

# Challenges and Opportunities in Education Financing in the Era of Digital Transformation

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## ABSTRACT

Digital transformation has significantly changed the education system, including in the aspect of financing, which is a key factor in improving the quality of and access to education. This study aims to analyze the challenges and opportunities of education financing in the era of digital transformation and to formulate an adaptive and sustainable conceptual model. The method used is a descriptive qualitative approach through a literature review, analyzing various scientific literature, policy reports, and related research findings from the past 5–10 years. The research findings indicate that the main challenges include the digital divide, limited education budgets, low digital literacy, and the complexity of digital system-based governance. On the other hand, digital transformation opens opportunities through the utilization of financial technology (fintech), digital platforms, and big data, which can enhance financial inclusion, budget efficiency, and transparency in the management of education funds. A synthesis of the findings indicates that digital transformation serves as a strategic mediator capable of converting challenges into opportunities through technological innovation and multi-stakeholder collaboration. Therefore, an integrative approach is required that combines adaptive policies, human resource capacity building, and the optimization of digital technology to create an inclusive, efficient, and sustainable education financing system in the digital era.

## 1. INTRODUCTION

Education financing is a fundamental pillar in ensuring the sustainability, equity, and quality of education systems. From the perspective of human capital theory, education is a strategic investment that contributes to the development of productive human resources, long-term economic growth, and national competitiveness. In this regard, education financing should not be understood merely as budget allocation, but as a strategic mechanism for ensuring equitable access, improving educational quality, and sustaining institutional performance. In Indonesia, education financing involves not only the government through public expenditure, but also households, private institutions, and non-state actors. This multi-source financing structure requires adaptive governance, particularly in response to structural changes brought about by digital transformation. Digital transformation has become one of the most significant structural shifts affecting contemporary education systems. The rapid development of digital technologies including artificial intelligence, big data, cloud computing, and digital platforms has transformed not only pedagogical practices but also institutional governance, administrative systems, and financial management in education. In the educational context, digital transformation has accelerated efficiency, flexibility, and accessibility in educational services, while also reshaping how educational institutions allocate, manage, and monitor financial resources. Recent studies

show that digital transformation has improved institutional efficiency and expanded educational access through technology-based systems, particularly in administration, learning management, and governance modernization (Fuadiy, Rozi, Arafah, Kamal, & Sunoko, 2025). In Indonesia, the acceleration of digital transformation in education became particularly visible after the COVID-19 pandemic, which forced educational institutions to rapidly adopt digital systems across teaching, administration, and financial operations. This shift has encouraged schools and higher education institutions to implement digital governance instruments such as e-budgeting, e-RKAS, and digital financial reporting systems. These instruments have demonstrated significant potential in improving transparency, accountability, and efficiency in education financing management. For example, the implementation of e-RKAS has been shown to strengthen school financial governance through more transparent and accountable planning and reporting mechanisms (Trimiltin & Ahmad, 2025). However, the adoption of these systems remains uneven and highly dependent on institutional readiness, technological infrastructure, and digital competency.

Despite its transformative potential, digital transformation has also generated substantial challenges in education financing. One of the most persistent challenges is the digital divide, reflected in unequal access to infrastructure, internet connectivity, digital devices, and digital literacy across regions and social groups. This inequality creates disparities in both access to educational services and the distribution of financial resources. Raihan et al. found that digital transformation in education often produces a paradox in which technology intended to democratize access instead deepens inequality due to structural disparities in access and capacity (Raihan, Ahmad, & Rochimah, 2025). Similarly, Basuki et al. emphasized that unequal digital infrastructure remains a major obstacle to inclusive digital education financing, particularly in underdeveloped regions. These findings indicate that education financing in the digital era is no longer limited to funding allocation, but also concerns technological equity and institutional inclusiveness. In addition to access inequality, education financing in the digital era is constrained by rising costs and institutional limitations. Although Indonesia mandates that at least 20% of the national budget be allocated to education, the expansion of digital systems has increased financial demands beyond conventional educational spending. Educational institutions are now required to invest not only in physical infrastructure, but also in digital infrastructure, cybersecurity, information systems, and digital capacity building. At the same time, low digital literacy among educators and administrators reduces the effectiveness of digital financial systems, while institutional limitations in governance and regulation create further inefficiencies. Existing studies confirm that digital transformation in education financing often faces obstacles related to budget limitations, governance complexity, and unequal institutional capacity, particularly in developing contexts (Susanto et al., 2025). Nevertheless, digital transformation also creates strategic opportunities to redesign education financing systems in more adaptive, efficient, and inclusive ways. The growth of financial technology (fintech), digital payment systems, crowdfunding platforms, and data-driven governance has opened alternative pathways for expanding financial access and improving budget efficiency in education. Digital innovation allows educational institutions to diversify financing sources, reduce administrative costs, improve resource allocation, and enhance financial transparency. Previous studies show that digital financial systems can improve accountability, optimize funding efficiency, and expand financial inclusion in educational institutions (Rusmiyati, Abdullah, Zulaikha, & Takdir, 2025). These developments suggest that digital transformation should not be viewed solely as a source of disruption, but also as an opportunity to construct more sustainable education financing models.

Previous studies have made important contributions to understanding digital transformation in education; however, most of them focus on digital learning, educational management, or

financial governance in fragmented ways. Some studies emphasize digital learning effectiveness, others discuss administrative digitalization, while several focus only on financial accountability tools such as e-RKAS. Few studies comprehensively examine how digital transformation simultaneously generates structural challenges and strategic opportunities in education financing, and fewer still propose an integrative conceptual model to synthesize both dimensions. The novelty of this study lies in its integrative analytical framework that positions digital transformation not merely as a technological shift, but as a strategic mediating variable linking structural financing challenges with innovative financing opportunities. Unlike previous studies that examine these issues separately, this study offers a comprehensive synthesis of challenges, opportunities, and adaptive financing strategies within a single conceptual framework. This study is significant both theoretically and practically. Theoretically, it contributes to the development of education financing discourse by extending conventional financing perspectives toward a more systemic and digitally adaptive framework. Practically, this study provides strategic insights for policymakers, educational institutions, and stakeholders in designing education financing systems that are more inclusive, transparent, efficient, and sustainable in the digital era. In this context, the urgency of this study lies in the need to formulate an adaptive financing model capable of responding to technological change while minimizing structural inequality in education systems. Based on this background, this study addresses three main research questions: (1) What are the main challenges faced in education financing in the era of digital transformation? (2) What strategic opportunities does digital transformation create for education financing? and (3) How can these challenges and opportunities be synthesized into an adaptive and sustainable education financing model? These questions guide the analysis presented in the results and discussion section.

## 2. METHODS

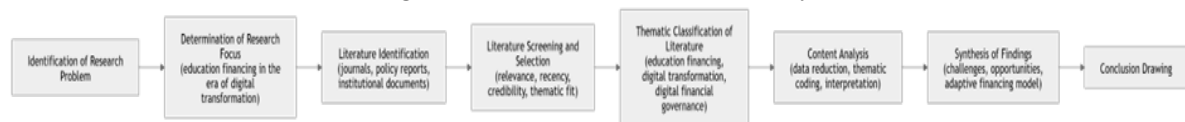
This study employed a qualitative approach with a library research design to examine the challenges and opportunities of education financing in the era of digital transformation. A qualitative approach was selected because it enables an in-depth and contextual understanding of complex educational phenomena, particularly those related to financing systems, institutional adaptation, and digital transformation. The study was conducted through a systematic literature review process to identify, evaluate, and synthesize relevant scholarly works published within the last 5–10 years. The literature selection focused on primary sources in the form of peer-reviewed journal articles, policy reports, and institutional publications directly related to three main themes: (1) education financing, (2) digital transformation in education, and (3) digital financial governance. To improve methodological transparency, the selected primary literature was grouped thematically based on the main analytical focus, as presented in Table 1.

Table 1. Primary Literature Classification Based on Analytical Themes

Theme	Focus of Literature	Representative References
Education Financing	Equity, allocation, efficiency, and sustainability of education funding	Mafazi & Ahmad (2024); Shofiyati & Shaleh (2024); Kamal et al. (2025)
Digital Transformation in Education	Digitalization of educational systems, access, and institutional adaptation	Lazwardi & Kurniawan (2025); Yaqin et al. (2026); Pratama et al. (2025)
Digital Financial Governance	E-budgeting, e-RKAS, transparency, and accountability in financial systems	Trimiltin & Ahmad (2025); Do et al. (2025); Ubihatun et al. (2024)

The data were collected through three stages: literature identification, literature screening, and thematic classification. In the identification stage, relevant literature was collected from scientific databases, indexed journals, and policy documents using keywords related to education financing, digital transformation, fintech, and educational governance. In the screening stage, sources were selected based on relevance, recency, credibility, and alignment with the research focus. In the classification stage, the selected literature was organized into thematic categories to facilitate systematic interpretation. The analytical procedure followed four sequential steps: (1) identification of relevant literature, (2) screening and selection of sources, (3) thematic coding and content classification, and (4) synthesis and interpretation of findings. These steps form the research flow presented in Figure 1. The data were analyzed using qualitative content analysis to identify recurring patterns, conceptual relationships, and dominant themes related to education financing in the digital era. The analysis followed three interconnected procedures: data reduction, data display, and conclusion drawing. Data reduction was conducted by selecting and focusing on literature directly relevant to the research questions. Data display involved organizing findings into thematic categories to compare challenges, opportunities, and strategic responses across studies. Finally, conclusion drawing was carried out inductively by synthesizing patterns across the literature to formulate an adaptive and sustainable conceptual model of education financing (Annasthasya, Alfindoria, Rahayu, & Khair, 2025). This analytical process ensured that the findings were systematically derived, conceptually grounded, and aligned with the research objectives.

Figure 1. Research Flow of the Study



### 3. RESULTS AND DISCUSSION

#### 3.1. Challenges in Education Financing in the Digital Era

Digital transformation in education does not automatically result in equitable access; rather, in many cases, it reinforces pre-existing inequalities. One of the main challenges in education financing in the digital era is the emergence of the digital divide, which creates disparities in access to technology and educational resources. This gap occurs not only between regions but also between socioeconomic groups. Research indicates that digital education transformation in Indonesia tends to reproduce social inequalities, particularly in regions with limited infrastructure and technology access. This suggests that education financing is not merely about budget allocation but also about the distribution of access to technology as an integral part of the modern education system (Yaqin, Nugraha, & Fadhillah, 2026). Disparities in education financing are also reflected in regional disparities influenced by fiscal capacity and local policies. These disparities result in uneven quality of educational services, particularly regarding the provision of digital facilities and learning technologies. A study on the education funding equity index in Indonesia indicates significant differences among provinces regarding the allocation and utilization of education budgets (Kamal, Ahmad, & Rochimah, 2025). In the context of digitalization, regions with low fiscal capacity tend to face limitations in investing in educational technology, thereby widening the quality gap in education across regions. The next challenge is the limited education budget that must be aligned with the demands of digital transformation. Although the government has allocated a minimum of 20% of the national budget (APBN) for education, funding needs continue to rise alongside the requirements for developing digital infrastructure, such as technological devices, internet networks, and educational information systems. Research indicates that education funding in Indonesia still faces various

challenges, including budget efficiency and transparency in fund management (Ananda, Pajriani, Rahmadani, Wahyuni, & Alamsah, 2025). Consequently, digital transformation adds complexity to the management of education funding, which was already grappling with various structural obstacles.

Budget constraints and low digital literacy also pose significant barriers to the optimization of technology-based education financing. Digital literacy is not only related to the ability to use technology but also encompasses an understanding of digital systems, data security, and the effective utilization of technology. Research indicates that there remains a digital competency gap among students and educators in Indonesia, which impacts the effectiveness of digital education implementation (Sjarief & Madyakusumawati, 2024). This situation highlights that investment in education financing must not be limited to infrastructure but must also include human resource capacity development. The implementation of digitalization in education financing also presents challenges in terms of governance and security. Digital-based financing systems such as e-budgeting and e-RKAS do offer transparency and accountability, but on the other hand, they also open up new potential risks such as data breaches, system errors, and misuse of technology. Studies on the digitalization of education financing governance indicate that while digital systems can enhance efficiency and transparency, their implementation still faces various technical and institutional challenges (Trimiltin & Ahmad, 2025). Therefore, system readiness, regulatory frameworks, and institutional capacity-building are necessary to ensure that digital transformation in education financing can proceed optimally and sustainably.

### **3.2. Opportunities in Education Financing in the Digital Era**

Digital transformation not only presents challenges but also opens strategic opportunities for developing a more inclusive and innovative education financing system. One of the key opportunities is the growth of financial technology (fintech), which enables the diversification of education financing sources beyond conventional schemes. Fintech platforms such as educational crowdfunding, digital-based loans, and electronic payment systems provide easier access for the public to obtain education financing. Research indicates that the development of fintech in Indonesia has enhanced financial inclusion and expanded public access to financial services, including within the education sector (Do, Ahmad, & Rochimah, 2025). This demonstrates that digital transformation can reduce barriers to accessing education financing, particularly for segments of the population previously excluded from the formal financial system. Digitalization also presents opportunities to improve the efficiency of education budget utilization. The use of technologies such as Learning Management Systems (LMS), online learning platforms, and digital administrative systems can significantly reduce educational operational costs. Funds previously allocated to physical needs such as classrooms, printed teaching materials, and manual administration can be redirected toward technology-based learning quality development. Studies indicate that the implementation of digital learning systems can enhance the efficiency and effectiveness of educational processes while optimizing the use of available resources (Lazwardi & Kurniawan, 2025). Thus, digitalization impacts not only the improvement of educational quality but also overall funding efficiency. Another opportunity lies in the opening of collaborative spaces among various stakeholders in education financing. The digital era enables integration between the government, the private sector, financial institutions, and digital platforms to create a more synergistic education financing ecosystem. This collaboration can take the form of partnerships in providing digital infrastructure, technology-based funding, and the development of industry-based education programs. Research indicates that multi-stakeholder collaboration within a digital ecosystem can enhance the effectiveness of resource management and expand access to educational services. This underscores that digital transformation opens opportunities to create more integrated and sustainable education financing models.

Digital transformation also drives the emergence of innovative and adaptive education financing models tailored to community needs. One model gaining traction is the income share agreement (ISA), where education costs are paid after students begin earning an income. Additionally, there is the subscription-based learning model, which enables access to education through a more flexible subscription system. These innovations offer lighter financing alternatives that align with the economic conditions of the community. Research indicates that digital-based business model innovations in education can enhance public access to and participation in higher education. Thus, digital transformation not only changes how learning occurs but also how education is funded. The use of digital technologies such as big data and artificial intelligence (AI) also presents opportunities for more effective and targeted management of education funding. These technologies enable more accurate data analysis in budget planning, the distribution of educational aid, and the evaluation of funding policies. With data-driven systems, governments and educational institutions can identify needs more specifically and allocate resources optimally. Studies indicate that the use of digital technology in education management can enhance the quality of decision-making and transparency in resource management (Ubihatun et al., 2024). Therefore, the integration of digital technology into education financing represents a strategic opportunity to create a more efficient, transparent, and equitable education system.

### 3.3. Synthesis of Challenges and Opportunities in Digital Financing Models

A synthesis of the challenges and opportunities in education financing in the era of digital transformation reveals a dialectical relationship that is mutually influential and inseparable. Challenges such as access gaps, budget constraints, and low digital literacy are fundamentally consequences of the system's unpreparedness to respond to rapid technological changes. However, on the other hand, the opportunities arising from digitalization actually provide space to address these various obstacles in a more innovative manner. Digital transformation in education acts as a mediating variable capable of linking structural limitations with the potential for developing a more adaptive financing system. Research indicates that the integration of digital technology into the education system can significantly enhance efficiency, accessibility, and the quality of educational services (Lazwardi & Kurniawan, 2025). Within a conceptual framework, education financing in the digital era can no longer be viewed as a linear system but rather as a dynamic system involving interactions between various internal and external factors. Internal factors include institutional capacity, education policies, and human resource readiness, while external factors encompass technological advancements, economic conditions, and the digital ecosystem. Digital transformation serves as the primary link integrating these two factors through the use of technologies such as fintech, big data, and digital platforms. Studies indicate that the use of digital technology in education management can enhance the effectiveness of governance and transparency in funding (Trimiltilin & Ahmad, 2025). Consequently, an adaptive education financing model must be able to accommodate this complexity through a systemic and technology-based approach.



Figure 2. Education Financing Model in the Era of Digital Transformation

Figure 2 illustrates that digital transformation serves as a strategic bridge connecting challenges and opportunities in education financing. Every emerging challenge, such as budget

constraints and access gaps, can be addressed through the appropriate use of digital technology (Kefi, Purba, & Daryanto, 2023). For example, budget constraints can be addressed through the efficiency of digital systems, while access gaps can be minimized through more inclusive online learning platforms. Research indicates that the use of digital technology in education can significantly expand access and enhance funding efficiency. This underscores that digital transformation is not merely disruptive but also solution-oriented in the context of education financing. The conceptual model proposed in this study emphasizes the importance of an integrative approach to managing education financing in the digital age. This approach combines technological innovation, adaptive policies, and human resource capacity building as the main pillars in creating a sustainable financing system. Digital transformation must be leveraged not merely as a tool but as a strategy in designing an education financing system responsive to the changing times. Studies indicate that the success of implementing digital transformation in education heavily depends on the synergy between technology, policy, and institutional readiness. Therefore, this synthesis of challenges and opportunities forms the foundation for formulating a more inclusive, efficient, and future-oriented education financing model.

#### 4. CONCLUSION

This study concludes that education financing in the era of digital transformation is shaped by a dynamic interaction between structural constraints and technological opportunities. In response to the first research question, the study finds that the main challenges in education financing include the digital divide, unequal access to technological infrastructure, limited education budgets, low digital literacy, and the complexity of digital-based financial governance. These challenges demonstrate that education financing in the digital era is no longer limited to budget provision, but also involves institutional readiness, technological equity, governance capacity, and the ability of educational actors to adapt to digital systems. Without adequate institutional preparedness, digital transformation risks reinforcing educational inequality and weakening the effectiveness of education financing systems. In response to the second research question, this study finds that digital transformation creates significant strategic opportunities for improving education financing systems. The development of financial technology (fintech), digital payment systems, crowdfunding platforms, and data-driven governance offers new possibilities for diversifying funding sources, improving financial inclusion, increasing budget efficiency, and strengthening transparency and accountability. Digital systems also enable educational institutions to reduce administrative costs, optimize resource allocation, and improve financial decision-making through more accurate and integrated data management. These findings confirm that digital transformation is not only a source of disruption, but also a strategic opportunity to redesign education financing in more innovative, inclusive, and efficient ways. In response to the third research question, this study proposes that the challenges and opportunities of digital transformation can be synthesized into an adaptive and sustainable education financing model through an integrative approach. This model positions digital transformation as a strategic mediating instrument that connects structural financing challenges with innovative financing opportunities. An adaptive education financing system in the digital era must therefore be built on three interconnected pillars: technological innovation, adaptive policy frameworks, and human resource capacity development. The integration of these three dimensions provides a more responsive and sustainable foundation for improving access, equity, efficiency, and quality in education financing. Therefore, the future of education financing depends not only on the availability of funds, but also on the capacity of education systems to govern digital transformation strategically and inclusively.

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