

Manufacturing Needs, Practices, and Performance in Georgia, 1999-2002

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THE 2002 GEORGIA MANUFACTURING SURVEY EXECUTIVE SUMMARY

The *Georgia Manufacturing Survey* (GMS) is a statewide survey conducted every 2-3 years by Georgia Tech's Economic Development Institute and School of Public Policy to assess the business and technological paths of Georgia's manufacturers. The theme of GMS 2002 was Innovation in Manufacturing. This summary presents the 2002 survey's key findings.

Manufacturers Shift Priorities, Search for Markets

Manufacturers' priorities have shifted since 1999. More manufacturers have needs in marketing and product development in 2002 than in 1999. In contrast, concerns about information technology hardware and software declined from peak 1999 levels. Human resource problems are still a foremost worry of Georgia manufacturers, although at below peak 1996 levels. Most human resource needs involved technical and supervisory skills, rather than basic skills.

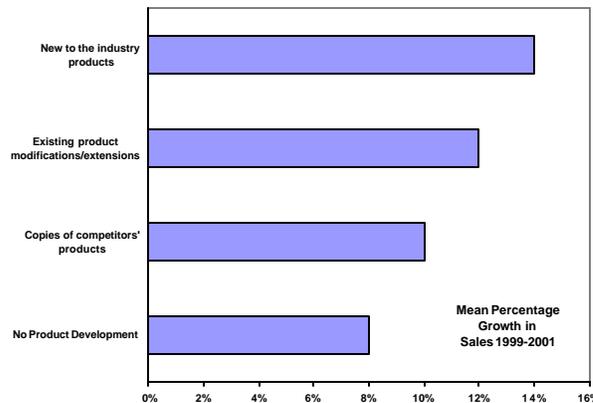
More Georgia Manufacturers Compete on Price

About half of Georgia manufacturers underwent major changes in strategy or structure in the last two years. An increasing share of Georgia manufacturers dealt with economic and structural changes by competing on low price. The percentage of Georgia manufacturers competing on price is up from 19 percent in 1999 to 27 percent in 2002. However, low price (along with quick delivery) strategies are associated with

lower returns on sales and lower employee wages.

Product Development Is Positively Associated With Higher Performance

More than 60 percent of Georgia manufacturers do some type of product development. Twenty-two percent are developing new-to-the-industry products and 37 percent offer support services that add value to their products. Companies with new-to-the-industry products and value-added service offerings had significantly higher growth, profitability, and produc-



tivity than those not engaged in these practices.

Out-of-state branch plants are more likely to do product development than are Georgia-headquartered or single-establishment enterprises. This finding suggests that a good portion of the state's product development and innovations come from linkages with innovative out-of-state companies.

Use of Computers Is Positively Associated with Higher Performance

Manufacturers with more than 20 percent of their shop floor employees regularly using com-

puters have significantly higher sales growth, profitability, and productivity. Virtually all manufacturers use e-mail, and company Web sites, shared databases, and high-speed Internet connections also are prevalent among the majority of manufacturers. Although most Georgia manufacturers have Web sites, only 6 percent got 10 percent or more of their 2001 sales through the Web. Customer requirements drive IT adoption for more than one-third of Georgia manufacturers, and IT adoption rose with facility employment size.

Georgia Tech-Assisted Manufacturers Had Comparatively Higher Productivity

Twenty-four percent of manufacturers surveyed used Georgia Tech for business assistance. The top benefits reported by Georgia Tech customers were improved management and employee skills, improved an existing process, and increased productivity. Compared to manufacturers not assisted by Georgia Tech, Georgia Tech clients on average experienced a value-added increase of \$353,000 to \$443,000 (or \$3,000 on a per employee basis) adjusting for what value-added per worker would have been if the company had not been a client.

Methodology

- The survey is used to inform manufacturing assistance programming and regional innovation initiatives in Georgia.
- Mail surveys were sent to 4,000 manufacturers with 10 or more employees from April to October 2002.
- Completed surveys from 636 manufacturers were weighted to reflect employment and industry distributions in the Georgia Department of Labor database.

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Section 1

Introduction: The 2002 Georgia Manufacturing Survey

The Georgia Manufacturing Survey 2002 is the fourth in a series of statewide surveys conducted since 1994.¹ The primary objectives of the survey are (1) to identify trends and needs in the manufacturing base, and (2) to measure change in the performance of firms assisted by Georgia Tech's Economic Development Institute (GT/EDI).

The 2002 survey went to all Georgia manufacturing firms with 10 or more employees. Of the 711 responses received, 636 surveys met the criteria of manufacturers with 10 or more employees. These were weighted to reflect the actual distribution of manufacturers by industry and employment size in Georgia.

This report is divided into six sections. Section 2 examines manufacturer problems and needs. Section 3 focuses on use of manufacturing technologies and techniques. Section 4 looks at manufacturing strategies. Section 5 examines operating, workforce, and performance measures. Section 6 summarizes survey responses about use of information and assistance sources, including Georgia Tech. For more information about the survey, see Appendix 1.

Box 1

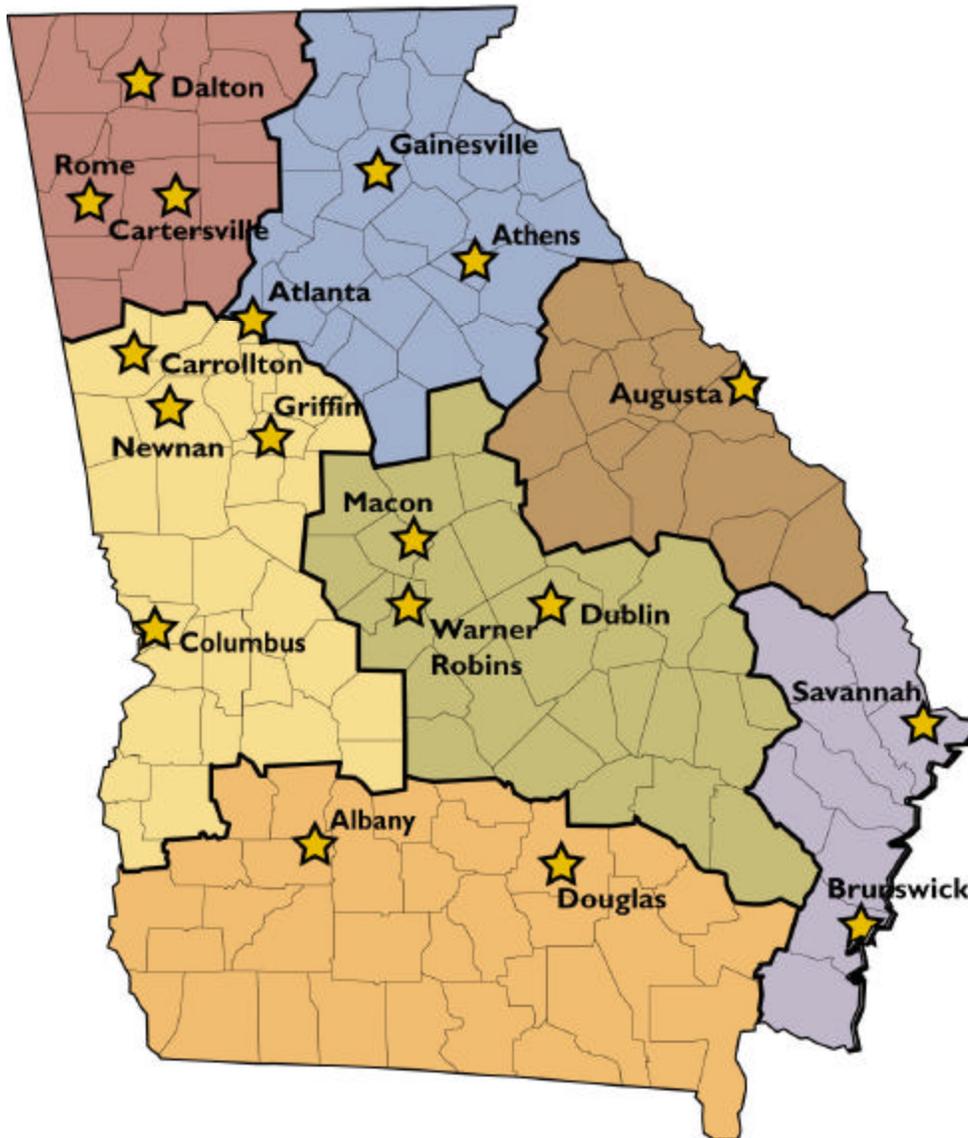
Industry Group Definitions

<u>Industry Group</u>	<u>Two-Digit SIC</u>	<u>Description</u>
Food products	20	Food and kindred products
	21	Tobacco manufacturers
Textiles, apparel	22	Textile mill products
	23	Apparel and textile products
Resource industries	24	Lumber and wood products
	25	Furniture and fixtures
	26	Paper and allied products
	28	Chemicals and allied products
	32	Stone, clay, glass, and concrete products
	33	Primary metal industries
Metals, machinery	34	Fabricated metal industries
	35	Industrial machinery and equipment
	37	Transportation equipment
Electronics, instruments	36	Electronics and other electrical equipment
	38	Instruments and other related products
Miscellaneous, plastics, printing	27	Printing, publishing, and allied products
	29	Petroleum refining and related industries
	30	Rubber and miscellaneous plastic products
	31	Leather and leather products
	39	Miscellaneous manufacturing industries

¹ Jan Youtie and Philip Shapira, "Manufacturing Needs, Practices and Performance in Georgia: 1994 Georgia Manufacturing Technology Survey," GMEA Evaluation Working Paper E9501, Revised, March 1995; Jan Youtie and Philip Shapira, "Manufacturing Needs, Practices and Performance in Georgia, 1994-1998," GMEA Evaluation Working Paper E9703, May 1997.

Throughout this report, information will be broken down by employee size, industry group, and regions (GT/EDI) in 2001. Industry groupings and their two-digit standard industrial classifications (SIC) are described in Box 1. Results will also be presented in terms of GT/EDI's major geographic service areas—Northwest (Dalton, Rome, Cartersville), Northeast (Gainesville, Athens, northeast Atlanta), West (Carrollton, Newnan, Columbus, Griffin), East (Augusta), Central (Macon, Dublin, Warner Robins), South, (Albany, Douglas), and Coastal (Savannah, Brunswick). (See Figure 1.)

Figure 1. Georgia Regions Used in Analysis



Section 2

Problems and Needs

We start by examining the most significant problems or needs of Georgia manufacturers. The Georgia Manufacturing Survey 2002 asked a question that has been posed in all four manufacturing surveys, including those conducted in 1994, 1996, and 1999: “In which of the following areas does your facility have the most significant problems or needs?” There were two modifications to this question from the 1999 survey:

- The computer-based business and process systems category was reclassified as “computer software/packages for accounting, planning, order entry, scheduling, inventory, etc.”
- An additional response category was added: “Financial planning or assistance with loan applications and fundraising.”

Manufacturers’ Problems Have Shifted

Human resource problems were a foremost worry of Georgia manufacturers, as has been the case in the past three surveys. Forty-four percent of respondents mentioned human resources as a problem or need, although the extent of concern is below peak 1996 levels. Technical and supervisory skills were the most common human resource problems, with 27 percent of respondents indicating problems finding technical skills and 26 percent reporting problems finding supervisory skills. In contrast, a small and declining percentage of manufacturers expressed problems finding basic skills (11 percent). Market development and manufacturing process difficulties also ranked high among manufacturers’ concerns in the 2002 survey, with 37 percent and 34 percent of respondents, respectively, reporting that they had problems in these areas. (See Table 2.1.) More manufacturers raised problems in the marketing and product development areas in 2002 than in 1999. There was also an increase in manufacturing process needs between 1999 and 2002. In contrast, concerns about information technology hardware and software declined from peak 1999 levels.

Table 2.1
Manufacturing Problems and Needs: 2001, 1999, 1996, 1994

					Difference
	2002	1999	1996	1994	2001-1999
Human resources problems	44%	39%	53%	44%	5%
Technical skills	27%	25%	31%	n/a	2%
Supervisory, team skills	26%	21%	33%	n/a	5%
Basic skills	11%	13%	16%	n/a	-2%
Market development, exporting	37%	25%	17%	15%	12%
Manufacturing process	34%	29%	27%	37%	5%
Plant layout, expansion	24%	22%	22%	25%	2%
Computer applications	20%	27%	17%	13%	-7%
Computer software/packages	16%	19%	23%	26%	-3%
Computer hardware/systems	10%	16%			-6%
Automation			15%	8%	n/a
Product development, design	19%	13%	13%	12%	6%
Environmental, health & safety	18%	15%	17%	29%	3%
Quality assurance	17%	17%	19%	22%	n/a
General business analysis/finance	16%	11%	12%	12%	5%
Waste management	16%	11%			5%
Energy costs, conservation	15%	10%	13%	16%	5%
Material-related	9%	5%	5%	10%	4%
Financial planning/fundraising	6%	n/a	n/a	n/a	n/a

Source: Georgia Manufacturing Survey 2002, weighted responses of 710 surveys; Georgia Manufacturing Survey 1999, weighted responses of 727 manufacturers; Georgia Manufacturing Survey 1996, weighted responses of 1,002 manufacturers; Georgia Manufacturing Technology Survey 1994, weighted responses of 1,180.

Problems and Needs by Size, Industry, and Region

The higher level of concern for large manufacturers with 500 or more employees' was finding technical and management skills. They were also concerned with the manufacturing process. Companies with 50 to 499 employees were also most concerned with manufacturing process issues. They also were more apt to have problems finding basic skills in comparison to the other sizes of companies. Businesses with 10 to 49 employees indicated marketing as their greatest need. They were also comparatively more interested in financial planning and computer hardware and software. (See Figure 2.2.)

The emphasis given to specific problems differed by industry. The food processing and electronics industries were more likely to report problems or needs than were the other industries. Food processors indicated more concern with problems such as technical skills, plant layout, marketing, and environmental concerns such as energy costs and environmental compliance. Compared to other industries, the food processing industry was least likely to have quality assurance problems or needs. The electronics industry was most concerned with manufacturing process issues, technical and management skills, quality assurance, and marketing. The textile/apparel industry had greater marketing needs than needs in any other category. Resource industries cited manufacturing process and plant layout as problem areas. The machinery industry most often mentioned problems with manufacturing process, marketing, and technical skills. (See Table 2.2.)

Marketing was the major concern for manufacturers in the Northeast, Northwest, South, and Coastal regions with technical skills indicated as an equal concern in the Coastal region. The manufacturing process was the major concern for manufacturers in the West, Central, and East regions. (See Table 2.3.)

Figure 2.1
Manufacturing Needs and Problems by Facility Employment Size

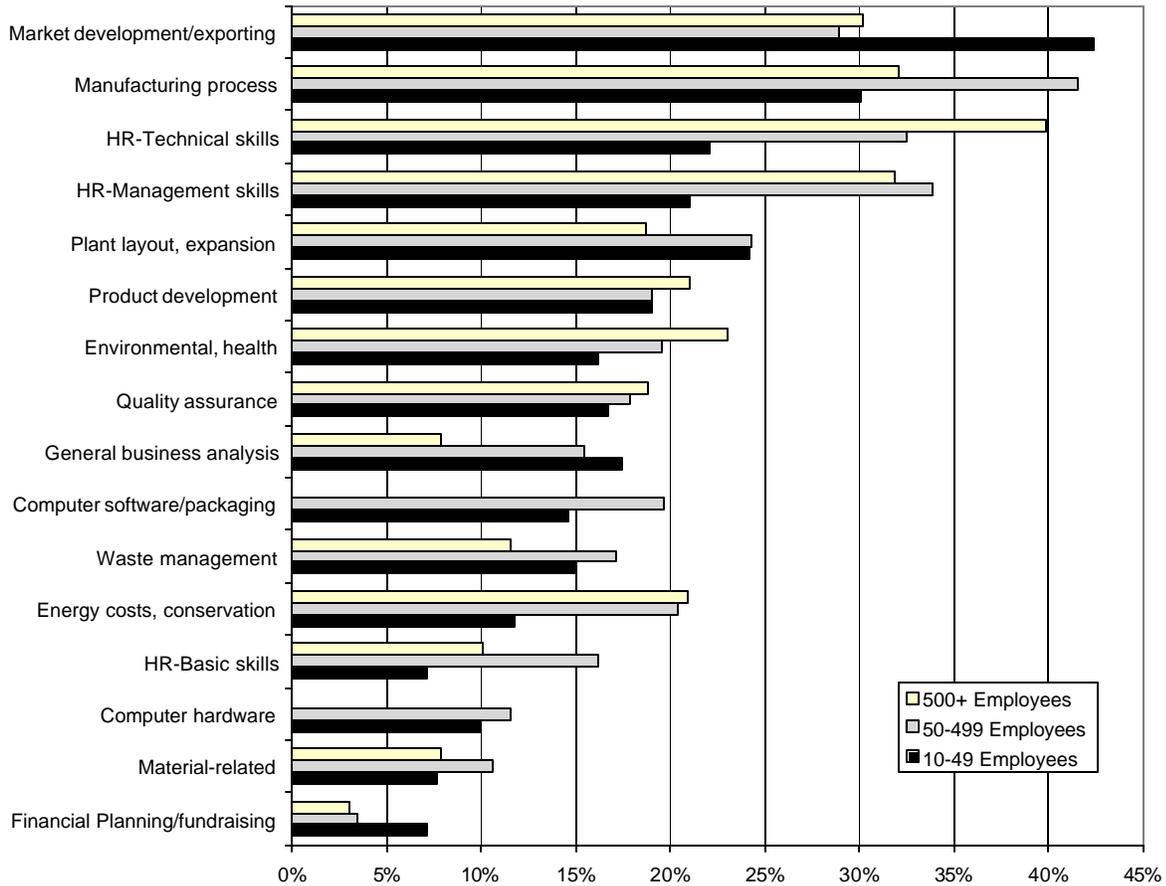


Table 2.2
Manufacturing Problems and Needs by Industry

	Apparel/					
	Food	Textiles	Resource	Machinery	Electronics	Other
Manufacturing process	37%	24%	40%	37%	40%	28%
Market development, exporting	40%	42%	35%	34%	30%	40%
Plant layout, expansion	40%	17%	34%	17%	7%	19%
Technical skills	42%	18%	20%	31%	33%	32%
Computer software	21%	16%	11%	11%	17%	27%
Supervisory, team skills	26%	28%	26%	23%	30%	28%
Quality assurance	3%	10%	14%	24%	30%	21%
Computer hardware	11%	5%	7%	10%	6%	21%
Environmental, health & safety	26%	10%	22%	20%	12%	18%
Product development, design	26%	19%	15%	18%	29%	22%
Basic skills	11%	7%	12%	12%	14%	9%
Waste management	18%	10%	23%	10%	11%	15%
General business analysis/finance	13%	19%	12%	15%	23%	23%
Energy costs, conservation	26%	20%	15%	12%	8%	14%
Material-related	3%	4%	11%	9%	16%	8%

Source: Georgia Manufacturing Survey 2002, weighted responses of 636 manufacturers.

Table 2.3
Manufacturing Problems and Needs by Region

	Northeast	Northwest	West	South	Central	East	Coastal
Manufacturing process	35%	31%	35%	24%	40%	49%	37%
Market development/exporting	43%	36%	35%	36%	33%	17%	40%
Plant layout, expansion	24%	29%	23%	26%	17%	14%	35%
HR-Technical skills	23%	28%	21%	34%	28%	24%	40%
Computer software/packaging	16%	18%	19%	11%	9%	21%	19%
HR-Supervisory/team skills	29%	28%	25%	22%	24%	17%	27%
Quality assurance	16%	17%	21%	18%	8%	29%	25%
Computer hardware	11%	14%	8%	4%	10%	10%	15%
Environmental, health & safety	16%	18%	17%	16%	22%	26%	13%
Product development, design	17%	27%	17%	21%	17%	7%	21%
HR-Basic skills	9%	6%	13%	13%	17%	7%	19%
Waste management	14%	12%	19%	15%	20%	27%	13%
General business analysis/finance	21%	14%	18%	14%	10%	17%	13%
Financial Planning	6%	5%	5%	5%	6%	5%	9%
Energy costs, conservation	16%	20%	14%	12%	9%	21%	14%
Material-related	8%	7%	7%	14%	7%	15%	11%

Source: Georgia Manufacturing Survey 2002, weighted responses of 636 manufacturers.

Section 3 Manufacturing Strategy

What were manufacturers' strategies for addressing the needs depicted in Section 2? This section explores the selection of strategies that manufacturers chose to compete for customer sales. The analysis for this section is based on the question that asks manufacturers to rank six strategies from 1 (highest importance) to 6 (lowest importance). The six strategies are low price, high quality, innovation/new technology, quick delivery, adapting to customer needs, and value-added customer and product services. The results represent the percentage of manufacturers that chose each strategy as their highest choice. This question was also asked in the 1999, which facilitates exploration of changes in manufacturing strategy over time.

More than half of Georgia manufacturers chose quality of service as their primary strategy in competing for customer sales. Low price was a primary strategy for 27 percent of Georgia manufacturers. Adapting to customers needs was cited by 11 percent of the manufacturers, followed by value-added services at 7 percent. Innovation/new techniques was a top strategy for the fewest manufacturers (5 percent). These four strategies declined in primary usage between 1999 and 2002.

Quality and low-cost strategies were more prominent among Georgia manufacturers in 2002 than in 1999. Particularly significant was the increase in the percentage of manufacturers competing on low price, which rose from 19 percent in 1999 to 27 percent in 2002. Fewer companies competed through quick delivery, customer adaptation, low price, and, particularly, innovation or new technology in 2002 than in 1999. (See Figure 3.1.)

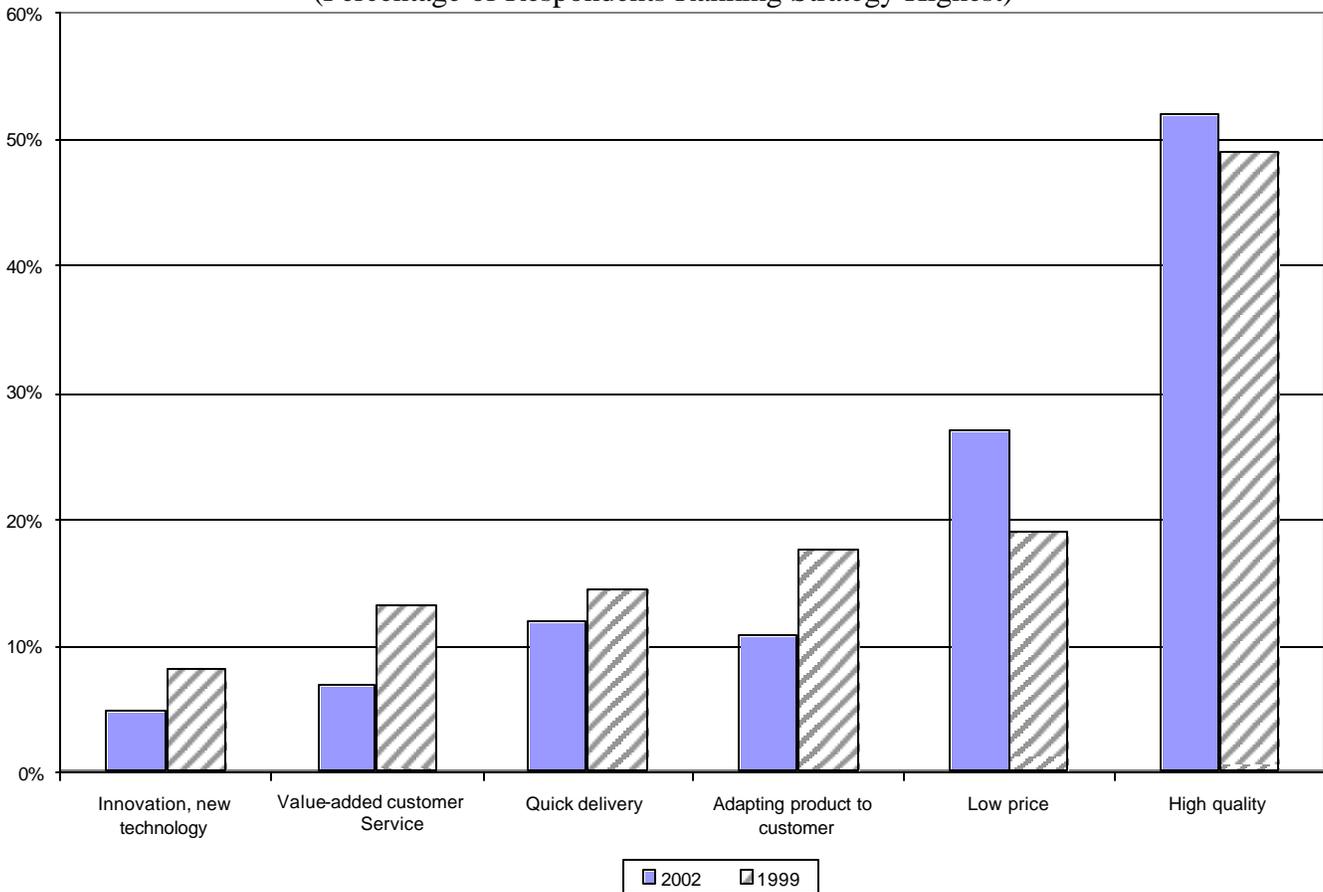
Strategies by Firm Characteristics

By employment size, the largest and the smallest firms were more likely to compete primarily on quality than were medium-sized companies. Medium-sized companies, on the other hand, tended to compete more on low price than did large or small companies. Small and medium-sized companies also were more apt to say that quick delivery or innovation was a primary strategy for them than were the largest companies.

All industries favored high quality as a primary sales strategy and were least likely to favor innovation-related strategies. Food processors had an especially high percentage of firms competing primarily on high quality, and they also placed a comparatively greater emphasis on value-added services. Textile/apparel firms were the near exception as about the same percentage picked low price as their primary strategy (38 percent) as picked high quality (41 percent).

The highest percentage of manufacturers competing primarily on high quality was in the Coastal region (61 percent), while the lowest percentage was in the Central region (42 percent). The West region had the highest percentage of manufacturers competing primarily on low price (38 percent). The Central region had the highest percentage of firms emphasizing quick delivery strategies, while the South region had the highest percentage of firms adapting to customer needs. The Central, Northeast, and Coastal regions had relatively higher percentages of respon-

Figure 3.1 Most Important Manufacturing Strategies: 1999 vs. 2002
(Percentage of Respondents Ranking Strategy Highest)



dents stressing value-added services strategies, and those in the Northeast and Northwest were most apt to stress innovation/technology strategies.

Outcomes of Strategies

How have these strategies fared in generating return on sales, which manufacturers care about, and employee wages, which economic developers care about? The strategies can be divided into two groups based on these two outcomes. The first group, made up of quick delivery and low price, generated the lowest average returns on sales of 6.6 percent and 7.3 percent, respectively. This group also paid the lowest average annual wages—less than \$30,000.

Table 3.1. Most Important Manufacturing Strategies by Facility Employment Size
(Percentage of firms indicating strategy is of highest importance)

	Employment Size			
	All Respondents	10-49	50-499	500 +
High quality	52%	54%	45%	57%
Low price	27%	22%	34%	20%
Quick delivery	12%	11%	13%	0%
Adapting to customers needs	11%	12%	10%	12%
Value-added services	7%	7%	6%	5%
Innovation/new techniques	5%	5%	4%	0%

Table 3.2. Most Important Manufacturing Strategies by Industry
(Percentage of firms indicating strategy is of highest importance)

	Apparel/					
	Food	Textiles	Resource	Machinery	Electronics	Other
High quality	58%	41%	55%	51%	47%	50%
Low price	32%	38%	23%	28%	29%	21%
Quick delivery	5%	20%	10%	7%	7%	14%
Adapting to customers needs	8%	10%	13%	10%	15%	8%
Value-added services	13%	8%	7%	5%	5%	6%
Innovation/new techniques	3%	6%	4%	5%	7%	3%

Source: Georgia Manufacturing Survey 2002, weighted responses of 636 manufacturers

Table 3.3. Most Important Manufacturing Strategies by Region
(Percentage of firms indicating strategy is of highest importance)

	Northeast	Northwest	West	South	Central	East	Coastal
High quality	53%	54%	45%	52%	42%	49%	61%
Low price	22%	21%	38%	31%	33%	31%	21%
Quick delivery	12%	11%	8%	14%	18%	5%	3%
Adapting to customers needs	11%	13%	6%	16%	12%	4%	3%
Value-added services	9%	4%	5%	4%	10%	5%	9%
Innovation/new techniques	6%	7%	4%	1%	4%	0%	3%

Source: Georgia Manufacturing Survey 2002, weighted responses of 636 manufacturers

Table 3.4
Manufacturing Returns and Wages By Most Important Manufacturing Strategy
(Numbers shown are mean values)

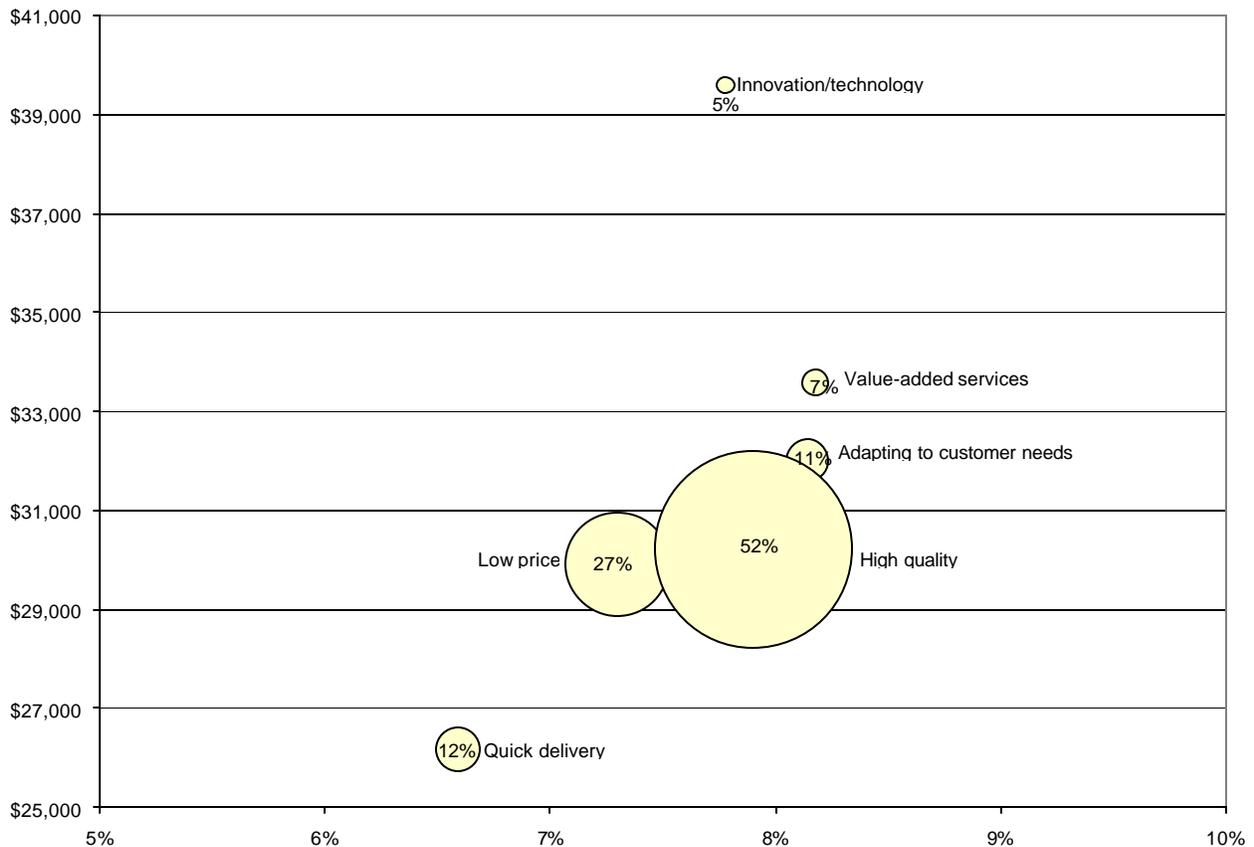
Manufacturing Strategies	Average Return on Sales 1999-2001	Average Employee Wage
High quality	7.9	\$30,216
Low price	7.3	\$29,927
Value-added customer and product services	8.2	\$33,577
Adapting product to customer needs	8.1	\$32,001
Quick delivery	6.6	\$26,173
Innovation, new technology	7.8	\$39,583

Source: Georgia Manufacturing Survey 2002, weighted responses of 636 manufacturers.

The second group—made up of high quality, value-added services, adapting to customer needs, and innovation—generated average return on sales of 7.8 percent to 8.2 percent. Average wages in this group were all above \$30,000. Firms that competed through innovation paid the highest average annual wages, nearly \$40,000.

The bubble chart in Figure 3.2 illustrates these findings graphically. The sizes of the bubbles represent the percentages of Georgia manufacturers that compete primarily through the various strategies. The vertical axis shows the average 2001 wages associated with these strategies. The horizontal axis shows average return on sales from 1999-2001 associated with these strategies. Manufacturers who compete primarily through innovation strategies have relatively high returns on sales and higher employee wages. However, most Georgia manufacturers use strategies that are associated with low wages.

Figure 3.2
Manufacturing Returns and Wages By
Percentage of Respondents Ranking Strategies Highest

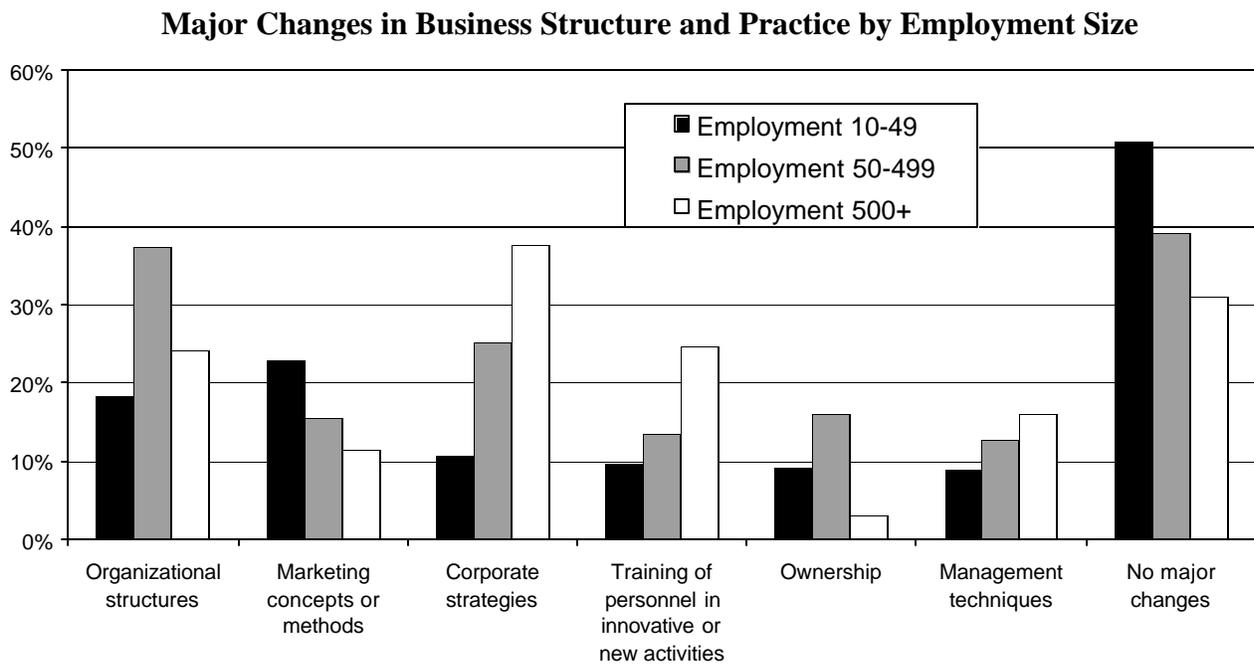


Impact of Business Structure and Practices

One factor that affects manufacturing strategies is whether the facility went through major changes. To investigate such changes, the survey asked whether the facility underwent major changes in business structure or practices during the 1999-to-2001 period. More than half the companies surveyed made major changes over the two-year period. Organizational changes were the most common, with 25 percent companies having undergone such changes. Twenty percent of firms implemented marketing-related changes. Seventeen percent of firms were involved in new corporate strategies. Twelve percent took their employees through training for new activities. Changes in ownership were experienced by 12 percent of firms. And 11 percent of firms instituted new management techniques.

Small firms with fewer than 50 employees were least likely to have undertaken any major changes. When they did make such changes, new marketing concepts or methods were most prominent. Medium-sized firms with 50 to 499 employees were most likely to be involved in changes in organizational structure or new ownership. Changes in corporate strategies, training, and management techniques were most prevalent among large manufacturers with 500 or more employees. (See Figure 3.3.)

Figure 3.3



Source: Georgia Manufacturing Survey 2002, weighted responses of 636

Organizational structure changes were most prominent among firms in the electronics industry and those in the western part of the state. Changes in corporate strategies, training, and ownership were most common among firms in the eastern part of the state. Companies in the southern

part of Georgia were most likely to say that they had not made any major changes in business structure or practices. (See Tables 3.5 and 3.6.)

Table 3.5. Major Changes in Business Structure and Practice by Industry

	All Respondents	Food	Apparel/ Textiles	Resource	Machinery	Electronics	Other
Organizational structures	25.6%	18.4%	25.7%	24.9%	27.1%	37.6%	24.2%
Marketing concepts or methods	19.8%	21.1%	23.3%	19.7%	17.9%	19.9%	19.3%
Corporate strategies	17.1%	10.5%	21.3%	15.4%	18.8%	17.0%	17.3%
Training of personnel in innovative or new activities	11.7%	10.5%	4.2%	9.2%	12.8%	12.5%	20.0%
Ownership	11.5%	10.5%	9.5%	13.9%	12.3%	9.0%	8.9%
Management techniques	10.6%	10.5%	8.1%	11.2%	11.9%	9.9%	10.1%
No major changes	45.9%	50.0%	43.2%	48.3%	43.4%	44.3%	45.3%

Source: Georgia Manufacturing Survey 2002, weighted responses of 636 manufacturers.

Table 3.6. Major Changes in Business Structure and Practice by Region

	All Respondents	Northeast	Northwest	West	South	Central	East	Coastal
Organizational structures	25.6%	22.5%	29.5%	33.7%	25.1%	21.2%	26.8%	19.5%
Marketing concepts or methods	19.8%	18.9%	18.9%	20.3%	21.8%	25.8%	16.5%	13.8%
Corporate strategies	17.1%	17.5%	17.6%	20.2%	15.5%	8.4%	24.3%	18.3%
Training of personnel in innovative or new activities	11.7%	10.6%	13.5%	9.6%	11.2%	10.3%	20.0%	13.5%
Ownership	11.5%	9.6%	15.6%	9.1%	10.0%	12.0%	21.8%	8.2%
Management techniques	10.6%	10.2%	12.3%	12.1%	10.5%	7.8%	7.0%	13.1%
No major changes	45.9%	47.2%	41.4%	42.8%	49.5%	45.4%	37.9%	62.5%

Source: Georgia Manufacturing Survey 2002, weighted responses of 636 manufacturers.

Table 3.7 looks at the link between major structural changes and corporate strategies. Companies experiencing no major structural changes are most apt to prioritize low price or high quality strategies. Manufacturers undergoing organizational changes emphasize value-added service and innovation strategies. Respondents undertaking major changes in marketing stress quick delivery, adapting to customers, value-added services, and innovation. Firms experiencing changes in corporate strategies are most apt to give top ranking to customer adaptation and innovation strategies. New training initiatives are most linked to quick delivery and value-added service strategies. Changes in ownership tend to be linked to innovation strategies. And changes in management techniques foster quick delivery and customer adaptation strategies.

Table 3.7. Types of Major Changes and Corporate Strategies

Types of Major Changes	All Respondents	High Quality	Low Price	Quick Delivery	Adapting to Customer	Value-added Services	Innovation Technology
Organizational structures	25.6%	23.0%	27.9%	24.0%	26.8%	41.0%	37.3%
Marketing concepts or methods	19.8%	19.1%	16.6%	31.4%	30.6%	31.6%	29.4%
Corporate strategies	17.1%	15.2%	14.3%	18.2%	24.0%	16.6%	30.1%
Training of personnel in innovative or new activities	11.7%	12.4%	9.6%	17.1%	11.3%	16.4%	6.3%
Ownership	11.5%	10.0%	10.3%	9.8%	14.3%	13.0%	22.6%
Management techniques	10.6%	9.3%	8.9%	16.5%	19.0%	10.2%	11.7%
No major changes	45.9%	47.8%	51.5%	33.7%	30.1%	31.4%	42.2%

Source: Georgia Manufacturing Survey 2002, weighted responses of 636 manufacturers.

Summary

We saw that although high quality strategies are the norm, an increasing proportion of Georgia manufacturers are competing on low price. The combination of low price (most prevalent among textile/apparel firms and medium-sized manufacturers) and quick delivery strategies are associated with lower returns on sales and lower wages. Companies with innovation as their primary strategy have relatively high returns on sales (although high quality, customer adaptation, and value-added service strategies had even higher average sales returns) and the highest average annual wages, but only 5 percent of respondents reported that they use innovation as a top competitive strategy.

We also saw that about half of Georgia manufacturers underwent major changes in strategy or structure in the last two years. Major changes were especially common among medium-sized and large manufacturers. Such changes were most closely associated with strategies that prioritize quick delivery, adapting to customers, value-added services, and innovation and technology.

Section 4 New Product and Process Development

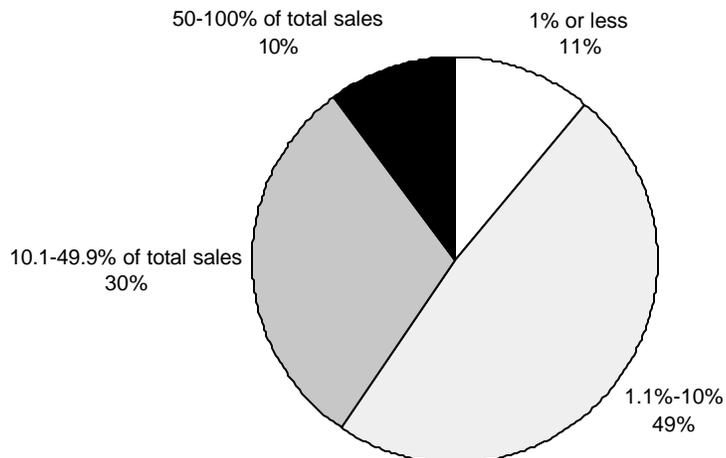
As the previous chapter indicated, being innovative and developing new products is associated with above-average profitability. However, innovative product or process development is not a main strategy for most Georgia firms. This chapter examines some of the issues surrounding new product and process development.

Product Development

We asked companies to indicate what types of new or improved products their firms developed over the past three years. More than half of the responding firms were involved with modifications or extensions to existing products or product lines. Less than 15 percent copied competitors' products. Products new to the industry were developed by 22 percent of the respondents. Less than 40 percent of firms said that did no product development.

For most companies with new-to-the-industry products, these products do not make up the majority of total company sales. The average percentage of sales accounted for by new-to-the industry products is 17 percent. But for 10 percent of companies, new products are responsible for half or more of total sales. (See Figure 4.1.)

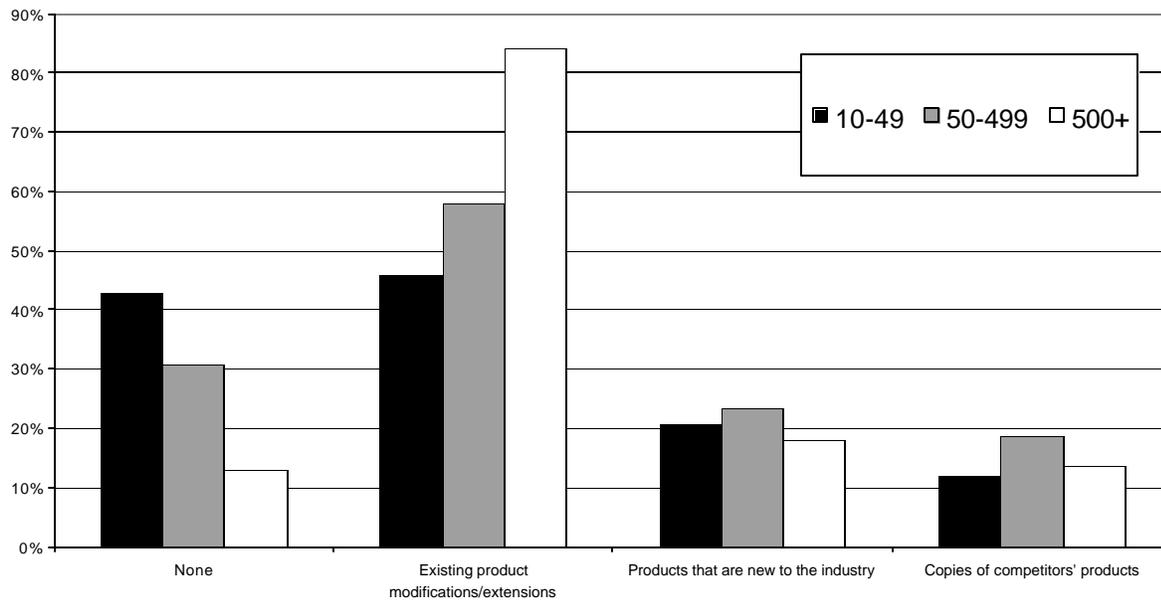
Figure 4.1
Percentage of Total
2001 Sales from New to the Industry Products



Source: Georgia Manufacturing Survey 2002, weighted responses of 636 manufacturers.

Smaller firms were less likely to be engaged in product development than their large firm counterparts. The percentage of firms with fewer than 50 employees not engaged in product development was three times the size of the percentage of firms with 500 or more employees. Large firm product development efforts were almost exclusively devoted to modifications or extensions of existing products. Medium-sized firms were slightly (although not significantly) more apt to be involved in products that are new to the industry and in copies of competitors' products. (See Figure 4.2.)

Figure 4.2
Types of Product Development by Facility Employment Size



Source: Georgia Manufacturing Survey 2002, weighted responses of 636 manufacturers.

Textile, apparel, and food products manufacturers were most likely to have been engaged in any product development activity. For these industries, existing product modifications were particularly prevalent as a means for product development. Apparel and textile firms were also most apt to say that they copied competitors' products. The electronics industry had the highest percentage of firms developing products that were new to the industry. (See Table 4.1.)

Table 4.1. Types of Product Development by Industry

	All Respondents	Food	Apparel/ Textiles	Resource Machinery	Electronics	Other
None	37.3%	28.9%	28.7%	39.4%	42.2%	35.6%
Existing product modifications/extensions	51.7%	63.2%	60.8%	49.8%	46.8%	52.4%
Products that are new to the industry	21.6%	10.5%	24.0%	20.5%	18.4%	26.5%
Copies of competitors' products	14.6%	10.5%	24.2%	13.1%	12.2%	17.0%

Source: Georgia Manufacturing Survey 2002, weighted responses of 636 manufacturers.

Regional differences were also noteworthy. Manufacturers in the South region were least involved in product development, with particularly low rates of developing products new to the industry. Firms in the regions around Atlanta (e.g., Northeast, Northwest, and West) had the highest rates of product development. (See Table 4.2.)

Table 4.2. Type of Product Development by Region

	All Respondents	Northeast	Northwest	West	South	Central	East	Coastal
None	37.3%	36.3%	28.3%	35.0%	45.2%	38.4%	63.8%	36.8%
Existing product modifications/extensions	51.7%	52.7%	60.3%	57.0%	40.6%	47.8%	34.1%	50.8%
Products that are new to the industry	21.6%	23.4%	23.7%	22.7%	15.1%	21.7%	15.7%	8.4%
Copies of competitors' products	14.6%	14.2%	16.6%	18.1%	12.4%	13.6%	14.5%	20.0%

Source: Georgia Manufacturing Survey 2002, weighted responses of 636 manufacturers

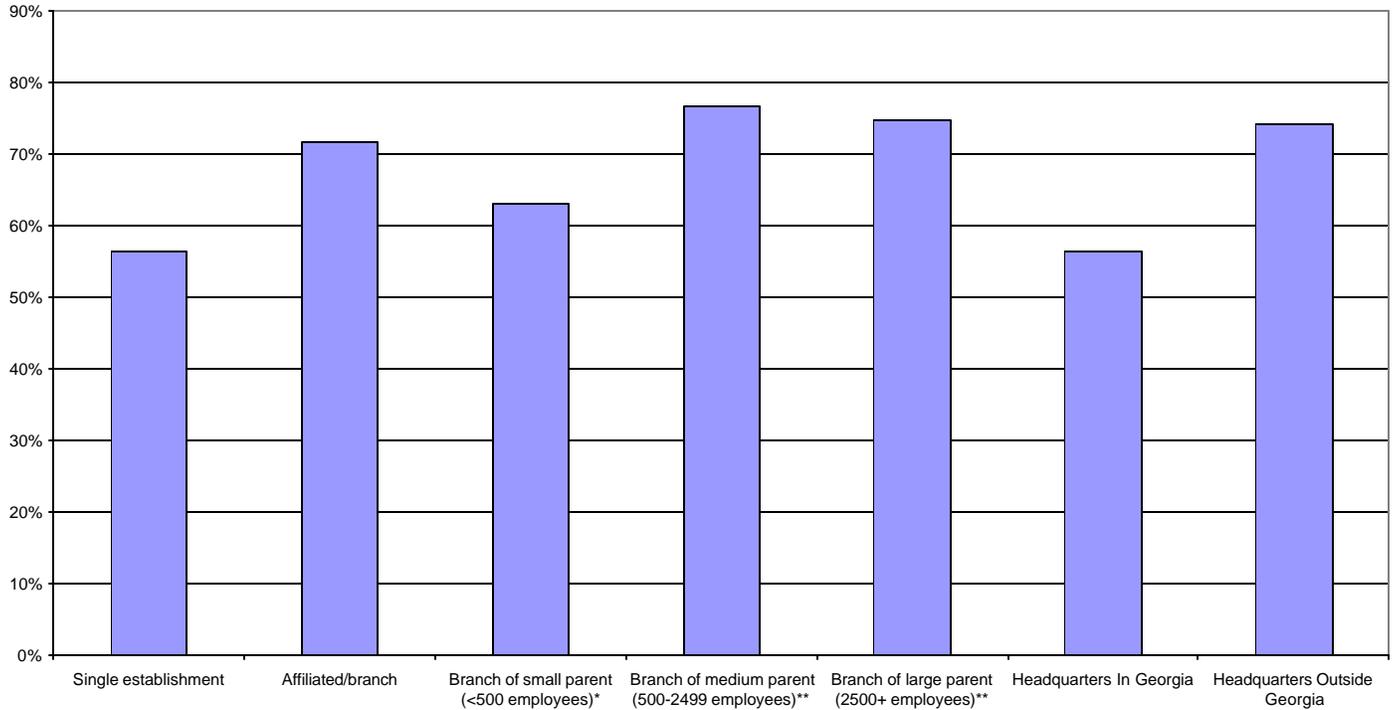
It is generally believed that branch plants are limited in their product development activity. However, we found that the majority of branch plants are involved in product development. In fact, product development activities are at a higher percentage of out-of-area branch plants than at Georgia-headquartered and single-facility plants. Three-quarters of all branch plants with out-of-state headquarters conduct some type of product development activity at the plant compared to 56 percent of single-establishment facilities and 56 percent of facilities with Georgia head offices. (See Figure 4.3.) Higher product development rates for branch plants with out-of-state headquarters persist even after controlling for industry. Single-establishment electronics firms are the exception; a slightly higher percentage of them develop products, as do their branch plant counterparts. (See Table 4.3.)

Table 4.3. Product Development in Single and Branch Facilities by Industry

Single and Branch Facilities	All	Food	Textiles	Resource	Machinery	Electronics	Other
Single establishment	56.4%	65.3%	62.9%	54.7%	47.9%	56.9%	51.2%
Affiliated/branch	71.6%	75.2%	82.4%	68.8%	66.4%	50.9%	78.9%
Headquarters In Georgia	56.3%	67.8%	66.2%	55.2%	49.6%	53.5%	54.0%
Headquarters Outside Georgia	74.2%	77.6%	87.2%	73.2%	67.0%	63.4%	78.0%

Source: Georgia Manufacturing Survey 2002, weighted responses of 636 manufacturers.

Figure 4.3
Product Development by Branch vs. Headquarters Location



*54% of these are headquartered in Georgia, **21% of these are headquartered in Georgia.
Source: Georgia Manufacturing Survey 2002, weighted responses of 636 manufacturers.

How were these products developed? All but 5 percent of the respondents engaged in product development did it in-house. Many of these firms (45 percent) did product development on their own without any industry or customer collaboration. Thirty-seven percent developed their products in collaboration with their customers. And 14 percent of respondents developed their products in cooperation with other companies. Modifications to existing products and development of new-to-the-market products were most likely to be done in-house. Copies of competitor products most often tended to be done in collaboration with customers. (See Table 4.4.)

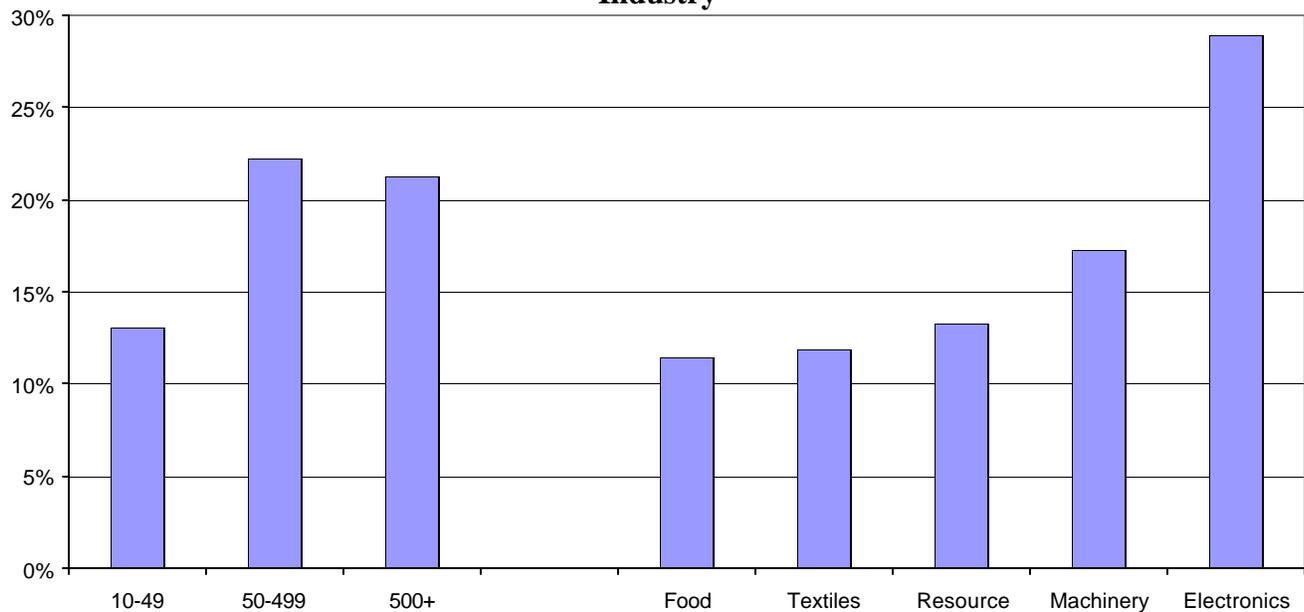
Table 4.4. How Products Were Developed by Type of Product Development Activity

How were these products developed?	All	Modifications of Existing	Copies of Competitor	New to Industry
Mainly by your company	44.5%	46.3%	37.7%	43.5%
Mainly by your company in collaboration with customers	36.7%	36.6%	51.3%	35.6%
Mainly by your company in cooperation with other companies or organizations	14.3%	14.6%	4.8%	15.7%
Mainly by other companies or institutions	4.5%	2.5%	6.2%	5.2%
	100.0%	100.0%	100.0%	100.0%

Patenting is an important indicator of the innovativeness of new products or processes. Across all Georgia companies doing product development, only 17 percent applied for any patents in the last three years. Nearly 40 percent of the firms submitting patent applications applied for a single patent, whereas only a little more than 10 percent applied for five or more patents. Patent applications were most prominent among medium-sized and large firms and electronics manufacturers. (See Figure 4.4.)

When asked about their plans for introducing new or improved products over the next

Figure 4.4
Percentage of Firms that Applied for Patents by Employment Size and Industry



Source: Georgia Manufacturing Survey 2002, weighted responses of 636 manufacturers.

two years, two-thirds of the firms said that they would be continuing product development work already in the pipeline. Twenty-five percent had no plans to develop further new or improved products, and 9 percent planned to begin new product development initiatives.

Process Development

Over the last three years, 44 percent of the respondents introduced processes that were new to or significantly improved the firm. Introduction of improved processes was most prevalent among large manufacturers, electronics firms, and manufacturers in the East region around Augusta. (See Figure 4.5. and Tables 4.5 and 4.6.)

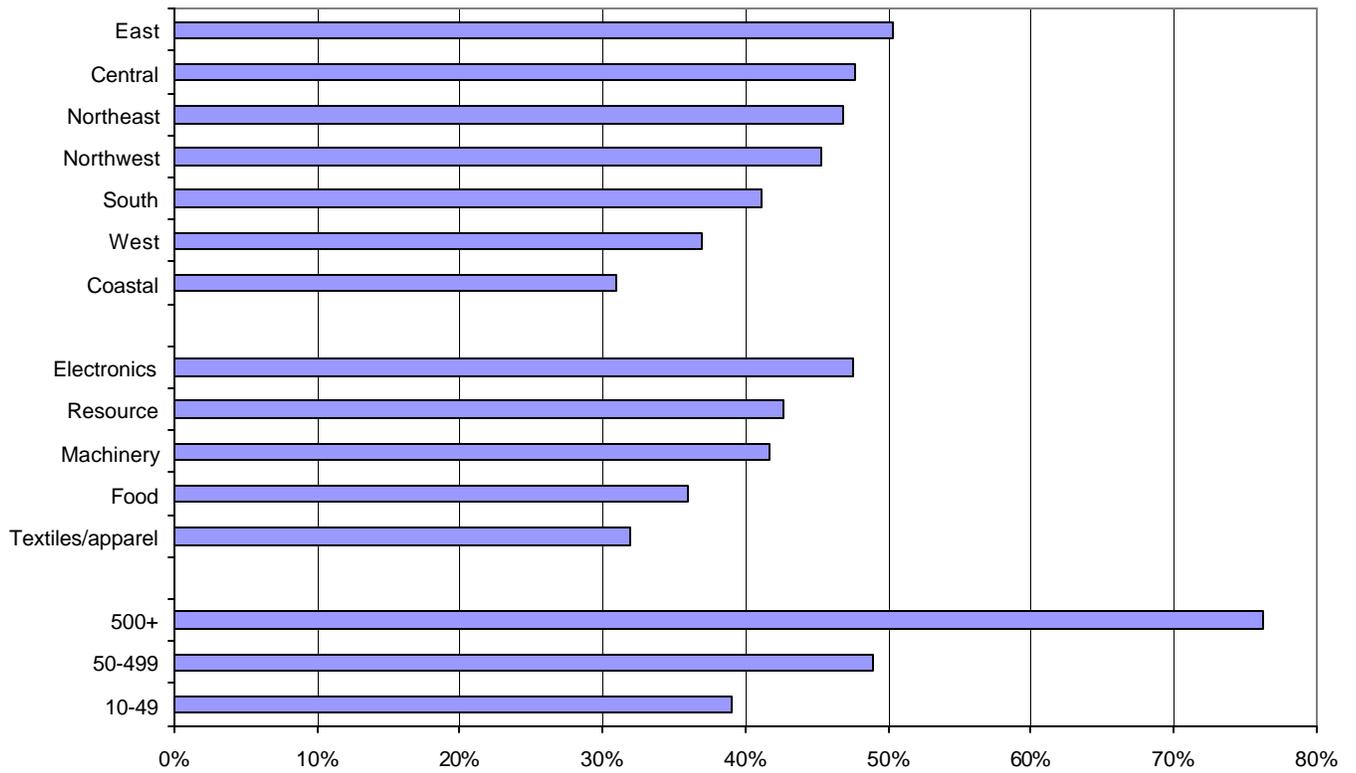
Although most firms implemented established processes, 30 percent of the firms introduced new-to-the industry processes. The latter were most prevalent among large firms and those in sectors other than food processing. Overall, about half the firms said they developed in-house the processes that they were introducing. Thirty-five percent devel-

oped these processes in collaboration with other companies or organizations, and 16 percent relied solely on external organizations. Large manufacturers, textile/apparel firms, and electronics firms were most likely to have developed these processes in-house, whereas smaller firms and resource-intensive industries were most likely to utilize processes developed by outside companies.

More than 60 percent of companies plan to introduce new or improved processes that are already being developed. Some 20 percent plan to work on new or improved processes over the next two years. And 17 percent had no plans to introduce new processes. Large manufacturers are most apt to have new processes underway, although even most small manufacturers have already developed new processes for introduction into the company. Smaller companies and resource-intensive manufacturers had the highest percentage of firms with no plans to introduce new or improved processes.

Figure 4.5

Manufacturers Introducing New or Improved Processes in Last Year by Company Characteristics



Source: Georgia Manufacturing Survey 2002, weighted responses of 636 manufacturers.

Table 4.5
Process Development Introduction by Facility Employment Size

During the last 3 years, did you introduce any process that was new to or significantly improved to your firm?	Facility Employment Size			
	All	10-49	50-499	500+
% Yes	44.0%	39.0%	48.9%	76.3%
If the process was new to or significantly improved your firm, was it new to the industry?				
	All	10-49	50-499	500+
% Yes	31.0%	27.0%	33.6%	55.3%
How were these processes developed	All	10-49	50-499	500+
Mainly by your company	48.8%	49.0%	47.8%	54.0%
Mainly by your company in cooperation with other companies or organizations	35.5%	34.4%	36.4%	38.9%
Mainly by other companies or institutions	15.7%	16.5%	15.8%	7.1%
	100.0%	100.0%	100.0%	100.0%
What are your plans to introduce new or significantly improved processes?				
	All	10-49	50-499	500+
New or improved processes already are being developed	61.4%	56.3%	64.8%	82.5%
Plan to start work on new or improved processes within 2 years	20.9%	23.1%	18.6%	17.5%
No plans to develop new or improved processes	17.7%	20.6%	16.5%	0.0%
	100.0%	100.0%	100.0%	100.0%

Source: Georgia Manufacturing Survey 2002, weighted responses of 636 manufacturers.

Table 4.6
Process Development Introduction by Industry

During the last 3 years, did you introduce any process that was new to or significantly improved your firm	Industry					
	Food	Textiles/ Apparel	Resource	Machinery	Electronics	Other
% Yes	36.0%	31.9%	42.6%	41.7%	47.6%	58.8%
If the process was new to or significantly improved your firm, was it new to the industry?	Food	Textiles/ apparel	Resource	Machinery	Electronics	Other
% Yes	20.2%	30.8%	29.2%	34.9%	32.0%	31.7%
How were these processes developed?	Food	Textiles/ apparel	Resource	Machinery	Electronics	Other
Mainly by your company	33.3%	53.2%	47.1%	40.5%	55.4%	57.1%
Mainly by your company in cooperation with other companies or organizations	50.0%	40.7%	33.7%	40.9%	32.3%	29.3%
Mainly by other companies or institutions	16.7%	6.1%	19.2%	18.6%	12.3%	13.6%
	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
What are your plans to introduce new or significantly improved processes?	Food	Textiles /apparel	Resource	Machinery	Electronics	Other
New or improved processes already are being developed	58.4%	69.6%	59.7%	62.4%	57.3%	61.0%
Plan to start work on new or improved processes within 2 years	24.8%	27.4%	16.5%	19.0%	26.7%	22.4%
No plans to develop new or improved processes	16.8%	3.0%	23.7%	18.6%	16.0%	16.0%
	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Source: Georgia Manufacturing Survey 2002, weighted responses of 636 manufacturers.

Constraints on Product and Process Development

The data suggests that majority of Georgia manufacturers are involved in product development but much of their activity (e.g., patenting, developing new-to-the-industry products) is limited. To explore the constraints on product or process development, the survey asked firms to indicate the importance of a list of factors that kept the firm from developing innovative processes or products. Table 4.7 shows the percentage of firms rating each of the possible deterrents “highly important.” The responses suggest that there are diverse constraints preventing Georgia’s manufacturers from engaging in product or process development. No one factor was rated to be a highly important constraint to most firms. The largest percentage of respondents (37 percent) rated “lack of long-term customer commitments to support development costs” as a highly important constraint. Slightly more than 30 percent of respondents rated “new product/process development costs too high” and “unclear whether benefits exceed the costs” to be highly important constraints. Least likely to be considered highly important constraints were that “product/process development is done by another unit” and “my company is not interested in new products/processes.” Most Georgia manufacturers are not constrained by factors that are difficult to change, such as lack of interest or other out-of-state units being responsible for product or process development.

The degree to which various factors were important differed by size, industry, and regional location. “Lack of long-term customer commitments to support development costs” was most frequently mentioned as a highly important deterrent by small and medium-sized manufacturers but not by large manufacturers. Large manufacturers were more apt to emphasize “lack of market information” or “organizational rigidities.” The smallest manufacturers, those with fewer than 50 employees, also were much more apt to say that the high cost or product/process development was a highly important deterrent than were medium-sized or large manufacturers.

“Lack of long-term customer commitments to support development costs” was a highly important constraint on the majority of textile and apparel manufacturers. Food processors and machine shops were more likely to emphasize problems with the high cost of new product development. Food processors, along with electronics firms, were also most likely to rate “unclear whether benefits exceed costs” to be a highly important constraint. The “impact of regulations or standards” was also most apt to be a constraining factor to food processors.

Manufacturers in West, Northwest, and Northeast regions were most apt to emphasize problems with “lack of long-term customer commitments to support development costs.” “Lack of financing” was most constraining to firms in the Coastal region. The Coastal and Central regions also had the highest proportion of firms “unclear whether benefits exceed costs.”

It is interesting that companies engaged in product development and companies not so engaged are almost equally likely to be concerned about lack of long-term customer commitments to support development costs. But companies not involved in product development are more apt to view costs as a deterrent than are those currently performing product development.

Table 4.7. Constraints on Product/Process Development
(Percentage of Respondents Indicating that Constraint is of High Importance)

Constraints	All	Company Does Product Development	
		Yes	No
Lack of long-term customer commitments to support development costs	37.3%	36.4%	38.9%
New product/process development costs too high	31.8%	28.7%	37.0%
Unclear whether benefits exceed the costs	30.6%	28.0%	35.1%
Lack of qualified personnel	25.8%	24.2%	28.5%
Lack of available financing	22.0%	21.6%	22.7%
Lack of in-house product development systems	19.7%	19.1%	20.7%
Cost of financing too high	16.9%	14.2%	21.6%
Lack of market information	16.7%	18.5%	13.7%
Existing customers not interested in new products	14.1%	8.1%	20.1%
Organizational rigidities within the company	13.4%	13.8%	12.9%
Impact of regulations or standards	12.5%	14.1%	9.7%
No capability to sell them	11.6%	12.1%	10.8%
Lack of information on technology	10.6%	11.1%	9.7%
Product/process development is done by another unit	9.3%	9.1%	9.7%
My company is not interested in new products/ processes	5.9%	2.4%	12.0%

Source: Georgia Manufacturing Survey 2002, weighted responses of 636 manufacturers.

Summary

In summary, we found that more than 60 percent of Georgia manufacturers are engaged in some type of product development, with 22 percent developing new-to-the-industry products. Virtually all of these 60 percent have some in-house product development capability. At the same time, these companies face constraints in terms of customer commitments and costs. There also are opportunities for more firms to be encouraged to develop new-to-the-industry products, submit patents, and engage in new processes that add value.

Some observers have generally believed that Georgia's relatively lower rankings in number of patents and other indicators of product development and innovation capability were due to the prominence of branch plants in the state's manufacturing base. Significantly, we found that out-of-state branch plants are more likely to do product development than are Georgia headquartered or single-establishment enterprises. This finding suggests that a good portion of the state's product development and innovations come from linkages with innovative out-of-state companies.

Section 5 Use of Information Technology in Manufacturing

The 1999 Georgia Manufacturing Survey was conducted at the peak of the dot.com economy. We found that Georgia manufacturers had dramatically increased their adoption of information technologies (IT), with most manufacturers reporting that they had a company Web site and that they used e-mail. Now that basic adoption of IT is relatively widespread, and with the decline of the dot-com economy, it is interesting to see how manufacturers are making use of these technologies. This chapter examines how IT is used to make information available to employees, customers, and suppliers, and how it is used as a vehicle for sales acquisition.

Information Technology Adoption

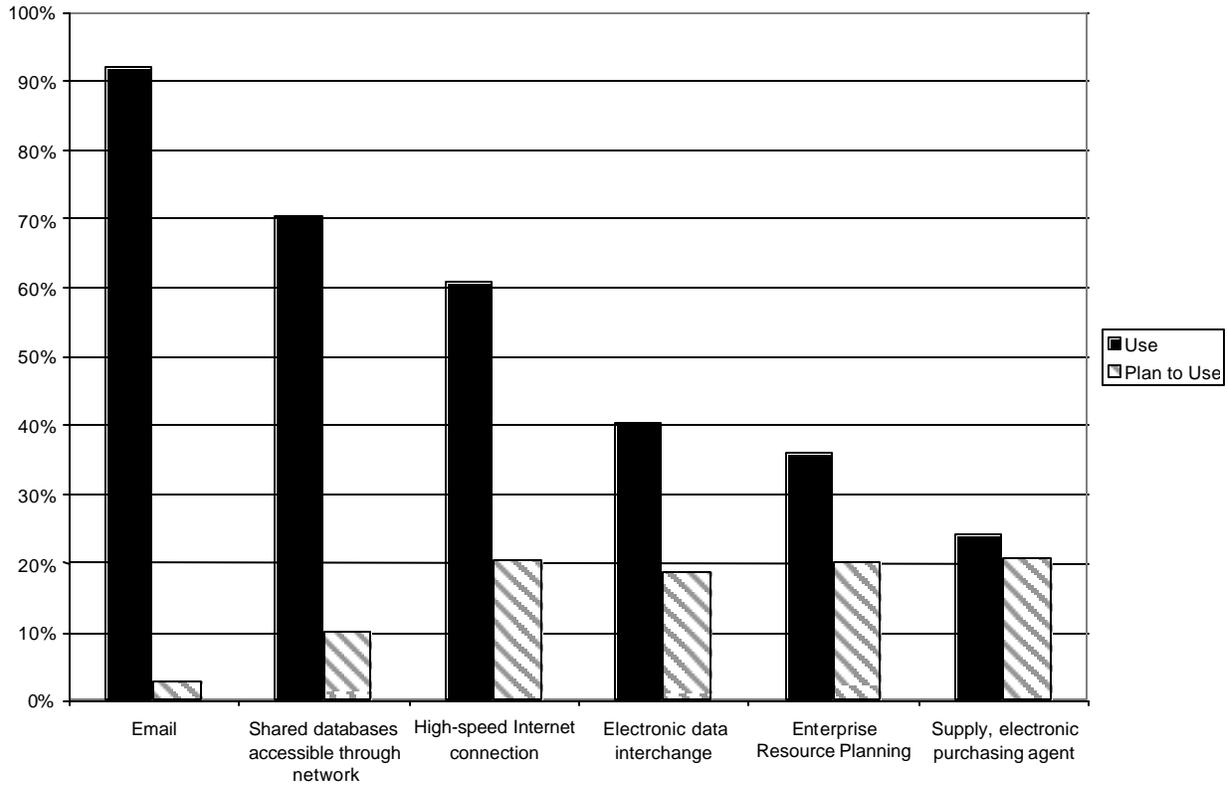
Manufacturers were asked to indicate their use of IT ranging from e-mail to electronic purchasing agents. Virtually all companies have e-mail at their facility. Seventy percent have shared databases accessible through a network. Just over 60 percent have a high-speed Internet connection such as ISDN, DSL, T1, or cable modems. On the other hand, fewer than half of manufacturing respondents use electronic data interchange (EDI), enterprise resource planning (ERP) or similar software, or electronic purchasing agents. Planned use of these technologies is highest for electronic purchasing agents, high-speed Internet connections, and ERP. (See Figure 5.1.)

IT adoption rates are highest for large manufacturers and decline with size. Even e-mail, which is almost universal, is used by 90 percent of small manufacturers compared to all large manufacturers. IT adoption is highest in electronics firms and lowest among food processors and resource-intensive manufacturers. EDI is more prominent among textile manufacturers than any other industry group. Nearly the same percentage of textile firms uses EDI as have a high-speed Internet connection. By region, firms in the South, Central, and Coastal (especially for shared databases and purchasing agents) regions of the state generally have lower IT adoption. (See Tables 5.1, 5.2, and 5.3.)

Table 5.1. IT Usage by Employment Size

	All	Facility Employment Size		
	Respondents	10-49	50-499	500+
E-mail	92.2%	89.9%	95.5%	100.0%
Shared databases accessible through a network	70.2%	61.9%	81.0%	94.8%
High speed Internet connection	60.8%	50.5%	73.6%	91.4%
Electronic data interchange	40.3%	26.5%	56.1%	88.1%
Enterprise Resource Planning	36.1%	25.5%	48.5%	76.2%
Supply, electronic purchasing agent	24.2%	14.2%	35.7%	64.8%

Figure 5.1. Use and Planned Use of Information Technologies



Source: Georgia Manufacturing Survey 2002, weighted responses of 636 manufacturers.

Table 5.2. IT Usage by Industry

All Respondents	Food	Apparel/ Textiles	Resource	Machinery	Electronics	Other
E-mail	86.5%	90.9%	89.5%	92.5%	97.3%	98.7%
Shared databases accessible through a network	61.1%	76.3%	63.3%	71.2%	87.5%	75.7%
High speed Internet connection	62.5%	61.5%	50.0%	61.3%	76.7%	73.4%
Electronic data interchange	45.2%	58.9%	30.9%	38.5%	48.5%	42.1%
Enterprise Resource Planning	39.4%	33.8%	32.3%	40.5%	59.8%	31.4%
Supply, electronic purchasing agent	21.9%	25.4%	20.0%	30.7%	33.3%	22.2%

Source: Georgia Manufacturing Survey 2002, weighted responses of 636 manufacturers.

Table 5.3. IT Usage by Region

All Respondents	Northeast	Northwest	West	South	Central	East	Coastal
E-mail	95.4%	89.5%	89.2%	89.2%	90.5%	100.0%	96.4%
Shared databases accessible thru the network	77.8%	66.0%	73.8%	60.9%	65.0%	78.8%	55.7%
High speed Internet connection	62.8%	63.7%	62.9%	56.1%	50.9%	67.2%	62.3%
Electronic data interchange	39.3%	37.1%	42.9%	38.3%	33.8%	75.8%	45.4%
Enterprise Resource Planning	36.2%	37.4%	38.3%	34.7%	30.1%	40.6%	39.7%
Supply, electronic purchasing agent	25.2%	25.4%	25.3%	23.4%	22.6%	23.2%	21.6%

Source: Georgia Manufacturing Survey 2002, weighted responses of 636 manufacturers.

Information Available Electronically

IT hardware and software have the potential to enhance the dissemination of various types of information to customers, suppliers, and workers. We asked manufacturers to indicate the types of information that are available electronically at their facility. The most common type of electronic information was accounts payable/receivable, followed by customer order information, financial/accounting data, and company and product literature. Least common were electronic customer profiles and bids/quotes.

Large firms were more likely to use electronic information than are small firms. Differences between large and small firms were most pronounced in adoption of electronic accounts payable/receivable and order tracking systems. But the percentages of small and large firms with electronic financial/accounting data, customer profile information, and bids and quotes were not that different. (See Figure 5.2.)

Across industries, electronics and food processing firms tended to have higher adoption rates of electronic information systems, and resource-intensive industries had relatively lower rates. Customer profile information was an exception. The electronics sector had the lowest percentage of firms using customer profile information. (See Table 5.4.) By region, the Northeast generally had the highest percentages of firms with electronically available information across the spectrum of information types, whereas those in the Central region generally had the lowest percentages.

Figure 5.2 Information Available Electronically by Facility Employment Size
(Percentage of Respondents Reporting Information Available Electronically)

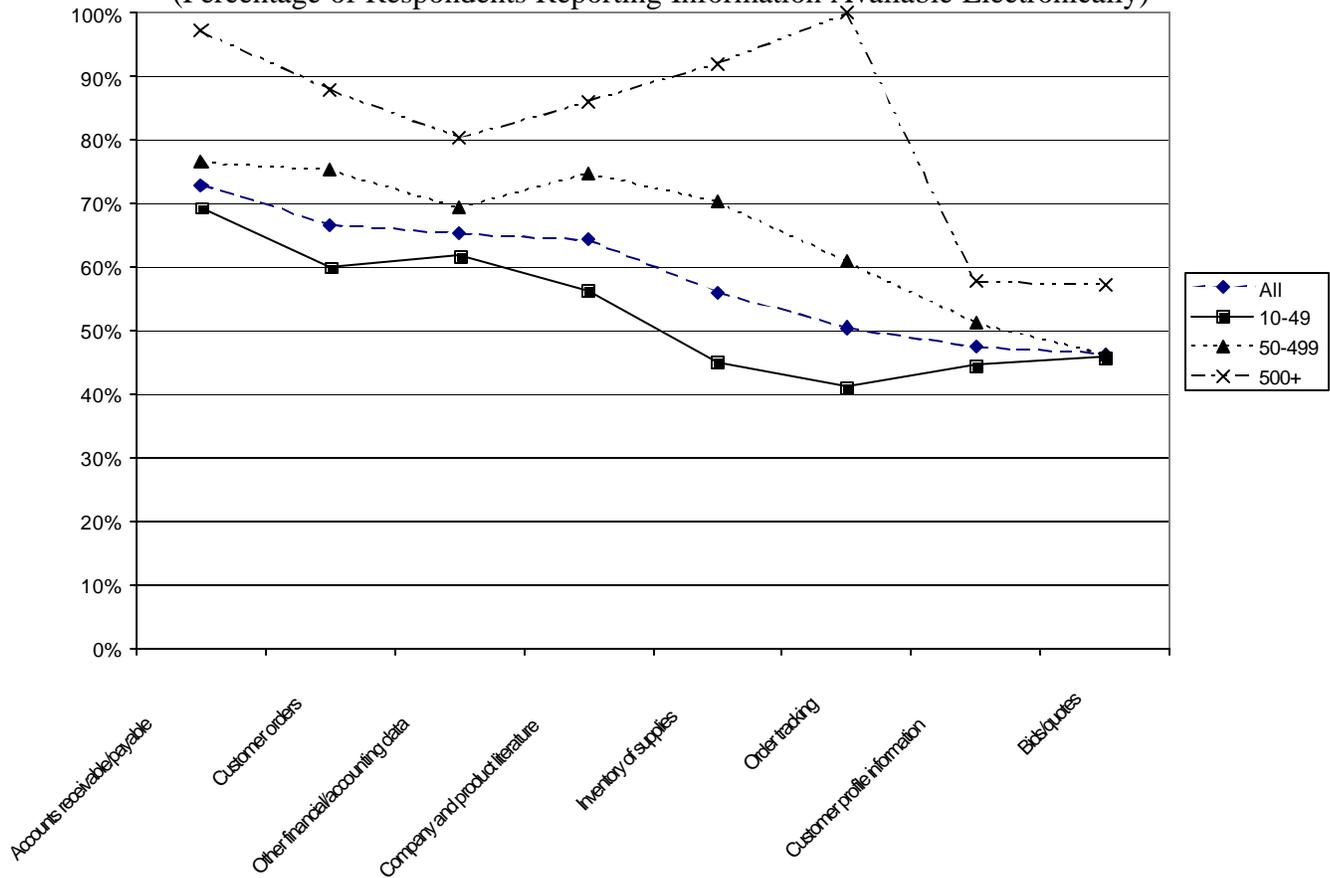


Table 5.4. Information Available Electronically by Industry
(Percentage of Respondents Reporting that Information Was Available Electronically)

	All	Apparel/					
	Respondents	Food	Textiles	Resource	Machinery	Electronics	Other
Accounts receivable/payable	73.0%	81.6%	73.7%	70.3%	72.0%	81.1%	73.0%
Customer orders	66.7%	73.7%	74.7%	65.0%	64.3%	74.8%	62.3%
Other financial/accounting data	65.3%	71.0%	67.4%	64.5%	63.5%	70.2%	63.8%
Company and product literature	64.3%	76.3%	62.0%	60.1%	68.4%	70.3%	62.6%
Inventory of supplies	56.1%	71.0%	64.1%	49.9%	55.0%	67.5%	54.0%
Order tracking	50.5%	63.1%	64.0%	43.8%	50.6%	59.3%	45.8%
Customer profiles	47.5%	50.0%	48.0%	43.4%	52.4%	34.3%	51.7%
Bids/quotes	46.4%	36.8%	26.0%	46.5%	53.9%	62.1%	50.8%

Source: Georgia Manufacturing Survey 2002, weighted responses of 636 manufacturers .

Table 5.5. Information Available Electronically by Region

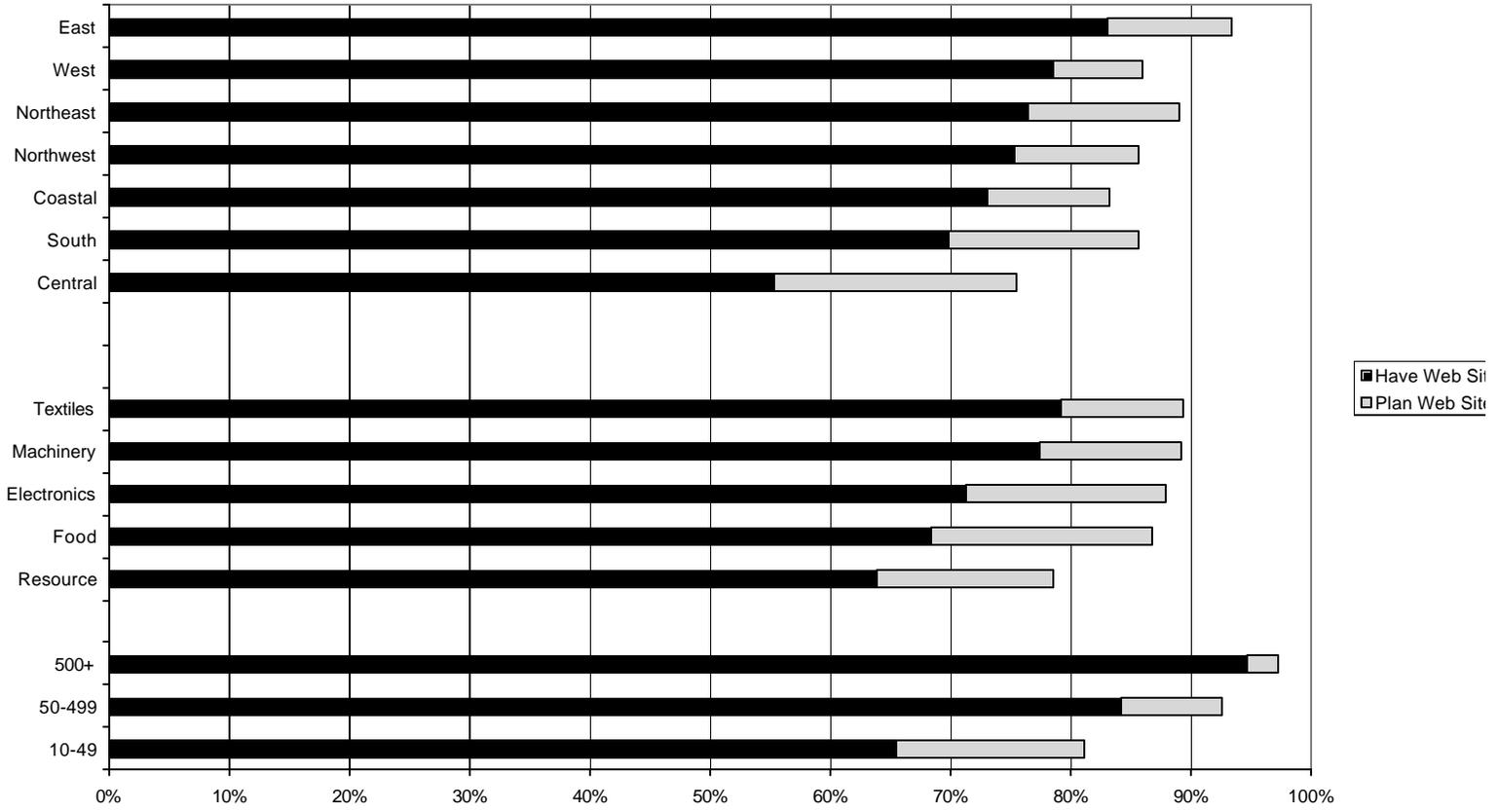
	Northeast	North- west	West	South Central	East	Coastal	
Accounts receivable/payable	76.1%	74.8%	72.0%	67.4%	62.3%	80.1%	80.4%
Customer orders	66.9%	72.2%	68.4%	66.8%	54.9%	64.0%	67.1%
Other financial/accounting data	70.9%	62.2%	62.1%	56.3%	59.6%	65.6%	78.6%
Company and product literature	68.6%	66.4%	66.5%	55.0%	56.1%	60.1%	64.4%
Inventory of supplies	58.6%	55.7%	55.4%	56.1%	43.8%	65.7%	59.8%
Order tracking	52.9%	51.6%	52.2%	54.6%	37.8%	52.6%	39.6%
Customer profiles	49.6%	52.5%	48.8%	45.5%	27.3%	55.4%	50.0%
Bids/quotes	47.5%	43.8%	49.0%	56.3%	42.6%	32.0%	41.4%

Source: Georgia Manufacturing Survey 2002, weighted responses of 636 manufacturers

Manufacturing Web Sites

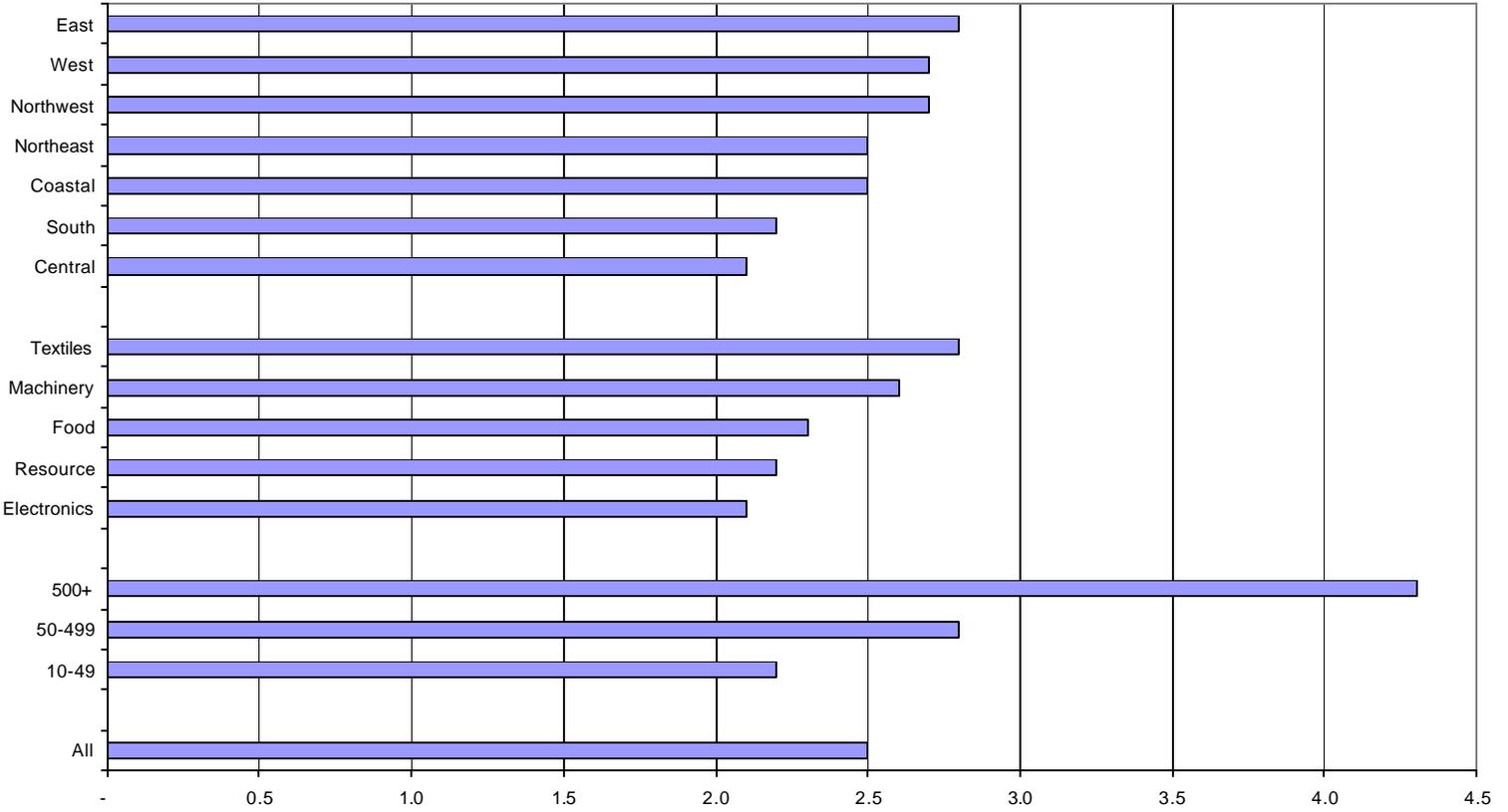
Seventy-four percent of manufacturers responding to the Georgia Manufacturing Survey 2002 have a company Web site. Another 12 percent have plans for a Web site. Large firms, textile and machinery sector manufacturers, and respondents in the East region were most likely to report having a Web site. Small manufacturers, resource-intensive or food processing establishments, and those in the Central region were least apt to report having a Web site. (See Figure 5.3.)

Figure 5.3
Percentage of Manufacturers with a Company Web Site



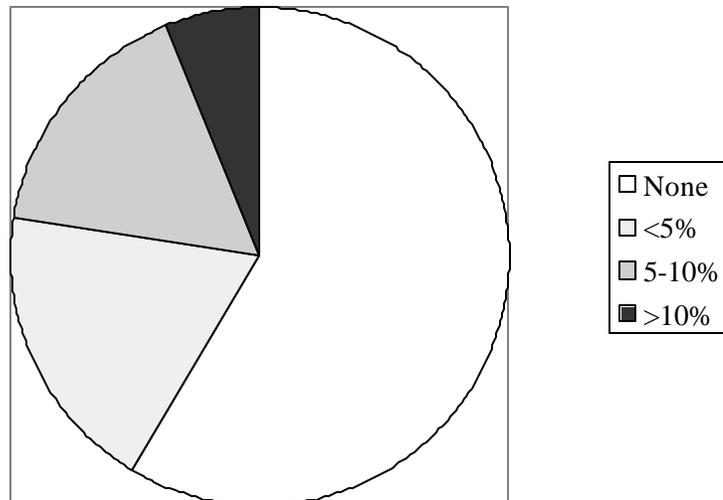
What do these company Web sites do? The most common Web-based applications, for two-thirds of the manufacturers, are providing information about the company and about products and/or services. After that, the percentages of companies using Web sites for other purposes drop off considerably. Thirty-six percent of firms use their Web site to link electronically with customers. Twenty-six percent allow firms to place on-line orders. Next most common are allowing suppliers to link electronically with the company (17 percent), capturing customer information (16 percent), and providing on-line customer service (14 percent). No more than 8 percent integrate their Web site and back office systems. Based on a simple index that counts the number of Web-based applications used, we found that Web-based applications are more prominent among larger firms, with not much difference in adoption of applications between medium and small manufacturers. Web-based applications are most common among textile firms and least used by electronics firms. Manufacturers in the East, Northeast, and Northwest regions use relatively more Web-based applications, while those in the South and Central parts of the state use relatively fewer applications. (See Figure 5.4.)

Figure 5.4. Mean Number of Web-based Applications by Company Characteristics



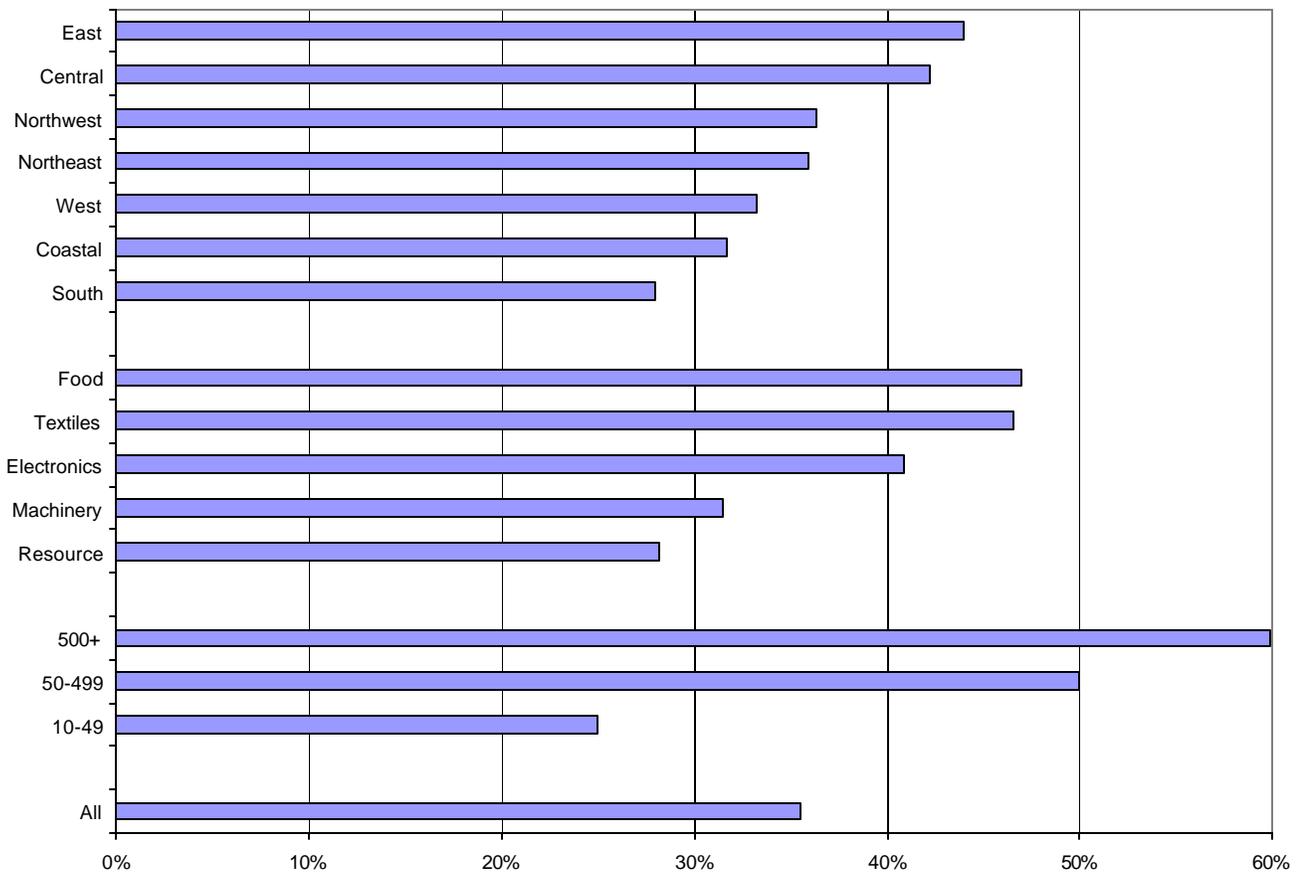
Forty percent of manufacturers with a Web site generated a portion of company sales from the site. Most of these portions were fairly small. But for 6 percent of manufacturers, their Web site accounted for more than 10 percent of their sales for fiscal year 2001. (See Figure 5.5.)

Figure 5.5. Percentage of 2001 Sales Placed Through the Web Site



Customer requirements often serve as a significant incentive for manufacturers to adopt technology. Thirty-six percent of manufacturers indicated they are required by at least one of their customers to use electronic transactions. Electronic transaction requirements are particularly prevalent among medium-sized and larger firms, at least 50 percent of which have at least one customer that imposes this requirement (compared to only 25 percent of small manufacturers). More than 40 percent of food processing, textile, and electronics firms must use electronic transactions (versus only 28 percent of resource-based firms), and more than 40 percent of manufacturers in the Central and East regions of the state (as opposed to only 28 percent in the South region). In contrast, only 3 percent of Georgia manufacturers require their customers to use electronic transactions. (See Figure 5.6.)

Figure 5.6. Percentage of Manufacturers Required by Customers to Use Electronic Transactions by Company Characteristics



Summary

Despite the decline of the dot-com economy, virtually all manufacturers adopted IT and were beginning to use it in a variety of information-intensive manufacturing functions. E-mail was universal, and company Web sites, shared databases, and high-speed Internet connections also were prevalent among the vast majority of manufacturers. As with many technologies, IT adop-

tion rates were higher for large than small manufacturers. Customer requirements drove IT adoption for more than one-third of Georgia manufacturers. However, almost none of the manufacturers in turn required their customers to use electronic transactions.

Usage of IT to enhance information provision varied depending on the type of information and systems capabilities. Most firms had their accounting, customer orders, and company and product information in electronic form, while electronic customer profiles and bids/quotes were less common. Manufacturing Web sites were most apt to be used as electronic brochures offering company and product/service information. Transactions services via the Web were less prevalent, and only 8 percent of firms linked their Web site and back office systems. Similarly, the Web did not serve as a significant means for taking in sales as only 6 percent of manufacturers got 10 percent or more of their 2001 sales through the Web.

Section 6.

Company Performance and Manufacturing Innovation

During the recent economic downturn, some manufacturers have maintained solid performance while others have struggled. This chapter examines size, industry, and regional attributes of manufacturers across three performance measures: (1) percent changes in sales, which is a measure of growth; (2) average annual return on sales, which is a measure of profitability; and (3) percent change in value-added per employee, which is a measure of productivity. We then look at various product, process, and information technology practices and their connection with these three performance measures.

Performance Measures

Definition

Change in annual sales or gross value of shipments can be viewed as a measure of growth performance. Two-thirds of Georgia's manufacturers experienced an increase in sales revenues between 1999 and 2001, which is less than the 80-plus percent reporting sales increases between 1996 and 1998. The median firm increased sales by more than 5 percent from 1999 to 2001, while the top 10 percent of firms experienced a 36 percent sales increase. (See Table 6.1.)

Average annual return on pre-tax sales can be considered a measure of profitability. Over the 1999-to-2001 time period, the three-year average annual pre-tax return on sales for the median firm was 6 percent. The top 10 percent of firms had a 15 percent annual return on sales. Negative return on sales was reported by less than 10 percent of respondents.

Value-added per employee is a measure of productivity. It is calculated by subtracting the cost of purchased inputs (e.g., materials and services) from total sales/gross revenues and dividing the result by the number of employees. Sixty percent of Georgia manufacturers experienced an increase in value-added per employee between 1999 and 2001. The median company raised value-added per employee by 2 percent, and the top 10 percent of manufacturers raised its value-added per employee by 46 percent. Part of the reason that value-added per employee remained positive for most manufacturers was their attention to expenditures. The average manufacturing respondent's expenditures on materials, parts, and services declined from \$10.4 million in 1999 to \$9.5 million in 2001—a 9 percent decline. On a per-employee basis, expenditures declined by 17 percent.

Performance Measures by Manufacturing Characteristics

By facility employment size, the typical firm with fewer than 500 employees had higher sales growth rates than did those with 500 or more employees. The reverse was true for change in value-added per employee. The average large manufacturer also had higher three-year returns on sales, followed by small, then medium-sized manufacturers. Large manufacturers had better growth rates at the top end of the distribution. Small manufacturers had worse rates at the bottom end than did their large firm counterparts. By industry, electronics firms had higher growth rates in virtually all performance measures than did manufacturers in other industries. The exception

was value-added per employee, in which electronics firms at the bottom end of the distribution had among the worst rates. Overall, manufacturers in the Northeast region had the highest growth rates. (See Table 6.1, 6.2 and 6.3.)

Table 6.1. Performance Indicators by Facility Employment Size

	All	Employment Size		
	Respondents	10-49	50-499	500 +
<u>% Change in sales 1999-2001</u>				
Median	5%	5%	6%	3%
Top 10%	36%	41%	33%	36%
Bottom 10%	-21%	-29%	-19%	-15%
<u>Average (3 year) annual return on (pretax) sales</u>				
Median	6%	9%	6%	15%
Top 10%	15%	25%	15%	25%
Bottom 10%	0%	-3%	0%	0%
<u>% Change in value-added per employee 1999-2001</u>				
Median	3%	0%	4%	18%
Top 10%	46%	43%	42%	49%
Bottom 10%	-29%	-33%	-21%	0%

Source: Georgia Manufacturing Survey 2002, weighted responses of 636 manufacturers.

Table 6.2. Performance Indicators by Industry

	Apparel/ Food Textiles Resource Machinery Electronics Other					
	Food	Textiles	Resource	Machinery	Electronics	Other
<u>% Change in sales 1999-2001</u>						
Median	7%	6%	7%	0%	17%	3%
Top 10%	47%	33%	50%	32%	78%	31%
Bottom 10%	-14%	-34%	-14%	-38%	-5%	-19%
<u>Average (3 year) annual return on (pretax) sales</u>						
Median	6%	6%	6%	9%	9%	9%
Top 10%	15%	25%	15%	15%	25%	25%
Bottom 10%	-3%	0%	0%	-3%	0%	-3%
<u>% Change in value-added per employee 1999-2001</u>						
Median	2%	2%	5%	0%	10%	0%
Top 10%	112%	38%	45%	50%	51%	39%
Bottom 10%	-23%	-31%	-35%	-26%	-35%	-22%

Source: Georgia Manufacturing Survey 2002, weighted responses of 636 manufacturers.

Table 6.3. Performance Indicators by Region

	Northeast	Northwest	West	South	Central	East	Coastal
<u>% Change in sales 1999-2001</u>							
Median	6%	6%	6%	7%	4%	-14%	5%
Top 10%	41%	3%	40%	36%	29%	46%	41%
Bottom 10%	-17%	-33%	-28%	-33%	-38%	-43%	-29%
<u>Average (3 year) annual return on (pretax) sales</u>							
Median	9%	9%	6%	3%	9%	3%	6%
Top 10%	25%	25%	25%	15%	25%	15%	9%
Bottom 10%	0%	0%	0%	-3%	0%	0%	-3%
<u>% Change in value-added per employee 1999-2001</u>							
Median	8%	0%	2%	7%	-3%	13%	-4%
Top 10%	46%	32%	53%	50%	28%	43%	64%
Bottom 10%	-20%	-47%	-38%	-23%	-25%	-42%	-32%

Source: Georgia Manufacturing Survey 2002, weighted responses of 636 manufacturers.

Product, Process, and IT Operating Indicators

This section explores the association between product, process, and IT indicators and our three outcome measures. The results are summarized in Table 6.4 and discussed below.

Export sales

In fiscal year 2001, 7.5 percent of sales were exported to customers outside the United States by the average Georgia manufacturer. Forty-six percent of Georgia manufacturers were engaged in some form of exporting. Among firms that export, 55 percent of firms did relatively little exporting (i.e., export sales only accounted for 5 percent or less of total sales). About 2 percent of Georgia manufacturers got the majority of their sales from customers outside the United States and the rest fell in the middle. Exporting had modest performance implications for profitability and productivity. The average exporting company had higher (while not significantly higher) average return on sales and value-added per employee, although average percentage change in sales was lower than non-exporting manufacturers.

Companies with improved or new products

As we saw in Section 4, 63 percent of responding manufacturers had developed improved or new products, specifically line extensions and modifications, copies of competitor products, or new-to-the-industry products. Companies developing any of these improved or new products had significantly higher average sales growth and return on sales, but did not have higher average value-added per employee.

Companies with new-to-the-industry products

We also saw that 22 percent of responding manufacturers had developed new to the industry products. Such companies were found to have significantly higher average sales growth, return on sales, and value-added per employee than do those without new-to-the-industry product development.

Patent applications

Seventeen percent of responding manufacturers applied for at least one patent in the 1999-2001 time frame. These firms had significantly higher return on sales than firms not having filed for a patent. In addition, the mean values of patent-filing companies for the growth and productivity measures, while not statistically significant, were higher than the means for companies not having filed for a patent.

Companies with new processes

More than 30 percent of manufacturers introduced new or significantly improved processes. On average, these companies had higher returns on sales and growth in value-added per employee, although they had lower average sales growth than companies not introducing new/improved processes.

ISO certification

Nearly 16 percent of responding manufacturers were certified to the ISO/QS 9000 standard, with certification for another 8 percent in process. ISO/QS-certified firms had higher average returns on sales and value-added per employee growth (the latter not statistically significant), but not higher average sales growth than firms not ISO-certified.

Value-added services

Value-added services include training, software development, maintenance, arrangement of financing, manufacturing consulting, or other services that add value to the product. Thirty-seven percent of manufacturing respondents offered value-added services. On average, firms offering such services had higher averages along all three performance dimensions—average growth in sales, average return on sales, and average growth in value-added per employee—than did firms not offering value added services.

Use of computers

Nearly half of responding manufacturers had at least 20 percent of employees using computers or other programmable machine controllers at least once a week as part of their job. One out of five respondents reported that a majority of its employees used computers or programmable controllers weekly. Firms with more than 20 percent of employees using computers had higher average values across all three performance dimensions than those with a lower percentage of (or no) computer users.

Transaction-based Web sites

Thirty-seven percent of companies had Web sites that link electronically with customers/suppliers, and 26 percent had Web sites that allow customers to place orders. Firms with Web sites electronically linking customers/suppliers or accepting orders had higher average returns on sales. Higher average growth in value-added per employee also was found among firms with Web-based order-taking capabilities (although not customer/supplier linkages). Neither of these Web-based capabilities was associated with average sales growth or growth in value-added per employee.

Summary

This chapter examined various product, process, and information technology innovations against three measures of performance—percent change in sales, average annual return on sales, and change in value-added per employee. Examination of these measures suggests that Georgia manufacturers' close attention to sales and declining expenditures helped them maintain growth, profitability, and productivity.

We utilized these three performance measures to assess relationships between product, process and IT practices. Although only bivariate relationships were examined and no multivariate or controls were included, the product, process and IT practices, were nonetheless found to be related to one or more of these three performance measures.

Companies with new-to-the-industry products, value-added service offerings, and substantial employee use of computers had significantly higher growth, profitability, and productivity than those not engaged in these practices. General product development efforts that include modifications, extension, and copies also were positively linked to sales growth and return on sales. Manufacturers submitting patent applications during 1999 to 2001 had significantly higher return on sales as well. In addition, significantly higher return on sales and growth in value-added per employee accrued to companies that introduced new processes. Firms with Web-based customer/supplier linkages or ordering capabilities had significantly higher returns on sales than those without these capabilities. On the other hand, export sales were not significantly related to any of the three performance indicators, but had higher mean averages for at least one of these measures.

Table 6.4. Manufacturing Innovation Indicators and Performance Outcomes
(Mean Values Reported)

Operating Indicator	Percentage Change in Sales	Average Return on Sales	Change in Value-added Per Employee
<u>Export sales (median=0%)</u>			
0%	12.0% ***	7.8%	-6.2%
1% or more	8.2%	8.2%	9.4%
<u>Companies with improved and new products (63%)</u>			
Yes	11.8% ***	8.6% ***	-4.4%
No	8.2%	6.6%	9.0%
<u>Companies with new to industry products (22%)</u>			
Yes	14.0% ***	9.1% ***	23.9% **
No	9.4%	7.5%	-6.4%
<u>Companies with patent applications (17%)</u>			
Yes	11.6%	10.7% ***	3.8%
No	10.3%	7.5%	0.3%
<u>Companies with new processes (31%)</u>			
Yes	13.6%	9.3% ***	12.1% *
No	17.1%	8.0%	5.5%
<u>Company ISO 9000 certified/in process (23%)</u>			
Yes	9.1%	9.9% ***	7.2%
No	11.2%	7.4%	-1.1%
<u>Company offers value-added services (37%)</u>			
Yes	12.1% *	9.6% ***	9.4% *
No	9.5%	7.1%	-10.3%
<u>% employees using a computer at least weekly (median=20%)</u>			
Yes	12.0% *	8.4% ***	13.6% ***
No	9.5%	7.5%	-13.0%
<u>Web site allows customers/suppliers to link on-line with company (37%)</u>			
Yes	7.3%	9.2% ***	-24.7%
No	12.2% ***	7.0%	15.4% ***
<u>Web site allows customers to place/request orders on-line (26%)</u>			
Yes	3.6%	9.4% ***	8.4%
No	12.8% ***	7.3%	-2.1%

*Significant at the 10% level, ** significant at the 5% level, *** significant at the 1% level.

Source: Georgia Manufacturing Survey 2002, weighted responses of 636 manufacturers.

Section 7

Company Performance and Workforce Innovation

The previous chapter suggested that manufacturing product, process, and information technology practices were associated in various ways with company growth, profitability, and productivity. This chapter looks certain workforce practices and the extent to which these practices are linked to these three performance measures. (See Table 7.1.)

Average Annual Wages

Employees in the median company had average annual wages of about \$28,000. This figure was about 6 percent higher than it was in 1999. In the top 10 percent of the distribution, employees earned around \$50,000, which was about the same as in 1999. The bottom 10 percent of the distribution saw employees earning \$15,000, which was 13 percent higher than in 1999. Analysis of wages against performance suggests that firms paying higher wages had significantly higher sales growth and growth in value-added per employee.

Training Dollars Per Employee

The median respondent spent about \$5,000 on training in fiscal year 2001. Firms at the top of the distribution spent \$80,000, while at the bottom of the distribution they spent nothing. On a per-employee basis, the median company spent \$80. The top 10 percent spent \$844 per employee. Most companies used the majority of their training dollars to fund routine activities and tasks. The median company used only about 10 percent of its training budget for new activities and tasks. The distribution of training dollars shows that roughly 20 percent of respondents spent more than half of their training budget on new activities or tasks, while 40 percent of respondents spent none of their training budget on new activities or tasks.

The factor of training dollars per employee was positively associated with profitability and productivity. Responding manufacturers spending more than the median training dollars per employee had significantly higher average return on sales and improvement in value-added per employee than firms spending at or below the median amount for training per employee.

Employees with Baccalaureate Degrees

Eighty-seven percent of responding manufacturers had at least one employee with a four-year (e.g., B.A., B.S.) or higher degree. The median company had three degreed employees, and the top 10 percent of respondents had 20 employees. Thirty percent of manufacturers had at least one employee with a bachelor's degree in an information technology field, and 42 percent of manufacturers had at least one employee with a science or engineering bachelor's degree.

Companies with more than one employee with a bachelor's (or higher) degree had significantly higher average return on sales and growth in value-added per employee than those with only one or no degreed employees. The same was true for manufacturers with employees holding technical degrees (e.g., B.A. or B.S. with a major in IT, science, engineering).

Table 7.1. Workforce Innovation Indicators and Performance Outcomes

Workforce Indicator	Percentage Change in Sales	Average Return on Sales	Change in Value-added Per Employee
<u>Average annual wages (median=\$28,379)</u>			
\$28,379 or less	7.6%	7.6%	-25.3%
More than \$28,379	12.4% ***	8.0%	17.0% ***
<u>Training dollars spent/employee (median=\$80)</u>			
\$80 or less	7.9%	5.7%	-25.8%
More than \$80	8.1%	15.4% ***	19.6% ***
<u>Number of employees with college degrees (median=3)</u>			
0 or 1	10.8%	6.7%	-15.7%
More than 1	10.5%	9.6% ***	20.3% ***
<u>Number of employees with science, engineering, or IT college degrees (median=1)</u>			
0 or 1	10.9%	7.5%	-17.4%
More than 1	12.3%	9.0% ***	24.0% ***

*Significant at the 10% level, ** significant at the 5% level, *** significant at the 1% level.
 Source: Georgia Manufacturing Survey 2002, weighted responses of 636 manufacturers.

Summary

Workforce practices are positively and significantly associated with performance indicators, with the caveat that we only examined direct bivariate relationships. Companies paying average annual wages above median levels had significantly higher sales growth and increases in value-added per employee than companies paying wages at or below the median. In addition, significantly higher average return on sales and increased value-added per employee accrued to companies with training dollars per employee above median levels, and with more than one employee with a bachelor’s or higher degree.

Section 8

Who Uses Georgia Tech (and Other Assistance Providers) and How Do These Manufacturers Benefit?

Past Georgia Manufacturing Surveys have found that companies using outside service providers are better off than companies going at it alone. This section takes a further look at assistance source usage. It opens with an examination of the types of companies that seek outside assistance across a range of service providers—from Georgia Tech to other universities and technical colleges, to private sector firms, to other manufacturers. It then investigates the type of assistance that manufacturers are interested in seeking. It closes with an analysis of the type of benefits that manufacturers can experience from outside assistance by focusing on the quantitative and qualitative impacts of Georgia Tech assistance. A model that compares the productivity of Georgia Tech clients and nonclients shows that the average client had \$3,000 more in value-added per employee (a measure of productivity) than if it had not been a client.

Business Assistances Sources

Almost seven out of 10 Georgia manufacturers use some type of business assistance provider. Georgia Tech was used by 24 percent of all manufacturing survey respondents followed by a private-sector consulting firm or vendor (19 percent), another manufacturer (11 percent), and a technical college/Quick Start program (10 percent). (See Figure 8.1.)

Facility employment size is a major determinant of using outside assistance. In general, the larger the firm, the more apt it is to use outside assistance sources. Private-sector consulting firms, technical colleges, and federal laboratories are especially more likely to be used by the largest firms with 500 or more employees. Georgia Tech uniquely penetrates medium-sized firms with 50 to 499 employees (although it has fairly substantial penetration of large firms as well). More than 35 percent of medium-sized firms, (or about half of all medium-sized manufacturers that use outside assistance), use Georgia Tech. The biggest challenge is with the smallest companies having 10 to 49 employees because they are least likely to use any outside assistance source. (See Figure 8.2 and Table 8.1.)

By industry, Georgia Tech's highest penetration is among electronics firms. (See Table 8.2.) Food processors tend to use a combination of Georgia Tech, other universities, and private consultants. Textile/apparel and resource-based industries are least likely to use any outside assistance.

By region, Georgia Tech's penetration appears highest in the Central and Coastal regions. (See Table 8.3.) The East region has the highest percentage of firms using private consultants. Technical college services are also more prevalent in the East and Coastal regions.

**Figure 8.1 Business Assistance Sources Used by Manufacturers
(Percentage of manufacturers using source in last two years)**

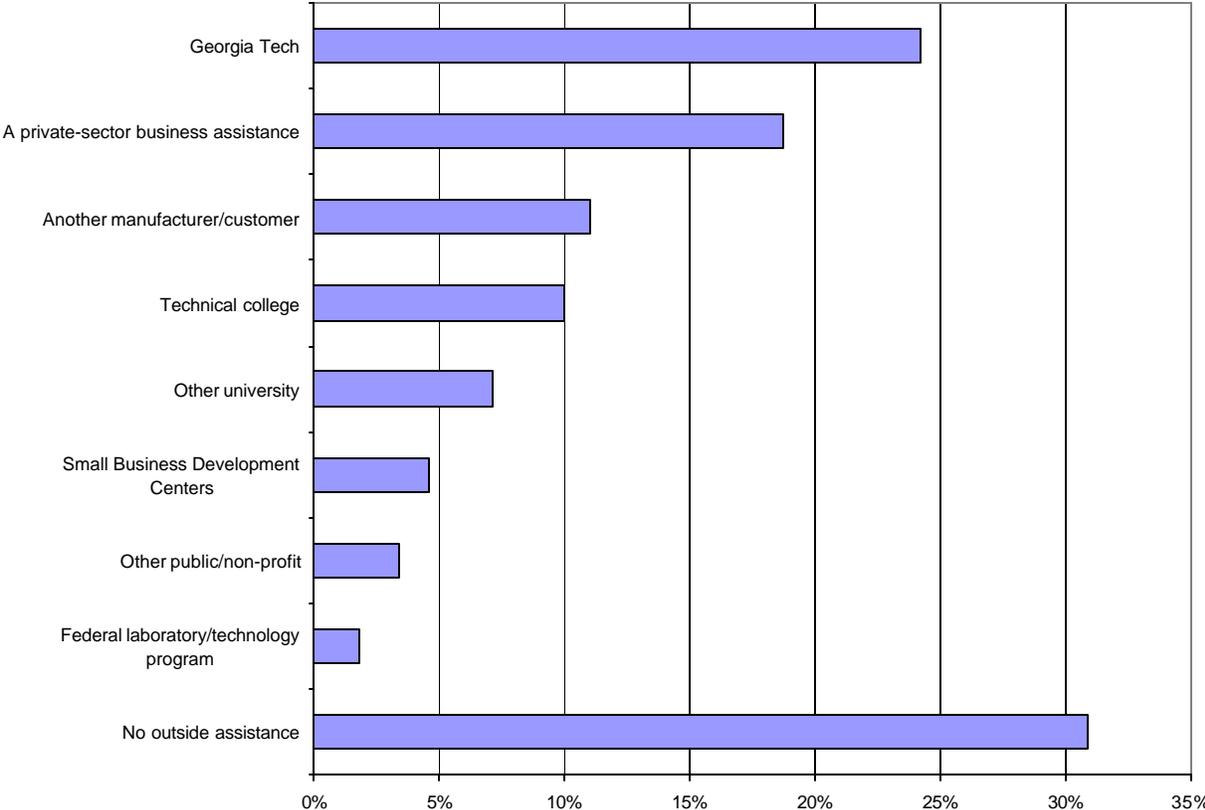


Figure 8.2. Selected Business Assistance Sources by Facility Employment Size
 (Percentage of Respondents Using Assistance Source in Last Two Years)

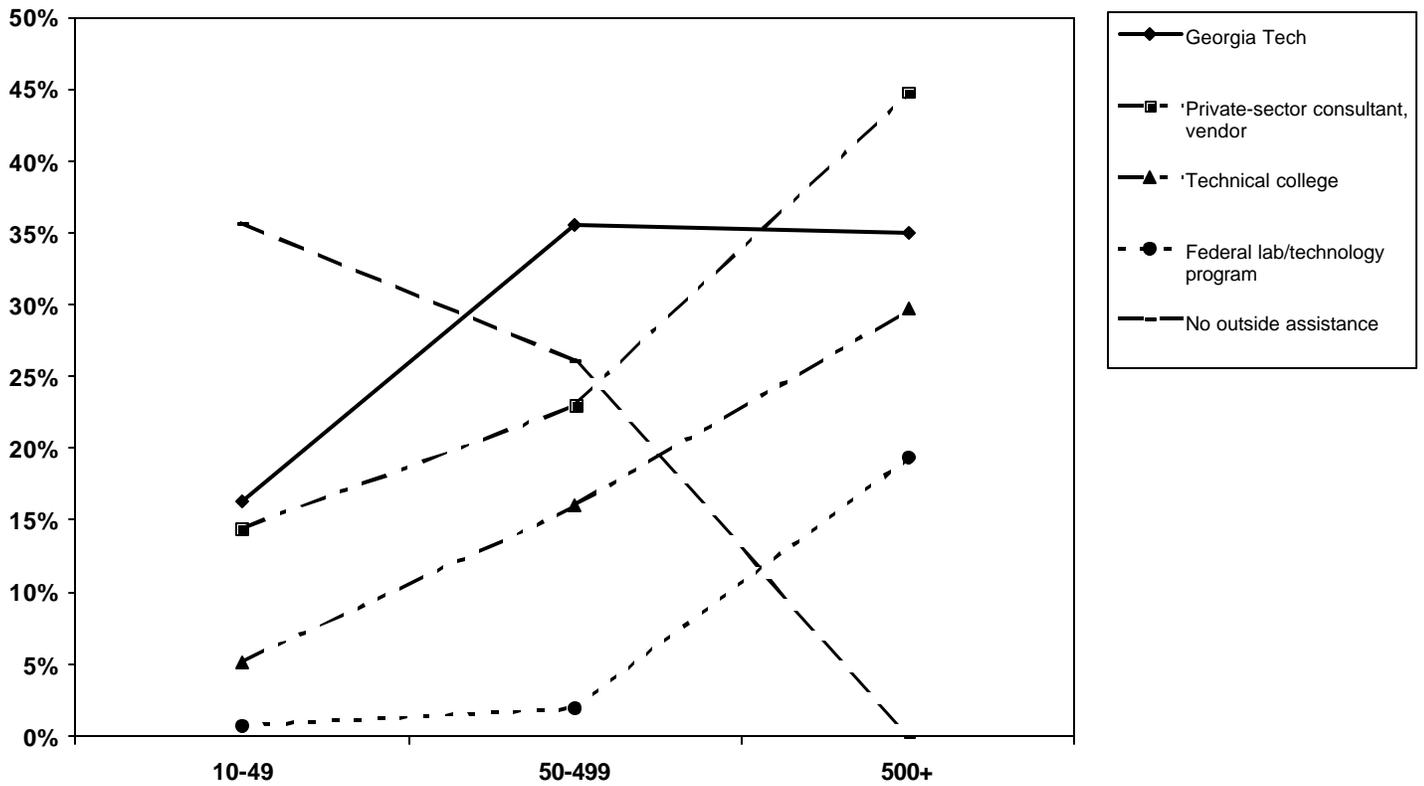


Table 8.1 Business Assistance Sources Used by Facility Employment Size
(Percentage of respondents using business assistance source in last two years)

Assistance Sources	All	Employment		
	Respondents	10-49	50-499	500+
Georgia Tech	30.9%	16.3%	35.5%	35.0%
Private-sector consultant, vendor	1.8%	14.4%	23.0%	44.8%
Another manufacturer/customer	3.4%	9.7%	12.6%	15.9%
Technical college	4.6%	5.1%	16.0%	29.7%
Other university	7.1%	3.6%	11.2%	21.6%
Small Business Development Centers	10.0%	5.0%	3.6%	8.7%
Other public/non-profit	11.0%	3.3%	3.8%	0.0%
Federal laboratory/technology program	18.7%	0.7%	1.9%	19.4%
No outside assistance	24.2%	35.7%	26.1%	0.0%

Source: Georgia Manufacturing Survey 2002, weighted responses of 636 manufacturers.

Table 8.2 Business Assistance Sources Used by Industry
(Percentage of respondents using business assistance source in last two years)

Assistance Sources	All	Food	Textiles	Resource	Machinery	Electronics	Other
	Respondents						
Georgia Tech	24.2%	31.6%	12.5%	22.4%	28.2%	42.3%	23.3%
Private-sector consultant, vendor	18.7%	26.3%	18.4%	15.9%	17.7%	22.5%	21.1%
Another manufacturer/customer	11.0%	13.1%	12.5%	10.0%	10.3%	16.2%	10.2%
Technical college	10.0%	7.9%	11.5%	5.5%	15.7%	17.9%	8.9%
Other university	7.1%	23.7%	9.5%	5.2%	5.4%	12.5%	3.3%
Small Business Development Centers	4.6%	2.6%	2.2%	4.1%	4.4%	16.3%	4.6%
Other public/non-profit	3.4%	5.3%	3.2%	2.0%	3.9%	9.9%	2.7%
Federal laboratory/technology program	1.8%	5.3%	0.0%	3.0%	0.5%	6.3%	0.0%
No outside assistance	30.9%	26.3%	33.6%	34.9%	28.2%	24.4%	28.4%

Source: Georgia Manufacturing Survey 2002, weighted responses of 636 manufacturers.

Table 8.3 Business Assistance Sources Used by Region
(Percentage of respondents using business assistance source in last two years)

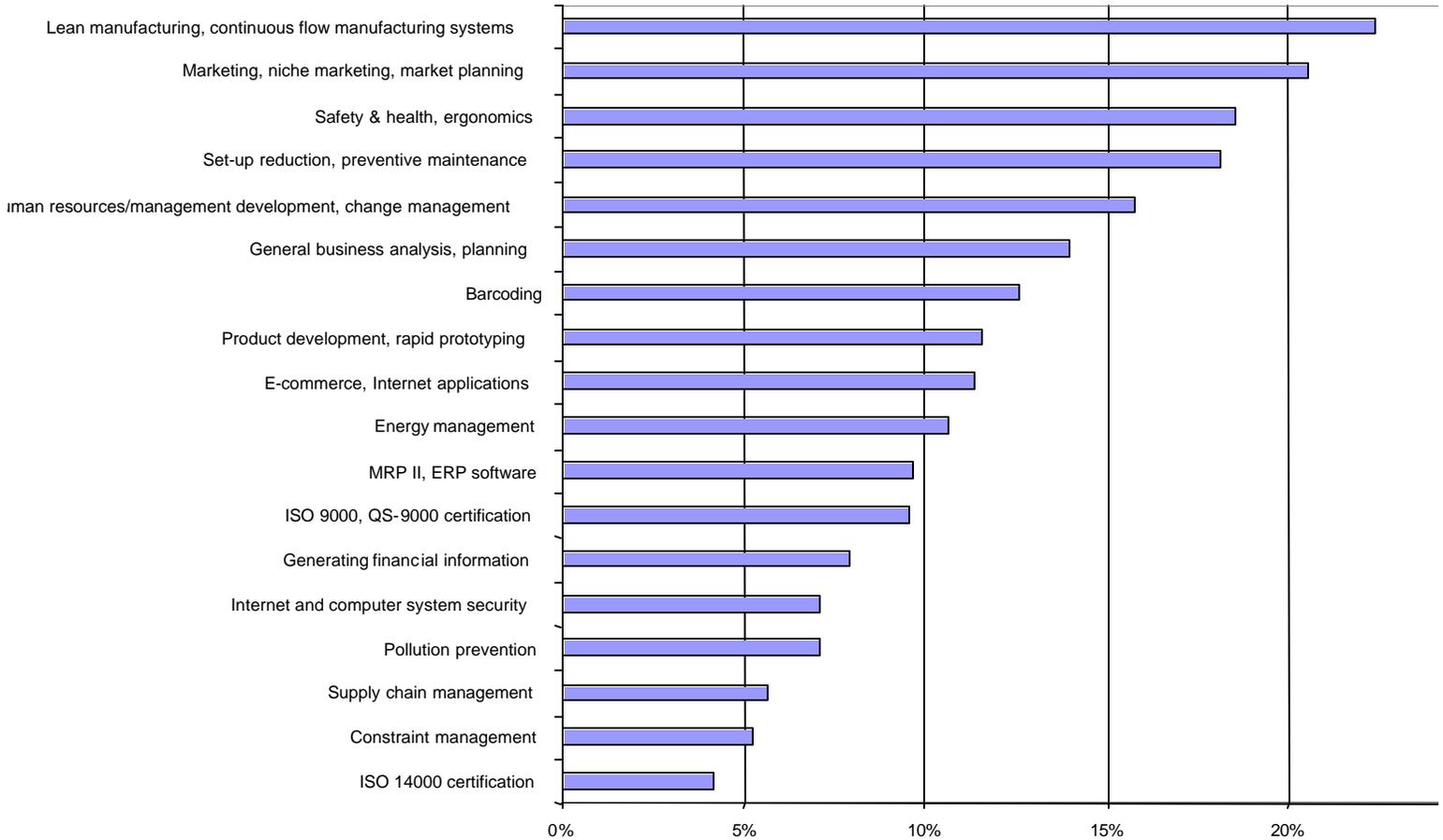
Assistance Sources	All	Northeast	Northwest	West	South	Central	East	Coastal
	Respondents							
Georgia Tech	24.2%	20.3%	20.6%	23.0%	29.0%	32.8%	25.4%	36.8%
Private-sector consultant, vendor	18.7%	21.4%	17.2%	16.1%	12.1%	15.2%	30.6%	26.3%
Another manufacturer/customer	11.0%	10.8%	8.6%	10.8%	13.2%	8.1%	9.0%	25.7%
Technical college	10.0%	5.3%	9.6%	14.5%	9.4%	10.6%	22.3%	21.0%
Other university	7.1%	6.5%	8.1%	10.2%	1.9%	6.5%	8.8%	10.9%
Small Business Development Centers	4.6%	4.3%	2.3%	8.4%	2.7%	7.4%	7.7%	0.0%
Other public/non-profit	3.4%	4.0%	2.3%	5.2%	1.6%	4.5%	0.0%	3.5%
Federal laboratory/technology program	1.8%	1.6%	0.8%	1.7%	2.5%	2.0%	4.4%	2.1%
No outside assistance	30.9%	28.2%	39.0%	29.7%	33.4%	26.2%	35.9%	17.9%

Source: Georgia Manufacturing Survey 2002, weighted responses of 636 manufacturers.

Areas of Interest in Training/Technical Assistance

More than half the companies responding to the Georgia Manufacturing Survey 2002 were interested in receiving training or technical assistance. The most frequently mentioned areas of interest were lean manufacturing and marketing, followed by safety and health and set-up reduction/preventive maintenance. (See Figure 8.3.)

Figure 8.3. Areas of Interest for Training and Technical Assistance
(Percentage of Companies Interested)



Source: Georgia Manufacturing Survey 2002, weighted responses of 636 manufacturers

Interest in assistance area differed by company size. (See Table 8.4.) Medium-sized manufacturers were most interested in lean services as well as those concerning MRP/ERP and ISO 9000. Interest in marketing services was most prevalent among small manufacturers. Interest in safety and health, human resources, and energy management assistance was highest among large manufacturers.

By industry, food processors had the highest percentage of firms interested in any type of assistance across the board, but especially human resource and change management assistance. (See Table 8.5.) Electronics firms also showed substantial interest in lean, general business and financial analysis, MRP/ERP, and ISO 9000. Manufacturers in the South and Coastal regions were more apt to be interested in marketing than were those in other parts of the state. The Northwest and West regions had the highest percentage of firms interested in lean manufacturing assistance. Manufacturers in the Northwest region were also most apt to be interested in safety and health, while those in the East, South, and Coastal regions focused on set-up reduction. (See Table 8.6.)

**Table 8.4. Areas of Interest for Training or Technical Assistance
by Facility Employment Size**
(Percentage interested in receiving service)

	All	10-49	50-499	500+
Lean manufacturing, continuous flow manufacturing systems	22.4%	16.7%	32.0%	15.9%
Marketing, niche marketing, market planning	20.6%	23.7%	16.5%	12.9%
Safety & health, ergonomics	18.6%	11.7%	28.1%	32.4%
Set-up reduction, preventive maintenance	18.2%	11.0%	29.3%	21.6%
Human resources development, management development, team training, change management	15.8%	11.9%	20.5%	30.2%
General business analysis, planning	14.0%	16.3%	10.4%	13.7%
Barcoding	12.6%	11.7%	14.9%	3.0%
Product development, rapid prototyping	11.6%	11.9%	12.0%	3.0%
E-commerce, Internet applications	11.4%	12.1%	10.8%	5.0%
Energy management	10.7%	4.5%	18.5%	33.9%
MRP II, ERP software	9.7%	7.4%	13.8%	5.0%
ISO 9000, QS-9000 quality certification	9.6%	7.8%	12.6%	6.7%
Generating financial information for obtaining capital	7.9%	8.5%	7.7%	0.0%
Internet and computer system security	7.1%	7.7%	6.7%	0.0%
Pollution prevention	7.1%	3.4%	12.0%	16.5%
Supply chain management	5.7%	4.8%	7.3%	5.0%
Constraint management, theory of constraints techniques	5.3%	2.5%	8.7%	16.5%
ISO 14000 certification	4.2%	2.6%	6.1%	9.7%

Source: Georgia Manufacturing Survey 2002, weighted responses of 636 manufacturers.

Table 8.5. Areas of Interest for Training or Technical Assistance by Area and Industry
(Percentage interested in receiving service)

	All	Food	Textiles	Resource	Machinery	Electronics	Other
Lean manufacturing, continuous flow manufacturing systems	22.4%	29.0%	20.8%	22.9%	21.7%	27.8%	19.8%
Marketing, niche marketing, market planning	20.6%	29.0%	21.4%	18.9%	16.8%	19.9%	24.6%
Safety & health, ergonomics	18.6%	23.7%	21.0%	15.9%	19.2%	20.6%	18.3%
Set-up reduction, preventive maintenance	18.2%	29.0%	13.7%	18.8%	19.9%	17.9%	15.2%
Human resources development, management development, team training, change management	15.8%	36.8%	18.4%	11.5%	16.1%	13.5%	14.4%
General business analysis, planning	14.0%	23.7%	9.6%	13.9%	11.1%	21.8%	14.9%
Barcoding	12.6%	13.2%	7.3%	10.2%	14.8%	16.1%	16.7%
Product development, rapid prototyping	11.6%	18.4%	7.1%	7.4%	13.2%	18.8%	15.6%
E-commerce, Internet applications	11.4%	10.5%	13.0%	8.9%	11.3%	12.7%	14.3%
Energy management	10.7%	21.0%	14.9%	10.1%	7.0%	9.8%	9.8%
MRP II, ERP software	9.7%	13.2%	4.2%	10.3%	9.2%	17.2%	10.0%
ISO 9000, QS-9000 quality certification	9.6%	0.0%	8.3%	10.1%	11.3%	17.2%	8.7%
Generating financial information for obtaining capital	7.9%	5.3%	10.0%	7.0%	9.0%	14.4%	5.7%
Internet and computer system security	7.1%	7.9%	6.1%	7.5%	4.3%	10.9%	8.7%
Pollution prevention	7.1%	10.5%	4.2%	10.3%	4.0%	1.8%	7.3%
Supply chain management	5.7%	2.6%	7.6%	3.1%	5.2%	11.7%	9.0%
Constraint management, theory of constraints techniques	5.3%	13.2%	2.2%	3.5%	5.4%	14.4%	5.2%
ISO 14000 certification	4.2%	0.0%	2.0%	4.5%	6.9%	4.5%	3.3%

Source: Georgia Manufacturing Survey 2002, weighted responses of 636 manufacturers.

Table 8.6. Interest in Receiving Training, Technical Assistance by Area and Region
(Percentage interested in receiving service)

	All	Northeast	Northwest	West	South	Central	East	Coastal
Lean manufacturing, continuous flow manufacturing systems	22.4%	21.3%	26.5%	25.8%	22.0%	18.7%	17.6%	20.3%
Marketing, niche marketing, market planning	20.6%	20.9%	16.2%	14.2%	29.9%	23.7%	16.4%	29.3%
Safety & health, ergonomics	18.6%	18.9%	26.6%	13.6%	17.4%	15.0%	19.0%	7.8%
Set-up reduction, preventive maintenance	18.2%	15.8%	18.7%	18.9%	22.2%	13.8%	25.1%	23.8%
Human resources development, management development, team training, change management	15.8%	17.2%	14.4%	13.4%	18.7%	15.4%	13.4%	13.1%
General business analysis, planning	14.0%	15.8%	11.2%	14.6%	12.5%	11.6%	11.1%	23.6%
Barcoding	12.6%	13.2%	11.2%	12.7%	15.0%	11.4%	9.6%	14.6%
Product development, rapid prototyping	11.6%	11.7%	11.3%	12.8%	17.6%	8.0%	4.7%	10.8%
E-commerce, Internet applications	11.4%	9.4%	12.0%	17.9%	11.7%	8.1%	4.3%	19.0%
Energy management	10.7%	10.8%	14.6%	8.1%	9.4%	3.5%	23.7%	9.7%
MRP II, ERP software	9.7%	12.9%	3.3%	16.1%	11.0%	4.6%	7.9%	4.4%
ISO 9000, QS-9000 quality certification	9.6%	7.9%	8.9%	12.3%	8.2%	14.0%	11.5%	8.2%
Generating financial information for obtaining capital	7.9%	6.9%	5.4%	7.3%	12.5%	7.9%	7.2%	15.7%
Internet and computer system security	7.1%	8.0%	4.5%	6.3%	6.2%	8.4%	2.6%	17.1%
Pollution prevention	7.1%	6.9%	10.5%	2.6%	5.3%	7.7%	14.1%	2.7%
Supply chain management	5.7%	8.2%	5.4%	6.2%	2.0%	2.6%	0.0%	11.4%
Constraint management, theory of constraints techniques	5.3%	5.8%	4.4%	6.8%	5.3%	2.5%	2.1%	11.4%
ISO 14000 certification	4.2%	5.0%	2.3%	3.9%	2.6%	7.7%	4.4%	2.1%

Source: Georgia Manufacturing Survey 2002, weighted responses of 636 manufacturers.

Benefits from Georgia Tech Assistance

Nine out of 10 survey respondents served by Georgia Tech/EDI report benefits from this assistance. Almost half of these manufacturers said that management skills and know-how were improved. (See Table 8.7.) The next most frequently mentioned benefits were improved an existing process (39 percent), increased productivity (39 percent), and improved employee skills (37 percent).

Table 8.7. Benefits from Georgia Tech Assistance

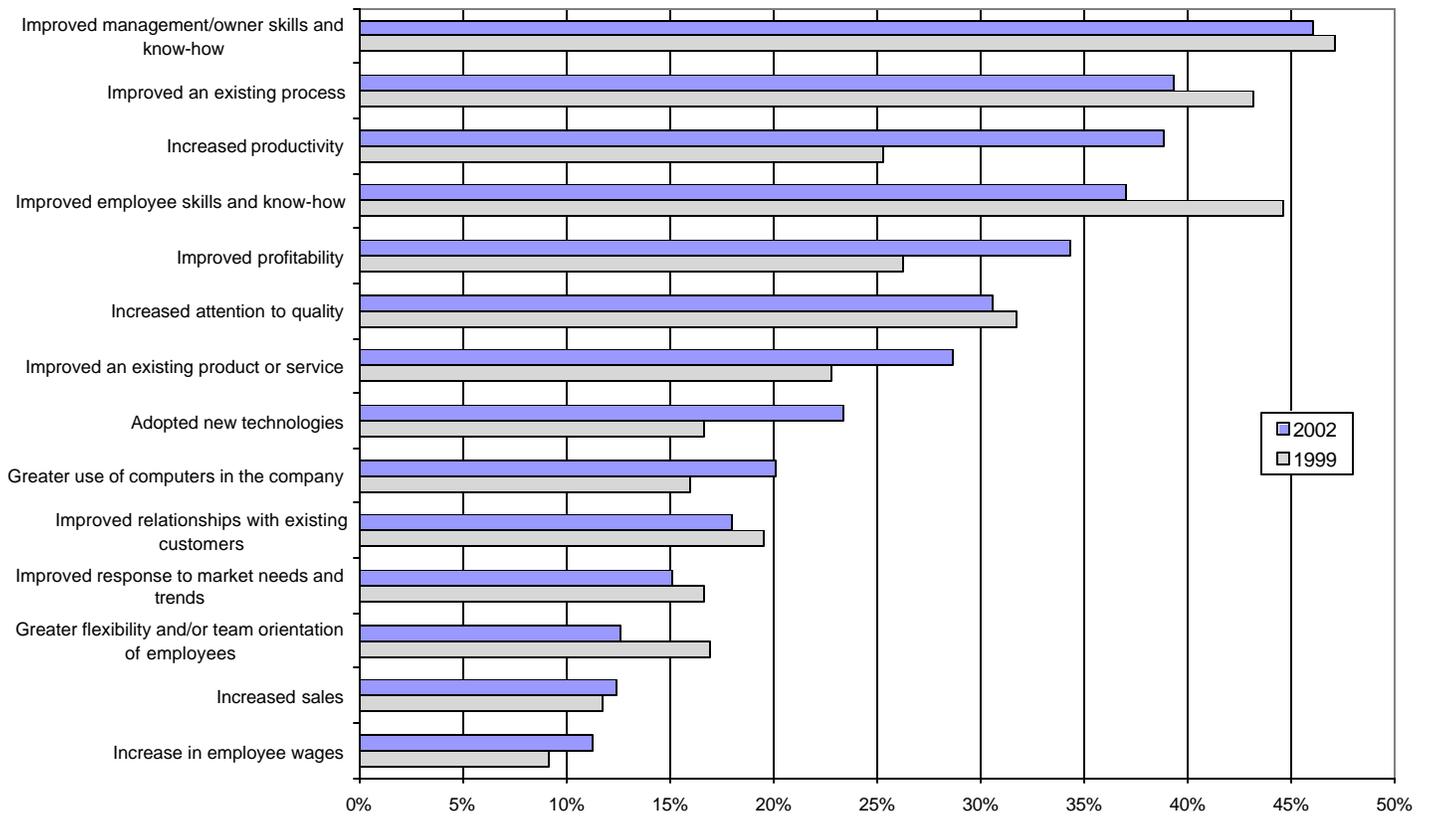
(Percentage of Georgia Tech customers reporting that benefits already resulted, benefits are expected, and no benefits have resulted/are expected)

Benefits	% Georgia Tech Customers		
	Resulted in past 2 years	Expected in next 2 years	Neither
Improved management/owner skills and know-how	46.1%	27.6%	26.3%
Improve an existing process	39.3%	31.4%	29.3%
Increased productivity	38.8%	25.4%	35.8%
Improved employee skills and know-how	37.0%	26.1%	36.9%
Improved profitability	34.3%	30.7%	35.0%
Increased attention to quality	30.6%	25.1%	44.3%
Improve an existing product or service	28.7%	23.4%	47.9%
Adopted new technologies	23.4%	25.1%	51.5%
Greater use of computers in the company	20.1%	22.3%	57.6%
Improved relationships with existing customers	18.0%	23.5%	58.5%
Improved response to market needs and trends	15.1%	22.5%	62.4%
Greater flexibility and/or team orientation of employees	12.6%	20.6%	66.8%
Increased sales	12.4%	34.5%	53.1%
Increase in employee wages	11.3%	19.4%	69.3%

Source: Georgia Manufacturing Survey 2002, weighted responses of 113 manufacturers.

Some of these benefits were more pervasive in the 2002 survey than in the 1999 survey. A higher percentage of Georgia Tech customers in 2002 reported that they experienced quantitative outcomes such as productivity increases and profitability increases than was reported in 1999. In addition, existing product/service improvement, adoption of new technologies, and greater use of computers were more prevalent benefits among Georgia Tech customers in 2002 than in 1999, even as softer employee-related benefits (e.g., skill improvements, team orientation) were cited less often. (See Figure 8.4.)

Figure 8.4. Types of Benefits from Georgia Tech Assistance: 2002 vs. 1999
 (Percentage of Georgia Tech Customers Reporting that Benefit Already Resulted)



Twenty percent of Georgia Tech customers in the survey provided estimates of returns and investments from Georgia Tech/EDI. Over the survey period, total impacts experienced by Georgia Tech/EDI customers included more than \$17 million in increased sales and \$4.3 million in cost savings. Nearly 220 new jobs were created, and more than 510 existing jobs were saved.

A few Georgia Tech assisted customers gained substantial benefits. Seven Georgia Tech added sales of more than \$1 million. One customer reported cost savings of \$1 million. Two Georgia Tech customers invested more than \$1 million into their projects.

Impact of Georgia Tech Assistance on Productivity

Although Georgia Tech-assisted manufacturers report benefits, this does not necessarily prove that the results are attributable to Georgia Tech services. For example, unassisted firms could also have experienced these same benefits during the 1999-2001 time period. Benefits or lack thereof may have arisen from the general economic conditions of the time rather than the assistance received from Georgia Tech. Georgia Tech-assisted manufacturers may also have been influenced by other companies (for example, vendors and consultants, other manufacturers) or by other public assistance sources (for example, federal laboratories, other state-funded educational or assistance institutions).

To account for these influences, we have developed a model to estimate the impact of Georgia Tech project-related extension services on client productivity. Productivity is measured by value added per employee, which is calculated as sales less the cost of materials, parts, services, and other purchased inputs divided by the number of employees. Drawing on Jarmin², we examined the growth rate in the standard value-added production function from 1999 to 2001 (logged), as a function of receiving Georgia Tech services. We controlled for an array of facility characteristics, including:

- facility employment growth rate 1999-2001 (logged)
- change in the capital/labor ratio 1999-2001 (logged)
- whether this is the only facility in the company (dummy variable)
- industry classification (dummy variables)
- whether the facility is located in a metropolitan statistical area (dummy variable)
- whether the facility is located in a county with a Georgia Tech extension office (dummy variable)
- whether the survey respondent reported using a private consultant (dummy variable)
- whether the survey respondent reported using a non-Georgia Tech public service provider (dummy variable)
- whether the survey respondent reported participating in a cooperative activity with other firms involving product or process development (dummy variable).

This model was estimated using ordinary least squares. Table 8.8 presents the results. Georgia Tech assistance is positively and significantly linked to productivity growth. Over the study pe-

²Ronald S. Jarmin, 1999. "Evaluating the Impact of Manufacturing Extension on Productivity Growth," *Journal of Policy Analysis and Management* 18 (1): 99-119. We employ a similar model which estimates the logged change in value-added per employee as a function of changes in labor and capital (logged), along with control variables representing manufacturing characteristics (e.g., employment size, industry, location, and status as a branch plant).

riod, Georgia Tech clients experienced a 0.4 percent logged growth rate in value-added per employee over non-clients. This is equivalent to a value-added increase of \$353,000 to \$443,000 for the average client facility (or \$3,000 on a per employee basis), adjusting for what value-added per worker would have been if the company had not been a client.³

Table 8.8: Productivity is Significantly Higher for Georgia Tech Clients Than for Non-clients
Ordinary Least Squares – Value-Added per Employee Growth Rate 1999-2001

Variables	
% Change in labor inputs (employees)	-0.0924 ***
% Change in capital/labor	0.0391 ***
Georgia Tech client	0.0028 *
Located in an urban county	0.0036 **
Located in a county with a Georgia Tech regional office	0.0010
Used a private consultant	0.0012
Used a public service provider	-0.0018
Participates in inter-firm collaboration	-0.0003
The only facility in the company	0.0006
Food	0.0106***
Textile	-0.0009
Resource	0.0059 ***
Machinery	-0.0021
Electronics	0.0044
Constant	0.9998***
R-squared 0.086 ***	
N 317	
NOTE: The dependent variable is percent change in value-added per employee 1999-2001 logged. All growth rates denote logged values for period. Preliminary analysis, subject to revision.	
***Clients vs. Non-Clients: differences significant at less than the 1%; **Clients vs. Non-Clients: differences significant at the 5%; *Clients vs. Non-Clients: differences significant at the 10%	
Source: Georgia Manufacturing Survey, weighted responses of 636 manufacturers.	

³ Ronald S. Jarmin, Memo: Estimated Impact of Manufacturing Extension, February 12, 1997. The range is based on 90 percent confidence intervals.

Appendix 1

Survey Framework, Questionnaire Design, and Administration

Survey Framework

The population for the survey was all manufacturing establishments with 10 or more employees in the state of Georgia. An establishment is defined by the U.S. Census Bureau as "a single physical location where business is conducted or where services or industrial operations are performed."

To identify all manufacturing establishments/facilities, we compiled a list of Georgia establishments from Dun & Bradstreet's Market Place database and EDI's internal activity and reporting system. This list of companies was cleaned of duplicates, out-of-state companies, and insufficient addresses. Further refinement was provided by matching the company names and zip codes to an NCOA (National Change of Address) database updated weekly. Companies that had moved or had an undeliverable address were removed from the list. This process resulted in 4,437 companies.

Questionnaire Design

The questionnaire was designed to approximate previous Georgia Manufacturing Surveys to enable comparisons and determine trends. Themes addressed in the questionnaire included manufacturers' problems and needs, changes in business structure and practices, product and process development, constraints to development, use of information technology, manufacturing productivity and performance, workforce costs and training, and interest in technical assistance.

The 2002 survey specifically focused on two areas: (1) innovation, and (2) use of information technology. Questions 9-11 about product and process development drew on the Centre for European Economic Research, Innovation Survey 2000, Mannheim Germany, and on Michael Collins, Charles France, Peter LaPlaca, and Anne Brown, *Industrial Marketing Assessment Tool*, Gaithersburg, Maryland: National Institute of Standards and Technology, 1997. Question 12 about information technology drew on KPMG, Study of U.S. Small Manufacturers' eBusiness Needs, Gaithersburg, Maryland: National Institute of Standards and Technology, June 12, 2000.

Once a draft questionnaire and cover letter had been designed, a pilot test was conducted to get feedback on the survey's format, wording, and design. Comments from the manufacturers and EDI field staff and executives were incorporated into a final version presented in Appendix 2.

Administration

The survey was conducted from April 2002 to October 2002 using four waves of mailings and follow-up. A packet containing a questionnaire, a cover letter from the Director of Georgia Institute of Technology's Economic Development Institute, and a self-addressed, postage-paid envelope was mailed to 4,437 manufacturing establishments. Shortly after the first mailing, about 1,000 survey packets were distributed at a Georgia Manufacturers Association meeting. A second follow-up mailing consisted only of a letter signed by the Director of the Georgia Department of Technical Education (DTAE). For the third mailing, the full survey packets were mailed; 500 of the packets included a calling card. Finally, a fourth wave of mailing was done with assistance provided by each Georgia Tech regional office (seven offices) and each Georgia

Tech Department of Technical Education office (30 offices). The Georgia Tech regional offices were given survey packets for each customer in their area that had not responded as of that date. The Department of Technical Education offices were given 20 survey packets of randomly assigned companies in their area that had not yet responded. These packets were given to the Georgia Tech or DTAE office to be mailed out to the identified companies with the expectation that the field office would follow up with a personal phone call or visit to encourage responses. This entire process yielded a total response of 710 surveys.

The response to the survey was as follows:

Companies in initial database	4,437
Wrong address/undeliverable	287
Out of business	31
Not a manufacturer	45
Declared refusals	15
Non-respondents	3,348
Respondents with <10 employees	75
Complete surveys with mfgs of 10+ employees	636
Response rate	15.9%

The response rate was calculated by eliminating all the wrong addresses, non-manufacturers, and companies that were out of business from the list of Georgia manufacturers. Then, the number of completed survey forms of manufacturers with 10 or more employees (636) was divided by the total number of manufacturing establishments, established as legitimate, in the target population (3,999). The response rate was 15.9 percent.

To evaluate the representativeness of the survey responses, Table 1.1 compares them to Georgia Department of Labor information. All manufacturing SIC codes were grouped into six categories: Food, Apparel, Resources (lumber, furniture, paper, chemicals, stone, clay, glass and concrete), Machinery (metals, industrial machinery, and transportation), Electronics, and Miscellaneous. Smaller establishments with fewer than 20 employees and to a lesser extent those with 10-to-19 employees are most noticeably underrepresented in the sample. Machinery and electronics industries are more highly represented than the other industries. Because of the importance of scale and product characteristics in determining firm behavior such as technology use, the sample was stratified by industry and establishment size and an expansion weight was applied.⁴ The Georgia Department of Labor database of 5,445 establishments was used to calculate these weights. Note that Table 1.1 has a total survey response of 636. This total excludes survey forms from companies with fewer than 10 employees, and companies with missing employment and industry information.

⁴ See Terance Rephann and Philip Shapira, *Survey of Technology Use in West Virginia Manufacturing*, Morgantown, WV: West Virginia University Regional Research Institute, December 1, 1993, p. 8. Non-respondent surveys were not conducted. However, a few non-respondents told us that they did not understand, use, or feel that the technologies mentioned in the survey were applicable to their business. It is possible that the survey respondents are more advanced in technology use than the non-respondents.

**Table A.1: Number of Establishments by Industry and Employment Size
Georgia Department of Labor (2000) vs. Survey Respondents**

<u>Industry</u>	<u>GA Dept. of Labor 2000</u>		<u>Georgia Survey</u>	
	<u># estab.</u>	<u>% estab.</u>	<u># estab.</u>	<u>% estab.</u>
Food and kindred products and tobacco	358	6.6%	38	6.0%
Textile mill products, apparel and textile products	737	13.5%	70	11.0%
Lumber and wood products, Furniture and fixtures, Paper and allied products, Chemicals and allied products, Stone, clay, glass and kindred products	1,798	33.0%	185	29.1%
Primary metal industries, Fabricated metal industries, Industrial machinery and equipment, Transportation equipment	1,190	21.9%	200	31.4%
Electronics and other electrical equipment, Instruments and other related products	297	5.4%	43	6.8%
Printing, publishing, and allied products, Petroleum refining and related industries, Rubber and miscellaneous plastic products, Leather and leather products, Miscellaneous manufacturing industries	<u>1,065</u>	<u>19.6%</u>	<u>100</u>	<u>15.7%</u>
Total	5,445	100.0%	636	100.0%
<u>Number of employees</u>				
10-19	1,635	30.0%	127	20.0%
20-99	2,523	46.3%	361	56.7%
100+	<u>1,287</u>	<u>23.7%</u>	<u>148</u>	<u>23.3%</u>
	5,445	100.0%	636	100.0%

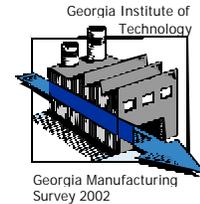
Refusal to participate in the study is not the only type of non-response. Some respondents preferred not to answer one or more of the items on the questionnaire. Inter-item response rates are presented on each table. In many cases, the response rates neared or exceeded 90 percent, but for a few questions, response rates were below 70 percent. What these item response rates mean is unclear. For example, the 76 percent rate for return on sales may reflect a preference not to disclose this information, whereas the 74 percent rate for hours spent on training may mean that the company did not collect the information. (Inter-item response rates are shown in Appendix 3.)

Another step in the analysis involved verification of the accuracy of responses to certain questions. The project team ran checks on answers to the performance measure questions. For items that fell outside generally accepted ranges (e.g., payroll per employee or average wages of more than \$75,000), the team telephoned the respondents to verify and, in many cases correct, the information on the survey. Responses were checked for internal consistency. If a response conflicted with a previous response (i.e., the response was checked that the Company did not have a Web site, but then they checked that the Web site provided information about the company), then similar responses were examined and where not verifiable, the Internet was checked, or a phone call was made to the company. In addition, when the subset of a question received a higher level of response than the original question (i.e., only two people had four-year college degrees but of these 10 people majored in information technology), it indicated that the respondent did not understand the question correctly.

Appendix 3 contains a breakdown of survey responses for every question on the survey form. Percentages of general managers answering each question and of item response rates are available. For questions that ask for quantitative information, percentile breakdowns, means, and standard error of the means are presented.

Appendix 2 Questionnaire

The Georgia Manufacturing Survey 2002



Georgia Tech is conducting this survey to help make Georgia's manufacturers more competitive by improving state business and technology services to industry.

- Survey questions refer to this facility.
- All individual firm and facility information will be kept in a secured, limited access location. Results will only be presented in an aggregated form. Your firm or facility's identity will not be revealed in any publication or presentation of the results of this survey.
- We understand you do not always keep exact records of all activities—estimates are fine.
- In return for completing this survey, we will send a survey summary and customized report with industry comparisons.

Please return this survey in the enclosed postage-paid envelope within 10 days to: Jan Youtie, Economic Development Institute, Georgia Institute of Technology, Atlanta, Georgia 30332-0640

Any questions about the survey? Tel: 1 (888) 272-2104 · Fax: 404/894-0069 · E-mail: jan.youtie@edi.gatech.edu · www.cherry.gatech.edu/survey

Please confirm your name and address and make any changes.

THANK YOU FOR YOUR HELP.

1. This facility is *(Please check one)*

- a. A single-establishment enterprise, not affiliated with any other enterprise
- b. An affiliate of a parent group or holding company that comprises two or more establishments
If YES to b. The parent group has fewer than 500 employees in total
 The parent group has 500 – 2499 employees
 The parent group has 2500 or more employees

2. Is your company's head office located in Georgia?

- Yes
- No, head office is located in _____(US state) or _____ (country outside of the US)

3. Are most of your customers: *(please check one)*

- Local – within approximately 50 miles of this plant
- Regional – within approximately 200 miles of this plant
- National
- International

4. Your facility's **main product** or manufacturing activity is: *(Please check one)*

- | | |
|-------------------------------------|--------------------------------------|
| ? Food, beverages, feed | ? Stone, clay, glass, or concrete |
| ? Textiles | ? Primary metals |
| ? Apparel | ? Fabricated metals |
| ? Lumber and wood, except furniture | ? Industrial machinery |
| ? Furniture | ? Electrical or electronic equipment |
| ? Paper and paper products | ? Transportation equipment |
| ? Printing and publishing | ? Instruments |
| ? Chemicals and allied products | ? Other (please describe) |
| ? Rubber and plastics | |
-

5. For your plant's main product(s), how many other rival firms compete with your facility for customer sales?

- 0 – 5 competitor firms
- 6 – 19 competitor firms
- More than 20 competitor firms

6. For the plant's main product(s), please RANK the order of importance of the following factors according to how your facility competes for customer sales? 1=most important, 6=least important. *Please do not give the same ranking to more than one factor.*

- _____ Low price
- _____ High quality
- _____ Innovation/new technology
- _____ Quick delivery
- _____ Adapting product to customer needs
- _____ Customer service that adds value to products/processes (i.e., training, consulting)

7. In which of the following areas does your facility have the most significant problems or needs? (Check all boxes that apply.)

- Plant layout, expansion planning
- Manufacturing process, setup, scrap
- Product development/design
- Material failure, wear patterns, and other material-related issues
- Computer hardware/network systems (e.g., operating systems, LAN, communications, computer networks)
- Computer software/packages for accounting, planning, order entry, scheduling, inventory, etc.
- Quality assurance (e.g., ISO 9000, QS-9000, Malcolm Baldrige)
- Marketing, niche marketing, market planning, exporting
- General business analysis, planning
- Financial planning or assistance with loan applications and fundraising
- Basic skills (e.g., reading, writing, math, keyboard skills)
- Technical skills (e.g., quality control, preventive maintenance)
- Management skills, team-based improvement, problem-solving skills
- Energy costs, conservation
- Waste management
- Environmental, health, and safety compliance
- Other (please describe) _____

8. Did your facility undergo major changes in the following areas of business structure and practices during the period 1999-2001? (Please check all that apply)

- Ownership
- Corporate strategies
- Management techniques (e.g. knowledge management)
- Organizational structures
- Marketing concepts or methods
- Internal or external training of your personnel in innovative or new activities (i.e. not routine work)
- Other (please describe) _____

PRODUCT DEVELOPMENT

9.1 In the past 3 years, what types of improved and new products has the firm developed? Check all that apply.

- None → Go to question 10
 - Modifications or extensions to your own existing products or product lines
 - Copies of competitors' products
 - Products that are new to your industry
- Yes → What percentage of 2001 sales were from **new-to-the-industry** products?

--	--	--

 %

9.2 How were these products developed? (Please check one box)

- Mainly by your company
- Mainly by your company in collaboration with customers
- Mainly by your company in cooperation with other companies or organizations
- Mainly by other companies or institutions

9.3 Did your facility apply for any patents during the period 1999-2001?

- No
- Yes → If yes, how many? _____

9.4 What are your plans to introduce new products or existing products that contain significant technical improvements?

- New products already are being developed
- We plan to begin development within 2 years
- No plans to develop new products

PROCESS DEVELOPMENT

10.1 During the last three years, did you introduce any process that was new or significantly improved to your firm?

- No → Go to question 11
- Yes → Was it new to the industry? Yes No

10.2 How were these processes developed? (Please check one box)

- Mainly by your company
- Mainly by your company in cooperation with other companies or organizations
- Mainly by other companies or institutions

10.3 What are your plans to introduce new or significantly improved processes?

- New or improved processes already are being developed
- We plan to start work on new or improved processes within 2 years
- No plans to introduce new or improved processes

CONSTRAINTS TO PRODUCT OR PROCESS DEVELOPMENT

11. How much of a deterrent has each of the following factors been in keeping your facility from developing innovative products or processes over the past three years: (please check one box in each row)

		Low	Importance Medium	High
Economic deterrents	New product/process development costs too high	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Lack of available financing	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Cost of financing too high	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Unclear whether benefits exceed the costs	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Lack of long term customer commitments to support development costs	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Internal deterrents	Organizational rigidities within the company	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Lack of qualified personnel	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Lack of information on technology	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Lack of market information	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Lack of in-house product development systems	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	No capability to sell them	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other deterrents	Product/process development is done by another unit	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Impact of regulations or standards	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Existing customers not interested in new products	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	My company is not interested in new products/ processes	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Other (please describe)			

INFORMATION TECHNOLOGY

12.1 Which of the following types of information are available electronically at your facility?

- | | | |
|---|--|---|
| <input type="checkbox"/> Company and product literature | <input type="checkbox"/> Accounts receivable/payable | <input type="checkbox"/> Bids/quotes |
| <input type="checkbox"/> Customer profile information | <input type="checkbox"/> Other financial/accounting data | <input type="checkbox"/> Order tracking |
| <input type="checkbox"/> Customer orders | <input type="checkbox"/> Inventory of supplies | |

12.2 Which of the following electronic systems do you use or plan to use at your facility?

	Use	Plan to Use	Do not plan to use	Not applicable
E-mail	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Shared databases accessible through the network	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
High speed internet connection (e.g. ISDN, cable, DSL, T1)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Electronic data interchange (EDI)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Enterprise Resource Planning (ERP) or other software for production planning and control of orders, inventories	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Supply, electronic purchasing agent	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

12.3 Does your company have a Web site?

- Yes
- No, plan to get a Web site
- No, do not plan to get a Web site

Does your company Web site do any of the following? (check all that apply)

- Provide information about your company
- Provide information about products and/or services
- Allow customers to link electronically with your company
- Allow suppliers to link electronically with your company
- Allow customers to place or request orders online
- Integrate with your back office systems
- Capture customer information
- Provide on-line customer service

What percentage of your FY 2001 sales were placed through your Web site? _____%

- | | | |
|---|--------------------------|--------------------------|
| | Yes | No |
| 12.4. a. Do you require that your customers use electronic transactions? | <input type="checkbox"/> | <input type="checkbox"/> |
| b. Do any of your customers require that your facility use electronic transactions? | <input type="checkbox"/> | <input type="checkbox"/> |

MANUFACTURING PRODUCTIVITY AND PERFORMANCE

13. For the following questions, use approximate numbers or give an estimate. All estimates should be for this facility.

	2001	1999
What were your total annual sales or gross value of shipments at this plant in fiscal year 2001? In 1999?	\$	\$
Approximately how much did you spend at this location on purchased materials, parts, and services in fiscal year 2001? In 1999?	\$	\$
Approximately how much new capital investment was made at this location, including facility, equipment, machinery, and information systems in fiscal year 2001? In 1999?	\$	\$

14. What percentage of your sales in fiscal year 2001 was exported to customers **outside the U.S** %

An important purpose of the study is to learn more about your use of business assistance resources.

23. In the past two years, has your facility received business assistance from: (Check all that apply.)

- Georgia Tech (main campus or regional office)***
- Other university (not Georgia Tech)
- Technical college (Georgia Department of Technical and Adult Education, Quick Start)
- Small Business Development Centers
- Federal laboratory, NASA, or other federal technology program
- Other public or non-profit business assistance source
- A private-sector business assistance source, such as a private consultant, vendor
- Another manufacturer or customer not included in the above
- Facility has not received outside assistance

24. Would your company be interested in receiving training or technical assistance in any of the following areas? (Check all that apply.)

- Product development, rapid prototyping
- Lean manufacturing, continuous flow manufacturing systems
- Set up reduction, preventive maintenance, total productive maintenance
- Constraint management, theory of constraints techniques
- Supply chain management
- Electronic commerce, Internet applications
- Internet and computer system security
- MRP II, ERP, production scheduling, inventory management, accounting software
- Barcoding
- ISO 9000, QS-9000 quality certification
- ISO 14000 environmental management certification
- Human resources development, management development, team training, change management
- Safety & health, ergonomics
- Pollution prevention
- Energy management
- General business analysis, planning
- Marketing, niche marketing, market planning
- Generating financial information for obtaining working capital or capital for new technology/equipment
- Other topics (please describe)_____

Please check box if you would like to receive information about Georgia Tech's services, seminars, and workshops.

***** IF YOU RECEIVED ASSISTANCE FROM GEORGIA TECH IN THE LAST 2 YEARS, PLEASE COMPLETE BACK PAGE**

FOR COMPANIES RECEIVING ASSISTANCE FROM GEORGIA TECH

25. What impacts have resulted, or are expected to result, from the assistance provided by Georgia Tech? (Check box.)

	Resulted (In past 2 years)	Expected (In next 2 years)	Neither
Improve an existing product or service	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Improve an existing process	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Adopted new technologies	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Improved relationships with existing customers	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Improved response to market needs and trends	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Increased sales	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Improved profitability	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Improved employee skills and know-how	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Improved management/owner skills and know-how	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Increase in employee wages	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Greater flexibility and/or team orientation of employees	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Increased productivity	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Increased attention to quality	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Greater use of computers in the company	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other impact (please describe) _____			

26. Estimate the impact of the assistance you received from Georgia Tech on the following:

APPROXIMATE TOTAL BENEFITS

Number of jobs created	Jobs
Number of jobs saved	Jobs
Increased sales	\$
Savings in labor, materials, energy, waste, and other cost savings	\$

27. How much did the Georgia Tech assistance cost your facility? (Include personnel costs, materials, travel, marketing, equipment, and other investments—not just direct fees)

APPROXIMATE TOTAL COSTS

\$

YOUR ASSISTANCE IS GREATLY APPRECIATED!

Appendix 3
Manufacturer Responses by Survey Question

1a. This facility is

Single establishment enterprise	64.3%
An affiliate of a parent group or holding company	35.7%
	100.0%
Total respondents	634

1b. If this facility is an affiliate, then

the parent group has fewer than 500 employees	30.8%
the parent group has 500-2499 employees	28.9%
the parent group has 2500 or more employees	40.2%
	99.9%
Total respondents	235

2a. Is your company's head office located in Georgia

Yes	74.6%
No	25.4%
	100.0%
Total respondents	634

2b. Head office located in

another U.S. state	79.1%
country outside of the U.S.	14.1%
	93.2%
Total respondents	150

3. Are most of your customers

Local	17.4%
Regional	26.7%
National	48.4%
International	7.4%
	99.9%
Total respondents	634

4. Your facility's main product or manufacturing activity is:

Food beverages, feed	6.6%
Textiles	10.9%
Apparel	2.6%
Lumber and wood, except furniture	8.8%
Furniture	4.4%
Paper and paper products	4.0%
Printing and publishing	9.8%
Chemicals and allied products	7.3%
Rubber and plastics	8.8%
Stone, clay, glass or concrete	8.4%
Primary metals	1.7%
Fabricated metals	12.2%
Industrial machinery	5.6%
Electrical or electronic equipment	4.1%
Transportation equipment	2.4%

Instruments	1.3%
Other (please describe)	1.1%
	100.0%
Total respondents	636

5. How many other rival firms compete with your facility for customer sales?

0-5 competitor firms	33.9%
6-19 competitor firms	34.9%
More than 20 competitor firms	31.2%
	100.0%
Total respondents	632

6. Rank order of importance of the following factors facility competition for sales (percent ranking factor #1)

Low price	27.4%
High quality	51.8%
Innovation/new technology	4.7%
Quick delivery	11.5%
Adapting product to customer needs	11.1%
Customer service that adds value to products/processes	7.0%
	113.5%

7. In which of the following areas does your facility have the most significant problems or needs?

Plant layout, expansion planning	24.0%
Manufacturing process, setup, scrap	34.4%
Product development/design	19.0%
Material failure, wear patterns and other material-related issues	8.8%
Computer hardware/network systems	10.3%
Computer software/packages for accounting, planning, order entry,	16.0%
Quality assurance	17.2%
Marketing, niche marketing, market planning	36.9%
General business analysis	16.3%
Financial planning or assistance with loan applications and fundraising	5.6%
Basic skills (e.g., reading, writing, math, keyboard skills)	10.6%
Technical skills (e.g. quality control, preventive maintenance	26.6%
Management skills, team-based improvement, problem-solving skills	26.2%
Energy costs, conservation	15.3%
Waste management	15.7%
Environmental, health and safety compliance	17.6%
Other	7.3%
Total respondents	636

8. Did your facility undergo major changes in business structure and practices 1999-2001

Ownership	11.5%
Corporate strategies	17.1%
Management techniques	10.6%
Organizational structures	25.7%
Marketing concepts or methods	19.9%
Internal or external training of personnel in innovative or new activities	11.7%
Other	3.1%
Total respondents	636

9.1a In the past 3 years, what types of improved and new products has the firm developed?

None	37.4%
Modifications or extension to existing products or product lines	51.6%
Copies of competitors' products	14.6%
Products that are new to the industry	21.6%
Total respondents	622

9.1b If the products were new,

what percentage of 2001 sales were new to the industry products?

0 - 5.0%	32.9%
5.1 - 10.0%	26.6%
10.1 - 15.0%	8.9%
15.1 - 20.0%	12.4%
20.1% +	19.2%
	100.0%
Total respondents	160

9.2 How were these products developed

Mainly by your company	44.5%
Mainly by your company in collaboration with customers	36.7%
Mainly by your company in cooperation with other companies or organizations	14.3%
Mainly by other companies or institutions	4.5%
	100.0%
Total respondents	389

9.3 Did your facility apply for any patents during 1999-2001?

No	82.7%
Yes	17.3%
	100.0%
Total respondents	388

9.3b If applied, how many patents?

0-1 patents	42.0%
2-5 patents	45.5%
6+ patents	12.5%
	100.0%
Total respondents	64

9.4 What are the plans to introduce new products or existing products with significant technical improvements

New products already are being developed	65.6%
Plan to begin development within 2 years	9.0%
No plans to develop new products	25.4%
	100.0%
Total respondents	380

10.1a During the last 3 years, did you introduce any process that was new or significantly improved to your firm

No	56.0%
Yes	44.0%
	100.0%

Total respondents 619

10.1b If the process was new or significantly improved to your firm, was it new to the industry?

No 69.0%
Yes 31.0%

100.0%

Total respondents 259

10.2 How were these processes developed

Mainly by your company 48.8%

Mainly by your company in cooperation with other companies or organizations 35.5%

Mainly by other companies or institutions 15.7%

100.0%

Total respondents 273

10.3 What are your plans to introduce new or significantly improved processes?

New or improved processes already are being developed 61.4%

Plan to start work on new or improved processes within 2 years 20.9%

No plans to develop new or improved processes 17.7%

100.0%

Total respondents 271

11. How much of a deterrent has the following been in keeping your facility from developing innovative products or processes over the past 3 years?

% High
Importance

New product/process development costs too high 26.6%

Lack of available financing 18.3%

Cost of financing too high 14.4%

Unclear whether benefits exceed costs 24.7%

Lack of long term commitment to development costs 31.1%

Organizational rigidities 11.4%

Lack of qualified personnel 20.9%

Lack of information on technology 8.9%

Lack of market information 13.9%

Lack of in-house product development systems 16.5%

No capability to sell them 9.8%

Product/process development done by another unit 8.2%

Impact of regulations or standards 10.4%

Existing customers not interested in new products 10.3%

Company not interested in new products/processes 5.4%

12.1 Which of the following types of information are available electronically at your facility?

Company and product literature 64.3%

Customer profile information 47.5%

Customer orders 66.7%

Accounts receivable/payable 73.0%

Other financial/accounting data 65.3%

Inventory of supplies 56.1%

Bids/quotes 46.4%

Order tracking 50.5%

Total respondents 589

12.2 Which of the following electronic systems do you use or plan to use?	% Use
E-mail	92.2%
Shared databases accessible thru the network	70.2%
High speed internet connection	60.8%
Electronic data interchange	40.3%
Enterprise Resource Planning for production planning	36.1%
Supply, electronic purchasing agent	24.2%

12.3 Does your company have a Web site?

Yes	73.5%
No, plan to get a Web site	12.5%
No, do not plan to get a Web site	14.0%
	100.0%
Total respondents	625

12.3b If you have a company Web site, does it do any of the following?

Provide information about your company	68.2%
Provide information about products and/or services	66.0%
Allow customers to link electronically with your company	36.3%
Allow suppliers to link electronically with your company	17.2%
Allow customers to place or request orders online	26.1%
Integrate with your back office systems	7.6%
Capture customer information	16.0%
Provide on-line customer service	14.0%
Total respondents	449

12.4a Do you require that your customers use electronic transactions?

Yes	3.3%
No	96.7%
	100.0%
Total respondents	612

12.4b Do any of your customers require that your facility use electronic transactions?

Yes	35.5%
No	64.5%
	100.0%
Total respondents	602

13a. What were your total annual sales or gross value of shipments?

	2001	1999
0 - 1,000,000	12.0%	14.0%
1,000,001 - 10,000,000	55.7%	54.7%
10,000,001 - 20,000,000	13.2%	12.3%
20,000,001 +	19.1%	19.0%
	100.0%	100.0%
Mean sales	\$ 53,706,734	\$ 22,248,952
Median sales	\$ 4,496,352	\$ 4,100,000
Sales of Top 10%	\$ 47,176,178	\$ 46,000,000
Sales of Bottom 10%	\$ 1,000,000	\$ 396,712
Mean sales/employee	\$ 283,905	\$ 119,044

Median sales/employee	\$ 125,000	\$ 850,000
Sales/employee of Top 10%	\$ 333,333	\$ 341,667
Sales/employee of Bottom 10%	\$ 57,006	\$ 50,000
Total respondents	497	474

13b. How much did you spend on materials, parts and services?

	2001	1999
0 - 1,000,000	37.2%	37.3%
1,000,001 - 10,000,000	42.4%	42.4%
10,000,001 - 20,000,000	8.7%	9.5%
20,000,001 +	11.7%	10.8%
	100.0%	100.0%
Mean spending on direct inputs	\$ 10,391,938	\$ 9,450,970
Median spending on direct inputs	\$ 2,000,000	\$ 2,000,000
Spending on direct inputs of Top 10%	\$ 23,240,297	\$ 23,600,000
Spending on direct inputs of Bottom 10%	\$ 235,000	\$ 240,000
Mean spending/employee on direct inputs	\$ 112,286	\$ 93,679
Median spending/employee on direct inputs	\$ 56,180	\$ 58,333
Spending/employee on direct inputs of Top 10%	\$ 193,735	\$ 212,140
Spending/employee on direct inputs of Bottom 10%	\$ 10,000	\$ 10,800
Total respondents	416	437

13c. How much new capital investment was made?

	2001	1999
0 - 50,000	39.6%	40.3%
50,001 - 250,000	27.6%	27.4%
250,000 +	32.8%	32.2%
	100.0%	99.9%
Mean new capital investment	\$ 795,250	\$ 912,815
Median new capital investment	\$ 100,000	\$ 100,000
New capital investment of Top 10%	\$ 1,800,000	\$ 2,000,000
New capital investment of Bottom 10%	0	0
Mean new capital investment/employee	\$ 6,482	\$ 7,507
Median new capital investment/employee	\$ 2,143	\$ 2,000
New capital investment/employee of Top 10%	\$ 16,667	\$ 12,500
New capital investment/employee of Bottom 10%	0	0
Total respondents	455	428

14. What percentage of sales in 2001 was exported outside the U.S.

0 - 1	62.0%
2 - 5	17.3%
6 +	20.7%
	100.0%
Mean percentage of sales outside the U.S.	5.1%
Median percentage of sales outside the U.S.	0%
Percentage of sales outside the U.S. of Top 10%	15%
Percentage of sales outside the U.S. of Bottom 10%	0%
Total respondents	509

15. What was the average annual return on sales over the last 3 years?

25% or more	0.7%
-------------	------

-15%	1.1%
-9%	1.6%
-6%	1.0%
-3%	4.9%
0%	7.1%
+3%	19.7%
+6%	15.6%
+9%	19.5%
+15%	19.0%
+25% or more	9.9%
	100.1%

Average return on sales - mean	7.9%
Average return on sales - median	6.0%
Average return on sales over the last 3 years of Top 10%	25.0%
Average return on sales over the last 3 years of Bottom 10%	0%
Total respondents	481

16a. Do you offer support services to your customers?

Yes	37.3%
No, plan to offer	9.5%
No, do not plan to offer.	53.1%
	99.9%
Total respondents	585

16b. If yes, does your facility charge for value-added services?

Yes	19.3%
No	80.7%
	100.0%
Total respondents	209

16c. What percentage of your annual sales is from value-added services?

0 - 2 percent	39.7%
3 - 6 percent	35.2%
7 percent +	25.1%
	100.0%
Total respondents	40

17a. Is your facility

	% Yes
ISO 9000 or QS-9000 certified	15.8%
ISO 14000 environmental management certified	2.30%

18a. How many employees worked at this location?

	2001	1999
10-20	32.1%	32.4%
21 - 100	46.6%	45.4%
101 and above	21.3%	22.2%
	100.0%	100.0%
Mean number of employees 2001	96	103
Median number of employees 2001	35	33
Number of employees of Top 10%	250	252

Number of employees of Bottom 10%	12	12
Total respondents	636	579

18c. What was total payroll in 2001?

	2001	1999
0 - 1,000,000	52.1%	54.4%
1,000,001 - 2,000,000	18.5%	16.3%
2,000,001 +	29.4%	29.3%
	100.0%	100.0%
Mean payroll 2001	\$ 3,238,154	\$ 3,217,632
Median payroll 2001	\$ 1,000,000	\$ 926,000
Payroll of Top 10%	\$ 8,300,000	\$ 8,000,000
Payroll of Bottom 10%	\$ 273,200	\$ 250,000
Mean payroll/employee 2001	\$ 30,739	\$ 29,384
Median payroll/employee 2001	\$ 28,379	\$ 26,786
Payroll/employee of Top 10%	\$ 50,704	\$ 50,000
Payroll/employee of Bottom 10%	\$ 15,000	\$ 13,333
Total respondents	412	400

19. What percentage of workers used a computer or controller machine?

0% - 10%	36.0%
11% - 50%	44.2%
51% - 100%	19.8%
	100.0%
Mean percentage of workers using computers	31.7%
Median percentage of workers using computers	20.0%
Percentage of workers using computers in Top 10%	86.7%
Percentage of workers using computers in Bottom 10%	1.5%
Total respondents	600

20a. How many persons had a 4 year college degree or higher?

0 - 1	27.8%
2 ~ 5	40.3%
6 +	31.9%
	100.0%
Mean number of workers with 4 year college degrees	8
Median number of workers with 4 year college degrees	3
Number of workers with 4 year college degrees in Top 10%	20
Number of workers with 4 year college degrees in Bottom 10%	0
Total respondents	605

20b. How many persons majored in information technology?

0 - 1	84.4%
2 ~ 5	12.4%
6 +	3.2%
	100.0%
Mean number of workers with IT degrees	1
Median number of workers with IT degrees	0
Number of workers with 4 year college degrees in IT. in Top 10%	2

Number of workers with 4 year college degrees in IT. in Bottom 10%	0
Total respondents	473

20c. How many persons majored in science or engineering (excl IT)?

0 - 1	65.0%
2 ~ 5	22.7%
6 +	12.3%
	100.0%

Mean number of workers with science or engineering degrees	14
Median numbers of workers with science or engineering degrees	1
Number of workers with 4 year college degrees in Science/Eng. in Top 10%	7
Number of workers with 4 year college degrees in Science/Eng.in Bottom 10%	0
Total respondents	504

21a. How much did the company spend on training in 2001.

\$0 - \$1,000	33.3%
\$1,001 - \$50,000	55.0%
\$50,001 +	11.7%
	100.0%

Mean spending on training	\$	820,709
Median spending on training	\$	5,000
Spending on Training of Top 10%	\$	80,000
Spending on Training of Bottom 10%		0
Mean spending/employee on training	\$	586
Median spending/employee on training	\$	80
Spending/employee on Training of Top 10%	\$	844
Spending/employee on Training of Bottom 10%		0
Total respondents		465

21b. What percentage was related to new activities and tasks?

0% - 1%	41.9%
2% - 50%	37.4%
51% - 100%	20.7%
	100.0%

Mean percentage training related to new activities	45
Median percentage training related to new activities	10
Training related to new activities - Top 10%	100
Training related to new activities - Bottom 10%	0
Total respondents	368

22a. What percentage of employees in production work are in teams?

None	53.1%
1% - 50%	23.7%
51% - 100%	23.2%
	100.0%

Mean percentage of employees in teams	27.2%
Median percentage of employees in teams	0.0%
Employees in teams - Top 10%	100.0%
Employees in teams - Bottom 10%	0.0%

Total respondents 572

22b. Are planning and qual assur. integration into employees work responsibilities?

Yes 74.8%
No 25.2%

100.0%

Total respondents 463

22c. Are all team members qualified for all tasks?

Yes 36.2%
No 63.8%

100.0%

Total respondents 425

23. Have you received assistance from

Georgia Tech 24.2%
Other university (not Georgia Tech) 7.1%
Technical College 10.0%
Small Business Development Centers 4.6%
Federal lab, NAS, or other federal technology program 1.8%
Other public or nonprofit business assistant source 3.4%
Private-sector business assistance source 18.7%
Another manufacturer or customers 11.0%
No outside assistance 30.9%
Total respondents 505

24. Is your company interested in receiving training or technical assistance in any of the following areas:

Product development, rapid prototyping 11.6%
Lean manufacturing, continuous flow 22.4%
Set up reduction, preventive maintenance 18.2%
Constraint management 5.3%
Supply chain management 5.7%
Electronic commerce, Internet applications 11.4%
Internet and compute system security 7.1%
MRP II, ERP, production scheduling, inventory management, acctg software 9.7%
Barcoding 12.6%
ISO 9000, QS-9000 quality certification 9.6%
ISO 14000 environmental management certification 4.2%
Human resources development, management development 15.8%
Safety & health, ergonomics 18.6%
Pollution prevention 7.1%
Energy management 10.7%
General business analysis, planning 14.0%
Marketing, niche marketing, market planning 20.6%
Generating financial info for obtaining capital 7.9%
Other topics 1.6%
Total respondents 349

25. Check box if you want info about GA Tech's services, seminars & workshops

Total respondents	190
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26. What impacts have resulted or are expected from GA Tech's assistance?

	% Resulted
Improve an existing product or service	28.7%
Improve an existing process	28.7%
Adopted new technologies	23.4%
Improved relationships with existing customers	18.0%
Improved response to market needs and trends	15.1%
Increased sales	12.4%
Improved profitability	34.3%
Improved employee skills and know-how	36.6%
Improved management/owner skills and know-how	46.1%
Increase in employee wages	11.3%
Greater flexibility and/or team orientation of employees	12.6%
Increased productivity	38.8%
Increased attention to quality	30.6%
Greater use of computers in the company	20.1%
Total respondents	113

26. Estimate the assistance you received from GA Tech on the following:**26a. Number of jobs created**

None	74.8%
1 - 5	13.7%
6 - 100	11.5%
	100.0%
Mean number of jobs created	4
Total number of jobs created	2,509
Total respondents	87

26b. Number of jobs saved

None	72.8%
1 - 5	14.9%
6 - 100	12.9%
	100.6%
Mean number of jobs saved	7
Total number of jobs saved	4,055
Total respondents	82

26c. Increased sales

No increase in sales	69.0%
\$1 - \$500,000	17.3%
\$500,000 and above	13.7%
	100.0%
Mean sales increase	\$ 280,660
Total sales increase	\$ 154,581,252
Total respondents	71

26d. Savings in labor, materials, energy, waste and other cost savings

No savings in labor, materials, etc.		44.1%
\$1 - \$10,000		21.0%
\$10,001 and above		34.9%
		100.0%
Mean savings	\$	54,641
Total savings	\$	29,858,329
Total respondents		71

27. How much did the GA Tech assistance cost your facility (include personnel costs, materials, travel, marketing, equip, and other - not just direct fees)?

No cost		45.5%
\$1 - \$5,000		32.5%
\$5,001 - 20,000		22.0%
		100.0%
Mean costs	\$	27,191
Total costs	\$	23,514,536
Total respondents		108