

## Introduction

# 2021 MPI Manufacturing Study

Please answer all questions to the best of your ability and based on your manufacturing facility. The survey will take approximately 20 minutes to complete. If answering at a corporate level, please provide answers typical for all of your plants. The survey deadline is Jan. 29, 2021.

### Note:

- You must have a good understanding of your plant's operations practices and production metrics. If your answers to the study indicate otherwise, your submission will be rejected.
- Some questions require you to select a number using a slider mechanism. If you intend to answer 0 or the lowest possible figure, you will need to move the slider and then move back to 0 for your answer to be recorded.

## Screener

### A. In what industry does your company participate?

Manufacturing

Wholesale

Retail

Services

Government or non-profit

Other

### B. How familiar are you with your company's manufacturing practices and production measurements?

Extremely familiar

Very familiar

Fairly familiar

Somewhat familiar

Not familiar at all

**C. Which of the following best describes your title?**

Chairman, President, or CEO

COO or comparable

Other C-level title

Manufacturing VP, Director, or comparable

VP, Director, or comparable other than manufacturing

Plant/facility/production manager, supervisor, or comparable

Other titles

**Plant Profile**

**Plant Profile**

**1. Please indicate if this plant is part of a public or private company:**

Public

Private

**2. In which country or region is this plant located?**

United States

Mexico

Canada

Europe

Asia (not China)

China

Other

**3. What is the nature of manufacturing operations for primary products at this plant?**

Discrete (measured by numeric quantities)

Process (measured by weight or volume)

Both or hybrid

**4. What is the primary product that this plant manufacturers (e.g., axles, software, toys)?**

**5. What is the primary industry in which this plant participates?**

Food manufacturing

Beverage and tobacco product manufacturing

Textile mills

Textile product mills

Apparel manufacturing

Leather and allied product manufacturing

Wood product manufacturing

Paper manufacturing

Printing and related support activities

Petroleum and coal products manufacturing

Chemical manufacturing

Plastics and rubber products manufacturing

Nonmetallic mineral product manufacturing

Primary metal manufacturing

Fabricated metal product manufacturing

Machinery manufacturing

Computer and electronic product manufacturing

Electrical equipment, appliance, and component manufacturing

Transportation equipment manufacturing

Furniture and related product manufacturing

Miscellaneous manufacturing/Other

**6. How many years has it been since plant start-up?**

Less than 5 years

5 - 10 years

11 - 20 years

More than 20 years

**7. Which criterion below best describes the volume and product mix of your plant's operations?**

High volume/High mix  
High volume/Low mix  
Low volume/High mix  
Low volume/Low mix

**8. What is the approximate annual revenue (U.S. dollars) of the plant's corporate parent?**

Less than \$10 million  
\$10 million to \$50 million  
\$51 million to \$100 million  
\$101 million to \$500 million  
\$501 million to \$1 billion  
\$1 billion to \$2 billion  
\$2 billion to \$5 billion  
\$5 billion to \$10 billion  
More than \$10 billion

**9. Please report the approximate annual revenue for this plant:**

- *Report in U.S. dollars.*
- *Do not use \$ or punctuation.*
- *If plant is a cost center, please report the value of shipments from the plant.*
- *Plant revenue cannot be higher than corporate parent revenue.*

**Plant revenue in 2019**

**Plant revenue in 2020**

**10. How much progress has the plant made toward achieving world-class manufacturing status?**

No progress  
Some progress  
Significant progress  
Fully achieved

Human Resources

## Human Resources and Leadership

11. Please report the number of employees (all staff) for this plant:

- *Do not use punctuation.*

Employees in 2019

Employees in 2020

12. What percentage of plant employees are the following?

Frontline production associates

Material handling personnel

Quality control personnel

Supervisors and managers

Maintenance personnel

Plant administration

Office/administration personnel

Other personnel

Total

13. What percentage of plant employees are the following?

Permanent employees

Temporary employees

Total

**14. What percentage of plant employees are the following?**

Inhouse employees (i.e., on the plant's payroll)

0

Outsource employees (i.e., paid via contracts with third parties)

0

Total

0

**15. What percentage of plant production workers are represented by a union(s)?**

0%

1-25%

26-50%

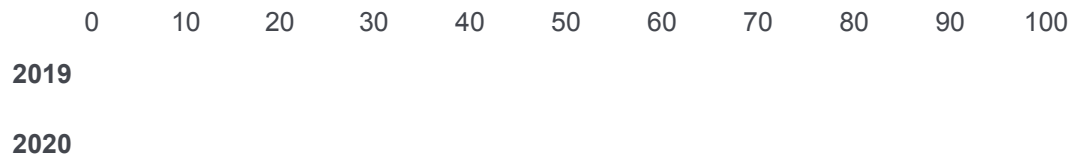
51-75%

76-99%

100%

**16. What was the plant's annual labor turnover rate? (number of voluntary and involuntary separations ÷ typical staffing level X 100)**

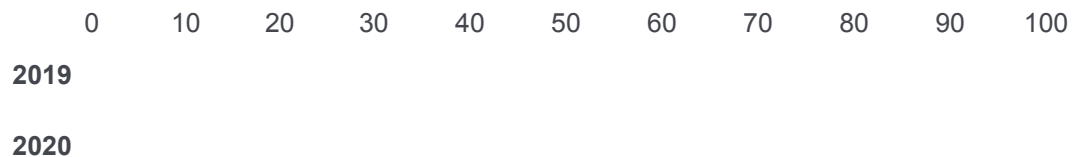
**Example: (19 employees separated ÷ 100 typical employees) X 100 = 19% labor turnover rate**



**17. What was the plant's absenteeism rate? ((number of unexcused absences during the year ÷ (number of employees X total workdays in the year) X 100)**

- *Total workdays = Number of employees X workdays in the year*
- *1 employee working 5 days per week for 50 weeks = 250 workdays*

**Example: (400 employee absences during year ÷ 25,000 total workdays in year) X 100 = 1.6% absenteeism**





**22. Which of the following human-resource practices/programs are used at this plant? (check all that apply)**

- Formal employee training program
- Apprenticeship program
- Teaming/team-building practices
- Leader/supervisor development
- Recruiting and hiring program
- Paid medical benefits
- Paid sick and/or personal days
- Formal safety/health program
- Paid vacation days
- Annual review and raise program
- Employee-ownership options
- Profit or revenue-sharing plan
- Bonus plan
- Education reimbursements
- None of these

**23. For 2020, how many: (report total for plant)**

- *It is unlikely that either safety measure will match or exceed the number of employees in the plant.*

**Job-related injuries and illnesses**

**Job-related injuries and illnesses resulting in lost work days**

**24. How difficult is it for this plant to find the skilled workers it needs?**

- Not at all difficult
- Somewhat difficult
- Very difficult
- Impossible



## Operations

# Operations

**25. Please indicate which of the following improvement methodologies are followed at the plant: (check all that apply)**

- Agile Manufacturing
- Lean Manufacturing
- Theory of Constraints
- Six Sigma
- Total Quality Management
- Toyota Production System
- Other methodology(ies)
- No methodology

**26. Please describe the depth and breadth of adoption of your chosen methodology(ies)?**

- None
- Minimal
- Moderate
- Extensive
- Complete

**27. What percentage of your workforce is fully engaged in your improvement methodology(ies)?**

0    10    20    30    40    50    60    70    80    90    100  
% of workforce

**28. Which of these programs and/or practices occur at this plant? (check all that apply)**

- Benchmarking
- Total productive maintenance
- Quality certifications (e.g. ISO)
- Continuous-improvement program
- Performance management system
- Open-book management
- Strategy/policy deployment

Waste elimination (i.e., seven wastes)

Zero-loss thinking

Value-stream mapping

Kaizen events/blitzes

PDCA problem-solving

DMAIC problem-solving

Visual management boards

5S workplace organization

Daily huddles/team meetings

None of these

**29. To what extent does production collaborate with the following groups? (check one for each row)**

|                          | No or poor collaboration | Fair collaboration    | Good collaboration    | Excellent collaboration |
|--------------------------|--------------------------|-----------------------|-----------------------|-------------------------|
| R&D/product development  | <input type="radio"/>    | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>   |
| Purchasing/procurement   | <input type="radio"/>    | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>   |
| Sales and marketing      | <input type="radio"/>    | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>   |
| Customer service/support | <input type="radio"/>    | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>   |
| Finance/accounting       | <input type="radio"/>    | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>   |
| Directly with suppliers  | <input type="radio"/>    | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>   |
| Directly with customers  | <input type="radio"/>    | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>   |

**30. Please report the following operation/production measures for your plant:**

**Manufacturing cycle time (hours from start of plant production to completion of primary product)**

**2019**

**2020**

**On-time delivery rate (% of goods delivered on time)**



0 10 20 30 40 50 60 70 80 90 100  
 2020

**Warranty costs — cost of products returned by customers and subject to warranty conditions (% of plant sales)**

0 2 4 6 8 10 12 14 16 18 20  
 2019  
 2020

**31. How did total production output (unit volume) change in 2019 vs. 2018?**

|               | Decreased more than 20% | Decreased 11-20%      | Decreased 1-10%       | Stayed the same       | Increased 1-10%       | Increased 11-20%      | Increased more than 20% |
|---------------|-------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-------------------------|
| 2019 vs. 2018 | <input type="radio"/>   | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>   |
| 2020 vs. 2019 | <input type="radio"/>   | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>   |

**32. What are the plant's total costs as a percentage of plant revenue?**

- *Total plant costs are all expenses — direct and indirect costs — to produce goods.*
- *A percentage of 100% would indicate the plant has no profit or is operating at a loss.*
- *Total plant costs percentage is approximately the inverse of the plant's profit percentage; if profit margin is 20% then Total Plant Costs percentage is approximately 80%.*

10 20 30 40 50 60 70 80 90 100  
 % of plant revenue

**33. What are the following as a percentage of total plant costs?**

- *Total should sum to 100%.*

Direct labor costs (costs of employees directly manufacturing a product)

Indirect labor costs (costs of employees not directly manufacturing a product, such as those working in maintenance, quality, planning/scheduling, and procurement)

Overhead costs (costs including general utilities, rent, and repairs)

Material costs (cost of materials used to manufacture a product)

Total

0

**34. Please report the plant's approximate sales per employee?**

- *Include all employees, not just direct labor.*
- *Report in U.S. dollars.*
- *Do not use \$ or punctuation.*

|             |       |        |        |        |        |
|-------------|-------|--------|--------|--------|--------|
|             | 30000 | 147500 | 265000 | 382500 | 500000 |
| <b>2019</b> |       |        |        |        |        |
| <b>2020</b> |       |        |        |        |        |

**35. How have per-unit manufacturing costs, excluding purchased materials, changed in the last 3 years?**

- Decreased more than 20%
- Decreased 10-20%
- Decreased 1-10%
- Stayed the same
- Increased 1-10%
- Increased 10-20%
- Increased more than 20%

**36. Which of the following practices are used to manage inventory? (check all that apply)**

- One-piece flow techniques
- Pull systems with kanban signals
- Parts/goods supermarkets
- Quick equipment changeovers
- RFID or real-time inventory tracking
- Just-in-time supplier deliveries
- Vendor-managed or -owned inventories
- None of these

**37. Please report the plant's total inventory turn rate (annual COGS ÷ average value of total inventory on hand)**

- *Report turns per year.*

- A rate of 12 means that inventory is turned over monthly.
- A rate of 100, which is exceptional but unlikely, means that inventory is turned over every few days.

|             |   |    |    |    |    |    |    |    |    |    |    |     |
|-------------|---|----|----|----|----|----|----|----|----|----|----|-----|
|             | 1 | 10 | 19 | 28 | 37 | 46 | 55 | 64 | 73 | 82 | 91 | 100 |
| <b>2019</b> |   |    |    |    |    |    |    |    |    |    |    |     |
| <b>2020</b> |   |    |    |    |    |    |    |    |    |    |    |     |

38. What are the plant's inventory turn rates for the following categories of material?

- Raw, WIP, or finished turn rate cannot be lower than the total inventory turn rate.

**Raw material turn rate**

|   |   |    |    |    |    |    |    |    |    |    |    |     |
|---|---|----|----|----|----|----|----|----|----|----|----|-----|
|   | 1 | 10 | 19 | 28 | 37 | 46 | 55 | 64 | 73 | 82 | 91 | 100 |
| Annual COGS ÷ average value of raw material on hand |   |    |    |    |    |    |    |    |    |    |    |     |

**Work-in-process (WIP) material turn rate**

|  |   |    |    |    |    |    |    |    |    |    |    |     |
|--|---|----|----|----|----|----|----|----|----|----|----|-----|
|  | 1 | 10 | 19 | 28 | 37 | 46 | 55 | 64 | 73 | 82 | 91 | 100 |
| Annual COGS ÷ average value of WIP on hand |   |    |    |    |    |    |    |    |    |    |    |     |

**Finished goods turn rate**

|   |   |    |    |    |    |    |    |    |    |    |    |     |
|---|---|----|----|----|----|----|----|----|----|----|----|-----|
|   | 1 | 10 | 19 | 28 | 37 | 46 | 55 | 64 | 73 | 82 | 91 | 100 |
| annual COGS ÷ average value of finished goods on hand |   |    |    |    |    |    |    |    |    |    |    |     |

39. What are the plant's inventory days of supply?

**Raw material inventory days of supply**

- Raw material inventory consists of material and components used to manufacture product.



|                               | Decreased by >20%     | Decreased by 11-20%   | Decreased by 1-10%    | No change             | Increased by 1-10%    | Increased by 11-20%   | Increased by >20%     |
|-------------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| Profitability                 | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Quality                       | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Production output             | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Speed (e.g., inventory turns) | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Timeliness                    | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

## Supply Chain

## Supply Chain

42. Which of the following best describes your relationship with suppliers and customers? (check one in each row)

|           | Buy and sell (e.g., cost and quality focus) | Certification (e.g., broad qualifications established) | Cooperation (e.g., sharing product ideas, best practices) | Partnership (e.g., sharing resources, intellectual property, cost savings) |
|-----------|---|--|---|--|
| Suppliers | <input type="radio"/>                       | <input type="radio"/>                                  | <input type="radio"/>                                     | <input type="radio"/>  |
| Customers | <input type="radio"/>                       | <input type="radio"/>                                  | <input type="radio"/>                                     | <input type="radio"/>  |

43. Which of the following criteria are assessed and documented for material/component suppliers? (check all that apply)

- Quality/reliability
- Delivery (to schedule)
- Productivity
- Total cost
- Adherence to specifications
- Service/responsiveness
- Labor practices
- Financial stability
- Ethics
- Environmental performance
- Criteria of supplier's suppliers
- Other
- No criteria



44. How have the following (on a per unit basis) changed in the past 12 months? (check one in each row)

|                           | Decreased<br>more than<br>10% | Decreased<br>6-10%    | Decreased<br>1-5%     | No change             | Increased<br>1-5%     | Increased<br>6-10%    | Increased<br>more than<br>10% |
|---------------------------|-------------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-------------------------------|
| Price for your products   | <input type="radio"/>         | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>         |
| Component/material costs  | <input type="radio"/>         | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>         |
| Employee wages            | <input type="radio"/>         | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>         |
| Employee benefits         | <input type="radio"/>         | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>         |
| Logistics/transport costs | <input type="radio"/>         | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>         |
| Utilities/fuel            | <input type="radio"/>         | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>         |

45. Please report the following customer and supplier measures for your plant:

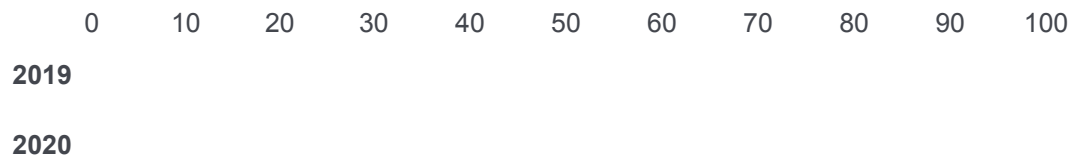
Customer reject rates (parts per million rejected)

- For example: 10,000 ppm = 1%.
- Do not use punctuation.

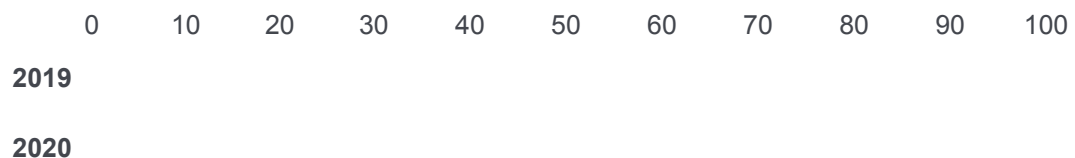
2019

2020

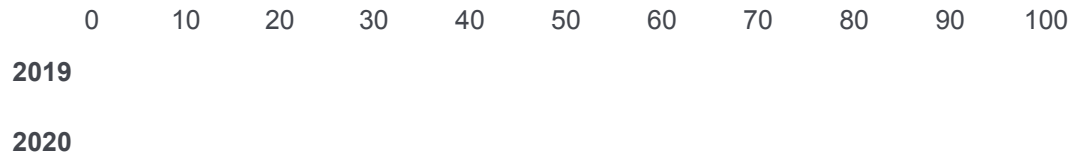
Customer retention rate (% of customers retained from previous year)



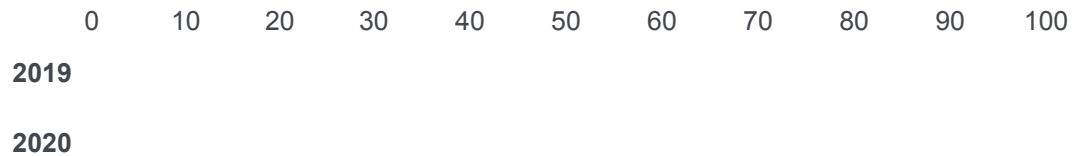
International sales (% of goods sold outside of home country)



**Imported material and components (% of dollar volume purchased from outside home country)**



**46. What percentage of this plant's primary product is provided by suppliers? (% of product dollar value)**



**47. Which of the following supply-chain programs and/or practices are in place? (check all that apply)**

- Certification of major suppliers
- Supplier-management program
- Sharing forecasts with suppliers
- Collaborative design with suppliers
- Customer-satisfaction surveys
- Kitting/preassembly for customers
- Collaborative design with customers
- Access to customer forecasts
- None of these

**Capacity/Equipment/IT**

**Capacity/Equipment/IT**

**48. Which of the following maintenance practices are in place at the plant? (check all that apply)**

- Planned maintenance activities
- Daily team maintenance involving operators
- Predictive maintenance techniques and tools
- Early equipment management
- Analysis of equipment characteristics (e.g., vibration, temperature)

Spare-parts management

Lockout/tagout practices

None of the above

**49. Please report the following capacity/equipment measures for your plant:**

**Production volume as % of designed plant capacity**

|             |   |    |    |    |    |    |    |    |    |    |     |
|-------------|---|----|----|----|----|----|----|----|----|----|-----|
|             | 0 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |
| <b>2019</b> |   |    |    |    |    |    |    |    |    |    |     |
| <b>2020</b> |   |    |    |    |    |    |    |    |    |    |     |

**Machine availability as % of scheduled uptime**

|             |    |    |    |    |    |    |    |    |     |
|-------------|----|----|----|----|----|----|----|----|-----|
|             | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |
| <b>2019</b> |    |    |    |    |    |    |    |    |     |
| <b>2020</b> |    |    |    |    |    |    |    |    |     |

**Unplanned maintenance as % of total maintenance expenses**

|             |   |    |    |    |    |    |    |    |    |    |     |
|-------------|---|----|----|----|----|----|----|----|----|----|-----|
|             | 0 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |
| <b>2019</b> |   |    |    |    |    |    |    |    |    |    |     |
| <b>2020</b> |   |    |    |    |    |    |    |    |    |    |     |

**Return on invested capital**

- *Calculated as follows: net operating profit after taxes ÷ capital invested X 100*

|             |   |    |    |    |    |    |    |    |    |    |     |
|-------------|---|----|----|----|----|----|----|----|----|----|-----|
|             | 0 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |
| <b>2019</b> |   |    |    |    |    |    |    |    |    |    |     |
| <b>2020</b> |   |    |    |    |    |    |    |    |    |    |     |

**50. How did the following technologies affect your plant's productivity in the past 12 months? (check one in each row)**

|   | Technology not in use | No effect             | Improved somewhat     | Improved significantly |
|---|-----------------------|-----------------------|-----------------------|------------------------|
| Cloud computing                                   | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>  |
| Mobile technologies                               | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>  |
| Big data/business analytics                       | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>  |
| Digital Twin                                      | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>  |
| Digital Thread                                    | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>  |
| Robots or cobots                                  | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>  |
| Enterprise resource planning (ERP)                | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>  |
| Customer relationship management (CRM)            | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>  |
| Internet of Things/Industry 4.0 technologies      | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>  |
| Additive manufacturing/3D printing                | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>  |
| Mixed, augmented, and/or virtual realities        | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>  |
| Supply-chain tracking and monitoring (e.g., RFID) | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>  |
| Supply-chain management system (SCM)              | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>  |
| Manufacturing execution system (MES)              | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>  |
| Warehouse management system (WMS)                 | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>  |
| Transportation management system (TMS)            | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>  |
| Enterprise asset management (EAM)                 | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>  |

**51. What is the typical payback period for the following technologies? (check one in each row)**

|  | Technology not in use | Less than 1 year      | 1 to 2 years          | 2 to 3 years          | More than 3 years     |
|--|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| Cloud computing                        | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Mobile technologies                    | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Big data/business analytics            | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Digital Twin                           | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Digital Thread                         | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Robots or cobots                       | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Enterprise resource planning (ERP)     | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Customer relationship management (CRM) | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

|   | Technology not in use | Less than 1 year      | 1 to 2 years          | 2 to 3 years          | More than 3 years     |
|---|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| Internet of Things/Industry 4.0 technologies      | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Additive manufacturing/3D printing                | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Mixed, augmented, and/or virtual realities        | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Supply-chain tracking and monitoring (e.g., RFID) | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Supply-chain management system (SCM)              | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Manufacturing execution system (MES)              | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Warehouse management system (WMS)                 | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Transportation management system (TMS)            | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Enterprise asset management (EAM)                 | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

**52. For which functions are technology (IT) applications and/or systems likely to be purchased or upgraded in the next 12 months? (check all that apply)**

- Enterprise management
- Planning/scheduling
- Design/development
- Procurement/purchasing
- Production/operations
- Logistics/distribution
- Human resources
- Accounting/finance
- Supply-chain management
- Asset management
- Customer service/support
- Maintenance
- None of these

**53. What were the following investments/expenses be as a percentage of plant sales in 2019?**

- **Percentages DO NOT need to sum to 100%.**



|  | Decrease<br>>20%      | Decrease<br>11-20%    | Decrease<br>1-10%     | No change             | Increase<br>1-10%     | Increase<br>11-20%    | Increase<br>>20%      |
|--|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| SG&A (selling, general, and administrative) expenses | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Research and development                             | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

**Green**

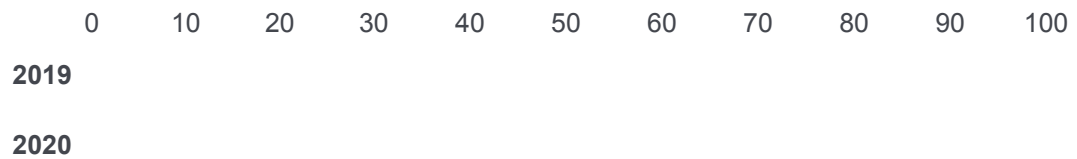
**Green/Sustainability**

**55. Which of these Green programs and/or practices occur at this plant? (check all that apply)**

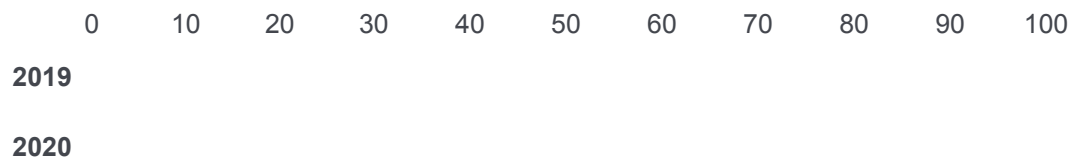
- Energy management
- Recycling/reuse programs
- Use of renewable energies
- Formal Green corporate program
- Carbon footprinting
- Sustainable packaging
- Environment-friendly logistics
- Energy production (e.g., biogas)
- None of these

**56. Please report the following green measures for your plant:**

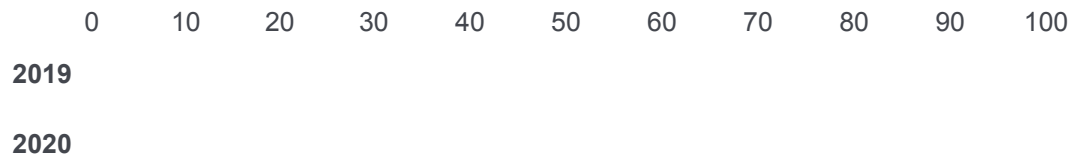
**Green products — finished goods that are recyclable/reusable (% of products)**



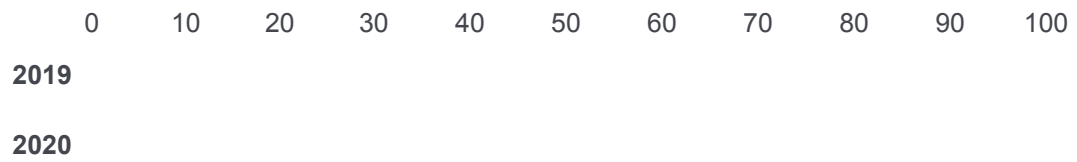
**Products with documented carbon footprints (% of products)**



**Green components and materials — i.e., recycled/reground/etc. (% of all purchased components and materials)**



**Renewable energy (% of plant energy used from a renewable source)**



**57. What was the percentage change in the energy cost per unit of product output ?**

- *Negative figure = decrease*
- *Positive figure = increase*

