Technology on the Factory Floor II: Benchmarking Manufacturing Technology Use in the USA

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by Paul M. Swamidass
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on the
Factory
Floor II

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All findings and conclusions are the responsibility of the author.

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Manufacturing has gained considerable attention over the past few years as U.S. industry has undergone a historic transformation. Part of this transformation has been the result of macroeconomic forces that made the world a much smaller planet and a more competitive marketplace. There are, however, other forces that also play a critical role in this transformation — forces that have not been examined as closely and are not so well understood. These are the forces of technology on the factory floor.

A few years ago, The Manufacturing Institute (the educational and research affiliate of the National Association of Manufacturers) and Paul Swamidass set out to fill some of the considerable gaps in our knowledge of manufacturing practices. The result was Technology on the Factory Floor, a ground-breaking look at how technology was being used in America’s factories. This first effort uncovered a number of important findings. For example, it revealed that computer-aided design was rapidly gaining almost universal acceptance among manufacturers. It also charted the emergence of just-in-time scheduling as a key manufacturing objective.

Technology on the Factory Floor also revealed that there were probably more questions raised by the study than it answered, and that a one-time snapshot was insufficient to understand where shop-floor practices were heading. The Manufacturing Institute and Professor Swamidass decided to undertake another, more far-reaching, survey to broaden and deepen the work from our initial study. The successful result is Technology on the Factory Floor II: Benchmarking Manufacturing Technology in the United States.

This second effort is considerably larger than our initial one, and involves nearly three times the number of participants. As with its predecessor, this report offers significant new insights into technology’s impact on the factory floor and corporate balance sheets. For example, reduced cycle time has emerged as the most frequently cited benefit of technology adoption. And the finding that several manufacturing technologies and techniques cluster and impart synergies beyond their individual impact has major implications for technology investment decisions.

These and other measurements offer a comprehensive picture of what technologies are being used and how they affect plant performance. We hope you will benefit from reading this report and will draw from it in plotting the future course of your own manufacturing operations. We welcome your comments on this study and encourage your participation in future ones.

Jerry J. Jasinowski
Chairman
The Manufacturing Institute
President
National Association of Manufacturers
This monograph, Technology on the Factory Floor II, is a sequel to the first report published in 1992. It is more comprehensive than the original. Unlike the original, this one reports on advanced technology use with "extreme skill," "moderate skill," as well as those with "some skill." Further, this study includes information on manufacturers' reasons for not investing in technologies, sources of assistance to manufacturers investing in new technologies, and the benefits of technology use. The performance of technology users in terms of manufacturing lead-time, and rejection and rework rates are new to this iteration of the study.

This second effort yields stronger conclusions than the first study because there were more than 1,000 participants, whereas the original study had 385 participants. Further, this study invited all NAM members in SIC classification 3400 to 3899 to participate regardless of their size or dues to the NAM; last time, the study was limited to firms paying the NAM annual dues of $300 or more.

**Technology Usage**

This study covers the usage of 15 selected technologies. (See Table 1 on page 2 for a list of acronyms for the technologies covered by this study.) Notable findings on technology usage are —

- CAD, TQM and JIT are the most widely used technologies, regardless of skill levels.
- Among extremely skilled users, CNC and CAD are the most widely used technologies.
- CAD is used by 97.4 percent of plants that consider CAD to be a relevant technology.
- Skilled use of technologies occurs in clusters.
- 96.5 percent of CAM users employ CAD, and 91 percent CNC installations use CAD.
- "Soft" technologies such as JIT, TQM, SQC and manufacturing cells occur in clusters.
- Notably, 87.4 percent of plants that consider JIT to be relevant are using JIT.

One hundred percent of larger plants (those with 100 or more employees) that consider CAD to be a relevant technology, use CAD; this is an outstanding level of penetration for this technology. The three hard technologies — CAD, CNC and CAM — are at the core of automation on the factory floors. CAD use leads the way for the use of CNC and CAM. The level of penetration by JIT noted above is astonishing considering that JIT was introduced in the United States only in the late 1970s.

In summary, the seven technologies — CAD, CAM, CNC, TQM, JIT, SQC and manufacturing cells — are setting the pace of competitive manufacturing on America's factory floors.

**Number of Technologies Used.** The average plant uses seven different technologies; only 30 plants (about 3 percent) use none of the 15 technologies investigated. Eighteen percent of the plants use 10 or more technologies; the maximum number used is 14 different technologies. The correlation between the number of technologies used and the number of benefits claimed is 0.49. The moderate correlation means that the use of several technologies does not always translate into a number of benefits.

The average plant is an extremely skilled user of 1.8 technologies, with 63.3 percent reporting extreme skill in the use of at least one technology. About 20 percent of the plants are extremely skilled in the use of four or more technologies. Given the clustering of technology use in plants mentioned earlier, it is reasonable to expect the extremely skilled use of more than one technology in many plants today. On the negative side, however, 36.7 percent of the plants are not extremely skilled in any of the technologies surveyed.
Improvements Since the Last Study. Among current respondents, 216 participated in both studies. The plants that participated in both reported that they made most significant progress in CAD (47 percent), TQM (36 percent) and CNC (30 percent) since the last study.

Technology Use in Small vs. Large Plants. There is an across-the-board difference in technology usage between small (fewer than 100 employees) and large plants (100 or more employees). On average, small plants are less likely to use technologies. It is notable, however, that small manufacturers do report use of all the technologies investigated in this study. A comparison of small and larger plant characteristics is included on page xi at the end of the "Executive Summary."

**Benefits of Technology Use**

Most Frequently Cited Benefits. Reduced cycle-time, market-share growth, progress toward zero defects and return on investment (ROI) were the top four direct benefits of technology use reported by our respondents. The most frequently mentioned direct benefit of technology use was reduced cycle time, cited by 66 percent of respondents. This is a truly important finding. One can infer from the finding that manufacturers are most often investing in manufacturing technologies to reduce the cycle time from order to shipping.

Number of Benefits Reported. The average plant reported 3.7 benefits directly attributable to the use of one or more technologies. More than 85 percent of the plants reported one or more benefits attributable to technology use, which also means that 15 percent reported no benefits. About 25 percent of the facilities reported six or more benefits attributable to technology use. About 3 percent (37 plants) reported 10 or more benefits attributable to technology use.

Benefits of Extremely Skilled Technology Use. JIT took the top honors as the one technology whose extremely skilled use was unaffably associated with the best performance, regardless of the performance metric used. Specifically, extremely skilled users of JIT reported —

- superior inventory turn at 10 (average = 8.04);
- the second lowest manufacturing lead time at 7.2 weeks;
- the lowest rejection and rework rate at 2.9 percent (average = 4.00 percent);
- superior sales-per-employee at $178,000 (average = $133,000); and
- the best ROI at 17.6 percent (average = 12.99 percent).

With these rewards associated with JIT, it is no wonder JIT is used by nearly 90 percent of those who consider it relevant to their operations. These findings should be an incentive to non-users of JIT to reconsider their hands-off approach to this technology. Further, those who use JIT now at less than an extremely skilled level should seek to become extremely skilled users. This study should convince even the most skeptical executive of the value of JIT, and those who consider JIT to be irrelevant to their operations should reevaluate their judgments in the light of the findings reported here.

Those who plan to excel in JIT use should consider investing in TQM, manufacturing cells and SQC, which are complementary technologies to JIT production.
TECHNOLOGY INVESTMENT DECISIONS

Reasons for Not Investing in Technologies. Not Relevant. Some manufacturers reported that certain technologies are not relevant to their operation. AGV, FMS and robots are the most frequently mentioned irrelevant technologies. Very few reported CAD or TQM as irrelevant to their operations.

Lack of Know-How. Surprisingly, a very small percentage of plants reported the lack of know-how as the reason for not investing in technologies. TQM (15.5 percent) and SQC (15.4 percent), rather interestingly, topped the list of technologies in which plants lacked know-how.

Lack of Capital. Investment in hard technologies such as automated inspection, CNC, CAM, robots and CAD, in the order given, is hampered by the lack of capital. It appears, relatively speaking, investments in soft technologies are hampered by the lack of know-how, and investments in hard technologies are hampered by the lack of capital.

Sources Assisting Decisions. Customers were most frequently mentioned (42.7 percent) as the source of assistance in manufacturing technology investment decisions. Government's role was surprisingly meager: rated at less than 1 percent. This raises important questions to explore in the next volume of the study. As the nationwide manufacturing extension infrastructure takes shape, the role and effectiveness of government in assisting plants in their technology investment decisions require better understanding.

Only nine plants indicated that they got assistance from the government in making technology investment decisions. These plants were small ($20 million in annual sales versus the average of $47.2 million for all plants). The sales-per-employee for these plants range from $80,000 to $130,000, a range that is below the average for all plants; this may be an indication of inadequate technology use and/or labor intensive operations. Their cost-of-goods-sold at 67.2 percent is much higher than the average of 60.6 percent for all plants. It appears that the plants seeking government help are much smaller than average, high-cost manufacturers, that do not use technologies very much, or are engaged in labor-intensive operations. The findings of this study also suggest the need for the investigation of how government assistance is delivered to needed firms.

Technology vendors are second (28.6 percent) to customers in providing assistance in technology investment decisions.

FUTURE PLANS TO BECOME EXTREMELY SKILLED USERS

TQM, CAD and JIT, in that order, are the most frequently cited technologies in which U.S. manufacturers plan to become extremely skilled users in the next two years. This is understandable, given the frequent use of these technologies and the benefits of these technologies reported by users.

Changes in Plans Since the Last Study. The 216 plants that participated in both studies show growing interest in manufacturing cells, SQC and JIT, and decreasing interest in robots, MRP II and CAM, when compared with plants reported in the original study.
THE PLANTS STUDIED

The Average Plant. This is a study of manufacturing plants, not a study of entire manufacturing firms with multiple plants. The focus on plants as opposed to entire companies is because technology usage can vary significantly among the diverse plants of a company. The average plant characteristics are —

• Employment is 228 workers, compared with 351 reported in the original study.
• Plant sales are $47.2 million.
• Sales-per-employee is $133,000.
• Pre-tax return on investment for three years is 12.99 percent.
• There are 24 product lines.
• Inventory turns are 8.04.
• The lead-time from order to shipping is 7.19 weeks.
• Rejection and rework rate is 4.00 percent.
• Direct labor cost is 18.3 percent of sales.
• Make-to-stock production is 20 percent of total production.

The reduction in the average employment per plant may be attributed to downsizing going on in the United States and to the inclusion of a number of smaller firms in the sample this time.

Comparing the Average Plants from the Two Studies. The average inventory turn has improved to 8.04 from 6.4. The average sales per employee is $133,000, which is less than the $141,000 reported in 1990. The difference is likely explained by the many smaller firms included in the latest sample. Smaller firms are generally less automated and tend to have lower sales per employee. The return on investment (ROI) for the average plant has improved to 12.99 percent, up from 11.9 percent reported in the original study (it was noted in the last study, however, that the estimate of ROI in 1990 might be an underestimate).

Key Features of Manufacturers Studied. The following lists several attributes of the plants that participated —

• More than 84 percent of the plants participating in the study have export sales.
• Forty-five percent have some sales to the U.S. Department of Defense.
• Four percent are certified in the ISO 9000 series and nearly one-fourth are in the process of certification.
• No plants with fewer than 100 employees are ISO certified.
• About 30 percent of the respondents use line or flow production.
• Nearly 45 percent use job shops.
• About 20 percent use manufacturing cells predominantly for production.
• More than 55 percent of the respondents use small-batch production.
• Fewer than 10 percent use mass production (17.6 percent in the original study).
• Less than 4 percent of the plants that are foreign-owned.
Small vs. Large Plants. There is a marked difference in the use of technologies by small (fewer than 100 employees) as opposed to large (100 or more employees) plants. Table ES-1 (below) contrasts the characteristics of small and large plants in the sample. Throughout the report, selected information by plant size is provided.

Table ES-1
A Comparison of Averages for Small & Larger Plants

<table>
<thead>
<tr>
<th>Sample size(n)</th>
<th>Small Plants Employment &lt;100</th>
<th>Larger Plants Employment &gt; 100</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Sales ($ million)</td>
<td>$5.4</td>
<td>$97.2</td>
</tr>
<tr>
<td>2. Employment</td>
<td>46.0</td>
<td>443.0</td>
</tr>
<tr>
<td>3. Sales/employee [$000]</td>
<td>114.0</td>
<td>144.0</td>
</tr>
<tr>
<td>4. Rejections (%)</td>
<td>3.5</td>
<td>4.5</td>
</tr>
<tr>
<td>5. Inventory turns</td>
<td>8.3</td>
<td>7.8</td>
</tr>
<tr>
<td>6. Cost-of-goods sold (% of sales)</td>
<td>58.9</td>
<td>62.5</td>
</tr>
<tr>
<td>7. Product lines</td>
<td>23.7</td>
<td>23.5</td>
</tr>
<tr>
<td>8. Models</td>
<td>71.5</td>
<td>143.0</td>
</tr>
<tr>
<td>9. Average lead time (weeks)</td>
<td>6.3</td>
<td>8.0</td>
</tr>
<tr>
<td>10. Direct labor costs (% of sales)</td>
<td>21.5</td>
<td>14.7</td>
</tr>
<tr>
<td>11. Return on investment (%)</td>
<td>11.5</td>
<td>14.7</td>
</tr>
</tbody>
</table>

Domestic vs. Foreign Plants. Another comparison made in this study is between domestic-owned manufacturing plants and foreign-owned plants (i.e., foreign ownership of at least 50 percent). Several differences emerge —

- Foreign plants, on the average, are almost twice as large as domestic plants (411 vs. 218 employees).
- Foreign plants averaged $172,000 in sales-per-employee, whereas domestic plants averaged $131,000.
- Rejection and rework rates are 2.83 percent in foreign plants, as opposed to 4.01 percent in domestic plants.
- Direct labor costs constitute 18.35 percent of sales in domestic plants, while they constitute only 15.4 percent in foreign-owned plants.
- Domestic plants reported a higher ROI at 13.09 percent, as opposed to 12.33 percent for foreign-owned plants.
A Survey of Manufacturing Technology Adoption 1993

This survey is expected to take about 12 minutes to complete.

IMPORTANT: The last time we did this study, 385 NAM members participated in it. The aggregate results of that study were published in the very successful report, Technology on the Factory Floor, which was mailed to NAM members in the fall of 1992. This survey will update the findings of the last study to reveal trends in manufacturing technology adoption in the United States; it will serve you as a useful benchmark. Your company data will not be divulged to anyone. If you want a free, 40-page report based on this study, give us your name and mailing address below (or attach a business card here):

Name and Address (optional; to help us mail you a copy of the final report)

IMPORTANT: If your company has many plants, evaluate any ONE plant with which you are most familiar. The following answers apply to the plant at:

1. City: ____________________________
2. State: __________________________
3. Zip: ____________________________

Rate your plant’s SKILL LEVEL in the use of the following:

<table>
<thead>
<tr>
<th>Technology</th>
<th>Extremely Skilled</th>
<th>Moderate Skill</th>
<th>Some Skill</th>
<th>Do Not Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>4. FMS</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>5. CIM</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>6. CAM</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>7. CAD</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>8. JIT/Variations of JIT</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>9. MRP</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>10. MRP II</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>11. ROBOTS</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>12. Manufacturing cells</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>13. SQC/SPC*</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>14. AGV</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>15. Automated inspection</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>16. LAN**</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>17. CNC</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>18. TQM</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>

* Includes statistical quality control and statistical process control; ** Local area networks

19. Did you participate in the study last time in 1990? Yes ( ) No ( )

20. Identify the technologies in which you have made the most significant progress since 1990. (Please use the item number from items 4-18 above to identify the technologies.)

#_______, #_______, #_______, and #_______

— 22 —
To remain competitive, in the next two years, we expect to become extremely skilled in the use of (circle as many as applicable) —

1. FMS 2. CIM 3. CAM 4. CAD 5. JIT 6. MRP

If we had the funds, we will most likely INVEST IN the following immediately (circle as many as applicable):

27. Automated inspection 28. LAN 29. CNC 30. TQM

Please indicate your reason(s) for NOT INVESTING in the following technologies by a circle around the appropriate number(s) in the table below (circle as many reasons as applicable):

<table>
<thead>
<tr>
<th>Technology</th>
<th>Not relevant</th>
<th>Lack of capital</th>
<th>Lack of know-how</th>
<th>Labor's resistance</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>31. FMS</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>32. CIM</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>33. CAM</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>34. CAD</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>35. JIT/Variations of JIT</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>36. MRP</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>37. MRP II</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>38. ROBOTS</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>39. Manufacturing cells</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>40. SQC/SPC*</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>41. AGV</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>42. Automated inspection</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>43. LAN</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>44. CNC</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>45. TQM</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

46. Which one of the following sources of assistance was most essential to your technology investment decision? (Circle one.)

1) A government agency  2) Consultants  3) Vendors  4) Customers  5) Other
We have made significant progress toward attaining the following objectives as a direct result of our investment in one or more of the above technologies. (Circle all applicable items.)


15. We mostly use (circle one):  1) line/flow production  2) job shops  3) manufacturing cells

16. We produce mostly (circle one):  1) one of a kind  2) small batch  3) large batch  4) mass production

17. The major product of this plant is:

18. Approximate annual sales of this plant: $

19. Total employment (all employees) at this plant is approximately:

20. Approximate average price per unit for your major product (circle one):

   1) less than $5  2) $5–100  3) $101–1,000  4) $1,001–2,000  5) $2,001–10,000  6) $10,001–999,999  7) More than $1 million

21. Approximate percent (based on value) of total sales to the defense department or any armed services:

   1) none  2) 1–10%  3) 11–25%  4) 26–50%  5) 51–75%  6) More than 75%  7) Don't know

22. Approximate rejection plus rework at the plant: ........................................... (%)

23. Approximate inventory turns (total inventory/sales): ....................................... ( )

24. Approximate (cost of goods sold)/(sales): ........................................................... ( %)

25. Approximate direct labor cost as a percentage of sales: .................................... ( %)

26. Approximate number of product lines produced at this plant: ............................ ( )

27. Average number of models per product line: ....................................................... ( )

28. Percent of total production at the plant that is made-to-stock: ......................... (%)

29. We require investments in manufacturing equipment be recovered in .................. ( months)
1. Approximate total labor hours to manufacture one unit of typical product: ................................. ( hours)
2. Approximate number of components in a typical product: ......................................................... ( )
3. For your typical product, the average lead-time from order to shipment? ................................. ( weeks)
4. Approximate percent of our purchases (raw materials and components) imported: .................. ( %)
5. Foreign ownership of the plant (circle one):
   1) none  2) under 10%  3) 10–25%  4) 25–50%  5) over 50%
6. Average Return on investment (pretax) for this plant over the past three years (circle one):
   42% or more  36%  30%  24%  18%  12%  6%  0%  -6%  -12%  -18%  -24%  -30%  -36%  -42% or less

Please rate your plant on the following (a rating of "7" means world-class performance, and a rating of "1" means that the item is in extreme need of improvement).

<table>
<thead>
<tr>
<th>In extreme need of improvement</th>
<th>World-class performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>7. Production planning, scheduling and control</td>
<td>1 2 3 4 5 6 7</td>
</tr>
<tr>
<td>8. Employee involvement and motivation</td>
<td>1 2 3 4 5 6 7</td>
</tr>
<tr>
<td>9. Automation and process technology</td>
<td>1 2 3 4 5 6 7</td>
</tr>
<tr>
<td>10. Just-in-time production</td>
<td>1 2 3 4 5 6 7</td>
</tr>
<tr>
<td>11. Labor productivity</td>
<td>1 2 3 4 5 6 7</td>
</tr>
<tr>
<td>12. Quality control/assurance</td>
<td>1 2 3 4 5 6 7</td>
</tr>
<tr>
<td>13. Decentralization of manufacturing decisions</td>
<td>1 2 3 4 5 6 7</td>
</tr>
<tr>
<td>14. Product design</td>
<td>1 2 3 4 5 6 7</td>
</tr>
<tr>
<td>15. Overall evaluation of our manufacturing</td>
<td>1 2 3 4 5 6 7</td>
</tr>
</tbody>
</table>

16. Percent of plant sales exported (based on value):
   1) None  2) 1–9%  3) 10–19%  4) 20–49%  5) 50% or more

17. The industry this plant belongs to is: (circle one)
   1) Fabricated metal  2) Machinery except electrical and computers  3) Electrical machinery and other electrical
   4) Transportation and aerospace  5) Measurement instruments, photo goods  6) Miscellaneous manufacturing

18. SIC code for the major products at this plant, if available:  

19. Your title (circle one):
   1) Owner  2) CEO  3) President  4) General Manager  5) Executive VP  6) Other VP  7) Manager  8) Other

20. In regards to ISO 90000, or 9001, etc., this plant is (circle one):
   1) certified  2) in the process of certification  3) very interested  4) slightly interested  5) not interested

Thank you!!

Please return the questionnaire in the postage-paid envelope to —

Dr. Paul M. Swamidass
Thomas Walter Center for Technology Management
Tiger Drive, Room 104, Auburn University, Auburn, AL 36849-5358.

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