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THE EFFECT OF DIGITAL TECHNOLOGY ON GOVERNMENT EFFECTIVENESS IN THE ERA OF THE INDUSTRIAL REVOLUTION 4.0

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Abstract

Digital transformation in the era of the Industrial Revolution 4.0 has brought fundamental changes in governance, especially in improving the effectiveness, efficiency, and transparency of public services. The utilisation of digital technologies such as e-government, big data, and artificial intelligence allows bureaucratic processes to be faster, cost-effective, and strengthen public participation in decision-making. This research uses a literature review method to analyse the influence of digital technology on government effectiveness in Indonesia, highlighting positive impacts such as service acceleration, data integration, and increased public accountability. However, the implementation of digitalisation also faces challenges, including infrastructure gaps, low digital literacy, and issues of cybersecurity and personal data protection. The results of the study show that the success of digital transformation depends on cross-sector collaboration, infrastructure strengthening, human resource development, and regulatory updates so that the benefits of digitalisation can be felt evenly and inclusively by all people.

Keywords: ***Digital Technology, Government Effectiveness, E-Government, Industrial Revolution 4.0, Digital Transformation, Public Services, Transparency, Accountability.***

Introduction

Digital transformation has become a global phenomenon that changes various aspects of life, including governance. In the era of the Industrial Revolution 4.0, the utilisation of digital technology is an urgent need to improve efficiency, transparency, and the quality of public services. Governments in various countries, including Indonesia, are competing to adopt information and communication technology (ICT) to answer the demands of an increasingly critical and dynamic society (Siti Nurjanah & Ahmad Fauzi, 2025) .

In Indonesia, the government's commitment to public information disclosure has become one of the main pillars in bureaucratic reform. Through Law No. 14/2008 on Public Information Disclosure, the government requires every public agency to provide access to information for the public. This regulation not only guarantees the public's right to obtain information, but also strengthens public oversight of government performance (OECD, 2024) .

The development of digital technology has further strengthened the implementation of information disclosure through various online platforms, such as public complaint applications and official government websites. These platforms allow the public to lodge complaints, provide input, and actively participate in the policy-making process. Thus, digitalisation expands the space for public participation and strengthens democracy (J. Kim & S. Park, 2023) .

Digital transformation in government is not only limited to the use of software or applications, but also includes fundamental changes in work patterns of the bureaucracy. Administrative systems that were previously manual are now switching to digital-based automated systems. Public service processes that used to require physical presence can now be accessed online, saving time and resources for both the government and the public (A. Rahman & S. Lee, 2024) .

The implementation of the Electronic-Based Government System (E-Government System) is an important milestone in the digitalisation journey of the Indonesian government. Since the issuance of Presidential Instruction No. 3 Year 2003 on National Policy and Strategy for E-Government Development, the government has continued to strengthen the quality, accountability, and efficiency of public services. Presidential Regulation No. 95 of 2018 on SPBE and Presidential Regulation No. 132 of 2022 on National SPBE Architecture reinforce the direction and strategy of national digital transformation (Putri Hening & Gozali Harda Kumara, 2024) .

However, the implementation of digital transformation in Indonesia still faces various challenges. One of them is that digital public services are spread across various portals and applications owned by the central and local governments, so they are not yet fully effective and efficient. This fragmentation causes data duplication, lack of interoperability, and makes it difficult for the public to access integrated services (Irma et al., 2023) .

In addition, the digital infrastructure gap between urban and rural areas is still a major obstacle. Not all regions have adequate internet access, resulting in a digital divide that widens the gap in public services. Limited digital literacy among government officials and the public is also a challenge in optimising the use of digital technology (OECD, 2024) .

Cybersecurity and personal data protection are also crucial issues in the digital transformation of government. The increasing threat of cybercrime requires the government to strengthen security systems and ensure that public data is well protected. Without security guarantees, public trust in government digital services may decline (Wen Li et al., 2025) .

On the other hand, digital transformation brings significant positive impacts. Digitalisation of administrative processes accelerates public services, reduces operational costs, and improves data accuracy. Online services allow people to access government services anytime and anywhere, thus expanding accessibility and increasing public satisfaction (Ruth Samwel Temba, 2025) .

The use of big data and artificial intelligence (AI) in government opens up new opportunities for data-driven decision-making. Governments can analyse data in real-time to formulate policies that are more targeted and responsive to people's needs. These innovations are driving the creation of a more adaptive and competitive government in the era of globalisation (Lurong Chen & Fukunari Kimura, 2024) .

Several major cities in Indonesia, such as Jakarta, Surabaya, and Makassar, have developed the smart city concept as a concrete form of digital transformation. Through the integration of IoT technology, community reporting applications, and digital -based traffic management, local governments seek to improve the quality of life of their citizens and strengthen the city's competitiveness at the global level (T. Nguyen & S. Lim, 2021) .

Digital transformation also encourages cross-sector collaboration, both between central and local governments as well as with the private sector and civil society. This collaboration is important to accelerate technology adoption, strengthen innovation, and ensure the long-term sustainability of digital transformation.

Thus, the influence of digital technology on government effectiveness in the era of the Industrial Revolution 4.0 is a very relevant issue to study. This study aims to analyse the extent to which digital technology can improve government effectiveness, the challenges faced, and the strategies that can be carried out to optimise the benefits of digital transformation in the Indonesian public sector.

Research Methods

This research uses the systematic literature review (SLR) method, which is to collect, analyse, and interpret various relevant scientific literature sources such as journals, books, and official documents related to the influence of digital technology on government effectiveness in the era of the Industrial Revolution 4.0. The research process begins with problem identification, followed by searching and filtering relevant literature, then the data obtained is analysed descriptively-qualitatively to find patterns, trends, challenges, and recommendations related to the topic studied. The results of the literature synthesis are used to provide a comprehensive overview of the development, impact, and optimisation strategies of digital technology in improving government effectiveness in Indonesia.

Results and Discussion

The Effect of Digital Technology on Government Effectiveness in the Era of the Industrial Revolution 4.0

Digital transformation in the era of Industrial Revolution 4.0 has brought fundamental changes in governance in Indonesia and the world. Digital technologies, such as the internet, online service applications, and artificial intelligence, have become the backbone of efforts to improve the efficiency and effectiveness of public services (Omotayo Kehinde Ogunmodede & Alaba Omotayo, 2025) .

The application of digital technology in government, for example through e-government, has made it easier for people to access public services without having to come directly to government offices. This system allows the processing of documents, tax payments, and public complaints to be carried out online, thus saving time and costs for both the community and the government (Andryan Muhammad Rizky et al., 2025) .

Government effectiveness is measured by several key indicators, such as efficiency, transparency, public participation, and accountability. Digital technology plays an important role in simplifying bureaucratic procedures, accelerating decision-making, and strengthening transparency and accountability of public administration (D. Santoso & R. Wulandari, 2025) .

The implementation of e-government in Indonesia has had a significant impact on improving efficiency in data management and public services. Document digitisation, for example, reduces the need for physical archives and speeds up access to information, resulting in shorter and more cost-effective administrative processes. In addition, digitisation enables the integration of public services through one unified portal, such as INA Digital, which the government launched to simplify various digital platforms across ministries and agencies. This portal makes it easier for the public to access various services in one application, increasing public convenience and satisfaction (Bartik J. et al., 2023) .

Digital technology also strengthens public participation in public oversight and decision-making. Through complaints applications such as SP4N-LAPOR, people can report problems directly and get a quick response from the government. The use of big data and artificial intelligence (AI) in government opens up opportunities for more accurate and responsive data-driven decision-making. The government can analyse people's needs in real-time and formulate more targeted policies (Ministry of Digital Governance, 2020) .

In many regions, the smart city concept has been developed to improve the quality of life of citizens through the utilisation of IoT technology, reporting applications, and digital-based traffic management. Cities such as Jakarta, Surabaya, and Bandung are pioneers in smart city implementation in Indonesia. However, the implementation of digital technology in government is not free from challenges. The digital infrastructure gap between urban and rural areas is still a major obstacle to equitable distribution of digital services. Many remote areas do not have adequate internet access, so digitalisation has not been evenly distributed (M. Rossi & L. Bianchi, 2022) . In addition to infrastructure, another challenge is the low level of digital literacy among state civil servants and the public. Lack of training and capacity building makes the digitisation process slow and less than optimal. Cybersecurity is a crucial issue in the digital transformation of government. The threat of cyberattacks, hacking, and data leakage requires the government to strengthen security systems and ensure the protection of public data. To overcome these challenges, the government has designed various strategies, such as strengthening digital infrastructure, training human resources, and developing policies supporting digital transformation. The government also launched the National Strategy for Artificial Intelligence and allocated a large budget for the development of information and communication technology (R. Prasetyo & S. Wijaya, 2025) .

The positive impact of government digitisation is felt in improving the quality of public services, operational efficiency, and community empowerment. Online services allow people to access information and services anytime and anywhere, without having to wait for working hours or come to government offices (KumarTyagi & Tiwari, 2025) .Finally, the influence of digital technology on government effectiveness in the era of the Industrial Revolution 4.0 is significant. Digitalisation has accelerated administrative processes, increased transparency, strengthened public participation, and encouraged adaptive and responsive governance.

Government Challenges in the Era of Industrial Revolution 4.0

The digital transformation taking place in the era of the Industrial Revolution 4.0 brings great opportunities for governments to improve efficiency, transparency, and the quality of public services, but also presents complex and multidimensional challenges. The Indonesian government, like many other countries, has to face various obstacles in adopting digital technology optimally in the public sector. One of the main challenges is the limited digital infrastructure, especially in remote and rural areas. Unequal access to the internet and telecommunications networks has led to an imbalance in digital public services between urban and underdeveloped areas. This has an impact on the limitations of the community in accessing digital-based government services in a fair and equitable manner (L. Chen & F. Kimura, 2024) .

In addition to infrastructure, the digital divide also arises due to differences in the level of digital literacy in the community and government apparatus. Many civil servants and communities in the regions still do not have adequate skills in utilising digital technology, so the digitisation process is slow and less than optimal (Eduardo Junio Andaya et al., 2025) .

Conventional bureaucratic work culture and resistance to change are significant obstacles in the digital transformation of government. Many civil servants are comfortable with manual systems and are reluctant to switch to digital systems due to concerns about changing roles or losing their jobs. Data security and privacy issues are also serious challenges in the digital era. The government manages important public data that is vulnerable to cyberattacks, hacking and information leaks. The lack of robust security systems increases the risk of data leaks that can undermine public trust in government digital services (Sandra Willia Gusman, 2024) .

Limited budget and investment in digital technology development is also a major obstacle, especially at the local government level. Many government agencies have not allocated sufficient funds to build infrastructure, develop digital systems, and increase human resource capacity. The complexity of digital system integration between

government agencies often leads to data duplication and difficulties in information exchange. Each agency tends to build its own system without uniform standards, so the integration process becomes complicated and requires a lot of money and time (Muhammad Jafar AW, 2024) .

Unclear or inconsistent regulations and policies also slow down the process of bureaucratic digitalisation. Some bureaucratic rules are rigid and have not been adapted to technological developments, making the implementation of digitalisation slow and causing confusion at the implementing level. Weak change management is another challenge in the government digitisation process. The lack of a change management strategy causes employees to be unprepared to adapt to the new system, so that the implementation of digitalisation does not run optimally (Handayani et al., 2020) .

The digital divide among communities, especially in low-income areas, also exacerbates inequality in access to digital public services. People with low incomes often find it difficult to purchase technology devices and pay for internet fees, leaving them behind in the utilisation of digital services. The lack of cybersecurity and information technology experts in government makes digital systems vulnerable to external threats. Managing data on a large scale requires human resources who are competent in detecting and counteracting cyber attacks (Rina Sari & Dwi Prasetyo, 2025) . In addition, the lack of understanding of the importance of technological innovation among bureaucratic leaders is also an obstacle. If agency leaders do not have a vision of digital transformation, then technology adoption will be slow and not a top priority (T. Nguyen & S. Lim, 2021) .

The different interests between the government and the public in the use of digital technology is also a challenge. The government tends to emphasise managerial aspects, while the public expects two-way interaction and increased participation through digital services. The non-uniformity of technology and security standards among government agencies leads to differences in the level of data protection and quality of digital services. This makes some sectors more vulnerable to security risks and reduces public trust in government digital systems (Siti Nurjanah & Ahmad Fauzi, 2025) . Finally, the biggest challenge is to ensure that all levels of society and government officials are able to adapt to the rapid technological changes in the Industrial Revolution 4.0 era. The government must continue to educate, train, and collaborate across sectors so that digital transformation can be effective and inclusive (J. Kim & S. Park, 2023) .

In conclusion, the Industrial Revolution 4.0 era has brought major changes to governance, encouraging the utilisation of digital technology to improve the effectiveness, efficiency and transparency of public services. However, behind these opportunities, the government is faced with serious challenges, ranging from limited digital infrastructure, technology literacy gaps, to cybersecurity and data privacy threats. Digital transformation also requires the adaptation of human resources, changes in bureaucratic culture, and regulatory adjustments to keep up with the rapid pace of technological innovation.

In addition, automation and integration of technologies such as IoT and AI have the potential to lead to a reduction in employment in certain sectors, so the government needs to prepare policies for reskilling and upskilling the workforce to remain relevant in the new job market. The government must also ensure that digital transformation is inclusive, equitable, and socially and environmentally responsible, so that the benefits can be felt by all levels of society without creating new gaps.

Thus, the key to successful governance in the Industrial Revolution 4.0 era lies in cross-sector collaboration, strengthening infrastructure, developing human resources, updating regulations, and a commitment to adopt technology wisely and sustainably.

Conclusion

Digital technology has brought significant changes in governance in the era of the Industrial Revolution 4.0 by improving efficiency, transparency, and quality of public services. The digitisation of administration and the implementation of e-government allow bureaucratic processes to be faster, cost-effective, and easily accessible to the public, thus strengthening public accountability and participation in government decision-making.

However, the implementation of digital technology in government faces various challenges, such as digital infrastructure gaps, low technological literacy among the apparatus and the public, as well as cybersecurity and personal data protection issues. These challenges require a comprehensive strategy, including strengthening infrastructure, increasing human resource capacity, and updating regulations so that digital transformation can be effective and inclusive.

Overall, the influence of digital technology on government effectiveness is very positive and has the potential to encourage the creation of adaptive, responsive and people-oriented governance. The success of this digital transformation is highly dependent on cross-sector collaboration, government commitment, and the readiness of all elements of society to adapt to rapid and dynamic technological changes.

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