

Manufacturing Needs, Practices, and Performance in Georgia, 1999 to 2001

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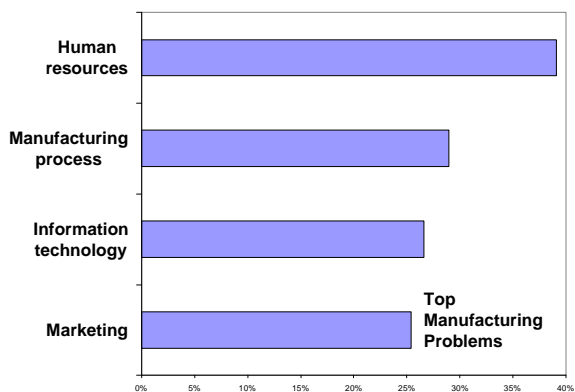
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Executive Summary

Problems and Needs

The 1999 Georgia Manufacturing Survey, cosponsored by Georgia Tech's Economic Development Institute (EDI) and its School of Public Policy, showed that human resources was the most frequently mentioned problem, though it declined in importance for the first time in 5 years. More than 700 Georgia manufacturers participated in the survey.

Manufacturing process difficulties also ranked high among manufacturers' concerns, as did market development, plant layout, and computer applications. More manufacturers indicated problems in the information technology area—hardware and business systems/software—than they did in 1996.



Technologies, Techniques

Two electronic commerce technologies—electronic mail and Web sites for information and marketing—were the most commonly used technologies noted in the 1999 survey. Use of electronic commerce tech-

nologies and techniques increased dramatically. The survey showed that 68 percent of responding manufacturers use e-mail, 59 percent have a Web site, and 22 percent engage in on-line ordering and selling. It took just one year for Web site use to go from 5 percent to 25 percent penetration in the state, compared with 7 to 12 years for manufacturing technologies such as computer-aided design or computer numerical control.

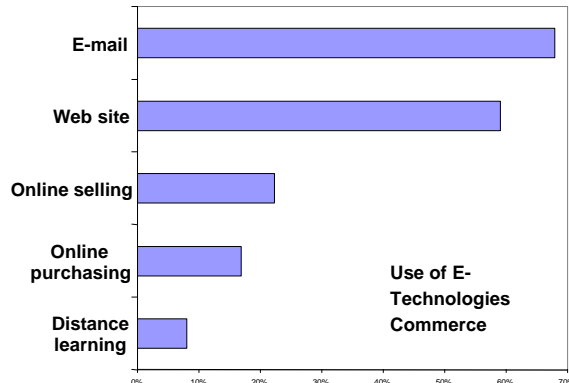
Among manufacturers with fewer than 50 employees, the numbers run less for e-commerce technologies. For example, only 19 percent of small manufacturers place orders and sell to customers compared to nearly 50 percent of large manufacturers.

Other frequently used technologies and techniques in the 1999 survey included teamwork in manufacturing planning and production; software for production planning and control of orders, scheduling, inventories (e.g., MRP II, ERP); and computer-aided design.

Manufacturing Strategies

Georgia manufacturers typically compete for customer sales first through the quality of their prod-

ucts followed by quick delivery, customer adaptation, and low price. Relatively few Georgia



firms compete primarily through innovation or new technology.

Encouraging manufacturers, especially smaller firms, to focus more on innovation is a major challenge in Georgia. Firms that invest in innovation are rewarded. Manufacturers who compete through innovation or new technology report returns on sales nearly 40 percent higher than firms competing through low prices.

Benefits to Customers

Manufacturers reported a range of benefits from being served by Georgia Tech/EDI. The most frequently reported benefits by manufacturing customers were:

- Improved management and employee skills
- Improved an existing process
- Increased attention to quality
- Improved profitability.

Section 1

Introduction: The 1999 Georgia Manufacturing Survey

The Georgia Manufacturing Survey 1999 is the third 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 1999 survey went to all Georgia manufacturing firms with 10 or more employees. More than 700 responses were received and 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
	24	Lumber and wood products
Resource industries	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 industry group and number of employees in 1999. 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—North Georgia, South Georgia, and metro Atlanta (see Figure 1).

Figure 1
Georgia Tech Regions



Section 2 Problems and Needs

This section examines problems and needs of Georgia manufacturers. Information summarized in this section is based on the question: “In which of the following areas does your facility have the most significant problems or needs?” Alternatives were designed to parallel current program services categories, with some modifications from the 1996 survey.

- The computer applications questions in 1996 were combined with automation into a category called “computer hardware/network systems”.
- A waste management category was added

As in 1994 and 1996, the human resource area was the most frequently mentioned problem area, according to the latest survey. However, the percentage of manufacturers saying that the human resources area was a significant problem area declined from 53 percent in 1996 to 39 percent in 1999. Within the human resources area, technical and supervisory skills—problems specifically relevant to modern manufacturing technologies and techniques—were more commonly mentioned than problems with basic skills. Basic skills ranked below many other problem areas. (See Table 2.1)

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

Area				Difference
	1999	1996	1994	1999-1996
Human resources problems	39%	53%	44%	-14%
Technical skills	25%	31%	n/a	-6%
Supervisory, team skills	21%	33%	n/a	-12%
Basic skills	13%	16%	n/a	-3%
Manufacturing process	29%	27%	37%	3%
Market development, exporting	25%	17%	15%	8%
Plant layout, expansion	22%	22%	25%	1%
Computer applications	27%	17%	13%	10%
Computer-based business and process systems	19%	23%	26%	-4%
Computer hardware/systems	16%			n/a
EDI, communications, LAN		n/a	10%	n/a
CAD, CAE, CAM		n/a	7%	n/a
Automation		15%	8%	n/a
Quality assurance	17%	19%	22%	-2%
Environmental, health & safety	15%	17%	29%	-3%
Product development, design	13%	13%	12%	0%
Waste management	11%			11%
General business analysis/finance	11%	12%	12%	-1%
Energy costs, conservation	10%	13%	16%	-3%
Material-related	5%	5%	10%	0%

Source: 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.

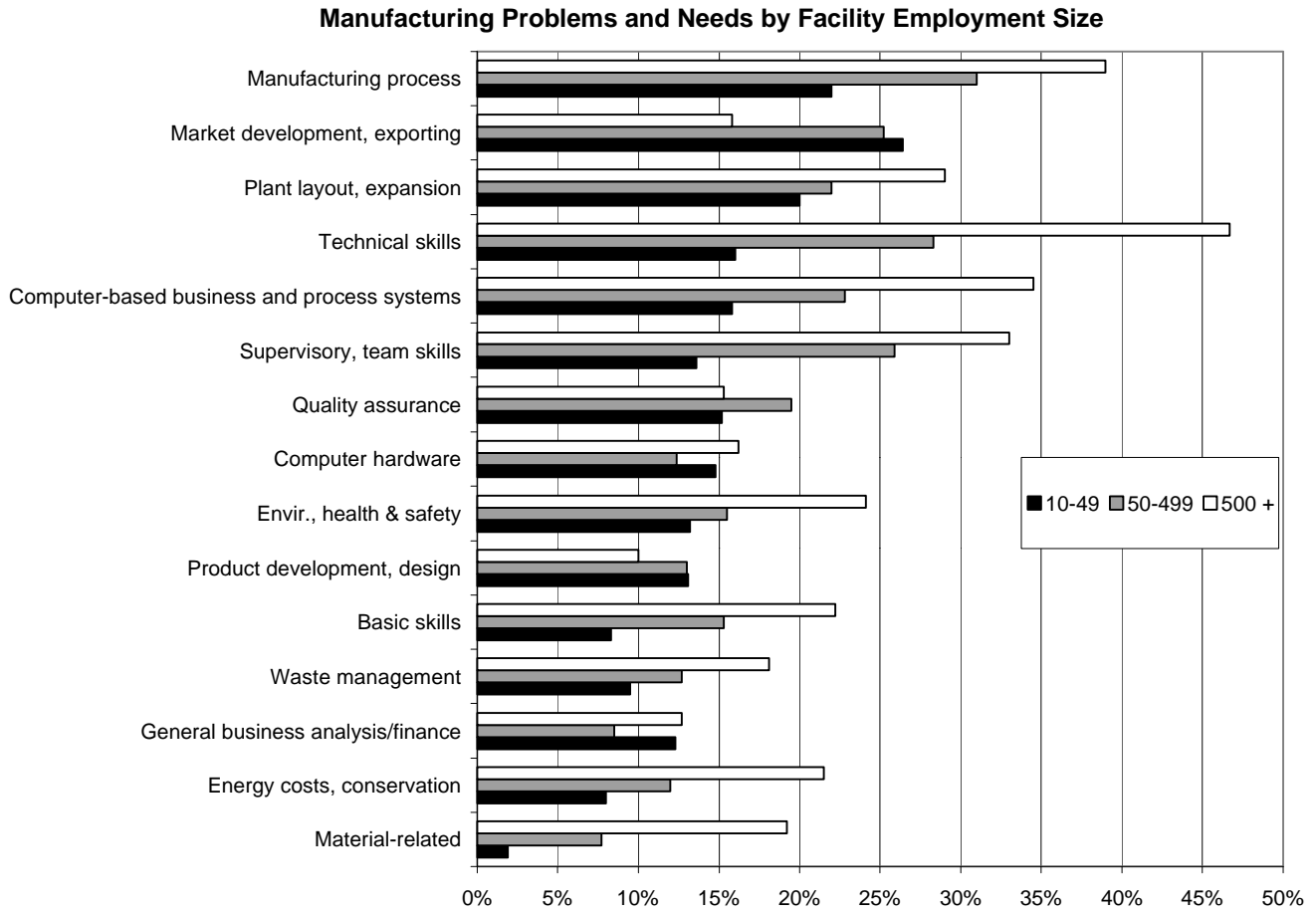
Manufacturing process difficulties also ranked high among manufacturers' problems, as did market development, plant layout, and computer applications. More manufacturers indicated problems in the computer applications—hardware and business systems/software—area than they did in 1996. Market development also ranked higher among Georgia manufacturers than it did in 1996.

Large manufacturers with 500 or more employees were more likely to report problems and needs than were small and medium-sized manufacturers in virtually all areas, with a few exceptions. Small manufacturers expressed more concern about market development and planning. Medium-sized manufacturers indicated more problems with quality assurance. (See Figure 2.)

The emphasis given to specific problems differed by industry. Market development, human resource skills (technical, supervisory, basic), environmental, health and safety, energy costs and conservation, and material-related concerns were greatest in food processing industries. Problems with manufacturing process, plant layout, technical skills, and product development were critical to machinery sectors. Basic skills figured very high in apparel and textiles firms, as did market development and exporting issues. Computer-based business and process systems were prominent among electronics and instruments manufacturers as well as were concerns about manufacturing process, market development, plant layout, quality, and product development. (See Table 2.2.)

By region, technical and basic skill problems were more critical to manufacturers in South and North Georgia. Metro Atlanta region firms were more likely to emphasize problems with plant layout and expansion, and general business analysis and finance. Environmental, health & safety was a more prominent concern to North Georgia firms. (See Table 2.3.)

Figure 2



Source: Georgia Manufacturing Survey 1999, weighted responses of 727 manufacturers.

Table 2.2
Manufacturing Problems and Needs by Industry

	Apparel/					
	Food	Textiles	Resource	Machinery	Electronics	Other
Manufacturing process	17%	20%	26%	31%	34%	27%
Market development, exporting	33%	36%	21%	19%	37%	25%
Plant layout, expansion	19%	14%	20%	27%	29%	20%
Technical skills	29%	16%	21%	27%	20%	21%
Computer-based business, process systems	10%	16%	17%	21%	43%	20%
Supervisory, team skills	27%	18%	14%	22%	26%	21%
Quality assurance	8%	14%	15%	21%	29%	17%
Computer hardware	18%	11%	14%	15%	14%	13%
Environmental, health & safety	29%	9%	18%	13%	9%	11%
Product development, design	10%	12%	11%	17%	17%	13%
Basic skills	15%	14%	10%	11%	6%	12%
Waste management	11%	14%	12%	8%	6%	13%
General business analysis/finance	12%	7%	9%	13%	20%	11%
Energy costs, conservation	19%	10%	13%	2%	9%	11%
Material-related	16%	6%	4%	1%	9%	5%

Source: Georgia Manufacturing Survey 1999, weighted responses of 727 manufacturers.

Table 2.3
Manufacturing Problems and Needs by Region

	North	Atlanta	South
Manufacturing process	28%	28%	23%
Market development, exporting	28%	24%	25%
Plant layout, expansion	19%	26%	17%
Technical skills	24%	17%	26%
Computer-based business and process systems	18%	22%	18%
Supervisory, team skills	20%	18%	19%
Quality assurance	16%	18%	16%
Computer hardware	14%	17%	11%
Environmental, health & safety	23%	9%	14%
Product development, design	12%	13%	13%
Basic skills	15%	6%	15%
Waste management	15%	9%	11%
General business analysis/finance	9%	14%	8%
Energy costs, conservation	15%	7%	11%
Material-related	6%	2%	7%

Source: Georgia Manufacturing Survey 1999, weighted responses of 727 manufacturers.

Section 3 Technologies and Techniques

Many have argued that industrial competitiveness depends more than ever on the diffusion, effective application, and further incremental improvement of known technologies. The Georgia Manufacturing Survey asked a series of questions about current and planned use of modern manufacturing technologies and techniques.

Georgia firms continue to adopt modern manufacturing technologies and techniques. Two electronic commerce technologies—electronic mail and Web sites for information and marketing—were the most commonly used technologies noted in the 1999 survey. Other notable technologies and techniques in the 1999 survey included teamwork in manufacturing planning and production; software for production planning and control of orders, scheduling, inventories (e.g., MRP II, ERP); and computer-aided design. (See Table 3.1.)

The top three technologies and techniques that manufacturers said they plan to use in the next two years were online purchasing from suppliers, online ordering and selling to customers, World Wide Web site for marketing and information, e-mail communication with customers and suppliers, software for production planning and control, and employee continuous improvement/problem solving teams. Online purchasing from suppliers and online ordering and selling to customers were particularly significant in the plans of firms not currently using these practices.

Use of electronic commerce technologies and techniques among Georgia manufacturers increased dramatically in the last two-and-a-half years. The survey shows that 68 percent of responding manufacturers use e-mail (compared to 38 percent in 1996), 59 percent have a Web site (compared to 16 percent in 1996), and 22 percent engage in online ordering and selling to customers (compared to 11 percent in 1996). The time required to diffuse electronic commerce technologies was much less than that required for design and manufacturing technologies or management practices. It took just one year for Web site use to go from 5 percent to 25 percent penetration in the state, compared with 7 to 12 years for manufacturing technologies such as computer-aided design or computer numerical control. (See Table 3.2.)

Small and medium-sized manufacturers with fewer than 500 employees were less likely than large manufacturers to use modern, off-the-shelf manufacturing technologies and methods. For example, among small manufacturers with fewer than 50 employees, usage of e-mail and Web sites are somewhat less, and are much lower for other types of e-commerce technologies. (See Table 3.3.) For example, only 19 percent of small manufacturers place orders and sell to customers compared to nearly 50 percent of large manufacturers. Differences between large manufacturers and small and medium-sized ones are also especially pronounced for CAD, software for production and control, teamwork and continuous improvement/problem-solving teams, ISO 9000/QS-9000 certification, and automated bills of materials via CAD-MRP. However, three technologies showed little difference in usage between small and large manufacturers—rapid prototyping, current or simultaneous engineering, and ISO 14000 certification—in part because their low usage levels.

By industry, electronics industries were the most frequent users of modern technologies and business practices. Food products firms ranked highly on MRP II, employee teams, CIM, and automated material handling. Doing business electronically and using data collection devices figured prominently among textile and apparel firms. Use of CAD/CAE, CAM/CAM, and NC/CNC was rather specific to firms in metals and machinery industries. (See Table 3.4).

Overall, use of modern manufacturing technologies and techniques is somewhat similar across the three Georgia Tech regions. (See Table 3.5.)

Table 3.1
Use and Planned Use of Technologies and Techniques:
 (Use as of 1999; Planned Use as of 2001)

Technologies, Techniques	USE		DO NOT USE			
	Currently Use	Plan to Expand	Do Not Currently Use	Plan to Use	Not Economically Feasible	Not Applicable
E-mail with customers, suppliers	68%	19%	32%	14%	1%	6%
World Wide Web site for marketing/information	59%	17%	41%	19%	2%	9%
Teamwork in manufacturing planning, production	57%	17%	43%	10%	4%	12%
Software for production planning and control (MRP, ERP)	51%	16%	50%	15%	8%	13%
Computer Aided Design (CAD)	48%	11%	52%	5%	8%	27%
Employee continuous improvement/problem solving teams	47%	14%	53%	16%	5%	10%
Just-in-time to customers	41%	9%	59%	9%	7%	21%
CAD product data exchange, electronic form	27%	9%	73%	10%	7%	33%
Automated bills of materials via CAD-MRP	24%	7%	76%	14%	14%	28%
Online ordering and selling to customers	22%	9%	78%	30%	6%	21%
Computer Numerical Control (CNC)	22%	6%	78%	6%	11%	41%
Product Data Management (PDM) systems	21%	6%	79%	17%	15%	24%
CAD data to create machine instructions (CAD/CAM)	17%	4%	83%	9%	11%	41%
Online purchasing from suppliers	17%	7%	83%	37%	6%	17%
ISO 9000, QS-9000 certification	17%	2%	83%	16%	17%	26%
Concurrent, simultaneous engineering	14%	3%	86%	5%	9%	43%
Cellular manufacturing	14%	4%	86%	4%	9%	45%
Automated assembly systems	12%	4%	88%	6%	16%	43%
Distance learning	8%	3%	92%	15%	15%	37%
Teleservice	8%	2%	92%	6%	13%	50%
Rapid prototyping	7%	2%	93%	4%	12%	50%
On-line supply chain management	6%	2%	94%	15%	12%	43%
ISO 14000 certification	1%	1%	99%	10%	18%	39%

Source: Georgia Manufacturing Survey 1999, weighted responses of 727 manufacturers.

Table 3.2
Dissemination of Technologies and Techniques

	% Currently Use Use (1999)	Use 2.5 Years Ago (1996)	Years from 5% to 25% Penetration
Design, Manufacturing			
MRP, ERP	51%	36%	8
CAD	48%	36%	7
CAD-MRP	24%	15%	10
CNC	22%	16%	12
Management Methods			
Teamwork--planning, produc- tion	57%	44%	12
Problem solving teams	47%	35%	9
JIT to customers	41%	32%	13
Information Technologies			
E-mail	68%	25%	4
Web site	59%	13%	1
Electronic exchange--CAD data	27%	4%	4

Source: Georgia Manufacturing Survey 1999, weighted responses of 727 manufacturers.

Table 3.3
Use and of Technologies and Techniques by Facility Employment Size
 (Percentage currently using technology/technique)

	All Respondents	Employment Size		
		10-49	50-499	500 +
Design and Manufacturing Technologies				
CAD	48%	40%	55%	94%
CNC	22%	17%	28%	30%
CAD/CAM	17%	14%	20%	30%
Software for production planning and control	51%	41%	61%	84%
Automated bills of materials via CAD-MRP	24%	20%	29%	50%
PDM	21%	15%	27%	43%
Automated assembly systems	12%	8%	16%	30%
Rapid prototyping	7%	5%	10%	8%
Information Technologies				
Electronic mail communication	68%	64%	72%	91%
Web site for information, marketing	59%	54%	64%	73%
Online ordering and selling to customers	22%	19%	25%	45%
Online purchasing from suppliers	17%	15%	16%	44%
CAD product data exchange, electronic form	27%	24%	29%	47%
Teleservice	8%	5%	9%	25%
Participate in online supply-chain mgt.	6%	2%	9%	26%
Distance learning	8%	4%	12%	29%
Management Methods				
Cellular manufacturing	14%	7%	22%	36%
Teamwork in manuf. planning, production	57%	52%	60%	86%
Employee contin. imprvt., prob. solv. teams	47%	41%	53%	82%
Just-in-time to customers	41%	37%	47%	54%
Concurrent or simultaneous engineering	14%	12%	16%	21%
ISO 9000, QS-9000 certification	17%	10%	25%	42%
ISO 14000 certification	1%	1%	2%	4%

Source: Georgia Manufacturing Survey 1999, weighted responses of 727 manufacturers.

Table 3.4
Use and of Technologies and Techniques by Industry
(Percentage currently using technology/technique)

	Apparel/					
	Food	Textiles	Resource	Machinery	Electronics	Other
Design and Manufacturing Technologies						
CAD	44%	31%	45%	73%	77%	48%
CNC	17%	15%	12%	47%	31%	24%
CAD/CAM	11%	7%	15%	33%	37%	18%
Software for production planning and control	54%	49%	51%	56%	74%	53%
Automated bills of materials via CAD-MRP	30%	18%	26%	26%	34%	28%
PDM	28%	12%	29%	18%	20%	27%
Automated assembly systems	17%	11%	13%	10%	11%	16%
Rapid prototyping	7%	5%	2%	12%	29%	8%
Information Technologies						
Electronic mail communication	72%	60%	65%	78%	91%	70%
Web site for information, marketing.	57%	55%	57%	61%	89%	62%
Online ordering and selling to customers	30%	32%	21%	21%	26%	22%
Online purchasing from suppliers	22%	14%	19%	16%	26%	17%
CAD product data exchange, electronic form	13%	13%	16%	42%	66%	34%
Teleservice	22%	2%	9%	9%	9%	6%
Participate in online supply-chain mgt.	26%	4%	6%	5%	9%	5%
Distance learning	13%	6%	11%	8%	17%	9%
Management Methods						
Cellular manufacturing	11%	14%	8%	26%	34%	19%
Teamwork in manuf. planning, production	57%	46%	59%	64%	71%	59%
Employee contin. imprvt., prob. solv. teams	48%	38%	51%	49%	69%	54%
Just-in-time to customers	39%	35%	47%	44%	40%	48%
Concurrent or simultaneous engineering	9%	9%	12%	23%	31%	14%
ISO 9000, QS-9000 certification	9%	11%	26%	16%	34%	17%
ISO 14000 certification	4%	1%	2%	1%	0%	1%

Source: Georgia Manufacturing Survey 1999, weighted responses of 727 manufacturers.

Table 3.5
Use and of Technologies and Techniques by Region
(Percentage of firms currently using technology/technique)

	All			
	Respondents	North	Atlanta	South
Design and Manufacturing Technologies				
CAD	48%	43%	48%	53%
CNC	22%	25%	23%	18%
CAD/CAM	17%	16%	18%	17%
Software for production planning and control	51%	51%	52%	49%
Automated bills of materials via CAD-MRP	24%	21%	27%	24%
PDM	21%	22%	23%	17%
Automated assembly systems	12%	13%	10%	13%
Rapid prototyping	7%	6%	10%	5%
Information Technologies				
Electronic mail communication	68%	66%	69%	69%
Web site for information, marketing.	59%	58%	62%	57%
Online ordering and selling to customers	22%	25%	17%	26%
Online purchasing from suppliers	17%	20%	14%	17%
CAD product data exchange, electronic form	27%	22%	30%	27%
Teleservice	8%	7%	5%	11%
Participate in online supply-chain mgt.	6%	6%	7%	6%
Distance learning	8%	11%	6%	8%
Management Methods				
Cellular manufacturing	14%	15%	15%	13%
Teamwork in manuf. planning, production	57%	53%	60%	56%
Employee contin. imprvt., prob. solv. teams	47%	45%	46%	51%
Just-in-time to customers	41%	40%	39%	44%
Concurrent or simultaneous engineering	14%	12%	16%	14%
ISO 9000, QS-9000 certification	17%	16%	17%	18%
ISO 14000 certification	1%	2%	1%	1%

Source: Georgia Manufacturing Survey 1999, weighted responses of 727 manufacturers.

Section 4 Manufacturing Strategy

Manufacturers may pursue a broad range of strategies in competing in the market for customer sales. The survey asked manufacturers to rank six strategies from 1 (highest importance) to 6 (lowest importance): low price, high quality, innovation/new technology, quick delivery, adapting product to customer needs, value-added customer and product services. Georgia manufacturers typically compete for customer sales first through the quality of their products. Nearly half of the respondents ranked high quality highest. Quality is followed by quick delivery, customer adaptation, and low price. Relatively few Georgia firms compete primarily through innovation or new technology. (See Figure 2.)

Strategies by Firm Characteristics

High quality was the first strategy for competing for customer sales across all facility employment size groups. Manufacturers with 500 or more employees were more likely to emphasize low price, and manufacturers with less than 500 employees were more likely to emphasize adapting to customer needs.

By industry, high quality figured most prominently among food processing industries. Low price prevailed most among apparel/textiles and resource-intensive industries. Apparel/textile firms also were most likely to mention quick delivery as an important strategy, along with machinery sectors. Machinery-related industries were also more likely to rank adapting to customer needs high among their strategies, as were electronics firms. Innovation and new technologies strategies was most common among electronic firms as well.

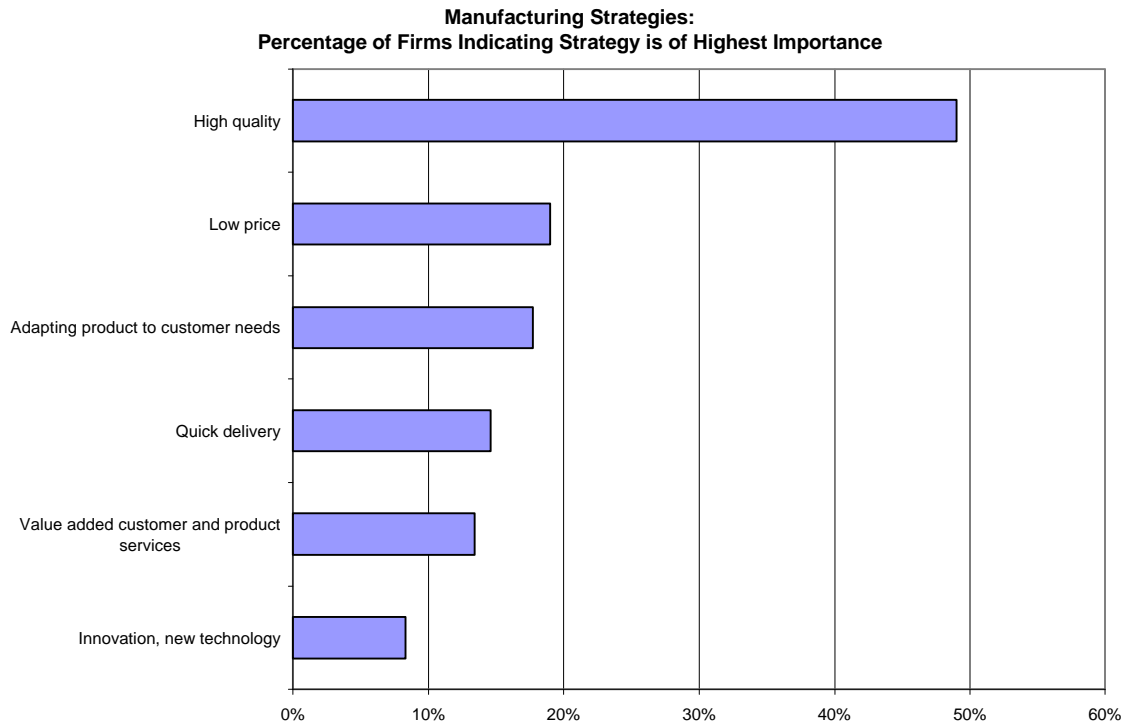
High quality was the most common primary strategy across all regions of the state. Low price was a more prominent primary strategy outside Atlanta.

Outcomes of Strategies

Firms that invest in innovation are rewarded. Manufacturers who compete through innovation or new technology report returns on sales nearly 40 percent higher than firms competing through low prices. (See Table 4.4.) Firms who compete through quick delivery also have high returns on sales. But innovation strategies not only rewards firms, it rewards employees as well. Manufacturers who compete through innovation or new technology have average wages roughly 15 percent higher than those competing primarily through low price, high quality, or quick delivery.

The bubble chart in Figure 3 illustrates these findings graphically. The sizes of the bubbles represent the percentages of Georgia manufacturers that compete primarily through the various strategies. The horizontal axis shows the average 1998 wages associated with the manufacturers and the strategies through which they primarily compete. The vertical axis shows average return on sales from 1996-1998 associated with these manufacturers and their strategies. Manufacturers who compete primarily through innovation strategies have both with higher returns on sales and higher employee wages. However, most Georgia manufacturers use strategies that are associated with low wages and lower returns on sales.

Figure 3



Source: Georgia Manufacturing Survey 1999, weighted responses of 727 manufacturers.

Table 4.1
Manufacturing Strategies by Facility Employment Size
 (Percentage of firms indicating strategy is of highest importance)

	All Respondents	Employment Size		
		10-49	50-499	500 +
High quality	49%	49%	49%	50%
Low price	19%	18%	20%	30%
Adapting product to customer needs	18%	20%	16%	9%
Quick delivery	15%	14%	13%	8%
Value added customer and product services	13%	16%	13%	15%
Innovation, new technology	8%	9%	8%	6%

Source: Georgia Manufacturing Survey 1999, weighted responses of 727 manufacturers.

Table 4.2
Manufacturing Strategies by Industry
 (percentage of firms indicating strategy is of highest importance)

	Apparel/					
	Food	Textiles	Resource	Machinery	Electronics	Other
High quality	64%	-53%	45%	48%	41%	50%
Low price	15%	24%	23%	16%	18%	14%
Adapting product to customer needs	12%	17%	15%	26%	24%	15%
Quick delivery	3%	21%	13%	18%	9%	15%
Value added customer and product services	7%	12%	16%	15%	9%	13%
Innovation, new technology	5%	4%	7%	8%	26%	10%

Source: Georgia Manufacturing Survey 1999, weighted responses of 727 manufacturers.

Table 4.3
Manufacturing Strategies by Region
 (percentage of firms indicating strategy is of highest importance)

	All Respondents	Region		
		North	Atlanta	South
High quality	49%	53%	45%	51%
Low price	19%	24%	14%	21%
Adapting product to customer needs	18%	20%	17%	17%
Quick delivery	15%	18%	14%	12%
Value added customer and product services	13%	9%	15%	15%
Innovation, new technology	8%	7%	11%	7%

Source: Georgia Manufacturing Survey 1999, weighted responses of 727 manufacturers.

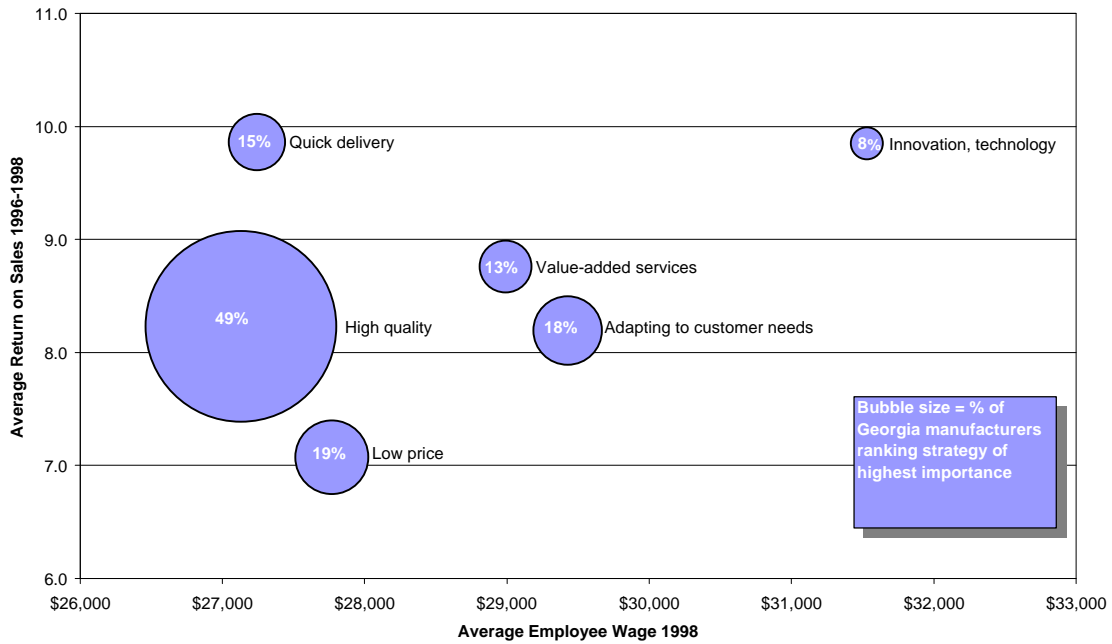
Table 4.4
Manufacturing Strategies, Average Return on Sales, and Average Employee Wage
 (Numbers shown are mean values)

Manufacturing Strategies	Average Return on Sales 1996-1999	Average Employee Wage
High quality	8.2	\$27,133
Low price	7.1	\$27,771
Value added customer and product services	8.8	\$28,992
Adapting product to customer needs	8.2	\$29,428
Quick delivery	9.9	\$27,247
Innovation, new technology	9.9	\$31,532

Source: Georgia Manufacturing Survey 1999, weighted responses of 727 manufacturers.

Figure 4

**Innovation/technology strategies yield higher returns/wages. . .
 but most Georgia companies prioritize low return/wage strategies**



Section 5

Manufacturing Performance

This section examines indicators of manufacturing performance by facility employment size, industry group, and region. First we look at operating characteristics such as timeliness, quality, and inter-firm collaboration are investigated. Next we examine workforce characteristics including use of computers, formal education, and company-provided training. The section closes with an examination of changes in key business and development outcome measures—sales, employment, average wages, and value-added per employee. Value-added per employee is a measure of productivity derived from sales less the cost of purchased materials and services per employee. All indicators are presented in terms of the top 10 percent of performers, the bottom 10 percent, and the median or 50th percentile. The absolute numbers for these indicators can be found in Appendix 3.

Operating Characteristics

Tables 5.1-5.3 shows that virtually all operating characteristics have a wide gap between the highest and lowest performance. The gap between the top 10 percent in machine utilization and the bottom 10 percent is especially substantial. Facility employment size does not necessarily explain this difference. Firms with 500 or more employees have slightly shorter delivery times and higher rates of machine utilization than do those with fewer than 50 employees, but for the most part, small and large manufacturers have similar operating characteristics.

By industry, food processing and resource-based manufacturers tend to have the shortest delivery times, times to manufacture, and percentage of on-time delivery. Electronics firms tend to have worse numbers for these time-related operating indicators. In the quality area, there is little difference among the top and median performers, but much more difference among the worst performers. The bottom 10 percent of food processing firms with respect to scrap and rework rates still have much lower rates than the bottom 10 percent of electronics firms. Apparel firms stand out on machine utilization and inter-firm cooperation measures. Apparel and textile firms with average machine utilization rates have better figures than do average performing machinery manufacturers. However, apparel and textile firms are less likely to engage in cooperative endeavors with other manufacturers than are those in other industry groups.

Workforce Characteristics

Tables 5.4-5.6 continue to show wide variations in workforce measures. For example, 10 percent of manufacturers have almost all of their workers using computers or programmable controllers on a weekly basis, whereas the lowest percent have virtually no computer usage. Likewise, for 10 percent of manufacturers, most of their workers have at least two years of industrial-related training, whereas the lowest 10 percent have no workers with industrial-related training.

Small companies tend to do better on our workforce measures, in part because most of these measures are stated in terms of percentage of employees, and smaller firms have a smaller employee base. Large companies that fall in the top 10 percent of providers of formal company training tend to provide more hours of training per employee than do their small firm counterparts.

By industry, electronics firms have the edge over other industry groups in employing workers with formal education and providing formal training. Electronics-firm employees also are more likely to use computers on a regular basis than do other industry groups. However, electronics firms in the bottom 10 percent on these measures are not much different from those in other industry groups with respect to workforce measures. Regional distributions of workforce characteristics show this same pattern, in part because most of the electronics firms are located in Atlanta.

Performance Measures

The variations in operating and workforce measures continue to be reflected in business and development outcomes. (See Table 5.7-Table 5.9.) The top 10 percent had more than three times the sales growth rates of the typical manufacturer, more than seven times the employment growth rates, more than four times the rate of increase in average wages, and more than six times the rate of increase in value-added per employee from 1996 to 1998. The worst performing firms had declines in all these measures.

By facility employment size, the typical firm with fewer than 500 employees had a higher sales growth rate than did those with 500 or more employees. Large manufacturers at either end of the average wage distribution had better average wage rate changes than did firms with fewer than 500 employees. In terms of value-added per employee, large manufacturers had better growth rates at the top end of the distribution, but worse rates at the bottom end than did firms with fewer than 500 employees.

By industry, electronics firms had better growth in virtually all performance measures than did manufacturers in other industries. The lowest performing electronics firms again were no different than those in other industries.

Issues

This section shows significant differences in operating, workforce, and outcome measures among Georgia manufacturers. Further analysis is required to determine whether manufacturers that rank highly on one measure also rank highly in others. Nevertheless, the data suggests that raising as many companies as possible closer to best or even average performance could significantly strengthen Georgia's industrial competitiveness.

Table 5.1
Operating Characteristics by Facility Employment Size

Operating Characteristics	All Respondents	Employment Size		
		10-49	50-499	500 +
<u>Delivery Time</u>				
Median	10	10	14	7
Top 10%	2	2	2	2
Bottom 10%	60	60	61	42
<u>Time to Manufacture</u>				
Median	5	5	5	5
Top 10%	1.0	1	1	1
Bottom 10%	30	30	21	36
<u>% On-time Delivery</u>				
Median	95%	95%	95%	95%
Top 10%	99%	99%	100%	99%
Bottom 10%	80%	80%	85%	85%
<u>Rework, Scrap Rate</u>				
Median	2%	2%	2%	3%
Top 10%	0.2%	0.1%	0.3%	0.4%
Bottom 10%	10%	10%	10%	11%
<u>% Machine Utilization</u>				
Median	80%	75%	82%	85%
Top 10%	95%	95%	95%	98%
Bottom 10%	1%	1%	5%	25%
<u>% Inter-firm cooperation</u>				
	64%	61%	65%	87%

Source: Georgia Manufacturing Survey 1999, weighted responses of 727 manufacturers.

Table 5.2
Operating Characteristics by Industry

Operating Characteristics	Food	Apparel/ Textiles	Resource	Machinery	Electronics	Other
<u>Delivery Time</u>						
Median	5	11	7	21	29	10
Top 10%	1	3	1	2	5	3
Bottom 10%	15	30	40	90	150	45
<u>Time to Manufacture</u>						
Median	2	7	2	14	14	4
Top 10%	1	2	1	1	4	1
Bottom 10%	10	21	20	60	45	35
<u>% On-time Delivery</u>						
Median	98%	95%	95%	90%	95%	95%
Top 10%	100%	99%	99%	99%	99%	99%
Bottom 10%	93%	85%	85%	75%	60%	80%
<u>Rework, Scrap Rate</u>						
Median	1%	2%	2%	3%	4%	1%
Top 10%	0.0%	0.4%	0.4%	0.4%	0.4%	0.4%
Bottom 10%	5%	10%	10%	15%	20%	10%
<u>% Machine Utilization</u>						
Median	80%	85%	80%	70%	80%	75%
Top 10%	97%	95%	96%	95%	98%	93%
Bottom 10%	2%	1%	2%	1%	1%	5%
<u>% Inter-firm cooperation</u>						
	63%	49%	65%	69%	68%	67%

Source: Georgia Manufacturing Survey 1999, weighted responses of 727 manufacturers.

Table 5.3
Operating Characteristics by Region

<u>Operating Characteristics</u>	All			
	Respondents	North	Atlanta	South
<u>Delivery Time</u>				
Median	10	12	10	10
Top 10%	2	2	2	2
Bottom 10%	60	52	60	60
<u>Time to Manufacture</u>				
Median	5	5	5	5
Top 10%	1.0	1	1	1
Bottom 10%	30	30	30	30
<u>% On-time Delivery</u>				
Median	95%	95%	95%	95%
Top 10%	99%	99%	99%	99%
Bottom 10%	80%	80%	80%	85%
<u>Rework, Scrap Rate</u>				
Median	2%	2%	2%	2%
Top 10%	0.2%	0.1%	0.3%	0.3%
Bottom 10%	10%	10%	15%	10%
<u>% Machine Utilization</u>				
Median	80%	80%	75%	80%
Top 10%	95%	96%	95%	95%
Bottom 10%	1%	2%	1%	1%
<u>% Inter-firm cooperation</u>				
	64%	64%	61%	67%

Source: Georgia Manufacturing Survey 1999, weighted responses of 727 manufacturers.

Table 5.4
Workforce Characteristics by Facility Employment Size

Workforce Characteristics	All Respondents	Employment Size		
		10-49	50-499	500 +
<u>% Workers Using Computers</u>				
Median	25%	25%	25%	20%
Top 10%	90%	90%	90%	70%
Bottom 10%	1%	0%	4%	3%
<u>% Workers with 4 Year Degree</u>				
Median	7%	10%	5%	5%
Top 10%	25%	25%	20%	15%
Bottom 10%	0%	0%	1%	2%
<u>% Workers - 2 Years Industrial Training</u>				
Median	10%	14%	10%	7%
Top 10%	60%	80%	40%	50%
Bottom 10%	0%	0%	2%	2%
<u>Hours of Company Training/Employee</u>				
Median	2	2	2	2
Top 10%	27	23	31	40
Bottom 10%	0	0	0	0

Source: Georgia Manufacturing Survey 1999, weighted responses of 727 manufacturers.

Table 5.5
Workforce Characteristics by Industry

Workforce Characteristics	Food	Apparel/ Textile	Resource	Machinery	Electronics	Other
<u>% Workers Using Computers</u>						
Median	20%	10%	25%	30%	75%	25%
Top 10%	100%	35%	95%	80%	100%	85%
Bottom 10%	1%	0%	1%	0%	5%	0%
<u>% Workers with 4 Year Degree</u>						
Median	5%	2%	10%	5%	18%	10%
Top 10%	20%	10%	25%	15%	70%	30%
Bottom 10%	1%	0%	0%	4%	4%	0%
<u>% Workers - 2 Years Industrial Training</u>						
Median	6%	5%	10%	15%	30%	10%
Top 10%	50%	30%	50%	80%	95%	20%
Bottom 10%	1%	0%	0%	4%	4%	0%
<u>Hours of Company Training/Employee</u>						
Median	2	1	2	1	5	3
Top 10%	23	20	30	22	40	31
Bottom 10%	0	0	0	0	0	0

Source: Georgia Manufacturing Survey 1999, weighted responses of 727 manufacturers.

Table 5.6
Workforce Characteristics by Region

	All Respondents	North	Atlanta	South
<u>% Workers Using Computers</u>				
Median	25%	20%	30%	20%
Top 10%	90%	70%	97%	80%
Bottom 10%	1%	0%	1%	2%
<u>% Workers with 4 Year Degree</u>				
Median	7%	5%	10%	5%
Top 10%	25%	20%	40%	20%
Bottom 10%	0%	0%	1%	0%
<u>% Workers - 2 Years Industrial Training</u>				
Median	10%	10%	10%	10%
Top 10%	60%	55%	80%	50%
Bottom 10%	0%	0%	0%	0%
<u>Hours of Company Training/Employee</u>				
Median	2	2	3	2
Top 10%	27	30	24	30
Bottom 10%	0	0	0	0

Source: Georgia Manufacturing Survey 1999, weighted responses of 727 manufacturers.

Table 5.7
Change in Manufacturing Performance by Facility Employment Size

	All Respondents	Employment Size		
		10-49	50-499	500 +
<u>% Change in Sales 1996-98</u>				
Median	19%	20%	18%	7%
Top 10%	73%	73%	71%	55%
Bottom 10%	-15%	-17%	-7%	-12%
<u>% Change in Employment 1996-98</u>				
Median	7%	9%	6%	0%
Top 10%	50%	50%	51%	50%
Bottom 10%	-18%	-20%	-17%	-18%
<u>% Change in Average Wage 1996-98</u>				
Median	6%	7%	6%	7%
Top 10%	29%	31%	22%	40%
Bottom 10%	-9%	-13%	-6%	0%
<u>% Change in Value-added per Employee 1996-98</u>				
Median	8%	7%	8%	11%
Top 10%	50%	48%	58%	77%
Bottom 10%	-19%	-22%	-16%	-32%

Source: Georgia Manufacturing Survey 1999, weighted responses of 727 manufacturers.

Table 5.8
Change in Manufacturing Performance by Industry

	Food	Apparel/ Textiles	Resource	Machinery	Electronics	Other
<u>% Change in Sales 1996-98</u>						
Median	11%	9%	20%	18%	52%	21%
Top 10%	80%	97%	55%	67%	119%	67%
Bottom 10%	-18%	-19%	-10%	-16%	4%	-17%
<u>% Change in Employment 1996-98</u>						
Median	3%	0%	5%	10%	25%	12%
Top 10%	50%	43%	30%	50%	82%	60%
Bottom 10%	-21%	-23%	-14%	-22%	-15%	-24%
<u>% Change in Average Wage 1996-98</u>						
Median	6%	6%	7%	6%	0%	5%
Top 10%	29%	25%	29%	30%	19%	30%
Bottom 10%	-14%	-6%	-6%	-7%	-9%	-17%
<u>% Change in Value-added per Employee 1996-98</u>						
Median	8%	8%	8%	12%	14%	3%
Top 10%	80%	45%	44%	50%	74%	37%
Bottom 10%	-42%	-8%	-14%	-18%	-16%	-30%

Source: Georgia Manufacturing Survey 1999, weighted responses of 727 manufacturers.

Table 5.9
Change in Manufacturing Performance by Region

	All Respondents	North	Atlanta	South
<u>% Change in Sales 1996-98</u>				
Median	19%	22%	20%	13%
Top 10%	73%	83%	81%	65%
Bottom 10%	-15%	-17%	-13%	-11%
<u>% Change in Employment 1996-98</u>				
Median	7%	9%	9%	6%
Top 10%	50%	31%	28%	29%
Bottom 10%	-18%	-22%	-21%	-15%
<u>% Change in Average Wage 1996-98</u>				
Median	6%	7%	6%	7%
Top 10%	29%	31%	28%	29%
Bottom 10%	-9%	-8%	-13%	-7%
<u>% Change in Value-added per Employee 1996-98</u>				
Median	8%	9%	11%	4%
Top 10%	50%	52%	50%	53%
Bottom 10%	-19%	-21%	-20%	-17%

Source: Georgia Manufacturing Survey 1999, weighted responses of 727 manufacturers.

Section 6 Who Uses Georgia Tech?

What are the characteristics of manufacturers that obtained assistance from Georgia Tech/EDI? How do these characteristics compare with the characteristics of 1) manufacturers using other assistance sources such as private sector firms and 2) those using no assistance at all? What types of assistance do manufacturers use and are interested in using in the coming years? This section will address these questions by profiling manufacturers using Georgia Tech/EDI and other providers of services.

Profile of Georgia Tech/EDI-assisted Manufacturers

Since 1996, 27 percent of the manufacturers surveyed received project-related assistance from Georgia Tech/EDI, based on Georgia Tech/EDI's internal customer activity and reporting system.² This number is comparable with estimates in the 1996 survey in which 25 percent of those firms surveyed received Georgia Tech assistance.

By employment size, Georgia Tech/EDI project assistance continued to figure more prominently among medium-sized and larger manufacturers. Of the 500+ employee firms surveyed, about 40 percent of them received assistance from Georgia Tech/EDI.³ By industry group, 40 percent of electronics manufacturers used Georgia Tech/EDI assistance in 1998. By region, a slightly higher percentage of firms in the south used Georgia Tech/EDI assistance than was the case in the north or Atlanta regions. This regional difference reflects the longer and more consistent history that Georgia Tech/EDI has had in the southern part of the state.

² A project is defined as assistance provided to a single firm or a group of firms in response to a manufacturing problem. While projects are the primary mode of assistance to firms, Georgia Tech/EDI also provides assistance in the form of "events" or short-term seminars and workshops.

³ Private sector penetration into Georgia manufacturing decreased by 5 percent since 1996. Facilities in the 10 to 49 employee category decreased their use of private sector resources from 40 percent in 1996 to 35 percent in 1998.

Table 6.1
Market Penetration of Georgia Tech/EDI
 (% Using Georgia Tech/EDI Project Assistance by Facility Characteristics)

<u>Facility Characteristics</u>	<u>Georgia Tech/EDI Project Assistance</u>	
	<u>Customers 1996</u>	<u>Customers 1998</u>
All Respondents	25%	27%
<u>Facility Employment Size</u>		
10-49	20%	19%
50-499	30%	38%
500+	44%	40%
<u>Industry</u>		
Food Products	21%	29%
Textiles, apparel	24%	27%
Resource-intensive	23%	25%
Metals, machinery	28%	27%
Electronics, instruments	35%	40%
Printing, other	23%	27%
<u>Georgia Tech Region</u>		
North	29%	26%
South	33%	30%
Metro Atlanta	18%	25%

Source: Georgia Manufacturing Survey 1998 (weighted responses of 727); and Georgia Manufacturing Survey 1996 (weighted responses of 1,002 manufacturers).

Use of Assistance Sources

Georgia Tech/EDI-assisted firms also used other assistance sources. For example, 51 percent of Georgia Tech/EDI assisted firms also used private-sector assistance sources, such as private consultants, vendors, customers, and industry associations. In the 1996 survey, 67 percent of the firms assisted by Georgia Tech/EDI also used private-sector assistance sources. This demonstrates that manufacturing firms using Georgia Tech/EDI assistance either (1) have needs that have changed in the past two years and can be met by Georgia Tech/EDI alone or (2) that Georgia Tech/EDI has diversified its services offered to the extent that firms no longer are forced to rely on assistance from sources other than Georgia Tech/EDI. In addition, 34 percent of Georgia Tech/EDI-assisted firms also used public or non-profit sources such as the Small Business Development Center/Business Outreach Services, technical institutes, the Georgia Power Company, and federal laboratories or other federal technology programs. Table 6.2 shows that of all the firms that used private sources of assistance, 33 percent of them also used Georgia Tech/EDI assistance, and 49 percent of the firms that used public or non-profit assistance also used Georgia Tech/EDI assistance.

Table 6.2
Use of Private Sector and Public Sector/Non-profit Assistance Sources by Georgia Tech/EDI Project Assistance
 (% Using Georgia Tech/EDI Project Assistance by Facility Characteristics)

	All Respondents	Georgia Tech/EDI Project Customers	
		Yes	No
Used Private Sector Provider	41%	33%	67%
Used Public Sector, Non-profit Provider*	19%	49%	51%
Neither Public/Non-profit nor Private	41%	1%	99%

*34 percent of respondents reporting they received assistance from Georgia Tech also reported using public/non-profit sources.

Source: 1999 Georgia Manufacturing Survey, weighted responses of 727 manufacturers.

Types of Assistance

Georgia Tech/EDI-assisted firms were more likely to report problems with manufacturing processes, market development, and technical skills. They were somewhat less likely to report problems with materials and waste management, a finding partially originating from the increased emphasis on environmental quality control standards (i.e. ISO 14000 certification). (See Table 6.3.)

Table 6.3
Manufacturing Problems and Needs by Georgia Tech/EDI Project Assistance

Problem/Need Area	Georgia Tech/EDI Project Customers	
	Yes	No
Manufacturing process	30%	25%
Market development, exporting	29%	24%
Plant layout, expansion	25%	20%
Technical skills	28%	20%
Computer-based business and process systems	26%	17%
Supervisory, team skills	21%	18%
Quality assurance	24%	14%
Computer hardware	17%	13%
Environ., health & safety	20%	13%
Product development, design	13%	13%
Basic skills	17%	10%
Waste management	10%	12%
General business analysis/finance	13%	10%
Energy costs, conservation	15%	9%
Material-related	4%	5%

Source: 1999 Georgia Manufacturing Survey, weighted responses of 727 manufacturers.

What types of services are manufacturers interested in receiving from Georgia Tech? The survey specifically focused on manufacturer interest in receiving training from Georgia Tech. Table 6.4

shows the lean manufacturing and set-up reduction were the most commonly reported area of interest for training from Georgia Tech. Marketing, safety and health, and human resource development were the next most common areas of interest for training from Georgia Tech.⁴

Table 6.4
Interest in Training from Georgia Tech by Facility Employment Size

Training Area	All	Facility Employment		
	Respondents	10-49	50-499	500+
Lean manufacturing	25%	19%	32%	40%
Setup reduction	23%	16%	30%	51%
Marketing, niche marketing	22%	25%	17%	13%
Human resource development	21%	14%	28%	50%
Safety & health, ergonomics	21%	15%	28%	30%
Barcoding	15%	13%	19%	24%
ISO 9000 quality certification	15%	14%	16%	9%
General business analysis	15%	16%	12%	28%
MRP II	15%	14%	16%	14%
E-commerce	14%	13%	14%	24%
Pollution prevention	11%	9%	12%	16%
Constraint management	11%	6%	15%	30%
Project management	10%	9%	12%	20%
Energy management	10%	5%	16%	27%
Supply chain management	10%	8%	12%	26%
Product development	8%	9%	7%	14%
ISO 14000 certification	5%	4%	7%	7%

Source: 1999 Georgia Manufacturing Survey, weighted responses of 727 manufacturers.

Interest in training from Georgia Tech differed by manufacturing facility employment size and industry group. Small manufacturers were more likely to be interested in receiving training from Georgia Tech in marketing than were large manufacturers. Large manufacturers showed greater interest in most of the other training areas (e.g., setup reduction, human resource development, safety & health/ergonomics, constraint management, supply chain management, barcoding, energy management, pollution prevention, MRP II, and ISO 14000). Lean manufacturing and setup reduction training figured most prominently among mid-sized manufacturers employing 50-499. By industry, greater than average interest was exhibited by: food products firms in safety and health, setup reduction, and lean manufacturing training; textiles/apparel in marketing and human resource development; resource-intensive industries in safety and health and setup reduction; metals and machinery in lean manufacturing, marketing, and human resource development; and electronics and instruments firms in lean manufacturing, MRP II, supply chain management, setup reduction, and marketing. (See Table 6.5.)

⁴ Using lean manufacturing as an example, the Table 6.4 shows that of all the firms with 10 to 49 employees, 19 percent of them desired training in lean manufacturing techniques. Similarly, 40 percent of the firms with 500 or more employees asked for lean manufacturing training.

Table 6.5
Interest in Training from Georgia Tech by Industry

Training Area	Food Products	Textiles Apparel	Resource Intensive	Metals, Machinery	Elec-tronics	Other
Lean manufacturing	38%	15%	23%	29%	37%	23%
Setup reduction	40%	9%	25%	23%	29%	23%
Marketing, niche marketing	23%	23%	17%	25%	29%	21%
Human resource development	19%	21%	17%	25%	26%	22%
Safety & health, ergonomics	41%	15%	27%	13%	20%	16%
Barcoding	27%	14%	13%	14%	26%	16%
ISO 9000 quality certification	9%	10%	13%	18%	26%	17%
General business analysis	19%	11%	12%	21%	26%	13%
MRP II	16%	10%	11%	20%	31%	16%
E-commerce	18%	15%	9%	14%	23%	16%
Pollution prevention	23%	6%	17%	6%	12%	5%
Constraint management	13%	6%	9%	11%	26%	11%
Project management	14%	7%	5%	16%	26%	10%
Energy management	24%	16%	10%	4%	6%	8%
Supply chain management	23%	7%	9%	8%	29%	7%
Product development	9%	6%	3%	14%	17%	9%
ISO 14000 certification	7%	2%	8%	2%	9%	7%

Source: 1999 Georgia Manufacturing Survey, weighted responses of 727 manufacturers.

Manufacturers also show significant interest in receiving information about Georgia Tech’s services. The survey form asked manufacturers if they would like to receive information about Georgia Tech’s services, seminars, and workshops. Thirty-eight percent of the respondents said they would like to receive such information. Of the manufacturers employing fewer than 500 workers, 38 percent said they would like information versus 34 percent of firms with 500 or more employees. We conclude that firm size was not a major determinant in making a firm say they would like information about Georgia Tech’s services. In contrast, when firms are delineated by industry, almost 50 percent of the food industry firms, 43 percent of the electronics firms, 39 percent of the resource industry firms, and 37 percent of firms in the machinery industry asked to receive information on Georgia Tech’s services.

Benefits from Georgia Tech Assistance

Seventy percent of survey respondents served by Georgia Tech/EDI experienced some benefit. Among these customers, the most frequently reported intermediate benefits were (See Table 6.6.):

- improved an existing process
- improved management skills
- improved employee skills
- increased quality
- improved profitability.

Manufacturers were more likely to report that they actually received know-how-related benefits such as improved management and employee skills. In contrast, they were more likely to expect to receive quantitative benefits such as profitability and sales.

Forty-five percent of EDI customers of projects in the survey provided estimates of returns and investments from Georgia Tech/EDI. (See Table 6.7.) Over the survey period, customers reported median added sales of \$400,000, median added cost savings of \$50,000, and median job impacts of 2 jobs. Total impacts experienced by Georgia Tech/EDI customers of projects were nearly \$14 million in increased sales, more than \$4 million in cost savings, and 43 new jobs.

A few Georgia Tech assisted customers gained substantial benefits. Three EDI customers of projects had added sales of more than \$1 million. Cost savings of \$1 million were reported by one EDI project customer. Two EDI customers invested more than \$1 million into their projects.

Table 6.6
Qualitative Benefits from Georgia Tech Assistance

Benefit Area	<u>Customer of EDI</u>		
	% Resulted in past 2 yrs	% Expected in next 2 yrs	% Neither
Improved management/owner skills and know-how	47%	16%	37%
Improved employee skills and know-how	45%	18%	37%
Improved an existing process	43%	26%	31%
Increased attention to quality	32%	22%	46%
Improved profitability	26%	28%	46%
Increased productivity	25%	29%	46%
Improved an existing product or service	23%	17%	61%
Improved relationships with existing customers	20%	12%	69%
Greater flexibility and/or team orientation of employees	17%	10%	73%
Adopted new technologies	17%	14%	69%
Improved response to market needs and trends	17%	15%	68%
Greater use of computers in the company	16%	12%	72%
Increased sales	12%	22%	66%
Increase in employee wages	9%	3%	88%

Table 6.7
Quantitative Benefits from Georgia Tech Assistance

	<u>Customer of EDI</u>	
	Median	Sum
Increased sales (\$000)	\$400	\$13,690
Labor, materials, energy, waste, other savings (\$000)	\$50	\$4,182
Jobs created or saved	2	43
Total Costs/Investment (\$000)	20	\$5,467

Appendix 1

Survey Framework, Questionnaire Design, and Administration

Survey Framework

The aim of the survey was to contact individuals at all identifiable manufacturing facilities—establishments—with 10 or more employees in 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 facilities, we compiled a list of Georgia establishments from Dun & Bradstreet's Market Place database and EDI's internal activity and reporting system. We then called manufacturers to update contact information.

Questionnaire Design

The questionnaire was designed to parallel the 1996 Georgia Manufacturing Survey and to enable comparisons with a similar survey conducted 1999 in Germany by the Fraunhofer Institute for Systems and Innovations Research. [Comparative results from this international benchmarking will be available in 2000]. The questionnaire included items asking about manufacturers' problems, needs, use of hard and soft technologies, production and management practices and strategies, business linkages, performance measures, the use of public and private industrial assistance services, and impacts on manufacturers served by the Georgia Tech's Economic Development Institute.

Once a draft questionnaire and cover letter had been designed, we conducted a declared pretest of three manufacturers who served on the EDI quality services advisory board. We received indepth comments about individual item wording. Along with extensive program management and staff review, these comments were incorporated into a final version, presented in Appendix 1.

Administration

The survey was conducted from April, 1999 to November, 1999. A packet containing a questionnaire, letter from the Georgia MEP director, and self-addressed, postage-paid envelope was mailed to 6,424 manufacturing establishments. A second follow-up mailing went to all non-respondents. Each regional office was assigned a minimum of 20 manufacturers to call and solicit responses. Researchers made more than one thousand focused telephone calls to encourage responses from manufacturers that had participated in the 1996 survey and from manufacturers in certain underrepresented regions and industry groups of the state.

The response to the survey was as follows:

Companies in initial database	6,424
Returned undelivered, out of business	428
Not a manufacturer	91
Outside of state	168
Declared refusals	16
Non-respondents	4,966
Completed survey forms	<u>755</u>
Response rate	13.2%

The response rate was calculated by dividing the number of completed survey forms by the total number of manufacturing establishments, in business, in the target population (manufacturers with 10 or more employees).

To evaluate the representativeness of the survey responses, Table 1.1 compares them to Georgia Department of Labor information. Smaller establishments with fewer than 20 employees and those in food and kindred products and printing and publishing/miscellaneous industries are most noticeably underrepresented in the sample. Because of the importance of scale and product characteristics in determining firm behavior such as technology use, we have stratified the sample by industry and establishment size and applied an expansion weight.⁵ The Georgia Department of Labor database of 5,551 establishments was used to calculate these weights. Note that the Table 1.1 has a total survey response of 660. This total excludes survey forms from companies with fewer than 10 employees, and companies with missing employment and industry information.

⁵ 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 (1998) vs. Survey Respondents**

<u>Industry</u>	<u>GA Dept. of Labor 1998</u>		<u>Georgia Survey</u>	
	<u># estab.</u>	<u>% estab.</u>	<u># estab.</u>	<u>% estab.</u>
Food and kindred products and tobacco	373	6.7%	44	6.7%
Textile mill products, apparel and textile products	835	15.0%	84	12.7%
Lumber and wood products, Furniture and fixtures, Paper and allied products, Chemicals and allied products, Stone, clay, glass and kindred products	1,811	32.6%	158	23.9%
Primary metal industries, Fabricated metal industries, Industrial machinery and equipment, Transportation equipment	1,162	20.9%	151	22.9%
Electronics and other electrical equipment, Instruments and other related products	294	5.3%	35	5.3%
Printing, publishing, and allied products, Petroleum refining and related industries, Rubber and miscellaneous plastic products, Leather and leather products, Miscellaneous manufacturing industries	<u>1,076</u>	<u>19.4%</u>	<u>188</u>	<u>28.5%</u>
Total	5,551	100.0%	660	100.0%
<u>Number of employees</u>				
10-19	1,728	31.1%	122	18.5%
20-99	2,552	46.0%	321	48.6%
100+	<u>1,271</u>	<u>22.9%</u>	<u>217</u>	<u>32.9%</u>
	5,551	100.0%	660	100.0%

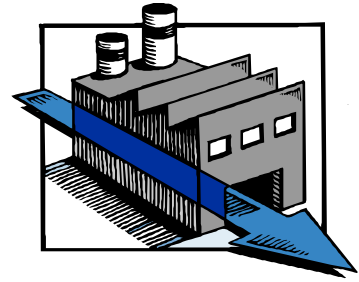
Refusal to participate in the study is not the only type of non-response. Some respondents preferred not to answer one or more of the items on the questionnaire. Inter-item response rates are presented on each table. In many cases, the response rates neared or exceeded 90 percent, but for a few questions, response rates were below 70 percent. What these item response rates mean is unclear. For example, the 76 percent rate for payroll may reflect a preference not to disclose this information, whereas the 85 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.

Appendix 3 contains a breakdown of survey responses for every question on the survey form. Percentages of general managers answering each question, and 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 1999



- Survey questions refer to this facility.
- All individual firm and facility information will be kept confidential.
- 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 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
P.O. Box 7340
Atlanta, Georgia 30357-9936
Tel: 404/894-6111 • Fax: 404/894-0069
E-mail: jan.youtie@edi.gatech.edu

Please confirm your name and address and make any changes.

THANK YOU FOR YOUR HELP.

1. 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, CPU, communications, computer networks)
- Computer-based business and process systems (e.g., accounting, order entry, scheduling, inventory, CAD/CAM, barcoding, electronic commerce)
- Quality assurance (e.g., ISO 9000, QS-9000, Malcolm Baldrige)
- Marketing, niche marketing, market planning, exporting
- General business analysis, planning
- 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) _____

PRODUCTS AND PRODUCTION

2. The main product or product group manufactured at this facility is: (Please check one box.)

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

3. a. Which of the following categories best describes how this main product or product group is produced at your facility?

(Please check one box.)

- New parts or products made one at a time to individual order
- New parts or products made in small production runs (less than 20 pieces a month)
- New parts or products made in medium production runs (20 to 1,000 pieces a month)
- New parts or products made in large production runs (more than 1,000 pieces a month)
- Process materials
- Remanufacture or refurbish old machines or parts

b. Once your facility receives customer orders, how does your production system respond? (Please check one box.)

- Full production on receipt of customer's order
- Pre-fabrication of stored parts, final assembly on receipt of customer's orders
- Shipped to customer from pre-made inventory
- Other

4. Does your facility use the following manufacturing technologies and techniques?
 If use, please indicate the year use began, and check box if you plan to expand use to other areas in next 2 years.
 If not use, please indicate whether you plan to use it in the next 2 years. If not, check why not.

	<u>Use</u>			<u>Not use</u>			
	Currently use	Year use began	Plan to expand use	Do not currently use	Plan to use	Do not plan to use— not economically feasible	Do not plan to use— not applicable
<u>Design And Manufacturing Technologies</u>							
CAD (computer-aided design)	<input type="checkbox"/> → 19__	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> →	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
CNC controlled machines	<input type="checkbox"/> → 19__	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> →	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
CAD data to create machine instructions (CAD/CAM)	<input type="checkbox"/> → 19__	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> →	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Software for production planning and control of orders, scheduling, inventories (e.g., MRP II, ERP)	<input type="checkbox"/> → 19__	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> →	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Automated bills of materials via CAD-MRP	<input type="checkbox"/> → 19__	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> →	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Product data management (PDM) systems to integrate product, process, and management data	<input type="checkbox"/> → 19__	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> →	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Automated assembly systems	<input type="checkbox"/> → 19__	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> →	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Rapid prototyping	<input type="checkbox"/> → 19__	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> →	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<u>Information Technologies</u>							
Electronic mail communication with customers or suppliers	<input type="checkbox"/> → 19__	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> →	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Worldwide web site for information and marketing	<input type="checkbox"/> → 19__	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> →	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Online ordering and selling (electronic commerce) to customers	<input type="checkbox"/> → 19__	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> →	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Online purchasing from suppliers	<input type="checkbox"/> → 19__	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> →	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
CAD product data exchange in electronic form with other firms (e.g., via disk or internet)	<input type="checkbox"/> → 19__	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> →	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Teleservice – electronic monitoring by vendor of your installed machinery and equipment (to aid maintenance, ensure uptime)	<input type="checkbox"/> → 19__	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> →	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Participate in online supply-chain management (e.g., electronic sharing and integration of production schedules)	<input type="checkbox"/> → 19__	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> →	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Distance learning (e.g., satellite delivery of training, video conferencing)	<input type="checkbox"/> → 19__	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> →	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<u>Management Methods</u>							
Cellular manufacturing	<input type="checkbox"/> → 19__	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> →	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Teamwork in manufacturing planning and production	<input type="checkbox"/> → 19__	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> →	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Employee continuous improvement and problem-solving teams	<input type="checkbox"/> → 19__	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> →	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Just-in-time (JIT) to customers	<input type="checkbox"/> → 19__	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> →	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Concurrent or simultaneous engineering	<input type="checkbox"/> → 19__	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> →	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
ISO 9000, QS-9000 certification	<input type="checkbox"/> → 19__	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> →	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
ISO 14000 environmental management certification	<input type="checkbox"/> → 19__	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> →	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

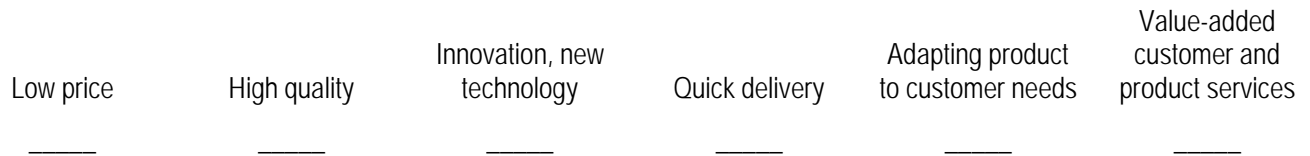
Continued

5. For the main product or product group at this facility, please describe the following characteristics of a typical order.

Average number of calendar days between receipt of customer's order and delivery (delivery time)	Calendar days
Percentage of orders delivered on schedule	%
Time needed to manufacture—average number of calendar days between production start and end (lead time), assuming all materials are available.	Calendar days
Percentage of products made in your facility that have to be re-worked as a result of quality control or scrapped due to errors	%
Machine utilization time—Attended running hours less time for setups, maintenance, repair, and failure <u>as a percent</u> of regular working hours.	%

COMPETITIVE STRATEGY

6. For the plant's main product or product group, please RANK the order of importance of the following factors in how you compete in the market for customer sales? 1 = Highest importance; 6 = Lowest importance. (Please do not give the same ranking to more than one factor.)



7. How important are the following to improve your plant's competitiveness?

	Very important	Important	Less important	Not important
Strategies				
Development of new or improvement of existing products	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Complementing products with value-added services (e.g., training of Customer staff, maintenance)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Improvements in marketing and selling	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Improvements in manufacturing processes	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Methods				
Investments in new machinery and plant equipment	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Investments in information technology systems	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Organizational strategies (team-based manufacturing)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Personnel strategies (workforce training, cross-training, pay-for-Skills)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

8. Do you offer value-added services to your customers such as training for your product, software development for your product, maintenance of your products, arrangement of financing, or other services?

- Yes
- No, plan to offer
- No, do not plan to offer

If yes, approximately what percentage of your annual sales is from value-added services. (If you don't charge customers for value-added services, enter "0")

_____ %

9. a. In the past 3 years, have you introduced new products or existing products that contained significant technical improvements (e.g., use of new materials or improvements in function, performance or operation, not changes to details.)?
- No** **Yes** What percentage of total plant sales did these products have last year (1998)? _____ %
- How long does it take on average to develop a new product, from conception to commercialization? _____ Months
- b. Were any of these new products new to the market?
- No** **Yes** What percentage of total plant sales did these products have last year (1998)? _____ %

MANUFACTURING PRODUCTIVITY AND PERFORMANCE

10. One important characteristic in assessing changes in Georgia manufacturing is value-added per employee, which is used as a measure of productivity. It is obtained from sales revenue less the total cost of purchased materials and services. If you don't know the approximate number, just give an estimate. All estimates should be for this facility.

	1998	1996
What were your total annual sales or gross value of shipments at this plant in fiscal year 1998? In 1996?	\$ _____	\$ _____
Approximately how much did you spend at this location on purchased materials, parts, and services in fiscal year 1998? In 1996?	\$ _____	\$ _____

11. Please estimate the following performance indicators for your facility.
- a. Approximate inventory turns per year (annual sales divided by value of inventory typically on hand) _____
- b. Approximate number of months required to recover investments in manufacturing equipment _____ (Months)
- c. Approximate number of product lines produced at this facility _____
- d. Approximate average annual return on sales (pre-tax) for this plant over the last three years (Circle the number closest to your facility's return on sales.)

	Negative return					Positive return				
-25% or more	-15%	-9%	-6%	-3%	0%	+3%	+6%	+9%	+15%	+25% or more

WORKFORCE AND TRAINING

12. Now, we would like to ask a few questions about your work force. If you don't know exact numbers, just give an estimate.

	1998	1996
On average, how many employees worked at this location? (Include temporary workers and convert part-time and contract labor to full-time equivalents.)	Full-Time Equivalent Employees	Full-Time Equivalent Employees
What was your total payroll at this location in fiscal year 1998? In 1996? (Please include direct payroll plus indirect fringe benefit payroll expenses. Include payments to agencies for temporary workers.)	Payroll \$ _____	Payroll \$ _____

13. Approximately what percentages of the employees at this facility have:

University or college (four year) degrees _____%

2 or more years of industrial-related training, through any combination of apprenticeship, technical college or vocational school, or formal training provided by your company, outside trainers, or another firm _____%

14. In total, approximately how many hours of formal training was provided to employees in fiscal year 1998? _____

15. Approximately what percent of employees at this location used a computer or programmable machine controller at least once a week as part of their job? _____%

16. If you have introduced teamwork into the production process:

		Yes	No
What percentage of employees in production work are in teams?	%	<input type="checkbox"/>	<input type="checkbox"/>
How many employees work in a production team on average?		<input type="checkbox"/>	<input type="checkbox"/>

AN IMPORTANT PART OF UNDERSTANDING MANUFACTURING PRACTICES CONCERNS THE RELATIONSHIP BETWEEN COMPANIES AND THEIR MARKETS. WE WOULD LIKE TO ASK SOME QUESTIONS ABOUT THESE RELATIONSHIPS.

17. Please estimate what percentage of your materials is purchased from the following locations. Also estimate what percentage of your shipments go to the following locations.

	Sources of purchased materials	Shipments of products
Georgia	%	%
Elsewhere in the United States	%	%
Canada	%	%
Europe	%	%
Mexico, Central and South America	%	%
East Asia	%	%
Elsewhere in the world	_____%	_____%
Total	100%	100%

18. Does your establishment cooperate with other firms in any of the following business areas?

If yes, please indicate the type of partner.

If no, please indicate your plans for future cooperation. (Check boxes to indicate answers.)

	Yes			No			Why not		
	Currently cooperate	Types of Partners Local National Global			Do not currently cooperate	Plan to start in next 2 years	Negative experiences	No suitable partners	Not needed
<u>Business Areas</u>									
Marketing/sales (e.g., through trade shows)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Bids on contracts	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Training with other firms	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Cooperative purchasing or shared benefits	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Quality or continuous improvement groups	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Providing customers value-added services	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Product development, process improvement or research cooperation with customers	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Product development, process improvement, or research cooperation with suppliers	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

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

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

- Georgia Tech (main campus or regional office)
- A public or non-profit business assistance source, such as a federal, state, or local government program, university (not Georgia Tech), technical institute, utility, technology transfer or training center
- A private-sector business assistance source, such as a private consultant, vendor, customer, or other private source
- Facility has not received outside assistance

20. Would your company be interested in receiving training from Georgia Tech on any of the following? (Check all that apply.)

- 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 to supply chain management
- 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
- General business analysis, planning
- Marketing, niche marketing, market planning
- Product development, rapid prototyping
- Energy management
- Project management
- Other topics (please describe) _____

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

FOR COMPANIES RECEIVING ASSISTANCE PROVIDED BY GEORGIA TECH

21. a. 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
Improved an existing product or service	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Improved 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"/>
Other (please describe) _____			

b. What impacts on your employees/managers 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
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 on staff (please describe) _____			

c. As a direct result of the assistance received from Georgia Tech, has there been any impact on the number of people your company employs? Please enter numbers. *If no employment effects resulted or are expected, please enter "0."*

	FULL TIME EQUIVALENT JOBS	
	RESULTED (IN PAST 2 YEARS)	EXPECTED (IN NEXT 2 YEARS)
Number of jobs created		
Number of employees that your company would have been forced to lay off		
Number of jobs eliminated		

22. a. Considering all the benefits from Georgia Tech assistance you identified in Question 21, but not the costs, what is your estimate of the dollar value, to date, of the following:

	APPROXIMATE TOTAL BENEFITS
Increased sales	\$ _____
Savings in labor, materials, energy, waste, and other cost savings	\$ _____

b. What has been the approximate total costs of your facility's involvement in the project(s)? (Total costs include personnel costs, materials, travel, marketing, equipment, and other project-associated investments.)

APPROXIMATE TOTAL COSTS
\$ _____

Your assistance is greatly appreciated!

Appendix 3
Manufacturer Responses by Survey Question

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

90.3% or 662 firms responding

Manufacturing process	26.3%
Market development, exporting	25.4%
Plant layout, expansion	22.3%
Technical skills	22.0%
Computer-based business and process systems	19.2%
Supervisory, team skills	19.1%
Quality assurance	16.8%
Computer hardware	15.7%
Envir., health & safety	14.5%
Product development, design	12.9%
Basic skills	11.5%
Waste management	11.1%
General business analysis/finance	10.9%
Energy costs, conservation	10.2%
Material-related	4.9%

2. The main product or product group manufactured at this facility is:

98.8% or 718 firms responding

Food, beverages, feed	6.8%
Textiles	10.7%
Apparel	4.2%
Lumber and wood, except furniture	6.2%
Furniture	2.3%
Paper and paper products	5.4%
Printing and publishing	3.7%
Chemicals and allied products	10.9%
Rubber and plastics	5.1%
Stone, clay, glass, or concrete	7.8%
Primary metals	0.6%
Fabricated metals	13.2%
Industrial machinery	4.4%
Electrical or electronic equipment	4.3%
Transportation equipment	2.3%
Instruments	1.1%
Other (please describe)	10.8%

3. a. Which of the following categories best describes how this main product or product group is produced at your facility? (Please check one box.)

98% or 713 firms responding

New parts or products made one at a time to individual order	22.8%
New parts or products made in small production runs (less than 20 pieces a month)	4.1%
New parts or products made in medium production runs (20 to 1,000 pieces a month)	20.2%
New parts or products made in large production runs (more than 1,000 pieces a month)	29.2%
Process materials	22.5%
Remanufacture or refurbish old machines or parts	1.2%

b. Once your facility receives customer orders, how does your production system respond?

99.1% or 719 firms responding

Full production on receipt of customer's order	63.5%
Pre-fabrication of stored parts, final assembly on receipt of customer's orders	9.5%
Shipped to customer from pre-made inventory	19.4%
Other	7.6%

4. Does your facility use the following manufacturing technologies and techniques? If use, please indicate the year use began, and check box if you plan to expand use to other areas in next two years. If not use, please indicate whether you plan to use it in the next 2 years. If not, check why not.

	USE		DO NOT USE			
	Currently Use	Plan to Expand	Do Not Currently Use	Plan to Use	Not Economically Feasible	Not Applicable
<u>DESIGN AND MANUFACTURING</u>						
CAD (computer-aided design)	48.0%	10.7%	52.0%	5.0%	8.1%	27.4%
CNC controlled machines	21.8%	5.8%	78.2%	5.8%	11.2%	41.0%
CAD data to create machine instructions (CAD/CAM)	17.2%	4.3%	82.8%	9.2%	10.9%	41.4%
Software for production planning and control of orders, scheduling, inventories (e.g., MRP II, ERP)	50.5%	15.5%	49.5%	14.5%	7.5%	12.7%
Automated bills of materials through CAD-MRP	24.4%	7.2%	75.6%	14.2%	13.5%	27.5%
Product data management (PDM) systems to integrate product, process, and management data	20.8%	6.4%	79.2%	16.5%	14.6%	23.7%
Automated assembly systems	12.0%	3.8%	88.0%	5.8%	15.5%	43.2%
Rapid prototyping	6.9%	1.7%	93.1%	3.5%	12.3%	50.3%
<u>INFORMATION TECHNOLOGIES</u>						
Electronic mail communication with customers or suppliers	67.9%	19.2%	32.1%	14.2%	1.2%	6.1%
Worldwide web site for information and marketing	59.0%	16.7%	41.0%	18.6%	2.2%	8.6%
Online ordering and selling (electronic commerce) to customers	22.3%	9.1%	77.7%	30.4%	6.4%	20.8%
Online purchasing from suppliers	16.8%	6.9%	83.2%	36.9%	6.2%	17.4%
CAD product exchange in electronic form with other firms (e.g., via disk or internet)	26.6%	8.8%	73.4%	10.0%	7.3%	33.4%
Teleservice--electronic monitoring by vendor of your installed machinery and equipment (to aid (maintenance, ensure uptime)	7.7%	2.3%	92.3%	5.7%	13.1%	49.6%
Participate in online supply-chain mgt. (e.g., electronic sharing and integration of production schedules)	6.1%	2.0%	93.9%	15.0%	12.2%	43.4%
Distance learning (e.g., satellite delivery of training, video conferencing)	8.0%	2.7%	92.0%	14.7%	14.8%	37.4%

MANAGEMENT METHODS

Cellular manufacturing	14.2%	4.3%	85.8%	4.0%	9.0%	45.2%
Teamwork in manufacturing planning and production	56.6%	17.3%	43.4%	10.4%	4.1%	12.0%
Employee continuous improvement and problem-solving teams	47.3%	14.3%	52.7%	15.9%	5.3%	10.3%
Just-in-time (JIT) to customers	41.1%	8.5%	58.9%	8.9%	6.5%	20.5%
Concurrent or simultaneous engineering	14.3%	3.0%	85.7%	5.0%	8.7%	42.9%
ISO 9000, QS-9000 certification	16.7%	1.8%	83.3%	16.3%	17.2%	26.4%
ISO 14000 environmental mgt. certific.	1.3%	0.7%	98.7%	10.3%	18.2%	38.5%

4. (continued) Year use of technologies and techniques first began.

	Percentiles					Mean	% firms responding	% use but year % do	
	25	50	75	95	missing			not use	
Design and Manufacturing Technologies									
CAD	1990	1994	1996	1998	1992.6	72.6	5.2	24.6	
CNC	1988	1992	1996	1999	1990.8	59.0	3.2	37.2	
CAD/CAM	1990	1994	1996	1999	1992.9	59.3	2.5	42.0	
Software for production planning and control	1990	1993	1997	1999	1992.0	87.6	5.2	36.8	
Automated bills of materials via CAD-MRP	1990	1995	1998	1999	1992.7	72.6	3.7	48.2	
PDM	1990	1995	1997	1999	1993.4	76.3	2.0	55.5	
Automated assembly systems	1985	1993	1996	1999	1990.0	56.8	2.0	44.8	
Rapid prototyping	1986	1993	1997	1998	1989.9	49.4	0.5	42.6	
Information Technologies									
Electronic mail communication	1996	1997	1998	1999	1996.6	93.8	7.1	26.0	
Worldwide web site for information, mkting.	1997	1998	1998	1999	1997.4	91.5	6.6	32.4	
Online ordering and selling to customers	1997	1998	1998	1999	1997.1	79.2	4.3	56.9	
Online purchasing from suppliers	1997	1998	1998	1999	1997.4	82.6	2.3	65.9	
CAD product data exchange, electronic form	1995	1997	1998	1999	1996.2	66.6	3.0	40.0	
Teleservice	1995	1996	1997	1999	1995.6	50.4	0.4	42.7	
Participate in online supply-chain mgt.	1996	1997	1998	1999	1996.8	56.7	0.6	50.5	
Distance learning	1995	1997	1998	1999	1996.0	62.6	0.7	54.6	
Management Methods									
Cellular manufacturing	1991	1995	1997	1999	1992.8	54.4	0.8	40.2	
Teamwork in manuf. planning, production	1989	1993	1996	1998	1990.7	87.7	7.9	31.0	
Employee contin. imprvt., prob. solv. teams	1990	1994	1997	1999	1991.4	89.7	7.0	42.4	
Just-in-time to customers	1989	1993	1996	1998	1990.8	79.5	4.5	38.4	
Concurrent or simultaneous engineering	1987	1991	1996	1998	1989.1	56.7	2.8	42.4	
ISO 9000, QS-9000 certification	1995	1997	1998	1999	1996.5	73.4	1.4	56.7	
ISO 14000 environmental mgt. Certification	1997	1998	1998	1999	1996.6	61.5	0.0	60.2	

5. For the main product or product group at this facility, please describe the following characteristics of a typical order.

Average number of calendar days between receipt of customer's order and delivery (delivery time)

95.1% or 693 firms responding

percentiles	in 1998
5%	1
25%	4
50%	10
75%	26
Mean	24.1

Percentage of orders delivered on schedule

95.4% or 699 firms responding

percentiles	in 1998
25%	90
50%	95
75%	98
95%	100
Mean	91.9

Time needed to manufacture—average number of calendar days between production start and end (lead time), assuming all materials are available.

93.6% or 684 firms responding

percentiles	in 1998
5%	1
25%	2
50%	5
75%	14
Mean	13.1

Percentage of products made in your facility that have to be re-worked as a result of quality control or scrapped due to errors

94.1% or 687 firms responding

percentiles	in 1998
5%	0.005
25%	1
50%	2
75%	5
Mean	4.2

Machine utilization time—Attended running hours less time for setups, maintenance, repair, and failure as a percent of regular working hours.

99.8% or 725 firms responding

percentiles	in 1998
25%	20

50%	75
75%	90
95%	98
Mean	59.0

**6. For the plant's main product or product group, please RANK the order of importance of the following factors in how you compete in the market for customer sales?
1 = Highest importance; 6 = Lowest importance.**

		Mean Rank	% Ranking 1	% Ranking 1 or 2	% Ranking 6
High quality	95.2% or 695 firms responding	1.92	46.6	75.1	0.9
Quick delivery	94.4% or 701 firms responding	3.00	13.8	41.6	4.1
Adapting product to customer needs	93.9% or 693 firms responding	3.28	16.6	35.4	7.7
Low price	94.5% or 696 firms responding	3.53	18	36	23.5
Value added customer and product services	94.0% or 692 firms responding	3.76	12.6	25.7	14.6
Innovation, new technology	94.1% or 692 firms responding	4.47	7.8	16.2	36.3

7. How important are the following to improve your plant's competitiveness?

	% Not Important	% Less Important	% Important	% Very Important
<i>Strategies</i>				
Improvements in manufacturing processes <i>96% or 707 firms responding</i>	1.9	10.4	41.5	46.2
Development of new or improvement of existing products <i>96.6% or 705 firms responding</i>	4.7	13.9	35.7	45.8
Improvements in marketing and selling <i>95.8% or 703 firms responding</i>	5.6	13.4	44.7	36.3
Complementing products with value-added services (e.g., training of Customer staff, maintenance) <i>96.2% or 705 firms responding</i>	12.1	30.7	36.2	21.1
<i>Methods</i>				
Investments in new machinery and plant equipment <i>96.5% or 707 firms responding</i>	2.7	20.4	45.2	31.7
Personnel strategies (workforce training, cross-training) <i>96.4% or 706 firms responding</i>	5.1	17.8	48.5	28.6
Investments in information technology systems <i>96.4% or 706 firms responding</i>	7.2	33.5	39.1	20.1
Organizational strategies (team-based manufacturing) <i>96.3% or 706 firms responding</i>	7.9	33.1	40.7	18.3

8. Do you offer value-added services to your customers such as training for your product, software development for your product, maintenance of your products, arrangement of financing, or other services?

96% or 701 firms responding

Yes	39.1%
No, plan to offer	11.5%
No, do not plan to offer	49.4%

If yes, approximately what percentage of your annual sales is from value-added services. (If you don't charge customers for value-added services, enter "0")

37.1% or 285 firms responding

percentiles	in 1998
25%	0.0
50%	0.0
75%	5.0
95%	50.0
Mean	7.9

9. a. In the past 3 years, have you introduced new products or existing products that contained significant technical improvements (e.g., use of new materials or improvements in function, performance or operation, not changes to details.)?

95.1% or 697 firms responding

No	46.5%
Yes	53.5%

What percentage of total plant sales did these products have last year (1998)?

49.1% or 373 firms responding

percentiles	in 1998
25%	5.0
50%	15.0
75%	30.0
95%	90.0
Mean	24.1

How long does it take on average to develop a new product, from conception to commercialization?

46.6% or 351 firms responding

percentiles	in 1998
25%	1.0
50%	4.0
75%	8.0
95%	12.0
Mean	10.8

b. Were any of these new products new to the market?

90.8% or 669 firms responding

No	68.1%
Yes	31.9%

What percentage of total plant sales did these products have last year (1998)?

30.4% or 221 firms responding

percentiles	in 1998
25%	5.0
50%	10.0
75%	20.0
95%	90.0
Mean	18.4

10a. What were your total annual sales or gross value of shipments at this plant in fiscal year 1998? In 1996?

1998 83.7% or 613 firms responding
1996 78.4% or 571 firms responding

Percentiles	1998 sales	1996 sales	change 1996-1998	% change 1996-1998
25	2,000,000	1,506,000	0	0.0
50	5,000,000	4,100,000	600,000	18.2
75	19,680,000	15,000,000	2,433,669	37.5
95	100,000,000	95,000,000	15,000,000	114.3
Mean	21,858,904	19,519,286	2,789,771	33.0

10b. Approximately how much did you spend at this location on purchased materials, parts, and services in fiscal year 1998? In 1996?

1998 77.7% or 569 firms responding
1996 70.9% or 517 firms responding

Percentiles	1998 purchased inputs	1996 purchased inputs	change 1996-1998	% change 1996-1998
25	750,000	600,000	0	0.0
50	2,190,469	2,000,000	200,000	16.1
75	10,000,000	8,000,000	1,100,000	43.2
95	49,723,258	53,121,992	8,000,000	114.3
Mean	12,458,421	12,049,002	1,065,145	36.7

11. Please estimate the following performance indicators for your facility.

a. Approximate inventory turns per year (annual sales divided by value of inventory typically on hand) <i>78.4% or 584 firms responding</i>	percentiles	in 1998
	25%	5.0
	50%	10.0
	75%	16.0
	95%	60.0
	5% Trimmed Mean	12.2
b. Approximate number of months required to recover investments in manufacturing equipment <i>76.1% or 563 firms responding</i>	percentiles	in 1998
	25%	15.0
	50%	24.0
	75%	36.0
	95%	65.0
	Mean	30.6
c. Approximate number of product lines produced at this facility <i>81.6% or 601 firms responding</i>	percentiles	in 1998
	25%	2.0
	50%	5.0
	75%	12.0
	95%	150.0
	Mean	45.7
d. Approximate average annual return on sales (pre-tax) for this plant over the last three years (Circle the number closest to your facility's return on sales.) <i>84% firms or 614 responding</i>	percentiles	in 1998
	25%	3.0
	50%	9.0
	75%	15.0
	95%	25.0
	Mean	7.8

12a. On average, how many employees worked at this location? (Include temporary workers and convert part-time and contract labor to full-time equivalents)

1998 *94.9% or 694 firms responding*
1996 *90.1% or 656 firms responding*

Percentiles	1998 employees	1996 employees	change 1996-1998	% change 1996-1998
25	17	15	-2	-3.7
50	40	35	2	7.7
75	90	80	9	25.0
95	450	475	50	82.4
Mean	109.7	102.1	7.5	18.5

12b. What was your total payroll at this location in fiscal year 1998? In 1996? (Please include direct payroll plus indirect fringe benefit payroll expenses. Include payments to agencies for temporary workers)

1998 76.3% or 550 firms responding
 1996 72.1% or 515 firms responding

Percentiles	1998 payroll	1996 payroll	change 1996-1998	% change 1996-1998
25	450,000	370,000	22,000	3.4
50	1,018,098	895,000	120,000	13.6
75	2,300,000	2,092,169	385,000	33.3
95	15,000,000	14,500,000	1,885,382	107.7
Mean	3,200,122.9	2,907,709.6	363,315.2	27.1

13. Approximately what percentages of the employees at this facility have...

University or college (four year) degrees	percentiles	in 1998
<i>97.4% or 707 firms responding</i>	25%	2.0
	50%	7.0
	75%	15.0
	95%	40.0
	Mean	11.0

2 or more years of industrial-related training	percentiles	in 1998
<i>93.2% or 675 firms responding</i>	25%	4.0
	50%	10.0
	75%	25.0
	95%	85.0
	Mean	20.5

14. In total, approximately how many hours of formal training was provided to employees in fiscal year 1998?

<i>85.4% or 619 firms responding</i>	percentiles	in 1998
	25%	10.0
	50%	95.0
	75%	450.0
	95%	5100.0
	Mean	1408.0

15. Approximately what percent of employees at this location used a computer or programmable machine controller at least once a week as part of their job?

95.7% or 695 firms responding

percentiles	in 1998
25%	9.0
50%	25.0
75%	50.0
95%	100.0
Mean	33.0

16. If you have introduced teamwork into the production process:

What percentage of employees in production work are in teams?

72.6% or 535 firms responding

percentiles	in 1998
25%	10.0
50%	50.0
75%	100.0
95%	100.0
Mean	52.7

How many employees work in a production team on average?

68% or 499 firms responding

percentiles	in 1998
25%	3.0
50%	5.0
75%	10.0
95%	72.0
Mean	15.3

Are planning and quality assurance tasks integrated into the employees' work responsibilities?

76% or 565 firms responding

Are all team members qualified for all tasks?

72.5% or 539 firms responding

Yes	No
82.6%	17.4%
37.9%	62.1%

17. Please estimate what percentage of your materials is purchased from the following locations. Also estimate what percentage of your shipments go to the following locations.

Sources of Purchased Materials

	Percentiles					% firms responding
	25%	50%	75%	95%	Mean	
Georgia	10	40	80	100	44.9	95.7%
Elsewhere in the United States	17	50	80	95	48.3	95.7%
Canada	0	0	0	5	0.87	95.7%
Europe	0	0	0	10	2.1	95.5%
Mexico, Central and South America	0	0	0	5	0.73	95.7%
East Asia	0	0	0	10	2.1	95.7%
Elsewhere in the world	0	0	0	5	0.99	95.7%

Shipments of Products

	Percentiles					% firms responding
	25%	50%	75%	95%	Mean	
Georgia	5	20	75	100	38.7	96.0%
Elsewhere in the United States	20	60	80	95	53.8	96.0%
Canada	0	0	1	10	1.5	96.0%
Europe	0	0	0	10	1.9	96.0%
Mexico, Central and South America	0	0	0.3	10	1.8	96.0%
East Asia	0	0	0	5	0.9	96.0%
Elsewhere in the world	0	0	0	7	1.2	96.2%

18. Does your establishment cooperate with other firms in any of the following business areas?

If yes, please indicate the type of partner.

If no, please indicate your plans for future cooperation. (Check boxes to indicate answers.)

Business Areas	YES			NO					
	Currently Cooperate	Types of Partners			Do Not Currently Cooperate	Plan to start in Next 2 years	Why Not Negative Experiences	No Suitable Partners	Not Needed
		Local	National	Global					
Marketing/sales (e.g., through trade shows)	43.1%	12.5%	28.5%	10.7%	56.9%	2.4%	1.3%	8.2%	24.8%
Bids on contracts	24.0%	10.2%	12.9%	5.3%	76.0%	0.6%	1.3%	9.7%	41.0%
Training with other firms	19.8%	8.9%	9.9%	2.9%	80.2%	2.5%	1.5%	12.8%	37.6%
Cooperative purchasing or shared benefits	16.8%	6.6%	9.0%	2.6%	83.2%	2.5%	1.1%	15.0%	38.4%
Quality or continuous improvement groups	21.9%	7.9%	11.2%	3.5%	78.1%	4.1%	1.1%	16.4%	30.7%
Providing customers value-added services	28.7%	9.9%	16.1%	5.7%	71.3%	3.0%	1.0%	11.9%	30.5%
Product development, process improvement or research cooperation with customers	38.7%	11.3%	24.4%	9.6%	61.3%	2.9%	1.4%	10.2%	25.0%
Product development, process improvement, or research cooperation with suppliers	44.3%	11.0%	30.6%	9.0%	55.7%	3.0%	1.2%	9.5%	21.0%

19. In the past two years, has your facility received business assistance from:

86.4% or 636 firms responding

Georgia Tech (main campus or regional office)	27.0%
A public or non-profit business assistance source, such as a federal, state, or local government program, university (not Georgia Tech), technical institute, utility, technology transfer or training center	19.1%
A private-sector business assistance source, such as a private consultant, vendor, or other private source	41.2%
Facility has not received outside assistance	28.8%

20. Would your company be interested in receiving training from Georgia Tech on any of the following? (Check all that apply.)

65% or 488 firms responding

a. Lean manufacturing, continuous flow manufacturing systems	24.8%
b. Set up reduction, preventive maintenance, total productive maintenance	22.9%
c. Constraint management, theory of constraints techniques	10.5%
d. Supply chain management	10.1%
e. Electronic commerce, Internet applications to supply chain management	13.7%
f. MRP II, ERP, production scheduling, inventory management, accounting software	14.9%
g. Barcoding	15.4%
h. ISO 9000, QS-9000 quality certification	14.6%
i. ISO 14000 environmental management certification	5.4%
j. Human resources development, management development, team training, change management	20.6%
k. Safety & health, ergonomics	20.5%
l. Pollution prevention	10.7%
m. General business analysis, planning	15.0%
n. Marketing, niche marketing, market planning	21.5%
o. Product development, rapid prototyping	8.1%
p. Energy management	10.0%
q. Project management	10.4%
r. Other topics (please describe)_____	3.4%
s. Please check box if you would like to receive information about Georgia Tech's services, seminars, and work-shops.	37.7%

21. a. What impacts have resulted, or are expected to result, from the assistance provided by Georgia Tech?

	%	%	%
	Resulted in past 2 yrs	Expected in next 2 yrs	Neither
Improved an existing product or service <i>10.9% or 79 firms responding</i>	22.8%	16.5%	60.8%
Improved an existing process <i>12.1% or 88 firms responding</i>	43.2%	26.1%	30.7%
Adopted new technologies <i>10.7% or 78 firms responding</i>	16.7%	14.1%	69.2%
Improved relationships with existing customers <i>10.6% or 77 firms responding</i>	19.5%	11.7%	68.8%
Improved response to market needs and trends <i>10.7% or 78 firms responding</i>	16.7%	15.4%	67.9%
Increased sales <i>10.5% or 76 firms responding</i>	11.8%	22.4%	65.8%
Improved profitability <i>11.0% or 80 firms responding</i>	26.3%	27.5%	46.3%

b. What impacts on your employees/managers have resulted, or are expected to result, from the assistance provided by Georgia Tech?

	%	%	%
	Resulted in past 2 yrs	Expected in next 2 yrs	Neither
Improved employee skills and know-how <i>11.4% or 83 firms responding</i>	44.6%	18.1%	37.3%
Improved management/owner skills and know-how <i>12.0% or 87 firms responding</i>	47.1%	16.1%	36.8%
Increase in employee wages <i>10.5% or 76 firms responding</i>	9.2%	2.6%	88.2%
Greater flexibility and/or team orientation of employees <i>10.6% or 77 firms responding</i>	16.9%	10.4%	72.7%
Increased productivity <i>12.0% or 87 firms responding</i>	25.3%	28.7%	46.0%
Increased attention to quality <i>11.2% or 82 firms responding</i>	31.7%	22.0%	46.3%
Greater use of computers in the company <i>10.3% or 75 firms responding</i>	16.0%	12.0%	72.0%

c. As a direct result of the assistance received from Georgia Tech, has there been any impact on the number of people your company employs? Please enter numbers

		Full-Time Equivalent Employees	
		Resulted in	Expected in
		past 2 yrs	next 2 yrs
Percentiles			
Number of jobs created <i>2.3% or 17 firms responding</i>	25%	1.5	2
	50%	2	5
	75%	7	10
	95%	10	150
	Sum	68	251

		Full-Time Equivalent Employees	
		Resulted in	Expected in
		past 2 yrs	next 2 yrs
Percentiles			
Number of employees you would have been forced to lay off <i>.3% or 2 firms responding</i>	25%	2	10
	50%	4	10
	75%	6	10
	95%	6	10
	Sum	8	10

		Full-Time Equivalent Employees	
		Resulted in	Expected in
		past 2 yrs	next 2 yrs
Percentiles			
Number of jobs eliminated <i>.4% or 3 firms responding</i>	25%	3	5
	50%	17	8
	75%	30	20
	95%	30	20
	Sum	33	33

22. a. Considering all the benefits from Georgia Tech assistance you identified in Question 21, but not the costs, what is your estimate of the dollar value, to date, of the following:

b. What has been the approximate total costs of your facility's involvement in the project(s)? (Total costs include personnel costs, materials, travel, marketing, equipment, and other project-associated investments.)

	Percentiles				
	25	50	75	95	Sum
Increased sales <i>2.5% or 19 firms responding</i>	200,000	400,000	2,000,000	20,800,000	13,689,548
Savings in labor, materials, energy, waste, and other cost savings <i>4.5% or 33 firms responding</i>	15,000	50,000	100,000	825,000	4,182,011
Total Costs <i>9.1% or 66 firms responding</i>	5,000	20,000	71,250	412,500	5,466,900