Manufacturing a Post-Pandemic Future

MPI 2021 Manufacturing Study
Executive Summary

$150.00 USD

The MPI Group
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Introduction

Manufacturing a Post-Pandemic Future examines plant-level manufacturing performances and practices in the United States and around the globe in 2019 and 2020 amid the challenges of the COVID-19 pandemic. Executives at 408 facilities responded to the MPI 2021 Manufacturing Study, and their insights can help other manufacturers to ready their plants, equipment, and workers for surges in demand as normalcy returns.

Manufacturing a Post-Pandemic Future can help executives benchmark their operational performances; compare best practices; assess management of workforces, equipment, and technologies; and restore their plants to pre-pandemic performance levels in five critical areas:

1. Human Resources *(page 2)* — After the pandemic, overcoming labor turnover, absenteeism, and recruiting issues will require more than just the basics. Employees now demand cultures that emphasize safety in three realms: physical (zero harm should be the company's top objective); professional (managers should reward workers for reporting problems); and emotional (leaders must cultivate diverse workplaces in which trust and respect are norms). Organizations that value employees and their long-term development will succeed in the post-pandemic future; those that don't … won't.

2. Operations *(page 4)* — As a new normal emerges in 2021, the foundations for continuous improvement must be reestablished — if they ever existed in the first place. Manufacturers must define strategies and goals that require higher performance (i.e., pursuit of perfection). To do so they'll need embedded performance systems; workplace standards; continuous-improvement programs; training and rewards that encourage problem-solving; and communication backbones — visual management boards, up-and-down communications, mistake-proofing alerts, etc. — that surface problems and facilitate lasting solutions.

3. Supply Chain *(page 9)* — Manufacturers must re-invest in their supply chains to prevent a recurrence of widespread disruptions when the next crisis occurs. This requires monitoring of supplier performances for potential problems; strengthening relationships and data-sharing with suppliers and customers; and establishing redundant supplier networks to guarantee backups for critical supplies.

4. Capital Equipment and Information Technology *(page 11)* — To develop agile operations, manufacturers must invest in new technologies and Industry 4.0 capabilities, including remote sensing to monitor operations and proactively address problems; automation and robotics to enhance performance and worker safety; virtual operations to rapidly reconfigure production; and business analytics to manage volatile demand.

5. Green/Sustainability *(page 14)* — COVID-19 remains the world's current focus, but climate change looms large as a long-term disruption. Manufacturers can take green steps now to boost their bottom lines and help the environment — by expanding the use of recycled and reuse materials in their products and facilities; converting vehicle fleets to greener sources of energy; deploying alternative energies (e.g., biogas, geothermal, solar, wind); and lowering energy consumption of equipment with energy management systems, Industry 4.0 technologies, and improved maintenance processes.

These objectives — and the challenges they entail — should be on the radar of all manufacturers (see study demographics and methodology on *page 15*). Unfortunately, as the MPI 2021 Manufacturing Study highlights, many aren't yet paying attention — putting their profits (and survival) at risk.

For more on manufacturing performances, practices, and trends, read on.

John Brandt
CEO
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Human Resources

Difficulties keeping and finding employees

As the pandemic swept the world, manufacturing managers and employees were forced to create COVID-compliant workplaces and secure PPE to keep workers safe and on the job. Staffing problems disrupted frontlines and forced employees to assume new assignments and roles, resulting in more hours and overtime for those able to work.

The MPI Manufacturing Study found that prior to the pandemic, labor turnover and absenteeism rates were already extremely high — and then rose further in 2020:

- Annual labor turnover: 25% in 2019 (median) and 30% in 2020 (median).
- Absenteeism rate: 12% in 2019 (median) and 20% in 2020 (median).

Most manufacturers had at least some difficulty finding skilled workers, with roughly one in five reporting that it was "very difficult" or "impossible" *(Figure 1)*. Not surprisingly, pressure to retain employees led to higher wages, with large increases over the past decade:

- $23.00 wages in 2020 (median) — up from $15.00 in 2010 (median).
- $16.00 starting wages in 2020 (median) — up from $10.83 in 2010 (median).

About a quarter of plant employees are frontline production associates *(Figure 2)*. Fully 80% of plant employees are permanent workers vs. 20% temporary, and 80% are inhouse employees (i.e., on the plant's payroll) vs. 20% outsourced employees (i.e., paid via contracts with third parties). About four-fifths of plants have at least some production workers represented by a union.

Figure 1. Finding skilled workers

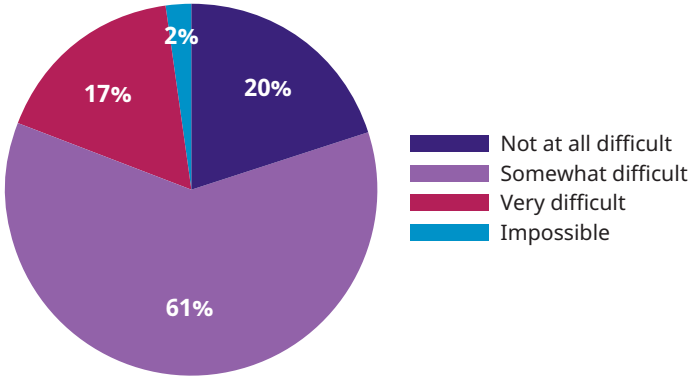
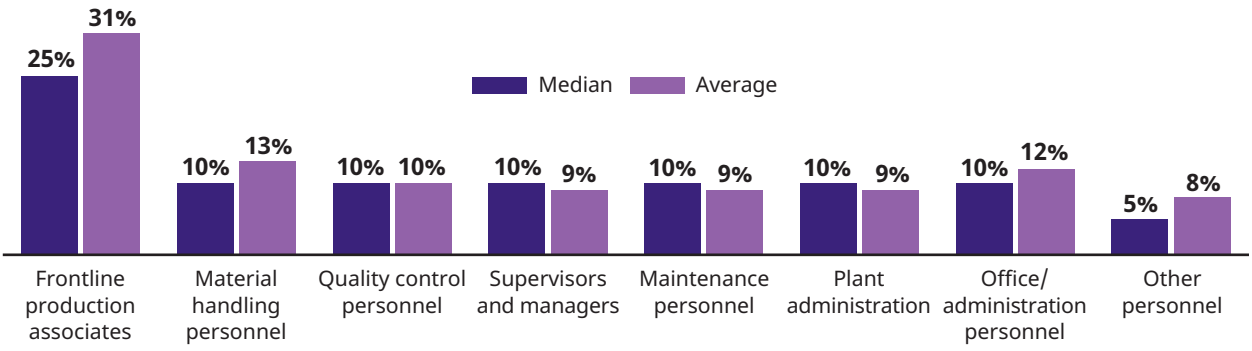


Figure 2. Plant employees by position



Training and empowerment still matter — to some

Despite workforce challenges that compounded operating issues, many plants remained committed to training and empowering employees: 23% of plants train each employee more than 40 hours annually, and another 38% train 20 to 40 hours. Manufacturers spent 10% of plant sales (median) on training in 2019 and 2020.

Approximately 46% of plants have a majority of their production employees participating in empowered or self-directed work teams *(Figure 3)*. Among plants that train employees more than 20 hours annually, 51% have empowered a majority of their production employees — vs. just 38% of plants that train less.

Approximately three-fourths of plants have a formal employee-training program, and half have a leader/supervisor development program. However, many other HR practices/programs that foster employee development, satisfaction, and performance are *not* used in many plants *(Figure 3)*. For example, less than half of plants have a formal safety/health or team-building programs.

For 2020, plants reported 10 (median) job-related injuries and illnesses (0.016 per employee), and 7 (median) job-related injuries and illnesses resulting in lost workdays (0.008 per employee).

Figure 3. Percentage of production employees in empowered or self-directed work teams

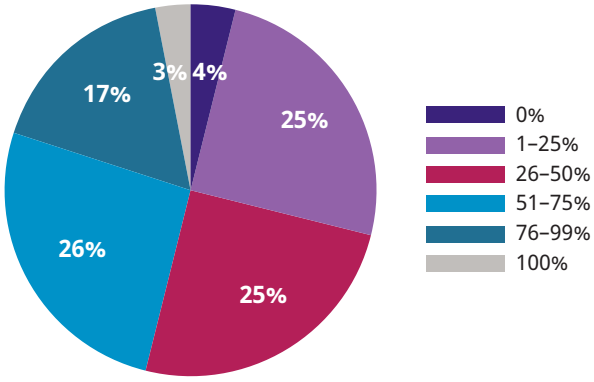
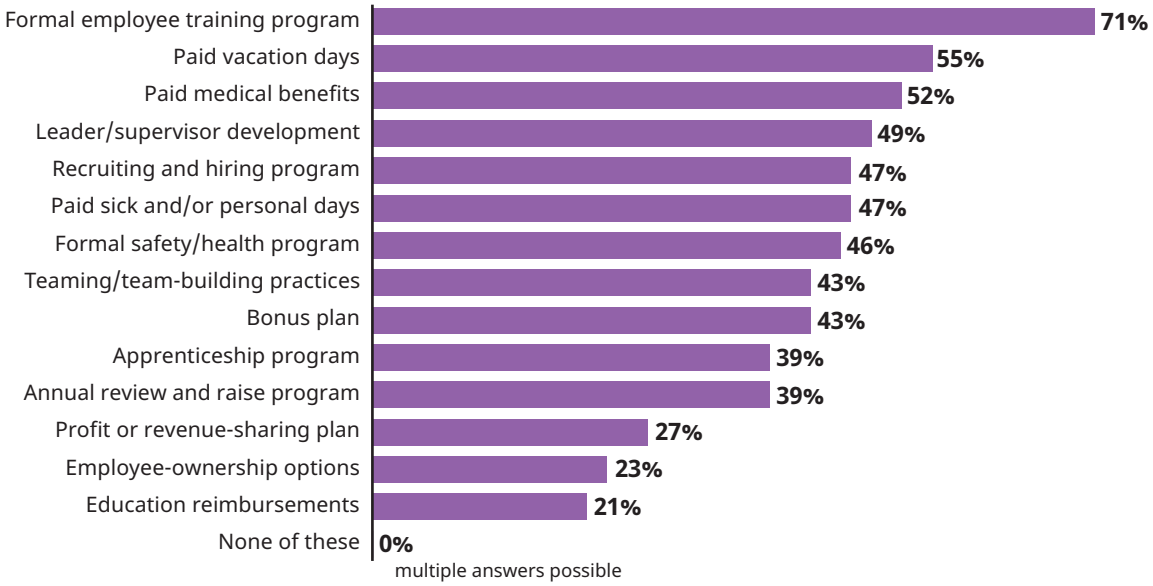


Figure 4. HR practices/programs in use



Operations

Time to reemphasize process improvement

Many plants have been in survival mode over the past year, struggling to efficiently move quality product to customers. Other plants failed — missing deadlines and deliveries, damaging their reputations and bottom lines. Why? Because the pandemic drove many leaders to focus on solving "today's biggest problem," instead of building high-performance cultures and systems that emphasize day-to-day accountability, process standards, and continuous improvement.

It's now time to renew commitments to process improvement — as dramatic statistics from the study highlight.

The application of lean manufacturing in plants — once *the* improvement method in industry, characterized by the flow of goods through production, pull systems, and a continuous effort to find problems and remove waste — is now found in just 50% of plants, down from 65% of plants in 2010 and 66% in 2015 *(Figure 5)*.

Figure 5. Improvement methodologies followed

Total Quality Management	**55%**
Lean Manufacturing	**50%**
Agile Manufacturing	**38%**
Six Sigma	**30%**
Theory of Constraints	**22%**
Toyota Production System	**15%**
Other methodology(ies)	**5%**
No methodology	**5%**

multiple answers possible

Even where improvement methodologies have been applied, 43% of executives report that the depth and breadth of adoption is "moderate," and 10% report "minimal" or "none." Approximately one-third report "extensive" and 10% report "complete" adoption. Similarly, just 64% of workforces (median) are fully engaged in their plants' improvement methods.

The pandemic drove many leaders to focus on solving "today's biggest problem," instead of building high-performance cultures and systems.

A majority of manufacturers also don't leverage other proven improvement programs/practices, including performance management systems, continuous-improvement programs, strategy/policy deployment, and benchmarking *(Figure 6)*.

And while a majority of executives report "good" or "excellent" collaboration with internal functions and supply-chain partners *(Figure 7)*, collaboration in approximately one-quarter of plants remains "fair" or "poor."

Figure 6. Improvement programs/practices

Quality certifications (e.g. ISO)	**61%**
Performance management system	**45%**
Total productive maintenance	**44%**
Continuous-improvement program	**43%**
Strategy/policy deployment	**32%**
Benchmarking	**31%**
5S workplace organization	**29%**
Waste elimination (i.e., seven wastes)	**27%**
Visual management boards	**27%**
PDCA problem-solving	**24%**
Value-stream mapping	**24%**
Open-book management	**23%**
Daily huddles/team meetings	**23%**
Kaizen events/blitzes	**21%**
Zero-loss thinking	**21%**
DMAIC problem-solving	**21%**
None of these	**1%**

multiple answers possible

Figure 7. Collaboration with production

	No or poor collaboration	Fair collaboration	Good collaboration	Excellent collaboration
Customer service/support	**5%**	**20%**	**41%**	**33%**
Directly with suppliers	**4%**	**19%**	**45%**	**31%**
Directly with customers	**6%**	**19%**	**44%**	**31%**
Finance/accounting	**4%**	**21%**	**45%**	**29%**
R&D/product development	**5%**	**25%**	**42%**	**28%**
Purchasing/procurement	**3%**	**20%**	**50%**	**26%**
Sales and marketing	**7%**	**22%**	**46%**	**25%**

Plant performance — perception vs. reality

Most executives report that common plant performances — quality, speed, profitability — improved over the past three years *(Figure 8)*. But production metrics for 2019 and 2020 show that many plants still have room — *lots* of room — to improve *(Figure 9)*.

Figure 8. Three-year plant performances

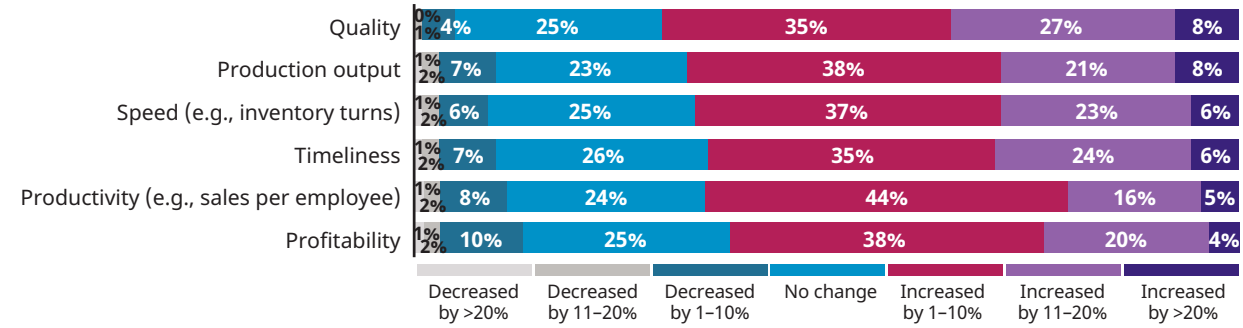


Figure 9. Production metrics in 2019 and 2020

	2019		2020	
	Median	Average	Median	Average
Manufacturing cycle time (hours from start of plant production to completion of primary product)	15 hours	105 hours	15 hours	110 hours
On-time delivery rate (% of goods delivered on time)	83%	76%	83%	77%
Perfect delivery rate (% of goods delivered on time to customer requested date, with perfect quality, and to all customer specifications)	80%	73%	80%	74%
Finished-product first-pass quality yield (% of product that passes final inspection)	83%	78%	84%	79%
Scrapped product (products that must be scrapped and cannot be reworked or sold at discount — % of plant sales)	5%	7%	5%	6%
Reworked product (products that must be reworked to meet quality criteria and be sold — % of plant sales)	15%	22%	14%	22%
Warranty costs (cost of products returned by customers and subject to warranty conditions — % of plant sales)	5%	6%	5%	6%
Sales per employee	$190,353	$203,732	$187,000	$204,570

Manufacturers face cost pressures

The dramatic impact of the pandemic on plants is highlighted in data on total production output: 32% reported a decrease from 2019 to 2020 vs. only 8% from 2018 to 2019 *(Figure 10)*.

Manufacturing costs for most plants (excluding purchased materials) rose over the past three years: 60% of executives reported an increase vs. just 17% a decrease *(Figure 11)*.

Plant total costs as a percentage of plant revenue were 62% (median) in 2020, with direct labor and materials consuming the highest percentages *(Figure 12)*.

Figure 10. Total production output (unit-volume change)

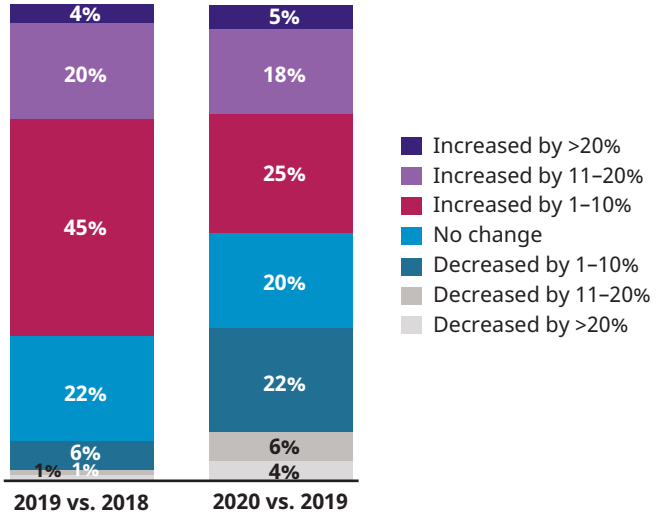


Figure 11. Per-unit manufacturing costs (excluding purchased materials) three-year change

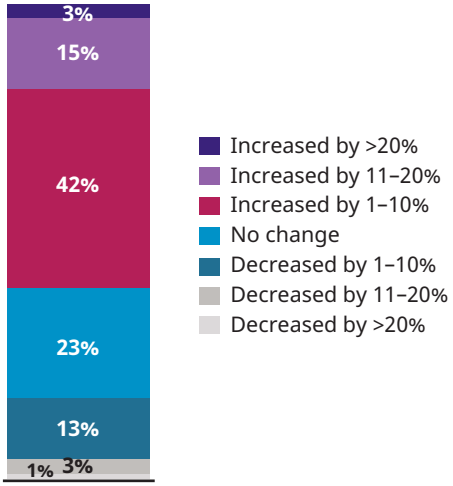
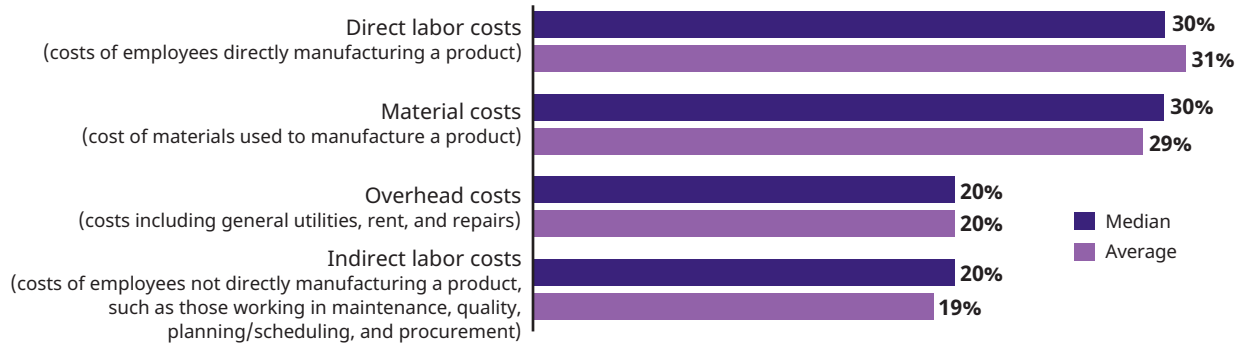


Figure 12. Costs as % of total plant costs



Many of the practices that manufacturers could use to better manage inventory — and costs — are missing at a majority of plants:

- Just-in-time supplier deliveries — only 45% of plants
- Quick equipment changeovers — 40%
- RFID or real-time inventory tracking — 37%
- Pull systems with kanban signals — 36%
- One-piece flow techniques — 28%
- Parts/goods supermarkets — 28%
- Vendor-managed or -owned inventories — 28%

Despite the lack of inventory-management practices, plants reported relatively high inventory turn rates, and hold reasonable amounts of inventory *(Figures 13 and 14)*. But they also report high percentages of obsolete inventory — 12% (median).

Figure 13. Inventory turn rates

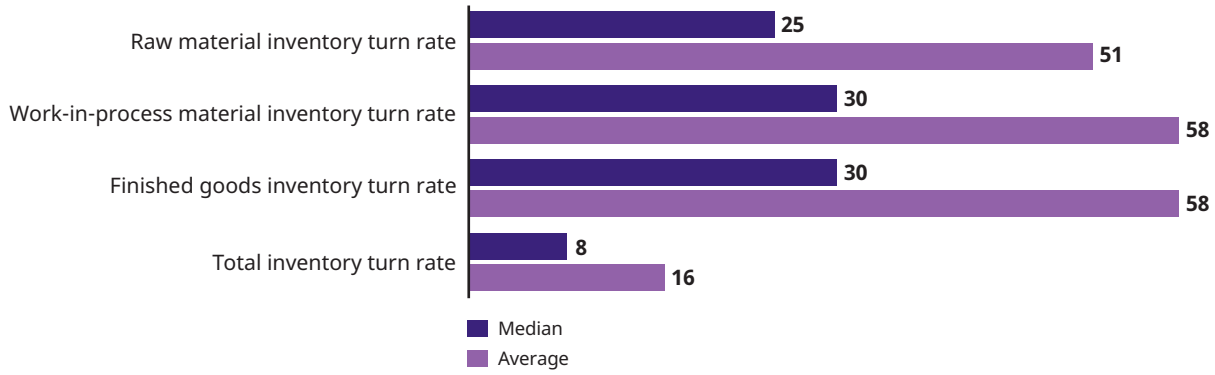
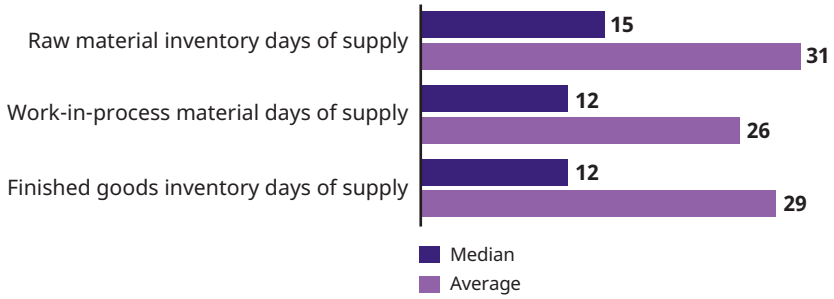


Figure 14. Inventory days of supply



Supply Chain

Fragile supply chains

At the start of the pandemic, early concerns regarding COVID-19 included disruptions among supply chains, principally those with ties to China. Sadly, the horrific toll on human life soon eclipsed all other issues. Yet many supply-chain problems illuminated by the pandemic remain.

Supply-chain performances improve when parties have deeper (i.e., non-transactional) relationships. Yet approximately one-third of executives describe their plants' relationships with suppliers and with customers as "buy and sell" *(Figure 15)*. In addition, many supply-chain programs/practices that help manufacturers manage and optimize those relationships are missing *(Figure 16)*.

Figure 15. Supply-chain relationships

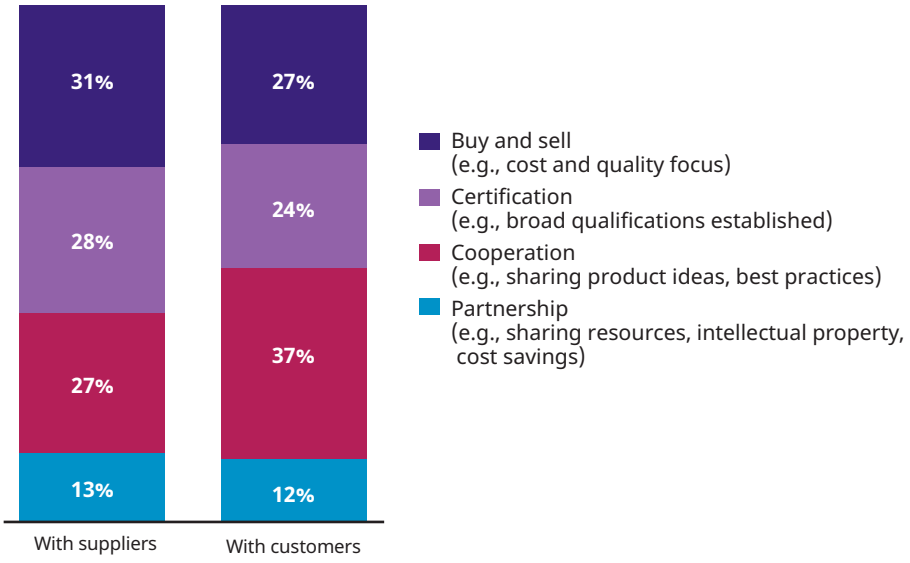
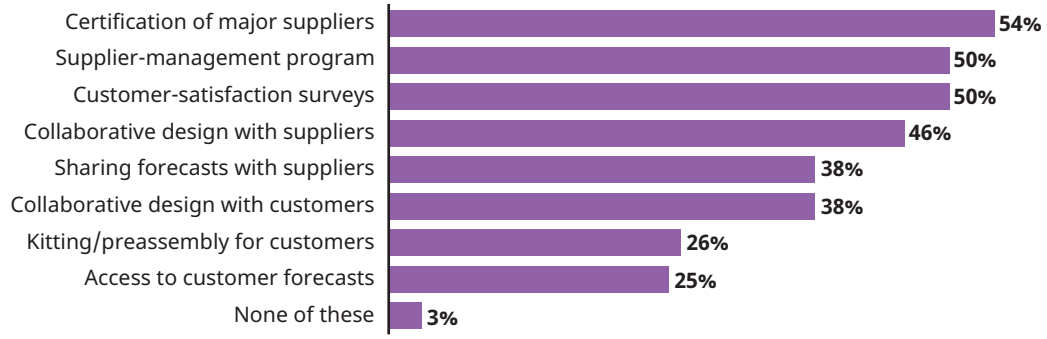


Figure 16. Supply-chain programs/practices



Plants relied on suppliers for 52% (median) of their primary products in 2020. So when 64% of plants report that component/material costs rose in the past 12 months, it directly impacts overall costs. Other plant costs on a per-unit basis also rose in the past 12 months; not surprisingly, a similar percentage of plants increased prices for their own products *(Figure 17)*.

Only 53% of manufacturers assess and document total costs from suppliers *(Figure 18)*. The most commonly reviewed supplier criterion is quality/reliability performance, but many other supplier criteria aren't monitored by high percentages of plants (e.g., only 29% monitor environmental practices).

From 2019 to 2020, manufacturers increased their percentages of sales into — and supply volumes from —international markets, a dynamic that could further exacerbate supply-chain delays *(Figure 19)*.

Figure 17. Per-unit changes in past 12 months

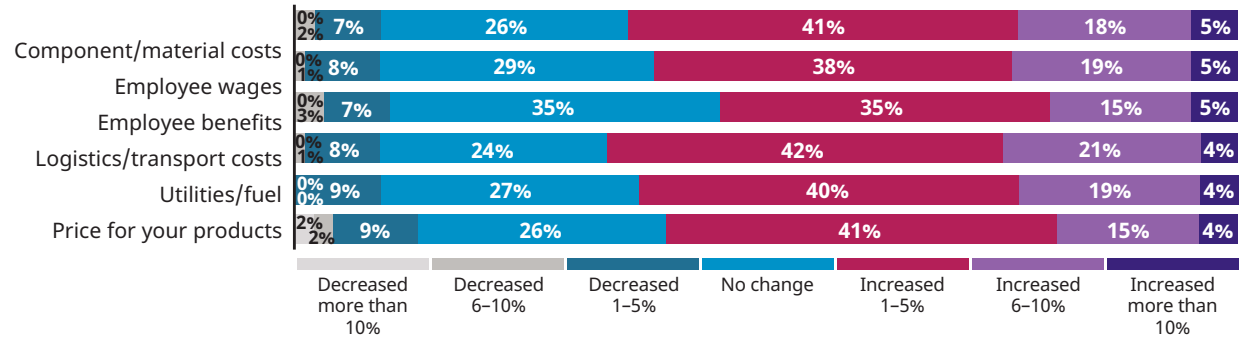


Figure 18. Assessed and documented supplier criteria

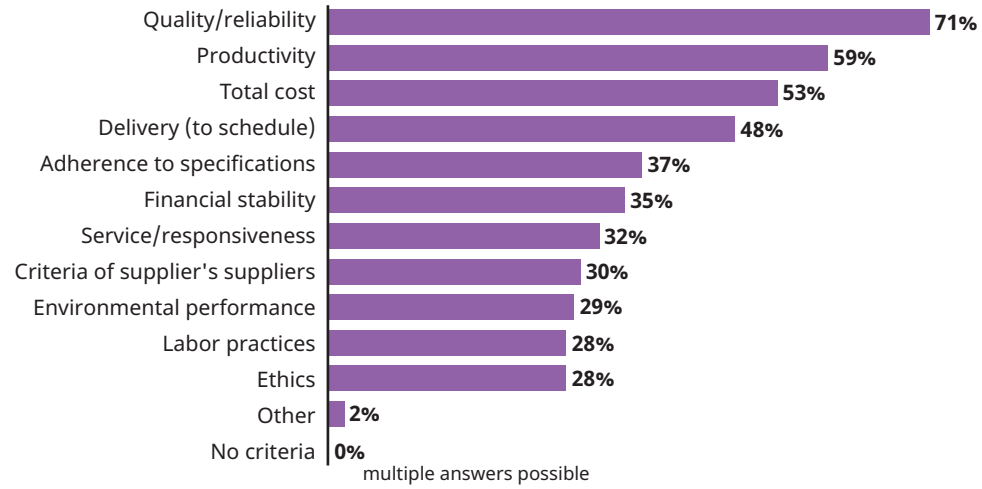


Figure 19. Supply-chain metrics in 2019 and 2020

	2019		2020	
	Median	Average	Median	Average
Customer reject rates (parts per million rejected)	5 ppm	1,691 ppm	4 ppm	1,347 ppm
Customer retention rate (% of customers retained from previous year)	71%	65%	73%	67%
International sales (% of goods sold outside of home country)	45%	44%	47%	46%
Imported material and components (% of dollar volume purchased from outside home country)	43%	42%	45%	43%

Capital Equipment and Information Technologies

Equipment performance lags

During the pandemic, plant executives saw facilities occasionally idled by factors beyond their control, such as missing workers and/or critical supplies. Other leaders saw production lines stalled by events *within* their control: equipment stoppages. Machine availability as a percentage of scheduled uptime was just 74% (median) in 2020, and 32% of maintenance that year was unplanned *(Figure 20)*.

Equipment performance would improve if more plants implemented maintenance practices to assess and respond to machine conditions before their equipment breaks down. The most common practice is planned maintenance activities, found at 62% of plants *(Figure 21)*.

Figure 20. Capital-equipment metrics in 2019 and 2020

	2019		2020	
	Median	Average	Median	Average
Production volume (% of designed plant capacity)	63%	60%	64%	62%
Machine availability (% of scheduled uptime)	75%	71%	74%	73%
Unplanned maintenance (% of total maintenance expenses)	28%	35%	32%	36%
Overall equipment effectiveness[1]	39%	41%	36%	42%
Return on invested capital	32%	37%	32%	37%

Figure 21. Maintenance practices

[1] Computed based on finished-product first-pass yield, production capacity as a % of designed capacity, and machine availability.

IT improves productivity

Approximately two-thirds or more of executives report that a range of technologies (IT) "somewhat" or "significantly" improved the productivity of their plants in the past 12 months *(Figure 22)*. Technologies most likely to improve productivity are:

- Customer-relationship management (CRM) — 78% of plants
- Supply-chain tracking and monitoring (e.g., RFID) — 76%
- Mobile technologies — 75%
- Enterprise resource planning — 75%
- Supply-chain management (SCM) system — 75%

A majority of executives indicate that the typical payback period for technologies is one year or more; about one-third reported payback periods of two years or more *(Figure 23)*.

Figure 22. Technology effect on plant productivity

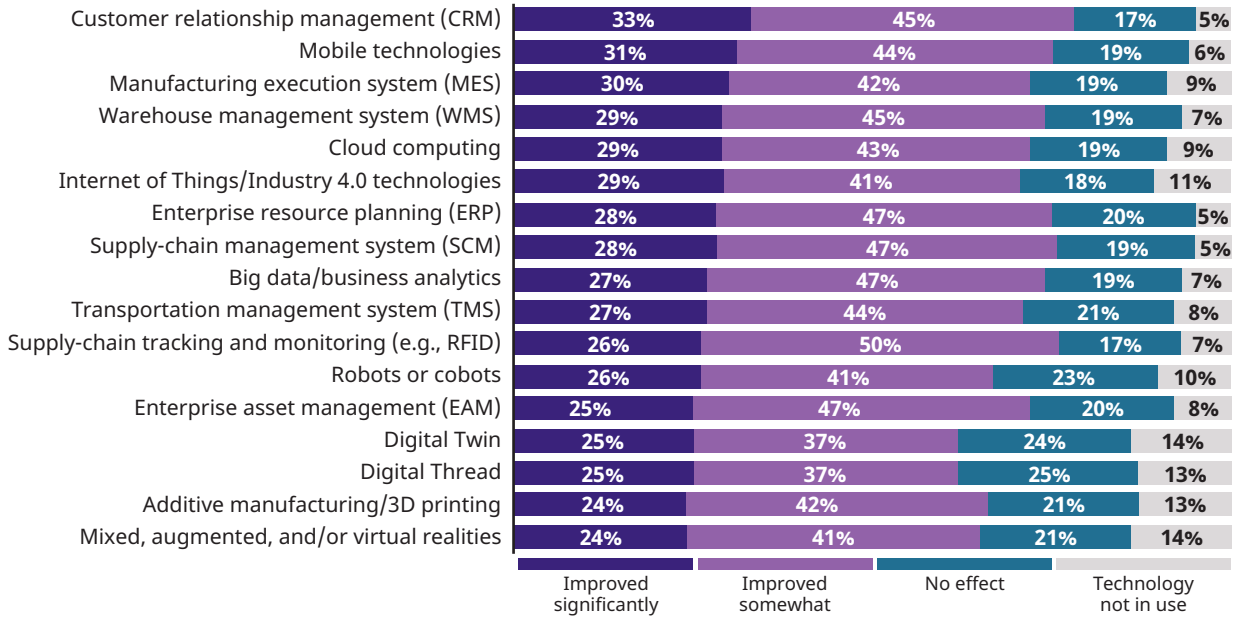
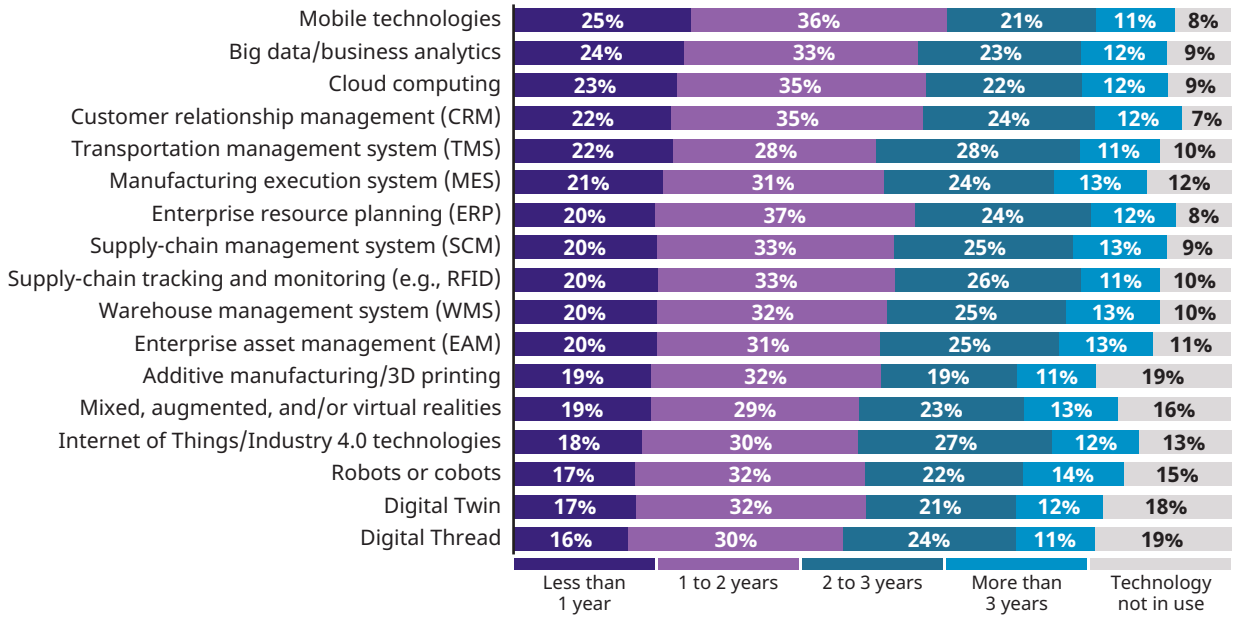


Figure 23. Typical technology payback period



Technology investments and upgrades

Plants invested 10% (median) of plant sales in IT hardware and another 10% in IT software in 2019 *(Figure 24)*. A majority of plants reported nearly all categories of investments increased from 2019 to 2020:

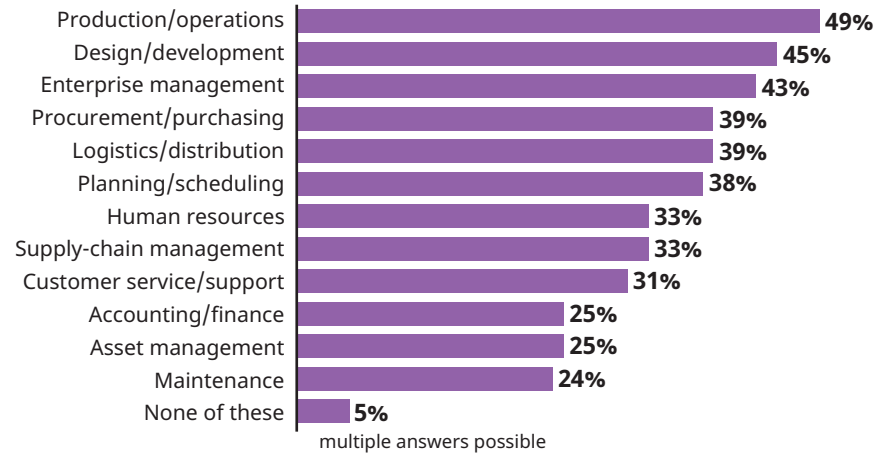
- Information technology spending, software — 60% of plants increase
- Material and components — 57% increase
- Research and development — 56% increase
- Employee costs (all wages, benefits, etc.) — 56% increase
- Information technology spending, hardware — 56% increase
- Transportation/logistics costs — 56% increase
- Process-improvement initiatives — 54% increase
- Capital equipment spending — 53% increase
- Utilities/energy — 53% increase
- SG&A (selling, general, and administrative) expenses — 52% increase
- MRO (maintenance, repair, and overhaul) expenses — 48% increase

Functions most likely to see purchases or upgrades of technology applications or systems in the next 12 months are production/operations, design/development, and enterprise management *(Figure 25)*.

Figure 24. Investments in 2019 (% of plant sales)[2]

	Median	Average
Capital equipment spending	10%	11%
Information technology spending — hardware	10%	9%
Information technology spending — software	10%	9%
Process-improvement initiatives	10%	9%
Employee costs (all wages, benefits, etc.)	10%	15%
Utilities/energy	10%	11%
Material and components	10%	14%
Transportation/logistics costs	10%	9%
MRO (maintenance, repair, and overhaul) expenses	10%	9%
SG&A (selling, general, and administrative) expenses	10%	9%
Research and development	9%	8%

Figure 25. Functions for which technology applications and/or systems likely to be purchased or upgraded in next 12 months



[2] Investment will not sum to 100%; some investments can be applied to two or more cost categories.

Green/Sustainability

Environmental performance rebounds

After years of stagnant plant-sustainability data, manufacturers appear to be focusing again on green initiatives. The use of some green programs/practices *(Figure 26)* has increased in recent years, and many green metrics *(Figure 27)* have improved considerably: for example, green products were 41% of finished goods (median) in 2020, up from 20% in 2017.

Figure 26. Green programs/practices

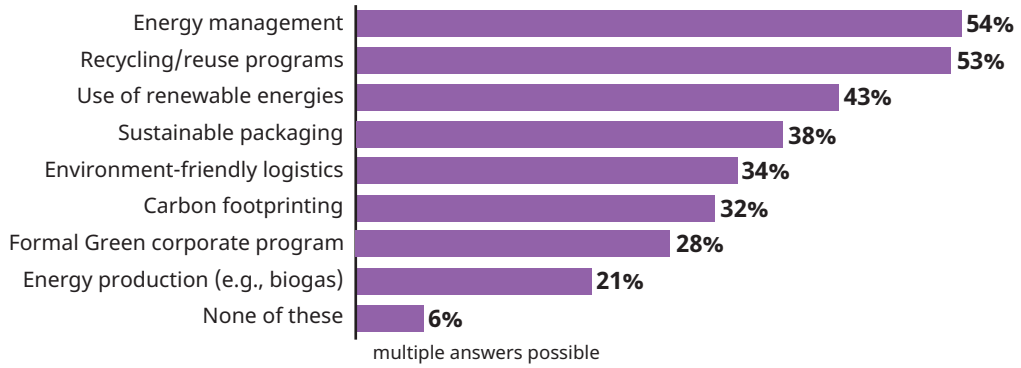
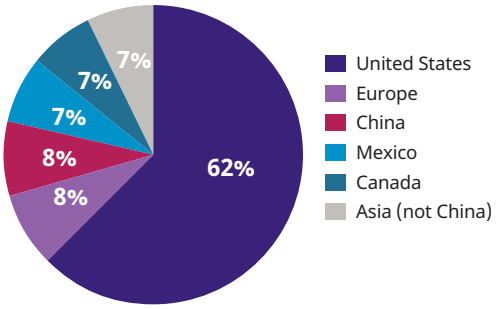


Figure 27. Green metrics

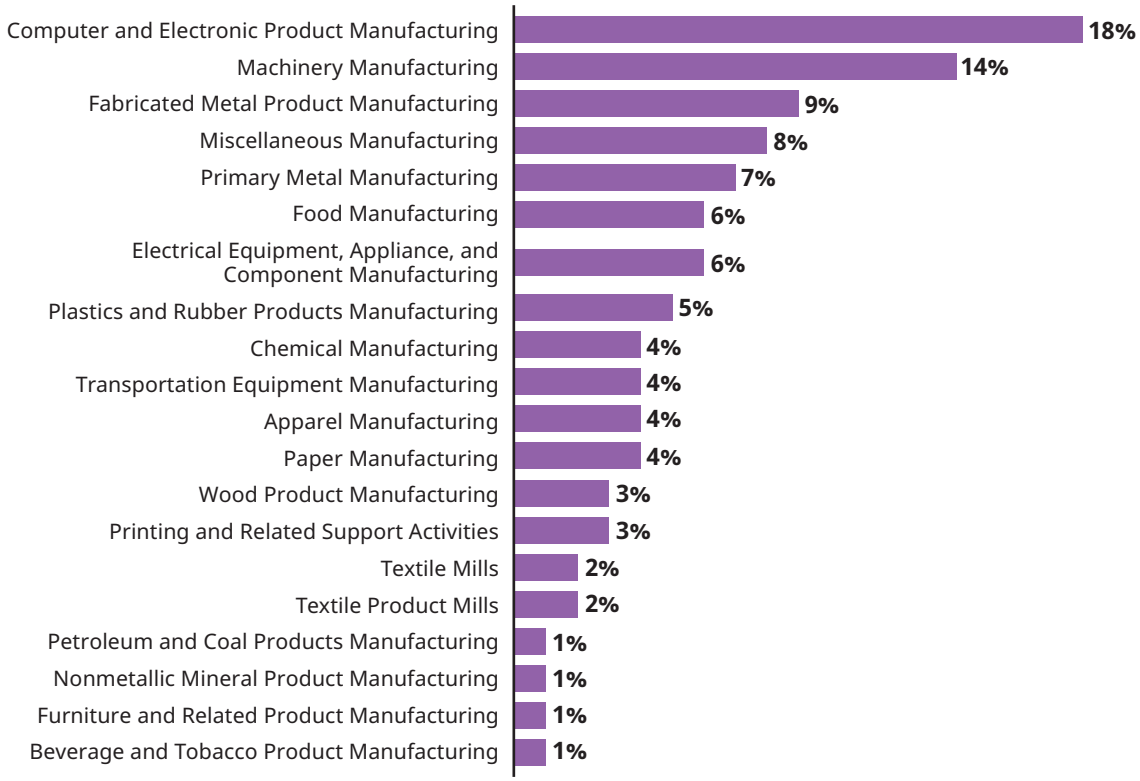
	2019		2020	
	Median	Average	Median	Average
Green products — finished goods that are recyclable/reusable (% of product)	38%	39%	41%	42%
Products with documented carbon footprints (% of products)	34%	36%	39%	39%
Green components and materials — i.e., recycled/reground/etc. (% of all purchased components and materials)	35%	37%	42%	41%
Renewable energy (% of plant energy used from a renewable source)	34%	36%	37%	39%
Percentage change to energy cost per unit of product output from previous year	4%	3%	6%	5%

Plant Profile

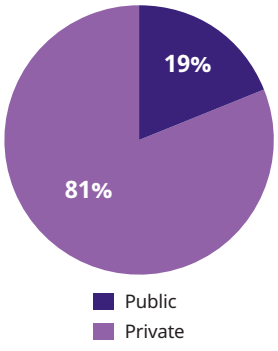
Country



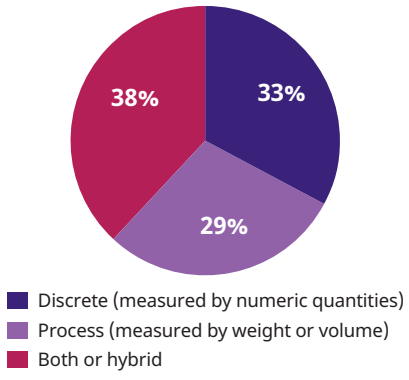
Primary product



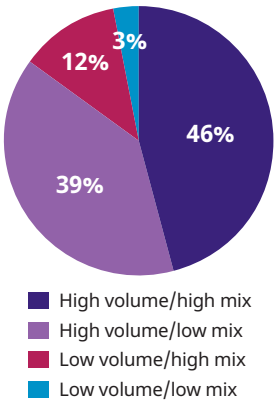
Type of company



Nature of operations



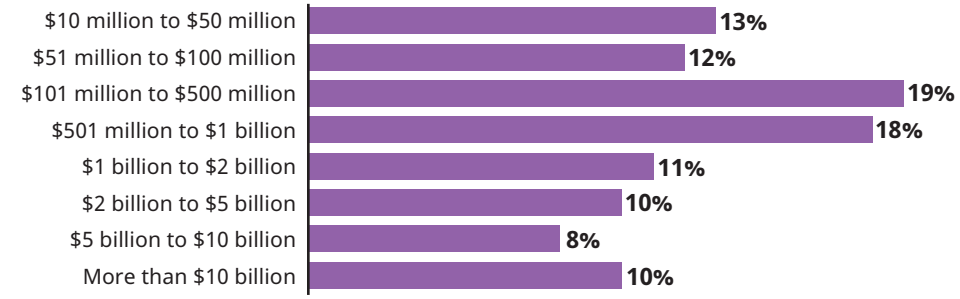
Plant volume and mix



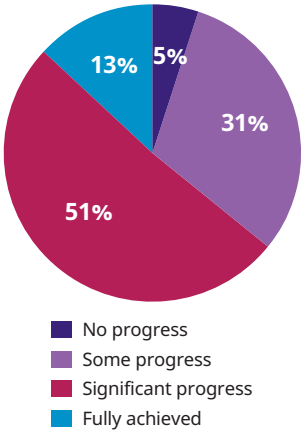
Plant revenue and employees

	Median	Average
Plant annual revenue		
Plant revenue 2019	**$50,000,000**	**$133,165,881**
Plant revenue 2020	**$54,000,000**	**$169,771,745**
Plant employees		
Employees in 2019	**455**	**853**
Employees in 2020	**450**	**867**

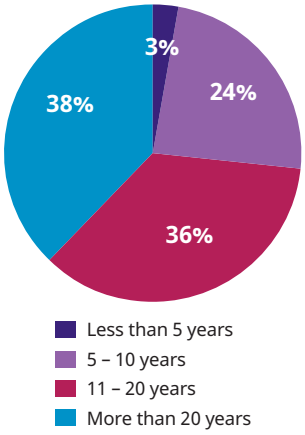
Corporate-parent revenue



Progress toward world-class manufacturing status



Years since plant startup



Methodology

The MPI Manufacturing Study was conducted by The MPI Group using an online questionnaire promoted by a panel company to manufacturing plant executives and managers. The MPI Group received 408 valid participants in January and February 2021. Responses were entered into a database, edited, and cleansed to ensure answers were plausible, where necessary. All respondent answers to the survey are anonymous.

MPI Manufacturing Study questions consisted of:

- Directive single-answer questions for which respondents were asked to "check one" answer category
- Directive multiple-answer questions for which respondents were asked to "check all that apply"
- Open-ended numeric questions for which respondents were asked to respond with a number.

For this report, tables and charts for "check one" and "check all" answer categories are presented either in the format presented on the survey or, where more meaningful, in descending order based on the percentage of responses for a particular answer category (i.e., the answer category with the highest percentage is listed first). Data for directive questions is presented with the percentage of responses for each answer category.

Tables and charts for open-ended questions are presented with the median and average statistics. *Note:* The median is the "typical" measure, not distorted by a few unusually high or low values in the sample due to special circumstances. The median figure represents the midpoint of the figures for a particular measure, with one-half of participants reporting figures above it and one-half below.

The MPI Group

The MPI Group (MPI) serves leaders with research, advice, and performance-targeted solutions that provide a competitive advantage in today's fierce marketplace. MPI combines the disciplines of research, strategic advice, knowledge development, and hands-on leadership to create a difference — in performance, in profits, and in the people who make them possible.

In addition to the *MPI Manufacturing Study,* MPI conducts other public research studies, exploring strategies, best practices, operational measures, and profitability across new management opportunities, technologies, and methodologies, including Industry 4.0 and Disruptive Technologies.

MPI also offers credible, independent, and private-label research on issues that matter to customers — along with access to associated custom content including infographics, blogs, eBriefs, white papers, keynote presentations, webinars, videos, interactive tools, and social media support.

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MPI offers presentations on the MPI 2021 Manufacturing Study data and other MPI research. To learn more about the *MPI 2021 Manufacturing Study Executive Summary,* schedule a presentation, purchase Study data, or to find out more about other research conducted by MPI, contact:

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