Unlocking the potential of smart manufacturing

How private 5G networks enable the full benefits of Industry 4.0

verizon√

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While processes and output differ widely by industry, all manufacturers face the same set of business challenges: the need to increase productivity and operational efficiency, reduce costs and downtime, maintain safety and security and identify new revenue streams.

Industry 4.0 aims to meet these challenges by revolutionizing manufacturing with new digital business models that allow factories to more quickly pivot what and how they build to better meet the demands of the market. Underpinning this revolution are key technologies such as Industrial Internet of Things (IIOT), artificial intelligence (AI), machine learning and edge computing. But running an Industry 4.0-enabled factory on existing wired networks or traditional wireless technologies, like Wi-Fi, means that processes are slower and often plagued by interference in the factory environment.

Fast, reliable private 5G networks are needed to make the factory more efficient and cost-effective. They are more agile than wired networks, allowing easier control of autonomous guided vehicles or robotics. They move data faster from IoT sensors to support near real-time video feeds with more flexibility and security built in helping to reduce the risk of breaches that could affect production and reputation.

Implementing industrial IoT solutions with private 5G networks is the key step to realizing the full potential of smart manufacturing and gaining a competitive edge in today's digital environment.
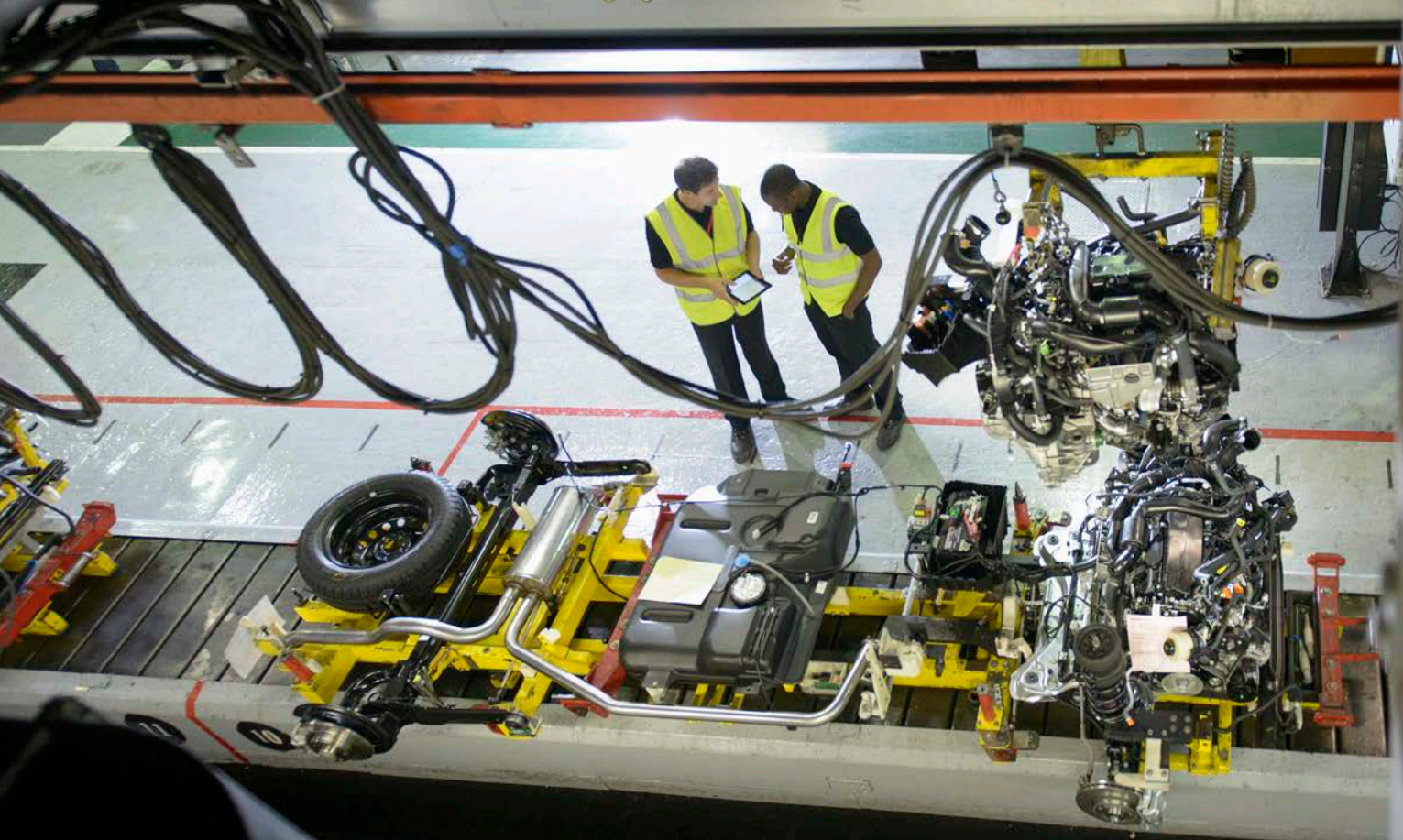
5G private networks in the factory

Today's factories and warehouses are increasingly digitized and leverage robotics, sensors, autonomous vehicles, augmented reality (AR) and other advanced technologies. Wired networks provide basic functionality for these systems, but they can be expensive to upgrade, reroute and extend and they can limit end-device mobility.[1]

While manufacturers appreciate the agility and flexibility of wireless, they have largely continued to use wired connections for critical operations because they perceive them as providing higher performance, reliability and security. Private 5G networks now offer a solution, because for the first time, a wireless approach can provide high-quality performance, reliability and security, giving manufacturers the best of both worlds.

These types of wireless networks are made possible by 5G technology, which offers greater processing power and lower latency for consistent, predictable coverage and high bandwidth. It has the power to enable an emerging set of technologies and applications that can help manufacturers transform their businesses. It will allow them to accelerate use of Industry 4.0 technologies like industrial IoT, AI, machine learning, AR, digital twins and edge computing. And once these technologies are in place, private 5G networks enable large-scale connectivity, extended battery life for connected devices and the ability to capture near-real-time data throughout the factory.

These 5G benefits will translate into positive business outcomes — on average, manufacturers anticipate cost savings of roughly 38% from using 5G to connect their machines and equipment wirelessly.[2] Likewise, productivity of both equipment and the labor force is anticipated to increase more than 40% with 5G connectivity.[2]

Leveraging a private 5G network allows for even higher data transmission speeds and more resilient connections than typically possible with public Wi-Fi and 4G.[3]

With these advantages, adoption of private 5G networks is projected to grow significantly. According to a 2022 report from Research and Markets, the global private 5G network market is expected to reach $36.08 billion by 2030, with a CAGR of 47.5% across the eight-year period.[3]

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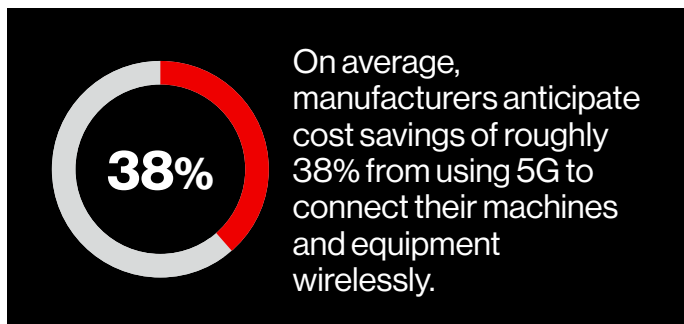
Operational gains with private 5G networks

Manufacturers may be hesitant to implement private 5G networks due to upfront costs, but they stand to realize significant gains in operational efficiency and security. The biggest value gains from private 5G networks come from:

- Accelerating production cycles by connecting factory assets that are in motion, such as autonomous guided vehicles and forklifts.

- Improving quality control and enabling predictive maintenance by increasing visibility into critical processes using cameras and computer vision.

- Creating a foundation that will efficiently and effectively scale to support new production lines and future factories.

Private 5G networks allow manufacturers to use real-time data on machines, products and processes to optimize operations and perform factory activities in the most efficient sequence.[4] Meanwhile, near real-time video feeds and data allow them to keep a more accurate inventory, with faster restocking.

Robots, cameras and other connected devices can be moved and reassigned more quickly and easily, allowing for greater customization.[4] Employees also have greater freedom to move around the factory, controlling machines from mobile tools like tablets and AR devices.

The reduced need for employees on the floor, combined with real-time monitoring, faster emergency shut-offs and more sensors on factory equipment, can promote a safe manufacturing environment.[4]

Preventive maintenance will also be improved by more and faster sensors, as well as cameras that can be easily moved around the factory.[4] Both preventive and scheduled maintenance can be performed remotely, using technical support provided over AR/VR.

Cost savings with private 5G networks

These improvements can bring a variety of cost savings. For example, context-aware robotics can raise productivity up to 20% and AGVs can boost productivity by more than 25%.[5] Maintenance costs can be reduced up to 10% with predictive maintenance and quality assurance driven by AI can catch up to 90% more defects in products than human operators.[5]
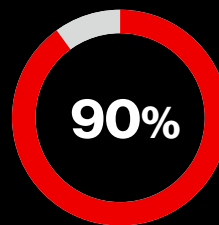
Further, private 5G networks enable machines to do more of the work in the factory, reducing the amount of unnecessary motion, which is responsible for 6.9 weeks wasted each year in the average US warehouse at a cost of $4.3 billion across industries.[6] Reducing the need for manual labor in the factory could further lead to a reduction in workplace injuries, which accounted for $171 billion in costs in the US in 2019.[7]

Finally, 5G private networks are more secure than traditional wireless technology like Wi-Fi.

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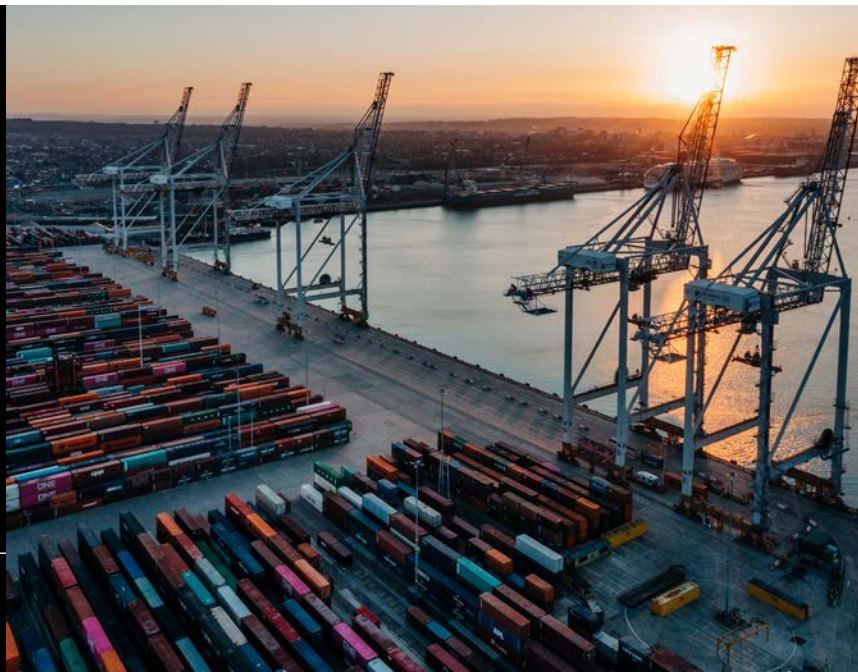
Private 5G networks in action

Private 5G networks can empower a variety of applications, such as digital twins. For example, engineers could monitor and test an aircraft engine's digital twin from their computers while the physical engine is in a manufacturing facility.[9]

Sensors in key locations can provide near-real-time updates on the engine's performance, as well as any issues, with data sent over a 5G network to applications running on multi-access edge computing. Engineers can simulate the engine's life cycle and material stressors in real-world conditions, with faster optimization prior to physical implementation.

Seventy-six percent of manufacturers responding to a survey said digital twins will be important or extremely important to their firm's priorities in the next 12 months.[10]

The Smart Factory @ Wichita

Verizon also works with Deloitte as a Builder-level collaborator in The Smart Factory @ Wichita ecosystem of 20 leading organizations.[8] Verizon's Private 5G Network, deployed at the Smart Factory, provides:

- **Improved operational efficiency:** Predictive maintenance analytics can improve uptime and productivity by addressing about 50% of the root causes of downtime.

- **Improved quality assurance and reduced defects:** Detection of potential defects in manufactured products or services before they reach customers improves the customer experience and reduces waste.

- **Material handling automation:** Management of AGV and autonomous mobile robot fleets can help improve reliability, consistency, safety and accuracy when moving material across the plant.

One real-life use case brought needed network upgrades to the UK's Port of Southampton, which covers hundreds of acres, but had only intermittent public 4G coverage, leading to loss of data.[10] Southampton port workers offload nearly 600,000 vehicles per year, with new vehicles driven off ships and into large parking decks for temporary storage. Ideally, staff would scan and track each car using handheld devices, but the connectivity issues meant they needed to log important information manually.

Verizon added eight access points, covering up to 230 acres at the port, which allowed employees to electronically track vehicles and update customs more quickly with real-time information. Consistent, portwide connectivity also brings the option to build a digital twin of the port to provide a virtual testing ground for new ideas like autonomous shipping trials.

**Unlocking the potential of smart manufacturing**

Getting started with private 5G networks

Manufacturers can have their private 5G networks up and running in just a couple of months when working with an experienced technology solutions partner like Verizon.

One often-overlooked early step is to start conducting the time-consuming but relatively inexpensive baseline assessments of current infrastructure and cybersecurity in the production environment(s). Once they have determined their current capabilities and needs, Verizon can deploy the fast, secure network that will optimize every manufacturing site across the business. But even while leveraging private 5G networks, it is essential that manufacturers have the option to match use cases with the right wireless spectrum. Verizon's ability to provide and manage bandwidth all along the wireless spectrum, including unlicensed spectrum like CBRS and Wi-Fi, gives industrial customers a single partner to enable them to align their industry 4.0 initiatives with the right service.

With the increasing pressure to move to digitization, businesses are realizing that high-speed, high-performance connectivity is a factory essential today and going forward. By maximizing use of advanced technologies, these enterprises can operate more efficiently and more effectively and stand out as leaders in today's market.
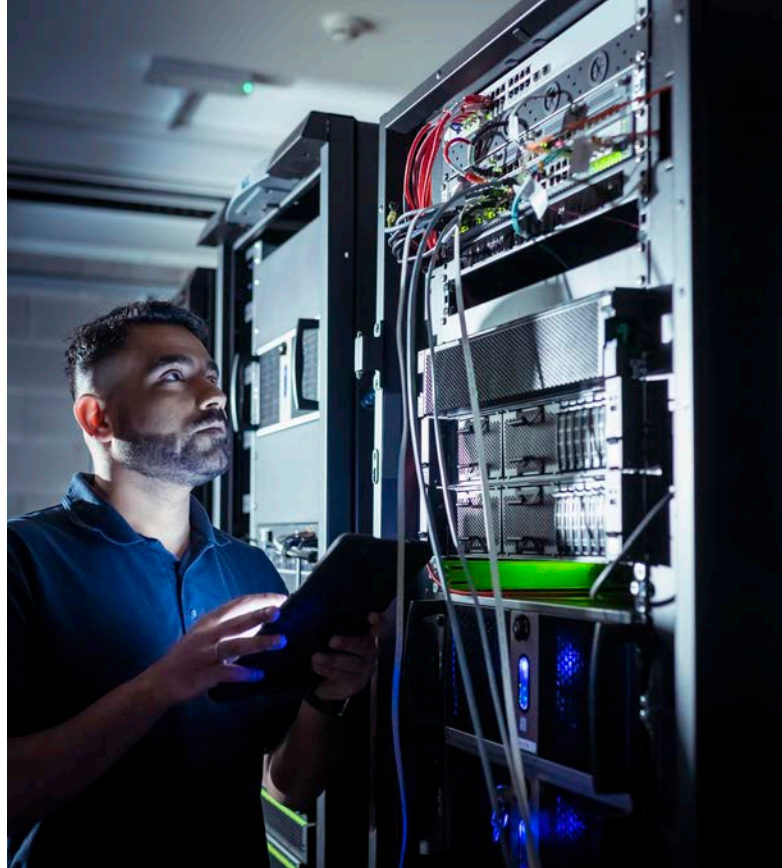
Read more at Verizon.com/PrivateWireless

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