Smart Factories

Designing the Future with Connected Manufacturing

THREAD IN MOTION

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THREAD IN MOTION

A comprehensive guide to smart manufacturing, helping manufacturers identify, prioritize and benefit from opportunities connectivity brings into business operations. Best practices and lessons learned from smart factories around the globe built by industry leaders.

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INTRODUCTION

It can be said that it all started with the invention of the steam engine in the 18th century and its use in textile production. The systems, which are normally moved by human and animal power, have become more comfortable and faster with the steam engine over time. Later, electrical machines took the place of steam engines. The production line accelerated with the assembly line produced by Ford and in the second half of the 20th century, with the development of computer systems, the communication between production and machines became much more fragile and faster.

The new technologies that came with Industry 4.0 have made smart factories possible by introducing them into our lives. The first of the bright intelligence factories also called "lights out manufacturing", was established in China, since no people work in it. With the use of robots in this factory that produces mobile phone modules, the number of workers decreased, while the share of defective products decreased from 15% to 5%. “Dark factories”, a feature of Industry 4.0, can detect business needs through sensors, communicate and interact with other remote production tools (sensors, actuators, machines, robots, conveyors, etc.) via the web, and provide the production information they need in cloud systems. It includes intelligent machines and systems that draw from “big data”. The use of the “Internet of Things (IoT)” is becoming widespread to establish the intelligent decision-making environment and predictive, preventive, prescriptive, proactive, basically autonomous decision-making capabilities of interconnected devices. IoT started the industrial revolution, often referred to as Industry 4.0, with the emergence of the smart factory.

INTRODUCTION

The processing of big data and the contact of objects with each other is known as the internet of things. With the help of the internet of things, smart homes, smart cities, and smart environments can be designed, not smart factories. The key role in this technology is the sensors. Sensors that measure the physiological properties of objects and convert them into numerical values enable these data to be used by other devices via the web. Reduction in labor costs, low energy consumption, reduction in environmental pollution, and prevention of work accidents can be counted as the main advantages of automation in production. However, on the other side of the coin is the unemployment that will be created by the transformation in the workforce.

Comments on the Internet of Things (IoT) are often about how they will affect our daily lives. From drone delivery of a pizza to turning on your home heating from your phone, smart and connected devices have become commonplace in recent years.

WHAT IS A SMART FACTORY?

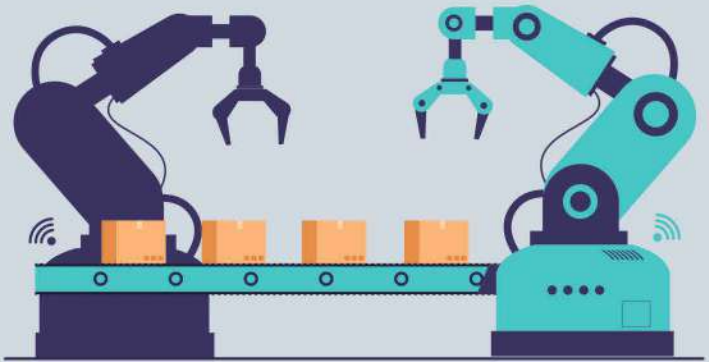
Smart Factories are assumed to be new generation production facilities where machines talk among themselves, production is organized by machines, not people. The National Institute of Standards and Technology (NIST)[1] defines smart manufacturing as fully integrated, collaborative manufacturing systems that respond in real-time to meet changing demands and conditions in the factory, supply network, and customer requirements. According to the definition of the Smart Manufacturing Leadership Coalition (SMLC)[2], smart manufacturing is the ability to solve current and future problems in a way that allows it to be implemented with an overt infrastructure while creating advantageous value.

Smart manufacturing and smart factory is a broad production concept that has emerged to optimize the manufacturing period.

Smart manufacturing, a process that uses computer controls, modeling, big data, and other automation to increase manufacturing efficiency, aims to leverage advanced information and manufacturing technologies to address a dynamic and global market. It also ensures that all information about the production period is available when needed.

At the center of the smart factory are the smart sensors, motors, and robotics used in the production and assembly lines, in short, advanced technology and the big data collected in this way. Sensors make it possible to monitor processes that increase awareness of what is happening in various areas across the fabrication.

Vibration detection, for example, motors, bearings, or other equipment can alert when maintenance is required.



KEY FEATURES OF SMART FACTORIES

Smart Factory defines an environment where machinery and equipment can improve their processes by themselves with the help of automation and auto-optimization. The most important factor triggering the emergence of smart factories can be considered as the disruption of production activities caused by human or tool errors in companies. In response to this situation, the development period of the Smart Factory (SF) concept, which has achieved the transition of automation systems to the next stage to eliminate the existing problem, has begun.

The defining features of SF are visibility, connectivity, and autonomy. With the help of the Internet of Things known as IoT, being able to monitor the status of all equipment in real-time and read data from sensors makes all factory data visible. The most important advantage created by the smart factory system is that every stage of the production period is under test. In other words, it is the possibility of foreseeing the errors or malfunctions that may occur. The emergence of this foresight is caused by the fact that all the actors of the machines and the production line are in contact with each other. With Smart Factories, it can be ensured that production and supplyprocesses are in communication with each other and display proactive work. While increasing the production speed and quantity, it aims not to compromise on quality and reduce quality and cost in the right amount. Smart Factories, which are designed to dominate the production, supply, and the whole process of the users with realistic works and real-time working methods, can detect or foresee the malfunctions, problems, and problems that may occur by monitoring the system in real-time, and can provide recovery with less damage.

Perhaps the most important feature of the smart factory is connectivity. In the smart factory, all objects are equipped with smart sensors to obtain continuous information and to update these details continuously. At the stage of obtaining the necessary information to make various decisions about processes in the smart factory, all these objects need to be related to each other. With the help of this relationship, all these data collected on internal and external processes provide the opportunity to monitor the supply chain from beginning to end.

KEY FEATURES OF SMART FACTORIES

At the same time, other features of smart factories include optimization, agility, proactivity, and transparency. With the help of automated workflows, asset synchronization, advanced traceability, advanced programmability, and optimized energy consumption within the smart factory, efficiency, function time, and quality are increased; costs and waste are reduced. The transparent network enables the organization to make more accurate decisions by providing simultaneous monitoring and traceability with the method of simultaneous alarms and warnings throughout the facility. In a proactive system, employees can act quickly without anticipating problems before they happen. However, this prediction is not always correct or the problem is defined incorrectly. This can lead to quality errors, overstocking, safety losses, etc. The ultimate agility and flexibility allow the smart factory to adapt to schedule and product changes with minimal intervention.

There are many structural components of smart factory formation. The first of these components; is an intra-system communication system. In IoT technology; Machinery, devices, and equipment used in production can automatically communicate witheach other via network method so that production can be followed with minimal human contribution, possible malfunctions can be prevented by forecasting method, downtimes can be reduced, raw materials, materials, semi-products, etc. The need can be quickly determined and supplied. Another structure that has a role in the formation of smart factories is Cyber-Physical Systems. Cyber-Physical Systems, which can communicate between the physical environment and the virtual environment, are systems that can distinguish and control even the smallest details in the production process and offer solutions for possible problems.

With the use of Cyber-Physical Systems (CPS) applications in production, smart machines constantly share information on issues such as the current stack level, possible problems, losses, changes in demand, differences in orders. Processes and deadlines are tested to maximize efficiency and optimize delivery times.

KEY FEATURES OF SMART FACTORIES

Another component of smart factories is Cloud computing technology. Instant data obtained from objects in smart factories are stored in cloud-based systems. In this way, the monitoring of the production period is very simple and possible problems can be intervened simultaneously, even remotely. With the help of cloud computing technology, which removes the limits of storage and computing; However, all data produced and stored globally, not locally, constitute Big Data. Big data; It is processed or raw data obtained over time and systematically or randomly.

In the formation of smart factories, the artificial intelligence period takes place after cloud computing and big data. It is envisaged that when the devices that create tasks in the production stages are equipped with an artificial intelligence-based working system, they will be able to use initiative and make recommendations. Another smart factory component is Simulation.

It is possible to describe the simulation as restructuring in a computer environment by modeling processes inside or outside the business (supply, production, distribution, marketing, sales, etc.) to observe and regulate the situation, flow, or behavior of the whole or related part of the supply chain. Cybersecurity is also a critical component for smart factories.

Cybersecurity; The cyber environment is defined as the combination of tools, policies, safety understanding, security measures, rules, risk management approaches, actions, training, best practices, insurance, and technologies to protect the assets of the organization and its users.

WHY DOES THE WORLD NEED SMART FACTORIES?

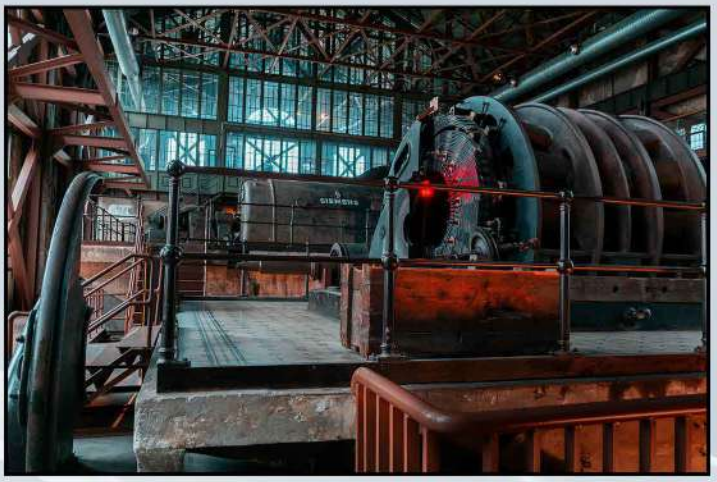
As it is known, the 1st Industrial Revolution had begun when man dominated the power of water and steam and produced mechanical tools. Afterward, mankind, who dominated electricity, switched to mass production with the help of electrical energy and the 2nd Industrial Revolution began. Then, in the 3rd Industrial Period, automatic production is based on the development and joint use of electronic and information technologies.

Manufacturers are constantly working on information and communication technologies that can increase value. These valuation efforts were named Industry 4.0 in Germany. It led to the start of the 4th Industrial Revolution that the whole world would adopt. The purpose of Industry 4.0 is to create a large communication network among the production staff, to create flexible and dynamic self-organized production processes to provide production-related advantages for customizable products. The 4th Industrial Revolution will provide higher quality and faster production with cyber-physiological systems. Smart factories will have features similar to being self-organized as required by the 4th Industrial Revolution, and production will always have a more sensitive place in these processes, which are of great importance for our future.

Due to the increase in the world population and many related reasons, inevitable advances were made in the industry. With industrialization, the rise of Capitalism and many related innovations began to emerge. A faster production process was entered at every moment. Combined with the quality of the products and the consumer's greater desire to follow the products, inevitable progress has been made in the industry. With the growth of business and the workplace, the workload has increased continuously. Accordingly, employers began to seek solutions to reduce their workload and solution experts began to emerge.

After the establishment of Smart Factories, the costs of workers and workers began to be reduced. Fewer workers meant less cost. Smart Factories may be costly at first, but these factories can easily meet the costs of an advanced worker and allow quality production. As consumption increases, production increases. As production increased, errors and deficiencies that could arise from errors, problems, and quality were in question. Now, with the existence of smart factories, it can predict qualified errors and problems before they happen. Foreseeable errors are resolved from the beginning and possible errors and costly accidents can be prevented beforehand. Being able to test the system as desired with Smart Factories with a few keys caused the spread of Smart Factory systems more easily and demanded more.

WHY DOES THE WORLD NEED SMART FACTORIES?



One of the examples Smart Factories brought into our lives:
Siemens Electronic Works, Chengdu, China.

In Chengdu, southwest China, Siemens operates one of the country's most advanced factories. In 2018, the World Economic Forum[3] recognized this factory as one of the "most technologically advanced factories" in the world. An example of the "Industry 4.0" concept, this factory contains technologies that have achieved a lot of success.

Employees using 3D simulation, augmented reality and other techniques to perfect the design and operations of their factory are helping to increase output by 100 percent and shorten cycle time. The highlights of the plant are the technological level of its production, a high level of automation, and quality control.

Bosch Automotive, Wuxi, China

An important application of the Internet of Things (IoT), one of the leading technological innovations that experts say strengthens Industry 4.0, and another successful example of the use of these technologies is the Bosch factory in China.
The factory is renewing its production infrastructure by applying radiofrequency identification-based vehicle management, placing sensors on machines, and analyzing real-time machine data and inventory. They can also use advanced data analytics to deeply understand and eliminate output losses, simulate process settings, and predict machine outages.

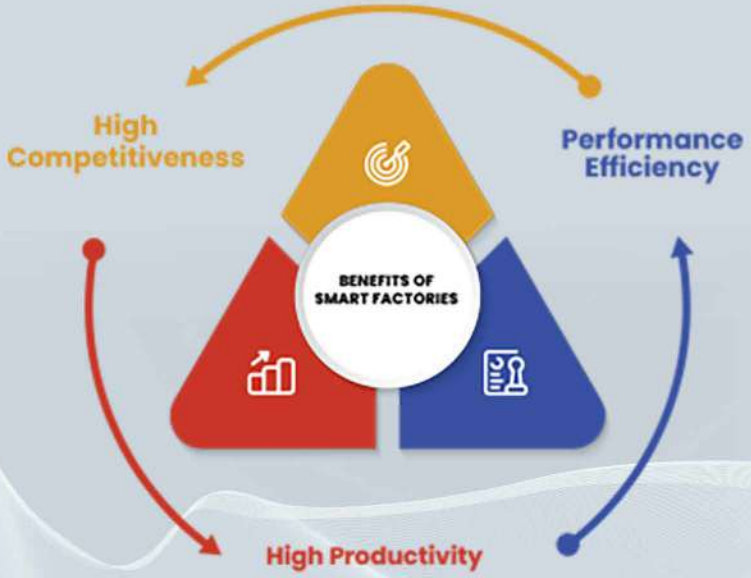
As it can be understood from the above examples, there are a few important specialties that Smart Factories offer as a benefit.

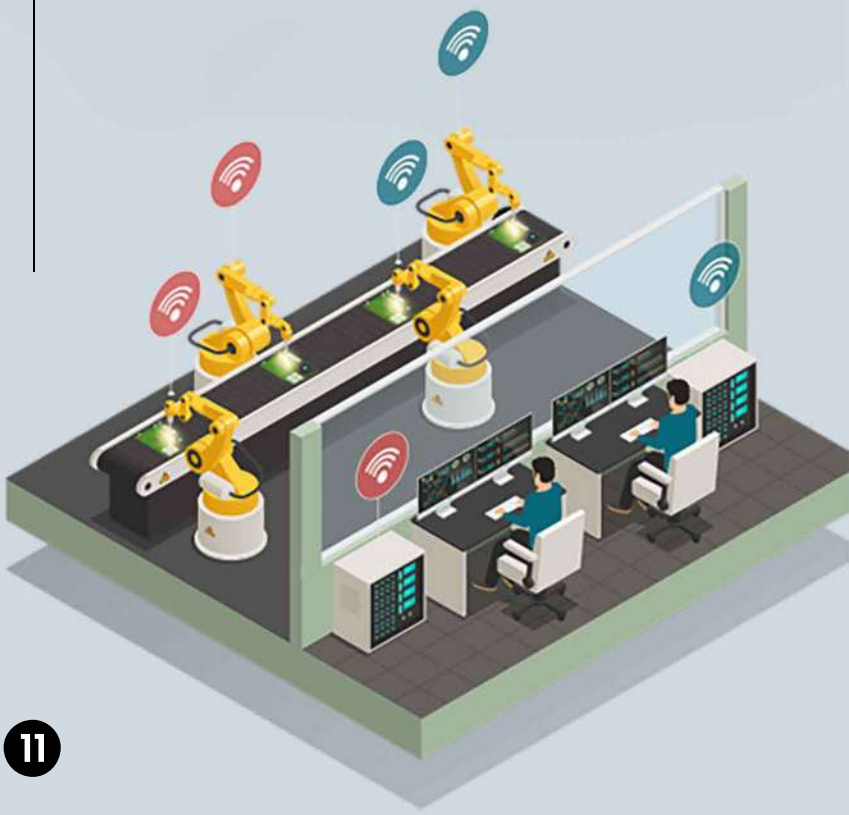
WHY DOES THE WORLD NEED SMART FACTORIES?

High Competitiveness;
In the factory hardware and the embedded systems required for this, the machine's embellishment with the web and strong networks enables businesses to be more productive and more competitive in a global sense.

High Productivity;
With the help of smart production processes, more access to data is provided over the entire supply chain network. With the ability of manufacturers and suppliers to reach the simultaneous data they need regarding production and orders, the required material, the amount of supply of this material, and the treatment time can be determined exactly, thus increasing productivity. At the same time, Smart Factories provide high productivity.

Performance Efficiency;
The instant collection of all data throughout the supply chain, the real-time detection of errors or emergencies, and the ability to intervene, the fact that the data is precise by collecting data not only from people but also from objects, allows better evaluation of performance and makes necessary improvements more rapidly and more actively.





THE FUTURE OF DIGITAL FACTORIES

Germany is leading the 4th industrial revolution by making its cyber-physiological systems. In addition, the German National Academy of Sciences and Engineering[4] predicts that new production processes will increase productivity by at least 30%. Cyber-physiological systems will lead to productivity and change not only in production but also in many other sectors such as health services and agriculture. This development will accelerate with the introduction of products produced in smart factories. Although we cannot see the future, we can make predictions about the smart factories of the future.

Components, vehicles, shipping containers, machines, and conveyor systems in today's advanced automated factories will be equipped with thousands of sensors and contact systems together with Industry 4.0, thus increasing speed, efficiency ad quality. These factories; To summarize, we have information about the future of the product before the product is launched, with the creation of virtual reality, simulation, and virtual prototypes; These factories will enable us to predict the future and enable us to make sound decisions and to produce high quality, fast and low-cost products.

One of the biggest innovations brought by the term digital factory is the transfer of all developments and data about the factory to the digital environment, briefly to the computer. All data about the factory is transferred to this environment by using different software for each factory. In this environment, the fact that the factory starts production and the evaluation of the results of the production is a part of the term digital factory.

Through these software systems arranged for factories, the malfunctions seen in the working process of the factory can also be evaluated. All the details encountered during the production and production phase in the facilities are controlled by software. In addition, with the help of the system, faults in factories can be determined in a short time. In addition, it is determined what kind of steps should be taken for maintenance and repair. The fact that all these details can be planned with the help of the smart factory system ensures continuity in the productive structure of the factory.

THE FUTURE OF DIGITAL FACTORIES

All these details are tested with the digital factory application before the factory is built on the system, and details about what will happen when the factory starts to operate are revealed. Thus, the level of return of the factory can be easily determined. Even if this system is still in the installation phase, it is a structure that gives information about how the factory will give the highest performance. Instant data analysis can be done with the help of smart factories equipped with production automation systems. The digital factory system minimizes the risk, especially for newly established factories. Because before you start making serious investments, data about what will be encountered is obtained. This ensures a high rate of successful results. Another advantage offered is that the pre-production processes are shown step-by-step system-oriented. When a factory under construction is completed, how much it can produce, which equipment will work with which materials, daily, weekly, monthly, and even annual production capacity can be easily analyzed in the digital environment. Therefore, you can choose equipment to increase your production volume or reach a very high production volume, and you can revise this equipment.

A more effective evaluation of resource use will also reduce costs as much as possible. With the help of this system, the factory will be able to provide harmony to the continuous changes in the developing world in a simple way. In addition to all these advantages, great savings will be achieved in terms of time. These systems also contain features that will increase the production value and standard.

PRODUCTION AND RESULTS IN SMART FACTORIES

Long before the concept of Industry 4.0 entered our lives, Siemens started to lay the foundations of digitalization in production. With Fully Integrated Automation (FIA) in 1996, companies were able to coordinate the components of their processes and integrate their software and hardware into these processes. Siemens soon expanded this range and introduced PLM software to the whole world in 2007. PLM is an extremely useful software that achieves product lifecycle management for optimizing product development. The explorer robot sent to PLM Mars was used in Curiosity and played an active role in sending the robot to Mars by reducing the complexity of the extremely complex control stages. To be able to perform all stages of Curiosity's descent reliably and to successfully fulfill the missions that will be given after the landing, NASA, to design it mechanically, to carry out simulations and tests before launching to Mars, to fulfill the requirements most reliably and successfully during the mission, He has run a consortium with Siemens and PLM Software products from Siemens have been used in the development of this unique space tool.

In the process of communication of objects in production, another factor as important as the communication of machines is the communication of products. In the age of Smart Factories, it is inevitable that 'Smart Products' will appear in front of us as products as well as machines start to communicate by getting smarter. Not only knowing how, where and when it was produced; Little by little, "Smart Products" appear before us, which record which raw material is used from which supplier, can decide how to package it, and where it will be shipped.

Smart Products, which stay in touch with Smart Factories even after their production, can manage maintenance-repair processes, know when service needs will arise, when parts need to be replaced, how long they have been used, even by whom, and can guide their users in line with their maintenance-repair requirements, they extend their life cycles and at the same time increase the perception of quality with the additional services they offer to their users.

Similarly, Sebastian Vettel's world champion Formula 1 car was developed with Siemens software. PLM allowed the design and control processes of the vehicle to be carried out in such a short time that it can be considered superior.

Likewise, the luxury vehicle Maserati Ghibli, specially made in Grugliasco around Turin and produced at the Avvocato Giovanni Agnelli Factory[5] equipped with the latest technology, is one of the most beautiful examples, equipped with Siemens technologies from production to planning, engineering to the design, and embodying the magnificent results of digital production. Maserati has achieved the most difficult sales figures in its history with this vehicle and has clearly shown that digitalization will play an even more active role in production in the future.

THE FUTURE OF SMART FACTORIES

The creation of mass production, the industrial revolution, and the development of information technology are the first three manufacturing revolutions, respectively. In its most basic form, Industry 4.0 is defined as the use of information and communication technology to digitize operations, resulting in higher quality, reduced prices, and more efficiency.

Integrating operating technology with information technology in a production environment is accomplished by using embedded systems to monitor and control physical operations. By connecting all of these sensor devices in networks to computing systems, the Internet of Things (IoT) emerges, allowing massive volumes of data to be collected, processed, and transmitted.

Today, the more pragmatic words "smart factory" and "smart manufacturing" are increasingly common, especially in North America. Sensors, robots, digitalization, industrial IoT (IIoT), and deep data analysis are basically interchangeable, as are the goals of increased productivity, a competitive advantage over low-wage countries. More than 85 percent of industrial manufacturers believe smart factory projects will be the key driver of manufacturing competitiveness in the next five years, according to a report published in September 2019 by the Manufacturers Alliance for Productivity and Innovation and Deloitte.[6]

According to a CNN report filed on Jan. 23, 2020,[7] adopting Industry 4.0–inspired technologies—sensors, robotics, autonomous transport systems, data collection, and IIoT—reduced the time needed to deploy new applications by 80% and quality issues by 5% in BMW factories which produces approximately 320.000 vehicles annually.

THE FUTURE OF SMART FACTORIES

The Era of Artificial Intelligence

Artificial intelligence (AI) was barely acknowledged in the early days of Industry 4.0 -that is, less than 10 years ago- which is a tribute to today's dizzying pace of technological progress. AI is now a critical component of the smart industry. For instance, a production optimization system gathers photos at critical assembly points when the part leaves the mold, throughout downstream processing, and intelligently transforms the data to detect errors and changes. Engineers are presented with these insights in context, allowing them to complete the loop by implementing and evaluating a corrective action.

AI using companies can connect failure modes by cavity to accelerate failure analysis and defend downstream quality complaints by sharing data with their customers, therefore having a picture record of every unit created is valuable. This kind of traceability can be invaluable for mission-critical parts, such as those used in medical equipment.

Using Data

To enhance their production processes, manufacturers now acknowledge the importance of having consistent, useful, and comparable data sets. They are abandoning inefficient approaches such as acquiring as much data as possible in order to search for new sources of meaning and value in these enormous, unstructured data sets. They've shifted their attention to specialized data sets, such as asset-condition indicators.

Manufacturers can employ linked technologies that do not break the bank but do lay the stage for continuous innovation by making sensible selections that fit their capabilities. Also, smart manufacturing is more than a single technology. Fundamentally, it's always about clever people using smart technology first and foremost. That is why Generation Z will take over the places of the old people that are unable to work with that much technological development.

BENEFITS OF AND OBSTACLES IN IOT IMPLEMENTATION

Discussions on the Internet of Things (IoT) are mostly about how it will affect our daily lives. From drone delivery of a pizza to turning on your home heating from your phone, smart, connected devices have become commonplace in recent years.

Yet far from consumers, perhaps one of the most lucrative applications for the IoT is in the manufacturing industry. In fact, IoT ushered in the latest industrial revolution, often referred to as Industry 4.0, with the emergence of the smart factory: using the Industrial Internet of Things (IIoT) to create the intelligent decision-making environment of connected devices and their predictive, preventive, prescriptive, proactive, that is, essentially autonomous decision-making capabilities.

IoT is already being used by manufacturers to improve quality control, increase operational efficiency, and transform the customer experience, among other things. Better product quality, increased operational efficiency and safety, better stock tracking, and more precise demand forecasting are all benefits that manufacturers who use IoT see as a return on their investment. Some businesses are embracing technology to differentiate themselves and improve the consumer experience. And this, in many ways, is only the beginning. Industry 4.0 technologies are predicted to be implemented in all key business divisions by 85 percent of industrial enterprises during the next five years.

What could be the obstacles?

While the value of digital innovation is evident, widespread adoption has been slow. Existing competencies are the largest barrier for many firms. They lack the internal skills needed to create and implement digital innovation projects. Organizations are attempting to handle today's goals while also investing in the people needed to help transform their businesses, despite ongoing pressure on IT budgets.

Another stumbling block for producers is outdated technology. Before these facilities can begin integrating IoT, they must first upgrade their equipment to make it digitally ready. Some industrial organizations have put off technological investment in order to meet their immediate aims of lowering costs and increasing returns.

However, the lack of IoT integration is not always owing to a lack of investment. Digital innovation will be pursued by businesses, but many of these initiatives will fail. This can happen when projects go beyond budget, deployment durations are too long, legacy platform compatibility issues or schedule issues develop, and resources are not allocated appropriately.

BENEFITS OF AND OBSTACLES IN IOT IMPLEMENTATION

It will take time to transition to smart manufacturing, as a strong IoT strategy requires time and resources to implement. The first step in a successful IoT journey is determining where to begin and what problems to tackle. To come up with a hypothesis for what you're trying to solve, you need to look at the facts. It will be critical to select a focused team to work swiftly to innovate, test, and learn.

While some may find the rapid growth of technology intimidating, the turbulence of technical advances is keeping costs low as the latest technology becomes more prevalent. This is true for some robots and other software that analyzes data which increases the appeal of initial capital investments.

Businesses should also be aware of when they require outsourced assistance. Finding a dependable partner who specializes in IoT solutions can help you develop, deploy, and maintain your IoT solution with minimal disturbance to your regular operations. And, as with any major effort, meticulous planning is essential. Companies must devote time to communicating with all elements.

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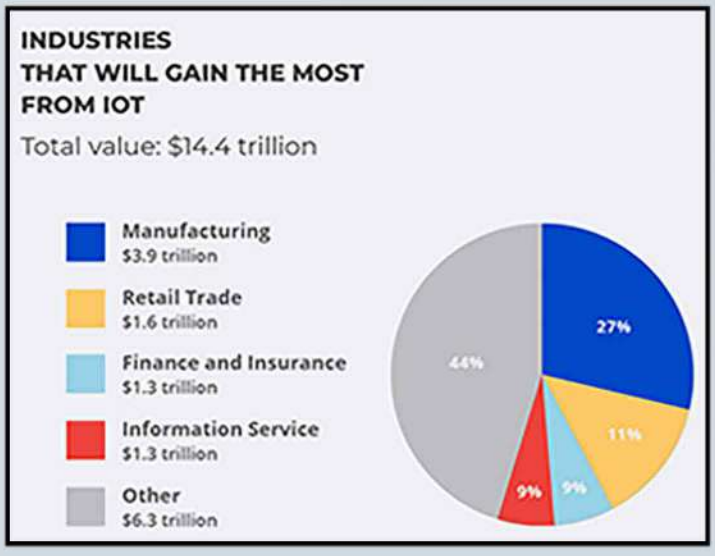
WHAT DO YOU NEED TO HAVE BEFORE USING IIOT IN YOUR FACTORY?

There is no such thing as a "one-size-fits-all" approach for connecting gadgets to the internet and applications as almost every IIoT application necessitates a tailored solution. However, here are some things that should be taken into account while implementing an IIoT device.

It could be a single sensor or a network of sensors, a machine in its whole, or even an industrial landscape. Once connected to the cloud, a device can be operated as well as provide useful data for other applications. It usually involves a sensor that creates data or many sensors on an IoT device that transfer data to the cloud via a transmission module in various IoT scenarios.

A high-bandwidth or high-speed connection is not required for most IoT devices. The required connectivity is provided at a low-cost thanks to very low energy consumption and restricted bandwidth.Thread in Motion's smart gloves[8] are especially designed light and also with a small screen in order to consume low power and have long battery life.



Source: Cisco

When you use the connection and data from a device or sensor for a higher purpose, it becomes an IOT resource. A cloud platform's software and data make gadgets smart. For example, Thread in Motion's smart gloves has its own data analytics platform that collects and gathers data, analyses and gives outcomes for more efficient processes in factories.
An IoT platform enables you to gather, store, display, and analyze data, as well as generate management reports and control external operations.

The Internet of Things (IoT) makes our lives easier, safer, and more comfortable as it has given rise to notions such as smart cities, smart environments, and smart transportation. Many new cars are already Internet of Things (IoT) vehicles that send data to a car maintenance provider and can be controlled via an app. Future self-driving automobiles will communicate with one another to ensure that passengers arrive safely.

The IIOT enables remote monitoring, testing, analysis, control, and trend detection which will lead to completely new and improved insights. You can enhance operations and cut costs by using these insights and analytics, but you may also create new goods and services.

HOW TO TURN YOUR FACTORY INTO A SMART FACTORY?

The task of getting started may be intimidating. The practically infinite configurations of smart factory solutions offer a variety of paths to take on the journey, all of which must be defined, planned, and executed at a pace that is appropriate for the company and the challenge—or opportunity. Manufacturers can start with the following steps as they consider how to develop their smart factory.

Investing in smart factories frequently begins with a focus on specific possibilities. Digitization and insight development, if identified, stimulate actions that can create new value. The smart factory's construction and scaling, on the other hand, can be as fluid and flexible as the notion itself. Manufacturers can begin the journey to a real smart factory at any point in their network—value creation can begin with and scale from a single asset, and iteration and growth can be accomplished using an agile methodology.

In reality, starting small, testing concepts in a controllable context, and then scaling once lessons have been learned can be more productive. Once a "win" has been realized, the solution can be scaled to include additional assets, production lines, and factories, potentially resulting in exponential value creation.

Which precise issues to solve and how to generate value through smart factory solutions will be determined by a company's manufacturing strategy and environment. Adapting the strategy to each event and situation can assist ensure that the smart factory that emerges satisfies the manufacturer's needs.

It is not always about technology.

A smart factory journey demands more than a collection of interconnected assets. Manufacturers would require a system for storing, managing, interpreting, and acting on the data gathered. Furthermore, firms would require the necessary expertise and processes to guide them through the trip.

Think wisely.

The smart factory solution, as previously said, is a comprehensive solution that connects what happens inside the four walls with what happens across the whole digital supply network. As a result, every firm embarking on the smart factory path should consider the whole range of supply chain partners and customers from the start in order to reach a really successful end.

The smart factory, rather than being an end state, is an ongoing solution that incorporates numerous characteristics such as agility, connectivity, and transparency. At a high level, the smart factory's dynamic nature calls for never-ending creative thinking: conceptualizing the possibilities of the practically infinite configurations that a smart factory solution makes possible.

Investing in a smart factory capability can help enterprises stand out and operate more effectively and efficiently in an increasingly complex and fast-changing ecosystem.

USE-CASES OF SMART FACTORIES

Predictive Analytics

The use of IoT devices in the assembly line to integrate manufacturing intelligence into the product's life cycle as well as improve the efficiency and productivity of manufacturing activities is known as smart manufacturing. However, the use of these devices generates a massive amount of structured and unstructured data.

As a result, predictive analytics assists manufacturers in maintaining their assembly line equipment by collecting raw data from sensors and analyzing it to discover machine faults. Predictive analytics can also help you figure out how people use things and predict what will happen in the future.

Data-Based Manufacturing

Smart factories create data for monitoring, maintenance, and basic production line management in addition to using machines, smart sensors, and robotic platforms. However, much of the data collected by these technologies is stored in the factory's information silos.

As a result, integrating big data and AI services on the cloud allows the correct data to arrive at the right place at the right time, breaking down information silos and unlocking the potential of context data. Manufacturers can also use big data to implement data-driven initiatives to gain a competitive advantage.

Digital Twins

The Internet of Things, AI, machine learning, and cloud computing are all used in the digital twin technology. Digital twins are virtual replicas of physical products, and their use on the factory floor can be extremely beneficial.
Engineers and managers can mimic various processes, run experiments, find faults, and achieve desired results using virtual duplicates of equipment and spare parts without jeopardizing or harming physical assets.

Predictive Maintenance

Poor maintenance practices can cause a factory's overall productive capacity to diminish, putting it at risk in today's highly competitive environment. Unplanned downtime costs industrial firms billions of dollars every year. Predictive maintenance aims to solve these problems by allowing manufacturers to increase the value of their equipment while avoiding unforeseen downtime and reducing planned downtime.

Furthermore, by utilizing advanced sensor technology, producers may gather and analyze operating data in real-time for industrial and consumer products, which can aid in the prediction of future failures, decreasing downtime and associated maintenance costs.

USE-CASES OF SMART FACTORIES

Remote Production Control

Remote process monitoring and equipment configuration are possible with IoT devices. For starters, personnel can collect data on manufacturing processes from afar and determine whether they or their consequences comply with specific regulations and standards. Second, they can remotely tweak and configure equipment, which saves them a lot of time and work.

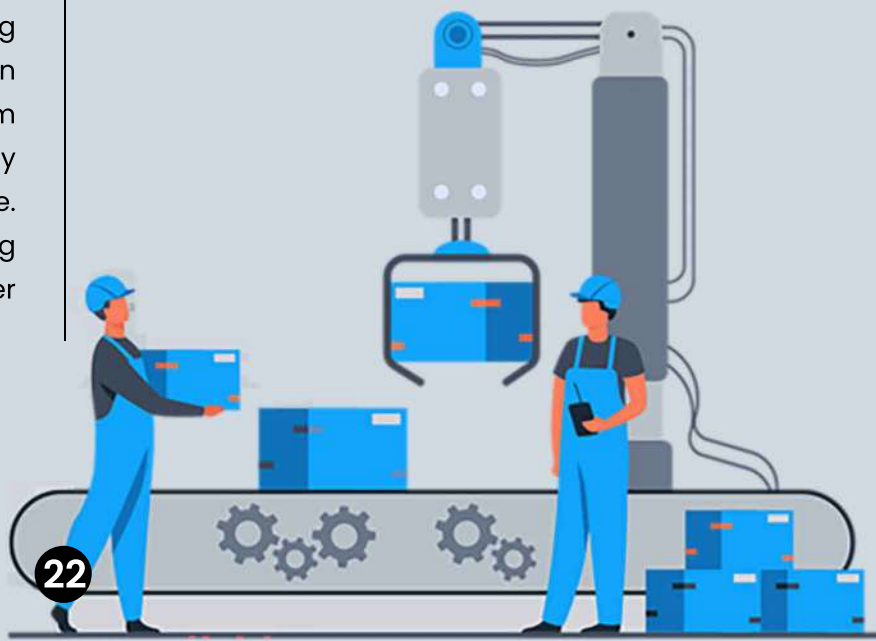
Furthermore, automated devices enable staff to resolve numerous performance concerns via virtual networks without having to be physically present, simplifying equipment administration and control. Employees can also be aware of the position of devices, such as movable assets, using virtual equipment monitoring.

Tracking

While manufacturing companies have already profited from more powerful tools for demand planning and logistics management based on big data analytics, efficient solutions for tracking manufacturing production across the supply chain are still needed. A daily flow of data from manufacturing lines is required to highlight any irregularities and opportunities in real-time. Companies can optimize their plant loading by using big data analytics to examine prior loads, consumer data, and changes to significant projects.

Asset Management

Manufacturers may acquire and monitor real-time information on all of their assets in web or mobile applications using IIoT devices. Vehicles delivering raw materials or finished goods (fleet management), objects in warehouses (inventory management), and resources used during the manufacturing process are all examples of tracked assets. As a result, you can track and optimize assets throughout the manufacturing process, from the supply chain to the finished product. Asset monitoring allows for the early and accurate detection of faults that have a negative influence on product quality or time-to-market.



EXAMPLES OF SMART FACTORIES

Schneider Electric, France

Schneider Electric's le Vaudreuil facility is a shining example of a smart factory, having been recognized as one of the world's most advanced production sites, employing Fourth Industrial Revolution technology at scale. The factory has incorporated the most up-to-date digital technologies, such as the EcoStruxureTM Augmented Operator Advisor, which allows operators to use augmented reality to speed up operation and maintenance, resulting in a productivity boost of 2% to 7%. The company's first application of EcoStruxureTM Resource Advisor saves up to 30% on energy and adds to long-term improvement.

Johnson & Johnson DePuy Synthes, Ireland

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EXAMPLES OF SMART FACTORIES

Bosch, China

Combining IIoT and Big Data, Bosch drives the digital transformation of its Bosch Automotive Diesel System factory[9] in Wuxi, China.

The corporation connects its gear in order to keep track of the complete production process at its plant's heart. This is accomplished by embedding sensors in the factory's machines, which are then utilized to collect data on the machines' state and cycle time. When the data is acquired, complex data analytics systems evaluate it in real time and notify workers when bottlenecks in the production process are discovered. This method aids in the prediction of equipment breakdowns, allowing the firm to plan maintenance procedures well ahead of time. As a result, the manufacturer can keep its equipment running and operational for extended periods of time. According to the corporation, leveraging data analysis in this way has resulted in a 10% boost in output in some sectors, as well as improved delivery and customer satisfaction. Finally, having a better understanding of the plant's operations allows for better and faster decision-making across the board, allowing the company to reduce equipment downtime and improve production processes.

The Tesla Gigafactory, Germany

Following the Gigafactories in Nevada, Buffalo, and Shanghai, this is the fourth Gigafactory. It will also be Tesla's first Gigafactory in Europe, and it could be the company's largest factory to date. The Berlin Gigafactory, set to open in 2021, will be the first of its kind, according to Tesla, and will be the world's most advanced high-volume electric vehicle production plant. It will be used to manufacture batteries, powertrains, and automobiles, beginning with the Model Y and Model 3, on a 300-hectare site near Grünheide, with a goal of producing 500,000 units per year in the future.

Tesla is aiming to not just build a smart automobile, but also to use smart manufacturing methods. The facility's first images, released by firm CEO Elon Musk, show a smart factory with solar panels dominating the rooftop, resulting in a more sustainable means of manufacturing. Tesla claims the usage of a new dimension of casting systems and an efficient body shop on its official website, claiming to be pushing the frontiers of vehicle safety. Tesla's never-ending quest to improve factory efficiency has allowed them to disrupt the automobile business.

EXAMPLES OF SMART FACTORIES

DHL, Netherlands

Fetch Robotics, based in California, has created Autonomous Mobile Robots (AMRs) that work together to locate, track, and move items in warehouses and logistics centers.

Fetch AMRs are being used to execute pick and place operations in a DHL distribution center in the Netherlands. At DHL, AMRs move throughout the plant independently with the workers, automatically learning and sharing the most effective routes. According to the business, using self-driving robots in this fashion can help reduce order cycle time by up to 50% and increase picking productivity by up to twice. Robots will be able to undertake ever more difficult assignments as they become more autonomous, versatile, and cooperative, relieving employees of monotonous chores and increasing productivity.

Infineon, Germany

Infineon's smart factory in Dresden dazzles the world with its intelligent networked manufacturing. Over 200 robots[10] aid employees at the company, which has a 92 percent automation level. For all four of the company's segments, Infineon produces over 400 different products based on 200mm and 300mm wafers in a timely and high-quality manner. The factory's 200mm line is the most automated[11] in the world, and its 300mm line was designed to achieve fully automated manufacturing, increasing productivity by 70%.

System controls, wafer transport, and production management are all linked and regulated in real time by IT systems within the organization. The systems can also connect with other Infineon locations all over the world. The wafers are transported autonomously, and the smart factory is controlled by algorithms and central operating and monitoring systems. The corporation improves production control by anticipating the effects of changes to its product portfolio. This allows them to respond quickly to the needs of their customers.

EXAMPLES OF SMART FACTORIES

Haier, China

The SmartFactoryKL was created to pave the way for the "intelligent factory of the future." It is the world's first manufacturer-independent Industry 4.0 manufacturing plant, serving as a demonstration of the value of high-quality, flexible manufacturing and how it can be applied effectively. SmartFactoryKL has been led by specific strategic goals that drive innovation for the past four years; the goal is to see artificial intelligence implemented in manufacturing. An 'order-to-make' mass customisation platform and a remote AI enabled, intelligent service cloud platform to foresee maintenance needs before they occur are two examples of AI-driven transformations.

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