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The Impact of Digitalization on Productivity and Economic Performance in the Industrial Sector

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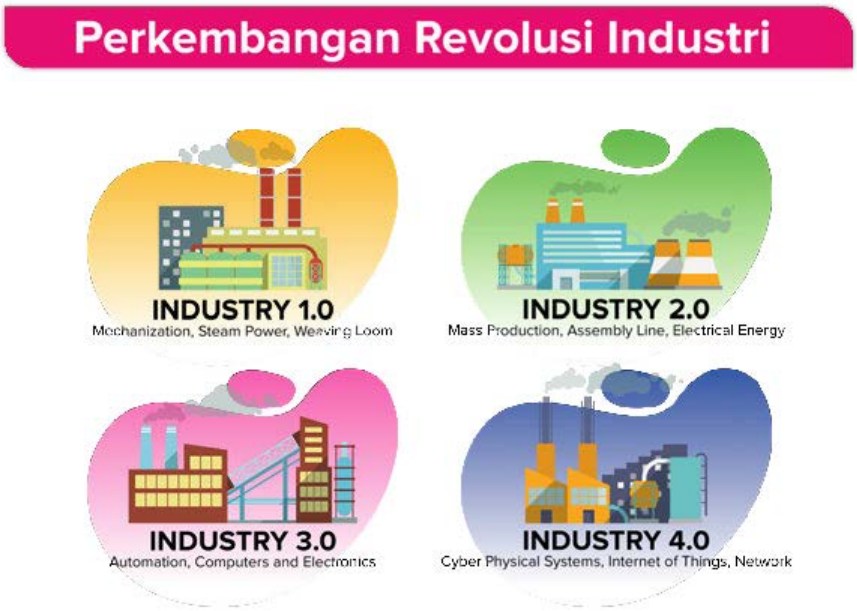
Abstract: Digitalization has become an important part of the global economic transformation, impacting various fields, including the manufacturing sector. The focus of this research is how digitalization impacts economic performance and productivity in the industrial sector in Indonesia. It has been shown that productivity, operational efficiency, and financial performance improve by using secondary data obtained from websites and online papers that utilize digital technology in their operations. There is evidence that technologies such as automation, the Internet of Things (IoT), big data, and artificial intelligence (AI) can help businesses become more efficient and competitive. This result shows that digitalization is a key factor in facing competition in Industry 4.0.

Keyword: digitalization, industrial productivity, digital transformation, industrial sector.

INTRODUCTION

The industrial and processing sectors play a significant role in driving Indonesia's economic growth. Often referred to as the main pillar of national economic growth due to its important role, the processing industry. The output generated by this sector in various regions is closely related to its significant impact on national income (Ali, 2023).

The development of digital technology has had a significant impact on various economic sectors, including the industrial sector. Digitalization, which includes the use of information and communication technology (ICT), automation, the Internet of Things (IoT), and artificial intelligence (AI), has transformed the way industries operate, innovate, and compete in the global market. This change not only enhances operational efficiency but also boosts productivity and impacts overall economic performance.



The history of the fourth stage of the Industrial Revolution 4.0 began in the 18th century. According to Prof. Schwab, there have been four industrial revolutions throughout history. The steam engine powered factory machinery, railways, and sailing ships at the beginning of the first wave of the Industrial Revolution. After that, steam engines evolved into various equipment that required human power and jobs that needed human and animal labor. As a result, production can increase and be more widely distributed. However, the high unemployment rate is a weakness of this industrial revolution (Fitria Alayida et al., 2023).

The industrial revolution has reached its peak due to the advancements in digital technology that have greatly impacted human life around the world. The fourth industrial revolution, or the fourth generation, drives the use of automation systems in all activity processes. The continuously evolving internet technology serves as the foundation for online business and transportation activities, connecting millions of individuals around the world. The development of online transportation companies like Gojek, Uber, and Grab shows an increasingly strong relationship between business and human needs. Social media tools, nanotechnology, drone technology, and advancements in biotechnology all demonstrate how much the world and human existence have changed (Fitria Alayida et al., 2023).

The emergence of digital economy centered around the Internet of Things (IoT) is a byproduct of the Industrial Revolution. Profesor Klaus Martin Schwab, the head of the World Economic Forum, stated that the Industrial Revolution 4.0 is about to begin. (Beritasatu.com, Hashim, 2018). According to the book The Fourth Industrial Revolution (2017), we are currently living in the dawn of a revolution that has fundamentally changed how we live, work, and interact with one another. This revolution is attributed to the development of the Internet of Things. Materials science, robotics, cloud computing, 3D printing, and nanotechnology are all developing at more rapid speeds.

In the context of industry, digitalization offers great potential to optimize production processes, enhance product quality, reduce operational costs, and accelerate time to market. Technologies such as big data and analytics enable companies to make more accurate decisions based on real-time data, while cloud computing technology and management software allow for easier and faster access to critical information.

However, although digitalization offers many advantages, its implementation also presents challenges. Not all industries or companies are equally prepared to adopt digital

technology, whether in terms of infrastructure or human resources. In addition, adapting to new technology requires a significant initial investment, which may be beyond the reach of small or medium-sized enterprises.

Digital advancement also affects international trade activities. Digital advancement in the field of international trade occurs when digital technology transforms social activities or economic activities. Trade in the digital era focuses on marketing strategies. Global trade in the future will be greatly influenced by the digital era. People who trade digitally still face several challenges, but those who can adapt will reap greater rewards. On the contrary, those who cannot keep up with the times risk being left behind. New technologies are often made available due to international trade and access to markets for the necessary inputs and outputs to enhance production and improve competitiveness. However, only businesses that have the talent and ability to implement new data-driven solutions can benefit from this.

Therefore, research on the impact of digitalization on productivity and economic performance in the industrial sector becomes important. This research aims to understand the extent to which digitalization has positively impacted productivity and economic performance, as well as to identify the challenges faced in its implementation. Thus, the results of this research are expected to provide a clearer picture of the role of digitalization in driving economic growth and industrial competitiveness in this modern era.

METHOD

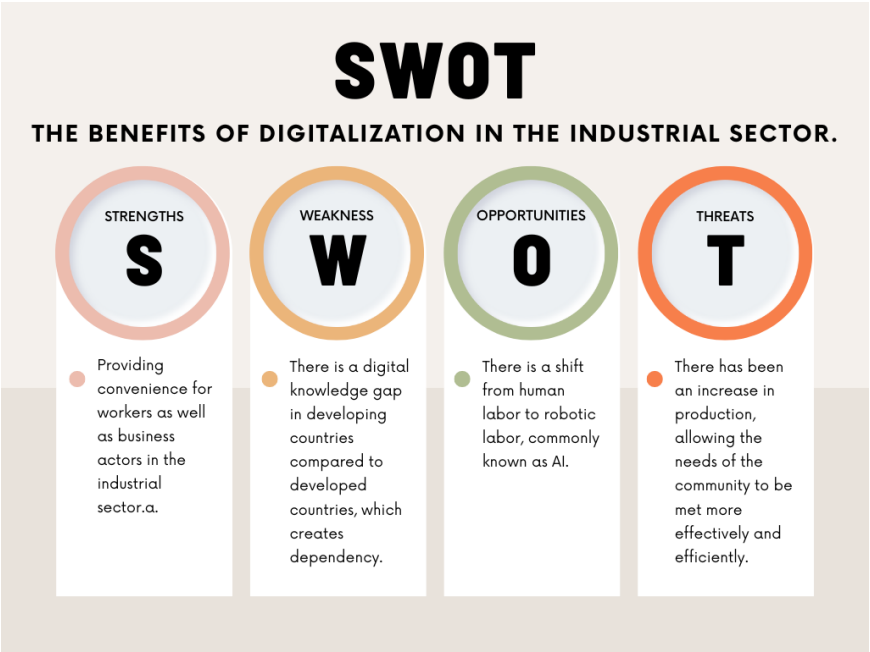
This scientific article is written using a literature review method. The references used come from online analysis sources such as Google Scholar and other online journals. Because of its exploratory nature, this research was conducted. The data used in this research is literature on the Impact of Digitalization on the Industrial sector; the data was obtained through online media and other sources. Used as supplementary data for research issues. By using literature studies, the researcher will elaborate on and analyze the data and information that has been collected.

RESULTS AND DISCUSSION

The Influence of Digitalization on Industrial Productivity

In today's digital technology era, the role of information technology is crucial in transforming the scale of industrial sectors and business development. Its role in the digitalization of supply chains and industrial networks requires the integration of digital data from various sources to drive physical production and distribution.

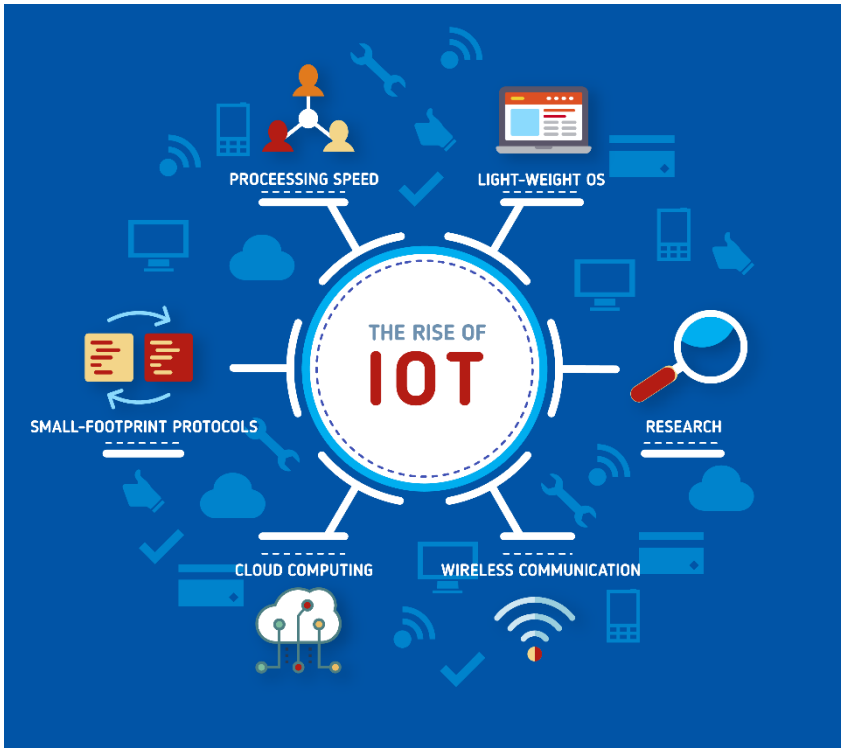
It is impossible to deny that the digitalization of logistics has brought about a variety of effects, both positive and negative. Here, we present a SWOT analysis as a comparison between the positive and negative factors leading up to the industrial sector's digitalization.



There are two main technologies of the 4.0 industrial revolution that are useful for creating more efficient and effective outcomes or outputs, namely:

1. Internet of Things (IoT)

Internet of Things (IoT) is a concept where various physical devices equipped with sensors, software, and other technologies are interconnected through the internet, allowing them to collect and exchange data without direct human interaction. IoT enables everyday objects, such as household appliances, vehicles, industrial machines, and medical devices, to communicate with each other and be controlled remotely.



Internet of Things (IoT) plays a significant role in enhancing industrial productivity in the era of digitalization. Here are some important aspects in which IoT affects industrial productivity:

IoT enables the automation of industrial processes by utilizing connected sensors and devices to collect data in real-time. This data can be used to optimize machines, reduce downtime, and accelerate the production process. For example, machines connected to the IoT can automatically adjust temperature, speed, and production flow based on the data collected. In addition, IoT also facilitates predictive maintenance by monitoring the condition of equipment and machines in real-time. Connected sensors can detect signs of damage or wear before problems occur. This allows maintenance to be carried out before damage occurs, thereby reducing unexpected downtime and larger repair costs.

In the supply chain, IoT can assist in real-time inventory tracking and logistics. IoT sensors can track items from production to delivery, enabling better inventory management and reduced storage costs. This also helps in anticipating market demand and optimizing production according to needs.

IoT generates big data from various industrial processes that can be analyzed to uncover patterns, trends, and valuable insights. This data helps companies make more accurate decisions, such as adjustments in production processes or the development of new products based on identified market needs. IoT connects various devices and machines in an integrated network, creating an interconnected ecosystem. This connectivity enables collaboration between systems, enhances production efficiency, and ensures that every element in the production process works synergistically.

2. Artificial Intelligence (AI)

Artificial Intelligence (AI) is a branch of computer science that focuses on the development of systems or machines that can perform tasks typically requiring human intelligence. Examples of such tasks include voice recognition, natural language processing, decision making, learning from data, and pattern recognition. AI is designed to mimic the way humans think, learn, and solve problems, although not always in exactly the same way.

Artificial Intelligence (AI) plays a very significant role in driving industrial productivity through the influence of digitalization. Here are some key roles of AI in enhancing industrial productivity:

a. Automation of Production Processes, AI enables the automation of various production processes that previously required human intervention. By using AI-controlled robotics, many repetitive and manual tasks can be performed more efficiently and quickly. This reduces production time, lowers labor costs, and enhances the precision and quality of the product results.
b. Predictive Maintenance, AI enables predictive maintenance, which is the maintenance of machines based on data processed by AI to predict when a machine is likely to fail. This helps reduce unplanned downtime, extend machine lifespan, and optimize resource usage.
c. Big Data Analysis, In the era of digitalization, industries generate a lot of data. AI can be used to analyze this big data quickly and accurately, to identify patterns and trends that can be utilized in better business decision-making, such as supply chain optimization, inventory management, or improving production efficiency.
d. Supply Chain Optimization, By using AI, industries can manage and optimize their supply chains more effectively. AI can predict market demand, identify potential disruptions, and optimize distribution and logistics to ensure that goods arrive at the right place and time, with minimal costs.
e. The increase in product innovation, AI enables faster product design through simulations and testing conducted in a digital environment. With AI, companies can quickly experiment with various designs and manufacturing processes without having to build physical prototypes first, ultimately speeding up the innovation cycle.

Based on the research findings, digitalization has been shown to have a positive impact on the productivity of the industrial sector. The application of digital technologies such as automation, artificial intelligence (AI), and the Internet of Things (IoT) allows production processes to run more efficiently. For example, in the manufacturing industry, the use of robotics and automation systems has increased production speed while reducing human error rates. This contributes to an increase in output without having to significantly raise labor costs.

Case studies on several companies that have adopted digital technology also show an increase in productivity of up to 20-30% compared to companies that still use conventional methods. The key factors at play are the ability to digitalize in order to enhance traceability of the production process, reduce downtime, and improve product quality control. The use of real-time data from sensors integrated into production machines helps companies predict and prevent machine failures, thereby maximizing production time.

However, the impact of digitalization is not uniform across all industries. Technology-intensive industries, such as automotive, pharmaceuticals, and electronics, are adopting digitalization more rapidly than traditional sectors like textiles or food processing. This shows that the readiness of infrastructure and the skills of the workforce play a crucial role in maximizing the benefits of digitalization.

The Impact of Digitalization on the Economic Performance of the Industrial Sector

Digitalization also has a significant impact on the economic performance of the industrial sector. Research shows that companies that adopt digitalization tend to be more competitive in the global market. This is due to increased production efficiency that allows companies to offer products at more competitive prices without compromising quality. In addition, digitalization accelerates the process of product and service innovation, which helps companies respond to market needs more quickly.

In the context of macroeconomics, digitalization in the industrial sector contributes to the increase in a country's Gross Domestic Product (GDP). With the increase in productivity and efficiency, the industry is able to create greater added value in the global supply chain. Countries that are more advanced in adopting digital technology, such as Germany and South

Korea, show higher growth in their industrial sectors compared to countries that are still lagging in digitalization (Fitria Alayida et al., 2023).

However, this research also revealed that digitalization does not automatically improve the economic performance of all companies. Some companies are struggling to adapt, especially small and medium enterprises (SMEs) that have limitations in terms of access to technology and capital investment. Another challenge is the unpreparedness of the workforce to operate new technologies, which ultimately hinders the digital transformation process (Diansari et al., 2022).

Challenges in the Implementation of Digitalization in the Industrial Sector

Although digitalization offers various benefits, there are several challenges that the industry must face in implementing this technology. The main challenge is the high investment costs, especially for advanced technologies like AI, IoT, and automation systems. One of the main findings is that digital technology, especially advanced ones like Artificial Intelligence (AI), the Internet of Things (IoT), and automation systems, requires a significant investment cost. This poses a significant challenge for small and medium-sized enterprises that do not have sufficient resources to invest. In the large industrial sector, the investment costs can be offset by potential savings in the future, but for small industries, the investment risks are higher. In addition, the digital skills gap among the workforce also poses a barrier. Many workers in the industrial sector do not yet possess the necessary skills to operate digital technology, so there is a need for massive training programs (Nasution et al., 2023).

Another challenge is related to data security. The increasing connectivity of industrial systems through digital technology raises the risk of cyber attacks. Other results indicate that the increasing connectivity of industrial systems with digital technology heightens the risk of cyber attacks. This threat is real and is growing alongside the increase in digitalization. Companies that do not have a strong cybersecurity system will be vulnerable to data theft, sabotage, and operational disruptions that can have significant financial and reputational impacts. Therefore, the company must allocate additional resources for cybersecurity to protect their digital infrastructure (Wahyudi et al., 2023).

Opportunities for the Future of Digitalization in the Industrial Sector

In the future, digitalization is expected to continue evolving with the emergence of new technologies such as blockchain, 5G, and more advanced artificial intelligence. This technology has the potential to further change the way industries operate, from supply chain management to product distribution. Industries that quickly adopt new technologies will have a competitive advantage in the global market.

Another opportunity is the opening of new markets for industrial companies that can offer digital-based solutions. For example, companies can create more personalized products and services according to consumer demand, which is only possible through data analytics and digital technology. On the other hand, the government also plays an important role in creating regulations that support technological development, as well as providing incentives for industries that invest in digitalization.

CONCLUSION

Digitalization has a significant impact on increasing productivity and economic performance in the industrial sector. The application of technologies such as automation, artificial intelligence (AI), the Internet of Things (IoT), and big data enables more efficient production processes, reduces operational costs, and enhances product quality. Companies that successfully adopt this technology tend to be more competitive and innovative, which ultimately contributes to overall economic growth..

However, the challenges in implementing digitalization cannot be overlooked. High investment costs, skill gaps in the workforce, and cyber security threats are some of the main obstacles faced by many companies, especially Small and Medium Enterprises. (UKM). Industries that are less prepared in terms of infrastructure and human resources tend to adopt digitalization more slowly, which ultimately affects their performance in the market. To that end, in order for digitalization to be effectively implemented across all industrial sectors, strong support is needed in terms of infrastructure provision, human resource training, and conducive regulations.

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