

Plant Services

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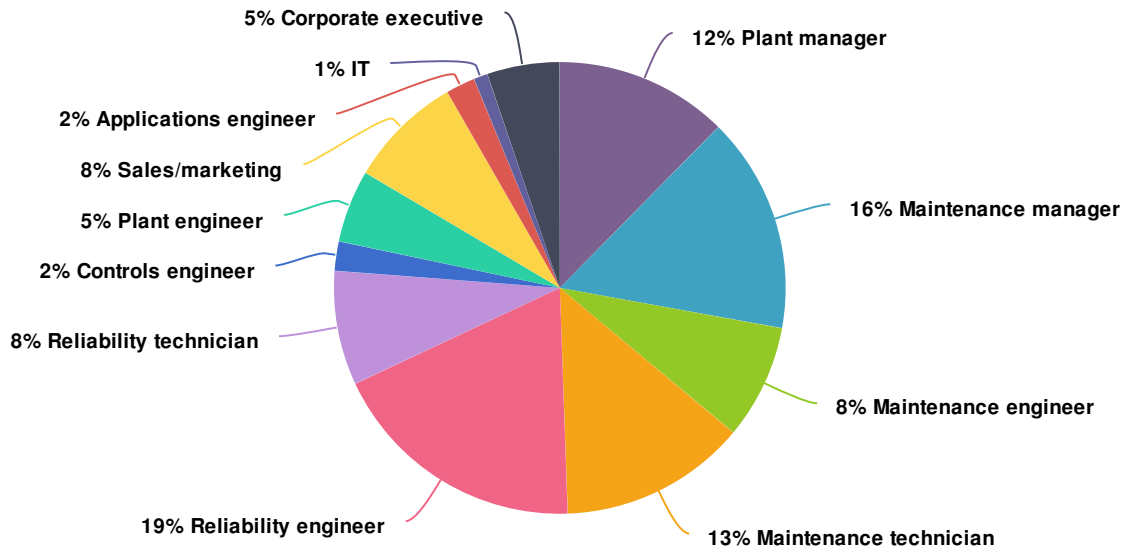
SMART SOLUTIONS FOR MAINTENANCE & RELIABILITY

2020 PdM Survey

Plants get comfortable
with predictive tools
while gearing up
for data management
challenges

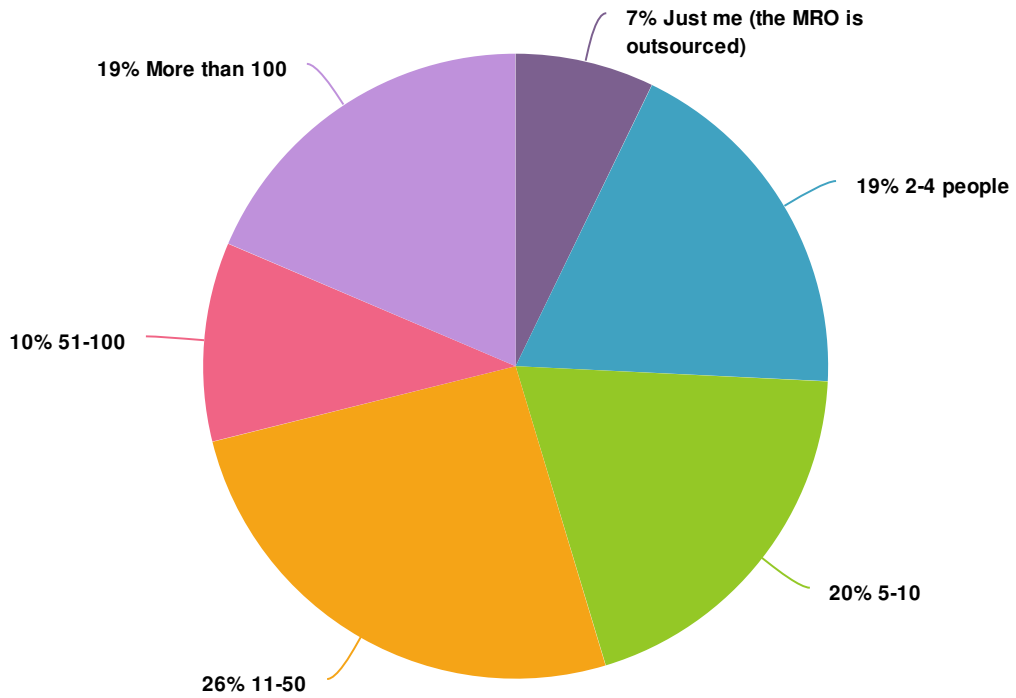
Plant Services PdM-RxM Survey 2020

1. What is your primary job function?



Value	Percent
Plant manager	12.4%
Maintenance manager	15.5%
Maintenance engineer	8.2%
Maintenance technician	13.4%
Reliability engineer	18.6%
Reliability technician	8.2%
Controls engineer	2.1%
Plant engineer	5.2%
Sales/marketing	8.2%
Applications engineer	2.1%
IT	1.0%
Corporate executive	5.2%

2. How big is the maintenance/reliability staff at your plant?



Value

Percent

Just me (the MRO is outsourced)



7.2%

2-4 people



18.6%

5-10



19.6%

11-50



25.8%

51-100



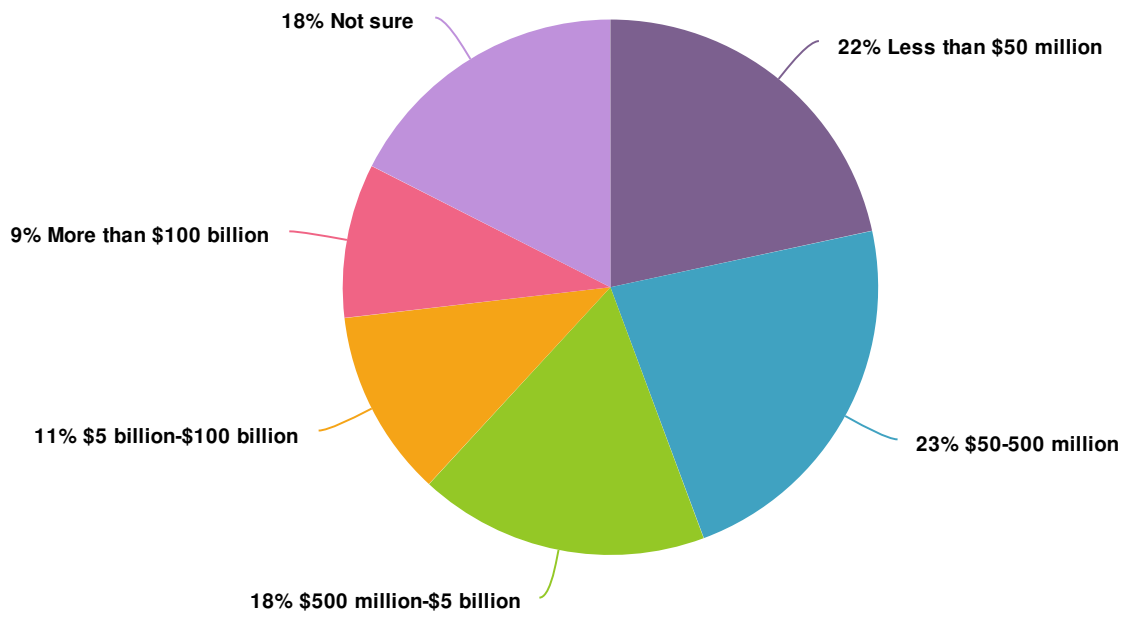
10.3%







More than 100



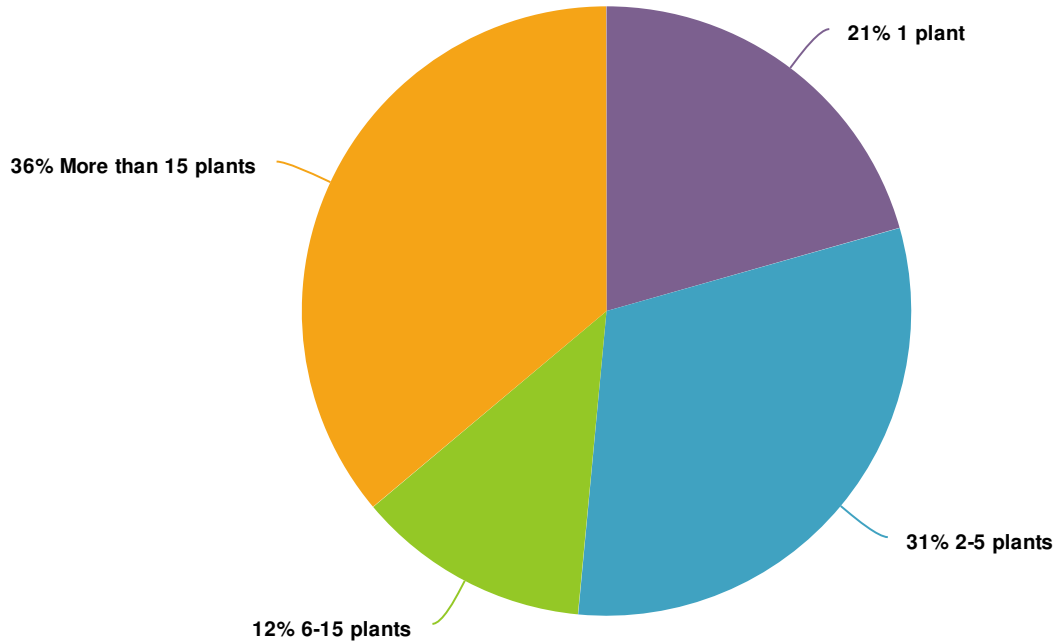
18.6%





3. What is the annual revenue of your organization?



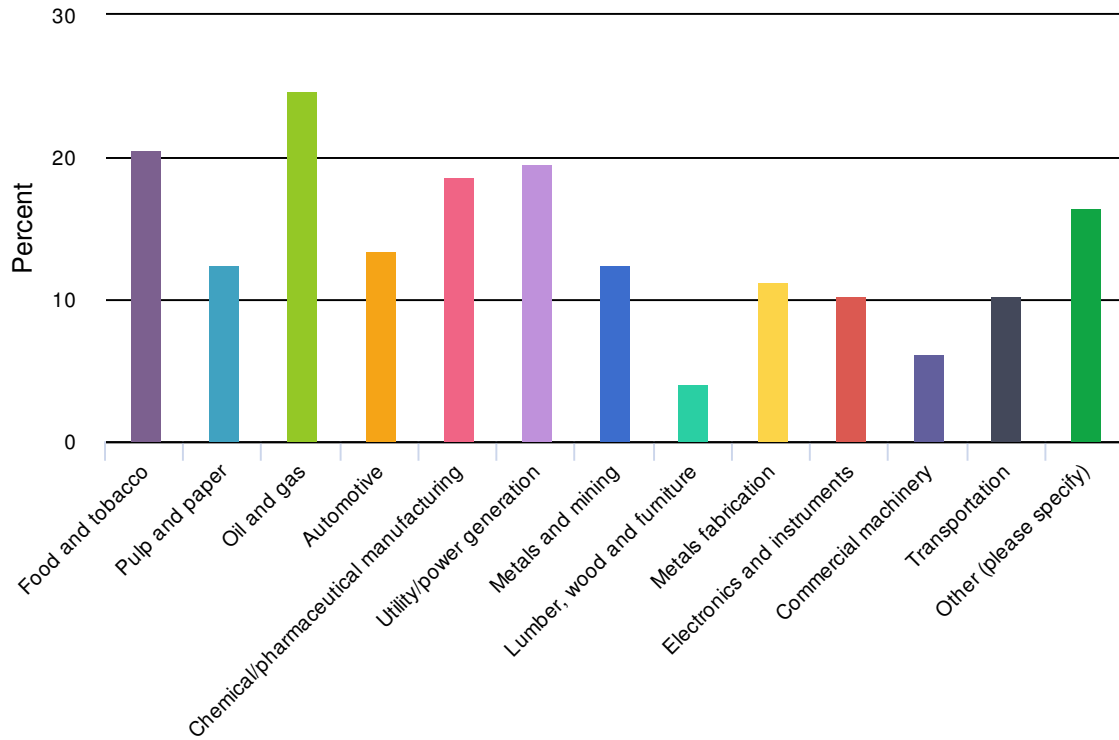
Value		Percent
Less than \$50 million		21.6%
\$50-500 million		22.7%
\$500 million-\$5 billion		17.5%
\$5 billion-\$100 billion		11.3%
More than \$100 billion		9.3%
Not sure		17.5%

4. How many total plants does your organization manage?



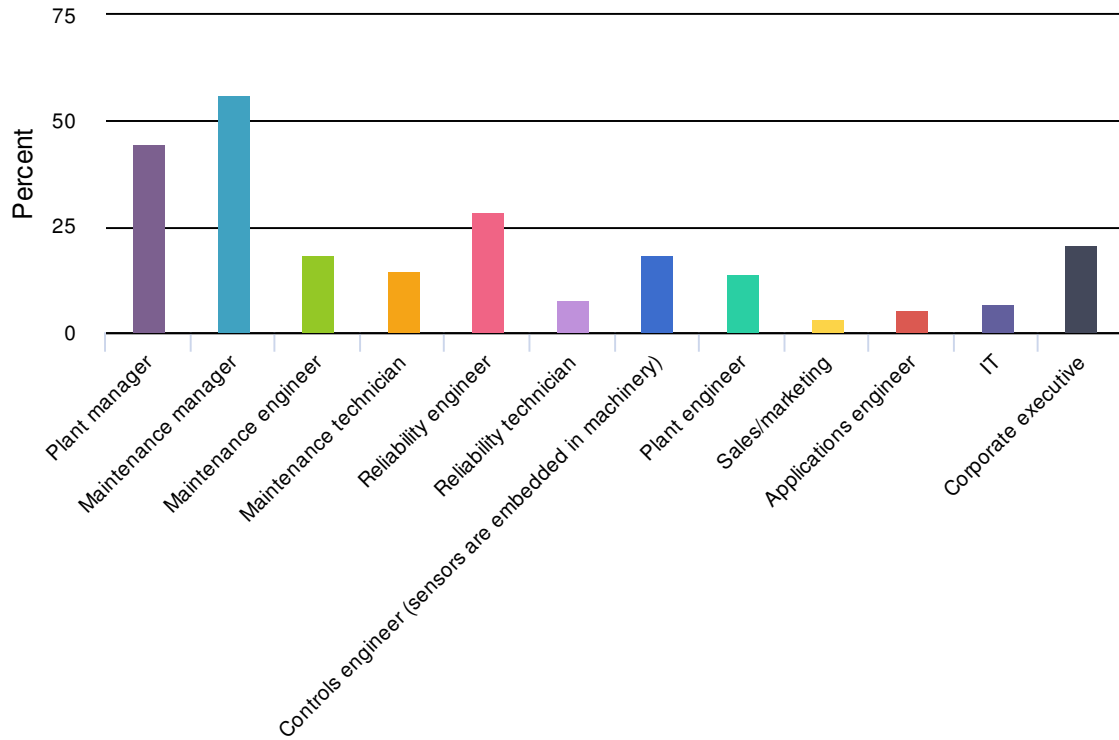
Value		Percent
1 plant		20.6%
2-5 plants		30.9%
6-15 plants		12.4%
More than 15 plants		36.1%

5. What vertical does your plant most closely align with? (Please check all that apply.)



Value	Percent
Food and tobacco	20.6%
Pulp and paper	12.4%
Oil and gas	24.7%
Automotive	13.4%
Chemical/pharmaceutical manufacturing	18.6%
Utility/power generation	19.6%
Metals and mining	12.4%
Lumber, wood and furniture	4.1%
Metals fabrication	11.3%
Electronics and instruments	10.3%
Commercial machinery	6.2%
Transportation	10.3%
Other (please specify)	16.5%

6. Who in your plant makes decisions on asset monitoring tools and configurations?
(Please check all that apply.)

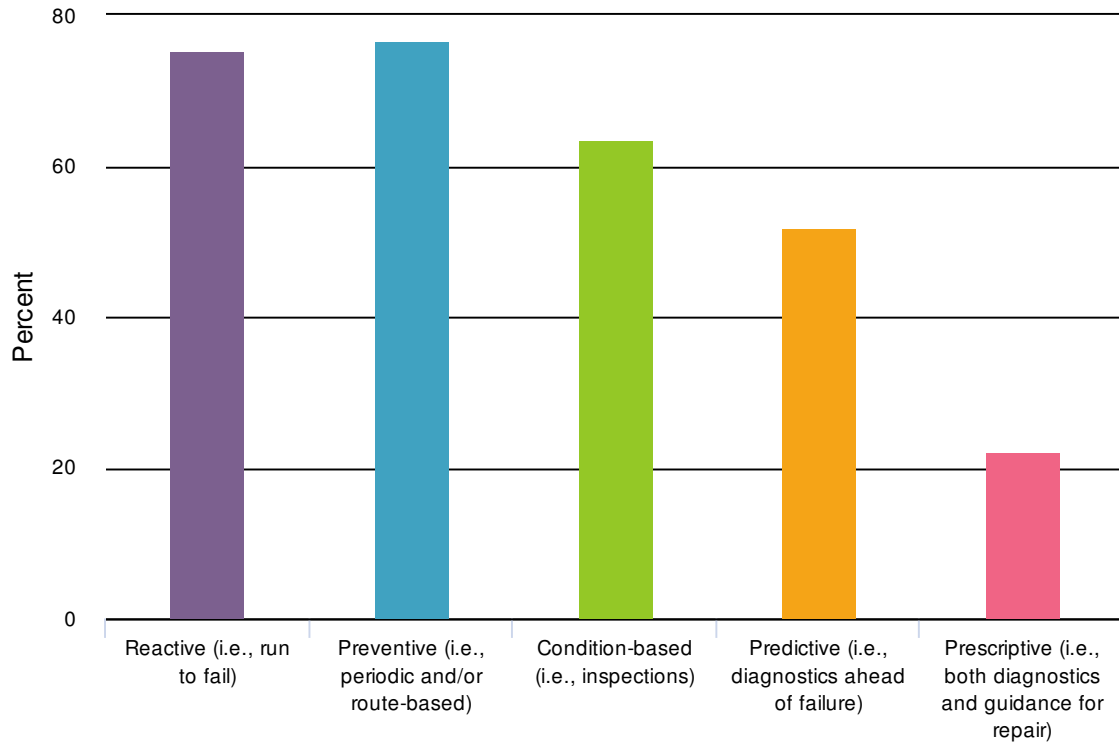







Value	Percent
Plant manager	44.8%
Maintenance manager	56.3%
Maintenance engineer	18.4%
Maintenance technician	14.9%
Reliability engineer	28.7%
Reliability technician	8.0%
Controls engineer (sensors are embedded in machinery)	18.4%
Plant engineer	13.8%
Sales/marketing	3.4%
Applications engineer	5.7%
IT	6.9%
Corporate executive	20.7%

7. Which of these technologies are you using to monitor assets?

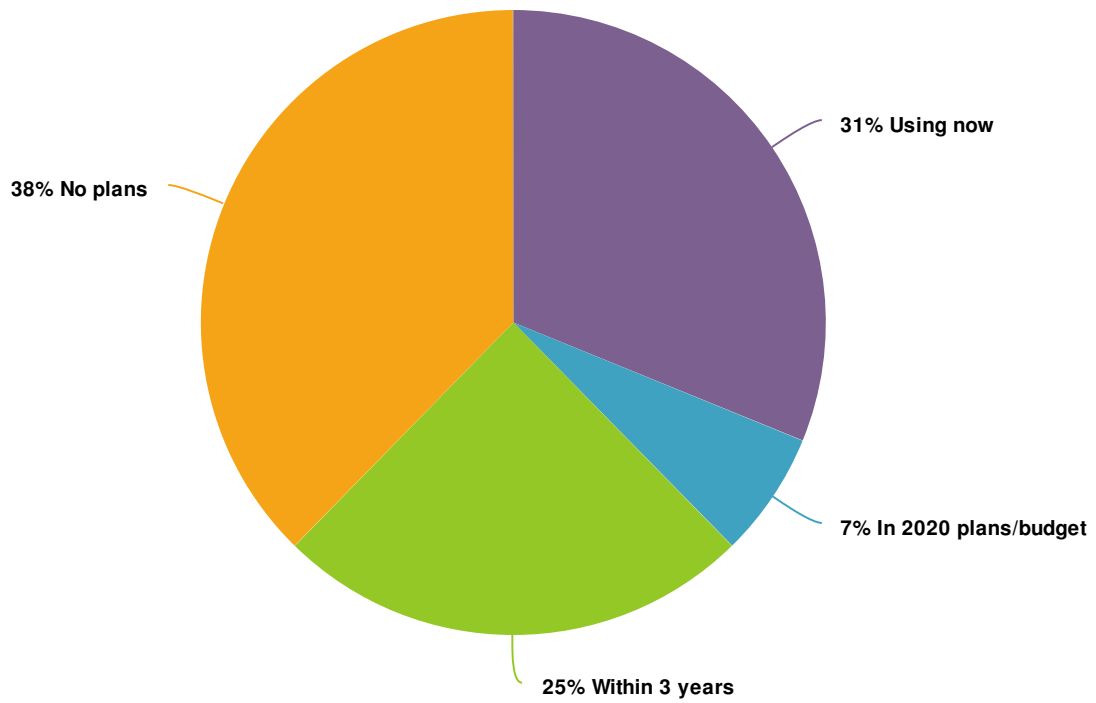
	Using now	In 2020 budget	Within 3 years	No plans
Controls equipment (controllers, networks, software) Row %	77.9%	3.5%	5.8%	12.8%
Self-diagnostic (smart) instrumentation and final control elements (drives, valves) Row %	46.5%	7.0%	16.3%	30.2%
Specialized system control systems (combustion controls, steam trap monitors, water/wastewater, cooling systems, compressed air) Row %	52.3%	9.3%	8.1%	30.2%
Predictive maintenance (PdM) technologies for condition- monitoring (thermography, oil analysis, vibration, ultrasound, motor testing) Row %	66.7%	10.3%	12.6%	10.3%
Instrumentation (valve analysis, signal processing and alarm management software) Row %	60.0%	8.2%	12.9%	18.8%
Automation, data archiving, and reporting software Row %	54.7%	17.4%	15.1%	12.8%
Automation of work order generation (including repair history, diagnostics, procedure and parts information) Row %	48.8%	14.0%	17.4%	19.8%
Embedded remote monitoring devices Row %	35.3%	11.8%	24.7%	28.2%
Energy monitoring and control devices (drives, valve actuators) Row %	42.4%	11.8%	18.8%	27.1%





8. Which types of maintenance approaches are currently deployed by your plant?
 (Please check all that apply.)



Value		Percent
Reactive (i.e., run to fail)		75.3%
Preventive (i.e., periodic and/or route-based)		76.6%
Condition-based (i.e., inspections)		63.6%
Predictive (i.e., diagnostics ahead of failure)		51.9%
Prescriptive (i.e., both diagnostics and guidance for repair)		22.1%

9. To what degree does your team or organization currently engage in RxM prescriptive maintenance?



Value		Percent
Using now		31.2%
In 2020 plans/budget		6.5%
Within 3 years		24.7%
No plans		37.7%

10. Which mature predictive maintenance (PdM) technologies have you deployed or are you planning to deploy?

	Using now	In 2020 budget	Within 3 years	No plans
Vibration Row %	70.1%	5.2%	10.4%	14.3%
Ultrasonic Row %	44.7%	7.9%	21.1%	26.3%
Acoustic Row %	21.1%	10.5%	18.4%	50.0%
Corrosion Row %	39.5%	14.5%	9.2%	36.8%
Infrared Row %	56.6%	19.7%	7.9%	15.8%
Oil analysis Row %	63.6%	13.0%	5.2%	18.2%
Predictive modeling software Row %	15.6%	13.0%	22.1%	49.4%
Electric motor testing Row %	44.2%	15.6%	13.0%	27.3%

11. What percent of assets are on each technology?

	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
Vibration Row %	22.1%	10.4%	5.2%	7.8%	6.5%	11.7%	7.8%	13.0%	10.4%	0.0%	5.2%
Ultrasonic Row %	34.2%	15.8%	9.2%	6.6%	5.3%	7.9%	5.3%	2.6%	6.6%	2.6%	3.9%
Acoustic Row %	57.9%	6.6%	7.9%	6.6%	2.6%	1.3%	3.9%	3.9%	3.9%	3.9%	1.3%
Corrosion Row %	42.1%	10.5%	6.6%	2.6%	1.3%	3.9%	2.6%	11.8%	10.5%	5.3%	2.6%
Infrared Row %	23.7%	9.2%	11.8%	14.5%	2.6%	5.3%	3.9%	3.9%	15.8%	6.6%	2.6%
Oil analysis Row %	23.7%	13.2%	1.3%	13.2%	5.3%	5.3%	10.5%	6.6%	10.5%	7.9%	2.6%
Predictive modeling software Row %	68.8%	2.6%	6.5%	0.0%	0.0%	3.9%	1.3%	6.5%	3.9%	3.9%	2.6%
Electric motor testing Row %	33.8%	14.3%	6.5%	2.6%	5.2%	10.4%	5.2%	6.5%	10.4%	2.6%	2.6%

12. Which advanced PdM features have you deployed?

	Using now	In 2020 budget	Within 3 years	No plans
Internet-enabled / IIoT technologies Row %	26.3%	11.8%	26.3%	35.5%
Troubleshooting decision tree Row %	43.4%	9.2%	18.4%	28.9%
HMI with color-coded alerts Row %	42.1%	10.5%	14.5%	32.9%
Optimized PdM work processes Row %	43.4%	11.8%	19.7%	25.0%
Route optimization for mechanics and operators Row %	44.7%	11.8%	19.7%	23.7%
Energy consumption of assets Row %	31.6%	17.1%	21.1%	30.3%

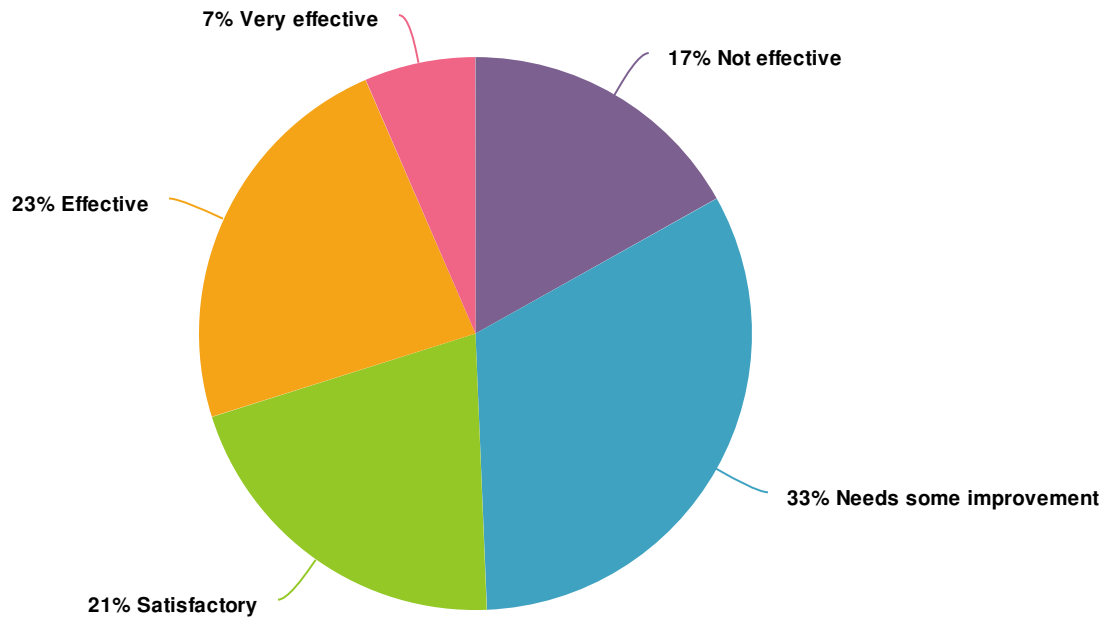
13. Please rate the drivers for deploying your PdM solutions.

	Not a factor	Low	Medium	High
Reduce maintenance costs Row %	10.4%	9.1%	37.7%	42.9%
Reduce operational costs Row %	10.4%	9.1%	33.8%	46.8%
Improve uptime Row %	10.4%	5.2%	24.7%	59.7%
Knowledge capture Row %	13.0%	28.6%	41.6%	16.9%
Increase visibility into troubled assets Row %	14.3%	16.9%	41.6%	27.3%
Environmental, health, and safety issues Row %	13.0%	14.3%	35.1%	37.7%
Regulatory compliance Row %	13.0%	22.1%	28.6%	36.4%
Energy management Row %	18.2%	26.0%	36.4%	19.5%
Reduce risk Row %	10.4%	10.4%	37.7%	41.6%

14. Who uses the information provided by your PdM systems and with what frequency?

	Never	Weekly	Monthly	Quarterly
In-house maintenance Row %	13.0%	54.5%	22.1%	10.4%
In-house operations Row %	23.7%	40.8%	30.3%	5.3%
In-house reliability engineers Row %	23.7%	47.4%	23.7%	5.3%
Totally outsourced to third-party maintenance and repair Row %	53.9%	5.3%	21.1%	19.7%
Third-party remote monitoring Row %	69.7%	9.2%	15.8%	5.3%
OEM supplier Row %	61.8%	5.3%	22.4%	10.5%

15. Please rate the performance of your PdM program over the past 12 months.



Value	Percent
Not effective	16.9%
Needs some improvement	32.5%
Satisfactory	20.8%
Effective	23.4%
Very effective	6.5%

16. What types of assets are managed by your PdM solutions?

	Using now	In 2020 budget	Within 3 years	No plans	Asset type not installed
Automation assets (field devices, control valves) Row %	45.3%	4.7%	10.9%	25.0%	14.1%
Control system assets (DCS, I/O, controllers, networks) Row %	40.6%	7.8%	15.6%	21.9%	14.1%
Production assets (rotating equipment, mechanical pumps) Row %	70.3%	3.1%	14.1%	6.3%	6.3%
Distribution pipelines Row %	31.3%	7.8%	15.6%	23.4%	21.9%
Electrical systems Row %	56.3%	6.3%	17.2%	17.2%	3.1%
Fleet vehicles Row %	21.9%	6.3%	14.1%	35.9%	21.9%
HVAC/R system Row %	37.5%	7.8%	12.5%	35.9%	6.3%

17. Please rate the importance of PdM in relation to other investments?

	1- Least Important	2	3 - Moderately Important	4	5 - Most Important
PdM technologies Row %	17.2%	9.4%	29.7%	29.7%	14.1%
Reliability solutions Row %	14.1%	10.9%	21.9%	31.3%	21.9%
EAM/CMMS Row %	14.1%	10.9%	29.7%	25.0%	20.3%
Safety systems Row %	9.4%	10.9%	17.2%	20.3%	42.2%
DCS Row %	15.6%	18.8%	25.0%	18.8%	21.9%
Field devices Row %	20.3%	15.6%	29.7%	21.9%	12.5%
Plant process networks Row %	17.2%	15.6%	21.9%	28.1%	17.2%
EH&S solutions Row %	14.1%	14.1%	31.3%	17.2%	23.4%
Sustainable & energy management Row %	9.4%	15.6%	26.6%	32.8%	15.6%

18. Please rate the obstacles limiting the success of your PdM initiatives.

	Not a factor	Low	Medium	High
No improvements needed Row %	42.2%	18.8%	20.3%	18.8%
Budget constraints Row %	4.7%	7.8%	35.9%	51.6%
Undefined financial benefits Row %	6.3%	23.4%	32.8%	37.5%
Limited IT resources Row %	10.9%	29.7%	29.7%	29.7%
Lack of executive support Row %	9.4%	23.4%	32.8%	34.4%
Limited engineering resources Row %	9.4%	29.7%	35.9%	25.0%
Undefined operational benefit Row %	7.8%	29.7%	37.5%	25.0%
Lack of EAM integration Row %	15.6%	23.4%	35.9%	25.0%
Poor program execution Row %	7.8%	39.1%	29.7%	23.4%
Level of employee engagement Row %	9.4%	23.4%	40.6%	26.6%

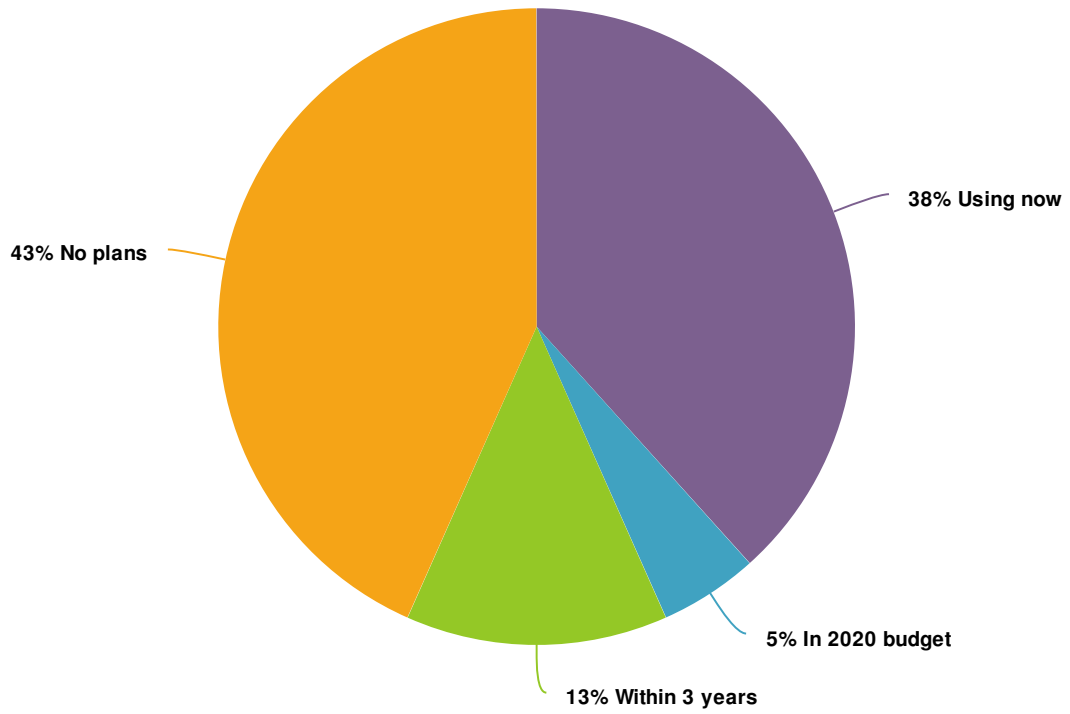
19. What data collection methods do you use with your PdM system?

	Using now	In 2020 budget	Within 3 years	No plans
Paper-based system Row %	62.5%	6.3%	3.1%	28.1%
Handheld data collector Row %	60.9%	9.4%	14.1%	15.6%
Embedded sensors/monitoring devices Row %	54.7%	10.9%	18.8%	15.6%
Wireless sensors/transmitters Row %	42.2%	14.1%	18.8%	25.0%
Internet-enabled sensors Row %	26.6%	9.4%	18.8%	45.3%
Industrial-grade smartphone Row %	10.9%	6.3%	18.8%	64.1%
Consumer-grade smartphone Row %	21.9%	7.8%	6.3%	64.1%
Industrial-grade tablet Row %	29.7%	6.3%	28.1%	35.9%
Consumer-grade tablet Row %	18.8%	6.3%	12.5%	62.5%
Industrial-grade PC Row %	37.5%	9.4%	17.2%	35.9%
Consumer-grade PC Row %	40.6%	14.1%	6.3%	39.1%

20. Is your PdM system integrated with any of the following higher-level systems?

	Using now	In 2020 budget	Within 3 years	No plans
Reliability solutions Row %	36.7%	5.0%	16.7%	41.7%
Historian Row %	41.7%	6.7%	8.3%	43.3%
EAM/CMMS system Row %	48.3%	13.3%	10.0%	28.3%
EH+S solution Row %	13.3%	13.3%	13.3%	60.0%
ERP system Row %	26.7%	11.7%	16.7%	45.0%
Cloud-based analytics Row %	15.0%	11.7%	23.3%	50.0%

21. Are you using OEM-enabled remote monitoring technologies and/or services?

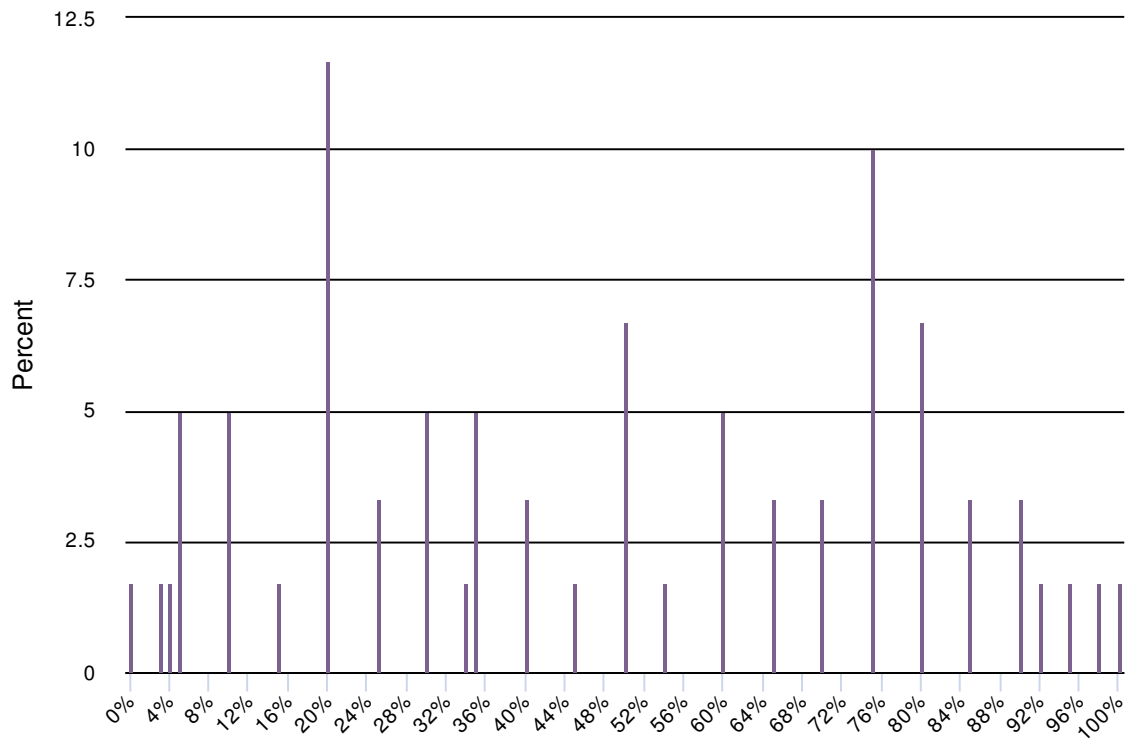


Value	Percent
Using now	38.3%
In 2020 budget	5.0%
Within 3 years	13.3%
No plans	43.3%

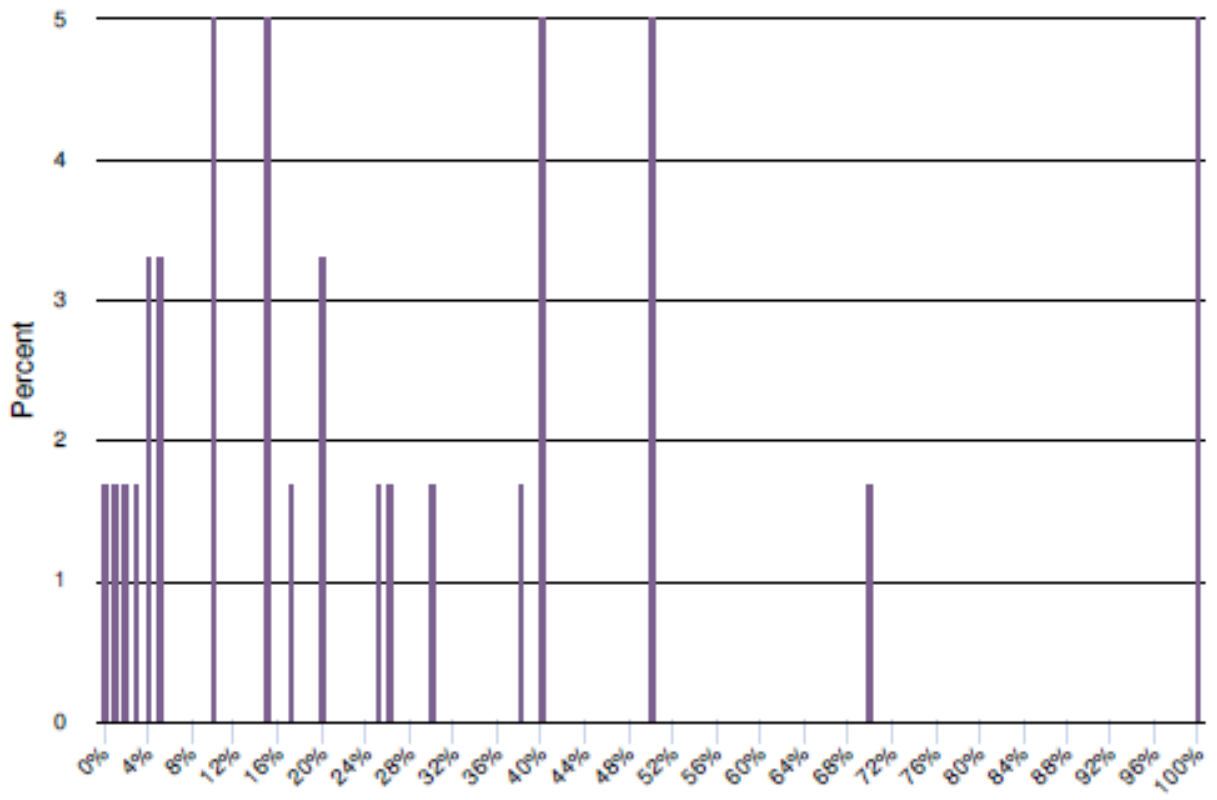
22. What changes, if any, are planned in your PdM investments for the following?

	Declining	No change	Increase 0 - 5%	Increase > 5%
Control systems (DCS, PLC) Row %	5.0%	60.0%	25.0%	10.0%
Production assets (rotating equipment, compressors) Row %	5.0%	46.7%	35.0%	13.3%
Instrumentation Row %	3.3%	51.7%	31.7%	13.3%
EAM/CMMS Row %	6.7%	61.7%	20.0%	11.7%
Data historian Row %	11.7%	63.3%	20.0%	5.0%
Predictive analytics software Row %	8.3%	56.7%	31.7%	3.3%

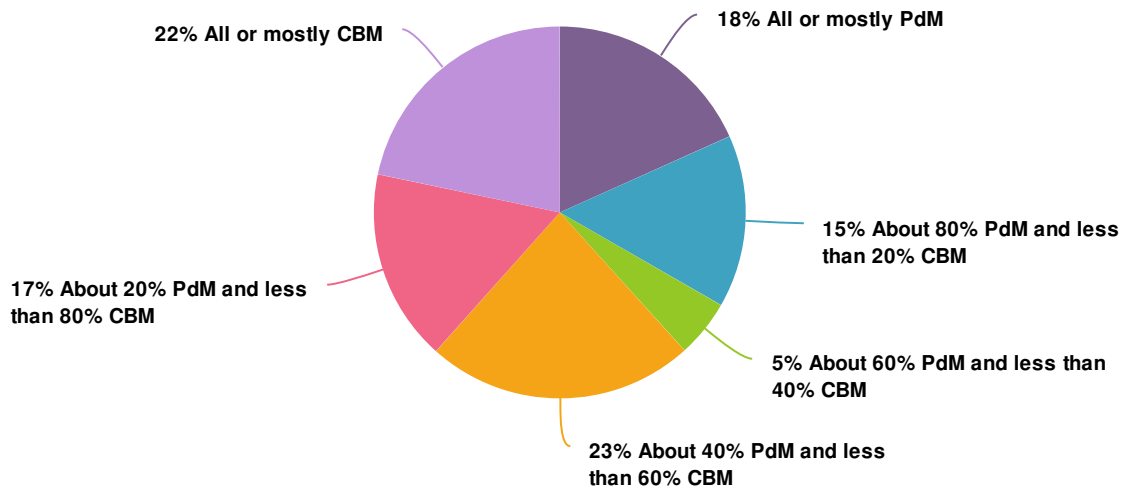
23. What is your percent Reactive Maintenance (annual average)?



24. What is your annual Maintenance Cost / Replacement Asset Value?

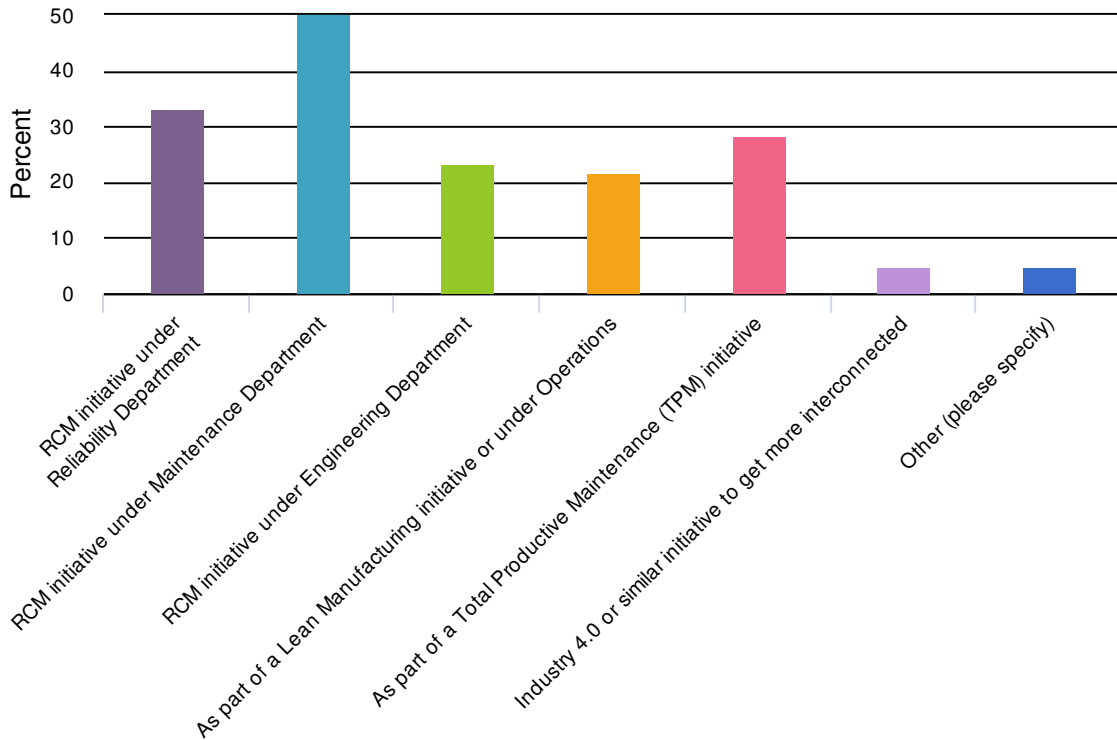


25. How much of your maintenance technology effort is predictive routes (PdM) versus condition based maintenance (CBM)?



Value	Percent
All or mostly PdM	18.3%
About 80% PdM and less than 20% CBM	15.0%
About 60% PdM and less than 40% CBM	5.0%
About 40% PdM and less than 60% CBM	23.3%
About 20% PdM and less than 80% CBM	16.7%
All or mostly CBM	21.7%

26. How is your Reliability/Maintainability/PdM/CBM program organized/supported? (check all that apply)



Value

Percent

RCM initiative under Reliability Department



33.3%

RCM initiative under Maintenance Department



50.0%

RCM initiative under Engineering Department



23.3%

As part of a Lean Manufacturing initiative or under Operations



21.7%

As part of a Total Productive Maintenance (TPM) initiative



28.3%

Industry 4.0 or similar initiative to get more interconnected



5.0%

Other (please specify)



5.0%