



Let's Solve

Whitepaper

5G: High-Speed Connectivity

Enables Emerging Dimensions in Manufacturing

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Introduction

Due to the increased volatility of the business environment, Manufacturing companies are under constant pressure to maintain their efficiency and sustain the profitability. "Factories of the Future - a concept of the fourth industrial revolution that is Industry 4.0, is today an obvious need because of increased role of services in the manufacturing sector. Such factories will feature sensors, machine-to-machine communication and interconnectivity between machines, material and man. A key enabler for these factories is 5G with its high capacity that boosts the communication system and supports these working conditions, provides flexibility and low latency. In-fact, the adoption of latest technologies such as Artificial Intelligence, cloud computing, real-time simulations, etc is highly dependent on the adoption of 5G. It enables the digital infrastructure that streamlines the operations leading to operational intelligence and improved business output.

5G and its Features

According to International Telecommunications Union (ITU), 5G should have a speed of 20 GB/S for the downlink and 10 GB/S for the uplink¹. The latency in 5G could be as low as 4 milliseconds to 1 millisecond. As per early tests, the 5G network would approximately be 100 times faster than the current technology². The infrastructure requirements will also be different from its previous generation. It will rely on smaller and densely deployed antennae. Rather than being attached to conventional huge towers, these antennae would be attached to existing buildings, lights posts and other physical infrastructure.

The key features of 5G are:

- // High data speed: It offers a data speed greater than 10GBPS
- // Ultra-low latency: Response time is as low as 1millisecond and availability greater than 99.9%
- // High capacity: It allows a high network density of up-to 1million devices/ square kilometre.
- // Flexibility: With its wireless connectivity, 5G provides flexibility to the manufacturers to move from fixed-line connectivity to mobile connections.

With these features, 5G greatly enhances the use of technologies such as:

Artificial Intelligence | Machine Learning | Cloud Computing | Real-time Simulation
IoT | Robotics | Big Data & Analytics | AR/VR



Manufacturing Industry

Current scenario

Though the manufacturing industry is preparing to adopt new and advanced technologies, it is lagging due to the level of connectivity, latency and bandwidth required for these technologies to work efficiently. It is still working on fixed connections on the shop floor. Ensuring the connectivity of so many machines, sensors, devices and networks is a tough task.

Due to the connectivity and slow response issues, real-time data availability and data collection becomes a concern and slows down the decision making. Also, connecting operations and infrastructure with kilometres of wires and cables is not efficient and reliable. At the same time, maintenance of so many physical wired connections is difficult and involves much effort. Along-with the technologies, the devices and sensors are also becoming more sophisticated. Hence, it is required for the manufacturers to be able to move to networks that can connect these quickly and efficiently.

Challenges Faced by the Industry

Data collection

Currently, real-time data is not available across all operations and machines. Decision making is usually dependent on past performance data.

Less scope of automation

Due to less reliable and fixed connectivity, automation is not possible everywhere in the production process.

Seamless integration

Integration of different production sites, process, components and systems in the value chain.

Visibility

Currently, the production processes and systems are independently managed and not with the connected network.

Remote maintenance

For different locations, specialized equipment and unsafe or less accessible machines/areas.

Slow troubleshooting

Since, real-time information is not available and use of advanced tools such as predictive analytics is in limited scope, it is difficult to identify and then resolve any issue.



5G in Action

How 5G helps in overcoming current challenges

5G, with its features and supported technologies can help overcoming these challenges through:

Performance optimization –

Technologies such as big data and analytics help in analyzing the underlying problems and its causes and identifying the proactive solutions to streamline the operations.

Enhanced troubleshooting –

This can be done by using Augmented Reality as a solution. AR can be used to identify the issues in the processes and solve them quickly and effectively. This also allows the real-time data sharing between different functions / locations/machine centres to help prevent the spread of the issue, and hence saves a lot of time in troubleshooting.

Smarter field devices –

These devices help in data collection and real-time tracking and monitoring of the operations and machines, thus giving visibility to the manufacturing facility.

Real-time communication –

With extremely faster speeds, 5G can enable real-time communication between machine, material and a man, which can greatly enhance factory safety and performance. This, in turn, improves the data collection, which, when combined with predictive analytics can help in preventing the machine failures and ensuring plant availability.

Use Cases

Reducing Machine downtime

Problem

Ensuring the availability of equipment/machine is a major challenge in any manufacturing industry. There are unplanned stoppages or downtime, which highly impact the production targets. Also, there are a good number of machines which are very expensive and even a smallest failure can cost a lot, both on machine and production front.

Solution

With 5G connected sensors, real-time machine data is available, and this combined with Machine Learning or Data Analytics can be used for predicting the failure even before it occurs. It also helps in identifying the operational inefficiencies and failure diagnostics, thus enabling the organization to improve the machine performance and availability.

Remote inspection

Problem

Manufacturing sites are usually scattered and across geographical locations. For example, a metal manufacturer will have mines at one location and its smelter at another. If the smelter team wants to check the ore quality at source, it needs to physically travel to the mines. Also, some specialized machines/ equipment needs repair and maintenance which only specialized technicians can perform. In case of emergency, the factory needs to wait for these skilled technicians to come and fix the issue. For this duration, the machine remains out of operation, adversely affecting plant operations.

Solution

Augmented Reality can be very useful in this case. Remote services facilitate the creation of virtual back office that use the data coming from smart devices for easy access to instructions and predictive analytics. Even the less skilled technicians can go and inspect the machines/product with the skilled technicians/engineers guiding them through the process remotely and virtually on tablets, mobile devices or headsets via 5G networks. 5G always ensures an uninterrupted and seamless functioning of AR.

Benefits of 5G

Apart from tangible benefits such as profitability, cost of production, etc, below are some major direct benefits 5G can provide:

1 Increased data flow

Organizations depend highly on data to improve their manufacturing process and to boost their operational & business intelligence. With the use of various devices, a vast amount of data is generated daily. This collection of data can be transmitted and analyzed faster with 5G's low latency and high bandwidth.

2 Increased machine availability

With the increased data flow, sensors with 5G connectivity can monitor and give the information of equipment performance in real-time. This information combined with technologies such as Machine Learning or predictive analytics, helps in proactively identifying the likelihood of any failure, thus preventing the equipment stoppage and downtime.

3 Unified supply chain

With the integration of smart devices, 5G enables the supply chain to transform from separately managed functions to a connected network of devices that share data in real time. It also enables quick communication between devices and functions and hence unifies the entire chain.

4 Increased automation

Automation requires massive wireless sensor networks and connectivity. Robotic systems to perform the tasks or to inspect the products in real-time with high accuracy require low latency and high reliability to communicate faster with backend systems. All this is now possible with the capabilities offered by 5G.

5 Enhanced mobility

5G provides support to the increased mobility on shop floor and it is more important as automation is increasingly prevalent. For example, 5G enables manufacturing companies to design and deploy robots: AGVs and Autonomous mobile robots (AMRs). These intelligent devices are extremely flexible and are not fixed to one particular location. With this increased mobility and wireless communication, 5G provides the support with security, real-time communication and monitoring with high data rates.

6 Asset tracking and management

5G provides high precision location information, which helps in effective Asset management with real-time tracking of machines, tools and even workforce.

Challenges

Introducing 5G to the manufacturing facility will not be a cakewalk. Especially at the beginning, all the concerns and challenges must be taken into consideration. Major challenges in adopting 5G are:

Cybersecurity

With the 5G speed, a cyberattack can happen faster, which has a potential of more data leakage that too quickly. But with significant enhancements such as elimination of known vulnerabilities, improved security protocols and capability to identify a security threat/bug prevent the breach of security.

Cellular connectivity

As the frequencies increase, the signal strength and range deteriorate rapidly compared to 4G frequencies. Hence, surroundings and weather can weaken the signal strength. To overcome this, a denser network is required with more small cells and base stations. For this, cellular signal boosters can be used to amplify the signals to improve the connectivity.

Investment

As of now, a total estimate of the installation cost is unidentified, but for the deployment of 5G, a substantial upgrade is required to the enterprise back-end systems. Total cost can vary depending upon the availability of an organization's existing infrastructure compatibility with 5G.

Workforce revolutionization

To harness the full potential of 5G, workforce needs to adapt to new skillsets to meet technological advances. It needs to know the intricacies of the machinery and understand the complex technological networks.

Heterogeneity

The wireless systems will be more diverse and go through continuous changes with additional devices in the wireless domain. Hence, new protocols are required to manage the collaboration of technologies in a coordinated and adaptive way.

Current Market Scenario

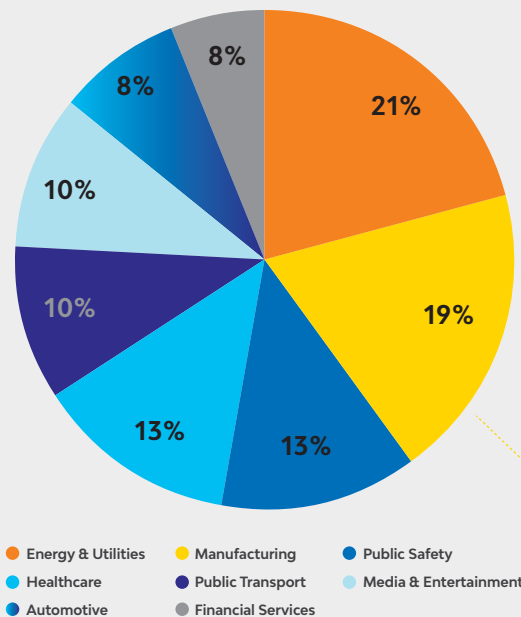
On April 2019, South Korea launched the first nationwide 5G mobile network. In USA also, Verizon rolled out 5G services in April 2019. Other countries like Japan and China have plans to make 5G services commercial by 2020³.

Few big companies who have started to adopt 5G:

1	2	3
Audi has started testing 5G for its robotic motion control	In factory connectivity, Nokia's 5G Oulu factory is using 5G	BMW Brilliance automotive in China is working on enabling 5G wireless coverage across all its plants.

Market Forecast:

5G-Enabled Digitalization Revenues for ICT¹ Players
100% = \$ 1 233 bn (in 2026)



Manufacturing ranks second, but required investments much lower than for energy & utilities

As per Ericsson report, the addressable industry digitalization market for service providers can grow up-to USD 700 billion by 2030. This corresponds to 47% of total 5G enabled market expected to be served by ICT players⁴.

As per the survey conducted by Ernst & Young in the UK, 10% companies are allocating money for 5G already, and 50% of enterprises plan to upgrade to 5G in the next two years.

Manufacturers are more interested, with almost two-thirds planning to implement 5G within two years of availability⁵.

Source: Ericsson & Arthur D. Little, 2017

Way Forward

5G devices that are currently available are at early stages only and have not come below the cost curve to make it feasible for large scale adoption. Today, only the initial set of 5G features is available and public 5G networks are just starting to appear. Getting into this level of ultra-low latency and high connectivity of 1 million sensors per square kilometre will take some time. But as the technologies evolve and become available, 5G will become more appealing to the manufacturers.

Conclusion

Manufacturing sector is currently on a journey of Digital Transformation and to support all the technological components and systems, a highly reliable and robust network is required and hence, 5G is the best fit here. 5G brings a massive change in device connectivity and network flexibility and helps initiate major advancements in the smart factories. It will help this sector in realizing the major gains such as improved productivity, increased operational efficiencies, performance improvements and increased safety. Although, 5G network roll-out for manufacturing sector might be a few years away, the time to start preparing is now – exploring new opportunities, testing technologies, building infrastructure and workforce, to have a smoother transition in future.

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Anjali has more than 5 years of experience in Manufacturing and digital Transformation. She has worked in operation excellence, predictive maintenance and digital strategy domains; and has driven and executed various Six Sigma Projects in the past.

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