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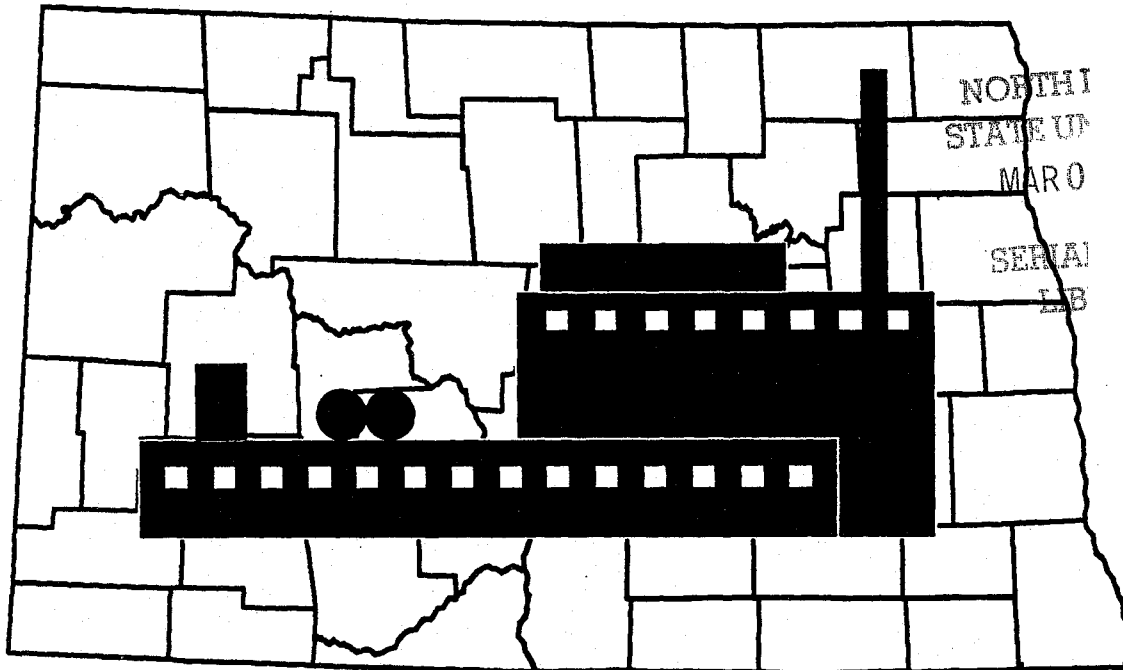
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# North Dakota Manufacturers: Attributes and Needs Assessment



by

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## *Preface*

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## Highlights

North Dakota's policy makers are placing increased emphasis on economic development, and the manufacturing sector is viewed by many as central to the state's economic development and diversification efforts. This report summarizes findings of a 1991 survey of 214 North Dakota manufacturers, or roughly 58 percent of the firms that serve markets outside their local area. Some of the key findings are

- ✓ Many North Dakota manufacturing firms are relatively new (almost 44 percent began operations at their present location after 1979) and relatively small (about 57 percent had gross sales of less than \$1 million in 1990).
- ✓ Most of the firms (77 percent) market some of their product outside the state, and they see marketing skills as critical to their future success. Only about one-fourth of the respondents reported that they are currently selling products outside the United States, but about one-half plan for their firms to serve international markets in the next five years. Many of these manufacturers may be seeking assistance with international marketing in the years ahead.
- ✓ The firms purchased about 58 percent of their inputs (including labor) from suppliers within the state. Almost all (98.5 percent) would make an effort to purchase more from in-state suppliers if items were available and prices were competitive. Establishing a brokerage network to connect manufacturers with in-state suppliers could enhance economic growth and development in the state.
- ✓ The manufacturers employed an average of 54 workers in 1991, but the typical (median) firm had only 15 employees. The average firm had increased its work force by 44 percent over the last 5 years, and the firms projected an average growth of 44 percent over the next 5 years.
- ✓ Established firms that had 20 or more employees 5 years prior to the survey accounted for almost 57 percent of all jobs created during the past 5 years. Smaller established firms (with less than 20 workers 5 years previous) were responsible for 19 percent and new firms (started within the last 5 years) for 24 percent. State assistance efforts should not overlook established companies.



- ✓ About 65 percent of the respondents sought financing during the last year, and 32 percent of these (or 21 percent of all survey firms) reported that they had difficulty obtaining financing. Financing problems were reported most frequently by new firms.
  
- ✓ Marketing and sales was the area in which the firms felt the greatest need for training and educational assistance. Similarly, marketing studies was the area of greatest need for technical assistance (consulting). Marketing is clearly one of the areas on which future technical assistance efforts should focus.

## North Dakota Manufacturers: Attributes and Needs Assessment

F. Larry Leistritz and Janet K. Wanzek\*

The 1980s could be characterized as a period of turmoil for the North Dakota manufacturing sector. Many of the state's major manufacturers are closely linked to agriculture, and some of these firms experienced difficulties as a result of those encountered by farmers and ranchers. At the same time, the whole U.S. manufacturing sector was experiencing the effects of increased foreign competition, which led to substantial restructuring of many industries. This restructuring included decentralization in some industries, with some firms increasing their reliance on out-sourcing for components as an alternative to in-house production while others sought to establish branch plants in locations where a favorable combination of production and distribution costs could be attained.

These forces, some positive and some negative, were reflected in changes in the state's manufacturing employment. After recording dynamic growth during the 1970s (manufacturing employment increased 86 percent from 1969 to 1979), the sector suffered an 11 percent decline in total employment from 1979 to 1983. Then, after a period with relatively little change in the mid 1980s, manufacturing employment grew steadily from 1987 to 1990, reaching an all-time high of 17,380 jobs in 1990 (Figure 1).

Recent growth in the state's manufacturing employment lends support to the view that this sector has substantial potential to contribute to future economic diversification and development. Expansion of the manufacturing sector is one of the major goals set forth in the **Growing North Dakota** economic development initiative (S.B. 2058), enacted by the 1991 North Dakota Legislative Session. The **Growing North Dakota** legislation contains a number of provisions that enable state entities to assist the manufacturing sector (e.g., by providing financing at favorable terms or by assisting in technology commercialization or transfer). For state assistance to be most effective, however, decision makers must understand the current composition of the manufacturing sector and the needs of its firms.

The purpose of this study was to develop a better understanding of the firms that make up the North Dakota manufacturing sector and their needs. Specific objectives were to (1) describe the firms that make up the manufacturing sector, in terms of such characteristics as their products, location, employment, suppliers, and related attributes, and (2) identify their needs for financing and technical assistance.

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Figure 1: Manufacturing Employment  
in North Dakota, 1966-1990

Source: Job Service North Dakota (1991)

### Procedures

The information needed to fulfill the project objectives was obtained through a survey of North Dakota manufacturers. The initial survey list was developed by cross-referencing a list of manufacturers compiled by the North Dakota Department of Economic Development and Finance with a similar list developed by the North Dakota State College of Science. The amalgamated list contained about 800 firms. A 16-page questionnaire was mailed to these firms on May 7, 1991. A reminder letter was mailed on June 4 to firms that had not returned their surveys, and in July telephone calls were made to the firms that had not yet responded. As a result of these contacts, we learned that about 130 of the 800 firms had closed or moved out of state while another 300 were engaged in activities that served local markets only (e.g., copy centers, custom meat packing). When these 300 firms were eliminated, the effective population size became 370 firms. From this group, we obtained a total of 214 useable responses, for a response rate of 58 percent.

The geographic distribution of the survey respondents is shown in Table 1, which also shows the number of manufacturing sector employers and their 1990 annual average employment as reported by Job Service North Dakota. Comparison of the two distributions indicates that the survey respondents are reasonably representative of the population of manufacturers. The information in Table 1 does indicate that the survey respondents have a somewhat higher employment level -- 39 employees per firm compared to 27 for the population. This is consistent with the decision to exclude locally oriented enterprises (most of which were very small) from the survey. The data summarized in Table 1 also suggest that firms located in Region 5 were somewhat over-represented in the sample whereas those in Regions 2, 4, and 7 were under-represented. (For a map of the State Planning Regions, see Figure 2.) Some of this apparent discrepancy, however, may be attributable to firms with multiple facilities. In the survey, the headquarters unit often reported the employment, as well as other information, for all of its North Dakota facilities combined, whereas Job Service reports each facility and its employees by the county where the facility is located.

TABLE 1. DISTRIBUTION OF NORTH DAKOTA MANUFACTURING FIRMS BY REGION, 1990 AND 1991

| Region <sup>b</sup> | 1990 Population <sup>a</sup> |                            |            | 1991 Survey     |                             |            |
|---------------------|------------------------------|----------------------------|------------|-----------------|-----------------------------|------------|
|                     | Number of Firms              | Annual Employment (Number) | % of Total | Number of Firms | Current Employment (Number) | % of Total |
| 1                   | 46                           | 226                        | 1.3        | 11              | 66                          | 0.8        |
| 2                   | 90                           | 1,167                      | 6.7        | 14              | 240                         | 2.9        |
| 3                   | 57                           | 1,539                      | 8.9        | 14              | 592                         | 7.3        |
| 4                   | 90                           | 2,289                      | 13.2       | 23              | 408                         | 5.0        |
| 5                   | 257                          | 7,980                      | 45.9       | 79              | 5,253                       | 64.6       |
| 6                   | 78                           | 1,678                      | 9.7        | 22              | 789                         | 9.7        |
| 7                   | 180                          | 3,002                      | 17.3       | 34              | 511                         | 6.3        |
| 8                   | 54                           | 815                        | 4.7        | 13              | 277                         | 3.4        |
| Total <sup>c</sup>  | 646                          | 17,380                     | 100.0      | 210             | 8,136                       | 100.0      |

<sup>a</sup>SOURCE: Job Service North Dakota. 1991. North Dakota Employment and Wages, 1990. Bismarck: Job Service North Dakota.

<sup>b</sup>For a map of the state planning regions, see Figure 2.

<sup>c</sup>Regional totals do not add to the state total because some county values represent a combination of manufacturing and other sectors.

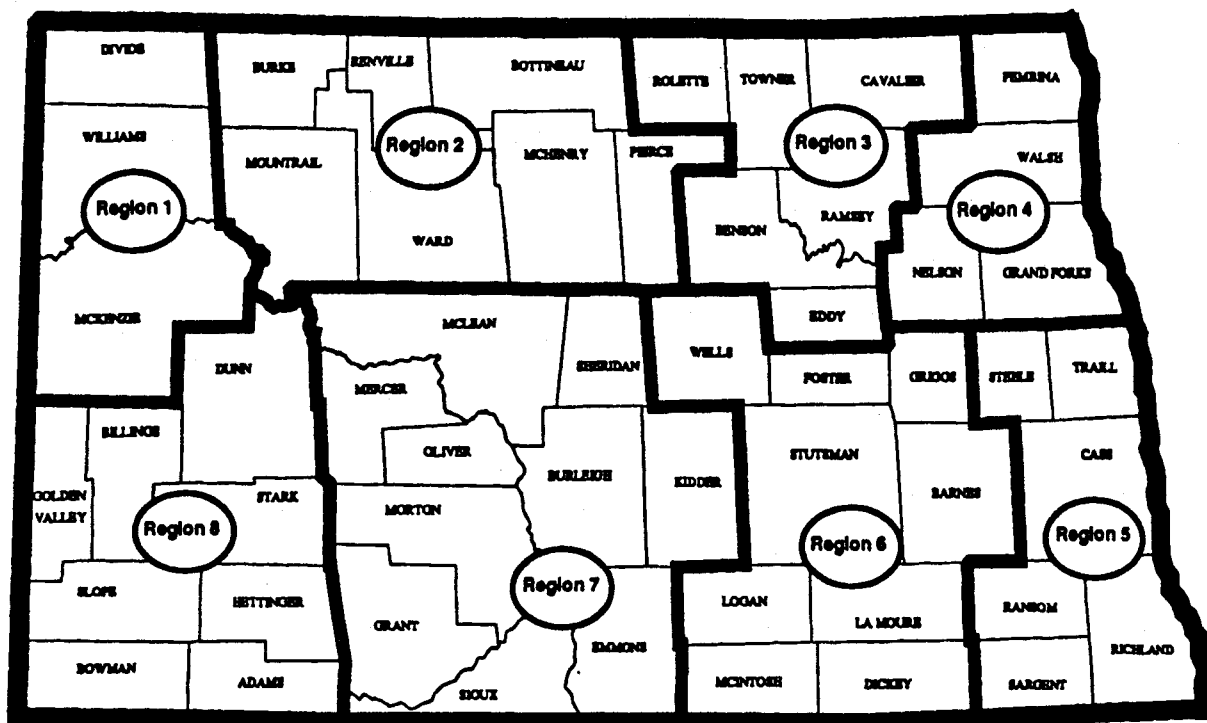


Figure 2. North Dakota State Planning Regions

## Results

The results of the survey are summarized in the sections that follow. These sections deal with (1) general characteristics, (2) sales and marketing, (3) expenditures and suppliers, (4) employment, (5) financing, (6) production capacity and equipment, and (7) needs for technical assistance.

### General Characteristics

Most of the respondents (79 percent) reported that their establishment was the only location of their firm, while 13 percent indicated that it was the headquarters, and 8 percent said it was a branch or regional office (Table 2). The firms varied greatly with regard to the length of time they had been operating in the community. About 44 percent had started in 1980 or after, and 25 percent had begun operations during the 1970s. About 79 percent of the respondents reported that the firm had been started from scratch while about 21 percent had purchased the firm (Table 2).

TABLE 2. SELECTED CHARACTERISTICS OF  
RESPONDENT MANUFACTURING FACILITIES,  
1991

| Characteristic                             | Percent |
|--|---------|
| <u>Type of establishment</u>               |         |
| Only location of firm                      | 79.0    |
| Headquarters of firm                       | 13.1    |
| Branch or regional office                  | 7.9     |
| <u>Year firm started in this community</u> |         |
| 1980 and after                             | 43.8    |
| 1970-1979                                  | 25.4    |
| 1950-1969                                  | 18.4    |
| 1920-1949                                  | 6.9     |
| Before 1920                                | 5.5     |
| <u>Origin of company</u>                   |         |
| Started from scratch                       | 78.5    |
| Purchased                                  | 20.6    |
| Inherited                                  | 1.0     |
| <u>Functions performed</u>                 |         |
| Assembly                                   | 73.7    |
| Fabrication                                | 68.7    |
| Production design                          | 67.6    |
| Research and development                   | 48.6    |
| Marketing research                         | 30.3    |
| Feasibility studies                        | 10.8    |
| <u>Type of product</u>                     |         |
| Durable goods                              | 66.0    |
| Nondurable goods                           | 34.0    |
| <u>High-tech firms</u>                     | 10.9    |
| <u>Agribusiness firms</u>                  | 24.2    |
| <u>New firms since 1987</u>                | 18.5    |
| <u>Firms established prior to 1987</u>     |         |
| Less than 20 employees in 1987             | 59.5    |
| 20 employees or more in 1987               | 22.0    |

When asked what specific functions their firm performs, almost 74 percent of respondents reported that they engage in assembly, 69 percent are involved in fabrication, and 68 percent are engaged in production design. Almost half (48.6 percent) are engaged in research and development, but only 30 percent reported that they undertake marketing research, and only 11 percent perform feasibility studies.

Of the responding firms, 66 percent were engaged in durable goods manufacturing (Table 2). Firms in the Standard Industrial Classification (SIC) categories that have been designated as high-tech (Smith and Barkley 1988) accounted for about 11 percent of the respondents. Agribusiness firms made up about 24 percent of the sample; these firms were about equally divided between nondurable goods manufacturers (primarily food processors) and durable goods manufacturers (primarily farm equipment producers). Firms that had been established since 1987 accounted for about 18.5 percent of the responding firms, established firms with fewer than 20 employees for 59.5 percent, and established firms with 20 employees or more for 22 percent.

### Sales and Marketing

The respondent firms reported gross sales for 1990 that averaged \$9.2 million (Table 3), but their sales volumes covered a wide range: almost 16 percent had annual sales of less than \$100,000 while about 4 percent had gross sales of \$50 million or more. As a group, the agribusiness firms had the highest level of gross sales in 1990, an average of \$32.6 million per firm. The median sales volume for agribusiness firms (\$1.5 million) also was much higher than that for all firms (\$642,500) (see Appendix Table 1). Nondurable goods manufacturers had a much higher average sales level than durable goods manufacturers, although median values differed substantially less.

When the firms compared their 1990 gross sales with those for 1989, the typical (median) firm reported an increase of 10 percent. About 15 percent of the respondents reported a negative change in sales while 22 percent indicated their sales had not changed. Nondurable goods manufacturers recorded substantially less growth in gross sales from 1989 to 1990 than the other firm types compared (Appendix Table 1).

When asked to project their gross sales for 1991 and 1992, the firms recorded mixed responses (Table 3). On average, the firms expected their 1991 gross sales to exceed the 1990 level by nearly 18 percent; the median value was 6.4 percent. One-third of the firms expected either no growth in sales or a decrease from 1990 to 1991. Among the firm types, the nondurable goods manufacturers projected a substantially lower sales growth, on average, from 1990 to 1991 than firms of other types (Appendix Table 1). There was little difference in the median values, however.

Looking forward to 1992, some firms were much more optimistic than the 1990-91 experience might suggest they should be, as the average expected increase in sales from 1990 to 1992 was 61 percent. The median value of 21 percent, however, probably better reflects the outlook of the typical firm. About 17 percent of the firms expected sales to either decline or remain the same (Table 3). Again, the nondurable goods manufacturers projected substantially less growth in sales from 1990 to 1992 than firms of the other types (Appendix Table 1).

TABLE 3. GROSS SALES OF RESPONDENT MANUFACTURING FACILITIES

| Gross Sales   | Value       |
|---|-------------|
| <u>Gross sales in 1990</u>                                    |             |
| Mean (N=180)  | \$9,160,922 |
| Median  | 642,500     |
| Distribution:   |             |
| Less than \$100,000   | 15.6%       |
| \$100,000 to 249,999  | 16.6        |
| \$250,000 to 499,999  | 12.2        |
| \$500,000 to 999,999  | 12.3        |
| \$1,000,000 to 4,999,999                                      | 26.6        |
| \$5,000,000 to 9,999,999                                      | 7.3         |
| \$10,000,000 to 49,999,999                                    | 5.5         |
| \$50,000,000 or more  | 3.9         |
| <u>Change in gross sales, 1990 compared to 1989</u>           |             |
| Mean (N=158)  | 18.3        |
| Median  | 10.0        |
| Distribution:   |             |
| Negative  | 14.6        |
| No change   | 22.2        |
| 0.01 to 9.9   | 11.4        |
| 10.0 to 24.9  | 26.0        |
| 25.0 to 49.9  | 15.8        |
| 50.0 to 99.9  | 6.9         |
| 100.0   | 3.2         |
| <u>Projected change in gross sales, 1991 compared to 1990</u> |             |
| Mean (N=166)  | 17.9        |
| Median  | 6.4         |
| Distribution:   |             |
| Negative  | 21.1        |
| Zero  | 12.0        |
| 0.1 to 9.9  | 25.3        |
| 10.0 to 24.9  | 19.3        |
| 25.0 to 49.9  | 12.7        |
| 50.0 or more  | 9.6         |
| <u>Projected change in gross sales, 1992 compared to 1990</u> |             |
| Mean (N=152)  | 61.3        |
| Median  | 21.4        |
| Distribution:   |             |
| Negative  | 9.9         |
| Zero  | 7.2         |
| 0.1 to 9.9  | 10.5        |
| 10.0 to 24.9  | 27.7        |
| 25.0 to 49.9  | 21.0        |
| 50.0 or more  | 23.7        |



The manufacturers also were asked about factors that had been important in affecting their sales volume and whether these factors had positive or negative effects (Appendix Table 2). Among the factors cited as having a positive effect, new products, raw material costs, the availability of financing, and changing consumer income were factors most often rated as critically or very important. Among factors cited as having negative effects, financing problems, taxes, and domestic competition received the highest ratings.

The respondents were asked where they sell their major products. On average, about 37 percent of the products are marketed within the local area, 21 percent within the rest of North Dakota, 37 percent elsewhere in the United States, and about 5 percent outside the United States (Table 4). About 10 percent of the firms reported that essentially all of their products are marketed locally; some of these may be supplying other firms that serve a wider market. At the other extreme, 26 percent reported that none of their products are marketed locally. Only about one-fourth of the firms reported selling products outside the United States, but about half of the respondents plan for their firms to serve international markets in the next 5 years. This suggests that a substantial number of these manufacturers may be seeking assistance with international marketing during the next few years.

TABLE 4. MARKETS AND MARKETING STRATEGIES OF RESPONDENT FIRMS, 1991

| Markets and Marketing Strategies   | Percent |
|--|---------|
| <u>Where major products are marketed (N=207)</u>                           |         |
| Within local market  | 36.7    |
| Within rest of North Dakota  | 21.4    |
| Within rest of United States   | 37.4    |
| International  | 4.9     |
| <u>Percent of products sold out-of-state</u>                               |         |
| Mean (N=206)   | 42.2    |
| Median   | 30.0    |
| Distribution:  |         |
| Zero   | 22.8    |
| 0.1 to 9.9   | 9.2     |
| 10.0 to 24.9   | 10.7    |
| 25.0 to 49.9   | 14.6    |
| 50.0 to 74.9   | 12.6    |
| 75.0 to 100.0  | 30.1    |
| <u>Degree of success in developing new customers/market niches (N=206)</u> |         |
| Very successful  | 18.9    |
| Successful   | 29.6    |
| Moderately successful  | 29.1    |
| Somewhat successful  | 17.5    |
| Not successful   | 4.5     |

The average firm sold about 42 percent of its products outside the state; the median value was 30 percent (Table 4). About 23 percent of the firms sold none of their products outside the state, while about 43 percent sold more than half of their products outside the state. Agribusiness firms and high-tech establishments had relatively high percentages of out-of-state sales (Appendix Table 3).

When asked how successful they have been in developing new customers/market niches for existing products in the past year, most respondents indicated that they had been successful or moderately successful (Table 4).

The respondents were asked about the importance of several factors in developing their out-of-state markets (Table 5). Factors that received relatively high ratings were initiation of contacts with out-of-state customers, the spreading of the firm's reputation outside the state, and referrals.

TABLE 5. RESPONDENTS' RATING OF IMPORTANCE OF SELECTED FACTORS IN DEVELOPMENT OF OUT-OF-STATE MARKETS, 1991

| Factors   | Critically        | Very      | Moderately | Slightly  | Not                               | Mean | N   |
|---|-------------------|-----------|------------|-----------|-----------------------------------|------|-----|
|   | Important         | Important | Important  | Important | Important<br>or Not<br>Applicable |      |     |
|   | -----percent----- |           |            |           |                                   |      |     |
| Acquired out-of-state sales prior to the company's founding | 7.3               | 15.3      | 11.3       | 8.1       | 58.1                              | 3.9  | 124 |
| Initiated contact with out-of-state customers               | 38.5              | 39.9      | 10.8       | 3.4       | 7.4                               | 2.0  | 148 |
| Reputation spread outside state                             | 27.9              | 51.0      | 11.6       | 4.1       | 5.4                               | 2.1  | 147 |
| Referrals   | 23.6              | 43.8      | 12.5       | 9.7       | 10.4                              | 2.4  | 144 |
| Through acquisition of governmental contract                | 5.3               | 6.9       | 7.6        | 14.5      | 65.7                              | 4.3  | 131 |
| Through customer leaving state                              | 4.3               | 8.0       | 7.2        | 20.3      | 60.1                              | 4.2  | 138 |

\*Mean score is based on a scale from 1 (critical) to 5 (unimportant).

The respondents were then asked about the marketing strategies they had used in developing new customers and/or market niches (Table 6). Improving product quality was the strategy that was rated the highest; almost 60 percent of the respondents rated this as very important or critically important. Adding new product features and models was the next most highly rated strategy.

TABLE 6. MARKETING STRATEGIES USED BY RESPONDENT FIRMS TO DEVELOP NEW CUSTOMERS AND MARKET NICHEs, 1991

| Marketing Strategies                                    | Critically Important | Very Important | Moderately Important | Slightly Important | Not Important or Not Applicable | Mean Score* | N   |
|---|----------------------|----------------|----------------------|--------------------|---------------------------------|-------------|-----|
|   | -----percent-----    |                |                      |                    |                                 |             |     |
| Improved product quality                                | 29.2                 | 30.3           | 19.0                 | 6.2                | 15.4                            | 2.61        | 195 |
| Added new product features and models                   | 13.8                 | 34.9           | 18.0                 | 10.1               | 23.3                            | 3.12        | 189 |
| Used new distribution channels                          | 13.7                 | 21.6           | 17.9                 | 12.6               | 34.2                            | 3.57        | 190 |
| Targeted advertising on product conviction and purchase | 8.1                  | 21.0           | 14.0                 | 14.0               | 42.4                            | 3.95        | 186 |
| Lowered prices to attract customers                     | 4.3                  | 14.5           | 17.2                 | 14.0               | 50.0                            | 4.26        | 186 |

\*Based on a scale from 1 (critical) to 5 (unimportant).

When asked about factors that had prevented them from pursuing new customers/market niches, the respondents identified "marketing" and "cost" as the major problems (Table 7).

### Expenditures and Suppliers

The manufacturers also were asked about the breakdown of their expenditures by category and by the location of the supplier. Mean values for each category of expenditure are shown in Table 8.

TABLE 7. FACTORS WHICH PREVENTED RESPONDENT FIRMS FROM PURSUING NEW CUSTOMERS AND/OR MARKET NICHES

| Factors                       | Critically<br>Important | Very<br>Important | Moderately<br>Important | Slightly<br>Important | Not Important<br>or Not<br>Applicable | Mean<br>Score* | N   |
|-------------------------------|-------------------------|-------------------|-------------------------|-----------------------|---------------------------------------|----------------|-----|
|                               |                         |                   |                         |                       |                                       |                |     |
| Cost                          | 19.5                    | 24.3              | 21.1                    | 12.4                  | 22.8                                  | 3.09           | 185 |
| Marketing                     | 18.5                    | 29.3              | 19.0                    | 10.3                  | 22.8                                  | 3.03           | 184 |
| Labor                         | 3.3                     | 21.2              | 22.2                    | 18.3                  | 35.0                                  | 3.77           | 180 |
| Production<br>capacity        | 11.8                    | 14.6              | 16.3                    | 18.3                  | 38.8                                  | 3.76           | 178 |
| Did not see<br>an opportunity | 8.5                     | 12.1              | 10.9                    | 10.3                  | 58.2                                  | 4.39           | 175 |

\*Based on a scale from 1 (critical) to 5 (unimportant).

TABLE 8. DISTRIBUTION OF EXPENDITURES BY RESPONDENT FIRMS, 1990

| Expenditure<br>Category | Percent of<br>Total<br>Expenditures | Location of Supplier |                  |                 |                 |
|-------------------------|-------------------------------------|----------------------|------------------|-----------------|-----------------|
|                         |                                     | Within<br>County     | Rest of<br>State | Rest of<br>U.S. | Outside<br>U.S. |
| -----percent-----       |                                     |                      |                  |                 |                 |
| Raw materials           | 30.3                                | 20.8                 | 22.5             | 52.8            | 3.9             |
| Processed<br>materials  | 21.9                                | 16.5                 | 17.7             | 62.6            | 3.2             |
| Labor                   | 27.4                                | 88.3                 | 9.5              | 2.2             | 0.0             |
| Subcontracting          | 4.7                                 | 51.5                 | 23.1             | 24.3            | 1.1             |
| Other                   | 15.7                                | 62.5                 | 16.8             | 20.2            | 0.5             |

The geographic distribution of the various categories of expenditures is shown in Table 8. The firms generally reported that their labor expenditures were concentrated in the county where the firm is located. Expenditures for processed materials and raw materials, on the other hand, were more likely to go to out-of-state suppliers. Overall, the respondent firms reported that about 58 percent of their total expenditures were to in-state entities.

The percentage of the firms' total expenditures made within the state was higher than average for nondurable manufacturers and for agribusiness firms (Appendix Table 4). The high-tech firms had the lowest percentage of in-state expenditures. New firms (started within the last five years) had the highest percentage of their expenditures within the state.

The manufacturers were asked whether they would purchase items that they presently obtain from outside the state from a North Dakota supplier if prices were comparable, and 98.5 percent replied that they would make an effort to buy from in-state suppliers. When asked to rate selected attributes of the North Dakota suppliers with which they have dealt, the manufacturers were most satisfied with on-time delivery and the quality of the products delivered (Table 9). They were least favorably impressed with regard to availability of items and material cost.

TABLE 9. RESPONDENTS' RATING OF NORTH DAKOTA SUPPLIERS WITH RESPECT TO SELECTED ATTRIBUTES

| Attribute                     | Rating            |           |         |         |     | Mean Score* | N   |
|-------------------------------|-------------------|-----------|---------|---------|-----|-------------|-----|
|                               | Extremely Good    | Very Good | Neutral | Not Bad | Bad |             |     |
|                               | -----percent----- |           |         |         |     |             |     |
| On-time delivery              | 22.6              | 57.0      | 14.7    | 2.8     | 0.0 | 1.98        | 177 |
| Quality of material delivered | 19.9              | 62.5      | 15.3    | 1.7     | 0.1 | 2.01        | 176 |
| Material cost                 | 9.6               | 29.4      | 39.0    | 8.0     | 4.5 | 2.78        | 177 |
| Transportation cost           | 13.7              | 32.6      | 37.7    | 9.1     | 6.9 | 2.63        | 175 |
| Availability of items         | 11.4              | 28.4      | 30.1    | 20.5    | 9.7 | 2.89        | 176 |
| Customer service              | 16.3              | 54.7      | 20.3    | 5.2     | 3.5 | 2.25        | 172 |

\*Mean score is based on a scale from 1 (extremely good) to 5 (bad).

### Employment

The manufacturers responding to the survey employed an average of 54 workers at the time of the survey. A few large firms influenced the average substantially, however; the median value was 15 workers (Table 10). The firms had increased their employment substantially over the last 5 years; the average number of workers employed by the firms 5 years previously was

TABLE 10. CURRENT, PAST, AND PROJECTED EMPLOYMENT OF NORTH DAKOTA MANUFACTURING FIRMS, 1991

| Employment                                   | Unit    | Value |
|--|---------|-------|
| <u>Total employment, current</u>             |         |       |
| Mean (N=176)                                 | number  | 53.8  |
| Median                                       | number  | 15    |
| Distribution:                                |         |       |
| 1- 5   | percent | 20.5  |
| 6-14   | percent | 27.3  |
| 15-24  | percent | 17.0  |
| 25-49  | percent | 13.6  |
| 50-99  | percent | 13.1  |
| 100 and over                                 | percent | 8.5   |
| <u>Total employment, five years ago</u>      |         |       |
| Mean (N=142)                                 | number  | 37.3  |
| Median                                       | number  | 8     |
| Distribution:                                |         |       |
| 1- 5   | percent | 29.6  |
| 6-14   | percent | 28.9  |
| 15-24  | percent | 13.4  |
| 25-49  | percent | 12.7  |
| 50-99  | percent | 8.5   |
| 100 and over                                 | percent | 7.0   |
| <u>Total employment, five years from now</u> |         |       |
| Mean (N=148)                                 | number  | 77.7  |
| Median                                       | number  | 26    |
| Distribution:                                |         |       |
| 1- 5   | percent | 10.1  |
| 6-14   | percent | 18.9  |
| 15-24  | percent | 14.2  |
| 25-49  | percent | 24.3  |
| 50-99  | percent | 17.6  |
| 100 and over                                 | percent | 14.9  |

37. The firms also anticipated substantial employment growth over the next 5 years. The average firm expected to have about 78 employees in 5 years; the median value was 26.

Operators and fabricators were the largest occupational category among the current employees of the North Dakota manufacturers, accounting for 34 percent of total employment (Table 11). The next largest groups were laborers (20.2 percent) and precision production, craft and repair workers (17.2 percent). Occupational distribution by firm type is shown in Appendix Table 5. Among the occupational groups, laborers had experienced the most rapid growth over the past 5 years (84.7 percent) followed by sales representatives and precision production, craft and repair workers (Table 11). Over the next 5

TABLE 11. EMPLOYMENT BY OCCUPATIONAL CATEGORY AND PAST AND PROJECTED CHANGES FOR NORTH DAKOTA MANUFACTURERS, 1991

| Occupational Category                     | Current Employment |         | Percent Change      |                              |
|---|--------------------|---------|---------------------|------------------------------|
|   | Avg. No. Per Firm  | Percent | From Five Years Ago | Expected Five Years From Now |
| Executive, administrative, and managerial | 4.8                | 8.9     | 33.3                | 31.3                         |
| Professional specialty                    | 3.6                | 6.7     | 44.0                | 44.4                         |
| Sales representatives                     | 2.4                | 4.4     | 71.4                | 95.8                         |
| Clerical workers                          | 4.3                | 8.0     | 38.7                | 30.2                         |
| Precision production, craft, and repair   | 9.3                | 17.2    | 66.1                | 40.9                         |
| Operators and fabricators                 | 18.5               | 34.3    | 35.0                | 59.5                         |
| Laborers                                  | 10.9               | 20.2    | 84.7                | 31.2                         |
| Other                                     | 0.3                | 0.6     | 50.0                | 33.3                         |
| Total Employees Per Firm                  | 54.1               | 100.3   | 44.3                | 44.4                         |

years, the most rapid growth was anticipated for sales representatives (95.8 percent) followed by operators and fabricators (59.5 percent). Overall, the average firm employed 37 people 5 years ago, employs 54 today, and expects to employ 78 in 5 years.

Survey respondents were also asked about their minimum requirements for employees in various occupational classes (Table 12). A college degree or post-graduate education was required by more than half of the respondents for executive, administrative, or managerial positions and by nearly 60 percent for professional specialty jobs. Technical college preparation was required by 45 percent of respondents for precision production, craft, and repair jobs and by 42 percent for clerical jobs. These findings reaffirm the importance of an educated work force to today's manufacturers.

The respondents reported the greatest degree of difficulty in locally recruiting employees in the categories of sales representatives and professional specialties. The greatest difficulty in retaining employees was reported for sales representatives.

TABLE 12. QUALIFICATIONS AND RECRUITMENT AND RETENTION CHARACTERISTICS OF EMPLOYEES IN THE MANUFACTURING INDUSTRY, NORTH DAKOTA, 1991

| Employees by Type  | Minimum Requirement for New Employees |                  |                     |                   |             |                    | Difficulty Finding Employees Locally |                        | Difficulty Retaining Employees Locally |                        |
|--|---------------------------------------|------------------|---------------------|-------------------|-------------|--------------------|--------------------------------------|------------------------|--|------------------------|
|  | Prior Work Experience                 | Some High School | High School Diploma | Technical College | B.S. Degree | Master's or Higher | Mean <sup>a</sup>                    | Difficult <sup>b</sup> | Mean <sup>a</sup>                      | Difficult <sup>b</sup> |
|  | -----percent yes-----                 |                  |                     |                   |             |                    |                                      |                        |  |                        |
| <b>Executive, Administrative, or Managerial</b>  | 65.1                                  | 2.7              | 26.7                | 16.0              | 44.7        | 6.0                | 3.36                                 | 41.1                   | 2.30                                   | 26.9                   |
| <b>Professional Specialty</b><br>(e.g., engineers, scientists, computer programmers, accountants, etc.)                                      | 48.1                                  | ---              | 8.7                 | 30.1              | 50.5        | 9.1                | 3.42                                 | 49.1                   | 3.01                                   | 28.4                   |
| <b>Sales Representatives</b>   | 70.6                                  | 4.6              | 41.7                | 14.8              | 30.6        | 2.8                | 3.55                                 | 51.8                   | 3.18                                   | 36.4                   |
| <b>Clerical Workers</b><br>(e.g., secretaries, typists, stenographers, word processor specialists)   | 59.9                                  | 5.0              | 41.8                | 41.8              | 5.7         | 4.3                | 2.49                                 | 13.4                   | 2.49                                   | 11.3                   |
| <b>Precision Production, Craft, and Repair</b><br>(e.g., mechanics, repairers, machinists and metal craftsmen, construction craftsmen, etc.) | 64.2                                  | 6.6              | 31.1                | 45.1              | 1.6         | 0.8                | 3.27                                 | 41.4                   | 2.85                                   | 23.6                   |
| <b>Operators, Fabricators</b><br>(e.g., machine operators, assemblers, inspectors, truck drivers, material handlers)                         | 63.4                                  | 14.0             | 48.8                | 19.4              | ---         | ---                | 2.43                                 | 25.2                   | 2.54                                   | 23.3                   |
| <b>Laborers</b>  | 49.0                                  | 32.0             | 38.1                | 6.2               | 2.1         | 12.4               | 2.43                                 | 11.9                   | 2.54                                   | 15.2                   |

<sup>a</sup>Based on a scale from 1 (very easy) to 5 (very difficult).

<sup>b</sup>Percent responding difficult and very difficult.



The survey data also provide insight regarding an important policy issue -- the potential of different types of firms for creating jobs. The net changes in numbers of workers employed by firms of different types are summarized in Table 13. Overall, the firms in the survey had an average net employment change of about 17 jobs, compared to the situation 5 years previously; the median value was 4. About 13 percent of the firms had a negative employment change over the 5-year period, while 11 percent reported no change in the total number of workers employed. When nondurable and durable manufacturers are compared, the nondurable firms created about 7.6 more jobs, on average, than their durable counterparts.

The role of new and small firms in job creation is also addressed in Table 13. Firms that had begun operations within the last 5 years created an average of about 35 jobs per firm and accounted for 24 percent of the total jobs created by the survey respondents. Firms that were established 5 years previous to the survey, but which had fewer than 20 employees at that time, created an average of 5.6 jobs per firm and accounted for about 19 percent of the total jobs created by all firms. Established firms with 20 or more employees 5 years previously created almost 38 jobs per firm and accounted for almost 57 percent of the total jobs created.

Agribusiness firms, on average, created almost 4 times as many jobs per firm as the other firms in the survey (Table 13). A few firms that recorded very large employment gains influenced the average substantially, however, as the median values for agribusiness firms and the other firms were 5.0 and 4.5, respectively.

High tech firms created about 7 more jobs per firm (or 39 percent more jobs) than the other firms in the study.

The survey also provides insights concerning the types of jobs that may be provided by the manufacturing sector in the future. The firms that responded to the survey currently employ an average of 54 workers, and they anticipate employing 78 workers 5 years from now. Operators and fabricators are expected to make up 44 percent of the new jobs created in the manufacturing sector; precision production, craft and repair workers would constitute about 15 percent; and laborers almost 14 percent (Appendix Table 6).

TABLE 13. JOBS CREATED IN THE LAST FIVE YEARS BY FIRMS OF DIFFERENT TYPES, 1991

| Jobs Created in Last 5 Years | All Firms         | Firm Type<br>Established Firms |                        | Firm Type            |                 | Firm Type    |              | Firm Type |           |       |
|------------------------------|-------------------|--------------------------------|------------------------|----------------------|-----------------|--------------|--------------|-----------|-----------|-------|
|                              |                   | New Firms                      | Less than 20 Employees | 20 or More Employees | NonDurable Mfgs | Durable Mfgs | Agribusiness | Other     | High-Tech | Other |
| Mean (Number)                | 17.1              | 35.4                           | 5.6*                   | 37.8*                | 22.5            | 14.9         | 38.5*        | 11.4*     | 23.8      | 17.0  |
| Median (Number)              | 4.0               | 14.0                           | 2.0                    | 13.0                 | 3.0             | 5.0          | 5.0          | 4.5       | 13.0      | 4.0   |
| Distribution of jobs:        | -----percent----- |                                |                        |                      |                 |              |              |           |           |       |
| Fewer jobs                   | 13.1              | 0.0                            | 14.9                   | 15.9                 | 19.3            | 10.4         | 15.4         | 12.7      | 5.0       | 14.5  |
| No change                    | 11.4              | 5.0                            | 16.8                   | 2.3                  | 12.3            | 11.3         | 12.8         | 11.1      | 0.0       | 13.1  |
| 1-10                         | 44.0              | 40.0                           | 51.5                   | 27.3                 | 36.8            | 46.3         | 28.2         | 48.4      | 40.0      | 44.1  |
| 11-25                        | 20.0              | 35.0                           | 13.9                   | 27.3                 | 21.1            | 20.0         | 28.2         | 17.5      | 25.0      | 19.3  |
| 26-50                        | 4.6               | 5.1                            | 1.0                    | 11.4                 | 3.5             | 5.2          | 5.1          | 4.0       | 15.0      | 2.8   |
| 51-100                       | 3.4               | 10.0                           | 2.0                    | 4.5                  | 0.0             | 5.2          | 2.6          | 4.0       | 10.0      | 2.8   |
| Over 100                     | 3.4               | 5.0                            | 0.0                    | 11.4                 | 7.0             | 1.7          | 7.7          | 2.4       | 5.0       | 3.4   |

\*Significant difference at .05 using Tukey Test.

Financing

The manufacturers were asked about activities they had undertaken in the last 12 months to obtain financing. Almost half (47.8 percent) of the respondents had tried to secure a loan for working capital, and 40 percent had sought financing for new equipment (Table 14). Loans for 3 other purposes were the objective of 14 to 30 percent of the respondents.

TABLE 14. NORTH DAKOTA MANUFACTURERS' EFFORT TO SECURE FINANCING IN THE LAST 12 MONTHS, 1991

| Efforts to Secure Financing                    | Percent |
|--|---------|
| Total number of loans sought:                  |         |
| None   | 35.4    |
| One  | 23.9    |
| Two  | 21.5    |
| Three  | 12.0    |
| Four or more                                   | 7.2     |
| Tried to secure a loan for:                    |         |
| New equipment                                  | 40.4    |
| New building                                   | 15.9    |
| Working capital                                | 47.8    |
| Overall business operation                     | 30.4    |
| Refinancing old debts                          | 14.4    |
| Number of financial institutions contacted:    |         |
| Distribution (mean = 1.5)                      |         |
| One  | 68.2    |
| Two  | 20.9    |
| Three  | 8.5     |
| Four   | 2.3     |
| Encountered difficulty in obtaining financing: |         |
| All firms                                      | 32.2    |
| Nondurable                                     | 24.0    |
| Durable  | 36.6    |
| New  | 52.6    |
| Established (<20 employees)                    | 27.1    |
| Established (20/+ employees)                   | 32.3    |
| Agribusiness                                   | 48.4    |
| High-tech                                      | 31.1    |

Overall, about 35 percent of the respondents had not needed to seek financing in the last 12 months. The remainder had attempted to obtain one or more loans. Of those who had sought financing, about 32 percent reported that they had encountered difficulty in obtaining financing (Table 14). Durable manufacturers reported such difficulties more frequently (37 percent) than their counterparts (24 percent). New firms (established within the last 5 years) reported financing difficulties more frequently (53 percent) than their established counterparts, and agribusiness firms reported problems more often (48 percent) than others.

The companies that had sought financing had contacted an average of 1.5 financial institutions. About 68 percent had contacted only 1 institution, 21 percent had contacted 2, about 8.5 percent had contacted 3, and only 2.3 percent had contacted 4 (Table 14). New firms contacted more financial institutions (an average of 1.6) than did established firms, and among the established firms, those with fewer than 20 employees 5 years ago contacted more institutions (1.4) than the larger firms (which contacted an average of 1.3 institutions). High-tech firms were almost identical to other firms with respect to the number of institutions contacted while agribusiness firms had a slightly higher average number of contacts (1.47) than their counterparts (1.40).

Those who had encountered some problems in obtaining financing were asked to rate a number of factors in terms of their importance as a barrier to obtaining financing. The judgment of the financial institution was the factor that received the highest rating (Table 15), followed by operation of the financial institution and the profit margin of the respondent's firm.

TABLE 15. BARRIERS TO OBTAINING FINANCING FOR NORTH DAKOTA MANUFACTURERS, 1991

| Barriers  | Critically<br>Important | Very<br>Important | Moderately<br>Important | Slightly<br>Important | Not<br>Important | Mean | N  |
|---|-------------------------|-------------------|-------------------------|-----------------------|------------------|------|----|
|   | -----percent-----       |                   |                         |                       |                  |      |    |
| Judgment of<br>the<br>financial<br>institution  | 43.4                    | 35.8              | 13.2                    | 1.9                   | 5.7              | 1.91 | 53 |
| Operation of<br>the<br>financial<br>institution | 33.3                    | 37.5              | 14.6                    | 10.4                  | 4.2              | 2.15 | 48 |
| Business plan                                   | 16.3                    | 22.4              | 30.6                    | 12.2                  | 18.4             | 2.94 | 49 |
| Profit margin                                   | 34.0                    | 24.0              | 16.0                    | 10.0                  | 16.0             | 2.50 | 50 |
| Credit<br>records                               | 18.7                    | 33.3              | 18.7                    | 14.6                  | 14.6             | 2.73 | 48 |
| Problems in<br>business<br>operation            | 11.6                    | 11.6              | 32.6                    | 20.9                  | 23.3             | 3.33 | 43 |

\*Based on a scale from 1 (critical) to 5 (unimportant).

The manufacturers also were asked what financing sources they had contacted. Commercial banks were by far the most frequently utilized source of financing. Of 135 firms that had sought financing, 113 had contacted a commercial bank, 86 had submitted a loan application, and 82 had received a loan (Table 16). The Small Business Administration and the Bank of North Dakota were other sources utilized by a number of respondents.

The respondents were asked to rate the degree of cooperation they received from each type of institution they contacted. Commercial banks received the highest rating, and the Bank of North Dakota received the lowest (Table 16).

### Production Capacity and Equipment

The manufacturers were asked whether they would have difficulty increasing their production volume in response to increased demand. About 35 percent responded that increasing production would be a problem. These respondents were then asked about the role of selected factors in limiting their production capacity. Financial constraints were the most serious limitation on production capacity for these manufacturers (Table 17), followed by limited physical space, limited production equipment, and personnel.

Producers who felt that increasing production would be a problem were asked what percentage of their production capacity was currently in use. They reported that, on average, about 76 percent of their capacity was being utilized (Table 18). This represented an increase of about 7 percent from the previous year. These producers planned to increase their capacity utilization substantially over the next 2 years; they projected that they would be utilizing an average of 101 percent of their current capacity in 2 years.

The manufacturers also were asked about the percentage of their machines that were operated manually (74.2 percent), automated (19.2 percent), numerically controlled (1.1 percent), and computer numeric controlled (5.4 percent). About half of the respondents indicated that 100 percent of their machines were manually operated.

The manufacturers also were queried about their satisfaction with their plant and equipment. The respondents were most satisfied with the age of their plant and least satisfied with the age and number of their machines (Table 19). The manufacturers also were asked whether they would consider a joint venture manufacturing plant, and 33 percent replied affirmatively.

TABLE 16. NORTH DAKOTA MANUFACTURERS' INTERACTIONS WITH FINANCIAL INSTITUTIONS, 1990-1991

| Financial Institution         | Contacted for a Loan | Submitted Loan Application To | Received a Loan From | Degree of Cooperation Received |                        |                      |                 |      | Mean Score* |
|-------------------------------|----------------------|-------------------------------|----------------------|--------------------------------|------------------------|----------------------|-----------------|------|-------------|
|                               |                      |                               |                      | Very Cooperative               | Moderately Cooperative | Slightly Cooperative | Not Cooperative |      |             |
| -----number-----              |                      |                               |                      | -----percent-----              |                        |                      |                 |      |             |
| Bank of North Dakota          | 31                   | 19                            | 16                   | 11.1                           | 33.3                   | 18.5                 | 11.1            | 25.9 | 3.07        |
| Other banks                   | 113                  | 86                            | 82                   | 49.5                           | 17.8                   | 17.8                 | 8.4             | 6.5  | 2.04        |
| Small Business Administration | 34                   | 21                            | 20                   | 31.0                           | 34.5                   | 13.8                 | 13.8            | 6.9  | 2.32        |
| Government programs           | 17                   | 11                            | 10                   | 27.3                           | 9.1                    | 36.4                 | 18.2            | 1.91 | 2.73        |
| Commercial investors          | 13                   | 7                             | 5                    | 33.3                           | 33.3                   | 22.2                 | 11.1            | ---- | 2.11        |

\*Based on a scale from 1 (very cooperative) to 5 (not cooperative).

TABLE 17. FACTORS THAT LIMIT PRODUCTION CAPACITY FOR NORTH DAKOTA MANUFACTURERS, 1991

| Factors                          | Rating               |                |                      |                    |               | Mean Score* | N  |
|----------------------------------|----------------------|----------------|----------------------|--------------------|---------------|-------------|----|
|                                  | Critically Important | Very Important | Moderately Important | Slightly Important | Not Important |             |    |
|                                  | -----percent-----    |                |                      |                    |               |             |    |
| Finance                          | 60.3                 | 22.1           | 10.3                 | 2.9                | 4.4           | 1.69        | 68 |
| Personnel                        | 25.0                 | 30.9           | 26.5                 | 11.8               | 5.9           | 2.43        | 68 |
| Limited production equipment     | 28.1                 | 35.9           | 20.3                 | 9.4                | 6.3           | 2.30        | 64 |
| Limited space                    | 35.9                 | 32.8           | 17.2                 | 4.7                | 9.4           | 2.19        | 64 |
| No desire to increase production | 2.4                  | 7.1            | 16.7                 | 7.1                | 66.7          | 4.29        | 42 |

\*Based on a scale from 1 (critical) to 5 (unimportant).

TABLE 18. UTILIZATION OF PRODUCTION CAPACITY BY NORTH DAKOTA MANUFACTURERS, 1991

| Production Capacity Utilization  | Percent |
|--|---------|
| Percent of production capacity currently in use:                                 |         |
| Mean (N = 68)  | 76.2    |
| Distribution:  |         |
| 50% or less  | 25.4    |
| 51 to 75%  | 20.9    |
| 76 to 95%  | 20.9    |
| 96% or more  | 32.8    |
| Percent of capacity utilization compared to last year:                           |         |
| Mean (N = 51)  | 7.1     |
| Distribution:  |         |
| -20 to -0.01%  | 3.9     |
| 0 (same as last year)  | 64.7    |
| 0.01 to 10%  | 13.8    |
| 11 to 30%  | 9.8     |
| More than 30%  | 7.8     |
| Percentage of current production capacity planned for use in two years from now: |         |
| Mean (N = 61)  | 101.3   |
| Distribution:  |         |
| 80% or less  | 14.8    |
| 81 to 95%  | 18.0    |
| 96 to 110%   | 60.6    |
| 111% or more   | 6.6     |

TABLE 19. NORTH DAKOTA MANUFACTURERS' SATISFACTION WITH PLANT AND EQUIPMENT, 1991

| Attribute          | Very Satisfied    | Satisfied | Neutral | Not Very Satisfied | Not Satisfied | Mean Score* | N   |
|--------------------|-------------------|-----------|---------|--------------------|---------------|-------------|-----|
|                    | -----percent----- |           |         |                    |               |             |     |
| Plant size         | 24.9              | 34.8      | 16.4    | 15.9               | 8.0           | 2.47        | 201 |
| Plant age          | 25.1              | 38.7      | 25.1    | 6.5                | 4.5           | 2.27        | 199 |
| Equipment size     | 13.0              | 46.5      | 25.0    | 11.5               | 4.0           | 2.47        | 200 |
| Equipment age      | 10.6              | 37.7      | 31.2    | 15.1               | 5.5           | 2.67        | 199 |
| Number of machines | 8.6               | 43.7      | 24.9    | 17.8               | 5.1           | 2.67        | 197 |

\*Mean score is based on a scale from 1 (very satisfied) to 5 (not satisfied).

The manufacturers also were asked about their plans for business changes within the next 2 years. Almost 80 percent planned to increase their market share, 76 percent would market existing products to different customers, and 75 percent want to increase their production capacity (Figure 3). About two-thirds of the respondents want to add new products within the next 2 years; 41 percent would redesign their product line and market it to different customers, and 38 percent would market a redesigned product line to the same customers. About 26 percent of the group wanted to diversify, and a similar number planned to add a new building. On the other hand, only 7 percent planned to add a new branch or to relocate.

#### Needs for Technical Assistance

The manufacturers were asked about areas in which they might need worker training and educational assistance. Of the subject areas specified, marketing and sales was the area that was rated as most important by the respondents (Table 20), followed by quality assurance and quality control. Other areas that received relatively high ratings were management training and finance. When ratings of the different areas for training and education were compared among the various types of firms, marketing and sales received the highest rating by all firm types except new firms (Appendix Table 7). For this group, financing was the most important topic, with sales and marketing a close second.



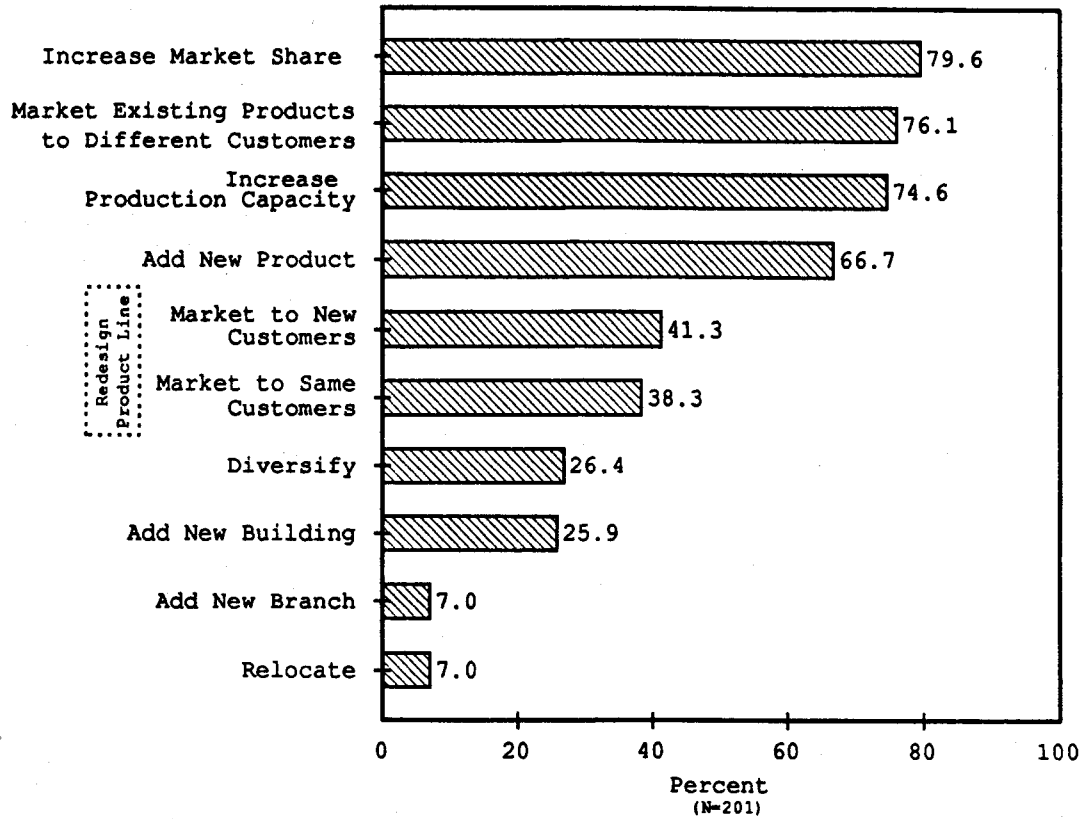


Figure 3: Respondents' Plans for Business Changes in the Next Two Years, 1991

TABLE 20. TRAINING AND EDUCATIONAL ASSISTANCE NEEDS OF NORTH DAKOTA MANUFACTURERS, 1991

| Area of Need                 | Mean Score* | Percent Rating Area as Critically or Very Important | N   |
|------------------------------|-------------|---|-----|
| Operator training            | 3.36        | 32.9  | 146 |
| Computer-aided design        | 3.65        | 24.6  | 142 |
| Basic computer skills        | 3.39        | 25.7  | 148 |
| Computer-aided manufacturing | 3.78        | 23.7  | 135 |
| Quality control              | 3.08        | 40.0  | 145 |
| Management training          | 3.11        | 39.4  | 145 |
| Marketing and sales          | 2.66        | 53.7  | 149 |
| Exporting                    | 3.60        | 28.4  | 141 |
| Quality assurance            | 3.07        | 40.4  | 141 |
| Financing                    | 3.23        | 37.2  | 145 |
| Labor relations              | 3.41        | 25.7  | 140 |

\*Based on a scale of 1 (critically important) to 5 (not important).

The respondents were also asked about their previous use of certain types or sources of training and continuing education (Table 21). On-the-job training was the type of training most often used, followed by seminars and in-house class instruction. Respondents expressed the highest level of satisfaction with on-the-job training.

TABLE 21. MANUFACTURERS' USE AND RATING OF TRAINING AND CONTINUING EDUCATION SOURCES, 1991

| Source or Type of Instruction | Percent Using This Source or Type | Degree of Satisfaction |  | N   |
|-------------------------------|-----------------------------------|------------------------|--|-----|
|                               |                                   | Mean Score*            | Percent Rating Source as Very Satisfied or Satisfied |     |
| In-house class instruction    | 62.7                              | 3.67                   | 44.7   | 166 |
| On-the-job training           | 92.3                              | 2.26                   | 78.2   | 183 |
| Computer-aided instruction    | 41.8                              | 4.66                   | 18.4   | 158 |
| Colleges and universities     | 45.2                              | 4.50                   | 22.7   | 155 |
| Seminars                      | 68.5                              | 3.53                   | 43.1   | 165 |
| Vendor training               | 55.1                              | 4.08                   | 33.0   | 156 |

\*Based on a scale of 1 (very satisfied) to 5 (not satisfied).

The manufacturers also were asked in which areas they perceived the greatest need for technical assistance (consulting). The area that received the highest rating was marketing studies (Table 22), followed by quality assurance and process improvement. Marketing studies were also the most highly rated subject area for durable manufacturers, for nondurable manufacturers, and for agribusiness firms (Appendix Table 8). New firms indicated the greatest degree of interest in assistance in developing international markets, followed by process improvement. Large established firms (that had 20 or more employees 5 years previously) placed the highest priority on process improvement, with quality assurance a close second, and marketing studies ranking third. High-tech firms gave the highest rating to process improvement and inventory control.

The respondents also indicated which of a number of potential areas for computer specialist assistance would be most important to them. The most highly rated areas were inventory control, job costing/estimating, production control, and accounting (Table 23).

TABLE 22. MANUFACTURERS' NEEDS FOR TECHNICAL ASSISTANCE (CONSULTING) BY SUBJECT AREA, 1991

| Subject Area                              | Rating of Importance |                |                      |                    |               | Mean Score* | N   |
|---|----------------------|----------------|----------------------|--------------------|---------------|-------------|-----|
|   | Critically Important | Very Important | Moderately Important | Slightly Important | Not Important |             |     |
|   | -----percent-----    |                |                      |                    |               |             |     |
| Accounting and records                    | 5.4                  | 15.1           | 22.0                 | 18.3               | 39.2          | 3.71        | 186 |
| Human resource management                 | 3.9                  | 11.1           | 31.7                 | 18.9               | 34.4          | 3.69        | 180 |
| Financial analysis/<br>cost control       | 7.0                  | 23.2           | 23.2                 | 16.2               | 30.3          | 3.39        | 185 |
| Computer system                           | 6.5                  | 21.5           | 29.0                 | 19.9               | 23.1          | 3.32        | 186 |
| Inventory control                         | 5.3                  | 26.7           | 24.6                 | 17.1               | 26.2          | 3.32        | 187 |
| Plant layout and design                   | 3.8                  | 16.8           | 21.6                 | 24.9               | 33.0          | 3.66        | 185 |
| Production control                        | 5.9                  | 23.7           | 24.2                 | 20.4               | 25.8          | 3.37        | 186 |
| Research and development                  | 9.3                  | 19.8           | 23.1                 | 19.2               | 28.6          | 3.38        | 182 |
| Marketing studies                         | 16.1                 | 29.2           | 19.8                 | 16.1               | 18.7          | 2.92        | 192 |
| Strategic planning design                 | 8.2                  | 20.7           | 21.2                 | 20.1               | 29.9          | 3.43        | 184 |
| Process improvement                       | 7.1                  | 24.0           | 30.6                 | 18.0               | 20.2          | 3.20        | 183 |
| Material handling                         | 8.2                  | 14.8           | 23.0                 | 25.7               | 28.4          | 3.51        | 183 |
| Industrial waste management               | 4.3                  | 14.1           | 22.7                 | 20.0               | 38.9          | 3.75        | 185 |
| Prototype testing                         | 5.9                  | 8.6            | 15.7                 | 22.2               | 47.6          | 3.97        | 185 |
| Product-process development               | 6.6                  | 12.2           | 26.0                 | 22.1               | 33.1          | 3.63        | 181 |
| Product and process<br>commercialization  | 3.9                  | 11.2           | 23.6                 | 25.3               | 36.0          | 3.78        | 178 |
| Developing international<br>markets       | 12.0                 | 17.4           | 20.7                 | 12.0               | 38.0          | 3.47        | 184 |
| Government/manufacturing<br>specification | 7.7                  | 15.3           | 18.6                 | 18.6               | 39.9          | 3.68        | 183 |
| Quality assurance                         | 15.1                 | 22.9           | 28.5                 | 14.0               | 19.6          | 3.00        | 179 |

\*Based on a scale from 1 (critical) to 5 (not important).

TABLE 23. MANUFACTURERS' NEEDS FOR COMPUTER SPECIALIST ASSISTANCE, 1991

| Areas of Need                  | Mean Score* | Percent Rating Area as Critical or Very Important | N   |
|--------------------------------|-------------|---|-----|
| Accounting                     | 3.32        | 34.4  | 154 |
| Production control             | 3.29        | 35.7  | 151 |
| Word processing                | 3.97        | 15.8  | 145 |
| Material control               | 3.47        | 29.9  | 147 |
| Job costing/estimating         | 3.22        | 41.4  | 152 |
| Computer-aided design          | 3.61        | 27.9  | 147 |
| Order processing               | 3.56        | 28.7  | 146 |
| Computer-aided manufacturing   | 3.86        | 18.9  | 148 |
| Computerized numerical control | 4.06        | 17.5  | 143 |
| Inventory control              | 3.21        | 40.9  | 154 |
| Direct numerical control       | 4.21        | 12.2  | 139 |
| Database management            | 3.85        | 21.1  | 142 |

\*Based on a scale from 1 (critically important) to 5 (not important).

Concerning topics of general interest to them, the respondents gave the highest ratings to product design and development, computer-aided cost estimating, waste management, and a computer integrated office (Table 24).

TABLE 24. TOPICS OF GENERAL INTEREST TO NORTH DAKOTA MANUFACTURERS, 1991

| Topic                           | Mean Score* | Percent Rating Topic as Critical or Very Important | N   |
|---------------------------------|-------------|--|-----|
| Computer numeric control        | 4.19        | 13.2   | 166 |
| Direct numeric control          | 4.25        | 11.9   | 160 |
| Computer integrated office      | 3.69        | 21.5   | 172 |
| Computer integrated engineering | 4.14        | 14.8   | 162 |
| Computer-aided cost estimating  | 3.49        | 31.4   | 169 |
| Robotics                        | 4.34        | 8.1  | 162 |
| Laser/optical sensing systems   | 4.27        | 12.3   | 163 |
| Microelectronics                | 4.44        | 6.8  | 161 |
| Automatic manufacturing cells   | 4.26        | 11.9   | 164 |
| Mechanical/civil technology     | 4.19        | 10.6   | 161 |
| Energy management               | 3.96        | 15.2   | 163 |
| Product design and development  | 3.23        | 38.9   | 167 |
| Waste management                | 3.55        | 27.4   | 168 |

\*Based on a scale from 1 (critically important) to 5 (not important).

## Conclusions and Implications

The manufacturing sector is viewed by many as being central to the state's efforts to achieve economic development and diversification. This report summarizes results of a study aimed at achieving a better understanding of the firms that make up the North Dakota manufacturing sector and their needs for support in such areas as financing, worker training, and technical assistance. The data base consists of information from 214 firms, or roughly 58 percent of the manufacturing firms that serve markets outside their local area.

The results reveal that many North Dakota manufacturing firms are relatively new (almost 44 percent began operations at their present location after 1979) and relatively small (about 57 percent had gross sales of less than \$1 million in 1990). Most of them (77 percent) market some of their product outside the state, and they see marketing skills as critical to their future success.

The firms represented in the survey purchased about 58 percent of their inputs (including labor) from suppliers within the state. Almost all of the respondents (98.5 percent) indicated that they would make an effort to purchase more inputs from in-state suppliers if the items were available and prices were comparable. These findings provide support to those of Leistritz (1991) and indicate that establishing a brokerage network to connect manufacturers with in-state suppliers could enhance economic growth and development in the state.

The manufacturing firms employed an average of 54 workers each in 1991, but the typical (median) firm had only 15 employees. The average firm had increased its work force by 44 percent over the last 5 years, and the firms projected an average growth of 44 percent over the next 5 years. The manufacturers reported the greatest degree of difficulty in *recruiting* sales representatives and persons in professional specialty occupations; they had the most problems in *retaining* sales representatives.

The survey provides insights about the role of various types of firms in job creation. While new firms (created within the last 5 years) and small firms (fewer than 20 employees 5 years prior to the survey) did create substantial numbers of jobs, the larger established firms (20 or more employees 5 years prior to the survey) accounted for almost 57 percent of the total jobs created during the past 5 years. This finding suggests that state assistance efforts, which are often targeted toward new or relocating firms, should not overlook the state's established companies.

Financing is often mentioned as an area of concern by the state's manufacturers, as well as by representatives of other business sectors. The survey results show that about 65 percent of the respondents sought financing during the last year and 32 percent of these (or 21 percent of all survey firms) reported that they had difficulty in obtaining financing. Financing problems were reported most frequently by new firms and by agribusiness firms.

When the firms were asked about areas in which they need training and educational assistance, marketing and sales received the highest rating. A similar question assessed areas in which firms saw a need for technical assistance (consulting); marketing studies received the highest rating, followed by quality assurance and process improvement. Clearly, marketing is one of the areas on which future technical assistance efforts should focus.

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**APPENDIX**





APPENDIX TABLE 1. GROSS SALES OF RESPONDENT MANUFACTURING FACILITIES, BY FIRM TYPE

| Gross Sales   | All Firms         | Durable Goods Manufacturers | Nondurable Goods Manufacturers | Agribusiness Firms      | High-Tech Firms |
|---|-------------------|-----------------------------|--------------------------------|-------------------------|-----------------|
| <u>Gross sales in 1990</u>                                    |                   |                             |                                |                         |                 |
| Mean (N=180)  | \$9,160,922       | 6,438,514                   | 15,631,356                     | 32,636,350 <sup>a</sup> | 3,189,845       |
| Median  | 642,500           | 588,500                     | 875,000                        | 1,500,000               | 1,500,000       |
| <u>Change in gross sales, 1990 compared to 1989</u>           |                   |                             |                                |                         |                 |
|   | -----percent----- |                             |                                |                         |                 |
| Mean (N=158)  | 18.3              | 21.7                        | 11.8                           | 22.5                    | 20.6            |
| Median  | 10.0              | 10.0                        | 5.0                            | 10.0                    | 12.5            |
| <u>Projected change in gross sales, 1991 compared to 1990</u> |                   |                             |                                |                         |                 |
| Mean (N=166)  | 17.9              | 23.5                        | 5.3                            | 28.2                    | 10.5            |
| Median  | 6.4               | 6.1                         | 6.9                            | 6.1                     | 8.8             |
| <u>Projected change in gross sales, 1992 compared to 1990</u> |                   |                             |                                |                         |                 |
| Mean (N=152)  | 61.3              | 79.9                        | 22.9                           | 85.3                    | 48.3            |
| Median  | 21.4              | 25.0                        | 13.3                           | 21.4                    | 25.0            |

<sup>a</sup>Agribusiness firms significantly different than other firms based on the Tukey test using  $\alpha = .05$ .

APPENDIX TABLE 2. FACTORS AFFECTING SALES VOLUME FOR NORTH DAKOTA MANUFACTURERS, 1991

| Factor                        | Positive or Negative Effect |                    | N   | Positive Effect |                                      | Negative Effect |                                      |
|-------------------------------|-----------------------------|--------------------|-----|-----------------|--------------------------------------|-----------------|--------------------------------------|
|                               | Positive (percent)          | Negative (percent) |     | Mean Score*     | Percent Critically or Very Important | Mean Score*     | Percent Critically or Very Important |
| New products                  | 97.4                        | 2.6                | 115 | 2.3             | 62.5                                 | 2.7             | 33.3                                 |
| Changing consumer tastes      | 79.2                        | 20.8               | 101 | 2.6             | 48.8                                 | 2.8             | 52.4                                 |
| Changing consumer income      | 58.7                        | 41.3               | 104 | 2.5             | 54.1                                 | 2.8             | 48.8                                 |
| Demographics (population/age) | 65.5                        | 34.5               | 84  | 3.1             | 30.9                                 | 3.5             | 20.7                                 |
| Defense spending              | 59.2                        | 40.8               | 49  | 3.5             | 24.1                                 | 4.6             | 10.0                                 |
| Foreign competition           | 34.4                        | 65.6               | 64  | 3.3             | 31.8                                 | 3.2             | 35.7                                 |
| Domestic competition          | 41.9                        | 58.1               | 117 | 2.6             | 46.9                                 | 2.6             | 57.4                                 |
| Energy costs                  | 53.7                        | 46.3               | 108 | 3.1             | 29.3                                 | 3.2             | 18.0                                 |
| Wage rates                    | 48.7                        | 51.3               | 113 | 3.0             | 36.4                                 | 2.8             | 44.8                                 |
| Raw material cost             | 43.3                        | 56.7               | 120 | 2.3             | 61.5                                 | 2.6             | 50.0                                 |
| New technology                | 85.8                        | 14.2               | 106 | 2.5             | 52.7                                 | 3.5             | 26.7                                 |
| Financing availability        | 64.2                        | 35.8               | 109 | 2.5             | 54.3                                 | 2.4             | 61.5                                 |
| Taxes                         | 37.7                        | 62.3               | 114 | 2.5             | 53.5                                 | 2.4             | 57.7                                 |

\*Based on a scale from 1 (critically important) to 5 (not important).

APPENDIX TABLE 3. MARKETS AND MARKETING OF RESPONDENT FIRMS, BY FIRM TYPE, 1991

| Subject Area  | All Firms | Durable Goods Manufacturers | Nondurable Goods Manufacturers | New Firms         | Established Firms      |                      | Agribusiness Firms | High-Tech Firms   |
|---|-----------|-----------------------------|--------------------------------|-------------------|------------------------|----------------------|--------------------|-------------------|
|   |           |                             |                                |                   | Less than 20 Employees | 20 Employees or More |                    |                   |
| ----- percent -----   |           |                             |                                |                   |                        |                      |                    |                   |
| <u>Where major products are marketed</u>                          |           |                             |                                |                   |                        |                      |                    |                   |
| Within local market   | 36.7      | 33.6                        | 40.4                           | 20.4              | 45.5 <sup>a</sup>      | 21.1 <sup>a</sup>    | 16.4 <sup>c</sup>  | 15.0 <sup>d</sup> |
| Within rest of North Dakota                                       | 21.4      | 23.7                        | 17.9                           | 22.3 <sup>b</sup> | 22.8 <sup>b</sup>      | 17.3                 | 24.5               | 26.6              |
| Within rest of United States                                      | 37.4      | 37.6                        | 36.7                           | 51.4 <sup>b</sup> | 27.9 <sup>a,b</sup>    | 54.7 <sup>a</sup>    | 49.6 <sup>c</sup>  | 52.8 <sup>d</sup> |
| International   | 4.9       | 5.1                         | 4.6                            | 5.3               | 3.7                    | 6.9                  | 9.5 <sup>c</sup>   | 4.7               |
| <u>Percent of products sold out-of-state</u>                      |           |                             |                                |                   |                        |                      |                    |                   |
| Mean (N=206)  | 42.2      | 42.7                        | 41.3                           | 46.7              | 31.6 <sup>a</sup>      | 61.6 <sup>a</sup>    | 59.1 <sup>c</sup>  | 57.5 <sup>d</sup> |
| Median  | 30.0      | 35.0                        | 30.0                           | 57.5 <sup>b</sup> | 20.0 <sup>a,b</sup>    | 68.0 <sup>a</sup>    | 52.5               | 68.0              |
| ----- number -----  |           |                             |                                |                   |                        |                      |                    |                   |
| <u>Degree of success in developing new customer/market niches</u> |           |                             |                                |                   |                        |                      |                    |                   |
| Mean score*   | 2.6       | 2.6                         | 2.7                            | 2.2               | 2.7                    | 2.5                  | 2.4                | 2.5               |

<sup>a</sup>Established firms with less than 20 employees significantly different than established firms with 20 or more employees based on the Tukey test using  $\alpha = .05$ .

<sup>b</sup>New firms significantly different than established firms with less than 20 employees based on the Tukey test using  $\alpha = .05$ .

<sup>c</sup>Agribusiness firms significantly different than other firms based on the Tukey test using  $\alpha = .05$ .

<sup>d</sup>High-tech firms significantly different than other firms based on the Tukey test using  $\alpha = .05$ .

\*Based on a scale of 1 (very successful) to 5 (not successful).

APPENDIX TABLE 4. DISTRIBUTION OF EXPENDITURES BY RESPONDENT FIRMS, BY FIRM TYPE, 1990

| Firm Type                         | Materials            |           | Expenditure Category |                      |                   | Total             |
|-----------------------------------|----------------------|-----------|----------------------|----------------------|-------------------|-------------------|
|                                   | Raw                  | Processed | Labor                | Subcontracting       | Other             |                   |
| All firms                         |                      |           |                      |                      |                   |                   |
| Percent of total expenditures     | 30.3                 | 21.9      | 27.4                 | 4.7                  | 15.7              | 100.0             |
| Percent made within state         | 43.3                 | 34.2      | 97.8                 | 74.6                 | 80.5              | 54.9              |
| Nondurable manufacturers          |                      |           |                      |                      |                   |                   |
| Percent of total expenditures     | 34.5                 | 19.6      | 22.5                 | 6.7                  | 16.7              | 100.0             |
| Percent made within state         | 53.0 <sup>a</sup>    | 36.9      | 98.0                 | 65.1                 | 73.7              | 60.6              |
| Durable manufacturers             |                      |           |                      |                      |                   |                   |
| Percent of total expenditures     | 28.2                 | 22.9      | 29.7 <sup>a</sup>    | 3.9                  | 15.3              | 100.0             |
| Percent made within state         | 37.2 <sup>a</sup>    | 32.5      | 97.7                 | 78.7                 | 84.0              | 52.2              |
| New firms                         |                      |           |                      |                      |                   |                   |
| Percent of total expenditures     | 19.1                 | 30.4      | 28.3                 | 21.6 <sup>c, d</sup> | 0.6 <sup>c</sup>  | 100.0             |
| Percent made within state         | 38.9                 | 29.7      | 94.8                 | 91.7                 | 97.5              | 69.2 <sup>c</sup> |
| Firms with less than 20 employees |                      |           |                      |                      |                   |                   |
| Percent of total expenditures     | 30.7                 | 22.5      | 28.4                 | 3.1 <sup>d</sup>     | 15.3              | 100.0             |
| Percent made within state         | 48.6 <sup>b</sup>    | 36.9      | 98.6                 | 77.1                 | 82.5              | 57.0              |
| Firms with 20 employees or more   |                      |           |                      |                      |                   |                   |
| Percent of total expenditures     | 33.8                 | 17.9      | 23.8                 | 3.6 <sup>c</sup>     | 20.9 <sup>c</sup> | 100.0             |
| Percent made within state         | 25.9 <sup>b</sup>    | 23.8      | 97.3                 | 69.2                 | 69.9              | 47.0 <sup>c</sup> |
| Agribusiness firms                |                      |           |                      |                      |                   |                   |
| Percent of total expenditures     | 41.3 <sup>e</sup>    | 23.0      | 17.0 <sup>d, e</sup> | 4.9                  | 13.8              | 100.0             |
| Percent made within state         | 55.0 <sup>e</sup>    | 30.0      | 97.2                 | 67.3                 | 76.5              | 57.1              |
| High-tech firms                   |                      |           |                      |                      |                   |                   |
| Percent of total expenditures     | 23.3                 | 28.8      | 22.8                 | 8.6                  | 16.5              | 100.0             |
| Percent made within state         | 13.8 <sup>e, f</sup> | 18.8      | 98.1                 | 91.0                 | 87.5              | 42.0 <sup>f</sup> |

<sup>a</sup>Nondurable manufacturers significantly different than durable manufacturers based on the Tukey test using  $\alpha = .05$ .

<sup>b</sup>Established firms with less than 20 employees significantly different than established firms with 20 or more employees based on the Tukey test using  $\alpha = .05$ .

<sup>c</sup>New firms significantly different than established firms with 20 or more employees based on the Tukey test using  $\alpha = .05$ .

<sup>d</sup>New firms significantly different than established firms with less than 20 employees based on the Tukey test using  $\alpha = .05$ .

<sup>e</sup>Agribusiness firms significantly different than other firms based on the Tukey test using  $\alpha = .05$ .

<sup>f</sup>High-tech firms significantly different than other firms based on the Tukey test using  $\alpha = .05$ .

APPENDIX TABLE 5. CURRENT EMPLOYMENT BY OCCUPATIONAL CATEGORY AND FIRM TYPE FOR NORTH DAKOTA MANUFACTURERS, 1991

| Firm Type                         | Executive,<br>Admin., &<br>Managerial | Professional<br>Specialty | Sales<br>Reps.   | Clerical<br>Workers | Precision<br>Production,<br>Craft &<br>Repair | Operators<br>&<br>Fabricators | Laborers          | Other            | Total                |
|-----------------------------------|---------------------------------------|---------------------------|------------------|---------------------|---|-------------------------------|-------------------|------------------|----------------------|
| <b>All firms</b>                  |                                       |                           |                  |                     |   |                               |                   |                  |                      |
| No. per firm                      | 4.8                                   | 3.6                       | 2.4              | 4.3                 | 9.3   | 18.5                          | 10.9              | 0.3              | 54.1                 |
| Percent                           | 8.9                                   | 6.7                       | 4.4              | 8.0                 | 17.2  | 34.3                          | 20.2              | 0.6              | 100.0                |
| <b>Manufacturers</b>              |                                       |                           |                  |                     |   |                               |                   |                  |                      |
| <b>Nondurable:</b>                |                                       |                           |                  |                     |   |                               |                   |                  |                      |
| Number                            | 6.7                                   | 3.6                       | 3.4              | 5.2                 | 13.6  | 28.5                          | 21.5 <sup>c</sup> | 0.4              | 82.9                 |
| Percent                           | 8.1                                   | 4.3                       | 4.1              | 6.3                 | 16.4  | 34.4                          | 25.9              | 0.5              | 100.0                |
| <b>Durable:</b>                   |                                       |                           |                  |                     |   |                               |                   |                  |                      |
| Number                            | 4.0                                   | 3.7                       | 1.9              | 3.9                 | 7.4   | 14.2                          | 6.2 <sup>c</sup>  | 0.2              | 41.5                 |
| Percent                           | 9.6                                   | 8.9                       | 4.6              | 9.4                 | 17.8  | 34.3                          | 14.9              | 0.5              | 100.0                |
| <b>New firms</b>                  |                                       |                           |                  |                     |   |                               |                   |                  |                      |
| Number                            | 4.3 <sup>a</sup>                      | 1.2 <sup>a</sup>          | 3.4              | 1.6 <sup>a</sup>    | 1.8 <sup>a</sup>                              | 6.1 <sup>a</sup>              | 17.2              | 0.0              | 35.6 <sup>a</sup>    |
| Percent                           | 12.1                                  | 3.4                       | 9.6              | 4.5                 | 5.1   | 17.1                          | 48.2              | 0.0              | 100.0                |
| <b>Established firms</b>          |                                       |                           |                  |                     |   |                               |                   |                  |                      |
| <b>Less than 20<br/>employees</b> |                                       |                           |                  |                     |   |                               |                   |                  |                      |
| Number                            | 1.9 <sup>b</sup>                      | 1.0 <sup>b</sup>          | 0.8 <sup>b</sup> | 1.4 <sup>b</sup>    | 2.7 <sup>b</sup>                              | 4.7 <sup>b</sup>              | 2.2 <sup>b</sup>  | 0.1 <sup>b</sup> | 14.8 <sup>b</sup>    |
| Percent                           | 12.8                                  | 6.8                       | 5.4              | 9.5                 | 18.2  | 31.7                          | 14.9              | 0.7              | 100.0                |
| <b>20 employees<br/>or more</b>   |                                       |                           |                  |                     |   |                               |                   |                  |                      |
| Number                            | 12.8 <sup>a,b</sup>                   | 11.5 <sup>a,b</sup>       | 6.0 <sup>b</sup> | 13.1 <sup>a,b</sup> | 29.8 <sup>ab</sup>                            | 60.7 <sup>a,b</sup>           | 30.7 <sup>b</sup> | 0.9 <sup>b</sup> | 165.5 <sup>a,b</sup> |
| Percent                           | 7.7                                   | 6.9                       | 3.6              | 7.9                 | 18.0  | 36.8                          | 18.6              | 0.5              | 100.0                |
| <b>Agribusiness firms</b>         |                                       |                           |                  |                     |   |                               |                   |                  |                      |
| Number                            | 9.4 <sup>d</sup>                      | 9.0 <sup>d</sup>          | 3.3              | 8.6 <sup>d</sup>    | 23.9 <sup>d</sup>                             | 37.9 <sup>d</sup>             | 26.9 <sup>d</sup> | 0.6              | 119.6 <sup>d</sup>   |
| Percent                           | 7.9                                   | 7.5                       | 2.8              | 7.2                 | 20.0  | 31.6                          | 22.5              | 0.5              | 100.0                |
| <b>High-tech firms</b>            |                                       |                           |                  |                     |   |                               |                   |                  |                      |
| Number                            | 5.8                                   | 4.0                       | 4.3              | 3.7                 | 7.7   | 32.0                          | 5.2               | 0.0              | 62.7                 |
| Percent                           | 9.3                                   | 6.4                       | 6.9              | 5.9                 | 12.3  | 50.9                          | 8.3               | 0.0              | 100.0                |

<sup>a</sup>New firms significantly different than established firms with 20 or more employees based on the Tukey test using  $\alpha = .05$ .

<sup>b</sup>Established firms with less than 20 employees significantly different than established firms with 20 or more employees based on the Tukey test using  $\alpha = .05$ .

<sup>c</sup>Nondurable manufacturers significantly different than durable manufacturers based on the Tukey test using  $\alpha = .05$ .

<sup>d</sup>Agribusiness firms significantly different than other firms based on the Tukey test using  $\alpha = .05$ .

APPENDIX TABLE 6. CURRENT, PAST, AND PROJECTED EMPLOYMENT BY OCCUPATIONAL CATEGORY FOR NORTH DAKOTA MANUFACTURERS, 1991

| Occupational Category                        | Average Number of<br>Employees Per Firm |                   |                        | Projected Employment<br>Growth in Five Years |         |
|--|---|-------------------|------------------------|--|---------|
|  | Current                                 | Five<br>Years Ago | Five Years<br>From Now | Number                                       | Percent |
| Executive, administrative,<br>and managerial | 4.8                                     | 3.6               | 6.3                    | 1.5  | 6.0     |
| Professional specialty                       | 3.6                                     | 2.5               | 5.2                    | 1.6  | 6.4     |
| Sales representatives                        | 2.4                                     | 1.4               | 4.7                    | 2.3  | 9.2     |
| Clerical workers                             | 4.3                                     | 3.1               | 5.6                    | 1.3  | 5.2     |
| Precision production,<br>craft, and repair   | 9.3                                     | 5.6               | 13.1                   | 3.8  | 15.2    |
| Operators and fabricators                    | 18.5                                    | 13.7              | 29.5                   | 11.0   | 44.0    |
| Laborers                                     | 10.9                                    | 5.9               | 14.3                   | 3.4  | 13.6    |
| Other  | 0.3                                     | 0.2               | 0.4                    | 0.1  | 0.4     |
| Total Average Per Firm                       | 54.1                                    | 36.0              | 79.1                   | 25.0   | 100.0   |

APPENDIX TABLE 7. TRAINING AND EDUCATIONAL ASSISTANCE NEEDS BY FIRM TYPE FOR NORTH DAKOTA MANUFACTURERS, 1991

| Subject Area          | All Firms                | Durable Goods Manufacturers | Nondurable Goods Manufacturers | New Firms         | Established Firms      |                      | Agribusiness Firms | High-Tech Firms |  |
|-----------------------|--------------------------|-----------------------------|--------------------------------|-------------------|------------------------|----------------------|--------------------|-----------------|--|
|                       |                          |                             |                                |                   | Less than 20 Employees | 20 Employees or More |                    |                 |  |
|                       | ----- mean scores* ----- |                             |                                |                   |                        |                      |                    |                 |  |
| Operator training     | 3.36                     | 3.45                        | 3.16                           | 3.33              | 3.50                   | 3.14                 | 3.21               | 3.43            |  |
| Computer-aided design | 3.65                     | 3.53                        | 3.87                           | 3.80              | 3.70                   | 3.41                 | 3.55               | 3.14            |  |
| Basic computer skills | 3.39                     | 3.46                        | 3.24                           | 3.81 <sup>a</sup> | 3.41                   | 2.95 <sup>a</sup>    | 3.33               | 3.60            |  |
| Computer-aided mfg.   | 3.78                     | 3.70                        | 3.93                           | 4.00              | 3.93                   | 3.36                 | 3.65               | 3.29            |  |
| Quality control       | 3.08                     | 3.10                        | 3.00                           | 3.45              | 3.21                   | 2.65                 | 2.79               | 3.00            |  |
| Management training   | 3.11                     | 3.21                        | 2.92                           | 3.53 <sup>a</sup> | 3.29 <sup>b</sup>      | 2.56 <sup>a,b</sup>  | 3.03               | 3.00            |  |
| Marketing and sales   | 2.66                     | 2.66                        | 2.67                           | 2.70              | 2.71                   | 2.53                 | 2.58               | 2.94            |  |
| Exporting             | 3.60                     | 3.48                        | 3.83                           | 2.86 <sup>c</sup> | 3.79 <sup>c</sup>      | 3.61                 | 2.97 <sup>d</sup>  | 3.77            |  |
| Quality assurance     | 3.07                     | 3.15                        | 2.90                           | 2.86              | 3.30                   | 2.69                 | 2.63 <sup>d</sup>  | 3.42            |  |
| Financing             | 3.23                     | 3.27                        | 3.13                           | 2.68              | 3.33                   | 3.26                 | 2.71 <sup>d</sup>  | 3.62            |  |
| Labor relations       | 3.41                     | 3.37                        | 3.46                           | 3.15              | 3.67                   | 3.11                 | 3.18               | 3.36            |  |

<sup>a</sup>New firms significantly different than established firms with 20 or more employees based on the Tukey test using  $\alpha = .05$ .

<sup>b</sup>Established firms with less than 20 employees significantly different than established firms with 20 or more employees based on the Tukey test using  $\alpha = .05$ .

<sup>c</sup>New firms significantly different than established firms with less than 20 employees based on the Tukey test using  $\alpha = .05$ .

<sup>d</sup>Agribusiness firms significantly different than other firms based on the Tukey test using  $\alpha = .05$ .

\*Based on a scale of 1 (critically important) to 5 (not important).

APPENDIX TABLE 8. MANUFACTURERS' TECHNICAL ASSISTANCE (CONSULTING) NEEDS BY SUBJECT AREA AND FIRM TYPE, 1991

| Subject Area                              | All Firms                | Durable Goods Manufacturers | Nondurable Goods Manufacturers | New Firms            | Established Firms      |                      | Agribusiness Firms | High-Tech Firms |  |
|---|--------------------------|-----------------------------|--------------------------------|----------------------|------------------------|----------------------|--------------------|-----------------|--|
|   |                          |                             |                                |                      | Less than 20 Employees | 20 Employees or More |                    |                 |  |
|   | ----- mean scores* ----- |                             |                                |                      |                        |                      |                    |                 |  |
| Accounting and records                    | 3.71                     | 3.75                        | 3.61                           | 3.52                 | 3.66                   | 4.05                 | 4.00               | 3.83            |  |
| Human resource management                 | 3.69                     | 3.67                        | 3.69                           | 3.96                 | 3.69                   | 3.38                 | 3.67               | 3.47            |  |
| Financial analysis/<br>cost control       | 3.39                     | 3.45                        | 3.27                           | 3.38                 | 3.43                   | 3.44                 | 3.62               | 3.44            |  |
| Computer system                           | 3.32                     | 3.35                        | 3.20                           | 3.52                 | 3.37                   | 3.00                 | 3.13               | 3.50            |  |
| Inventory control                         | 3.32                     | 3.39                        | 3.18                           | 3.48                 | 3.43                   | 3.02                 | 3.41               | 2.89            |  |
| Plant layout and design                   | 3.66                     | 3.60                        | 3.83                           | 3.81                 | 3.69                   | 3.53                 | 3.71               | 3.61            |  |
| Production control                        | 3.37                     | 3.33                        | 3.43                           | 3.56                 | 3.47                   | 2.98                 | 3.50               | 3.16            |  |
| Research and development                  | 3.38                     | 3.33                        | 3.54                           | 3.04                 | 3.54                   | 3.15                 | 3.08               | 3.61            |  |
| Marketing studies                         | 2.92                     | 2.91                        | 2.97                           | 3.04                 | 2.93                   | 2.88                 | 2.57 <sup>d</sup>  | 3.05            |  |
| Strategic planning<br>design              | 3.43                     | 3.48                        | 3.32                           | 3.58                 | 3.46                   | 3.18                 | 3.21               | 3.56            |  |
| Process improvement                       | 3.20                     | 3.19                        | 3.22                           | 2.89                 | 3.43 <sup>a</sup>      | 2.80 <sup>a</sup>    | 2.95               | 2.89            |  |
| Material handling                         | 3.51                     | 3.48                        | 3.62                           | 3.37                 | 3.70                   | 3.33                 | 3.63               | 3.33            |  |
| Industrial waste<br>management            | 3.75                     | 3.76                        | 3.77                           | 4.04 <sup>b</sup>    | 3.94 <sup>a</sup>      | 3.20 <sup>a, b</sup> | 3.75               | 4.06            |  |
| Prototype testing                         | 3.97                     | 3.91                        | 4.08                           | 3.63                 | 4.12                   | 3.78                 | 3.71               | 3.79            |  |
| Product-process<br>development            | 3.63                     | 3.63                        | 3.62                           | 3.26                 | 3.86                   | 3.35                 | 3.35               | 3.56            |  |
| Product and process<br>commercialization  | 3.78                     | 3.74                        | 3.84                           | 3.56                 | 3.90                   | 3.65                 | 3.64               | 4.00            |  |
| Developing international<br>markets       | 3.47                     | 3.39                        | 3.57                           | 2.63 <sup>b, c</sup> | 3.63 <sup>c</sup>      | 3.53 <sup>b</sup>    | 2.83 <sup>d</sup>  | 3.58            |  |
| Government/manufacturing<br>specification | 3.68                     | 3.63                        | 3.86                           | 3.33                 | 3.72                   | 3.95                 | 3.48               | 3.89            |  |
| Quality assurance                         | 3.00                     | 3.00                        | 2.98                           | 3.07                 | 3.08                   | 2.83                 | 2.98               | 3.39            |  |

<sup>a</sup>Established firms with less than 20 employees significantly different than established firms with 20 or more employees based on the Tukey test using  $\alpha = .05$ .

<sup>b</sup>New firms significantly different than established firms with 20 or more employees based on the Tukey test using  $\alpha = .05$ .

<sup>c</sup>New firms significantly different than established firms with less than 20 employees based on the Tukey test using  $\alpha = .05$ .

<sup>d</sup>Agribusiness firms significantly different than other firms based on the Tukey test using  $\alpha = .05$ .

\*Based on a scale from 1 (critical) to 5 (not important).



