the market and the most effective means of serving the market. Within another five-year period, TUSC should achieve a marked increase in the measurable data that reflect substantial economic growth in the primary area.

Future activities of the Center appropriately seem to group themselves into the following categories:

1. Continue to function as a technical and economic data bank that is basically oriented to small business and industry. Recipients of the data should include those from other government agencies such as the Small Business Administration and the Offices of the State Technical Services. Conceivably, the Center could become a regional or a national source of specialized materials that are problem-oriented to the needs of small business.
2. The TUSC-NASA materials should be researched thoroughly to identify ideas for innovative projects that could be applied in the primary area. Regional development would result from the creation of new industries in the primary area served by the Center.
3. Continue to provide through field service the inputs of new technology. The industrial specialists would continue to serve as the "swithching mechanisms" that enable uneducated and unsophisticated users of technology to apply the latest in technological concepts and understandings.
4. Function as a <u>studies</u> center. By performing "software-type" studies, both economic and technical, the Center could perhaps hasten the tempo of economic development within the region. Such studies are oftentimes too complex and much too costly to be undertaken by the small firms or the potential entrepreneurs who might have a very sound idea for the expansion of an existing firm or

for the creation of a new firm in the area. The knowledge gained and the techniques developed through such studies could be applied to other underdeveloped areas thereby multiplying the value added.

The future of TUSC is correlated in direct proportion to the continued sponsorship of the National Aeronautics and Space Administration. The needs for the services of TUSC are in many ways greater today than at the outset of the experiment in February 1964. One reason is that existing firms have grown to rely on the counsel of TUSC personnel and the information in the NASA data bank and the TUSC technical library. Another reason is that in the area there are more firms in operation today than was the case five years ago. The base of need has thus broadened. Thirdly, the development of a progressive attitude among the people in the region would likely be seriously impaired, if not reversed, should the Center and other self-help agencies in the area be removed or abandoned. A fourth reason is that Southeastern State College would experience a diminished influence in the area at the very time that it is overcoming the narrowly-conceived image of a teachers college. Finally, the mission of economic development in the region remains a challenge. With NASA's help, TUSC can seek even more effective ways of promoting progressive economic growth in the region.

APPENDIX A

SELECTED BIBLIOGRAPHY ON TECHNOLOGY AND ECONOMIC GROWTH

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APPENDIX B

INTERVIEW AND OBSERVATION GUIDE

Date_____

Code Number_____

INTERVIEW AND OBSERVATION GUIDE

I. NATURE OF THE BUSINESS

A. Data concerning the business operation

Type of organization_____
Principal product(s)_____
_____
SIC Number_____
Physical facilites_____
Plant size, location_____
_____
Warehouse size, location_____
Office size, location_____
Production facilities_____
_____
_____
Number of employees_____
Job classifications (by divisions)_____
_____
_____
_____
_____
Employee relations
Union or nonunion_____
_____
Fringe benefits_____
_____
_____
_____
_____
Number of customers_____
Market area_____
Annual sales_____
Assets--monthly average
Current
Accounts receivable_____
Inventory
Raw materials_____
Work-in-process_____
Finished goods_____
Fixed
Tangible_____
Intangible_____

Liabilities--monthly average
Short-term_____
Long-term_____ _____
Owner's equity_____ _____
Surplus_____ _____

B. Distinctive characteristics or organizational objectives

II. CHARACTERISTICS OF THE OWNERS

A. Socio-economic

B. Educational

C. Business or work experiences

D. Affiliations--professional, civic, personal

III. FINANCE

A. Beginning capital

B. Capitalization of expansion

C. Fiscal management

1. Accounting records

2. Compensation of the owner/manager

3. Earnings retention

4. Insurance

V. PRODUCTION

A. Nature of operation

1. Production control

2. Quality control

3. Patents

B. Procurement

C. Warehousing

D. Inventories control

E. Transportation

VI. MARKETING

A. Marketing organization

B. Advertising

C. Sales promotion

D. Credits and colletions

E. Pricing policy

VII. LOCATION

A. Geographic

1. Raw materials

2. Market

3. Transportation

B. Locale

1. Own or rent

2. Room for expansion

VIII. EXPANSION

A. Facilities

B. Product line

C. Market

D. Plans for long-term continuity of the business

APPENDIX C

TUSC IMPACT MEASUREMENT QUESTIONNAIRE

TECHNOLOGY USE STUDIES CENTER

AREA CODE 405 / 924-5412 SOUTHEASTERN STATE COLLEGE DURANT, OKLAHOMA 74701

January 24, 1969

To speed the use of knowledge: a cooperative effort of the University of Oklahoma, Oklahoma State University, and Southeastern State College.

To Recipients of TUSC Data:

We need your help in measuring the impact TUSC has had during the five-year period 1964 through 1968. We have the responsibility of furnishing NASA with an impact measurement study by March 31.

Enclosed is a questionnaire on which you can indicate how you or your organization might have used TUSC publications. Only through your help can we reflect TUSC's impact. Also enclosed is a self-addressed postage-paid envelope for your convenience in returning the completed questionnaire.

It would be most helpful if the questionnaire could be returned to us by February 1. Time does not permit extensive follow-up reminders. This is the only request you will receive. Will you help us?

Sincerely,

C. Henry Gold
Director

CHG:vd

Enclosures (2)

TUSC IMPACT MEASUREMENT QUESTIONNAIRE

1. Have your or your staff used any of the TUSC publications? Please check the proper answer.

_____ yes

_____ no

_____ do not know

2. If you answered yes to question number 1, please check the publications used.

_____ County Profile _____ County

_____ Four and One-Half Year Study

_____ Other _____ please list

3. If you answered yes to question number 1, please explain briefly how you or your staff have used the TUSC data furnished you. _____

_____

_____

_____

_____

4. How many new firms have been located or organized in your community during each of the past five years? How many new jobs were created?

Number of Firms	Year	Number of Jobs
_____	1964	_____
_____	1965	_____
_____	1966	_____
_____	1967	_____
_____	1968	_____

5. Were TUSC data furnished to any of the new firms? Please check the proper response.

_____ yes

_____ no

_____ do not know

6. If your answer to question number 5 was yes, please indicate whether any TUSC data were used in the decisions to locate or organize firms in your community._____

_____

_____

_____

_____

7. Do you know of any existing local firms that have expanded their operations substantially during the past five years? Please check the proper response.

_____ yes

_____ no

_____ do not know

8. If yes, do you know if TUSC data were used in the decisions to expand?_____

_____

_____

_____

9. Do you know of any other uses or input of TUSC data or the TUSC field service?

_____ yes

_____ no

10. If yes, please list them._____

_____

_____

_____

_____

Information about respondent:

_____

Name Organization

_____

Street City State Zip Code

APPENDIX D

QUESTIONNAIRE ON TUSC MAILINGS

Technology Use Studies Center
Southeastern State College
Durant, Oklahoma 74701
Area Code 405 — WA 4-5412

February 20, 1969

Dear Mr.

According to our records you have been sent one or more mailings from the NASA-sponsored Technology Use Studies Center. Attached to this letter is a list of Technology Use Studies Center mailings. Our records show the ones which are checked were sent to you.

At this time we are preparing for NASA a measurement of our impact. Please assist us by indicating on the attached sheet any uses you made of the materials which were sent to you.

Any quantitative information that you can furnish is sincerely needed. The NASA Technology Utilization Division has stressed that the study, in so far as possible, should contain quantitative evidence of the uses of TUSC publications and services.

The deadline for submitting the report to NASA is March 31. Therefore, we have enclosed for your convenience a postage-paid self-addressed envelope that you can use in expediting your response to this request.

Thank you most sincerely for any assistance you can give us in developing a realistic measurement of the Program's impact. Of course, whenever we can be helpful to you, please let us know.

Sincerely,

C. Henry Gold
Director

CHG:ab

Attachment

LIST OF TECHNOLOGY USE STUDIES CENTER MAILINGS

Technology Utilization in a Non-Urban Region: The First Four Years of an Experiment ____

The United States Space Effort, Bulletin 1 ____

Implications of the Space Effort for Science and Technology, Bulletin 2 ____

State-Local Taxes and Industrial Location, A Logical Frame of Reference, Bulletin 3 ____

Estimates of Electricity Sales by Utilities, by County and Class of Service, Oklahoma, 1950 and 1960, Bulletin 4 ____

Employment Changes by Industry in Oklahoma from 1940-1960, Bulletin 5 ____

Profile Data Books (by individual counties):

Atoka	____	Johnston	____	Marshall	____
Bryan	____	Latimer	____	Murray	____
Carter	____	LeFlore	____	Pittsburg	____
Choctaw	____	Love	____	Pushmataha	____
Coal	____	McCurtain	____	Sequoyah	____
Haskell	____	McIntosh	____		

Profile Data Books, Complete Set(s) (all 17 counties) ____

Searches: _____

_____

_____

_____

Remarks: _____

_____

_____

_____

_____

_____

_____