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Unlocking the smart factory:

Why private 5G networks
bring advanced analytics to life

IndustryWeek.

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Introduction

The manufacturing industry is undergoing a significant transformation driven by the convergence of advanced analytics and robust connectivity. As digitalization advances across industries, manufacturers are exploring innovative ways to optimize operations, enhance product quality and gain a competitive edge in an increasingly complex industry. At the heart of this transformation is the ability to harness the power of data for informed and accelerated decision-making.

Advanced analytics play a critical role in unlocking the full potential of manufacturing operations. By combining vast datasets with sophisticated algorithms, manufacturers can gain unprecedented insights into their processes, identify inefficiencies, predict future outcomes and ultimately, prescribe solutions. However, realizing the full potential of advanced analytics requires a robust and reliable connectivity infrastructure.

This paper examines how private 5G networks serve as the backbone for advanced analytics in manufacturing. By providing high-speed, low-latency communication and enhanced security, private 5G networks create an ideal environment for data collection, processing and analysis. Exploring the vital connection between advanced analytics and private 5G networks—two pivotal components of the modern smart factory—enables manufacturers to:

- Optimize production processes by identifying bottlenecks, reducing waste and improving overall efficiency.
- Enhance product quality by implementing rigorous quality control measures and minimizing defects.
- Accelerate innovation by leveraging data-driven insights to develop new products and services.
- Strengthen decision-making by making data-informed decisions that drive business growth and profitability.

This paper offers valuable insights for manufacturing leaders seeking to harness the power of advanced analytics and private 5G networks and drive their organizations forward.



The rise of advanced analytics in manufacturing

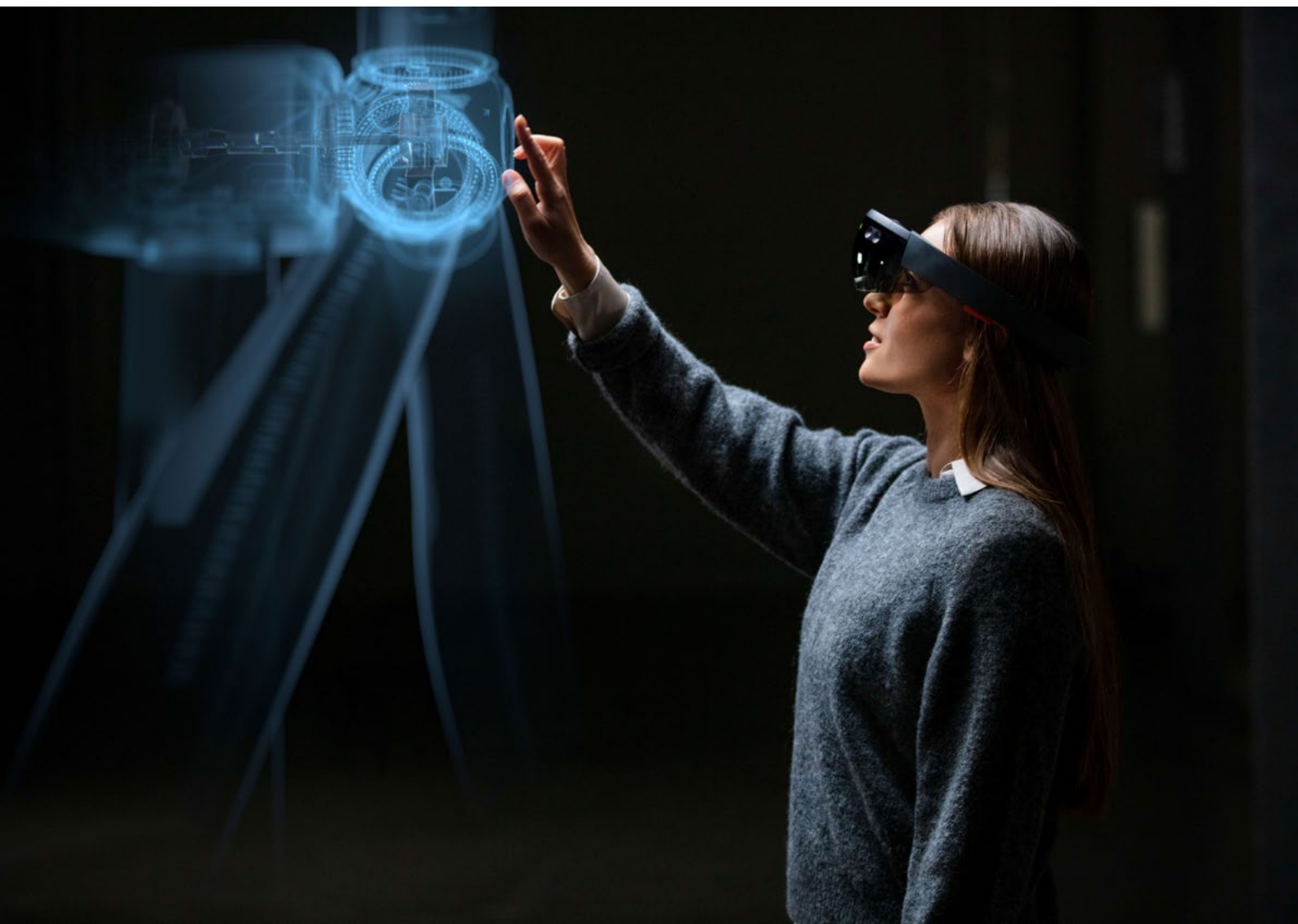
Advanced analytics marks a major step in data analysis, using sophisticated tools and techniques to gain deeper insights from complex datasets. Unlike traditional business intelligence, which focuses on historical descriptive statistics, advanced analytics predicts future trends, enabling organizations to make data-driven decisions.

Within manufacturing, the adoption of advanced analytics is becoming increasingly vital for improving operational efficiency, product quality and innovation. By analyzing data from various sources, including sensors, machines and enterprise systems, manufacturers can identify hidden patterns, optimize processes and discover new growth opportunities.

However, realizing the full potential of advanced analytics presents several challenges:

- Traditional data systems often struggle to capture, store and process the vast amounts of data generated in manufacturing. Legacy systems may lack the scalability and flexibility to support advanced analytics initiatives.
- Maintaining accurate, complete and consistent data is crucial for deriving meaningful insights, as poor data quality can undermine the effectiveness of analytics models.
- A shortage of skilled data scientists and analysts can slow the adoption of advanced analytics.
- Overcoming resistance to change and fostering a data-driven culture can be challenging.

By addressing these challenges and investing in advanced analytics, manufacturers can unlock significant business value.



The role of connectivity: The power of private 5G networks

While traditional wired and wireless networks have served as the backbone for industrial operations, their limitations are becoming clear in the digital age. To fully leverage the potential of advanced analytics and [Industrial IoT](#), a more robust and flexible connectivity solution is required.

Private 5G networks provide a game-changing approach to industrial connectivity, surpassing the limitations of traditional networks by offering these key advantages:

- High speed and low latency—5G delivers significantly faster data transfer speeds and reduced latency compared to previous generations, enabling real-time data processing and analysis. For example, a QoS evaluation found that private LTE has one-fifth the average latency of Wi-Fi, and 5G is even faster.
- Enhanced security—Dedicated and isolated networks provide a higher level of security, safeguarding sensitive data from external threats. Unlike Wi-Fi networks that often rely on less secure authentication methods, private 5G networks use strong device authentication and encryption mechanisms.
- Scalability and flexibility—Private 5G networks can be easily expanded to accommodate growing data demands and evolving operational needs. Unlike wired networks that require complex and expensive cabling expansions, private 5G networks can be easily scaled to accommodate new devices and applications by supporting an unmatched device density.
- Reliable coverage—Consistent connectivity across the entire manufacturing facility ensures uninterrupted data collection and transmission. Private 5G networks offer wider coverage and fewer dead zones compared to Wi-Fi, ensuring reliable connectivity and data collection for all devices.
- Bi-directional data flow—Private 5G networks enable seamless two-way communication between devices and systems across IT and OT borders, facilitating real-time data exchange and control. This bi-directional data flow is essential for supporting advanced applications like remote monitoring, control and automation.



Addressing data collection and transfer challenges

Private 5G networks excel at overcoming the challenges associated with data collection and transfer in manufacturing environments. They efficiently handle large volumes of data generated by industrial IoT devices, ensuring comprehensive data capture. With low latency, data is transmitted and processed swiftly, enabling real-time decision-making, while consistent connectivity across the facility guarantees seamless data collection from all areas.





Enabling real-time data processing and analytics

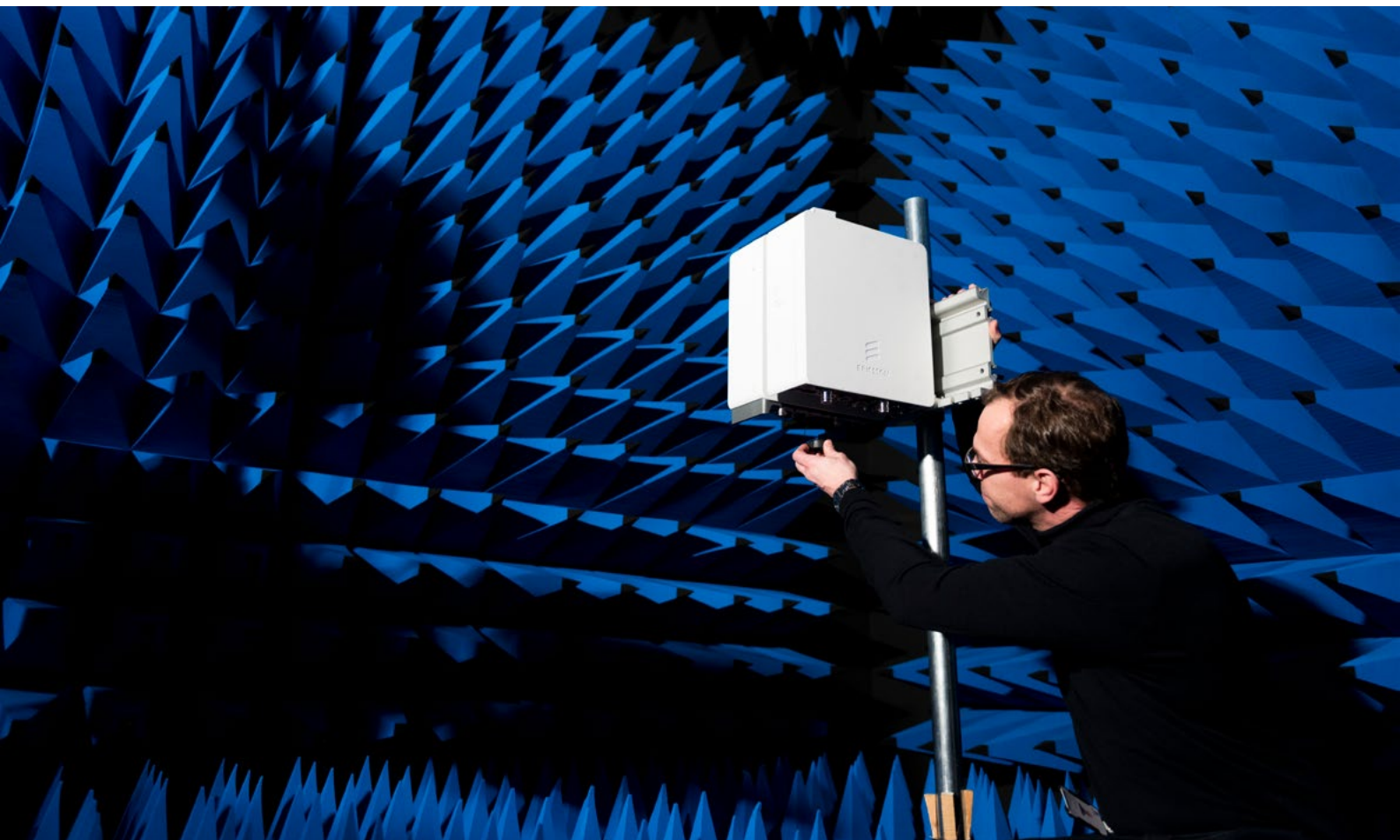
The combination of high speed, low latency, and reliable connectivity empowers manufacturers to leverage real-time data processing and analytics. This leads to:

- Optimized production processes—By analyzing data in real time, manufacturers can identify bottlenecks, reduce waste and improve overall efficiency.
- Enhanced product quality—Real-time data insights can be used to implement quality control measures and detect defects early in the production process.
- Accelerated decision-making—By providing timely information, private 5G networks empower manufacturers to make data-driven decisions and respond quickly to changing conditions.

Beyond these core benefits, private 5G networks offer additional advantages

- Improved quality of service (QoS)—Unlike Wi-Fi networks, which can struggle to manage QoS parameters like latency and throughput, private 5G networks provide tighter control over these factors, ensuring reliable performance for critical applications.
- Network redundancy—Private 5G networks can be designed with redundancy to minimize downtime and ensure business continuity.
- Enhanced security—Private 5G networks offer robust security features, including encryption, authentication and access control, to protect sensitive data.
- Integration with existing systems—Private 5G networks can be seamlessly integrated with existing IT and OT infrastructure, minimizing disruption.
- Cost efficiency—While private 5G networks may have higher upfront costs compared to traditional networks, they can offer long-term cost savings through improved efficiency, reduced downtime and enhanced security.

By addressing the limitations of traditional networks and providing a robust connectivity foundation, private 5G networks create an ideal environment for advanced analytics and digital transformation in manufacturing.



The convergence of advanced analytics and private 5G networks

The combination of advanced analytics and private 5G networks is ushering in a new era of manufacturing excellence. This powerful synergy enables manufacturers to harness data-driven insights with high-speed, low-latency connectivity, unlocking unprecedented opportunities for optimization, innovation and growth.

Use cases of advanced analytics enabled by private 5G

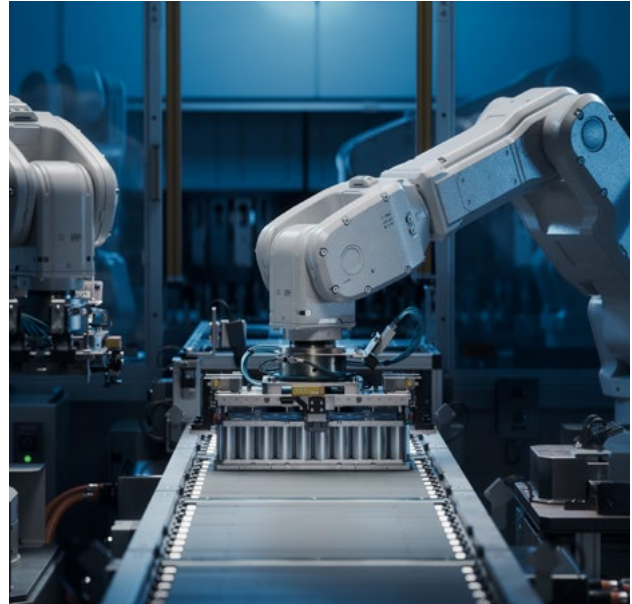
Predictive maintenance

Predictive maintenance is a cornerstone of modern manufacturing operations. By leveraging AI and machine learning algorithms, manufacturers can analyze data from a variety of sources to predict equipment failures before they occur. This proactive approach significantly reduces downtime, optimizes maintenance schedules and extends asset lifespan.

Benefits of predictive maintenance include:

- Increased equipment uptime—By predicting potential failures in advance, maintenance can be scheduled during planned downtime, minimizing production disruptions.
- Reduced maintenance costs—Preventing catastrophic failures helps avoid costly repairs.
- Improved asset utilization—Optimizing maintenance schedules maximizes equipment lifespan.

Case: [Ericsson powers smart manufacturing at Calpak's fully automated solar water heater production facility](#)



Quality assurance

Advanced analytics, powered by AI and computer vision, can transform quality control processes. By using real-time inspections with cameras and sensors, manufacturers can identify defects early in the production process, reducing waste and improving product quality.

Benefits of AI-powered quality assurance include:

- Better defect detection—Computer vision systems can identify defects that human inspectors might miss, leading to higher product quality and fewer customer complaints.
- Increased efficiency—Automated inspection systems process products at a faster rate than manual inspection, boosting overall production efficiency.
- Reduced costs—Early defect detection helps avoid costly rework and scrap.

Beyond defect detection, AI can also be used to:

- Optimize inspection processes—By analyzing inspection data, manufacturers can identify areas for improvement and enhance procedures.
- Predict quality issues—Using predictive analytics, manufacturers can identify potential quality problems before they occur, allowing for preventive action.

Case: [Advancing 5G computer vision with Hitachi, AWS and Ericsson](#)





Process optimization

Advanced analytics play a pivotal role in optimizing manufacturing processes, from product design to production execution. By leveraging data-driven insights, manufacturers can identify inefficiencies, reduce costs and improve overall performance.

Key areas of process optimization include:

- **Product design optimization**—AI-powered tools analyze historical data to identify opportunities for improving product design, optimizing material use, reducing costs and enhancing product functionality.
- **Process efficiency**—Analyzing production data reveals bottlenecks and inefficiencies, allowing for optimized production schedules, reduced waste and increased throughput.
- **Supply chain optimization**—Data analysis helps optimize inventory levels, transportation routes and supplier relationships, improving efficiency and cutting costs.
- **Energy optimization**—By studying energy consumption patterns, manufacturers can identify opportunities for energy savings, reduced operational costs and improved sustainability.

Case: [Inside Ericsson's cutting-edge 5G manufacturing hub in the US](#)

Demand forecasting

Accurate demand forecasting is essential for optimizing production, inventory and resource allocation. By leveraging advanced analytics and historical data, manufacturers can better predict future demand patterns.

Benefits of demand forecasting include:

- **Optimized inventory levels**—Accurate demand predictions help manufacturers avoid stockouts and excess inventory, improving cash flow and reducing holding costs.
- **Improved production planning**—Reliable forecasts enable better production scheduling, reducing lead times and enhancing customer satisfaction.
- **Enhanced resource allocation**—Understanding future demand allows manufacturers to efficiently allocate resources, such as labor and equipment, to meet customer needs.

While traditional forecasting relies on historical data and statistical models, advanced analytics techniques, such as machine learning and AI, can incorporate a wider range of factors—including economic indicators, social media sentiment and competitive activity—to boost forecast accuracy.

Case: [How Ericsson is applying machine learning to forecast demand in its production](#)



Autonomous mobile robots (AMRs)

AMRs are revolutionizing manufacturing by enhancing flexibility, efficiency and safety. Powered by AI, machine learning, and advanced sensors, AMRs can navigate complex environments, collaborate with human workers and optimize material flow.



Benefits of AMRs include:

- Improved efficiency—AMRs automate repetitive tasks, allowing human workers to focus on higher-value activities.
- Increased flexibility—AMRs adapt to changing production schedules and work environments.
- Enhanced safety—Equipped with advanced safety features, AMRs help prevent accidents and injuries.

Private 5G networks provide the essential connectivity for AMRs to operate effectively in a mobility scenario. By enabling real-time communication and data exchange, 5G networks support advanced AMR capabilities such as:

- Simultaneous localization and mapping (SLAM)—AMRs create and update maps of their environment in real time, allowing for autonomous navigation.
- Obstacle avoidance—AMRs detect and avoid obstacles, including moving objects and people, ensuring safe operation.
- Fleet management—5G networks facilitate efficient management and coordination of multiple AMRs within a manufacturing facility.

Case: [Turkcell and Ericsson execute 5G-supported Autonomous Mobile Robot solution](#)

Cyber-physical systems (CPS)

Cyber-physical systems (CPS) represent the convergence of the physical and digital worlds, enabling intelligent and automated control of complex systems. By integrating sensing, computation, control and networking, a CPS facilitates a seamless interaction between humans, machines and the environment.

Benefits of CPS in manufacturing include:

- Enhanced efficiency—CPS optimizes production processes by coordinating and automating various systems and equipment.
- Improved flexibility—CPS enables adaptable and reconfigurable manufacturing systems to respond to changing demands.
- Increased productivity—CPS streamlines operations and reduces manual intervention, leading to higher overall productivity.

The combination of CPS and 5G creates a powerful foundation for advanced manufacturing applications, such as digital twins, augmented reality and [autonomous things](#).

Learn more: [Digital twins: the journey towards a cyber-physical continuum - Ericsson](#)



Building a strategic roadmap for advanced analytics

Implementing a successful advanced analytics strategy requires a comprehensive approach that integrates key factors. This section outlines the essential components of such a strategy and highlights the critical elements for successful execution.

Key components of a successful advanced analytics strategy

- Clear business objectives—Define specific, measurable goals for analytics initiatives to ensure they align with overall business objectives and deliver tangible value.
- Data foundation—Invest in a robust data infrastructure that can capture, store, and manage data effectively. Implement data quality management, integration and governance practices to ensure data accuracy and reliability.
- Talent acquisition and development—Build a skilled analytics team with expertise in various techniques, including data science, machine learning and data engineering. Provide ongoing training and development opportunities to keep your team up to date with the latest advancements.
- Technology investment—Select appropriate analytics tools and platforms that meet your organization's specific needs. Consider factors such as scalability, ease of use, real-time data collection and integration with existing systems.
- Data governance—Establish a comprehensive data governance framework to ensure data quality, security and compliance with regulations. Define data ownership, access controls and data retention policies.
- Change management—Foster a data-driven culture within your organization by communicating the benefits of advanced analytics and addressing potential challenges. Provide training and support to employees to help them embrace the new technologies and processes.
- Continuous improvement—Establish a feedback loop to evaluate the performance of analytics initiatives and make necessary adjustments. Continuously monitor and refine your strategy to ensure it aligns with evolving business needs and technological advancements.

By carefully considering these factors and implementing a well-defined strategy, organizations can harness the power of advanced analytics.

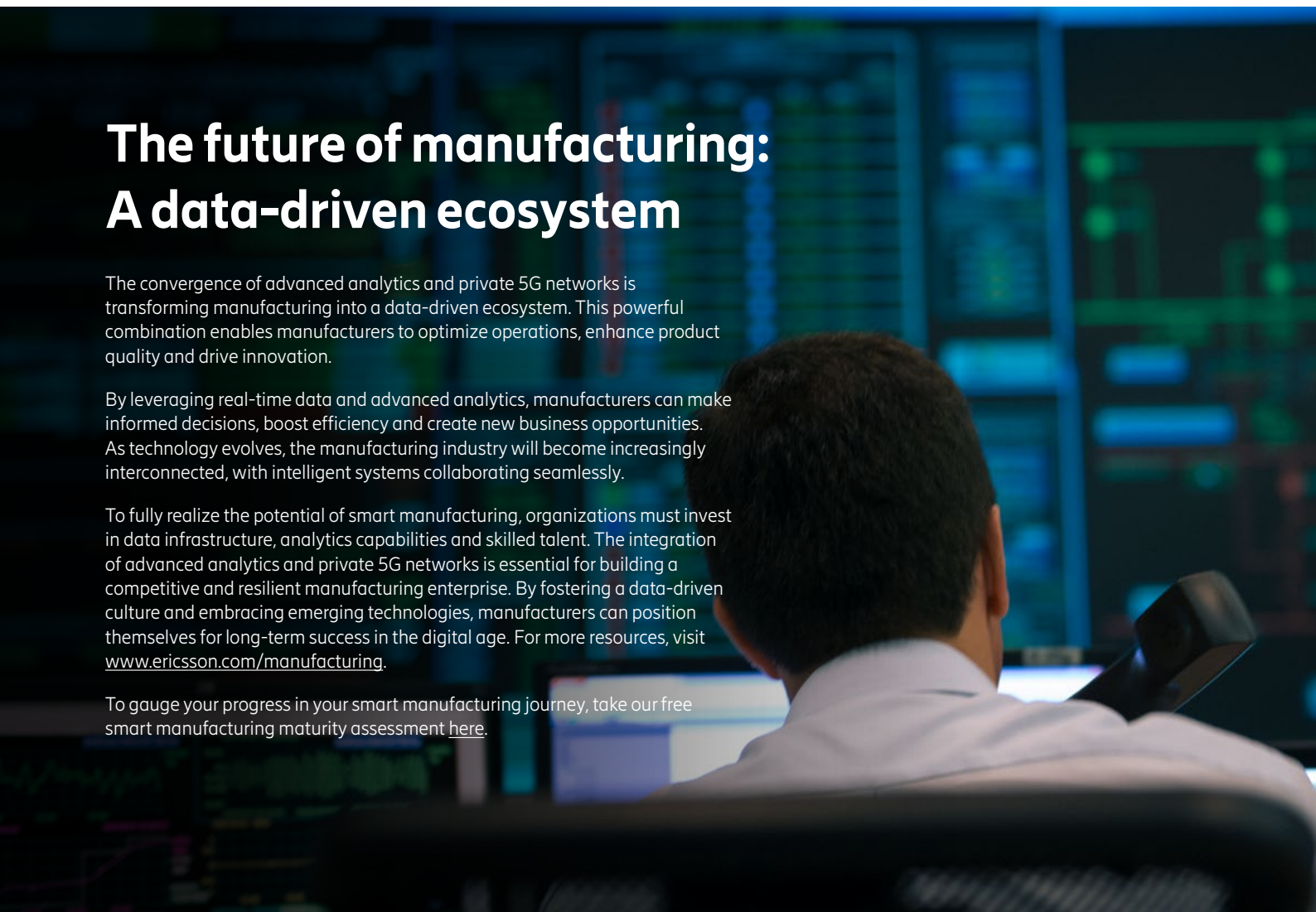
The future of manufacturing: A data-driven ecosystem

The convergence of advanced analytics and private 5G networks is transforming manufacturing into a data-driven ecosystem. This powerful combination enables manufacturers to optimize operations, enhance product quality and drive innovation.

By leveraging real-time data and advanced analytics, manufacturers can make informed decisions, boost efficiency and create new business opportunities. As technology evolves, the manufacturing industry will become increasingly interconnected, with intelligent systems collaborating seamlessly.

To fully realize the potential of smart manufacturing, organizations must invest in data infrastructure, analytics capabilities and skilled talent. The integration of advanced analytics and private 5G networks is essential for building a competitive and resilient manufacturing enterprise. By fostering a data-driven culture and embracing emerging technologies, manufacturers can position themselves for long-term success in the digital age. For more resources, visit www.ericsson.com/manufacturing.

To gauge your progress in your smart manufacturing journey, take our free smart manufacturing maturity assessment [here](#).



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