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# **A Review on Digitalization - Driving Innovation in Manufacturing Industry through Digitalization**

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## **ABSTRACT**

The utilization of computers and other IT technology to automate and modernize the manufacturing process is known as digitalization. The digital transformation converts the various data and information to machine readable and processable digital codes that increase efficiency and reduce processing time (Oden Technologies Ltd, 2022). Digitalization of manufacturing industry puts an end for traditional process and increase human-machine cooperation to attain streamlined operating process. Digitalization is believed to bring a revolution in manufacturing industry by integration state of art technologies like AI, IOT and robotics. Digitalization will empower manufacturing industries to improve their responsiveness and agility through altering market situations and customer requirements (Oulton, 2021).

Keywords: Digitalization in Manufacturing Industry, Modernization using digitalization, Digital Transformation in Manufacturing

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## **1. Introduction**

Smart technology, data analytics, and linked devices are helping manufacturers to significantly improve their efficiency, productivity, and accuracy as they undergo a digital transformation in the manufacturing industry. As well as affecting the operations, procedures, and energy footprint of factories and supply chains, digitalization is also changing how goods are conceived, manufactured, used, and maintained.

The capacity of manufacturers to increase their reactivity and agility in response to shifting market conditions and consumer needs is one of the primary drivers of digitalization. Manufacturers can reduce waste and customer dissatisfaction by matching their production cycles with demand throughout the year. By moving away from manual tasks and using automated solutions, it is possible to optimize processes, performance monitoring, and decision-making while preventing rework, downtime, errors, and bottlenecks. As a result, time and expenses will be saved. The manufacturing process' speed is the first change we're noticing as digitization alters the sector. Manufacturing must figure out how to react optimally in light of fast shifting consumer demands and a brisk pace of new product introduction/innovation (Enginess Team, 2021). Productivity is immediately increased by digitization, enabling firms to meet more aggressive deadlines and projects to advance more quickly. In particular, producers will be able to react quickly to changes coming from the engineering team by moving quickly from design to floor and back again. Any function, including supply chain and back-office software, industrial automation, data analytics, and more, can be digitized in a manufacturing firm (Jabil, 2022).

Every aspect of the organization could be affected by the digital evolution. It is a great fit for manufacturing given the industry's opportunities to boost effectiveness, productivity, and accuracy. Organizations understand that digital transformation is crucial for maintaining competitiveness over the long term and is a major factor in profitable growth. The manufacturing sector today faces a strategic imperative in the form of digital transformation.

### **1.1 Digitalization of Industry**

Factory digitalization combines traditional manufacturing methods with cutting-edge technological advancements. The ultimate objective is to increase profitability while maintaining quality through cost reductions. Efficiency and competition are also enhanced. The question of "when" a manufacturing should digitize is no longer "if," as the business environment becomes more and more digital. Digitalization is about how people and processes match with contemporary approaches to attaining manufacturing efficiency, safety, and lower operating costs. It is not just about the use of technology and automation. The design, manufacture, use, and maintenance of products are changing as a result of factory digitalization. It is also altering factory and supply chain operations, procedures, and energy footprints. The emergence of digital technology encourages improved stakeholder collaboration. For instance, new opportunities are created between suppliers and customers as well as between employees themselves (proekspert, 2021). The process of transformation can be divided into two categories when talking about industrial digitalization: smart factories and smart manufacturing.

Connected digital devices are used in "smart manufacturing" to monitor manufacturing production processes. Its objective is to find ways to automate processes and use data analytics to boost production efficiency. Manufacturing businesses may take better, more informed, and wiser decisions by gathering and evaluating data. To establish an optimal manufacturing system, physical production processes are coupled with digital technology enablers and data analytics. Information access is enabled through smart manufacturing and the smart factory, both of which use the Internet of Things.

### *1.2 The advantages of digitalization in manufacturing industry*

To enhance productivity, expand manufacturing capability, and develop procedures that add value, next-generation manufacturing utilizes digital technologies. Customers now demand a better standard of service as plants implement technology concepts. Digitizing manufacturing facilities helps businesses stay competitive and provides the following advantages.

**Increases in productivity and effectiveness:** Centralized facilities management makes it easier to keep an eye on everything and take charge when necessary. The human labor may monitor the entire factory at once while operating more centrally and without physically being on the manufacturing floor.

**Accelerated innovation:** It is clear that digital manufacturing technologies foster innovation in both process and design development. With the enormous advancements being made in CAD systems, the question is not whether a firm should use them but rather how rapidly.

**Genealogy and traceability of products:** Automated traceability is made possible by contemporary technology by logging data from manufacturing lines, product components, and machine parts that are continuously monitored. Each component and product has data recorded for it from beginning to end, including inspection findings, assembly information, and time spent at each station.

**Connectivity :** For producers, improved connection opens up three possibilities:

Digitization of the entire supply chain eliminates product production variability. The quality of each product is the same throughout production. The workforce can use more modern technology thanks to the platforms and tools that have been put in place, increasing productivity. Connectivity reveals additional chances to enhance procedures. Manufacturers can consider how they can optimize industrial output with clever data analytics.

**Enhanced quality :** Every element of the business may be substantially changed by the advantages of digitization. Manufacturers stand to get a new degree of operational awareness across sites using data from connected devices. This serves as the basis for important operational enhancements like the introduction of preventative maintenance programs. By identifying and resolving equipment difficulties earlier, factory digitalization detects and prevents quality problems.

**Data-driven decision-making without paper :** Businesses may make decisions more quickly thanks to real-time business information, giving them an advantage over rivals by responding to market volatility more quickly. The advantages of paperless manufacturing extend to numerous operational areas and possess the potential to completely change operations, especially when taking into account the dynamic nature of a shop floor and the number of stakeholders that need to communicate. Excel sheets and paper are expensive, time-consuming to file, and extremely prone to human error. Decision-making is slowed down, expenses rise, and the competitive edge is lost if data is not readily accessible in digital form. Data unification will allow for real-time reporting and monitoring, which will facilitate data-driven decision-making.

**Lower costs and downtime :** Predictive maintenance needs to be performed often to keep a manufacturing facility operating longer without failures. Workers are informed that a machine needs to be repaired through connected gadgets. Due to plant supervisors' ability to plan machine maintenance, the demand for constant on-call maintenance personnel is reduced. Unavoidably, less downtime results in lower expenses and higher earnings. You can make improvements to save energy expenditures in addition to figuring out which equipment consumes the most energy. It may be possible to connect current industrial equipment digitally to enable factory digitalization without making significant investments in high-tech machinery. Connection offers information that can be utilized to accurately estimate defects and prevent human mistake while evaluating industrial hardware.

**More effective safety management :** The way manufacturing businesses manage safety is evolving, and safety is a crucial component of lean production. Many companies are using software to improve their safety programs, which helps with paperwork, incident tracking, and overall safety culture. Digitalizing safety instruction management eliminates paper-based processes by allowing for the quick upload of already-existing instructions and the gathering of digital signatures.

### *1.3 Suggestions for a successful digitalization approach*

A digitalization strategy must be in place and take organizational and operational change into account. Cultural resistance to change, as well as leadership and stakeholder buy-in, are potential barriers. Therefore, it is crucial that you: Determine your digitalization goals; create a digitalization strategy; choose the best technology enablers; build technology leadership; educate your team; and instill a digital culture (proekspert, 2021).

**Combining digital and physical systems:** Data is the driving force behind digitalization in the manufacturing sector but achieving genuinely scaled value requires a seamless transition between OT and IT at all levels. A more coordinated response to business requirements, pooled resources, and cost savings will be brought about through the dismantling of silos and the integration of IT and OT.

**Technology enablers:** While there are a number of critical enabling technologies, including artificial intelligence (AI), machine learning, and advanced analytics, it is clear that the digital twin has a crucial role to play and is currently being used very successfully in the UK manufacturing sector. This sector is dependent on real-time process data and analytics. With the use of sensors, a digital twin of a physical industrial production line is created. This virtual representation of the physical production line may be used to identify possible problems, gain insightful information, and save time and money.

**Retraining employees :** More advanced digital abilities are increasingly in demand across all industries. The majority of larger companies report trouble finding software engineers, and 61% have trouble finding data analysts. Upskilling and reskilling will be necessary in the workplace to acquire new skills, keep up with technological improvements, and fill new responsibilities.

#### 1.4 The biggest step towards the Industrial Internet of Things is digitization (IoT)

A fully integrated product data loop is the vision of the Industrial Internet of Things. First, when machines are developed, they are outfitted with sensors. These sensors then continuously offer input across the supply chain for manufacturing. The manufacturing process can be improved in response to real-world data on topics like maintenance requirements and wear and tear. The capacity to uncover efficiencies is provided by business intelligence (BI) tools and dashboards, but some refining occurs automatically (through machine-to-machine communication). But data is the key to this entire process. There is a genuinely astonishing amount of data that can be gathered and used. And only if the product is totally digital can that data be effectively collected and managed:

In reaction to environmental challenges, designs can be altered automatically.

Products can be changed as they come off the production line by automatically pushing changes to the manufacturing floor.

We might eventually get at a stage where automation and AI continuously improve current designs in response to actual conditions, freeing engineers to concentrate on the invention of new goods.

#### 1.5 Businesses can benefit from digital transformation.

Currently, 75% of manufacturing organizations concur that digital transformation will allow them to strengthen their competitive position (see Figure 2). It is not unexpected that businesses prefer to concentrate on bottom-line rather than top-line improvements when looking more closely at how they believe they would gain a competitive edge. Two out of every three firms are aware of the potential for digitally changing operations to increase internal efficiency and, in turn, drive bottom-line performance. Every second firm claims that, when it comes to addressing top-line performance, digital technologies aid to enhance their value proposition and their customer interactions. These findings are very amazing given that manufacturing is mostly a B2B driven industry and that its goods can only be digitalized to a certain extent at this time (Jochen Bechtold, Christoph Lauenstein, 2014).

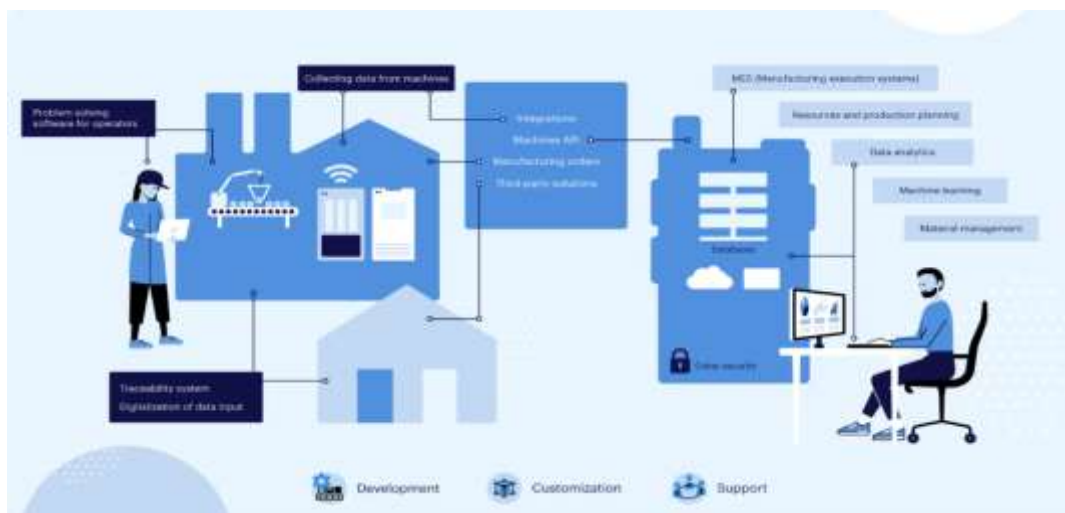


Figure 1: Digitalization service Source : (proekspert, 2021)

## 2. Challenges of Digitization

In most cases, organizations have multiple layers and different degrees of interdependence. There may probably be certain obstacles in the way of the organizational level digitalization process. The digitization process may face difficulties due to a number of variables. Let's look at few examples.

**Financial Limitations:** Organizational digitization necessitates a large infrastructural investment. Periodic maintenance and updates will also be needed for equipment and software. Depending on the type and scale of the firm, these costs can vary and be high (Oden Technologies Ltd, 2022).

**Employee Reluctance :** Changes are not always well received by employees. The work environment and the manner that business is conducted are set to undergo a total metamorphosis as a result of digitization, digitalization, and digital transformation. The new operational processes might not be as convenient for employees used to routines. Resistance to change is likely to result from the mandatory prescription of new skill sets and the improvement of old abilities.

**Employee Upskilling :** Any organization's foundation is its workforce. It might not always be cost-effective to hire fresh personnel who are up to date with the times. Existing employees' skills can be upgraded to facilitate the transition. Employee adaptation to their changing environment can be greatly aided by training sessions, seminars, and workshops in related fields of operation. However, in order for training to produce quantifiable advantages, it must have the support of all stakeholders and include time, money, and ongoing improvement.

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### 3. Conclusion

Smart businesses that embrace digitalization enjoy the biggest competitive advantages as factories become more digital. Additional technologies like machine learning, AI, IoT, digital twins, and a holistic, complete product lifecycle can arise once procedures have been digitalized. Digitization won't just speed up production. We already observe that it promotes creativity through quick product iterations. Better data exchange via APIs between departments, businesses, and software suites will only accelerate this iteration pace. Organizations are better equipped than ever to respond to consumer requests, market opportunities, and innovation trends by removing silos and enabling real-time data access from anywhere in the globe.

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