

DIGITAL TRANSFORMATION IN EDUCATION: A PESTEL ANALYSIS-BASED LITERATURE REVIEW IN CREATING A COMPETITIVE ADVANTAGE

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ABSTRACT

The demand to create globally competitive human resources with a competitive advantage has become an urgent need for every country. In the era of digital transformation, superior and competitive human resources serve as the most crucial foundation for the sustainability of a nation, both developed and developing countries like Indonesia. The purpose of this study is to observe, study, understand, and explain various external factors that influence the digital transformation process in education, in an effort to create adaptive, superior, and competitive human resources in today's rapid and fast-paced technological developments. This study utilizes a qualitative method with a PESTEL analysis and descriptive analytical approach to explore these matters. The secondary data used in this study is sourced from journals published within the last 5 years, educational institution publications, scientific articles, and other relevant documents. The results of this study indicate that PESTEL analysis is a technique capable of describing the impact of educational digital transformation on opportunities to create superior and competitive human resources in the future through the implementation of relevant digital technologies. Through this analysis, all macro factors influencing educational digital transformation policies—ranging from political, economic, social, technological, environmental, to legal—are analyzed to illustrate their connection to educational measures in efforts to improve student quality in order to create a competitive advantage in the world of education.

Keywords: Educational Digital Transformation, External factors, PESTEL Analysis

A. Introduction

The rapid and accelerating pace of technological change has compelled every organization, both educational and non-educational, to transform from conventional systems to digitalized ones. In today's fast-evolving technological era, digital transformation is no longer a mere alternative choice; it has become a primary necessity for organizations to confront global demands and competition. Digital disruption has profoundly transformed conventional organizations, impacting not only technological aspects but also altering organizational structures, cultures, and service models. The

adaptation of big data, artificial intelligence (AI), and digital collaboration platforms has driven a shift from hierarchical structures to flatter, network-based organizational models (Akbar & Pelitabangsa, 2025). As a subset of organizations, educational institutions are particularly affected by these technological shifts when formulating strategic policies to achieve superior and competitive educational services. The accelerated utilization of information and communication technology has reshaped the landscape of learning, school management, and interaction patterns among educational stakeholders. The demand for

adaptation to maintain relevance and create a sustainable competitive advantage amid increasingly fierce global competition is now non-negotiable.

On the other hand, digital transformation presents complex challenges, particularly at the implementation level within educational organizations. On one side, technological advancements offer significant opportunities for service development, such as administrative automation, personalized learning experiences, and strengthened student monitoring systems. However, on the flip side, digitalization in schools frequently collides with religious and cultural resistance, the risk of digital distractions on students' morals and character, and infrastructure limitations that require substantial financial investment (Fentyrina & Mardi, 2025).

To map out the complexities of the issues they will face, boarding school management must adopt a comprehensive perspective. They should not only focus on internal technological readiness but also conduct a thorough macro-analysis to examine and map out external opportunities and threats. In the context of strategic management, a PESTEL (Political, Economic, Social, Technological, Environmental, and Legal) analysis serves as a highly relevant and vital instrument for this purpose. Through this approach, boarding schools are expected to analyze deeply the government's political regulations regarding the vision and mission of digital education, micro- and macro-economic conditions, societal cultural shifts, technological developments, environmental factors, and legal regulations, including personal data protection for students. If managed effectively, all these factors will influence the success of schools as

educational institutions in executing a positive digital transformation to foster a distinct competitive advantage.

The role of digitalization has proven effective in enhancing the quality of education. In their research, Wiji and Titik Haryati stated that digitalization can improve learning quality and develop students' essential skills—namely creativity, communication, critical thinking, and collaboration (Sutarsih & Haryati, 2024). Previous studies have largely focused on digital pedagogy in regular classrooms or the partial adoption of Learning Management System (LMS) platforms. Consequently, a conceptual gap remains regarding how these external macro-factors collectively influence the entire ecosystem of a school as an educational institution in generating a sustainable competitive advantage.

In an effort to bridge this gap, this scientific paper aims to present a comprehensive overview of the digital transformation process in boarding schools through a PESTEL analysis. By synthesizing various academic literatures, this paper is expected to provide a strategic roadmap for stakeholders, school administrators, and policymakers in formulating targeted digitalization strategies. Ultimately, it is anticipated that a mature and adaptive integration of technology will bring about a school transformation that is superior, effective, efficient, and highly competitive, thereby fostering a sustainable competitive edge in this current era of digital disruption.

B. Method

The method employed in this scientific paper is a literature review using a qualitative PESTEL (Political, Economic, Social, Technological, Environmental, and Legal) analysis

approach. The qualitative approach was selected because the factors within the PESTEL framework are inherently qualitative in structure, requiring a deep understanding and interpretation of various phenomena that influence the implementation of educational policies in today's era of massive digital transformation.

This study began by gathering data through literature studies and secondary data analysis to understand the various factors underlying why an educational institution must undergo digital transformation, particularly those adopting a boarding system. Qualitative research allows researchers to study phenomena deeply within their natural context and interpret them in accordance with the meanings directly attributed by society to these phenomena.

In this study, data were collected through literature studies and secondary data analysis to examine the diverse factors influencing the digital transformation process in education. The literature study includes an analysis of various academic sources such as journals, books, and research reports relevant to technology-based educational policy. The researcher gathered data from scientific articles, educational institution publications, government policy progress reports, and other official documents to obtain a comprehensive description of the situation under study. Secondary data were obtained from policy documents, reports, statistics, and historical data available from various educational and government institutions. Analysing all these documents helps the researcher understand the prevailing context, as well as the challenges and opportunities associated with the technological transformation process in boarding schools.

The acquired data were analyzed using thematic analysis, whereby the main themes related to each PESTEL factor were identified and explored in a detailed and profound manner. This process involved data coding and efforts to identify patterns of interconnectedness among the various PESTEL factors. This analysis provides a simultaneous description that enables the researcher to understand how political, economic, social, technological, environmental, and legal factors influence policies regarding this digital transformation process. Data interpretation was conducted to comprehend the underlying meaning of the observed phenomena, as well as the relationship between different PESTEL factors and their impact on the implementation of digital transformation within the scope of policy.

Data triangulation was implemented as a step to ensure the validity and reliability of the research findings. By comparing and verifying information from various sources, such as literature studies and secondary documents, the researcher obtained a holistic, more comprehensive, and accurate overview of the actual situation being studied. The results of this study will be utilized to formulate comprehensive and sustainable policy recommendations, taking into account the PESTEL factors and how they can be integrated to support the digital transformation process in boarding schools to create a competitive advantage.

The qualitative approach in this study offers the advantage of providing a deep and contextual understanding of complex phenomena. With its inherent flexibility, this method allows the researcher to broadly explore the dynamics that necessitate an educational institution to undergo digital transformation in this era.

Consequently, the findings of this study can serve as a reference for consideration as well as relevant, applicable recommendations to accelerate the policy-making process for digital transformation in the world of education.

C. Results And Discussion

The Influence of Government Policy and Educational Political Systems on the Digital Transformation Process in Education

Political power plays a highly critical role in determining the vision, mission, direction, and priorities of national education policy in Indonesia. In Indonesia, which belongs to the cluster of developing nations, education functions not only as a means to intellectually elevate the nation but also as a strategic political instrument to maintain legitimacy and shape state ideology. During the Old Order era, education was directed toward fostering nationalistic and anti-imperialistic spirits aligned with the revolutionary fervor. Conversely, during the New Order era, education was utilized as a tool to perpetuate political stability and instill the sole ideology of Pancasila through the *P4* program (Guidelines for the Instillation and Implementation of Pancasila) and a centralized curriculum under direct state control. In the Reformation era, the paradigm of power in education underwent a shift alongside the implementation of regional autonomy and educational decentralization via Law Number 22 of 1999 and Law Number 20 of 2003 concerning the National Education System. Political power, through Article 31 paragraph (4) of the 1945 Constitution, mandates that a minimum of 20% of the State Budget (APBN) must be allocated to education. Political power in Indonesia profoundly

influences national education policy across various dimensions, ranging from curriculum determination, budget allocation, and bureaucratic structures to the formation of ideological discourse within education (Sari, Husaini, & Partner, 2025).

In today's digital era, the government is compelled to provide an educational system capable of supporting technological transformation, which must also be accompanied by the improvement of human resource quality. Consequently, educational policies must be able to balance political interests with continuously evolving educational needs. The digital transformation of education offers significant opportunities for the creation of a more modern, flexible, and innovative learning system. The utilization of technology through online learning platforms, artificial intelligence (AI), and educational information systems enables a more effective and efficient learning process. Technology transformation policies also assist the government in designing data-driven strategic policies, allowing for more accurate decision-making. The presence of digital technology ensures that education is no longer confined by space and time, enabling broader implementation to reach diverse communities across various regions. Digital transformation also plays a strategic role in driving more adaptive and inclusive educational policies. Technology allows students from various backgrounds to gain broader educational access without being restricted by geographical conditions. Digital-based educational policies can also help create a more personalized learning system tailored to the needs and capabilities of individual students (Rahmadani et al., 2026).

Accordingly, changes in the political direction of education are an absolute inevitability that the government must undertake to align with the changing conditions of a society that is realistically transforming due to the rapid advancement of technology. Through technological transformation, the learning process is no longer restricted to physical classrooms and school buildings. Instead, learning must be designed as a medium for students to engage in broader exploration through technology-based learning spaces that offer limitless access across space and time. Therefore, an educational system based on digital transformation stands as a viable political-educational policy alternative expected to address these challenges. The "Digital Classroom" initiative can serve as one of the national programs launched to stimulate and initiate the transformation of the educational system in this current era of digital transformation.

The Influence of Economic Conditions and Educational Budgets

The legal foundation of educational budget policy in Indonesia is comprehensively regulated under Article 31, Paragraph (4) of the 1945 Constitution, which mandates the state to prioritize at least 20% of both the State Revenue and Expenditure Budget (APBN) and the Regional Revenue and Expenditure Budget (APBD) for education. This provision is further interpreted in greater detail in Law No. 20 of 2003 concerning the National Education System (Article 49, Paragraph 1), which emphasizes a minimum allocation of 20% excluding educators' salaries. This principle is reinforced by Law No. 17 of 2003 concerning State Finances, which requires educational budgeting to be

included in state expenditure priorities, as well as Law No. 33 of 2004 concerning the Fiscal Balance Between the Central Government and Regional Governments, which regulates transfer fund mechanisms, including the Educational Special Allocation Fund (DAK) and the General Allocation Fund (DAU) to support equitable educational services across regions. Furthermore, Law No. 23 of 2014 concerning Regional Government asserts that primary and secondary education are mandatory regional affairs with a minimum funding requirement of 20% from the APBD. Further technical provisions are regulated in Government Regulation (PP) No. 18 of 2022 concerning Educational Funding, which emphasizes the effectiveness, efficiency, and control of budget utilization, as well as Regulations of the Minister of Finance (PMK) that govern the technical execution of the educational budget (Purwaningsih, 2026).

On the other hand, within the global context, digital transformation and the growth of a knowledge-based economy compel a nation to possess an adaptive and responsive educational system. Shifting economic structures also drive nations to conduct more holistic educational reforms, including curriculum redesign, strengthening teacher competencies, and adjusting learning methods. In this regard, Indonesia as a developing nation faces challenges, particularly regional disparities in educational quality, low digital literacy, and a gap between graduate competencies and industry needs. When compared to developed countries like Finland, Japan, and South Korea, Indonesia still lags in various educational indicators, especially regarding teacher quality, the effectiveness of learning evaluation, and curriculum alignment with modern

economic demands. Developed nations have successfully proven that quality education is the foundation of economic success. Finland, for example, has driven economic growth through the equitable distribution of educational services, teacher professionalism, and a competency-based curriculum that fosters creativity and problem-solving. Japan and South Korea have taken the strategy of strengthening the relationship between education and the industrial sector through STEM learning, applied research, and technology integration in schools. This demonstrates that an educational system relevant to economic needs can accelerate innovation and enhance competitiveness. Digital transformation in education has become a strategic factor in economic development because it supports digital literacy and technological skills. Indonesia has developed the *Merdeka Mengajar* platform, *Rumah Belajar*, and various digital literacy programs in an effort to realize digital transformation when confronting these challenges. The digital transformation process implemented has proven to increase educational access and strengthen 21st-century competencies, despite the remaining significant infrastructure barriers, particularly in frontier, outermost, and remote (3T) regions. Estonia, a country with the best digital education system in the world, demonstrates that full technology integration within its educational system can produce a competent digital workforce, which in turn boosts technology-based economic growth (B et al., 2025).

Through the budget allocated by the state—amounting to 20% of the APBN and APBD as stipulated by law—and accompanied by these structural changes in economic policy, a sense of optimism must be fostered that

educational change toward a better direction is an achievable inevitability. With the condition that this large budget and supporting economic policies must be capable of generating an equitable digital transformation in education that can be felt by all regions and territories in Indonesia. Infrastructure development to support this must be backed by a well-planned and transparent budget allocation, including improving the quality of educational human resources, developing digital learning platforms, digitalizing educational evaluation, and expanding communication access. If this is achieved, education will produce a generation capable of answering the challenges of rapid technological change and cultivate students who are creative, innovative, collaborative, adaptive, and competitive.

Perspectives and Attitudes of Society, Teachers, and Students toward Digital Transformation in Education

Support from society, educators, lecturers, and educational practitioners exerts a major influence on the adoption and effectiveness of digital transformation in education. South Korean society has demonstrated that support for technological digital transformation in education can accelerate technology adoption within learning enhancement spaces. The Korea Education and Research Information Service (KERIS, 2019) indicated that 95% of teachers and students in South Korea hold a positive attitude toward the use of technology in the learning process, which has successfully increased student engagement and learning outcomes (Anjani et al., 2024).

On the other hand, despite offering numerous benefits,

technological digital transformation also carries social and psychological risks. Excessive digital exposure among children and adolescents poses risks of addiction, stress, social isolation, and attention disorders. Therefore, digital ethics, cyber awareness, and the cultivation of a balance between technology utilization and real-world social interaction have become primary factors in safeguarding the mental health of the younger generation in society. Accordingly, it is anticipated that strengthening digital literacy will not only enhance technical capabilities but also support psychological well-being and the quality of social relationships (Jurnal et al., 2026).

The digital literacy of Indonesian society remains limited. Survey results from the Indonesian Internet Service Providers Association (APJII) from 2019 to the first quarter of 2020 revealed that the number of internet users in Indonesia reached 196.7 million people, or 73.7% by the second quarter of 2020. This figure marks a 64.8% increase compared to 2018. However, this growth in internet users stands in direct contrast to the national digital literacy index, which remains relatively low. Furthermore, according to a survey conducted by the Ministry of Communication and Informatics (Kemenkominfo) and the Katadata Insight Center (KIC), digital literacy in Indonesia currently stands at a score of 3.47 out of 5, which has yet to reach an optimal level. Consequently, based on these data, the digital literacy of the Indonesian public is still considered fairly low. This presents both a challenge and an opportunity for Indonesia to accelerate the pace of digital transformation through strategic implementation, human resource development, and collaboration among society, educators, and the government

to build infrastructures that support this digital literacy (Wahidin & Wati, 2024).

Strong digital literacy has proven to play a significant role in enhancing various aspects of students' technological competence. Students learn to understand how technological devices and applications operate to support the learning process. Critical thinking skills develop alongside improvements in digital literacy, digital security, and digital ethics. Moreover, collaboration skills, creativity, and the development of digital communication abilities further reinforce their competencies in facing an increasingly complex and technology-driven future. The integration of digital literacy serves as a vital investment that will support the readiness of the younger generation to adapt and contribute positively to an increasingly digitalized educational landscape (Devi & Winangun, 2024).

Technology Integration in the Digital Transformation of Education

Technology integration in the digital transformation of education through a technology-integrated curriculum exerts a significant impact on enhancing the accessibility, flexibility, and effectiveness of the teaching and learning process. Research findings indicate that technology enables more interactive, adaptive, and personalized learning experiences through the availability of engaging digital learning tools and efficient evaluation methods. Students can access learning with greater scheduling flexibility, while teachers can provide timely feedback and advance educational services through data-driven instructional strategies based on student performance analysis (Judijanto et al., 2025).

Digital transformation through technology has generated and

reinforced various creative and innovative learning models, including:

- **Blended Learning**, a strategic instructional model that combines the advantages of face-to-face learning with the flexibility of online learning.
- **Digital Project-Based Learning (PjBL)**, the use of digital technology to enrich instructional models by providing tools for research, collaboration, and digital product creation—such as the implementation of Canva-based learning in schools.
- **Gamification**, the application of game-design elements in non-game contexts to enhance motivation and active participation—for instance, the use of platforms like Quizizz and Kahoot for formative quizzes and exercises.

Furthermore, digital transformation enables the realization of adaptive technology, which is frequently powered by Artificial Intelligence (AI) to create unique, personalized learning pathways for individual students (Septio & Madhakomala, 2025).

Environmental Impact and Sustainable Educational Policies

One of the recently launched global educational agreements is the Education for Sustainable Development 2030 framework, which was established by the member states of the United Nations Educational, Scientific and Cultural Organization (UNESCO) in 2021. This framework outlines the priority areas and implementation guidelines for sustainable education in order to realize the Sustainable Development Goals (SDGs) by 2030. The curriculum, which serves as the central reference point for education, functions as a

fundamental instrument in embedding sustainable education within the system. Confronted by a changing world with concerning social and environmental shifts, the United Nations (UN) took strategic steps to formulate the SDGs. According to the United Nations Department of Economic and Social Affairs for Sustainable Development, the history of drafting the SDGs dates back to 1992 at the Earth Summit in Brazil. The event was attended by 178 countries, which subsequently adopted an action plan for sustainable development for human life and the environment known as Agenda 21. A subsequent meeting in 2000 resulted in the Millennium Development Goals (MDGs), which carried an agenda to reduce poverty by 2015. In 2002, Agenda 21 and the MDGs were further expanded with an emphasis on multilateral cooperation. Later, in 2012, UN member states adopted the document "The Future We Want," which laid the groundwork for developing the SDG proposal in 2013. Ultimately, in 2015, UN member states agreed upon the SDGs as a follow-up agenda to the 2015 MDGs (Khoirunnisa & Firmansyah, 2024).

One of the primary goals of the SDG agenda is Quality Education, which emphasizes the importance of ensuring inclusive, equitable, and quality education while promoting lifelong learning opportunities for all. Within the context of sustainable development, UNESCO promotes the application of the Education for Sustainable Development (ESD) concept, which aims to equip learners with the knowledge, skills, values, and attitudes that support sustainable development. ESD focuses not only on the mastery of academic knowledge but also on the development of critical thinking skills, environmental awareness, and social responsibility in

confronting various global challenges. Integrating sustainability values into the educational curriculum can raise environmental consciousness and drive societal behavioral shifts toward sustainable lifestyles. An educational approach integrated with sustainability issues in the learning process is capable of enhancing students' understanding of global challenges such as climate change and environmental degradation (Tanriani, Putera, & Nawawi, 2024).

The utilization of technology as a demand of modern advancements also carries environmental impacts that must be taken into account. The increased use of technology, which accelerates resource exploitation, energy consumption, and electronic waste (e-waste) generation, requires serious attention. Consequently, educational policies must also consider environmental sustainability by encouraging the utilization of eco-friendly digital technologies and fostering more effective recycling processes for electronic devices. Japan, as a country renowned for its rapid technological advancements, has implemented educational policies that oblige schools to use energy-efficient technology and recycle obsolete equipment. A report from the Ministry of Education, Culture, Sports, Science and Technology (MEXT, 2020) indicates that this initiative has successfully reduced electronic waste by up to 30% within the last five years. The implementation of green technology, such as energy-efficient computers and the utilization of renewable energy sources in schools, can effectively mitigate negative environmental impacts (Anjani et al., 2024).

Accordingly, a sustainable educational system will be capable of improving the quality of human

resources characterized by innovation and renewal in an effort to preserve life for future generations. Education is utilized as a vehicle to transform the human mindset from a pragmatic orientation toward immediate needs into a visionary outlook that cares about environmental changes, thereby leaving a positive environmental legacy for the sustainability of life itself.

The Legal Framework for Digital Transformation in Education

The digital transformation of education also exerts significant pressure on the legal domain to transform and keep pace with technological developments. Digital transformation has driven the legal system to accelerate bureaucratic processes, enhance transparency, and expand access to justice. Several emerging issues in this regard include personal data protection, cybercrime, digital copyright infringement, and ethical dilemmas surrounding the use of Artificial Intelligence (AI) technology. Slow regulatory responses will fail to provide adequate protection, whereas overly rushed regulation without deep, rigorous assessment poses a risk of stifling innovation. Therefore, the legal system in the digital era needs to be adaptive, proactive, and inclusive. In this context, education and law must share a close interconnection in shaping a healthy and sustainable digital ecosystem. While education must produce a technologically literate and legally aware society, the legal system must also be equitable and modern to support an educational process that is safe, inclusive, and accountable. Collaboration between educational policymakers and legal drafters will be the determining factor in formulating rules of the game that not only guarantee protection but also

foster innovation and creativity (Asriani et al., 2025).

D. Conclusions

The PESTEL approach is a macro-analytical framework that examines the digital transformation process in education deeply across political, economic, social, technological, environmental, and legal factors to provide a comprehensive and holistic overview in creating a competitive advantage. Digital transformation in education—when supported by clear political and statutory policies, adequate budgeting alongside supportive public economic conditions, well-planned technological infrastructure implementation, eco-friendly technology through the concept of sustainable education, and an equitable, accountable legal umbrella—will successfully drive innovation and creativity in this era of global competition.

An equitable digital transformation of education across all regions and territories enables the realization of superior human resources capable of answering future challenges. Technology provides limitless access, transcending space and time, and creates personalized educational services implemented within a digital education curriculum, which is expected to cultivate a generation that is adaptive, proactive, and inclusive.

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