The Challenge of Data Collection and Action in Manufacturing

Navigating Legacy Equipment and Manual Processes

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Introduction

In the ever-evolving realm of manufacturing, data collection and analysis have emerged as cornerstones of efficiency, productivity, and innovation. Yet, for many manufacturers, especially those with legacy equipment and manual processes, the journey towards comprehensive data integration is fraught with challenges. This article delves into the intricacies of these challenges, offering insights and empathetic perspectives on how companies can navigate this complex landscape.

The Legacy Conundrum

Legacy equipment, often defined as machinery that has been in service for decades, presents a unique set of challenges for data collection and integration. These machines, while robust and reliable, typically lack modern sensors and communication capabilities essential for real-time data capture. In an era where Industry 4.0 and the Internet of Things (IoT) are transforming manufacturing processes, the disconnect posed by legacy equipment can be a formidable barrier.

The Physical Disconnect

Unlike modern CNC machines equipped with sensors and network connectivity, older machines operate in isolation. This absence of digital interfaces means that crucial operational data, such as cycle times, machine health, and productivity metrics, remain trapped within the machines. As highlighted in "The Human Impact of Machining Technology" from Modern Machine Shop, companies like SSP have had to make significant investments to bridge this gap. By standardizing machine platforms and incorporating advanced monitoring systems, SSP managed to enhance data collection and operational efficiency (Hider, 2024).

The Financial Hurdle

Retrofitting legacy equipment with modern sensors and communication modules is not a trivial task. It often requires substantial financial investment, which can be a deterrent for small to medium-sized enterprises (SMEs). According to a study by the Manufacturing Institute, the cost of upgrading legacy systems is one of the primary reasons manufacturers delay modernization efforts (Manufacturing Institute, 2023). The challenge lies in justifying these costs against the backdrop of thin profit margins and competitive pressures. Additionally, the need for technical expertise to install and maintain these upgrades can add to the overall expense, making it a complicated decision for many companies.

In some cases, manufacturers might opt for hybrid solutions, where only the most critical machines are upgraded with new sensors and connectivity features. This approach allows companies to spread out the investment over time while gradually improving their data collection capabilities. However, it is essential to have a clear strategy and prioritize which machines will deliver the most value when upgraded.

Manual Processes: The Human Factor

While machinery forms the backbone of manufacturing, human operators are the lifeblood. Manual processes, ranging from material handling to quality inspections, are integral to many production lines. However, the reliance on human intervention introduces variability and challenges in real-time data capture.

The Visibility Challenge

Manual processes are inherently difficult to monitor in real time. Unlike automated systems that generate continuous streams of data, manual steps rely on human input, which can be sporadic

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and inconsistent. For instance, tracking the time taken for an operator to complete an inspection or move materials between workstations is challenging without direct observation or cumbersome manual logging. This lack of visibility can lead to inefficiencies and errors, impacting overall productivity and quality.

One potential solution is to implement semi-automated systems that can assist operators in performing their tasks while capturing essential data. For example, wearable devices and handheld scanners can record the time and actions taken by workers, providing valuable insights into manual processes. These tools can be particularly useful in quality control and assembly lines, where precision and consistency are crucial.

The Human Element

Furthermore, the human element introduces variability. Different operators may perform the same task at varying speeds and with different levels of precision. This variability can skew data, making it difficult to derive accurate insights. The importance of accounting for human factors is underscored by the experiences of companies like SSP, where manual labor was once a significant part of secondary operations. By adopting automation, SSP not only improved efficiency but also freed employees for higher-value tasks (Hider, 2024).

To mitigate the impact of human variability, manufacturers can implement standardized procedures and training programs. Ensuring that all operators follow the same protocols can reduce inconsistencies and improve data accuracy. Additionally, regular audits and performance assessments can help identify areas where further improvements are needed.

Strategies for Overcoming Data Collection Challenges

While the challenges posed by legacy equipment and manual processes are significant, they are not insurmountable. Several strategies can help manufacturers enhance their data collection capabilities, even in environments with older machinery and manual steps.

Incremental Modernization

Rather than undertaking a complete overhaul, manufacturers can adopt a phased approach to modernization. This involves gradually retrofitting legacy equipment with sensors and connectivity modules. Solutions such as IoT gateways can bridge the gap between old and new systems, enabling data collection from disparate sources. For instance, companies like Bosch have implemented IoT gateways to connect legacy machines to their centralized data systems, enabling real-time monitoring and predictive maintenance (Bosch, 2022).

Incremental modernization also allows manufacturers to test and validate new technologies before full-scale implementation. By starting with pilot projects and gradually expanding them, companies can minimize risks and ensure that the chosen solutions meet their specific needs. This approach also provides an opportunity to gather feedback from operators and make necessary adjustments.

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Leveraging External Expertise

Partnering with technology providers and integrators can provide valuable expertise and resources for data integration. External partners can assess the existing infrastructure, identify gaps, and recommend appropriate solutions. As demonstrated by SSP's collaboration with Hydromat for automation, external expertise can significantly enhance a manufacturer's data capabilities (Hider, 2024).

Collaborating with external experts also ensures that manufacturers stay updated with the latest industry trends and best practices. These partners can offer insights into emerging technologies and help companies adopt innovative solutions that can provide a competitive edge. Additionally, external support can accelerate the implementation process, allowing manufacturers to reap the benefits of data integration sooner.

Embracing Automation

Automating repetitive and labor-intensive tasks can reduce variability and enhance data accuracy. Automation technologies, such as robotic process automation (RPA) and automated guided vehicles (AGVs), can streamline material handling, inspections, and other manual processes. This not only improves efficiency but also generates consistent and reliable data.

For example, RPA can be used to automate data entry and reporting tasks, eliminating human errors and ensuring that data is captured accurately. AGVs can transport materials between workstations, reducing the need for manual labor and minimizing the risk of damage or delays. By integrating these technologies into their operations, manufacturers can achieve higher levels of productivity and data quality.

Implementing Standardized Protocols

Standardizing data collection protocols across the organization can ensure consistency and comparability. This involves defining clear guidelines for data capture, storage, and analysis. Adopting industry standards, such as the ISA-95 framework for manufacturing operations management, can provide a structured approach to data integration.

Standardized protocols also facilitate collaboration and data sharing between different departments and stakeholders. When everyone follows the same procedures, it becomes easier to compare and analyze data, leading to more informed decision-making. Additionally, standardized protocols can simplify regulatory compliance, ensuring that data collection practices meet industry and governmental requirements.

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Empathetic Perspective

While the technical and financial aspects of data integration are crucial, it is equally important to consider the human impact. Manufacturing employees, who have worked with legacy equipment and manual processes for years, may be apprehensive about changes. Addressing these concerns with empathy and clear communication is essential for a smooth transition.

Training and Upskilling

Investing in employee training and upskilling programs can alleviate fears and build confidence in new technologies. Providing hands-on training sessions, workshops, and continuous support can empower employees to embrace modernization. As SSP's experience shows, engaging the workforce with new equipment can enhance job satisfaction and retention (Hider, 2024).

Training programs should be tailored to the specific needs of different roles within the organization. Operators, technicians, and managers may require different levels of training and support to adapt to new systems. By offering personalized learning opportunities, manufacturers can ensure that all employees have the knowledge and skills needed to succeed in a data-driven environment.

Inclusive Decision-making

Involving employees in the decision-making process fosters a sense of ownership and collaboration. Seeking input from operators and technicians who work directly with the equipment can provide valuable insights and improve the acceptance of new systems. This inclusive approach promotes a positive work culture and enhances the overall success of data integration initiatives.

Regular feedback sessions and open communication channels can help address any concerns or challenges that arise during the transition. By actively listening to employees and acting on their suggestions, manufacturers can create a supportive environment that encourages continuous improvement and innovation.

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The Future of Manufacturing Data

As manufacturing continues to evolve, the importance of data integration will only grow. Companies that successfully navigate the challenges posed by legacy equipment and manual processes will be better positioned to leverage the benefits of Industry 4.0. The journey towards comprehensive data integration is not without its hurdles, but with the right strategies and an empathetic approach, manufacturers can unlock new levels of efficiency, productivity, and innovation.

Emerging technologies, such as artificial intelligence (AI) and machine learning, hold great potential for transforming data collection and analysis in manufacturing. These technologies can help manufacturers identify patterns and trends in large datasets, enabling predictive maintenance and optimized production planning. By staying ahead of technological advancements, manufacturers can maintain a competitive edge and drive long-term growth.

Conclusion

The challenge of collecting and acting on data in a manufacturing environment with legacy equipment and manual processes is multifaceted. It requires a combination of technical solutions, financial investment, and human-centric approaches. By embracing incremental modernization, leveraging external expertise, and prioritizing employee engagement, manufacturers can overcome these challenges and pave the way for a data-driven future.

The journey towards comprehensive data integration is ongoing, and manufacturers must remain adaptable and proactive in addressing new challenges. By fostering a culture of continuous improvement and innovation, companies can ensure that they are well-equipped to navigate the complexities of the modern manufacturing landscape.

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About the Author

John Traynor is COO and co-founder of Milvian Group with over a decade of experience solving challenges for manufacturing organizations. Early in his career, John worked closely with manufacturers to bring technology to the shop floor to capture data and improve production operations and quality. Over the past decade, he has been focused on bringing industrial IoT and, more recently, ML and AI, to production operations to help workers, managers, and executives raise situational awareness of production operations, gain actionable insight, and make more confident operational decisions. From small machine shops to multi-national organizations with hundreds of sites and thousands of assets, John has helped manufacturers increase value-adding activity, improve quality, and reduce waste and resource use.

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Industrial, commercial, and public sector customers seeking to enhance situational awareness of their machinery, assets, and environment turn to Milvian Group for data-driven solutions that improve operational decision-making and costs reductions. As an applied technology company, Milvian Group recommends, integrates, and implements top-tier hardware and cloud-native services, including IoT, data analytics, and AI technologies.

Milvian Group solutions are designed to solve business challenges, improve work conditions, and achieve sustainability goals by increasing uptime, enhancing machine availability, improving safety, and reducing resource consumption. The "Milvian Mark" represents our commitment to setting the gold standard for service and support in the tech industry.

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