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Realizing smart manufacturing

Extract from the Ericsson Mobility Report

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Realizing smart manufacturing

With the new standards in cellular connectivity, almost every asset in a factory can be connected and managed in order to solve operational challenges.

To be competitive, manufacturers seek efficiencies in production and the ability to deliver a broader mix of customized products. This requires operational processes and production lines to be integrated and adaptable to enable fast configuration changes and reduce lead times, without compromising on safety or quality.

Operational challenges are addressed by three main use case categories (see figure below). To realize these use cases, highly diverse assets must be connected on a large scale through a cost-effective and automated onboarding process. The characteristics of cellular networks make this possible.

Unlocking value with cellular connectivity

Cellular networks meet a range of requirements to support different manufacturing use cases, making it possible to securely and efficiently optimize manufacturing variables[1] with one communication system. They allow massive real-time data collection and analytics, increasing intelligent automation on the factory floor and enabling adaptive production. Cellular connectivity also enables fast and cost-efficient production line changes, as well as integration and optimization of contributing workflows.

In comparison, a fixed cabled network is mainly restricted to supporting critical applications for stationary machines, and Wi-Fi to supporting non-critical (massive) applications. In both cases, scaling connected operations is not feasible, as cables are costly to install and maintain and Wi-Fi cannot sustain high network performance.

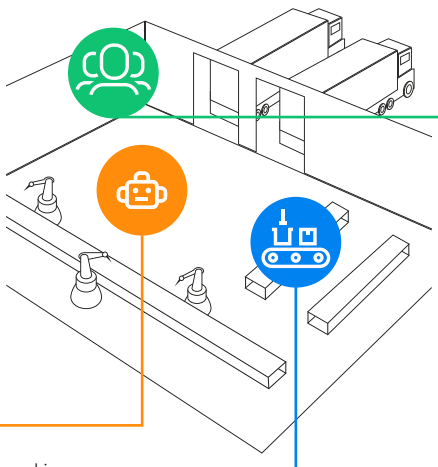
Addressing workflow challenges in manufacturing with cellular networks

As manufacturers seek to optimize utilization of every variable in production, the installed connectivity foundation (fixed or Wi-Fi) is also challenged. All variables cannot be managed with only a fixed cabled network, as a manufacturing site comprises more than stationary machines, such as rotating, moving machines and portable items: tools, materials, phones and tablets.

By connecting infrastructure, equipment and the workforce, cellular connectivity can be used to maximize data collection and provide actionable insights from different workflow processes.

Example of use cases enabled by cellular networks in a digital factory

Automation use cases
- Supply chain automation and assembly control
- Overview of entire production line and value chain processes for operational efficiency and quality
- Robot controller as cloud-based application
- Artificial intelligence automated quality testing
- Flexible production with cloud robotics

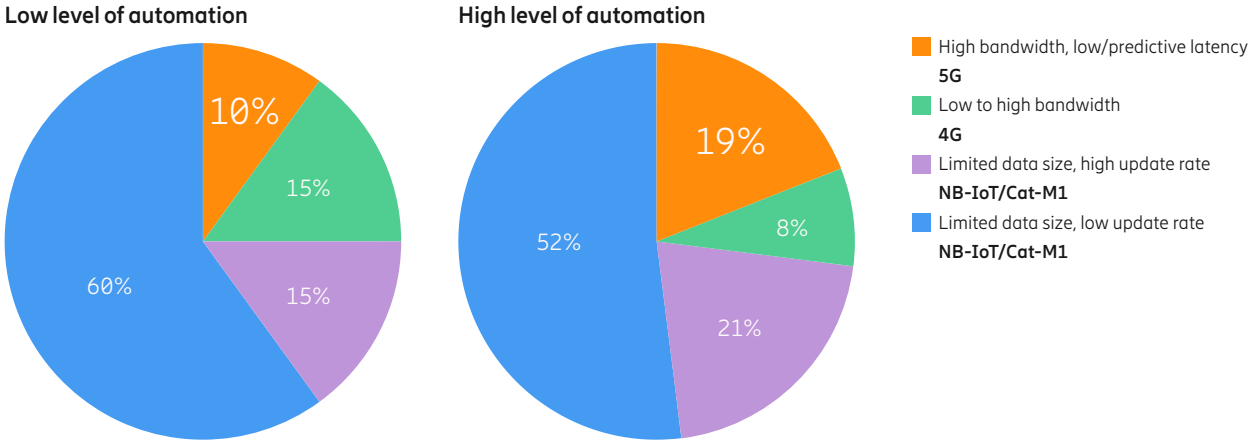


Location use cases
- Asset management
- Warehouse management
- Workforce safety and utilization

Monitoring use cases
- Remote plant monitoring
- Traffic management and route optimization (internal logistics, automated guided vehicles)
- Preventive and prescriptive maintenance
- Environmental compliance and regulations
- Workforce efficiency and manufacturing quality

[1] Manufacturing variables are all the input that goes into making the final product, including all materials and processes

Estimated share of different types of connected devices required to support use cases at a typical smart manufacturing site



Growing device, data and network demands

By 2023, the number of cellular Internet of Things (IoT) connections is forecast to reach 3.5 billion worldwide. The digitization of assets, equipment, vehicles and processes in a factory means that the number of connected devices will increase exponentially. The estimated number of connected devices needed in a typical smart factory is 0.5 per square meter.[2] This calculation is based on potential use cases and assets that would benefit from a connection.

The figure above illustrates the distribution of cellular connectivity requirements (supporting the previously mentioned use cases) in a fully deployed smart factory. The share of each type of connected device[3] depends on whether the site has a low or high level of automation.[4] Evolving to a higher level of automation will increasingly lead to a higher share of 5G connected devices. Both high bandwidth and consistently low latency are necessary to support large data volumes and real-time critical data, as well as to ensure consistent and secure communication.

Use case: Cost reductions with augmented reality

Most use cases enabled by cellular networks will reduce operational costs in a factory. One example is the testing and inspection of assets and products with augmented reality (AR). Guides and contextual information empower workers, and testing or maintenance is executed quickly with higher quality.

This use case has been implemented in a factory in Estonia, resulting in consistently improved product quality with reduced lead time. The improvement in workforce utilization and minimized scrap resulted in a cost reduction of 25 percent.

Customized production requires customized networks

Although efficiency and quality improvements throughout the manufacturing chain are vital for success, truly competitive output will rely on customizable or adaptive production.

Network connectivity must also be customized per use case, to deliver cost-efficient performance while scaling the number of connected devices.

Cellular technology offers the capabilities to handle different use cases' service requirements by using Quality of Service (QoS) mechanisms. The importance of this will increase as manufacturers are digitalized and demand more networked capabilities beyond their sites to include logistics, suppliers and other factories.

Manufacturing comprises more than just assets and processes at the factory site. The efficiency of production is also dependent on the timely arrival of resources. Moreover, the success of manufactured products in the market depends on continuous customer feedback and co-creation. Hence, collaboration across the whole ecosystem, as seen in the figure below, results in a higher degree of product and service customization. Cellular connectivity based on 4G and 5G technologies provides the mobility, security, availability and reliability needed to realize smart manufacturing.

The future connected manufacturing industry

Connected flows
The factory is integrated with wider networks, other factories and logistics.
- Logistics securely tracked throughout manufacturing process
- Awareness of precise location of vehicles

Connected site
The factory floor is a highly specialized environment with diverse needs.
- Extreme reliability and low latency
- Secure, high reliability, high availability network

Globally connected company and products
The factory-shipped, installed and delivered goods are globally connected and serviced.
- New forms of customer engagement
- New services and partner ecosystems enabled

[2] Average number based on data from different manufacturing sites. In dense areas, the connection density could be up to one connected device per square meter
[3] The exact distribution figures for a specific manufacturing site depends on the communication needs
[4] The level of automation is a continuum from manual to fully automatic operations (Parasuraman et al., 2000)

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