International Journal of Economic, Business, Accounting, Agriculture Management and Sharia Administration (IJEBAS)

International Journal of Economic, Business, Accounting, Agriculture Management and Sharia Administration (IJEBAS Journal) | ISSN (e): 2808-4713
Volumes 5 No. 4 (2025)

THE ROLE OF ARTIFICIAL INTELLIGENCE IN THE INDUSTRIAL SECTOR AND ITS INFLUENCE ON HUMAN RESOURCES IN INDUSTRIAL MANAGEMENT

Rismaja Putra
Industrial Management Akademi Teknik Indonesia Cut Meutia
Medan City, Indonesia
Email: putra.jissho@yahoo.com

Received	: 25 June 2025	Published	: 03 August 2025
Revised	: 10 July 2025	DOI	: https://doi.org/10.54443/ijebas.v5i4.3783
Accepted	: 28 July 2025	Published links	: https://radjapublika.com/index.php/IJEBAS

Abstract

Artificial Intelligence (AI) has become a key element in industrial transformation, bringing significant changes in operational processes, management, and innovation. This study aims to explore the role of AI in various industrial sectors, including automation, data analysis, logistics management, and product development. This study uses a descriptive qualitative research method by collecting research data through observation, interviews and literature studies. The results of the study show that the application of AI can increase efficiency, productivity, and the quality of industrial output as a whole. However, on the other hand, the adoption of this technology also has a major impact on human resources (HR). This study found that AI shifts the need for labor from manual skills to technology-based skills, creating the need for reskilling and upskilling. In addition, this shift presents social challenges, such as the potential for structural unemployment due to the reduction of routine job roles. However, AI also opens up new opportunities, such as jobs in data analysis and AI-based system management. This study concludes that the role of AI in industry must be balanced with strategic policies that support HR development, to ensure that this transformation has a positive impact on sustainability. This includes training programs, increasing access to technology, and adapting to changes in the work ecosystem in the digital era.

Keywords: ***Artificial intelligence, industry, Human Resources, Economic Transformation***

INTRODUCTION

The industrial revolution 4.0 has brought major changes to the industrial world, one of which is the emergence of Artificial Intelligence (AI) technology [1]. As a technology capable of imitating human intelligence, AI now plays a strategic role in various industrial sectors, such as manufacturing, logistics, health, and customer service [2]. Its advantages in automating processes, analyzing data quickly and accurately, and providing innovative solutions have made it an important element in increasing the efficiency and competitiveness of companies. The industrial revolution 4.0 is an era of transformation marked by the integration of digital technology into various aspects of life, especially in the industrial world. One important element of this revolution is the presence of Artificial Intelligence (AI) technology [3]. AI, as a system designed to imitate human intelligence, allows machines and software to learn, make decisions, and solve problems independently based on available data [4]. This gives AI the ability to adapt to complex situations, making it one of the most influential technologies in the modern era.

In the manufacturing sector, AI has brought extraordinary efficiency through the automation of production processes [5]. AI-based machines are able to replace manual work that requires high accuracy and repetition, such as component assembly and product quality checking [6]. Not only does it increase productivity, AI is also able to reduce human error, so that product quality becomes more consistent. In logistics, AI plays an important role in optimizing the supply chain [7]. This technology is used to predict market demand, design the most efficient shipping routes, and manage inventory in real-time. This helps companies reduce operational costs while increasing delivery speed, which ultimately provides greater customer satisfaction. In the healthcare sector, AI has revolutionized the way diagnosis and treatment are carried out [8]. AI algorithms are able to analyze medical data such as laboratory results, MRI scans, and patient health records to provide more accurate and faster diagnoses. In addition, AI is also used in drug development, where the process of discovering new drug molecules can be accelerated through computer simulations [9]. Meanwhile, in the field of customer service, AI comes in the form of chatbots and virtual assistants

that are able to provide fast and personal responses to consumers [10]. This system is designed to understand customer needs through natural language processing and provide relevant solutions, thereby improving the customer experience while reducing human workload. AI's advantages in process automation, data analysis, and innovative solutions make it a key element in improving operational efficiency and company competitiveness in the global market [11]. With AI, companies are able to process big data that was previously difficult to utilize optimally, so that business decisions can be made based on more accurate analysis. In the context of competitiveness, the application of AI not only helps companies survive, but also allows them to become pioneers of innovation in their respective sectors. However, the application of AI also requires attention to emerging challenges, such as the need for a workforce with digital skills, as well as adaptation of human resource management strategies. With the right integration between technology and workforce, AI has great potential to continue to drive industrial progress in the future [12].

However, this progress also presents major challenges, especially in human resource (HR) management. The adoption of AI often replaces routine and manual jobs, previously performed by humans [13]. This phenomenon triggers a major shift in the workforce structure, where technology-based skills become more important than traditional skills. As a result, low-skilled workers are at risk of losing their jobs, while the need for workers who are able to manage AI technology continues to increase [14]. On the other hand, AI not only threatens certain jobs, but also creates new opportunities in various fields, such as algorithm development, data analysis, and management of AI-based systems. However, taking advantage of these opportunities requires significant efforts in terms of reskilling and upskilling the workforce. Lack of access to relevant education and training can widen social and economic gaps, which ultimately hinders the growth of the industry itself. The use of artificial intelligence (AI) technology has become a double-edged sword in the global job and economic landscape. On the one hand, AI brings major disruption by replacing a number of jobs previously performed by humans, especially in fields that rely on routine and repetitive tasks [15]. However, on the other hand, this technology opens up significant new opportunities in various sectors, especially those related to technological innovation, data analysis, AI-based system management, and the development of advanced algorithm-based solutions. This opportunity is a breath of fresh air for individuals and companies that are able to take advantage of it.

However, to be able to seize this opportunity, great efforts are needed in the form of reskilling and upskilling of the workforce. This process not only requires the ability of individuals to learn new skills, but also requires the support of an education and training system that is relevant to industry needs. Unfortunately, not all individuals or regions have adequate access to such education and training facilities. These obstacles often stem from factors such as limited infrastructure, lack of funding, and inequality in the distribution of technology. The inability of some communities to adapt to these changes can widen social and economic disparities. Individuals or groups who do not have access to adequate education will be left behind in the competition, while those who are in a more superior position will further strengthen their dominance. This can create a vicious cycle of inequality that is difficult to overcome, where the less skilled lose out on job opportunities, while the more skilled increasingly dominate the technology-based labor market. Ironically, this gap can ultimately be detrimental to the growth of the industry itself [16].

When only a handful of people have the skills to support an AI-based ecosystem, the industry's capacity to grow inclusively and sustainably is limited. The industry needs a diversified workforce with diverse skills to ensure continued innovation and social inclusion. Therefore, it is important for the government, educational institutions, and the private sector to work together to create wider access to technology-based education and training, so that people can develop relevant skills and support inclusive economic growth. This step will not only help reduce social and economic disparities, but also strengthen the nation's competitiveness in facing the digital era. In the context of industrial management, AI not only provides benefits in terms of productivity, but also demands changes in the way companies manage human resources. Companies must be able to integrate AI technology with adaptive workforce development strategies, so that the positive impact of this technology can be maximized, without ignoring the human aspect. Based on these problems, this study focuses on the role of AI in the industrial sector and its impact on human resources. This study aims to understand how this technology can be optimally utilized, while identifying strategic steps in managing its impact on the workforce, so that a balance is created between technological innovation and human empowerment.

RESEARCH METHODS

The research entitled "The Role of Artificial Intelligence in Industry and the Impact on Human Resources in Industrial Management" uses a descriptive qualitative research method to deeply understand the phenomenon being studied. This method aims to describe the reality in the field based on qualitative data obtained through various data collection techniques. A descriptive qualitative approach is used because this research focuses on understanding and describing the role of Artificial Intelligence (AI) in industry, as well as its impact on human resources (HR). This

approach helps researchers explore information from the perspective of industry players, workers, and experts in the field of AI and HR management. The research subjects include first, industrial companies that use AI, both in production, management, and decision-making. Second, workers who are directly involved or affected by the implementation of AI, such as manual workers, managerial staff, and experts. Third, AI experts or practitioners who have insight into the implementation of this technology in industry. Subjects will be selected using purposive sampling or snowball sampling techniques to ensure that the data obtained is relevant and in-depth. The research location can include companies that have implemented AI in certain industrial sectors, such as manufacturing, logistics, or customer service. Data collection techniques are carried out by in-depth interviews with workers, company managers, and AI experts to gain an in-depth understanding of the role of AI and its impact on HR [17]. Then observations are also carried out by directly observing the work process in industries that use AI to see changes in work patterns, efficiency, and challenges faced by the workforce [18]. Documentation Materials: also collected such as company annual reports, case studies of AI implementation, and policies related to the use of technology in HR management. And finally Literature Study, this is done to review previous research, scientific articles, and industry reports that are relevant to the research topic. The data obtained is analyzed using the following steps with data reduction, namely selecting data that is relevant to the focus of the research, for example, data on changes in work efficiency, unemployment rates, or workforce retraining [19]. Then data presentation to Compile data in the form of descriptive narratives, diagrams, or tables to provide a clear picture of the role of AI and its impact on HR. And finally Conclusion Drawing by making interpretations and conclusions based on patterns or themes that emerge from the data. To ensure the validity and reliability of the data, several techniques are used, such as triangulation, member check and audit trail.

RESULTS AND DISCUSSION

Utilization of Artificial Intelligence (AI) in Indonesia

Artificial Intelligence (AI) is a technology that is increasingly important in the transformation of the global industry, including in Indonesia. AI refers to the ability of machines to imitate human intelligence, such as natural language processing, pattern recognition, and decision-making [20]. In the industrial context, AI is used to automate processes, increase efficiency, and create innovation in resource and service management. In Indonesia, the development of AI has begun to show a significant impact in various industrial sectors, such as manufacturing, logistics, customer service, and agriculture [21]. However, the application of this technology also faces unique challenges, including infrastructure readiness, workforce competence, and supporting regulations. In the manufacturing sector, AI is used to automate production lines, predict machine failures, and increase supply chain efficiency. Large manufacturing companies in Indonesia have begun implementing technologies such as machine learning and computer vision to detect product defects, monitor equipment conditions, and manage inventory.

AI plays an important role in optimizing logistics and transportation, including route planning, fleet management, and shipment tracking. This technology helps logistics companies in Indonesia to minimize operational costs, accelerate delivery of goods, and increase customer satisfaction. The customer service industry is leveraging AI through chatbots and virtual assistants to handle consumer inquiries quickly and efficiently [22]. E-commerce and banking companies in Indonesia often use this technology to improve user experience while reducing the workload of customer service teams [23]. In the agribusiness sector, AI is used to monitor crop growth, analyze soil conditions, and predict crop yields. In the fisheries industry, this technology helps fishermen identify potential fishing locations by utilizing weather data and ocean patterns. In the energy industry, AI is used to monitor energy consumption, improve power plant efficiency, and support renewable energy management. In the mining sector, AI technology helps in more accurate exploration and management of resources.

TABLE I. POSITIVE IMPACTS AND CHALLENGES OF AI IN INDONESIA

Positive Impact of AI Implementation in Industry	Challenges of AI Implementation in Indonesia
Operational Efficiency AI enables companies to automate tasks that were previously performed manually, reducing production time and costs.	**Infrastructure Readiness** Technology infrastructure issues, such as uneven internet networks, are obstacles to the widespread implementation of AI in Indonesia.
Product Quality Improvement With technologies such as predictive analytics, companies can minimize production errors and ensure high-quality products.	**Lack of Skilled Workforce** Many companies are struggling to find workers with the relevant skills to manage and develop AI.
Innovation and Global Competition The application of AI drives innovation that enables Indonesian industry to compete in the global market.	**Social and Economic Disparities** Unequal access to technology and education leaves some communities behind in AI adoption.
New Job Opportunities While some jobs will become obsolete, AI is also creating a need for workers with new skills, such as software development, data analysis, and managing AI-based systems.	**Regulation and Policy** Inadequate regulation is often a barrier to the development and application of AI technology in industry.

Source: Own Processing

With government support through initiatives such as Making Indonesia 4.0, the use of AI in industry has bright prospects. Indonesia can leverage AI to improve the competitiveness of the national industry, accelerate digitalization, and create innovative solutions that support economic growth. Collaboration between the government, companies, and educational institutions needs to be strengthened to overcome challenges, especially in terms of human resource development and technological infrastructure. Artificial Intelligence has an important role in industrial transformation in Indonesia. The application of this technology not only increases efficiency and innovation, but also opens up new opportunities for economic development. However, the successful implementation of AI requires infrastructure readiness, workforce skills development, and supportive regulations. With the right strategy, Indonesia has great potential to make maximum use of AI to support the progress of its industry.

Companies in Indonesia that Utilize AI in the Industrial Sector

Companies in Indonesia utilize Artificial Intelligence (AI) in the industrial sector because this technology offers various advantages that can increase their competitiveness in the global market. AI is able to automate processes that previously required time and human effort, such as market demand prediction, data analysis, or inventory management [24]. With AI, companies can reduce production time, avoid manual errors and maximize resource utilization. Then, AI helps companies ensure product quality through technologies such as machine learning and computer vision. In addition, AI also enables faster and more responsive customer service. AI can detect product defects faster than humans and AI-based Chatbots are able to handle customer complaints in real-time. In addition, AI allows companies to analyze large amounts of data quickly and accurately to support strategic decision making. Thus, companies can better predict market trends or consumer needs and business risks can be identified earlier. In the field of supply chain and logistics management, AI helps companies manage logistics and supply chains efficiently by predicting demand, designing optimal routes, and reducing distribution costs [25]. So that companies can avoid excess or shortage of stock and speed up delivery of goods to customers. In the financial, e-commerce, or technology industries, AI is used to detect suspicious activity or high-risk transactions. The consequences for the company are increasing consumer trust and minimizing company losses due to fraud. The application of AI encourages companies to continue to innovate and transform towards the digital era. Companies that utilize AI adapt more quickly to market and technological changes [26]. AI provides a competitive advantage for companies, both in the domestic and international markets. Companies that use AI can be more innovative, efficient, and responsive to customer needs. The Indonesian government through the Making Indonesia 4.0 initiative encourages the adoption of technologies such as AI to strengthen the national industry. Companies that adopt AI are in line with the government's vision to make Indonesia one of the main players in the industrial revolution 4.0. By utilizing AI, companies in Indonesia not only increase productivity and efficiency, but also strengthen their position amidst increasingly fierce global competition. AI is one of the strategic solutions to answer the challenges of modern industry.

TABLE II. COMPANIES IN INDONESIA THAT UTILIZE AI IN THE INDUSTRIAL SECTOR

No.	Company name	Industrial Sector	Application of AI	Benefits Obtained
1	PT Astra International	Automotive	Leveraging AI for predictive maintenance, production automation, and supply chain management	Increase production efficiency and reduce the risk of machine damage.
2	Tokopedia	E-commerce	AI-based chatbots for customer service and user experience personalization	Increase customer satisfaction and speed up problem resolution
3	GOJEK	Transportation and Logistics	Optimal route planning, recommendation systems and user behavior analysis	Reduce delivery times and increase fleet efficiency
4	PT Telkom Indonesia	Telecommunication	Customer data analysis using AI to personalize service and identify potential churn	Increase customer retention and operational optimization
5	Unilever Indonesia	Manufacturing	*AI-based demand forecasting and product distribution optimization*	Reducing excess stock and ensuring efficient distribution
6	Bukalapak	E-commerce	AI for fraud detection, customer service chatbots, and product recommendations	Reduce the risk of unauthorized transactions and improve user experience
7	Blue Bird Group	Transportation	AI-based demand prediction system to optimize taxi distribution	Minimize customer waiting time and increase operational efficiency
8	PT Pertamina	Energy	Infrastructure monitoring and fuel requirement prediction using AI	Increase distribution efficiency and reduce downtime at facilities
9	Halodoc	Health	AI-based chatbot for health consultation and doctor recommendation system	Accelerating health services and facilitating access to information
10	Xendit	Financial Technology	AI-based transaction fraud detection and payment automation	Increase transaction security and speed up the payment process

Source: Own Processing

The table above shows the breadth of AI adoption across various sectors in Indonesia, reflecting the enormous potential of this technology to support industrial transformation. Then what about the support or attitude of the Indonesian government in utilizing AI in various sectors in Indonesia?

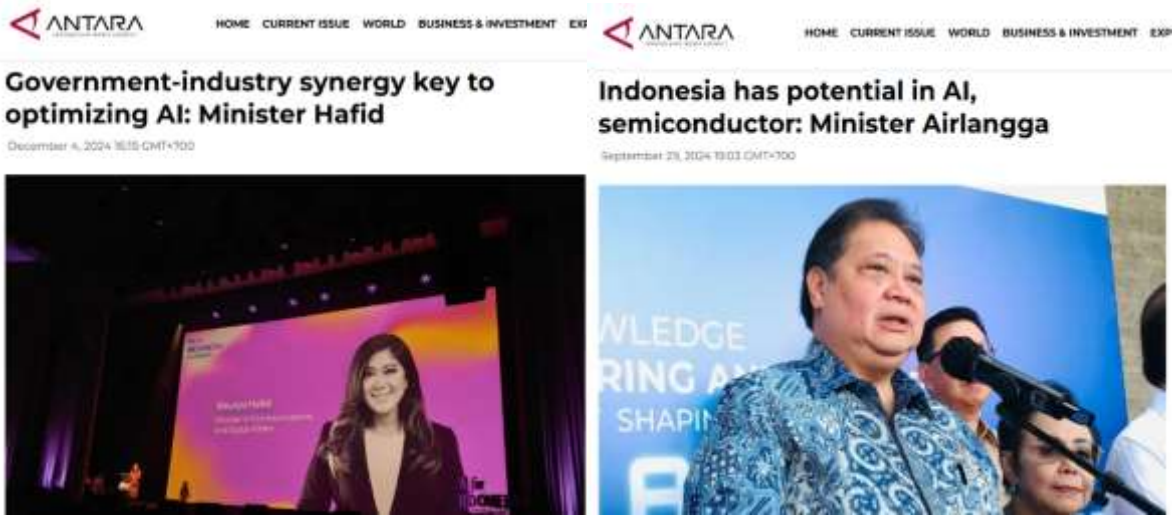

Figure I. Government response to the use of AI
Source: [27] [28]

The use of Artificial Intelligence (AI) in the industrial sector has become one of the main focuses of the Indonesian government in facing the industrial revolution 4.0 [29]. The government understands that AI has great potential to increase the competitiveness of the national industry, drive economic growth, and create new jobs. To support the

implementation of AI by industrial companies, the Indonesian government has taken various strategic steps that reflect a proactive attitude and support innovation. The Indonesian government has shown a positive and optimistic attitude towards the development and implementation of AI in the industrial sector. This attitude is reflected in the following aspects:

1. Encouraging Digital Transformation
   The government sees AI as an integral part of digital transformation in Indonesia, especially in supporting Making Indonesia 4.0, an initiative that aims to make Indonesia one of the world's largest economies by 2030.
2. Recognizing Challenges and Opportunities
   The government is aware that AI can create great opportunities in increasing industrial efficiency, but also raises challenges such as unemployment due to automation and skills gaps. Therefore, the approach taken is inclusive and long-term.
3. Multi-party Collaboration
   The government is open to collaboration with the private sector, academics, and international institutions to accelerate the development of AI in Indonesia.

Government Policy in Supporting the Utilization of AI

The following are the main government policies that support the utilization of AI in industrial companies:

1. National AI Strategy (Indonesia Artificial Intelligence Strategy - 2020-2045)
   Launched by the Ministry of Research and Technology, this national strategy aims to provide direction for the development and implementation of AI in Indonesia. Its main focuses include: 1) Increasing Human Resource Capacity. Through technology-based training and education to create a workforce that is ready to face the AI era; 2) Strengthening Technology Infrastructure. The government is committed to improving technology infrastructure, such as the development of data centers, fast internet networks, and cloud computing; 3) Focus on Priority Sectors. This strategy prioritizes the use of AI in five sectors, namely education, health, bureaucratic reform, food security, and mobility and transportation.
2. Making Indonesia 4.0 Initiative
   As part of the industrial revolution 4.0, the government has launched this program to support industrial digitalization, including through the adoption of AI. The sectors that are the focus include: food and beverage, textile and garment, automotive, electronics, and chemical industries.
3. Incentive Policy for Industry
   The government provides incentives in the form of Tax Reductions through the super tax deduction scheme, companies that invest in technology-based research and development (R&D), including AI, get a tax reduction of up to 300%. The government also provides Investment Support by providing convenience for investors in the technology sector to support the development of AI.
4. AI-Based Education and Training
   The government is working with universities and training institutions to create a curriculum that supports the development of skills in the field of AI [30]. Examples of programs include: AI Training by the Ministry of Communication and Informatics (Kominfo) and Cooperation with global technology platforms to provide online training.
5. Regulation and Ethics of AI Use
   The government has begun to draft regulations governing the use of AI, including aspects of data security, privacy, and ethics. This aims to ensure that the use of AI provides maximum benefits without causing significant risks to society.

The Indonesian government has a supportive and progressive attitude in encouraging the use of AI by industrial companies [31]. Through policies such as the National AI Strategy, Making Indonesia 4.0, and tax incentives, the government is trying to create an ecosystem that is conducive to the development of AI. However, challenges such as infrastructure and human resource skills still need to be overcome to ensure that the use of AI can provide an equitable and sustainable impact. With the right support, AI has the potential to be a major driver of Indonesia's industrial transformation in the future.

TABLE III. THE INFLUENCE OF AI ON HUMAN RESOURCES (HR) IN THE INDUSTRIAL SECTOR IN INDONESIA

The Impact of AI on HR	Explanation	Case Example in Indonesia
Increased Work Efficiency	AI is able to automate repetitive tasks so that work can be done faster and more accurately.	The manufacturing industry uses AI-based robots for product assembly, such as at the PT Toyota Motor Manufacturing Indonesia factory.
Changes in Skill Needs	Companies need workers with technical skills such as data literacy, coding, and analytics.	E-commerce companies like Tokopedia are hiring machine learning experts to improve customer experience through personalization.
Potential for Reducing Manual Labor	Automation can replace manual work, thereby creating the risk of workforce reduction in certain sectors.	Many logistics companies are starting to use AI in warehouse management, such as Gojek's Smart Warehouse.
Increased Job Opportunities in New Fields	AI creates the need for new professions, such as data scientists, AI engineers, and data analysts.	University of Indonesia opens a special data science study program to meet the needs of the AI-based industry.
Increase HR Productivity	With AI support, HR can focus on strategic and creative tasks that require human intelligence.	Employees at agritech companies like TaniHub use AI platforms to predict agricultural product price trends.
Skill Gap Risk	Not all workers are ready to adapt to AI technology, resulting in a gap in capabilities.	Many workers in traditional sectors such as textiles have difficulty adapting to AI-based automation technology.
Improvement of Training and Education	Companies and governments are investing in human resource training to keep pace with the development of AI technology.	The Ministry of Communication and Information's "Digital Talent Scholarship" program trains thousands of workers for digital skills, including AI.

Source: Own Processing

The Indonesian government has identified Artificial Intelligence (AI) as a key element in accelerating the national digital transformation [32]. This is evident in the government's support for the Making Indonesia 4.0 initiative, which aims to make Indonesia one of the world's largest economic powers by 2030 [33]. This approach shows that the government is not merely following global technology trends, but also has a strategic vision to utilize AI as a catalyst for economic growth. Digital transformation through AI is expected to increase the competitiveness of local industries in the global market by accelerating the adoption of advanced technologies. The government has demonstrated a balanced understanding of the benefits and risks of implementing AI. On the one hand, AI has the potential to increase industrial efficiency, reduce operational costs, and create more innovative products or services. On the other hand, implementing AI can bring challenges such as the risk of unemployment due to automation and the existence of a skills gap between existing workers and the needs of technology-based industries. With this awareness, the government's approach is inclusive, ensuring that the wider community can adapt to the changes brought by AI, and is long-term oriented to integrating technology with human needs.

The government's collaborative approach demonstrates openness to various parties, including the private sector, academics, and international institutions, to support the development of AI [34]. This approach recognizes the importance of synergies between technological innovations that often originate from the private sector and academic research with government policies. This multi-stakeholder collaboration enables the creation of an inclusive and sustainable AI ecosystem. By involving multiple actors, Indonesia can leverage global expertise, resources, and international networks to accelerate technological progress while ensuring that AI has a positive impact that is equitable across all sectors of society [35]. The Indonesian government's positive and optimistic attitude towards AI development reflects a focused strategic vision to make technology a key tool in increasing national competitiveness. By supporting digital transformation, recognizing the challenges, and prioritizing collaboration, the government shows that it sees AI not only as a technology of the future, but also as a strategic solution to building an inclusive, sustainable, and innovation-based economy.

CONCLUSION

Artificial Intelligence (AI) has brought significant changes to various aspects of industry in Indonesia, having a broad impact on operational processes, productivity, and company innovation. AI enables automation of routine tasks, increases work efficiency, and provides faster and more accurate data analysis capabilities. The implementation of AI has also driven digital transformation in the industrial sector, from manufacturing, logistics, to customer service, resulting in operational cost savings and increased company competitiveness. However, the impact of AI on human resources (HR) in companies also poses major challenges. On the one hand, AI replaces manual and repetitive work, potentially reducing the need for workers in certain types of jobs. This can trigger concerns about structural unemployment if the workforce cannot adapt quickly to technological changes. On the other hand, AI also creates new opportunities, especially in jobs that require analytical, technical, and creative skills that cannot be replaced by machines. Therefore, the need to increase HR capacity through training, reskilling, and upskilling is urgent for companies in Indonesia. Companies must invest in training programs to ensure that their workforce is able to keep up with technological developments and utilize AI optimally. Overall, the role of AI in the industry in Indonesia has a double impact, both in terms of efficiency and productivity, as well as challenges in HR management. The success of AI implementation in companies is highly dependent on an inclusive technology adaptation strategy, which not only takes into account operational efficiency, but also the welfare and development of workforce competencies. With the right approach, AI can be a major driver of economic growth while creating a more dynamic and innovative work ecosystem in Indonesia.

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