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A Study of the Relationship Between Industrial Growth and Population Change in South Dakota From 1970 to 1980

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A STUDY OF THE RELATIONSHIP BETWEEN INDUSTRIAL GROWTH AND POPULATION CHANGE IN SOUTH DAKOTA FROM 1970 TO 1980

BY

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INTRODUCTION

The long term trend of manufacturing firms located in urban or metropolitan areas throughout the U.S.A. is undergoing change. Within the past twenty years there has been an increase in industrial activity in the nonmetropolitan areas(1) of this country representing a reversal of the former situation. Nonmetropolitan or rural industrial growth increased during the 1960's by 3.4% while the metropolitan or urban areas during the same period witnessed a gain of only 1.7%(2).

Industrialization in South Dakota over the past ten years has created 7,400 new employment positions which include both manufacturing and mining. Based on 1977 wage levels, an additional seventy-five million dollars(3) in wages and salaries in the state has been realized. With the 20% increase in manufacturing employment in South Dakota from 1960 to 1970 and the 49% increase from 1970 to 1980 as an indication(4), I expect many South Dakota communities will continue to experience growth in manufacturing and processing employment throughout the decade of the 1980's.

STATEMENT OF THE PROBLEM AND IMPORTANCE OF THE STUDY

Due to the influence of recent national trends, this study seeks the answer to the following question: "Is there a relationship between industrial growth and population change in South Dakota from 1970 to 1980?"

Research related to this question is important for a number of reasons.

First, all communities in this state are experiencing a continuous process of change. Some communities are changing very rapidly while others are changing more slowly. According to Dean D. Monteith(5), whatever the rate of change, communities can make a conscious effort with planning to guide the direction of that change. The findings from this research should provide a basis for better planning.

Second, the results of this research can provide information relative to industrialization as a means of retaining our young people in our state. New jobs, for example, may provide employment opportunities for many farm and small town youth who would otherwise leave the state for employment elsewhere.

Third, documentation of increased employment opportunity suggests the potential to help decrease underemployment and increase family incomes (often by allowing a second household member to obtain work outside the home).

Fourth, the findings from this research should provide educators and administrators with a basis for more effectively concentrating their efforts on relevant programs within the control of a particular community.

Finally, South Dakota lacks research in this particular area and the findings of this research will help to meet this need.

OBJECTIVES OF THE STUDY

There are two parts to this study. The first is primarily descriptive, and the second is explanatory. The objectives of the study are:

I. To provide a profile of the existing manufacturing labor force, based upon the Standard Industrial Classification codes for manufacturing, in South Dakota, 1979.

II. To examine the relationship between population change and industrial growth in terms of establishments, employees, and annual payroll in South Dakota from 1970 to 1980 by counties.

SUMMARY OF LITERATURE REVIEW

Several economists as well as sociologists from land grant universities in America have been focusing on the employment effects of rural industrialization for several years. The work of Wadsworth and Conrad at Purdue(6) in 1966 constitutes an early example. Other studies on the employment effects of various types of rural economic development have been published starting from the late 1960's up to the early 1970's including the work of Anderson(7), Bradshaw(8), Ayer(9), Clevenger(10), Dobbs(11), Kiner(12), Gorman(13), Gray(14), West(15), Kuehn(16), Layton(17), and Leholm(18). Sorkin(19) reviewed the employment effects of business and industrial development pertaining to the American Indian Reservation from 1959 to 1972, and the book by Summers(20) includes a major chapter on employment and the income effects of industrial development.

These studies have drawn some conclusions regarding rural industrialization:

I. the low-wage nature of industries that move into rural areas;

II. the disruptive effects large plants can have on the socio-economic fabric of small communities if they cause a sudden, large influx of workers;

III. the fact that in-migrants take those new jobs that demand high skills and pay well.

However, studies do show that rural industrialization under many circumstances can be of benefit both to the local work force and to the community at large.

Is South Dakota experiencing the same effects of rural industrialization that those studies indicated? There has been little research done on this topic. Mary Wagner(21) discussed female participation in the labor force in South Dakota. She found that the percentage of working women in this state increased during both the decades from 1950 to 1960 and from 1960 to 1970, despite population losses, and she predicted that this trend would continue. Marvin Riley and Linda Baer(22) indicated South Dakota's population on April 1, 1980, was 690,768 which is an increase of 3.8% from 1970. The low fertility of the 1960's together with a continued high rate of out-migration gave South Dakota a population loss for the 1960's of 2.1%. The 1970's present a different picture, as a dramatic reduction in net out-migration during this decade was sufficient to give South Dakota a population increase in spite of the low fertility. However, research is lacking which examines the relationship between this population change and the changes in labor force in South Dakota. Thus, this study attempts to fill the gap.

THEORETICAL FRAMEWORK

Kerlinger states that the ultimate aim of science is theory. He defines theory as a set of interrelated constructs (concepts), definitions, and propositions that present a systematic view of phenomena by specifying relations among variables, with the purpose of explaining and predicting the phenomena(23).

As this research deals with population change and industrialization in South Dakota, the theories of migration may shed some light on the association.

Ravenstein in his "The Law of Migration"(24) believed that the desire of most men to 'better' themselves in material aspects was the most influential factor to migrate when migration occurred in streams. In other words, he suggested that the economic motive was the primary cause of migration.

Stouffer's theory of intervening opportunities(25) indicated a person would not pass over opportunities, but would move only far enough to realize the objectives being met. Employment openings are important opportunities.

Both Ravenstein and Stouffer agree that there is a well-established relationship between the level of migration in a society and the condition of the economy. However, Lee's theory(26) goes one step further by stating that this relationship between migration and the state of the economy can be attributed to the expansion or stability of industries and businesses during different parts of the

economic cycle. And in Beshers'(27) theory, the economic aspects of migration appear as job and career constraints affecting the decision to migrate. Most recently, Wardwell and Brown(28) confirm that economic decentralization is one of the major factors to explain the reversal of relative growth rates between metropolitan and nonmetropolitan areas. The most recent data on the nonmetropolitan employment mix has changed: in March, 1975, 9% were in agriculture while 23% were in manufacturing. This turnaround reflects the redistribution of population through migration. Today, in most areas, net migration has taken over as the prime determinant of local population change(29).

Besides the theories of migration, the theories of systems can be of further assistance to this theoretical orientation. Talcott Parsons(30) discussed equilibrium as a basis for the balance of integration within a system. LaPiere(31) believed that most social elements do not function except in relationship to other elements, thus, a change in one element may make possible a comparable change in another or in others. Loomis(32) continued with the idea that because the subsystems within the whole social system are interlinked, changes in one results in changes in the other.

Thus, from the above theories of migration, theories of systems, and the literature review, the following propositions can be derived to fit this study:

I. The relationship of elements within a social system are such that changes in one part of the system affect changes in the other parts.

II. Changes in the labor force base in the system affect the number of people who can be employed in the social system.

III. An increase in industries results in an increase in employment opportunities.

IV. When employment opportunities increase, population change is likely to occur.

V. This population change occurs mainly because of the changes in net migration.

In other words, population change in South Dakota may be associated with the economic betterment due to increased industrialization in South Dakota.

METHODOLOGY

In order to achieve the first objective of the study, a questionnaire* was developed in cooperation with South Dakota's Industrial Development Division and mailed (in early January 1979) to all manufacturing firms in the state of South Dakota. Tabular and multivariate statistical techniques were used to analyze data obtained from the survey in which individual firms were treated as units of analysis.

Census materials and other secondary sources were used to meet the second objective of this study. Mathematical applications were used to show the population change in South Dakota by counties from 1970 to 1980.

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*From Dr. Thomas L. Dobbs' South Dakota Industrial Division Questionnaire.

By using the information from the questionnaire (see Appendix I), objective one was achieved as a descriptive study. However, in order to meet the second objective of the study, a multiple linear regression statistical model was used to test the hypotheses. The research formula used for this section was of the form: $Y = a + b_1X_1 + b_2X_2 + b_3X_3$. The statpak program for stepwise regression was used to determine the validity of the independent variables, and the F test was used to test the null hypotheses. The 0.05 level of significance was accepted for this research.

The dependent variables and their measurement are the following:

I. Total population change by counties, 1970 to 1980, as reported in the U.S. Census (see Appendix II).

II. Population change by counties due to migration, 1970 to 1980, as reported in Marvin P. Riley and Linda Baer's South Dakota Population and Net Migration, 1970-1980 (see Appendix II).

The independent variables used in this research are selected from County Business Patterns 1970, 1979, South Dakota (see Appendix II), and include the following:

I. The change in numbers employed in manufacturing by county, 1970 to 1979*.

II. The change in dollar value of annual manufacturing payrolls by counties, 1970 to 1979*.

III. The change in numbers of manufacturing establishments by counties, 1970 to 1979*.

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*1980's data is not yet published, but will be included as soon as it is available.

The following null hypotheses are tested at 0.05 level of significance:

I. The set of independent variables mentioned above will not contribute significantly to the explanation of the overall population change by counties in South Dakota from 1970 to 1980.

II. The set of independent variables mentioned above will not contribute significantly to the explanation of the net migration change by counties in South Dakota from 1970 to 1980.

FINDINGS

Objective One

The profile of the existing manufacturing labor force can be described in terms of the following characteristics: sex; level of formal education; vocational training; average annual payroll; and mean percent receiving special training after having been employed in the firm.

The data will be discussed in conjunction with the following eight tables. The data in Table 1 show the number and percentages of manufacturing employees included in the survey, by sex and Standard Industrial Classification categories, 1979. Various kinds of industry demand different proportions of male and female employees. Fourteen types of industry have more than half of their labor force comprised of males, while in the other eight kinds of industry females make up more than half of their labor force. However, in the overall picture, the percentages of male and female employees are 59.6 and

40.4, respectively. This suggests that the employment opportunities for females in the labor force in South Dakota is increasing in comparision with the traditional male dominant labor force.

In Table 2, the manufacturing employees are presented by occupational category and sex. Male employees are mainly occupying the high paid positions while female employees are mostly found in the secretarial positions and almost half of the production jobs. Jobs in different types of industry demand different levels of formal education.

Most of the manufacturing jobs in South Dakota demand a relatively low level of formal education (Table 3). While educational levels of employees varied by type of industrial classification, 80.6% of all employees indicated an educational level of high school or less than high school. Most of these are employed in production and other than secretarial, sales or professional categories (Table 4). Of the firms indicating employees with vocational training, almost nine tenths of these employees had less than one year of such training (Table 5). This may suggest that the manufacturing labor force in South Dakota, 1979 do not demand high skills, according to the results of the mail survey.

The average employee salaries and wages per year in South Dakota, by Standard Industrial Classification category for 1979, can be seen in Table 6. The highest average employee salaries and wages is $14,192 while the lowest is $4,314 per year with an overall average of

Table 1. The Number and Percentage of Manufacturing Employees Included in the Survey, by Sex and SIC Categories, 1979

Standard Industrial Classification (SIC) Categories		Employment in Manufacturing Firms in 1979*					
		Male Employees		Female Employees		Total Employment	
		No.	%	No.	%	No.	%
01	Crops	64	68.8	29	31.2	93	100
10	Metal Mining	1,488	92.2	126	7.8	1,614	100
14	Nonmetallic Mining	70	27.7	183	72.3	253	100
20	Food	3,783	84.6	687	15.4	4,470	100
22	Textile Mill	30	44.1	38	55.9	68	100
23	Apparel	223	33.7	438	66.3	661	100
24	Lumber	473	80.4	115	19.6	588	100
25	Furniture	32	57.1	24	42.9	56	100
26	Paper	5	71.4	2	28.6	7	100
27	Printing	5,683	46.4	6,554	53.6	12,237	100
28	Chemicals	160	86.0	26	14.0	186	100
30	Rubber, Plastics	322	53.5	280	46.5	602	100
31	Leather	42	31.6	91	68.4	133	100
32	Stone, Concrete	364	68.7	166	31.3	530	100
33	Metal Industries	--	--	--	--	--	--
34	Metal Products	551	91.5	51	8.5	602	100
35	Machinery	1,698	81.1	395	18.9	2,093	100
36	Electrical	573	32.9	1,171	67.1	1,744	100
37	Transportation	294	75.6	95	24.4	389	100
38	Instruments	270	46.3	313	53.7	583	100
39	Miscellaneous Manufacturing	139	38.5	222	61.5	361	100
Overall		16,264	59.6	11,006	40.4	27,270	100

*Number of firms included in these tabulations = 242.

Table 2. Occupational Breakdown of Manufacturing Employees by Sex in South Dakota, 1979*

Occupational Category	Male Employees		Female Employees		All Employees	
	No.	%	No.	%	No.	%
Professional	1,375	88.7	175	11.3	1,550	100
Sales	580	87.6	82	12.4	662	100
Secretarial	221	18.3	986	81.7	1,207	100
Production	13,065	57.6	9,633	42.4	22,698	100
Other	1,023	88.7	130	11.3	1,153	100
Overall	16,264	59.6	11,006	40.4	27,270	100

*Number of firms included in these tabulations = 242.

Table 3. Formal Education of Manufacturing Employees in South Dakota, by SIC Category

Standard Industrial Classification (SIC) Categories		Level of Formal Education*							
		12 years or less		13-15 years		16 years or more		All levels	
		No.	%	No.	%	No.	%	No.	%
01	Crops	81	76.4	11	10.4	14	13.2	106	100
10	Metal Mining	1,676	94.1	42	2.4	64	3.5	1,782	100
14	Nonmetallic Mining	84	96.6	1	1.2	2	2.2	87	100
20	Food	3,069	78.6	704	18.0	133	3.4	3.906	100
22	Textile Mill	58	85.3	4	5.9	6	8.8	68	100
23	Apparel	--	--	--	--	--	--	--	--
24	Lumber	450	80.8	40	7.2	67	12.0	557	100
25	Furniture	45	80.4	6	10.7	5	8.9	56	100
26	Paper	3	42.9	2	28.6	2	28.6	7	100
27	Printing	466	63.1	152	20.6	120	16.3	738	100
28	Chemicals	108	65.9	30	18.3	26	15.8	164	100
30	Rubber, Plastics	505	90.2	33	5.9	22	3.9	560	100
31	Leather	125	94.0	6	4.5	2	1.5	133	100
32	Stone, Concrete	321	83.8	43	11.2	19	5.0	383	100
33	Metal Industries	--	--	--	--	--	--	--	--
34	Metal Products	214	70.2	52	17.0	39	12.8	305	100
35	Machinery	1,469	78.6	253	13.5	148	7.9	1,870	100
36	Electrical	1,165	77.7	235	15.7	99	6.6	1,499	100
37	Transportation	223	81.7	34	12.5	16	5.8	273	100
38	Instruments	8	66.7	4	33.3	0	0	12	100
39	Miscellaneous Manufacturing	87	88.8	7	7.1	4	4.1	98	100
Overall		10,157	80.6	1,659	13.2	788	6.2	12,604	100

*Number of firms in these tabulations = 118.

Table 4. Formal Education of Manufacturing Employees in South Dakota by Category of Occupation, 1979

Occupational Category	Level of Education*							
	12 years or less		13-15 years		16 years or more		All levels	
	No.	%	No.	%	No.	%	No.	%
Professional	261	28.6	214	23.4	438	48.0	913	100
Sales	298	55.2	141	26.1	101	18.7	540	100
Secretarial	572	68.2	207	24.7	60	7.2	839	100
Production	7,172	86.0	1,005	12.0	167	2.0	8,344	100
Other	1,854	94.2	92	4.7	22	1.1	1,968	100
Overall	10,157	80.6	1,659	13.2	788	6.3	12,604	100

*Number of firms in these tabulations = 118.

Table 5. Vocational Education of Manufacturing Employees in South Dakota, by SIC Category

Standard Industrial Classification (SIC) Categories		Level of Vocational Education*							
		Less than 1 year		1-2 years		More than 2 years		All levels	
		No.	%	No.	%	No.	%	No.	%
01	Crops	13-64	65.0	1	5.0	6	30.0	20	100
10	Metal Mining	--	--	--	--	--	--	--	--
14	Nonmetallic Mining	19	100.0	0	0	0	0	19	100
20	Food	3,280	93.3	206	5.9	28	0.8	3,514	100
22	Textile Mill	--	--	--	--	--	--	--	--
23	Apparel	--	--	--	--	--	--	--	--
24	Lumber	170	89.0	20	10.5	1	0.5	191	100
25	Furniture	0	0	0	0	1	100.0	1	100
26	Paper	7	100.0	0	0	0	0	7	100
27	Printing	131	84.5	16	10.3	8	5.2	155	100
28	Chemicals	28	100.0	0	0	0	0	28	100
30	Rubber, Plastics	453	96.2	14	3.0	4	0.8	471	100
31	Leather	2	100.0	0	0	0	0	2	100
32	Stone, Concrete	284	94.7	15	5.0	1	0.3	300	100
33	Metal Industries	--	--	--	--	--	--	--	--
34	Metal Products	178	90.0	15	7.6	5	2.4	198	100
35	Machinery	1,171	88.3	125	9.4	30	2.3	1,326	100
36	Electrical	473	63.9	264	35.7	3	0.4	740	100
37	Transportation	187	60.7	117	38.0	4	1.3	308	100
38	Instruments	5	83.3	1	16.7	0	0	6	100
39	Miscellaneous Manufacturing	1	100.0	0	0	0	0	1	100
Overall		6,402	87.9	794	10.9	91	1.2	7,287	100

*Number of firms in these tabulations - 91.

Table 6. Employee Salaries and Wages in South Dakota, by SIC Category

Standard Industrial Classification (SIC) Categories		Average Employee Salaries and Wages*
01	Crops	$ 9,793
10	Metal Mining	13,323
14	Nonmetallic Mining	13,064
20	Food	14,192
22	Textile Mill	**
23	Apparel	11,002
24	Lumber	11,402
25	Furniture	4,314
26	Paper	9,857
27	Printing	7,456
28	Chemicals	**
30	Rubber, Plastics	8,704
31	Leather	5,310
32	Stone, Concrete	8,567
33	Metal Industries	10,914
34	Metal Products	11,029
35	Machinery	10,521
36	Electrical	8,006
37	Transportation	8,462
38	Instruments	13,154
39	Miscellaneous Manufacturing	12,513
Overall		12,680

*Number of firms included in these tabulations = 225.

**Insufficient data or data of questionable reliability.

$12,680. The data in Table 7 indicated that 81.9% of the manufacturing labor force are performing production tasks, while another 5.7% are professional personnel.

The average number of the reporting firms' employees receiving special training after having been employed represents 12.3%, ranging from 0% to 38.3% (Table 8).

Objective Two

As objective two is explanatory, a stepwise regression program and an F test are used to analyze the data. The analysis involves two dependent and three independent variables:

I. Dependent variables

Y_1 = the numerical change of overall population in South Dakota by counties from 1970 to 1980.

Y_2 = the numerical change of net migration in South Dakota by counties from 1970 to 1980.

II. Independent variables

X_1 = the numerical change of manufacturing employees in South Dakota by counties from 1970 to 1979.

X_2 = the numerical change ($1,000) of manufacturing annual payroll in South Dakota by counties from 1970 to 1979.

X_3 = the numerical change of manufacturing establishments in South Dakota by counties from 1970 to 1979.

Data presented in the previous table indicated that of the independent variables X_2 contributed most to the dependent variable Y_2, while the second was X_3 and X_1 last.

Table 7. Occupational Categories of Manufacturing Employees in South Dakota, by SIC Category

Standard Industrial Classification (SIC) Category		Employees in Each Occupational Category											
		Professional		Sales		Secretarial		Production		Other		All Employees	
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
01	Crops	12	12.9	21	22.6	14	15.1	37	39.8	9	9.7	93	100
10	Metal Mining	113	7.0	0	0	71	4.4	1,113	69.0	317	19.6	1,614	100
14	Nonmetallic Mining	24	9.5	5	2.0	15	5.9	204	80.6	5	2.0	253	100
20	Food	449	9.3	295	6.1	585	12.2	3,405	70.9	70	1.5	4,804	100
22	Textile Mill	1	1.5	1	1.5	2	2.9	41	60.3	23	33.8	68	100
23	Apparel	82	12.4	14	2.1	66	10.0	457	69.1	42	6.4	661	100
24	Lumber	71	10.1	139	19.8	38	5.4	357	50.9	97	13.8	702	100
25	Furniture	4	7.1	1	1.8	2	3.6	14	25.0	35	62.5	56	100
26	Paper	1	14.3	0	0	1	14.3	2	28.6	3	42.9	7	100
27	Printing	197	1.6	116	0.9	324	2.6	11,578	94.6	22	0.2	12,237	100
28	Chemicals	37	19.9	23	12.4	22	11.8	60	32.3	44	23.7	186	100
30	Rubber, Plastics	28	4.7	2	0.3	17	2.8	548	91.0	7	1.2	602	100
31	Leather	2	1.5	0	0	5	3.8	126	94.7	0	0	133	100
32	Stone, Concrete	58	10.9	9	1.7	27	5.1	417	78.7	19	3.6	530	100
33	Metal Industries	25	17.1	5	3.4	21	14.4	95	65.1	0	0	146	100
34	Metal Products	45	7.5	41	6.8	50	8.3	342	56.8	124	20.6	602	100
35	Machinery	162	7.7	41	1.9	118	5.6	1,714	81.4	70	3.3	2,105	100
36	Electrical	151	8.7	20	1.1	93	5.3	1,291	74.0	189	10.8	1,744	100
37	Transportation	39	10.0	19	4.9	23	5.9	303	77.9	5	1.3	389	100
38	Instruments	51	8.7	23	3.9	27	4.6	411	70.5	71	12.2	583	100
39	Miscellaneous Manufacturing	32	8.9	3	0.8	15	4.2	310	85.9	1	0.3	361	100
All Categories		1,584	5.7	778	2.8	1,536	5.5	22,825	81.9	1,153	4.1	27,876	100

Table 8. Proportion of Employees in the Survey Receiving Special Training after Having Been Employed by the Firm, by SIC Categories

Standard Industrial Classification (SIC) Categories		Mean Percent Receiving Special Training
01	Crops	4.0
10	Metal Mining	5.0
14	Nonmetallic Mining	1.4
20	Food	13.6
22	Textile Mill	--
23	Apparel	0.7
24	Lumber	8.5
25	Furniture	33.3
26	Paper	0
27	Printing	8.3
28	Chemicals	11.3
30	Rubber, Plastics	1.3
31	Leather	33.3
32	Stone, Concrete	13.2
33	Metal Industries	--
34	Metal Products	13.4
35	Machinery	15.9
36	Electrical	10.0
37	Transportation	38.3
38	Instruments	2.5
39	Miscellaneous Manufacturing	0.7
Overall		12.3

*Number of employees included in these calculations = 212.

SUMMARY AND CONCLUSIONS

South Dakota is being affected by a national trend which finds manufacturing industries increasingly locating outside established, large, metropolitan areas. One result of this trend is that many manufacturing firms now locating in nonmetropolitan areas draw heavily on the female work force. This research indicates that South Dakota is experiencing this phenomenon as the average number of females in the work force has increased to over 40% in 1979, with some industries having females comprising over 70% of their labor force. The ratio of female to male employees was heaviest in such industries as non-metallic mining, leather, electrical, and the apparel industries.

In relation to the labor market, there are three interdependent segments of an area's labor force, according to occupational skills: (a) the skilled, (b) the semi-skilled, and (c) the unskilled. Judging from the results of this research, which indicated that 86.6% of the manufacturing employees had twelve years or less formal education and 87.9% had less than one year vocational education, it would lead one to suggest that the manufacturing labor force in South Dakota in 1979 contained mainly the semi-skilled and the unskilled. Linking this with the fact that the average special training received after having been employed by a firm is 12.3%, suggests that the manufacturing plants in South Dakota do not demand a high level of skills for their labor force.

Use of this mainly unskilled labor force helps to explain the relatively low level of average salaries and wages in South Dakota industries.

In short, the profile of the existing manufacturing labor force, according to the Standard Industrial Classification codes for manufacturing sectors in South Dakota, 1979 can be presented in the following manner: low-paid, unskilled with little education, and an increasingly female-oriented work force.

With this profile in mind, manufacturing growth in nonmetropolitan areas often provides employment directly for many local residents and commuters from surrounding areas. Many of these will be females, who in many cases are probably spouses adding a second income to the household. The increased possibilities for employment in a particular area may both slow out-migration and encourage in-migration by attracting workers from other areas. This leads to the subject of objective two: the relationship between population change and industrial growth in terms of employees, annual payrolls and number of industrial establishments in South Dakota by counties from 1970 to 1980.

The following data, as shown in tabular form on page 18, can help the interpretation.

SOURCE	F	R^2 ACCUMULATIVE
X_2	104.48	62.0%
X_3	1.91	63.1%
X_1	0.12	63.2%

From the stepwise regression program, the R^2 value of 0.632 means that about 63.2% of the variation in the overall population change is explained by the employees change in number, the change in annual payroll in number and the numerical changes of establishments in the manufacturing sector by counties in South Dakota from 1970 to 1980. Step one shows that change in annual payroll explains 62.0% of the variances in overall population change. Step two shows that change in the number of establishments explains another 1.1% of the variance of overall population change while step three shows that the change in number of employees explains only an additional 0.1% of the variance. Applying an F test to each independent variable, the result shows change in annual payroll contributing significantly to the explanation of the observed variation in overall population change, but not the other two independent variables.

However, dealing with the second hypothesis the picture is slightly different. Here are some data from the second table on page 18:

SOURCE	F	R^2 ACCUMULATIVE
X_2	28.92	31.1%
X_3	4.19	35.4%
X_1	4.46	39.7%

The R^2 value of 0.397 means that about 39.7% of the variation in the net migration change by counties in South Dakota from 1970 to 1980 is explained by the three independent variables mentioned

above. Step one shows that the change in annual payroll explains 31.1% of the variance in net migration change, while step two shows that the change in number of establishments explains an additional 4.3%. Step three shows that the change in number of employees explains another 4.3% of the variance of net migration change. Using the F test to test each explanatory variable, they all contribute significantly at the 0.05 level to the explanation of the observed variation in the net migration change. Thus, the three independent variables are valid in the explanation of net migration change, but only one independent variable is needed to explain the overall population change. With these statistical findings I can reject both my null hypotheses at the 0.05 level of significance.

As a conclusion, the answer to the statement of the problem: "Is there a relationship between industrial growth and population change in South Dakota from 1970 to 1980?" is "YES." There is a positive relationship between industrial growth and population change in South Dakota from 1970 to 1980. The industrial growth probably contributes about 63.2% to the population growth rate of 3.8% for 1970 to 1980 in South Dakota (in comparison with a population loss for the 60's of 2.1%). The industrial growth also explains about 39.7% of the net out-migration changing from a loss of 13.6% (from 1960 to 1970) to a loss of 4.0% (from 1970 to 1980). In other words, the reduction in net out-migration during the 1970's was sufficient to give South Dakota a population increase of 3.8% in spite of the

low fertility, and the industrial growth contributes 39.7% of the net migration change which is roughly two-thirds of what the industrial growth contributes to the overall population change (which is 63.2%). Thus, this supports my theoretical framework: an increase in industries results in an increase of employment opportunities; when employment opportunities increase, population change is likely to occur; this population change occurs mainly because of the changes in net migration.

IMPLICATIONS

The findings and conclusions do suggest that industrial growth affects population growth in South Dakota. The social systems always respond to population changes, like the educational system, the health-care system, the religious system, the trade system, etc. Thus, local planners need to utilize all necessary information to make appropriate planning to cope with this nonmetropolitan migration turnaround trend that is still on-going in South Dakota.

Local planners need to be aware of the multiplier effects on both income and employment which result from expenditures by the industry itself on supplies produced within the local community, and prepare to plan for the potential developments.

Furthermore, the profile of the existing manufacturing labor force provides valuable information for community resource development through the cooperation of educational and training institutions to assure that those preparing for entry into particular jobs are aware

of all available preparatory opportunities. In addition, appropriately targeted vocational education programs can be planned as inducements to high-skilled manufacturing plants seeking new locations.

LIMITATIONS AND RECOMMENDATIONS

This is a narrow scope study as it is only focused on the manufacturing sector. As a result, the manufacturing sector is only responsible for 63.2% of the overall population change and 39.7% of the net migration change. What are other factors that may contribute to population change?

First, excluded from consideration in this study were wholesale and retail trade, recreation and tourism, the government sector financed from out-of-state sources (like military forces, etc.), transportation and public utilities, finance, insurance, real estate, contract construction, mining, and even the declining agricultural services, forestry, and fisheries in the economic sector of South Dakota. These are unknown factors which may contribute to population change.

Second, though the economic reason is the prime factor for migration, there are other reasons too, like preference for rural living and modernization of rural life, which may contribute to the population change experienced in South Dakota during the last decade.

In short, the development of industrialization in South Dakota did explain part of the population growth. Other unknown factors, like those mentioned above, will need further investigation.

NOTES

1. Census reports classify cities with populations of over 50,000 as metropolitan areas. For purposes of this report, rural will denote those incorporated places with fewer than 40,000 persons in 1970, which includes all of South Dakota exclusive of Sioux Falls and Rapid City. The terms rural and nonmetropolitan will be used interchangeably throughout.

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APPENDIX I: DR. THOMAS L. DOBBS' SOUTH DAKOTA INDUSTRIAL DIVISION QUESTIONNAIRE

Firm Name _____ Phone _____

Address _____

City _____ Zip Code _____

1. History of Firm

a. What year did your firm begin production operations in the present community? _____

b. Which of the following describes your firm as it was at the time established in this community? Check one:
   (1) New firm _____
   (2) Relocated firm _____
   (3) New subsidiary or branch plant _____

c. If a relocated firm (2), please specify previous location:
   City _____ State _____

d. If a subsidiary or branch plant (3), please specify location of parent company:
   City _____ State _____

2. Products of Firm

a. Please list and describe the major products or product groups which your firm produces, processes, and/or fabricates and indicate the percentage of total sales which this product or product group makes up.

	Product (including brand name)	Layman's Description	% of Total Sales
(1)			
(2)			
(3)			
(4)			
(5)			
(6)			
(7)			
(8)			
		Total =	100%

b. What percent of your firm's products is in the form of:
   (1) intermediate goods (for further processing by another firm)? _____%
   (2) final goods (finished products ready for final consumers)? _____%
   Total = 100 %

3. Characteristics of Firm

a. What is the size of your plant? _____ (square feet)
b. What is your capital investment in plant and equipment? $_____
c. What is your sales volume (annually)? $_____
d. What is your payroll (annually)? $_____

4. Questions Pertaining to Expanding Plants Only

a. What is your estimated cost of expansion? $_____
b. When is expansion expected to be completed? _____(date)
c. What is the size of the expansion? _____(square feet)
d. How many employees will be added by the expansion? _____

Manager's Name _____

After completing both pages, return questionnaire to: South Dakota Industrial Division
P.O. Box 5004
620 S. Cliff
Sioux Falls, South Dakota 57103

(turn to second page)

5. Employee Numbers and Demographic Characteristics

a. What is the current (1979) total employment of your firm in this community? _____ employees

b. What was the approximate total in 1970? _____ employees

c. Please break this employment down among the following occupational and sex categories, both for the current year (1979) and for the year 1970. If your firm began operation at the present location after 1970, indicate the employee numbers for the first year of production operations:

Occupational Category	Specify number of employees: 1970 (or ____*) Male	Female	Total	1979 Male	Female	Total
Professional &/or managerial						
Sales						
Secretarial & Clerical						
Production (include foremen)						
Other (please specify type)						
Total						

*If production operations began after 1970, enter that year (same as 1,a on previous page) and enter employee numbers for that year.

6. Employee Education and Training

a. Please indicate the approximate number of employees in each occupational category which have the following education and training levels:

Occupational Category	Elementary-High School-College: approximate number in each category — 12 yrs. or less (high school degree or less)	13-15 (some college)	16 + (4 yr. college degree or more)	Total employees (same as last column of ques.#5)	Additional education of Vocational Training nature: approximate number in each category — None, or less than 1 yr.	1-2 yrs.	More than 2 yrs.	Total employees (same as last column of ques.#5)
Professional &/or managerial								
Sales								
Secretarial & Clerical								
Production (include foremen)								
Other (please specify type)								
Total								

b. What proportion of your employees receive special training after having become employed with your firm? (Do not include routine on-the-job training or training sessions of only a few days duration.) Approximately _____%

c. Please briefly describe the four most common types of training received by those employees referred to in "b":

Skills taught	Where training received (including that at plant)	Duration of the training (in weeks)
(1)		
(2)		
(3)		
(4)		

APPENDIX II: POPULATION CHANGE SOURCE

South Dakota population and net migration, 1970-1980 (final counts).

County	Population 1980	Population 1970	Population Change Number	Population Change Rate	Net Migration Number	Net Migration Rate
South Dakota	690,768	666,257	+ 24,511	+ 3.8	- 26,384	- 4.0
Aurora	3,628	4,183	- 555	- 13.3	- 725	- 17.3
Beadle	19,195	20,977	- 1,682	- 8.1	- 2,617	- 12.5
Bennett	3,044	3,088	- 44	- 1.4	- 432	- 14.0
Bon Homme	8,059	8,577	- 518	- 6.0	- 667	- 7.8
Brookings	24,332	22,158	+ 2,174	+ 9.8	+ 437	+ 2.0
Brown	36,962	36,920	+ 42	+ 0.1	- 2,829	- 7.7
Brule	5,245	5,870	- 625	- 10.6	- 987	- 16.8
Buffalo	1,795	1,739	+ 56	+ 3.2	- 212	- 12.2
Butte	8,372	7,825	+ 547	+ 7.0	+ 130	+ 1.7
Campbell	2,243	2,866	- 623	- 21.7	- 677	- 23.6
Charles Mix	9,680	9,994	- 314	- 3.1	- 995	- 10.0
Clark	4,894	5,515	- 621	- 11.3	- 680	- 12.3
Clay	13,689	12,923	+ 766	+ 5.9	- 241	- 1.9
Codington	20,885	19,140	+ 1,745	+ 9.1	+ 376	+ 2.0
Corson	5,196	4,994	+ 202	+ 4.0	- 622	- 12.5
Custer	6,000	4,698	+ 1,302	+ 27.7	+ 1,115	+ 23.7
Davison	17,820	17,319	+ 501	+ 2.9	- 611	- 3.5
Day	8,133	8,713	- 580	- 6.7	- 682	- 7.8
Deuel	5,289	5,686	- 397	- 7.0	- 485	- 8.5
Dewey	5,366	5,170	+ 196	+ 3.8	- 676	- 13.1
Douglas	4,181	4,569	- 388	- 8.5	- 561	- 12.3
Edmunds	5,159	5,548	- 389	- 7.0	- 622	- 11.2
Fall River	8,439	7,505	+ 934	+ 12.4	+ 898	+ 12.0
Faulk	3,327	3,893	- 566	- 14.5	- 619	- 15.9
Grant	9,013	9,005	+ 8	+ 0.1	- 362	- 4.0
Gregory	6,015	6,710	- 695	- 10.4	- 876	- 13.1
Haakon	2,794	2,802	- 8	- 0.3	- 333	- 11.9
Hamlin	5,261	5,520	- 259	- 4.7	- 274	- 5.0
Hand	4,948	5,883	- 935	- 15.9	- 1,130	- 19.2
Hanson	3,415	3,781	- 366	- 9.7	- 585	- 15.5
Harding	1,700	1,855	- 155	- 8.4	- 256	- 13.8
Hughes	14,220	11,632	+ 2,588	+ 22.2	+ 1,103	+ 9.5
Hutchinson	9,350	10,379	- 1,029	- 9.9	- 1,050	- 10.1
Hyde	2,069	2,515	- 446	- 17.7	- 545	- 21.7
Jackson*	3,437	2,920	+ 517	+ 17.7	+ 121	+ 4.1
Jerauld	2,929	3,310	- 381	- 11.5	- 439	- 13.3
Jones	1,463	1,882	- 419	- 22.3	- 536	- 28.5
Kingsbury	6,679	7,657	- 978	- 12.8	- 845	- 11.0
Lake	10,724	11,456	- 732	- 6.4	- 1,247	- 10.9
Lawrence	18,339	17,453	+ 886	+ 5.1	- 264	- 1.5
Lincoln	13,942	11,761	+ 2,181	+ 18.5	+ 1,649	+ 14.0
Lyman	3,864	4,060	- 196	- 4.8	- 587	- 14.5
McCook	6,444	7,246	- 802	- 11.1	- 843	- 11.6
McPherson	4,027	5,022	- 995	- 19.8	- 1,004	- 20.0
Marshall	5,404	5,965	- 561	- 9.4	- 567	- 9.5
Meade	20,717	17,020	+ 3,697	+ 21.7	+ 1,762	+ 10.4
Mellette	2,249	2,420	- 171	- 7.0	- 430	- 17.8
Miner	3,739	4,454	- 715	- 16.1	- 717	- 16.1
Minnehaha	109,435	95,209	+ 14,226	+ 14.9	+ 5,396	+ 5.7
Moody	6,692	7,622	- 930	- 12.2	- 1,108	- 14.5
Pennington	70,361	59,349	+ 11,012	+ 18.6	+ 147	+ 2.5
Perkins	4,700	4,769	- 69	- 1.4	- 239	- 5.0
Potter	3,674	4,449	- 775	- 17.4	- 984	- 22.1
Roberts	10,911	11,678	- 767	- 6.6	- 1,433	- 12.3
Sanborn	3,213	3,697	- 484	- 13.1	- 528	- 14.3
Shannon	11,323	8,198	+ 3,125	+ 38.1	+ 981	+ 12.0
Spink	9,201	10,595	- 1,394	- 13.2	- 1,594	- 15.0
Stanley	2,533	2,457	+ 76	+ 3.1	- 196	- 8.0
Sully	1,990	2,362	- 372	- 15.7	- 576	- 24.4
Todd	7,328	6,606	+ 722	+ 10.9	- 790	- 12.0
Tripp	7,268	8,171	- 903	- 11.1	- 1,477	- 18.1
Turner	9,255	9,872	- 617	- 6.3	- 473	- 4.8
Union	10,938	9,643	+ 1,295	+ 13.4	+ 638	+ 6.6
Walworth	7,011	7,842	- 831	- 10.6	- 1,227	- 15.6
Yankton	18,952	19,039	- 87	- 0.5	- 1,379	- 7.2
Ziebach	2,308	2,221	+ 87	+ 3.9	- 303	- 13.6

*Jackson and Washabaugh Combined into one on January 1, 1979. (Now called Jackson County.)

Source: U.S. Bureau of the Census - 1980 Advanced Report (Revised South Dakota 7/15/81).

THE CHANGE IN NUMBER OF EMPLOYEES, ANNUAL PAYROLL AND ESTABLISHMENTS OF MANUFACTURING SECTORS IN SOUTH DAKOTA BY COUNTIES FROM 1970 TO 1979

County	Employees Change In Number*	Annual Payroll Change In Number ($1,000)*	Establishments Change In Number*
Aurora	0	0	1
Beadle	344	2078	8
Bennett	0	0	1
Bon Homme	264	503	3
Brookings	841	3069	6
Brown	908	6230	- 4
Brule	0	0	0
Buffalo	0	0	- 1
Butte	136	360	5
Campbell	- 21	- 21	- 1
Charles Mix	0	0	0
Clark	0	0	0
Clay	116	541	1
Codington	843	2606	12
Corson	376	0	1
Custer	- 40	111	- 2
Davison	356	1607	3
Day	210	387	8
Deuel	0	0	1
Dewey	0	0	0
Douglas	0	0	0
Edmunds	28	64	5
Fall River	35	53	2
Faulk	0	0	- 1
Grant	97	726	3
Gregory	12	47	1
Haakon	0	0	0
Hamlin	0	0	3
Hand	28	122	1
Hanson	0	0	2
Harding	- 5	- 4	- 1
Hughes	- 9	130	- 1
Hutchinson	172	635	6
Hyde	6	7	1
Jackson	0	0	1
Jerauld	0	0	0
Jones	0	0	- 1
Kingsbury	57	127	5
Lake	314	1150	5
Lawrence	1360	5539	12
Lincoln	417	1789	5
Lyman	0	0	0
McCook	88	422	1
McPherson	6	27	3
Marshall	183	383	5
Meade	102	266	0
Mellette	0	0	- 1
Miner	0	0	- 2
Minnehaha	1125	19223	27
Moody	0	0	3
Pennington	1150	5169	- 2
Perkins	- 40	- 41	- 2
Potter	38	68	0
Roberts	31	71	- 8
Sanborn	0	0	0
Shannon	126	168	4
Spink	- 51	- 22	- 1
Stanley	0	0	0
Sully	0	0	1
Todd	0	0	0
Tripp	- 42	- 39	- 3
Turner	20	53	2
Union	895	2299	9
Walworth	31	220	1
Yankton	280	1623	3
Ziebach	0	0	- 1

*Absolute number in 1979 minus absolute number in 1970
Source: U.S. Bureau of the Census - County Business Patterns 1970, 1979, (South Dakota).

APPENDIX III: COMPUTER PRINTOUT FOR STEPWISE REGRESSION

1

DEPENDENT VARIABLE = Y_1

TEP 1 VAR. SELECTED... 4 (X_2)

UM OF SQUARES REDUCED IN THIS STEP **********
ROPORTION OF VARIANCE OF Y REDUCED 0.620
FOR THIS VARIABLE (D.F.=1, 64) 104.478

UMULATIVE SUM OF SQUARES REDUCED **********
UMULATIVE PROPORTION REDUCED 0.620 OF 382532900.000

ULTIPLE CORRELATION COEFFICIENT 0.787
TANDARD ERROR OF ESTIMATE 1506.825

FOR ANALYSIS OF VAR.(D.F.= 1, 64) 104.478

ARIABLE	REG.COE.	STD.ERROR COEF.	COMPUTED T	BETA COEF
4	0.72359	0.07079	10.22146	0.78748
NT'CEPT	-242.77510			

TEP 2 VAR. SELECTED... 5 (X_3)

JM OF SQUARES REDUCED IN THIS STEP 4285430.000
ROPORTION OF VARIANCE OF Y REDUCED 0.011
FOR THIS VARIABLE (D.F.=1, 63) 1.914

JMULATIVE SUM OF SQUARES REDUCED **********
JMULATIVE PROPORTION REDUCED 0.631 OF 382532900.000

JLTIPLE CORRELATION COEFFICIENT 0.795
TANDARD ERROR OF ESTIMATE 1496.175

FOR ANALYSIS OF VAR.(D.F.= 2, 63) 53.943

RIABLE	REG.COE.	STD.ERROR COEF.	COMPUTED T	BETA COEF
4	0.82081	0.09939	8.25838	0.89329
5	-77.87541	56.28406	-1.38361	-0.14966
T'CEPT	-175.63150			

EP 3 VAR. SELECTED... 3 (X_1)

M OF SQUARES REDUCED IN THIS STEP 265644.800
OPORTION OF VARIANCE OF Y REDUCED 0.001
FOR THIS VARIABLE (D.F.=1, 62) 0.117

MULATIVE SUM OF SQUARES REDUCED **********
MULATIVE PROPORTION REDUCED 0.632 OF 382532900.000

LTIPLE CORRELATION COEFFICIENT 0.795
ANDARD ERROR OF ESTIMATE 1506.772

FOR ANALYSIS OF VAR.(D.F.= 3, 62) 35.497

RIABLE	REG.COE.	STD.ERROR COEF.	COMPUTED T	BETA COEF
4	0.79547	0.12454	6.38743	0.86571
5	-80.66049	57.26450	-1.40856	-0.15502
3	0.31075	0.90848	0.34206	0.04114
T'CEPT	-197.03170			

.1

DEPENDENT VARIABLE = Y_2

STEP 1 VAR. SELECTED... 4 (X_2)

SUM OF SQUARES REDUCED IN THIS STEP 23501870.000
PROPORTION OF VARIANCE OF Y REDUCED 0.311
F FOR THIS VARIABLE (D.F.=1, 64) 28.921

CUMULATIVE SUM OF SQUARES REDUCED 23501870.000
CUMULATIVE PROPORTION REDUCED 0.311 OF 75509250.000

MULTIPLE CORRELATION COEFFICIENT 0.558
STANDARD ERROR OF ESTIMATE 901.452

F FOR ANALYSIS OF VAR.(D.F.= 1, 64) 28.921

VARIABLE	REG.COE.	STD.ERROR COEF.	COMPUTED T	BETA COEF
4	0.22775	0.04235	5.37785	0.55789
INT'CEPT	-599.02810			

STEP 2 VAR. SELECTED... 5 (X_3)

SUM OF SQUARES REDUCED IN THIS STEP 3242270.000
PROPORTION OF VARIANCE OF Y REDUCED 0.043
F FOR THIS VARIABLE (D.F.=1, 63) 4.189

CUMULATIVE SUM OF SQUARES REDUCED 26744130.000
CUMULATIVE PROPORTION REDUCED 0.354 OF 75509250.000

MULTIPLE CORRELATION COEFFICIENT 0.595
STANDARD ERROR OF ESTIMATE 879.801

F FOR ANALYSIS OF VAR.(D.F.= 2, 63) 17.275

VARIABLE	REG.COE.	STD.ERROR COEF.	COMPUTED T	BETA COEF
4	0.14318	0.05845	2.44988	0.35074
5	67.73729	33.09691	2.04663	0.29301
INT'CEPT	-657.43040			

STEP 3 VAR. SELECTED... 3 (X_1)

SUM OF SQUARES REDUCED IN THIS STEP 3270524.000
PROPORTION OF VARIANCE OF Y REDUCED 0.043
F FOR THIS VARIABLE (D.F.=1, 62) 4.457

CUMULATIVE SUM OF SQUARES REDUCED 30014640.000
CUMULATIVE PROPORTION REDUCED 0.397 OF 75509250.000

MULTIPLE CORRELATION COEFFICIENT 0.630
STANDARD ERROR OF ESTIMATE 856.612

F FOR ANALYSIS OF VAR.(D.F.= 3, 62) 13.635

VARIABLE	REG.COE.	STD.ERROR COEF.	COMPUTED T	BETA COEF
4	0.23212	0.07080	3.27848	0.56858
5	77.50957	32.55531	2.38086	0.33528
3	-1.09037	0.51648	-2.11118	-0.32492
INT'CEPT	-582.34180			

DO YOU WISH TO PRINT THE TABLE OF RESIDUALS