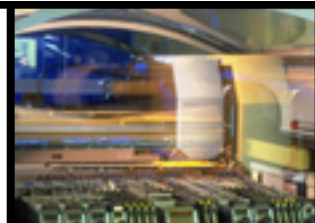




Innovation in Manufacturing:

The 2005 Georgia Manufacturing Survey



Program in Science, Technology and Innovation Policy

Economic Development and Technology Ventures

School of Public Policy, Ivan Allen College



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Findings

Georgia Tech Helps Georgia Manufacturers Compete in the Global Economy

One of the many ways Georgia Tech maintains its association with Georgia industry is through the Georgia Manufacturing Survey (GMS), which began in 1994 and is conducted every two to three years.

The purpose of the survey is to benchmark the use of modern manufacturing technology, practices and techniques, then to provide information to state agencies and business assistance sources throughout Georgia. The ultimate goal is to help Georgia manufacturers compete, improve their profitability and create jobs for Georgians.

This latest survey is one more step in Georgia Tech's ongoing effort to inform and assist Georgia manufacturers and decision-makers. When Georgia industry excels, so does the state's economy.

Focus on Innovation

Innovation is the theme for the 2005 GMS because innovation plays a key role in helping manufacturers achieve and sustain competitiveness in a global market.

Business strategy and new product development are innovation methods explored in the survey, but there are other ways to innovate. The 2005 GMS examines four general types of innovation, then looks at the extent to which Georgia manufacturers use these practices.

The survey also addresses other areas critical to manufacturing success, including information technology, manufacturing productivity and performance, workforce and training, and the use of business assistance resources.

Innovation—More than half of Georgia manufacturers made changes in either products or services during the past two years. Benefits typically realized from these innovations were increased capacity, greater quality, increased variety of offerings and greater responsiveness to customers.

Innovation Methods—Small manufacturers tend to use more informal innovation methods compared with larger manufacturers who tend toward more formalized methods, such as supplier engagement on product, process or service activities.

Strategies—Twenty percent of Georgia manufacturers choose low price as their chief strategy for competing. Fewer than 8 percent compete using strategies of innovation or new technology.

Profitability—From 2002 to 2005, the average margins widened between manufacturers that compete primarily on low price and those that compete on innovation. In 2005, manufacturers competing primarily through low price reported margins 2.5 percentage points lower than manufacturers competing primarily through innovation. In 2002, the two were separated by only a half of a percentage point.

Outsourcing—Eighteen percent of Georgia manufacturers were impacted by outsourcing during the last two years. Twelve percent gained work through in-sourcing.

Vulnerability—More than 23 percent of manufacturers competing on low price reported work that was outsourced compared with 14 percent of manufacturers competing on innovation.

Energy—Just over 19 percent of Georgia manufacturers expressed worries about energy costs and conservation, an increase from 15 percent in 2002.

Basic Skills—There was a dramatic rise in the concerns of Georgia manufacturers about basic skills, with 26 percent noting this as a concern in 2005, compared with 11 percent in 2002.

Training—Expenditures for training remained low, with 20 percent of Georgia manufacturers in 2004 reporting no expenditures for training.

Assistance—Manufacturers assisted by Georgia Tech experienced an almost \$10,000 value-added increase per employee between 2002 and 2004.

Strategies

Manufacturers Prioritize Strategies

As part of the GMS, manufacturers were asked to rank six strategies based on their importance in competing for sales. The strategies were low price, high quality, innovation/new technology, quick delivery, adapting to customer needs and value-added customer and product services.

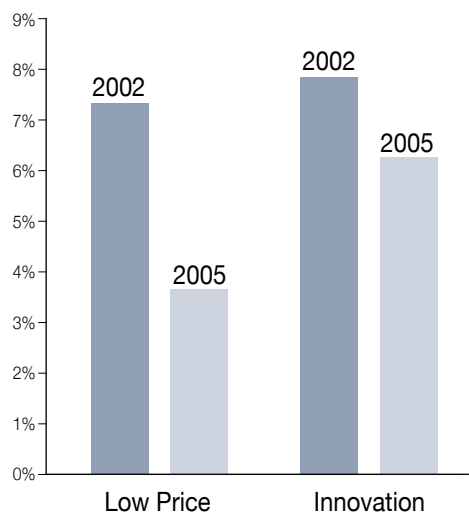
Strategy Preferences

- **Quality of service**—Strategy used by more than half of Georgia manufacturers.
- **Low price**—Twenty percent of manufacturers.
- **Adapting to customer needs**—Fourteen percent of manufacturers use this strategy.
- **Quick delivery**—Preferred strategy of 12 percent of manufacturers.
- **Value-added services**—The strategy used by 10 percent of manufacturers.
- **Innovation/new technology**—Fewer than 8 percent of Georgia manufacturers use this strategy.

Across all six strategies, results revealed that high-quality and innovation strategies were associated with the highest mean return on sales—well over 6 percent. Low-price and customization strategies were linked to the lowest mean return on sales of less than 4 percent. Quick delivery and value-added services strategies brought margins in the 5 percent range.

Profits Decline for Firms Competing on Low Price

Average Return on Sales for Manufacturers Competing Primarily Through Low Price vs. Innovation, 2002 vs. 2005



Source: Georgia Manufacturing Survey 2005, weighted responses of 639 manufacturers.

Meet the Authors

Jan Youtie and Philip Shapira

Dr. Jan Youtie and Professor Philip Shapira are co-directors of the 2005 GMS. Youtie is a principal research associate in Georgia Tech's Office of Economic Development and Technology Ventures and an adjunct associate professor in Georgia Tech's School of Public Policy. She specializes in applied research in economic development and manufacturing modernization.

Shapira is a professor in Georgia Tech's School of Public Policy. In addition to teaching, he conducts research on technology and innovation processes and policy, economic and regional development, and industrial competitiveness.

Research assistance was provided by Public Policy graduate students John Slanina, Jue Wang, Jingjing Zhang, Nooshin Ahangar-Mahalia, Ajay Bhaskarabhatla, Erin Lamos and Uttam Malani.

"I was most surprised by the significant rise in concerns about basic skills in the Georgia workforce in 2005.

Basic skills problems could act as a drag on the ability of our firms to continue to operate in today's environment, let alone to innovate."

—Jan Youtie

"We found that Georgia firms that emphasize innovation produce high returns both to themselves and to their workers and communities. The



problem is that too few Georgia firms focus on innovation. Firms, industry associations, universities, and state and local policymakers all need to be involved in new efforts to

stimulate many more of our small, mid-size and larger industrial enterprises to invest in the innovative strategies that will help them not only to survive, but also to grow."

—Philip Shapira



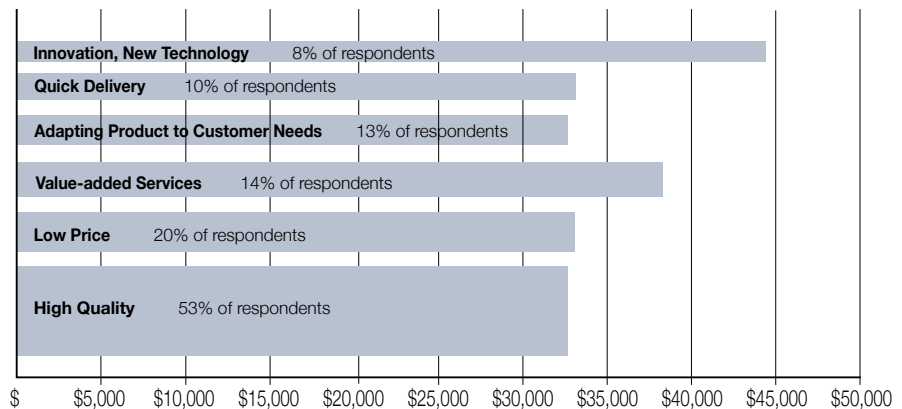


Strategies continued—

Manufacturers that compete primarily using innovation strategies have relatively high returns on sales and higher employee wages. Most Georgia manufacturers, however, use strategies associated with low wages.

Higher Returns in the Community Linked to Innovation Strategy

Average Manufacturing Wages By Percentage of Respondents Ranking Strategies Highest in 2005



Source: Georgia Manufacturing Survey 2005, weighted responses of 639 manufacturers.

Nearly half of survey respondents introduced a new or significantly improved product during the 2002-to-2004 period.

About the Survey

■ 650 Georgia Manufacturers with 10 or more employees participated in the survey.

■ Results were weighted by industry and employment size to represent the population.

■ Industry groupings were as follows:

Food/Textiles ranges from food, feed and beverages to leather and apparel. **Material** encompasses industries in wood, pulp and paper, plastics, and non-metallic minerals. **Machinery** also includes fabricated metals, and **Electronics/Transportation** covers electrical appliances. And **Science** comprises industries from petroleum to chemicals to medical supplies.

Manufacturers in food/textile/apparel/leather are most likely to compete using low price as their primary strategy. The highest percentage of respondents competing on innovation and technology operates in the electronics/electrical/transportation arena. Across all industries, most use high quality as their primary sales strategy. The strategy least likely deployed across all industries is innovation.

Most Manufacturers Focus on Quality and Price

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

Strategy	Food/ Textiles	Material	Machinery	Electronics/ Transportation	Science
High quality	50%	53%	51%	54%	58%
Low price	28%	17%	20%	20%	14%
Adapting product to customer needs	14%	14%	17%	10%	18%
Quick delivery	12%	14%	14%	11%	6%
Value-added customer service	7%	13%	6%	7%	18%
Innovation, new technology	2%	7%	8%	18%	12%

Source: Georgia Manufacturing Survey 2005, weighted responses of 639 manufacturers.

Innovation

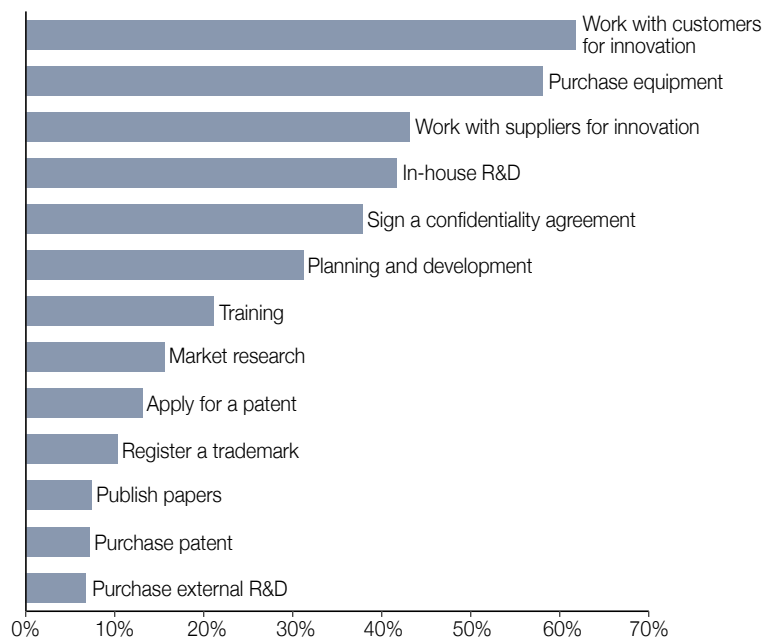
Creation and Dissemination of New Knowledge

When manufacturers were asked to indicate the extent to which their plant undertook any of 13 innovation-related activities during the 2002-to-2004 period, the most common innovations were: (1) working with customers to create or design a product, process or other innovation; and (2) purchasing machinery, equipment, computers or software to implement innovations.

The least common innovation activities undertaken were: (1) purchasing research and development from research organizations or other branches of the company; (2) purchasing or licensing patents, inventions, know-how or other types of knowledge; and (3) publishing papers or technical articles.

Firms Find Diverse Ways to Innovate

Adoption of Specialized Innovation Activities
(Percentage of establishments that engaged in the activity)



Source: Georgia Manufacturing Survey 2005, weighted responses of 494 manufacturers.

How Georgia Manufacturers Innovate

Nearly half of survey respondents introduced a new or significantly improved product during the 2002-to-2004 period. Seventeen percent introduced a new or significantly improved service. Larger manufacturers were more likely to introduce new goods, while smaller manufacturers were more likely to introduce new services. Nearly one-third of respondents introduced a new-to-the-market product in the 2002-to-2004 period.

Four Types of Innovation

Product Innovation

Technologically new products or significantly improved existing products

Process Innovation

Technologically new or significantly improved practices, technologies or delivery

Organizational Innovation

New or significant changes in manufacturer's structure, management methods or information exchange systems

Marketing Innovation

New or significant changes to packaging, sales methods or distribution channels



Innovation continued—

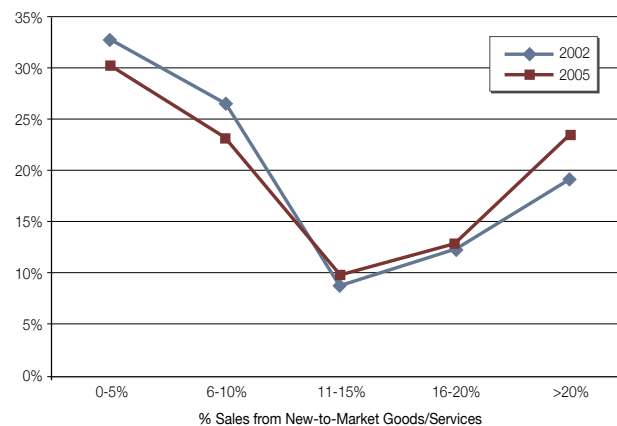
The typical manufacturer that introduced new-to-the-market goods or services reported that these goods and services accounted for nearly 20 percent of sales. And nearly 12 percent of respondents with new-to-the-market products or services said these offerings composed half of their sales.

The percentage of sales from new-to-the-market goods and services is about the same as it was in 2002, with the following exception: The number of manufacturers reporting more than one-fifth of sales from new-to-the-market products is higher in the 2005 survey than in the 2002 survey.

In 2002, the GMS found that innovation was limited mostly by financial considerations. But in 2005, lack of qualified personnel also ranked high along with financial considerations.

New-to-Market Sales Reflect Modest Gains

Percentage of Sales From New-to-Market Goods/Services, 2002 vs. 2005



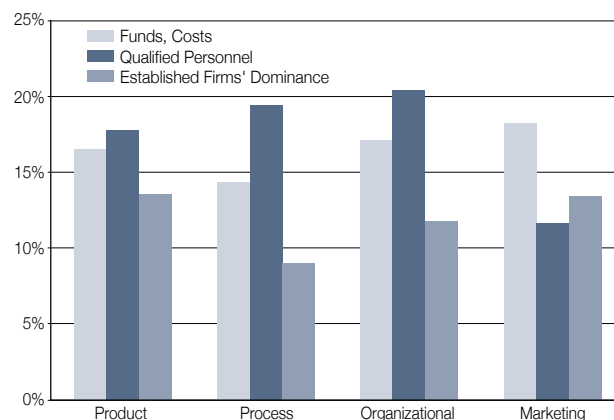
Source: Georgia Manufacturing Survey 2005, weighted responses of 421 manufacturers.

Manufacturers cited lack of qualified personnel and high costs as the chief barriers to product, process and organizational innovation. They also named costs and dominance of established companies as the primary barriers to marketing innovation, but lack of qualified personnel was a lesser factor in this category.

In 2002, the GMS found that innovation was limited mostly by financial considerations. But in 2005, lack of qualified personnel also ranked high along with financial considerations.

Barriers to Innovation

Top Three Most Prevalent Barriers to Innovation by General Innovation Area
(Percentage of respondents rating barriers to be of high importance)



Source: Georgia Manufacturing Survey 2005, weighted responses of 584 manufacturers.

Outsourcing

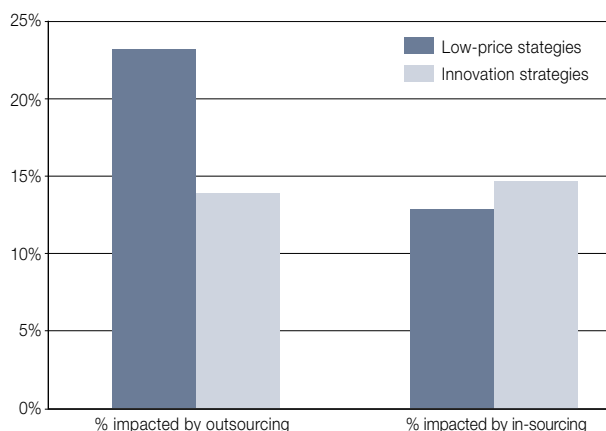
Outsourcing and Manufacturing Performance

In the last two years alone, nearly one in five Georgia manufacturers was impacted by outsourcing. For those affected, the most common outsourcing locations were elsewhere in the United States, followed by Asia, Mexico, and Central and South America. In-sourcing also occurred. Georgia manufacturers were most attractive when firms wanted to transfer work from other states.

A significantly higher percentage of manufacturers competing on a low-price strategy were affected by outsourcing than were manufacturers competing on an innovation strategy. More than 23 percent of manufacturers competing based on low price saw work outsourced compared with only 14 percent of manufacturers competing on innovation.

Innovation Means Less Outsourcing

Percentage of Establishments Reporting That Their Facility Was Impacted by Outsourcing/In-sourcing by Facility Strategy

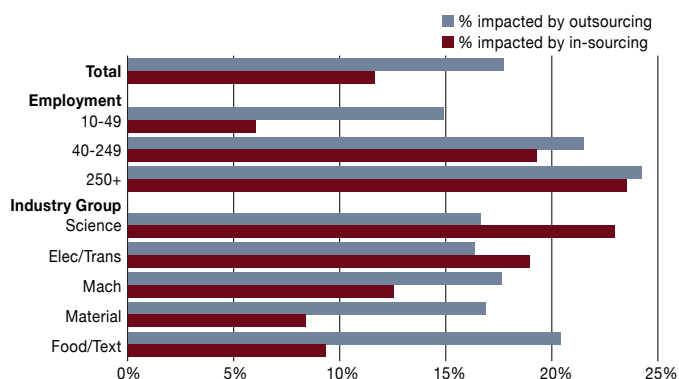


Source: Georgia Manufacturing Survey 2005, weighted responses of 617 manufacturers.

The rate of outsourcing was somewhat higher for large companies than for smaller companies. But the rate of in-sourcing was significantly higher for large companies. In-sourcing was nearly non-existent for manufacturers with fewer than 50 employees.

Large Firms Outsource More

Percentage of Establishments Reporting That Their Facility Was Impacted by Outsourcing or In-sourcing



Source: Georgia Manufacturing Survey 2005, weighted responses of 617 manufacturers.

By the Numbers

Among those affected by outsourcing —

26% Work moved from Georgia to another facility within the same company and within the United States

32% Work moved from Georgia to a different company within the United States

25% Work moved from Georgia to a different company in Mexico, or Central or South America

37% Work moved from Georgia to a separate company in Asia, including China and India



Lean manufacturing needs ranked high among manufacturers in the 2005 survey, with 40 percent of respondents indicating that they could use help in this area.

Performance

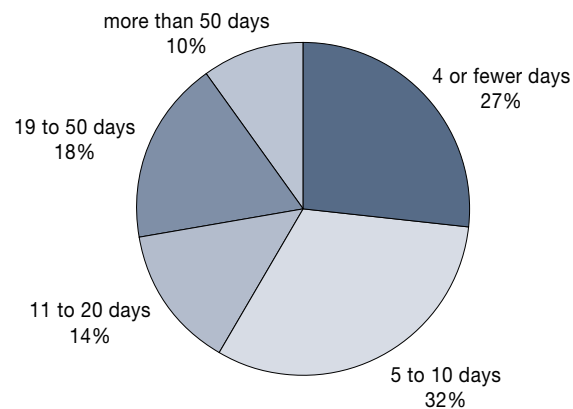
Manufacturers Experience Gains

Seventy-three percent of respondents to the GMS reported sales levels higher in 2004 than in 2002, with the typical, or median, manufacturer seeing 20 percent more sales in 2004 than two years earlier.

Another measure is improvement in delivery time, which is the difference between receipt of a customer order and delivery of it. Georgia firms have accelerated in this regard.

Delivery Times Reduced

Delivery Time (Between Receipt of Customer Order and Delivery) in 2004



Source: Georgia Manufacturing Survey 2005, weighted responses of 593 manufacturers.

Despite some overall gains, many Georgia companies realize they must enhance their productivity to remain competitive. One way of doing that is through lean manufacturing, which reduces costs and waste by means of operational improvements. Lean ranked high among manufacturers in the 2005 GMS, with 40 percent of respondents indicating they could use help in this area.

The average large manufacturer reduced its delivery time by 11 days from 2002 to 2004 compared with about seven days for small and medium-sized manufacturers.

The top 10 percent of manufacturers have delivery times in the two-day range, but delivery times can vary widely according to the product.

Concerns

Process, Cost and Skill Concerns Uppermost in 2005

Compared with previous years, manufacturing process and energy costs have become more important to Georgia manufacturers in 2005. In addition, worries about basic reading, writing, math and keyboarding skills have risen dramatically. Yet, training expenditures still remain low among Georgia manufacturers – and 20 percent of do not spend anything on training activities. Reflecting current cost concerns, fewer Georgia manufacturers report problems or needs in technological areas such as product design and computing technologies than they did in the late 1990s and early 2000s.

Although the percentage of manufacturers noting marketing problems dropped from 37 percent in 2002 to 25 percent in 2005, manufacturers nevertheless identified marketing as one of their top three most prevalent needs/problems. Product development needs dropped from 19 percent to 13 percent.

Human Resources Needs Dominate

Manufacturing Problems and Needs, 2002 — 2005

Problems/Needs	2005	2002	2005-2002
Human resources problems	49%	44%	5%
Basic skills	26%	11%	15%
Technical skills	23%	27%	-3%
Supervisory, team skills	16%	26%	-11%
Manufacturing process	39%	34%	5%
Market development, exporting	25%	37%	-12%
Expansion planning, facility layout	21%	24%	-3%
Energy costs, conservation	19%	15%	4%
Business, finance	16%	20%	-4%
Environmental, health & safety	15%	18%	-3%
Quality assurance	15%	17%	-3%
Computer applications	14%	20%	-6%
Product development, design	13%	19%	-7%
Waste management	10%	16%	-5%
Material-related	6%	9%	-3%

Source: Georgia Manufacturing Survey 2005, weighted responses of 648 manufacturers and the Georgia Manufacturing Survey 2002, weighted responses of 636 manufacturers.

Some Specifics

- 23 percent of respondents reported problems finding technically skilled workers.
- Manufacturers with 250 or more employees were more likely to have greater concern about finding employees with basic skills and management skills than were smaller manufacturers.
- But small manufacturers were more concerned about marketing, finance and information technology.





Information Technology

Usage Up in Some Areas

Information technology (IT) and production practices are a further enabling factor in encouraging innovation-based competition. The survey asked manufacturers about their adoption of 10 IT hardware and software applications, ranging from logistics management software to enterprise resource planning. Computer-aided design was the most prevalent application, used by nearly half the respondents; radio frequency identification ranked lowest, used by only 5 percent.

Nearly two-thirds of respondents indicated they obtain a portion of company sales through either a Web site or e-mail. Although Internet sales represent a small share of total sales, they appear to account for a rising share of sales.

About one in five manufacturers netted more than 10 percent of sales via the Internet.

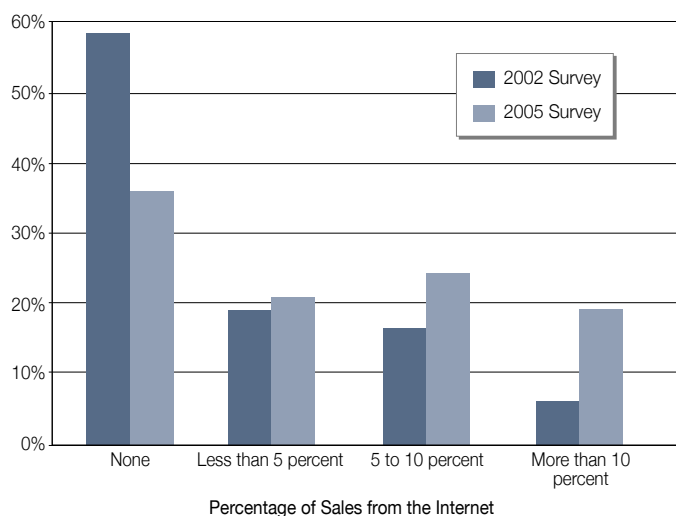
About one in five manufacturers netted more than 10 percent of sales via the Internet.

Some Specifics

- Concerns about information technology hardware and software declined from peak levels in 1999, with only 14 percent of respondents noting IT needs in 2005.
- The average manufacturer reported about 20 percent of its workers use a computer at least once a week.
- The average manufacturer said about 15 percent of its workers use e-mail.

Internet Sales Show Gains

Percentage of Company Sales Through the Internet



Source: Georgia Manufacturing Survey 2005, weighted responses of 261 manufacturers.

Training



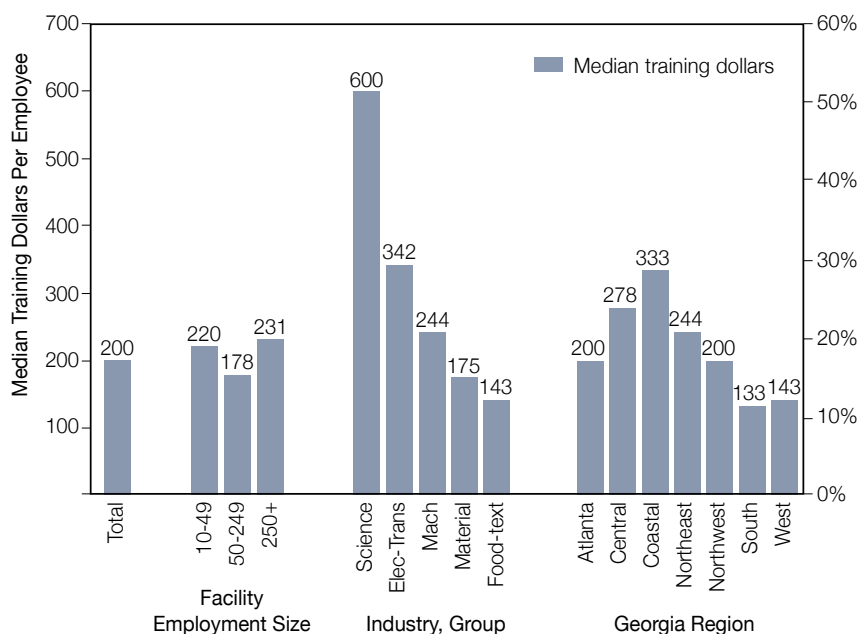
Workforce Skills Remain an Issue

Among manufacturers that spent money on training in 2004, the average respondent said about one-fourth of its training dollars went for new activities and tasks. Thirteen percent of respondents spent all of their training dollars on new activities and tasks.

The average large establishment spent more than twice what small and medium-sized manufacturers spent on new activities and tasks.

Science-related Industries Spend More on Training

Median Expenditures per Employee on All Training Activities in 2004 and Median Percentage of Training Dollars Related to New Activities and Tasks



Source: Georgia Manufacturing Survey 2005, weighted responses of 512 manufacturers.

Even with a dramatic increase in concerns over basic skills, expenditures for training were low, with 20 percent of respondents spending no money at all to train employees.

Some Specifics

■ Respondents in the Atlanta region spent the most on training on a per-employee basis, and those in south Georgia spent the least.

■ Nearly three-quarters of respondents had at least one worker with some technical, vocational or apprenticeship training; however, such workers accounted for only about 13 percent of employees in the median manufacturing firm.



Thank you to the GMS sponsors: Georgia Tech Economic Development and Technology Ventures, Georgia Tech School of Public Policy, Georgia Department of Labor, U.S. Economic Development Administration, Center for Paper Business and Industry Studies, U.S. Manufacturing Extension Partnership and the Georgia Department of Technical and Adult Education.

For more GMS information, contact Jan Youtie, 404.894.6111, e-mail: jan.youtie@edi.gatech.edu.

To download a pdf of the full report, visit www.edtv.gatech.edu, or www.cherry.gatech.edu/survey.

Manufacturing Assistance Leads to Higher Productivity

Manufacturers assisted by Georgia Tech reported significant benefits. The best way to assess whether these benefits can be attributed to Georgia Tech assistance (or some other factor) is to compare the change in productivity of manufacturers that have been served with that of unassisted manufacturers. Compared to manufacturers not assisted by Georgia Tech, Georgia Tech clients on average experienced a value-added increase of almost \$10,000 per employee between 2002 and 2004.

We Can Help Your Company

Perhaps we can help your company to become more competitive through innovation or address other concerns within your manufacturing process through our business assistance services listed below:

- Quality and International Standards
- Energy and Environmental Management
- Lean Enterprise Transformation
- Information Technology Strategies
- Government Procurement Assistance
- Trade Adjustment Assistance
- Strategic Marketing
- New Product Design and Development
- Assistance to Minority-owned Businesses
- Connection to all of Georgia Tech's Resources

To find out more, please contact one of our regional managers listed below.

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