

Process Industries Performance Study

Executive Summary

Performance Solutions 
by Milliken

Process manufacturers run unique, equipment-centric operations, which means they're challenged to find meaningful performance benchmarks for best practices, improvement methods, tools and techniques. To fill this gap, Performance Solutions by Milliken has launched the PSM Process Industries Performance Study¹.

The Study captured information from 153 U.S.-based, large-company, process-oriented organizations. It closely examines activities and metrics related to the 4Ms—Manpower/human resources, Methods, Machines, and Materials.

We found worrisome trends. Many process plants don't implement best practices typically associated with lean and other improvement methods. For example, only 45 percent regularly pursue waste elimination, just 26 percent use 5S workplace organization, and a slim 16 percent conduct value-stream mapping. A concept adopted by many of PSbyM's most successful clients—zero-loss thinking—is used by only 15 percent of process-centric organizations. It's no surprise that performance lags at many companies:

- **Safety:** 23 percent reported OSHA recordable incident rates of 20 or higher.
- **Quality:** 30 percent reported scrap and rework rates of 20 percent or higher.
- **Profitability:** 28 percent reported gross margins of 15 percent or lower.

Fortunately, there's hope. Some 90 percent of process-centric organizations report performance improvements over the past two years, with changes driven by improvement methodologies (*55 percent of plants use Total Quality Management and 50 percent use lean manufacturing²*) as well as performance management systems (*88 percent*). A few facilities recorded stellar performances in the past:

- **Safety:** A third reported OSHA recordable incident rates of 1 or lower.
- **Quality:** 18 percent reported scrap and rework rates of 2 percent or lower.
- **Profitability:** 30 percent reported gross margins of 45 percent or higher.

At PSbyM, we've helped executives to improve performance at thousands of process operations in a variety of industries around the world. We believe the benchmarks and findings in the next few pages will help your operations, too.



Phil McIntyre

Managing Director

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Employment Profile

Approximately two-thirds of process plants in the study (61 percent) have 500 or more employees; 28 percent had more than 1,000 employees. Half of all employees (median) are frontline staff (Figure 1). The percentage of plant employees that belong to a union is 12 percent (median) and 30 percent (average).

1. What percentage of plant employees are the following?

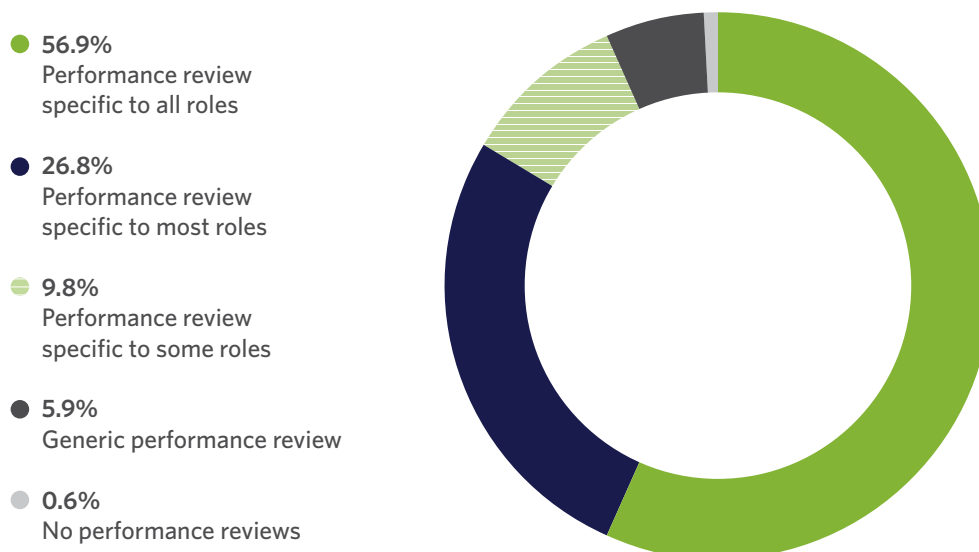
	MEDIAN	MEAN
Frontline Employees	50%	45.4%
Managers or Supervisors	10%	11.4%
Technicians/Technical Specialists (e.g., chemists)	10%	11.8%
Maintenance	10%	9.8%
Administration/Front Office	10%	9.6%
Plant Management/Senior Leadership	8%	8.9%
Other	0%	3.1%

Less than half of process plant employees are “completely capable” at a range of non-production tasks.

Development and Training

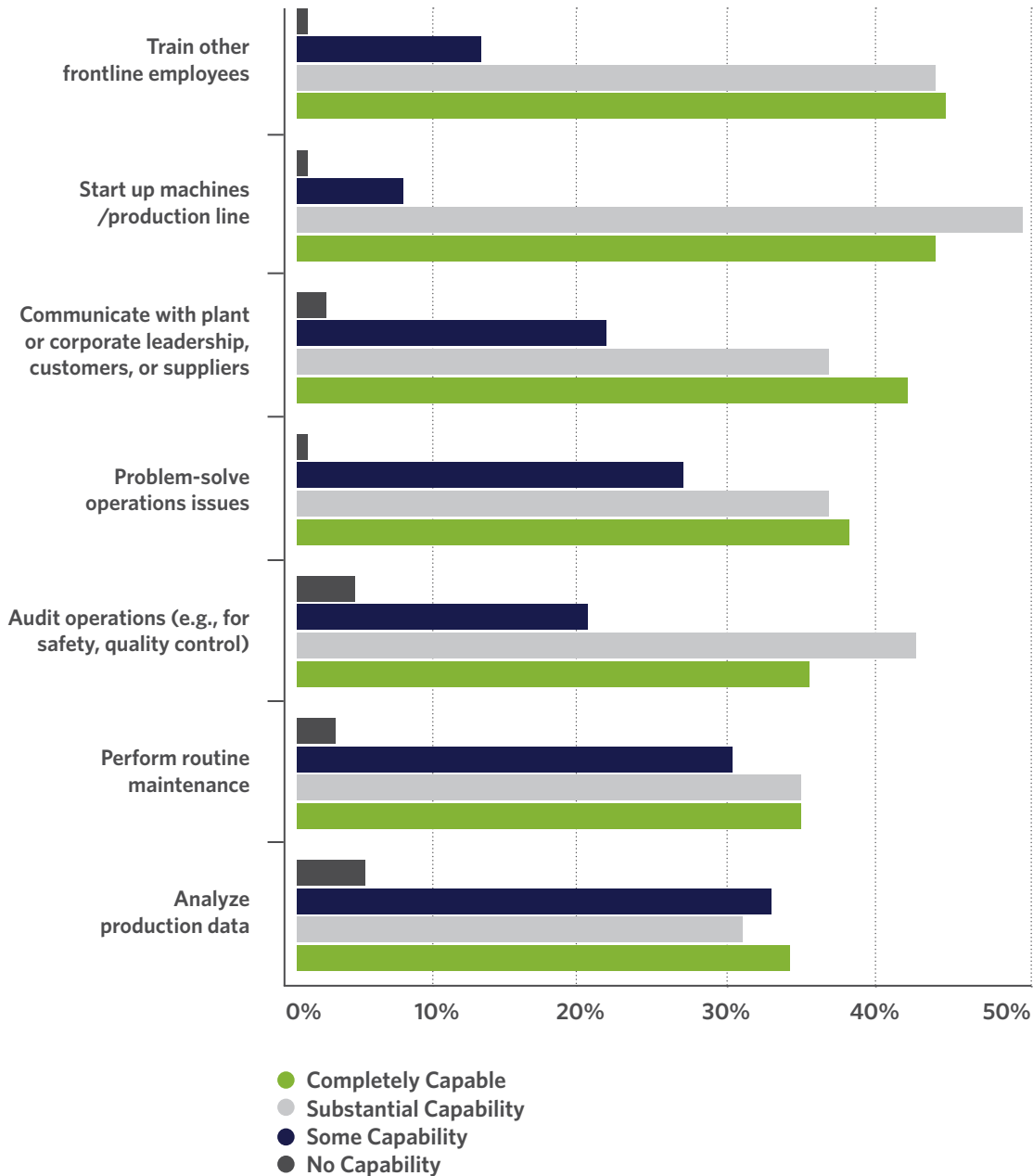
A large majority of plant employees are assessed annually in performance review programs: 90 percent (median) and 75 percent (average). And many performance review programs are specific to roles for employees (Figure 2).

2. Does the plant have a performance review program specific to each type of role (e.g., frontline, manager, technician)?



Half of frontline employees—50 percent (median) and 56 percent (average) regularly participate in organized work teams (e.g., safety team, quality team). But less than half of process plant employees are “completely capable” at a range of non-production tasks (e.g., machine startups) (Figure 3).

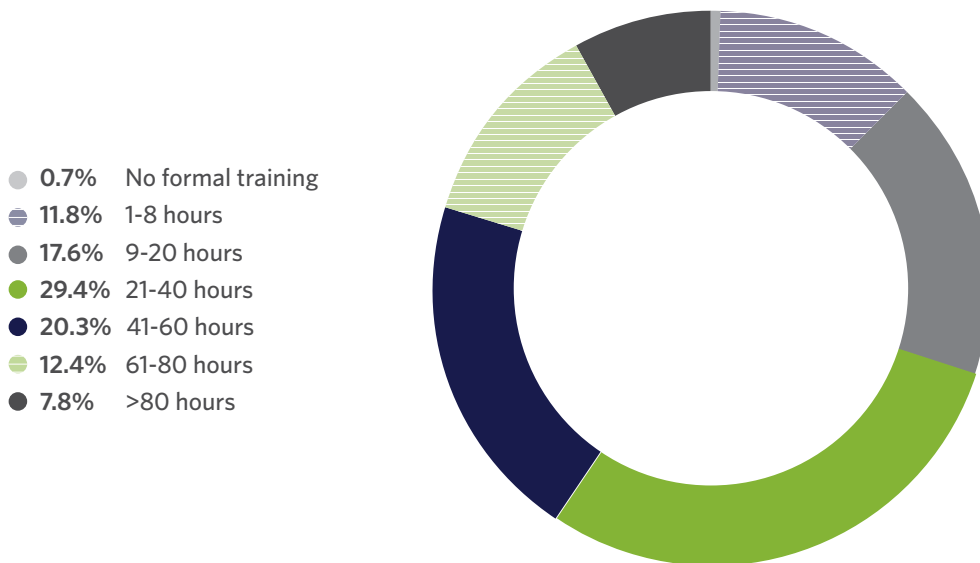
3. Please rate the capability of frontline employees to perform the following tasks:



A high percentage of frontline employees—80 percent (median) and 70 percent (average)—perform their roles with the aid of documented skill requirements and job instructions. Some plants back those tools up with adequate training, but many do not—a majority of process plants train frontline employees 40 hours or fewer annually (Figure 4). Most training occurs in on-site classrooms or on the job (Figure 5).

A majority of process plants train frontline employees 40 hours or fewer annually.

4. How many hours of formal training does each frontline employee receive annually?



5. What percentage of frontline-employee formal training is the following?

	MEDIAN	MEAN
Classroom on-site	30%	36.6%
On-the-job	30%	36.2%
One-on-one	10%	11.9%
Classroom off-site	0%	11.4%
Other	0%	3.8%

Management Activities

Managers/supervisors spend a majority of their time focused on daily operations—60 percent (median) and 60 percent (average)—with the rest of their days dealing with improvement or immediate crises:

- Continuous improvement activities: 20 percent (median) and 24 percent (average)
- Firefighting: 10 percent (median) and 15 percent (average)
- Other: 0 percent (median) and 2 percent (average).

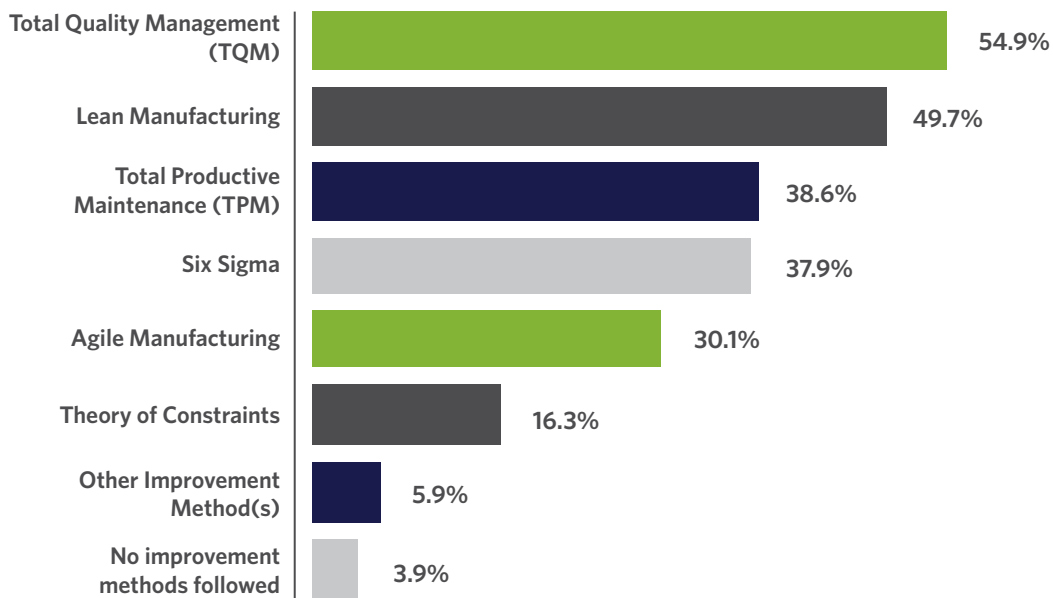
Employee Performances

Many process plants have problems with absenteeism—6 percent (median) and 11 percent (average). Similarly, many plants have trouble with employee turnover—10 percent (median) and 13 percent (average)—with a fifth of plants reporting turnover greater than 20 percent.

Improvement Methods

Adoption rates for improvement methodologies among process plants are relatively low, with only Total Quality Management (TQM) adopted by more than half of the facilities, followed by Lean Manufacturing (Figure 6). Where improvement methods are in place, only half of employees are engaged in implementing the approach—50 percent (median) and 53 percent (average).

6. Which of the following improvement methods are followed by the plant?

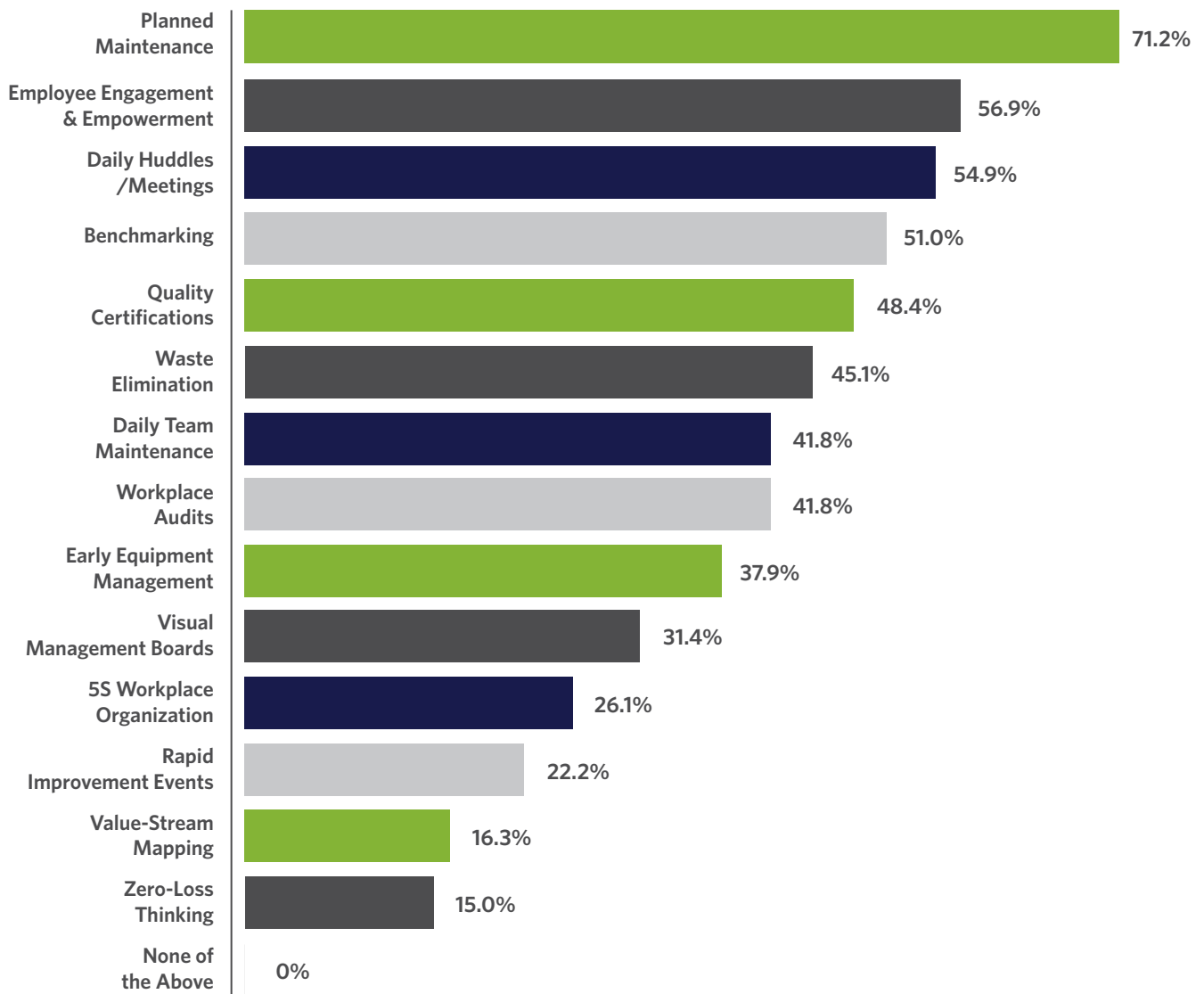


Many common best practices are not widespread among process plants.

Best Practices

Many common best practices are not widespread among process plants (Figure 7). For example, only 57 percent use employee engagement and empowerment, and only 31 percent use visual management. Just 15 percent use zero-loss thinking

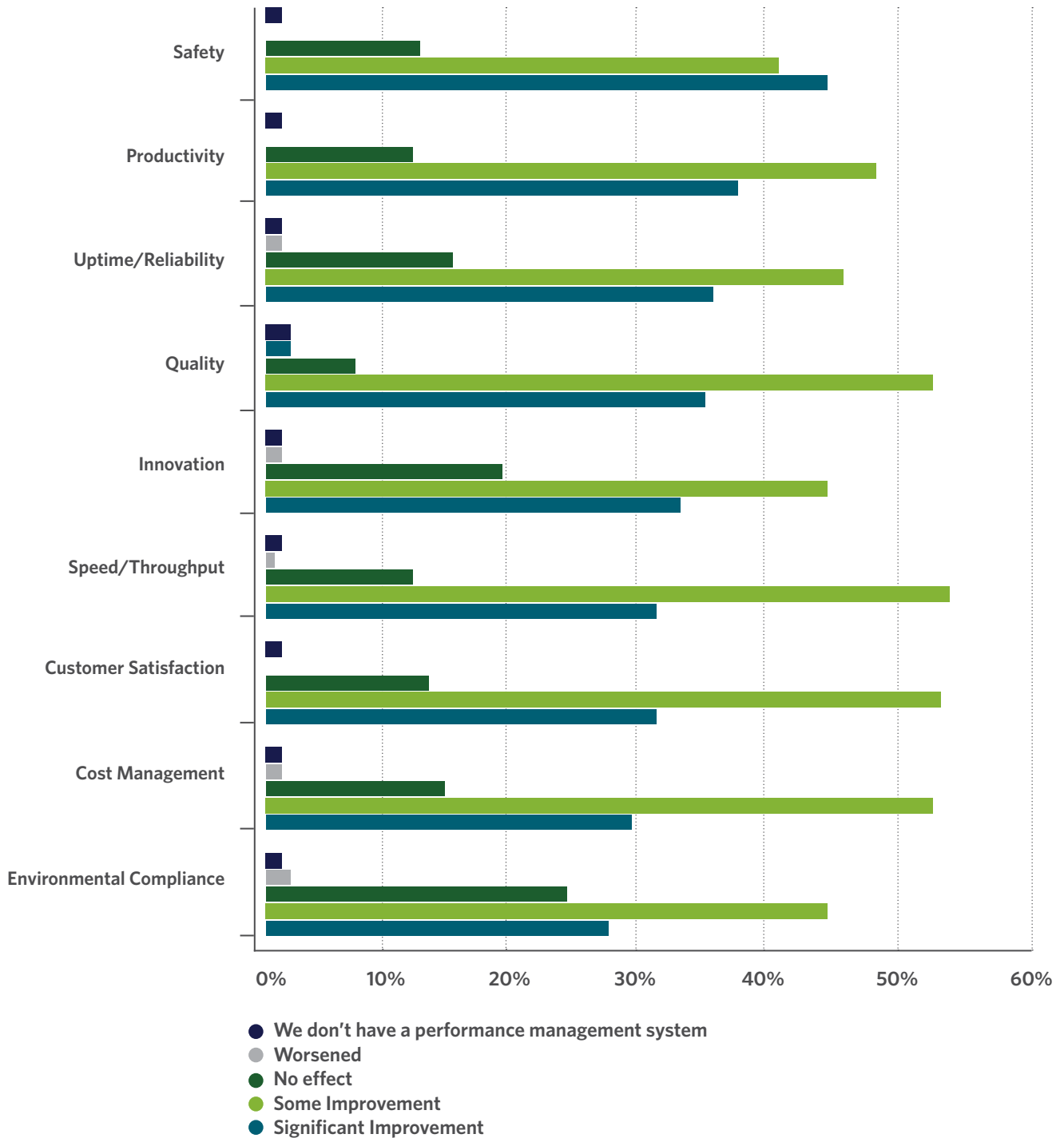
7. Which of the following practices are used regularly by the plant?



Performance Management System

Most process plants (88 percent) have a performance management system in place; 10 percent don't, and 3 percent of executives were unsure. A significant majority of plants report that their systems have positively impacted (some or significant improvement) a range of performances (Figure 8).

8. How has the plant's performance management system impacted the following?



Operations Performances

Despite executive sentiment that performance management systems have improved production performances (e.g., safety, quality, productivity), the metrics at many facilities tell a different story (Figure 9). For example, 20 percent of process plants have complete-and-on-time delivery rates of 50 percent or worse, and 13 percent of facilities report OSHA recordable incident rates of 50 or higher.

9. Operations metrics

	MEDIAN	MEAN
Gross margin percentage for the past year	30%	34.5%
Complete-and-on-time delivery performance percentage	87%	75.3%
Scrap and rework percentage rate (% of product that must be discarded or reworked/remixed to make an acceptable quality product)	10%	18.9%
Customer retention percentage rate (% of customers retained from previous year)	87%	71.7%
Sales per employess	\$65,000	\$350,000
OSHA recordable incident rate	3	48.5
Reportable environmental incidents	1	8.6

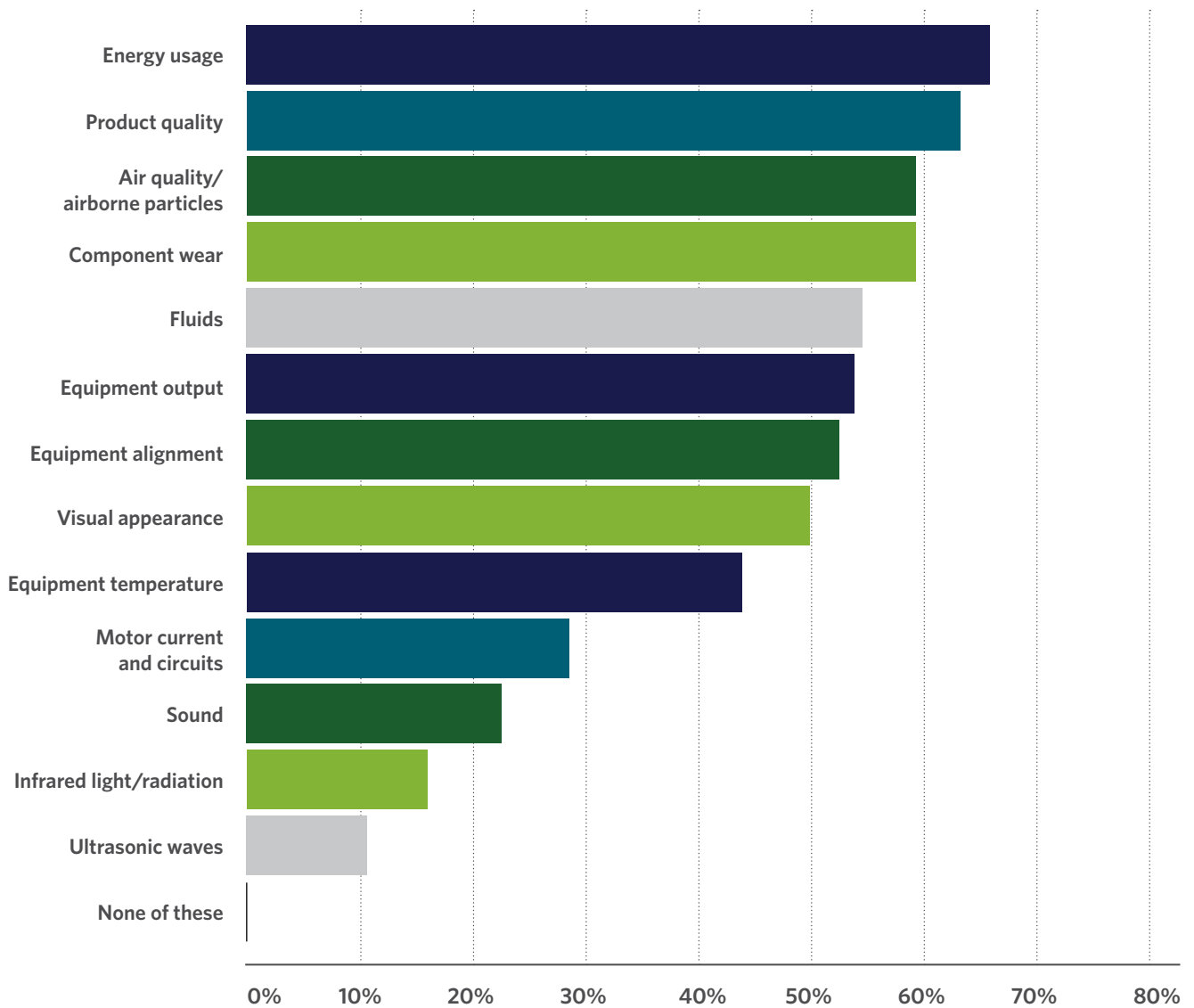
Maintenance Programs

All process plants in the study have maintenance programs in place, and describe their plant’s program as:

- Preventive: 67 percent
- Reactive: 18 percent
- Predictive: 15 percent

Maintenance programs are most likely to monitor equipment characteristics of energy usage, product quality, and air quality/airborne particles (Figure 10).

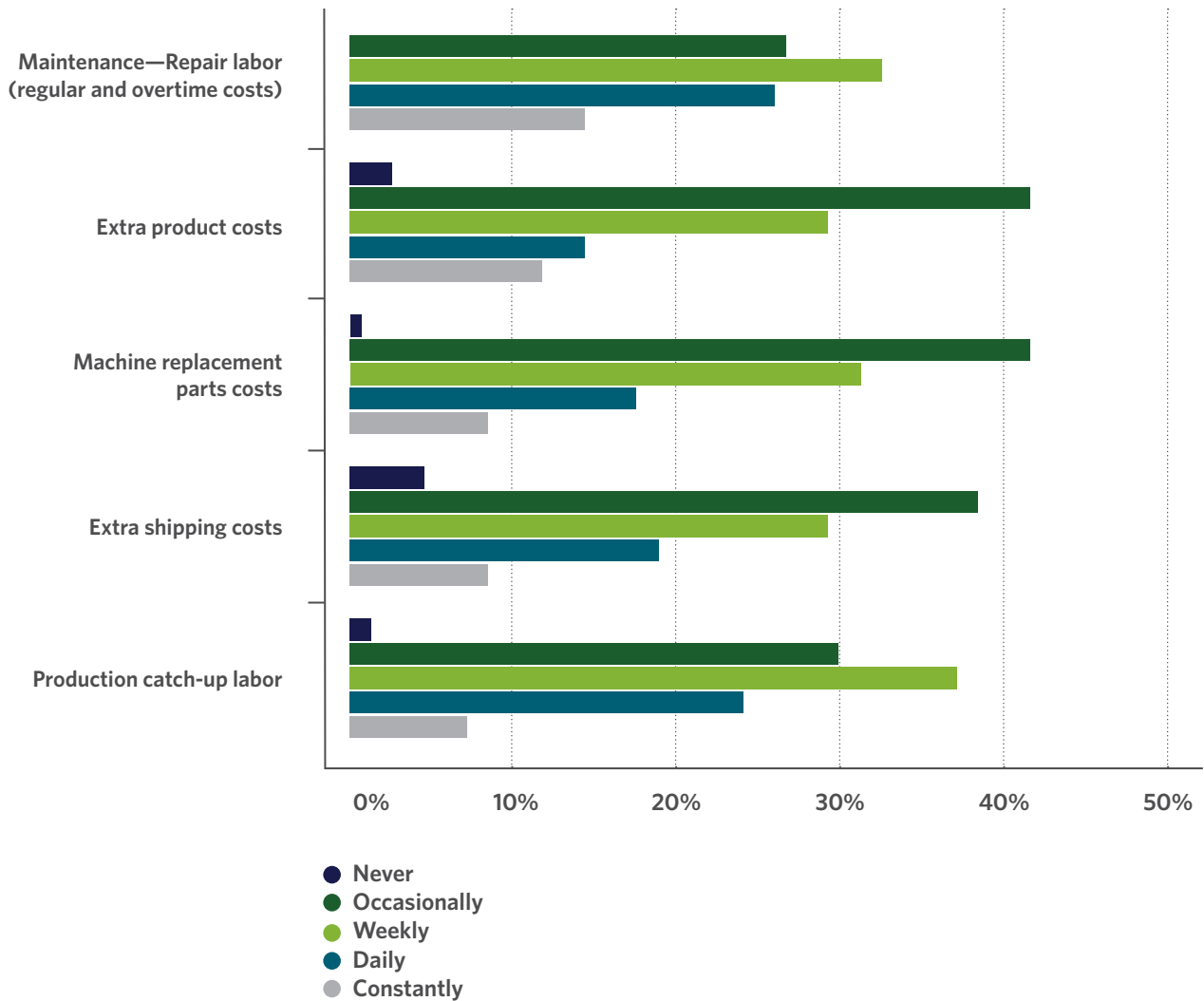
10. Which of the following equipment characteristics are regularly monitored by maintenance?



Equipment Breakdowns

Although most plants have preventive or predictive maintenance programs, many incur a range of costs due to equipment breakdowns. For example, 40 percent experience maintenance-repair labor costs “daily” or “constantly”, and 26 percent experience extra product costs (products are damaged during the breakdown or during ramp-up) “daily” or “constantly” (Figure 11). These plants should assess the quality and effectiveness of their maintenance programs.

11. How frequently are the following costs incurred in the plant due to equipment breakdowns?



41 percent of process plants reported machine uptime rates of 70 percent or lower over the past year.

(as a percentage of scheduled uptime)

Maintenance Performances

Many process plants struggle with equipment performance (Figure 12). For example, 41 percent reported machine uptime rates (as a percentage of scheduled uptime) of 70 percent or lower over the past year. If these plants could improve their equipment-maintenance operations, they would tap substantial hidden production capacity.

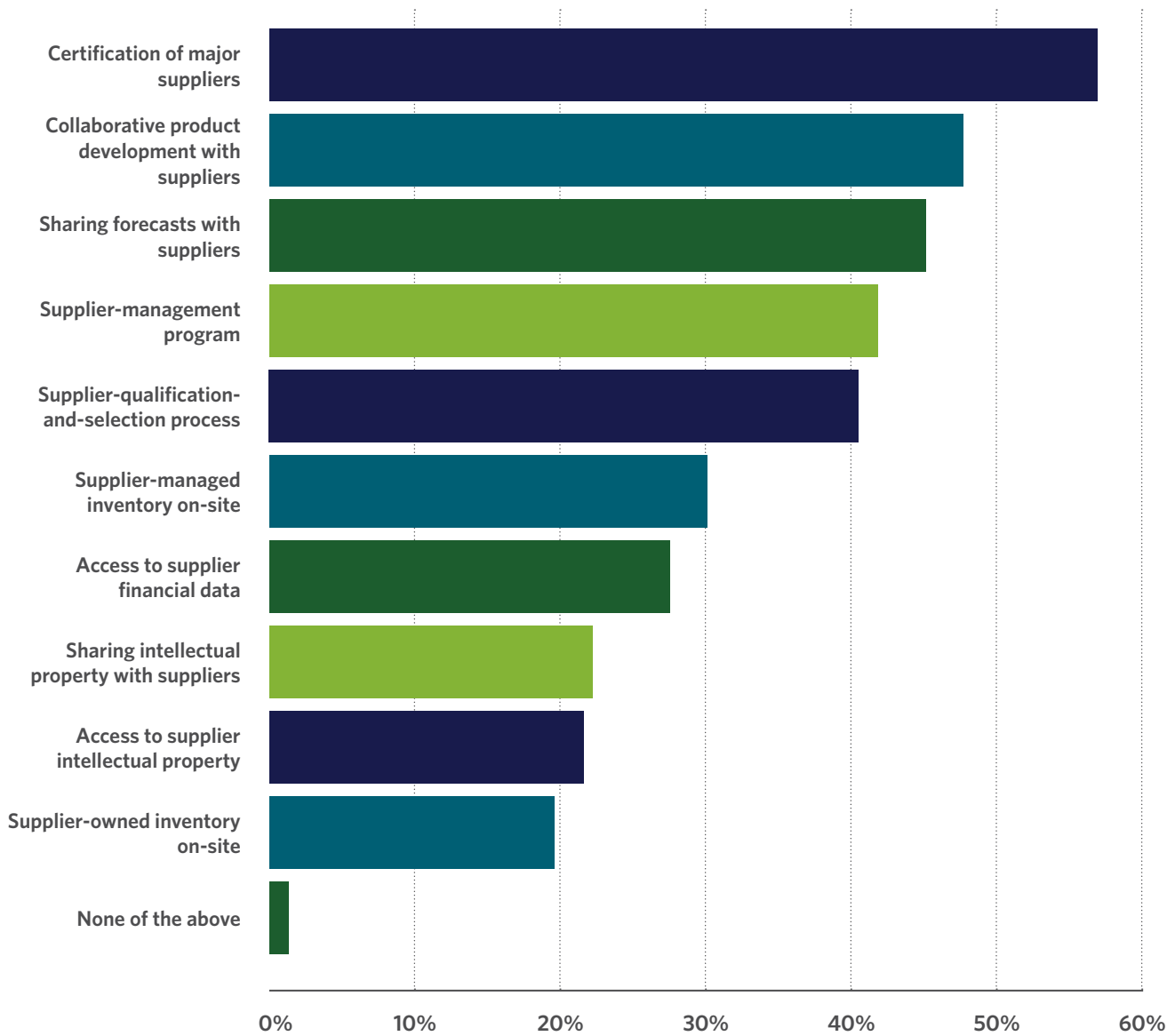
12. Maintenance metrics

	MEDIAN	MEAN
Changeover time (in minutes) for primary production lines/processes	34	41.5
Machine uptime percentage rate (% of scheduled uptime)	80%	66.7%
MACHINE DOWNTIME		
Minor work stoppages	80%	74%
Major breakdowns	20%	26%
Percentage of maintenance work that was unplanned maintenance	15%	20.9%
Capacity utilization percentage rate (actual output as % of designed plant capacity)	78%	66.4%
Overall equipment effectiveness percentage rate (% machine availability X % quality yield X % of optimal rate that equipment operates)	75%	63.4%

Supplier Programs/Practices

The performance of the supply chain is especially critical to a process plant’s performance and success. Yet barely half of plants certify their major suppliers (Figure 13).

13. Which of the following supplier programs and/or practices are in place at your plant?

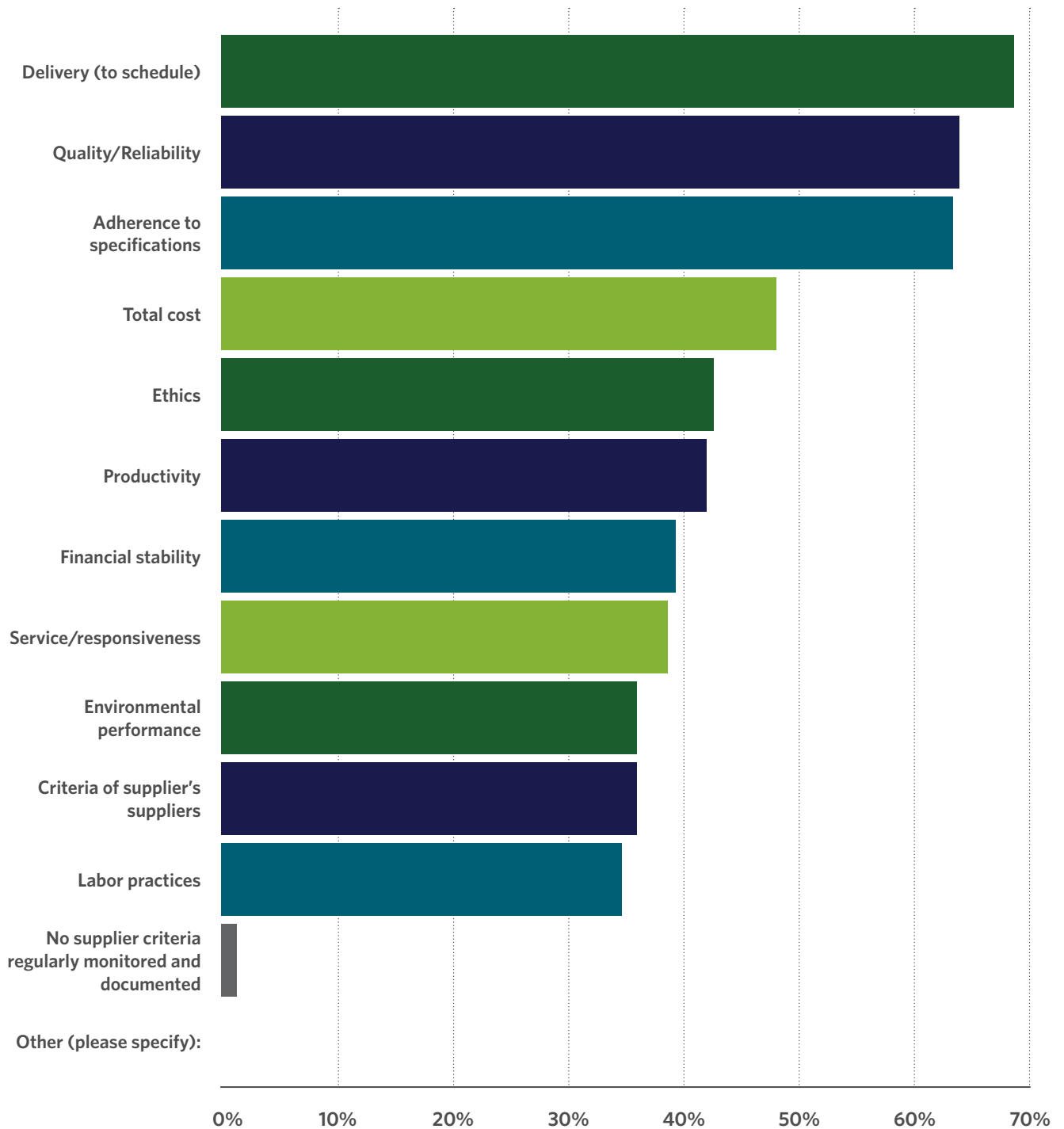


Less than half of process plants monitor suppliers’ total cost, which may explain why supplier prices over the past three years have increased at 81 percent of plants.

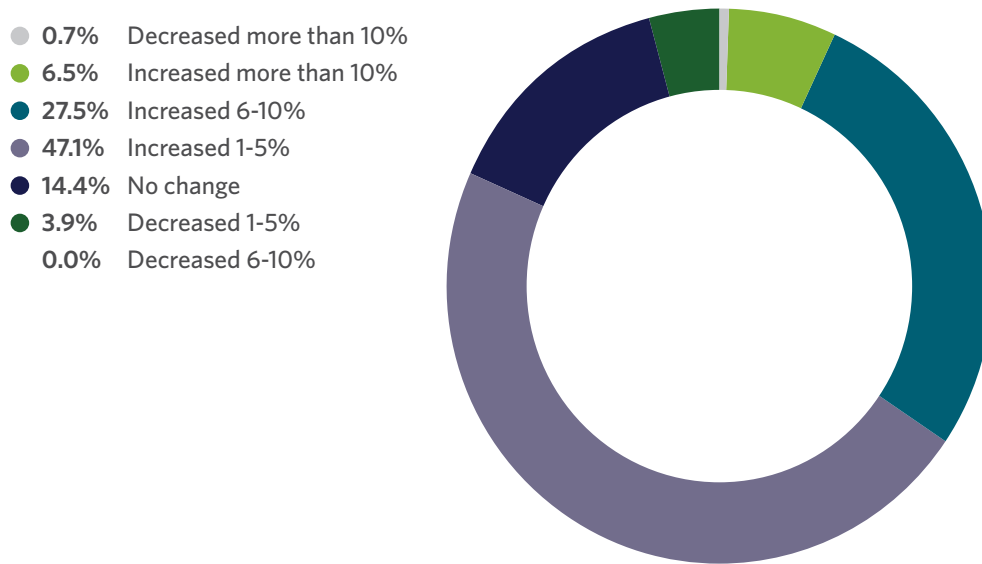
Supplier Criteria

Process plants are most likely to monitor suppliers' delivery to schedule, quality/reliability, and adherence to specifications (Figure 14). Less than half of plants monitor suppliers' total cost, which may explain why supplier prices over the past three years have increased at 81 percent of plants (Figure 15).

14. Which of the following supplier criteria are regularly monitored and documented at your plant?



15. By what percentage have the plant's supplier prices (per unit) changed in the past three years?



Supplier Performances

Many process plants were negatively impacted by the performances of their suppliers over the past year (Figure 16). For some plants, supplier improvements cannot come soon enough. For example, 11 percent of plants rejected a quarter or more of supplier goods, and more than a quarter of plants reported supplier complete-and-on-time delivery rates of 70 percent or worse.

16. Supply-chain metrics

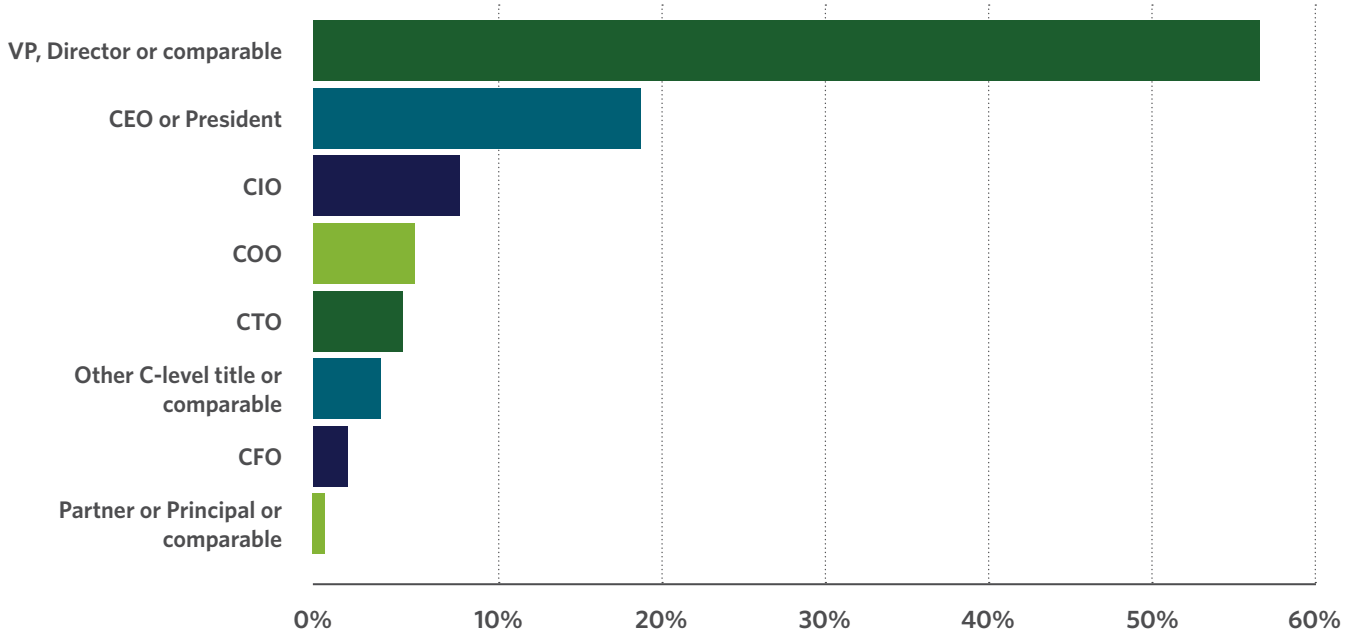
	MEDIAN	MEAN
Complete-and-on-time performance percentage rate of the plant's primary suppliers	90%	76.1%
Percentage of supplier goods rejected by the plant	5%	11.5%
Percentage of suppliers that provide 80% of the plant's materials and components	37.5%	43.9%
Percentage of supplier goods imported from outside of North America	19.5%	23.8%
Percentage of supplier shipments to the plant that are expedited	15%	21.8%

The PSM Process Industries Performance Study examined practices and performances at predominantly large-company, process-oriented, manufacturing facilities:

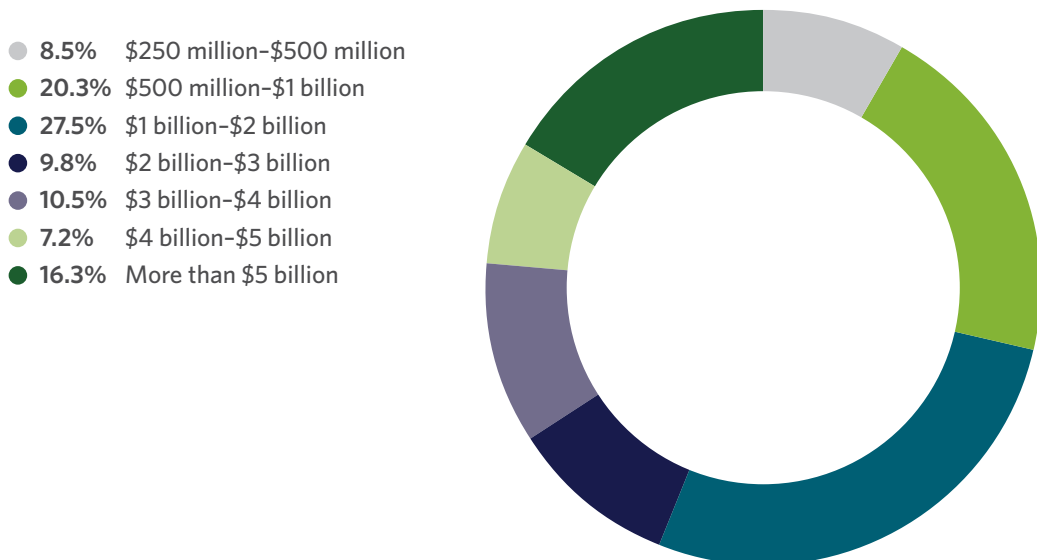
- Entirely process operations (i.e., machines make the products and employees operate the machines): 53 percent
- Mostly process operations: 20 percent
- Combination of process operations and discrete operations: 27 percent

A full profile of respondents to the Study is found in Figures 17-22.

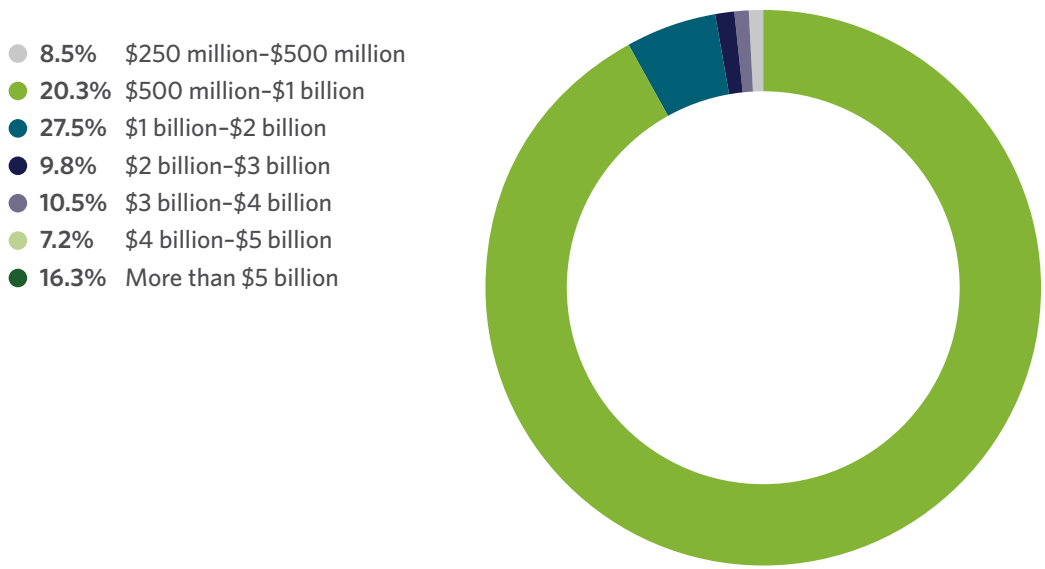
17. Which of the following best describes your title?



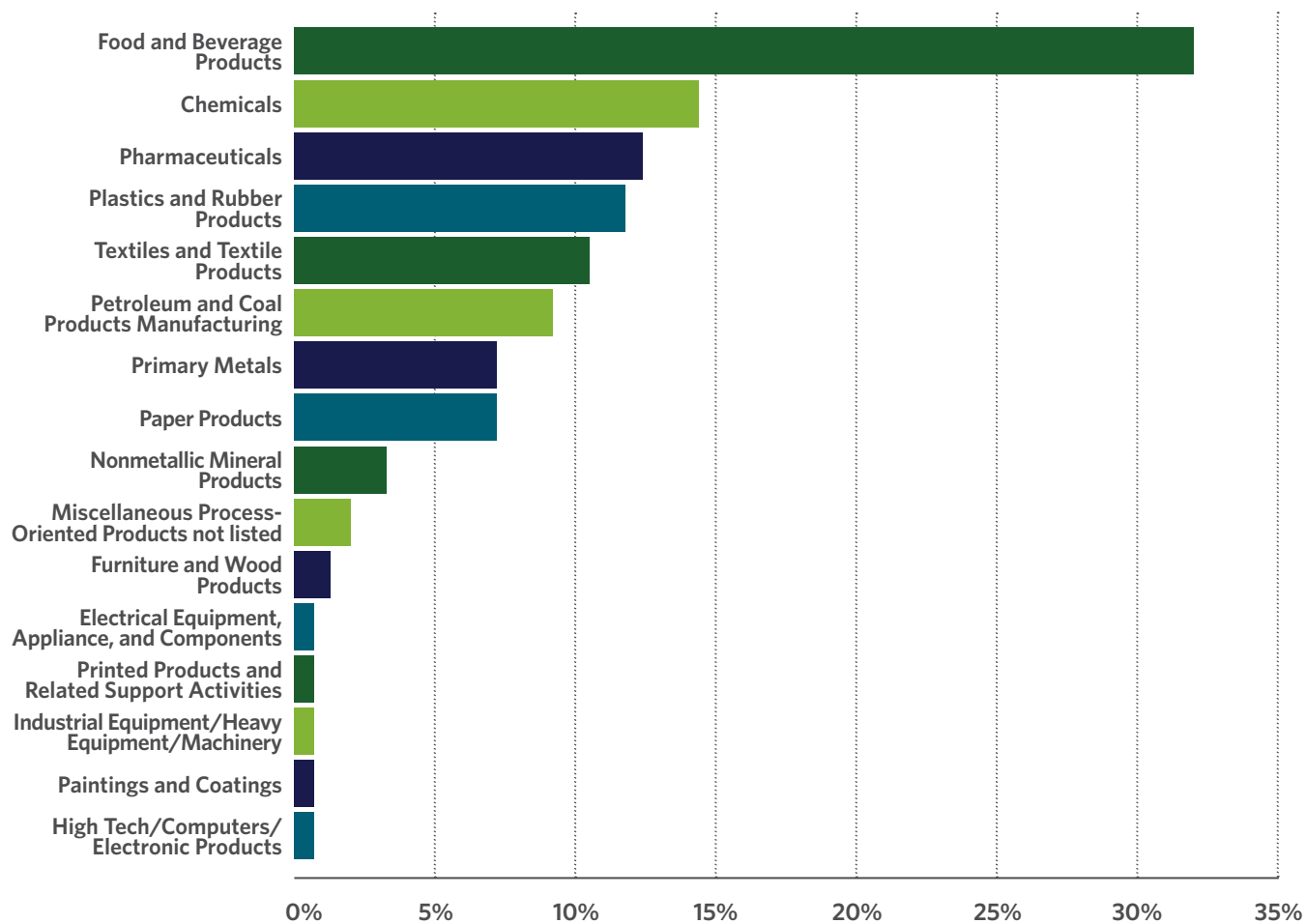
18. What is the approximate annual revenue of the plant's parent company?



19. In which country or region is the plant's parent company headquartered?



20. Which of the following products does the plant produce?



21. How many years has the plant been in operation?

- 1.3% Less than 5 years
- 7.8% 6-10 years
- 41.8% 11-25 years
- 33.3% 26-50 years
- 15.7% More than 50 years



22. Over the past two years, how much has your plant improved its overall operations performance?

- 2.6% Performance declined
- 7.8% No change to operations performance (list)
- 23.5% 1-5% improvement to operations performance
- 50.3% 6-15% improvement to operations performance
- 15.7% >15% improvement to operations performance



ABOUT PERFORMANCE SOLUTIONS

Performance Solutions by Milliken® works side-by-side with companies interested in strengthening and improving their operations. The strategic approach that made Milliken one of the safest, most efficient manufacturers in the world is the backbone of the consulting and educational services that Performance Solutions offers worldwide. Performance Solutions by Milliken practitioners are serving over 400-plus operations, in 25-plus countries, and covering a wide variety of industries.

¹ PSbyM Process Industries Performance Study, Performance Solutions by Milliken, 2019.
Process-oriented organizations were surveyed at the plant level.

² Plants could report the use of more than one improvement methodology.