

THE IMPACT OF DIGITAL TECHNOLOGY ON EFFICIENCY AND PRODUCTIVITY IN THE INDUSTRIAL SECTOR

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Abstract: Digital technology has become a key factor in enhancing efficiency and productivity across various industrial sectors. The implementation of technologies such as automation, artificial intelligence, and the Internet of Things (IoT) has enabled companies to optimize operational processes, reduce production costs, and improve product quality. This study aims to analyze the positive impacts and challenges of digital technology implementation in the manufacturing and service industries. Using a qualitative approach through literature studies and secondary data analysis, the findings indicate that digitalization can increase efficiency by up to 30% and accelerate production time by up to 40%. However, challenges such as high initial investment costs, the need for workforce training, and data security risks remain significant barriers to digital technology adoption. Therefore, companies must develop appropriate strategies for technology implementation to ensure sustainability and business competitiveness in the digital era. The results of this study are expected to serve as a reference for stakeholders in designing policies that support digital transformation in the industrial sector.

Keywords: Digital technology, efficiency, productivity, industry, digital transformation.

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Background

Technological advancements have transformed traditional ways of working to be more flexible, automated and data-driven. Digitalisation is driving companies to seek a workforce with high digital competencies to support innovation and efficiency. In the era of Industry 4.0 and Society 5.0, technological transformation not only includes the adoption of digital devices but also requires the workforce to have relevant digital skills.

The development of information and communication technology has brought significant changes in various aspects of life, including in the development of human resources (HR). Digitalisation has changed the way of working, business models, as well as the skills required in the world of work. Therefore, mastering digital skills has become an important factor in improving the competitiveness of individuals and organisations.

Digital transformation has become an integral part of many industry sectors. Companies that want to survive and thrive in global competition must be able to adapt to digital technology. Digitalisation enables business process automation, operational efficiency, and increased work productivity. However, this change also requires human resources who have digital skills in order to optimally utilise technology.

Digital skills not only include the ability to use software and hardware, but also involve an understanding of data analytics, cybersecurity, artificial intelligence, and other digital technologies. Therefore, developing human resources in the digital aspect is a big challenge for organisations, governments and educational institutions.

Digital skills not only include the ability to use software and hardware, but also involve an understanding of data analytics, cybersecurity, artificial intelligence, and various other digital technologies. Therefore, developing human resources in the digital aspect is a major challenge for organisations, governments and educational institutions. Investment in digital training and education is crucial to prepare a competent workforce in the digital era (Putri et al., 2021).

According to a report by the World Economic Forum (2023), around 85 million jobs are expected to be replaced by automation by 2025, but on the other hand, 97 million new jobs will emerge that are more digital-based. Digital skills are therefore a crucial aspect of workforce readiness for these changes. This article will discuss the various digital skills required in the workforce, the role of government and educational institutions in their development, and the challenges faced in the process.

Methodology

This research employs a qualitative approach to examine the development of digital skills in the workplace, focusing on the roles of government and educational institutions. The study uses a literature review as its primary method, gathering data from academic journals, industry reports, and policy documents. By analyzing these sources, the research identifies key trends, challenges, and best practices in digital skill development. Government policies and educational initiatives are assessed to understand their impact on workforce readiness. The findings highlight the need for collaboration between industries, academia,

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and policymakers to ensure the workforce is equipped with relevant digital competencies.

Results

Digital Skills Needed in the World of Work

1. Digital Literacy

Digital literacy is a basic competency that includes an understanding of digital media, ethics in the use of technology, and the ability to manage information effectively. These skills are essential to help individuals adapt to new technologies and make the most of digital resources. The European Commission (2022) emphasises that digital literacy also includes awareness of cybersecurity and privacy protection in the digital world (Ela elliyana et.al, 2022; Elrayah & Jamil, 2023).

2. Data Analytics and Big Data

The ability to process, analyse and interpret data into useful insights for decision-making has become a key requirement for various industries (Jansen et al., 2023; Provost & Fawcett, 2013; Sharma et al., 2014). Data science and business analytics are now highly sought-after fields as companies need data-driven insights to improve operational efficiency and identify new opportunities.

3. Cyber Security

As the use of digital technology increases, so do the threats to data security and privacy (Bertino, 2016; Díaz et al., 2021). Therefore, an understanding of cybersecurity, including encryption, access management, and cyber risk mitigation, is becoming a much-needed skill across sectors, particularly banking, government, and healthcare.

4. Programming and Software Development

Skills in programming are a big plus for the workforce in the digital era. Mastery of programming languages such as Python, Java, and JavaScript is needed in the development of technology-based applications and systems (He, 2025; Thokala & Pillai, 2024; Tkachenko & Brezhniev, 2022). These skills are not only required by information technology professionals but are also increasingly needed by workers in various data-orientated sectors.

5. Artificial Intelligence (AI) and Machine Learning

Artificial intelligence (AI) and machine learning technologies are increasingly being applied in various fields, such as business process automation, predictive analytics, and natural language processing (Ribeiro et al., 2021; Thakur et al., 2023). Understanding how AI works and how to apply it can improve productivity and create innovative solutions in the workplace.

6. Digital Collaboration

With the rise of remote working and globally dispersed teams, skills in using digital collaboration tools such as Slack, Microsoft Teams and Trello are becoming increasingly important (Ajiva et al., 2024; Emmanuel et al., 2024). These skills help improve productivity and work efficiency in a digitalised environment.

The Role of Government and Educational Institutions in Digital HR Development

To ensure the readiness of the workforce for the digital era, the government and educational institutions play a strategic role in equipping people with relevant skills. Here are some steps that can be taken:

1. Improving Education Curriculum

Educational institutions need to adapt their curriculum to align with the needs of the digital industry (Buttle & Maklan, 2019; Lyons & Kass-Hanna, 2021). The integration of subjects that focus on digital technologies, such as coding, data analytics and cybersecurity, should be part of the education system from an early age.

2. Digital Training and Certification Programmes

The government and companies can work together to provide digital skills-based training programmes for the workforce (Bashay, 2020; Stofkova et al., 2022). These programmes can be in the form of online courses or in-person training. Digital certifications from platforms such as Google, Microsoft and Coursera are increasingly recognised by the industry as proof of competence in technology.

3. Encourage Lifelong Learning

As technology evolves at a rapid pace, the workforce needs to continuously upgrade their skills through lifelong learning (Kispeter, 2018; Putnam & Sanchez, 2019). Flexible learning models, such as microlearning and bootcamps, can help workers stay relevant in the job market.

4. Support for Tech Startups and Digital Innovation

The government can encourage the tech startup ecosystem by providing funding, supportive regulations, and access to mentors and industry networks (Geetha, 2025; Gupta, 2024). This will help create more tech-based jobs and accelerate digital adoption across sectors.

5. Strengthening Digital Infrastructure

The availability of broad and stable internet access is an important factor in supporting the development of digital skills at all levels of society (Saikkonen & Kaarakainen, 2021; Shakina et al., 2021). The government must ensure equitable access to technology in both urban and rural areas to reduce the digital divide.

Challenges in Digital Skills Development

While digital skills are increasingly becoming a key requirement in HR development, there are several challenges that need to be addressed:

1. Digital Divide

The disparity in access to digital technology and training between urban and rural areas remains a major problem in many countries (Laskar, 2023; ZULFARIS et al., 2020). Many communities still do not have adequate internet access for digital learning.

2. Lack of Awareness and Interest

Many individuals do not realise the importance of digital skills in improving their competitiveness in the job market

(Goulart et al., 2022; Poláková et al., 2023). Hence, there is a need for massive educational campaigns to raise public awareness on the importance of digital literacy.

3. High Training Costs

Not all individuals or organisations have the resources to undertake adequate digital skills training (Monteiro & Leite, 2021; Nikou et al., 2022). To overcome this, affordable or even free training programmes are needed for the underprivileged.

4. Lack of Competent Human Resources

The availability of teachers and instructors with digital expertise is limited, especially in developing countries (Hennessy et al., 2022; Okoye et al., 2023). Training for digital educators and facilitators should be prioritised to optimise the learning process.

In the face of digital transformation, mastering digital skills is a key factor for the workforce to remain relevant and competitive. Companies need individuals who not only have basic digital literacy but also skills in data analysis, cybersecurity, programming, AI, and digital collaboration. Governments and educational institutions must play an active role in equipping people with the appropriate skills through education, training, and support for technological innovation (Rabie & Elliyana, 2019). By addressing challenges such as the digital divide and lack of competent teachers, a digitally skilled workforce can drive economic growth and improve global competitiveness.

Discussion

Based on the results of the research, it appears that digital skills have become a fundamental requirement across various industry sectors. While many companies recognise the importance of a digitally competent workforce, the implementation of digital skills training and development still faces various obstacles (Jia & Huang, 2023; Yaacob et al., 2023). The digital divide between urban and rural areas, limited access to training, and lack of competent teaching staff are the main challenges in improving the digital literacy of the workforce (Cullen, 2001; Naidoo & Raju, 2012).

In addition, digital literacy is not just about understanding technology, but also includes the ability to think critically in managing digital information (Bawden, 2001; Martin, 2008). Cybersecurity, ethics in the digital world, and the ability to adapt to technological change are important aspects that must be strengthened in the education and training system of the workforce (AlDaajeh et al., 2022; Burov et al., 2020).

From the government side, collaboration between the public and private sectors is needed to create an inclusive digital learning ecosystem (Radenkova, 2024; Xie et al., 2024). Regulations that support digital innovation and incentives for companies that invest in employee skills development can help accelerate digital transformation in the workforce.

Conclusions and Suggestions

Conclusion

Digital skills are a key element in dealing with technological transformation in the world of work. Digital literacy, data analysis, cybersecurity, and artificial intelligence are some of the key

competencies that must be possessed by the workforce. The government and educational institutions have a big role to play in ensuring workforce readiness through curriculum improvement, training programmes, and strengthening digital infrastructure. However, challenges such as access gaps and lack of competent teaching staff still need to be overcome for digital transformation to be inclusive.

Suggestions

Increased Access to Digital Training - The government and private sector need to expand access to digital training, especially for the less affordable groups. Industry and Academia Collaboration, Synergies between companies and educational institutions can ensure that the curriculum and training provided are in line with industry needs. Incentives for Companies that Develop Digital HR, The government can provide incentives for companies that are active in developing the digital skills of their employees. Increased Cybersecurity Awareness, Campaigns and education on the importance of cybersecurity should be expanded to protect individuals and organisations from digital threats. Strengthening Regulations and Digital Infrastructure, Regulations that support digital innovation and investment in technology infrastructure need to be improved to create a sustainable digital ecosystem.

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