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Challenges of Integrating Digital Innovation Strategies in Educational Technology to Enhance E-Government Implementation

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Abstract	This study aims to identify the main challenges in integrating digital technology in education and e-government in Indonesia. The research method uses a literature approach to collect and analyze relevant literature on digital innovation in educational technology and e-government in Indonesia. Primary sources include scientific articles, theory books, government policy documents, and international journals to compare technology implementations in developing countries. This approach enriches the analysis with various theoretical perspectives and valid information on the challenges and solutions of digital implementation in the education and government sectors. The work identifies key challenges in integrating digital technologies for e-government and education, such as uneven infrastructure, low digital literacy, and resistance to change. The digital divide in 3T areas exacerbates inequality in access to education and public services. Potential solutions include infrastructure development, digital literacy training, master plan development, and public awareness campaigns. With collaboration between the government, the education sector, and the community, Indonesia can utilize digital technology to improve the quality of public services and socio-economic life.
Keywords	Digital Innovation; Digital Transformation; Educational Technology; E-Government; Public Services

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1. INTRODUCTION

One of the main problems in integrating digital innovation into educational technology is the gap in infrastructure and accessibility of technology. In many areas, especially in remote areas, the limited availability of internet networks and the lack of adequate technological devices are obstacles to the optimal implementation of educational technology. This impacts the digital divide, which can hinder the effectiveness of e-government implementation in the education sector. The development of digital technology has become a major force in driving social and economic transformation worldwide. In Indonesia, one of the significant impacts of digital innovation can be seen in the education and government sectors, especially in the implementation of e-government and improving the quality of public services (Ramadhania & Sutisna, 2023; Tasyah et al., 2021). Integrating digital innovation strategies in educational technology to support e-government implementation is essential to create a more efficient, transparent, and inclusive system. However, despite the great potential of digital technology, Indonesia still faces various challenges in optimizing the use of technology in both sectors.

The development of digital technology has become a major force in driving social and economic transformation worldwide. In Indonesia, one of the significant impacts of digital innovation can be seen in the education and government sectors, especially in the implementation of e-government and improving the quality of public services (Ramadhania & Sutisna, 2023; Tasyah et al., 2021). Integrating digital innovation strategies in educational technology to support the implementation of e-government is a crucial step in creating a more efficient, transparent, and inclusive system. With optimal use of technology, the educational administration can run more effectively, access to educational services becomes wider, and coordination between educational institutions and the government can be improved.

However, even though digital technology has great potential, Indonesia still faces various challenges in optimizing the use of technology in the education and government sectors (Richardo Sibarani et al., 2023; Saputra, 2020; Yufarika, 2023). One of the main problems is the gap in infrastructure and technology accessibility, especially in remote areas. Limited internet networks and the lack of digital devices are obstacles to the optimal implementation of educational technology. In addition, low digital literacy among educators and state civil servants is also a significant challenge, considering that adopting technology requires the readiness of human resources to be used optimally in supporting e-government. From a policy aspect, the absence of systematic and integrated regulations supporting digital innovation in education is also an inhibiting factor. Many policies related to e-government and educational technology are still partial, causing the implementation of digital innovation to run suboptimally (Richardo Sibarani et al., 2023; Susilawati et al., 2023; Sutopo et al., 2022). In addition, resistance to change in the educational environment and government bureaucracy slows down the digital transformation that should improve the efficiency and quality of public services.

Several previous studies stated that the implementation of e-government in DPM-PTSP Bandung City has been running well, although its socialization has not been optimal (Kusuma et al., 2021). The implementation of e-government in Sukajaya Village needs to be improved, focusing on improving system integration, community digital skills, and technology support policies (Hamim et al., 2024). The implementation of e-government in Bima Regency faces challenges related to accessibility, digital literacy, cultural and organizational changes, official support, and budget allocation, which require an inclusive approach and better outreach (Riksfardini et al., 2023).

Although many studies have discussed the implementation of technology in education and e-government, few have comprehensively identified and explored the specific challenges faced by Indonesia in integrating digital innovations in both sectors, especially in remote areas and in the context of low digital literacy. Previous studies have often focused on technical or theoretical aspects without considering the structural and socio-cultural barriers that hinder technology adoption. Therefore, this study fills this gap by analyzing practical barriers and proposing locally relevant solutions to advance technology integration in education and government. This research is also important to strengthen the understanding of how technology can improve education governance and systems, which directly impact the country's social and economic development. This study aims to identify the key challenges in integrating digital technology in education and e-government in Indonesia.

2. METHODS

This study uses a qualitative method with a literature study approach (library research). The type of research used is descriptive-analytical, which aims to describe the challenges and provide in-depth insights into the challenges in implementing digital-based educational technology in e-government. Data sources in this study consist of primary and secondary sources. Primary sources include journal articles indexed by Scopus, SINTA, and Google Scholar (Google Scholar) that discuss digital innovation, digital education, e-government, and the application of technology in the government and education sectors. Data collection was carried out with systematic steps, namely: (1) identifying relevant keywords

such as "digital innovation," "educational technology," "e-government," and "digital transformation"; (2) selecting sources from leading academic databases such as Scopus, SINTA, and Google Scholar; (3) evaluating the credibility and relevance of the literature based on recency, relevance to the Indonesian context, and citation level; and (4) grouping sources based on the main themes that contribute to the research analysis. Data analysis uses a thematic analysis approach. Content analysis was conducted by examining patterns, trends, and key findings from various sources related to the implementation of educational technology in e-government. Thematic analysis was used to group information into key themes, such as infrastructure challenges, regulations, digital literacy, and strategic solutions. This approach allows the study to comprehensively describe the relationship between digital innovation, education, and e-government effectiveness.

3. FINDINGS AND DISCUSSIONS

Findings

Challenges in Integrating Digital Innovation Strategies in Educational Technology to Enhance E-Government Implementation in Indonesia

Indonesia faces various challenges in integrating digital innovation strategies into educational technology to improve the implementation of e-government and the quality of public services. Although digital technology has become urgent, various obstacles remain, especially in the education and government sectors. One of the main issues is the digital divide, which is still clearly visible. Data from the Ministry of Education, Culture, Research, and Technology (*Kemendikbud*) noted that as many as 48 thousand schools have poor internet connections. Even more concerning, there are around 12 thousand schools in the outermost, disadvantaged, and frontier (3T) areas without internet access (Arifai et al., 2021). This inequality is even more apparent when compared to schools in urban areas with better technological infrastructure and more adequate access to digital devices (Subroto et al., 2023).

Another major challenge is the imbalance in the provision of technology infrastructure (Hasanah et al., 2024; Richardo Sibarani et al., 2023). In many remote areas, stable internet access is still a rarity. This limitation not only hampers technology-based learning activities but also affects the efficiency of educational administration. For example, implementing digital student data management technology becomes difficult without adequate infrastructure. This limitation is a significant obstacle to improving the efficiency of educational management, especially in areas with minimal access.

In addition to infrastructure issues, digital literacy is also a crucial challenge. Many educators and students still do not have adequate skills to utilize technology optimally. Based on research, as many as 40% of teachers and education personnel face infrastructure limitations in areas with limited internet access. In addition, 40% of teachers feel less confident utilizing technology for learning and management activities (Harianto, 2024). This indicates the need for additional training to improve their digital competencies.

However, this problem does not stop in the education sector. In implementing e-government, the government's unpreparedness is a major challenge. One of the causes is the absence of a clear master plan as a reference in developing national e-government. This has caused various government application services, both Government-to-Government (G2G), Government-to-Business (G2B), Government-to-Citizen (G2C), and Government-to-Employee (G2E), to not be well integrated. A concrete example is the SiMaya application, where disposition can be done online, but other processes, such as submitting assignment letters, still require manual documents that take time. This problem shows that many e-government applications in Indonesia are still partially digital, resulting in less than optimal public service efficiency (Nugroho & Purbokusumo, 2020).

The limited competent human resources also exacerbate the unpreparedness in implementing e-government. A lack of adequate personnel or experts often hampers special units operating and maintaining e-government infrastructure. In addition, the low digital literacy of the community is also a major challenge. Various studies show that digital literacy in Indonesia is still low (Candrasari & Claretta, 2020; Sari et al., 2021). This impacts the less-than-optimal utilization of technology-based public services by the wider community.

The budget is also an issue that is no less important. Although the allocation of the education budget has been set at 20% of the APBN, not all of it has been allocated to improve the quality of education through technology. Most funds are still used for other needs, so investment in educational technology infrastructure is not optimal (Mongan, 2019). This causes the digital divide to be an unresolved problem still. Not only that, the problem of resistance to change is also a major obstacle. Many teachers are reluctant to adopt new technologies, even though these technologies can help improve the quality of learning (Noegroho & Zahra, 2024). This kind of attitude is often caused by a lack of understanding of the benefits of technology, low self-confidence, or even mental unpreparedness to switch from conventional learning methods to digital-based methods.

These challenges create a series of interrelated problems, thus hampering the integration of digital innovation strategies in education and government. In fact, with proper implementation, digital technology can be a very effective tool to improve efficiency, transparency, and quality of public services. Real steps are needed to overcome these problems. The government must immediately design a clear master plan for technology integration in the education and e-government sectors. In addition, significant investment must be made to improve technology infrastructure in remote areas. Training and mentoring for teachers, ASN, and the general public are also needed to improve digital literacy. With collaborative efforts from various parties, the challenges in integrating digital innovation strategies can be overcome so Indonesia can move towards an inclusive and quality digital era.

Integration of Digital Innovation Strategy in Educational Technology to Improve E-Government Implementation and Public Service Quality

Integrating digital innovation in the education and e-government sectors is a major challenge facing Indonesia. Various factors, such as infrastructure inequality, low digital literacy, and resistance to change, are the main obstacles to achieving optimal digital transformation. Various theories from prominent figures provide useful perspectives to analyze this situation. These theories can help us understand how digital technology can function as a driver of change but also show the challenges that must be faced for this change to be achieved.

Joseph Schumpeter is known for the Innovation and Creative Destruction concept, which explains how technological innovation can destroy and replace old systems with new, more efficient ones (Jackson, 2021). In the Indonesian context, the application of technology in education and e-government is in line with this idea, where traditional systems that rely on manual processes are starting to be replaced by digitalization. Data shows that there are efforts to improve technological infrastructure in education and government, but resistance to change is still a major problem. As noted in the study, many teachers feel less confident using technology for learning (Harianto, 2024), and some government officials also showed resistance to new e-government applications. This reflects Schumpeter's theory that innovation often faces resistance from old systems that are structured and accustomed to traditional ways. For these digital innovations to succeed, deep systemic change is needed, but it must be balanced with strategies to overcome this resistance.

Clayton M. Christensen's Disruptive Innovation Theory explains how initially considered simple or unattractive innovations can displace more established models in revolutionary ways (Christensen & Dillon, 2020; Shukla, nd). Digital technology in Indonesia, as seen from the government and schools' efforts to adopt technology, has the potential to be a disruptive innovation that can improve inequality in education and government services. However, major challenges remain, especially related to

infrastructure in remote areas and low digital literacy. Based on data, despite initiatives to implement technology in education and e-government, limited internet access and low ability to utilize technology hinder the full potential of this innovation (Arifai et al., 2021; Subroto et al., 2023). As Christensen explains, disruptive innovation requires enabling conditions, including more equitable access and better competencies, to successfully create major change.

In his concept of The Network Society, Manuel Castells emphasizes that modern society relies on network technology to manage information and create social connectedness (Castells, 2023). The implementation of e-government and educational technology in Indonesia is very much in line with this concept, where technology is at the center of social and political transformation. However, existing data shows that the striking digital divide between urban and remote areas prevents Indonesia from fully transforming into an inclusive networked society. Schools in 3T areas that do not have internet access and minimal technological infrastructure (Arifai et al., 2021). Reflects the main challenges in building a connected digital society. Castells explained the importance of equitable access to network infrastructure to create an inclusive and connected society, which is still a major challenge in Indonesia.

Marc Prensky introduced the concept of Digital Natives and Digital Immigrants, distinguishing between generations born in the digital era and those who have had to adapt to technology (Mandasari & Anggraini, 2021; Rahmah et al., 2025; Tayo et al., 2021). In Indonesia, most students fall into the category of digital natives, who naturally adapt faster to technology. On the other hand, many teachers in Indonesia fall into the category of digital immigrants, facing difficulties in using technology. Data shows that around 40% of teachers feel less confident using technology for learning activities (Harianto, 2024). This suggests that to integrate technology into education effectively, there needs to be intensive training and ongoing support for teaching staff to transform into digital natives in the context of educational technology.

In his draft Post-Industrial Society, Daniel Bell explains that modern society is shifting from an industrial-based economy to a knowledge- and information-based economy (Zakaria & Buaben, 2021). This is very relevant to developing e-government and educational technology in Indonesia, where technology is key to improving the quality of public services and education. However, data shows that Indonesia is still in the early stages of this transition, where unpreparedness of infrastructure and low human resource capacity are the main obstacles to accelerating this transition (Nugroho & Purbokusumo, 2020). Although there have been efforts to shift to an information-based society, this condition shows that major challenges in improving infrastructure and increasing digital literacy must be addressed immediately to accelerate the transition to a post-industrial society.

Peter Drucker's Knowledge Economy draft emphasizes the importance of knowledge as a key resource in the modern economy (Lewaherilla et al., 2021). The development of educational technology and e-government in Indonesia should reflect the need to manage knowledge efficiently in the public sector. However, data shows that Indonesia still faces low digital literacy, which causes ineffective knowledge management. Many educators and government employees have not been able to utilize technology optimally, indicating that Indonesia needs to improve training and knowledge management to utilize technology to improve the efficiency of public services and education (Candrasari & Claretta, 2020; Sari et al., 2021).

The constructivist learning theory proposed by Piaget and Vygotsky emphasizes the importance of active and collaborative learning (Arafah et al., 2023; Fathoni, 2023). Digital technology can support this approach by enabling project-based learning and distance collaboration. However, data shows that the use of technology in learning is still not optimal in many schools in Indonesia. According to constructivism theory, technology-based learning can be a solution to increase the effectiveness of learning, especially in areas that are underserved by technology (Subroto et al., 2023).

In his theory of Change Management, John Kotter shows that major changes require systematic and strategic management (Dounia, 2024; Greenway, 2021). This is particularly relevant to the situation

in Indonesia, where many teachers and civil servants resist change, both in terms of accepting new technologies and changing working methods. Data on teachers' lack of confidence and limited technological infrastructure suggest that change will not be achieved without a sound change management strategy (Harianto, 2024). Managing change effectively is key to integrating technology in the education and government sectors. Richard Heeks' E-Government for Development Theory highlights the importance of implementing e-government in developing countries by considering local challenges, such as low infrastructure and digital literacy. Data in Indonesia shows that limited infrastructure and low digital literacy are the main obstacles to implementing e-government (Nugroho & Purbokusumo, 2020). This is very relevant to the local context of Indonesia, where the implementation of e-government must be adjusted to existing conditions.

Finally, Hofstede's cultural dimensions theory suggests cultural factors can influence technological resistance (Novianti & Cahayani, 2022; Sahar & Kurniawan, 2020). In Indonesia, resistance to adopting new technologies, especially in the education and government sectors, is often influenced by cultural factors, such as old habits and uncertainty about change. This supports Hofstede's theory that identifies cultural barriers as an important factor in technology adoption in society.

Discussion

Indonesia currently faces several challenges in integrating digital technology to improve the implementation of e-government and the quality of public services, especially in the education sector. Some of the main challenges faced include The digital divide between urban and rural areas remains a significant problem. Many remote, disadvantaged, and frontier (3T) areas do not yet have adequate internet access, hampering the use of technology in education and government services. The level of digital literacy among teachers, students, and the general public is still low. Many educators do not yet have adequate digital skills to integrate technology into the learning process, and the general public often finds it difficult to utilize e-government services effectively. Some educators and government employees resist using technology in their work, often due to a lack of understanding of the benefits of technology or a fear of change. The lack of a comprehensive master plan for technology integration in e-government has resulted in fragmented and ineffective implementation. This has resulted in many government digital programs not running optimally.

The digital divide is one of the main challenges in implementing e-government and improving the quality of education services in Indonesia. Research by Alexander Kennedy et al. (2024) highlighted that limited internet access in remote areas hampers the use of technology in government administration and the education system (Kennedy et al., 2024). Although internet access is relatively stable in urban areas and digital infrastructure is more developed, the outermost, disadvantaged, and frontier (3T) areas still experience limited access. This creates a significant gap in the use of technology between urban and rural communities. As a result, digital services that should facilitate access to information and educational administration cannot be accessed equally by all levels of society. This inequality is further exacerbated by geographical factors that make it difficult to provide digital infrastructure widely and evenly. Therefore, without serious intervention from the government and the private sector, this digital divide will continue to hamper the development of e-government and the quality of education in Indonesia.

In addition to the limitations of digital infrastructure, low digital literacy among educators and students is another obstacle to implementing technology in the education sector. A study published by Hazizah (2024) shows that many schools still have limitations in ownership of electronic devices and internet access (Hazizah et al., 2024). This condition has implications for low digital literacy among students and teachers, ultimately impacting the effectiveness of technology-based learning. Students and teachers, as the main agents in the learning process, also experience difficulties operating information and communication technology (ICT) devices. Another study found that teachers aged 20-58 years face challenges in adopting new technologies in the learning process (Richardo Sibarani et al.,

2023). These barriers not only stem from a lack of technical skills but also from psychological factors such as fear of change and reluctance to learn new technologies. Therefore, comprehensive and ongoing digital literacy training is needed for educators and the provision of technology facilities in schools to address the digital literacy gap effectively.

Another challenge in integrating technology for e-government and education is the lack of a comprehensive master plan for implementing digital technology. A study published in the Wahana Pendidikan Scientific Journal (2024) highlighted that weak regulations and a lack of e-government implementation guidelines are major obstacles to optimizing technology-based services. Many government digital programs are fragmented and ineffective due to the absence of clear and integrated policies in the digital sector's infrastructure and human resources development. In addition, research published in other studies shows that geographical conditions, socio-economic conditions of the community, and the lack of participation from the government and private sector in information and communication technology education are further exacerbating the digital divide in Indonesia (Richardo Sibarani et al., 2023; Riset & Brin, 2022; Sutopo et al., 2022; Yazid & Karmila, 2024). Without systematic planning, technology integration in public services and education will not run optimally. Therefore, the government needs to formulate strategic and comprehensive policies for developing digital technology, ensure adequate infrastructure, and improve the community's digital literacy so that the benefits of e-government and digitalization of education can be felt evenly throughout Indonesia.

4. CONCLUSION

Challenges to Integrating Digital Innovation Strategy in Educational Technology to Improve E-Government Implementation include Uneven technological infrastructure, low digital literacy, resistance to adopting new technology, and lack of planning are the main obstacles that must be overcome. The digital divide, especially in the 3T areas, exacerbates the inequality of access to technology-based education and public services. In addition, the unpreparedness of the community and government employees in using digital technology hinders this transformation process. Several potential solutions can be implemented to overcome these challenges, including building internet infrastructure in remote areas, intensive training to improve digital literacy, preparing a national master plan for technology integration, and launching a public awareness campaign about technology. Hopefully, these solutions can accelerate the transition to an inclusive digital era and improve the efficiency and quality of public services. With collaboration between the government, education sector, and society, Indonesia has the potential to overcome these obstacles and utilize digital technology as a tool to improve the quality of social and economic life.

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