FLUKE
Reliability

Sustainable Maintenance and Reliability

Harnessing CMMS and Sensors for Efficient Facilities Management

Best Practices Webinar Series

Meet the Speaker

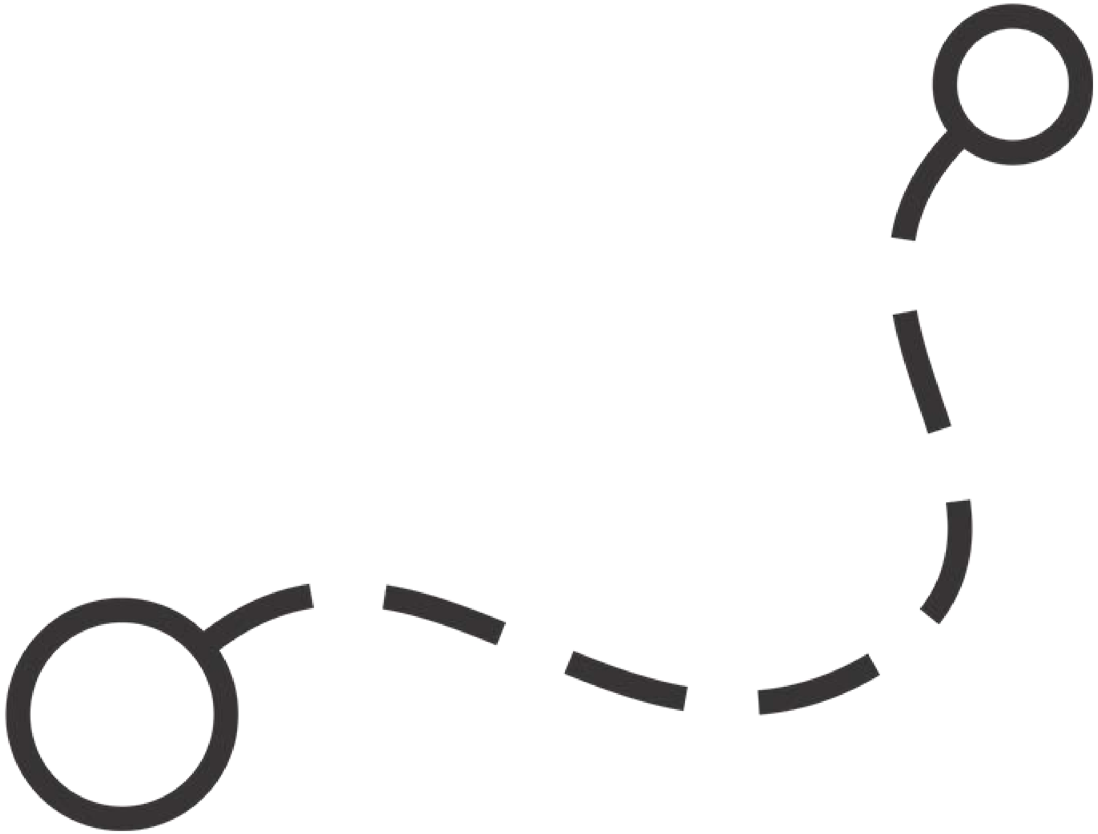
Michael Mills

Technical Sales Manager

Currently based out of southwest Florida, Michael leads a team of solutions engineers who help pair customers with solutions that align with their M&R strategies. Whether it's creating a maintenance historian, transporting data from system to system to trigger action and analytics or connecting information into the hands of maintenance professionals.

- Point 39 years in EAM leveraging best-of-breed solutions and best practices.
- Deployment of CMMS, Mobile and IIoT solutions across industries including Packaging, Life Sciences, Manufacturing, Public Sector & Utilities.
- Focus on high value deliverables leveraging Reliability Centered Maintenance in support of CBM and ICM.

Sustainable Maintenance and Reliability

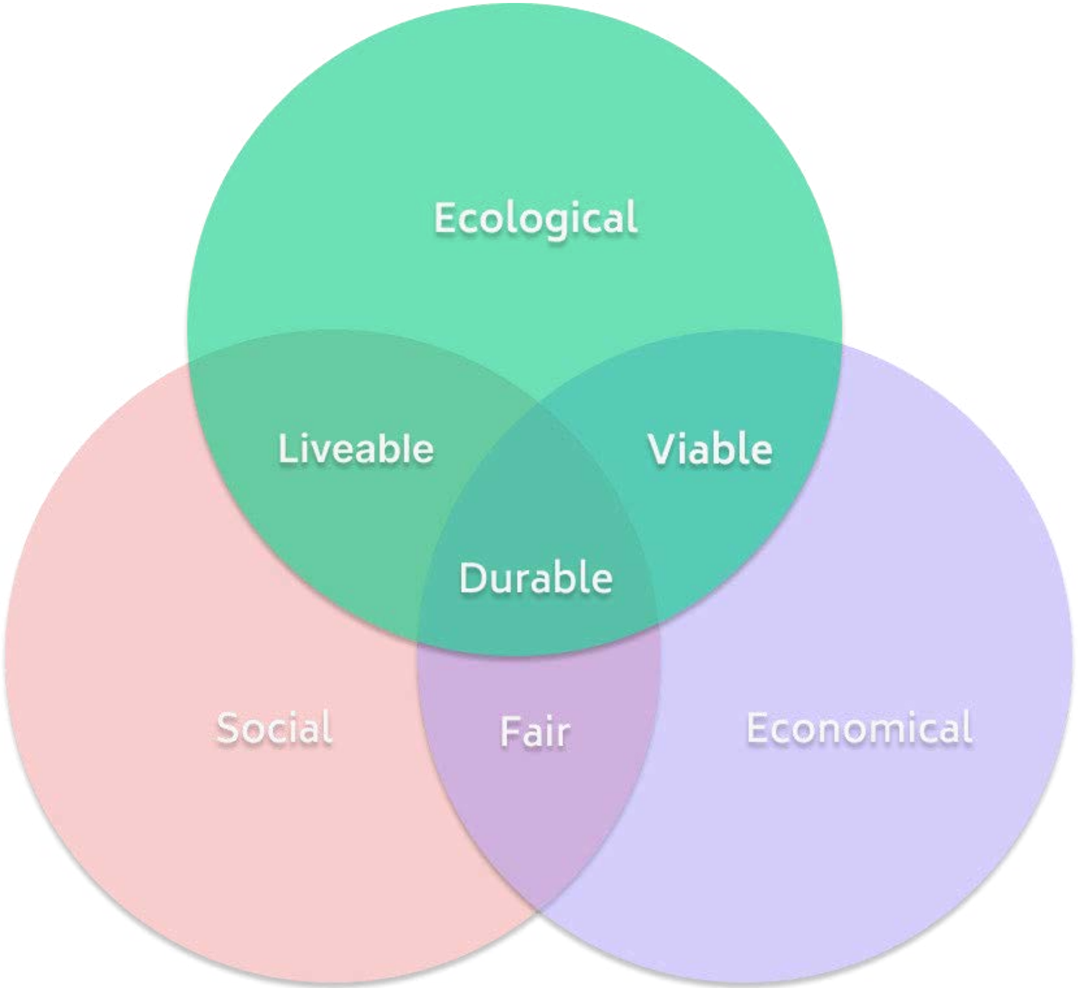


Sustainability within the context of Maintenance and Reliability

The practice of ensuring that the maintenance and reliability strategies and activities within an organization are aligned with the principles of environmental, social, and economic sustainability. It involves balancing the need to maintain and operate assets efficiently with minimizing negative impacts on the environment, society, and the economy, both in the short and long term.

Understanding Sustainability in Maintenance and Reliability

- The Triple-Bottom Line
  - **Environmental**
  - **Social**
  - **Economic**



Industry Mandates

- EU new mandatory ESF reporting rules
- SEC Proposes Rules to Enhance and Standardize Climate-Related Disclosures for Investors

Sustainable manufacturing in Industry 4.0: an emerging research agenda

- Machadoa, Carla. "Full Article: Sustainable Manufacturing in Industry 4.0: An Emerging ..." *Tandfonline*, Taylor and Francis Group, 30 July 2019, www.tandfonline.com/doi/full/10.1080/00207543.2019.1652777.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Sustainable manufacturing in Industry 4.0: an emerging research agenda

Carla Gonçalves Machado, Mats Peter Winroth & Elias Hans Dener Ribeiro da Silva

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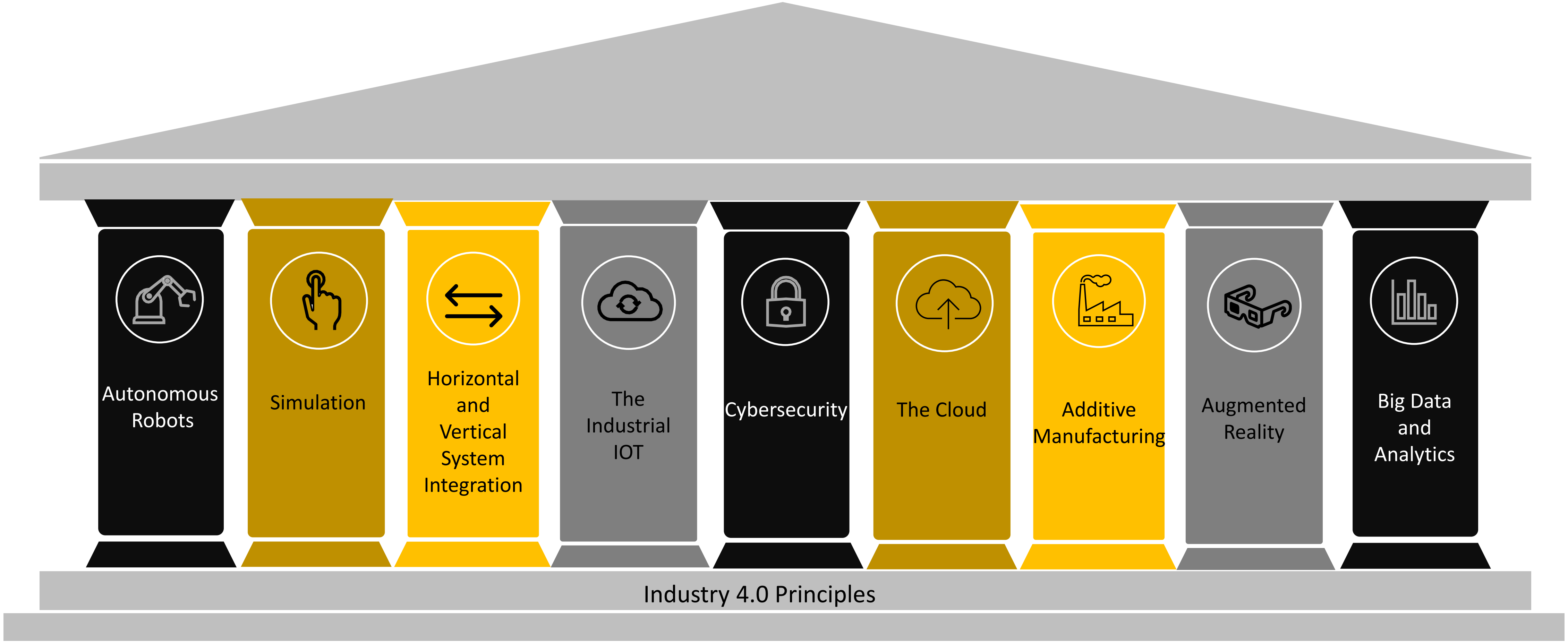
Sustainable Manufacturing in Industry 4.0			
Technological Pillars*	**Scope of Sustainable Manufacturing****	**Industry 4.0 and SM *****	**Sustainability Dynamics Model******
1. Autonomous robots 2. Simulation 3. Horizontal and vertical system integration 4. The industrial IoT 5. Cybersecurity 6. The cloud 7. Additive Manufacturing 8. Augmented reality 9. Big data and analytics	1. Manufacturing Technologies 2. Product lifecycles 3. Value creation networks 4. Global manufacturing impacts	1. Business Model 2. Value Creation Network 3. Equipment 4. Human Factor 5. Organization of Smart Factories 6. Sustainable Manufacturing Processes 7. Product Development	1. Direct effects on Environmental dimension 2. Direct effects on Social dimension 3. Direct effects on Economical dimension 4. Indirect effects on Environmental dimension 5. Indirect effects on Social dimension 6. Indirect effects on Economical dimension
Industry 4.0 Principles ***** Digitization and integration of vertical and horizontal value chains Digitization of product and service offerings Digital business models and customer access			

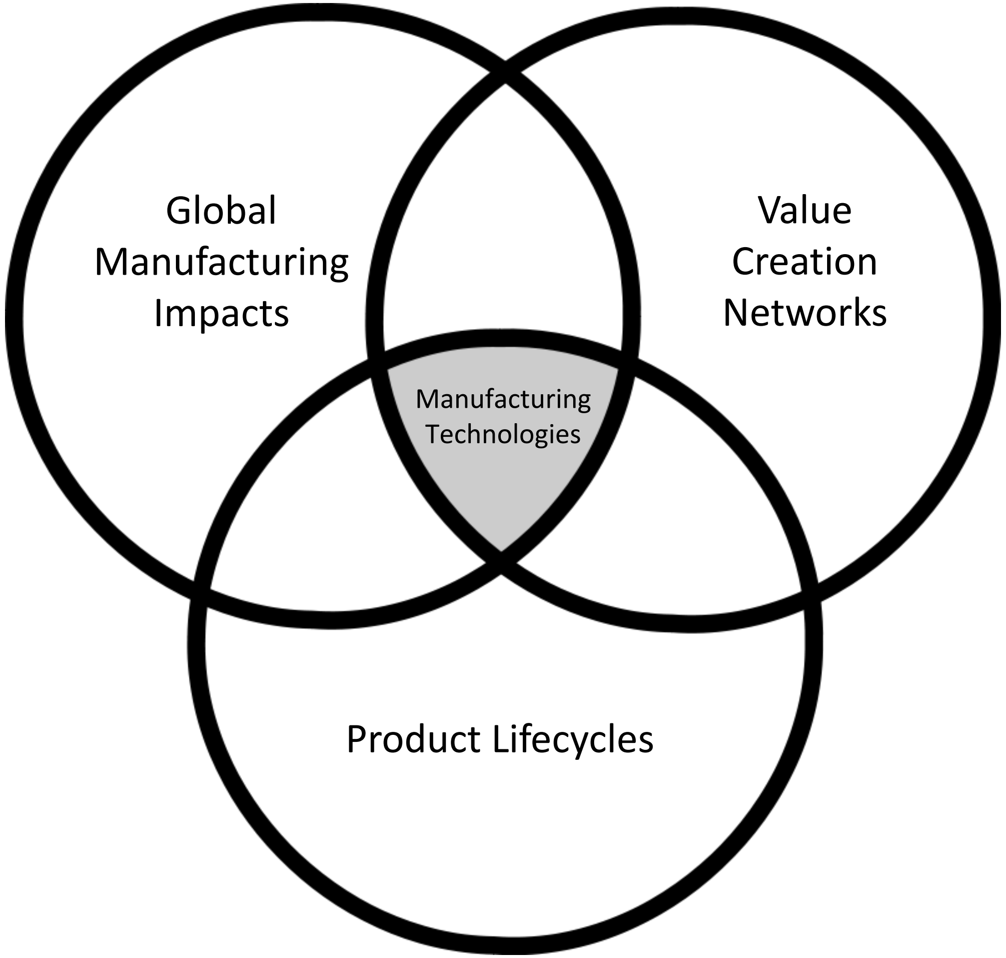
*Rüßmann et al., 2015; **Bonvoisin's et al., 2017; ***Hermman, 2014, Stock and Seliger, 2016, Kiel et al., 2017, Waibel, 2017;**** Stark et al., 2016; *****Geissbauer et al., 2016

Technological Pillars of Sustainability



Deploying a best of breed EAM across the organization allows you to extend the life cycle of equipment, reduce excess spend through repairable assets and increase environmental visibility and transparency.

Scope if Sustainable Manufacturing



Direct Effects → **Indirect Effects** ←

Economical Dimension
- Product Development
- Equipment
- Business Model

Environmental Dimension
- Sustainable Manufacturing Processes
- Organization of Smart Factories

Social Dimension
- Human Factor
- Value Creation Network

Sustainability and Industry 4.0: Definition of a Set of Key Performance Indicators for Manufacturing Companies

by

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able 2. KPI of the selected articles.

Paper	Economic KPIs	Environmental KPIs	Social KPIs
[34]	Manufacturing costs, Commercial costs, Research and development costs, General and administrative costs, Financing costs, Environmental costs, Social costs	Global warming, Ozone depletion, Acidification, Eutrophication, Photochemical ozone, Non-fossil resources, Fossil resources, Raw materials, Consumables, Electrical energy, Thermal energy, Biodiversity, Resource use	Human health, Human resources, Philanthropy
[16]	Resource use, Global warming, Ozone depletion, Acidification, Eutrophication, Photochemical ozone, Toxicity, Waste, Material intensity, Energy intensity, Material recyclability, Durability, Service intensity, Voluntary actions, Environmental management systems, Environmental improvements above the compliance levels, Assessment of suppliers	Value added, Contribution to GDP, Expenditure on environmental protection, Environmental liabilities, Ethical investments, Employment contribution, Staff turnover, Expenditure on health and safety, Investment in staff development	Preservation of cultural values, Stakeholder inclusion, Community projects, International standards of conduct, Business dealings, Child labor, Fair trading, Collaboration with corrupt regimes, Intergenerational equity, Income distribution, Employee satisfaction, Satisfaction of social needs, Staff turnover
[40]	Cycle time, Changeover time, Uptime, Inventory, Facility costs, Labor costs, Material costs, Utility costs, Net profits, Revenue growth, Return on assets, Profit to revenue ratio, Cost reduction, Adhere to production plan, Improving delivery performance, Energy costs, Direct labor costs, Raw materials costs, Packaging costs, Scrap costs, Consumables costs, Processing tools-related costs, Water costs, Maintenance costs, Cost of PPE, jigs/fixtures, equipment, Other non-operational energy costs, Indirect labor costs, Training costs, Costs of waste disposal treatment, Lead time, Productivity, Utilization of manual labor	Raw materials, Water, Energy, Transportation, Life cycle assessment, Greenhouse gas, Flaring gas, Fresh water used, Oil spills, Waste, Raw materials, Packaging material, Energy, Transportation, Idle energy losses, Renewable energy, Water, Waste, Residue generation intensity, Greenhouse gas, Hazardous gas emission, Material recovered, Consumables recovered, Used packaging material recovered, Used raw material/scrapped parts recovered usage, Hazard materials, Renewable material usage	Physical load index, Noise, Risk, Wage, Workload, Injuries, Injury frequency rate, Social investment, Local procurement and supplier development, Fight against corruption, Workforce diversity and inclusion, Workforce engagement, Workforce training and development, High temperature surfaces, High-speed components and splashes, High-voltage electricity, Physical load index, Work accidents, Work illnesses, Percentage of workers with work-related disease, Noise, Corrosive chemicals, Toxic chemicals, OSHA citations, Employee turnover, Employee satisfaction, Fair trading, Staff training, Diversity, Community quality of life, Community outreach activities, Charitable contributions, Injuries
[53]	Manufacturing costs, Commercial costs, Research and development costs, General and administrative costs, Financing costs, Environmental costs, Social costs	Waste, Air emission, Energy, Greenhouse gas, Hazard materials, Ozone, Water, Materials, Energy, Land useBiodiversity, Natural management and conservation	Health and safety, Professional development, Employee satisfaction, Health and safety of the product at use phase, Employee satisfaction, Product responsibility, Fair trading, Equity, Human rights, Public service policy, Justice

The role of technology in supporting sustainable practices

Overview of CMMS and Its Benefits in Maintenance

- Explanation of CMMS and its core functionalities for maintenance management
- How CMMS enhances maintenance planning, scheduling, and execution
- Case studies highlighting the positive impact of CMMS on maintenance efficiency and cost reduction

Role of Sensors in Improving Reliability and Sustainability

- Introduction to sensors and their significance in real-time data collection
- How sensors contribute to condition-based maintenance and predictive analytics
- Examples of sensor applications in reliability (equipment health monitoring, vibration analysis, thermal imaging)

Synergies Between CMMS and Sensors for Sustainable Maintenance

- Understanding the integration between CMMS and sensor data
- How CMMS utilizes sensor information for data-driven decision-making
- Demonstrating the potential for reduced downtime and optimized maintenance schedules

Benefits of Using CMMS and Sensors for Sustainable Maintenance

- Extending asset lifespan through proactive maintenance strategies
- Improving energy efficiency and reducing environmental impact
- Enhancing equipment reliability and reducing unplanned breakdowns
- Ensuring compliance with environmental regulations and safety standards

Addressing Challenges and Mitigating Risks

- Overcoming data integration and interoperability challenges
- Ensuring the accuracy and reliability of sensor data
- Navigating workforce training and adoption for successful implementation

Best Practices for Implementing CMMS and Sensor Solutions

- Conducting a comprehensive sustainability assessment of maintenance practices
- Selecting appropriate sensors based on facility needs and equipment criticality
- Establishing maintenance KPIs and performance metrics for sustainability tracking

Real-life Success Stories of Sustainable Maintenance and Reliability

- Case studies showcasing organizations achieving sustainable outcomes using CMMS and sensors
- Highlighting improvements in equipment uptime, maintenance costs, and overall reliability

Future Trends in Sustainable Maintenance and Reliability

- Advancements in sensor technology and IoT integration
- The role of AI and machine learning in predictive maintenance
- Incorporating circular economy principles in maintenance strategies

Conclusion

- Recap of the significance of sustainability in maintenance and reliability
- Emphasizing the role of CMMS and sensors in driving sustainable facilities management
- Call to action: Encouraging the audience to embrace technology-driven sustainable maintenance practices for a resilient and efficient future.

Questions

QUESTIONS?

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Thank you!

To learn more about Fluke Reliability and our Webinar Series

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FLUKE Reliability

THANK YOU!