

Integration Of Technology In Internal Control: A Study Of Schools In The Digital Era

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Article Info

Article history:

Accepted: 10 January 2025

Publish: 15 January 2025

Keywords:

Internal Control

Educational Technology

Operational Efficiency

Cybersecurity

Schools

Abstract

In the digital era, educational institutions face new opportunities and challenges in internal control. This study examines the development of technology-based internal control systems in schools, aiming to enhance operational efficiency, accountability, and transparency. Using a qualitative approach, the study involves literature analysis and case studies from schools that have implemented internal control technologies. Findings indicate that technologies such as cloud-based systems, data analytics, and automation improve resource management and financial monitoring, and strengthen compliance. Major challenges include resistance to new technologies, high implementation costs, and cybersecurity risks. This article suggests strategies for policymakers and school administrators to design effective technology-based internal control frameworks. This research is expected to assist schools in optimizing internal management and enhancing standards of accountability and transparency.

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1. INTRODUCTION

Technological advancements in the digital era have been revolutionary in transforming the way organizations, including educational institutions, manage their internal processes. In this context, technology-based internal control is essential to ensure efficiency, transparency, and accountability. Traditional internal control systems—often reliant on manual processes—are not only time-consuming but also prone to human error and misuse (Munifah, 2023). Through the implementation of digital technologies, such as cloud-based systems, schools can significantly enhance asset, financial, and regulatory compliance management. For example, cloud-based systems facilitate real-time data management, enabling more transparent and accurate oversight of budget allocations or project execution.

As a concrete example of digital internal control implementation, the government has initiated a school digitalization program that includes the provision of ICT devices such as laptops, projectors, and network equipment (Government of Indonesia, 2021). This program is designed to support a digital-based education system and create infrastructure in line with the Merdeka Belajar vision. The presence of this digital infrastructure facilitates the implementation of technology-based internal control, particularly in financial and operational management, as described by Rahayu (2018). For illustration, taken from an article by Telkom University (2024), a Private Vocational High School in Sumedang has integrated the concept of internal control into its curriculum, especially in subjects

like financial literacy and entrepreneurship. This initiative not only teaches students about effective asset and financial management but also provides training for teachers to enhance their understanding of the importance of internal control in the business world. This demonstrates that digital internal control is evolving within the Indonesian educational environment, supporting the enhancement of transparency and management efficiency in schools.

At the international level, the use of blockchain technology in Singaporean schools provides another innovative example of digital internal control (Noor, 2020). In this context, blockchain is used to accurately record financial transactions and educational fund expenditures, enabling independent verification and unalterable data security. This technology not only enhances security but also ensures transparency by allowing every flow of funds to be tracked by authorized authorities. The potential of blockchain in developing countries can vary, depending on a number of factors that affect its implementation. On one hand, the industrial and commercial sectors view blockchain as a significant technological achievement. However, in developing countries, the main focus is more on the aspect of trust that can be built through blockchain technology (Underwood, 2016). The implementation of this blockchain technology also involves staff training and close cooperation with technology providers, ensuring that schools can optimally utilize this technology to enhance their financial and operational management.

These examples illustrate how digital internal control can be an effective solution for the complex management challenges of the modern era. These systems not only enhance operational efficiency but also strengthen the capacity of schools to meet societal expectations regarding transparency and accountability. Every organization, whether profit-oriented or non-profit, inevitably faces various risks in conducting its activities, regardless of the circumstances (Kumaat, 2011). Risk is a condition that can potentially hinder the execution of previously planned programs and activities, thus leading to the failure to achieve set objectives. Therefore, internal control no longer just focuses on existing facts but rather shifts towards a risk-based approach (Kumaat, 2011).

Implementing digital internal control with the right technology support is a strategic step to enhance the competitiveness and sustainability of educational institutions. However, many schools still rely on traditional internal control methods that are manual and less efficient. These limitations often result in higher risk of errors, lack of transparency, and potential misuse of resources. According to Deloitte (2020), the development and adoption of technology-based internal control systems have become an urgent need to improve effectiveness and efficiency in managing school resources.

This paper is designed to explore the development and implementation of technology-based internal control systems in school environments. Furthermore, it will discuss the benefits that can be achieved, the challenges that may be encountered, and strategic recommendations for the implementation of these systems. The goal is to provide comprehensive insights into how educational institutions can leverage technology to enhance the effectiveness of internal control, meeting the demands for transparency and accountability in the digital era.

The Internal Control System (ICS) is defined as a process designed and implemented by management, the board of directors, and other parties to provide sufficient assurance that the organization's objectives will be achieved. The primary objectives of the ICS include the reliability of financial reporting, compliance with laws and regulations, and the effectiveness and efficiency of operations. The Committee of Sponsoring Organizations of the Treadway Commission (COSO) describes internal control as a system consisting of five main elements: control environment, risk assessment, control activities, information and communication, and monitoring. All of these are designed to protect assets, ensure accurate financial reporting, and enhance operational efficiency (COSO, 2013).

Traditional ICS methods often rely on manual processes that are prone to errors and inefficiencies. However, with technological advancements, digital tools such as Enterprise Resource Planning (ERP) systems, cloud computing, and blockchain technology offer the potential to overcome these limitations (Deloitte, 2020; PwC, 2021). Existing literature reviews demonstrate the

adoption of these technologies in educational institutions and their impact on enhancing internal control processes.

The main components of Internal Control according to the COSO Framework include several critical elements. First, the Control Environment, which forms the foundation that shapes organizational culture including ethics, integrity, and effective leadership. Second, Risk Assessment involves the identification and analysis of risks that could impede the achievement of organizational goals, essential for planning control measures. Third, Control Activities consist of procedures and policies that ensure necessary actions are taken to manage risks, including authorization, reconciliation, and segregation of duties. Fourth, Information and Communication emphasize the importance of a system that guarantees the proper and timely flow of information, supporting control functions and decision-making. Finally, Monitoring involves an ongoing or periodic process to evaluate the performance quality of internal control over time, ensuring that all audit findings and inspections are addressed promptly. Effective use of these elements helps organizations achieve their goals by reducing operational risks and enhancing the reliability of financial reporting.

Sri Rahayu, Yudi, Rahayu, & Ridwan, M. (2018) state that the primary purpose of the Internal Control System (ICS) is to support organizations in effectively and efficiently achieving their strategic goals in compliance with applicable regulations. The main focus of the SPI is to ensure the reliability of financial reporting, which guarantees that the reports produced are accurate and free from material errors, thus trustworthy to stakeholders including investors and regulators. Additionally, the SPI is designed to enhance operational efficiency through optimal resource management and waste prevention, as well as ensuring compliance with laws and regulations, helping organizations avoid penalties or legal violations. This system also serves as a mechanism for the prevention and detection of fraud, including asset embezzlement or financial report manipulation, by implementing strict supervision and segregation of duties. Lastly, the SPI plays a vital role in protecting the organization's assets, both physical and non-physical, from risks of loss due to misuse or theft. Research by Doyle, Ge, and McVay (2007) and frameworks like COSO underline the importance of effective SPI implementation to improve financial reporting reliability and operational compliance.

2. METHOD

Penelitian ini mengadopsi pendekatan kualitatif dengan menggabungkan tinjauan literatur yang ekstensif dan analisis studi kasus mendalam (Yusanto, 2020). Sumber data utama meliputi artikel jurnal ilmiah, laporan resmi pemerintah, serta dokumentasi dari sekolah-sekolah yang telah menerapkan sistem pengendalian internal berbasis teknologi. Dari data ini, tema-tema kunci diekstrak dan dianalisis secara sistematis untuk mengidentifikasi praktik terbaik dan mengungkap tantangan yang dihadapi. Proses analisis ini bertujuan untuk mengeksplorasi dampak teknologi pada pengendalian internal dalam konteks pendidikan, serta untuk mengemukakan rekomendasi yang dapat membantu institusi pendidikan meningkatkan efektivitas dan efisiensi operasional mereka.

3. FINDINGS AND DISCUSSION

Findings and discussion of the research related to the use of technology in internal control in schools, discussing its implications for the benefits, challenges, and cases encountered, are as follows:

3.1 Advantages of Technology-Based Internal Control

In the context of developing internal control systems, technology plays a crucial role in enhancing organizational performance and effectiveness. Below are the five main advantages of implementing technology-based internal control, as evidenced through research and practical observations across various sectors:

3.1.1 Enhanced Operational Efficiency through Automation

The implementation of technology-based internal control systems offers significant enhancements in operational efficiency. Automation of routine functions such as payroll, inventory management, and financial reporting reduces human errors and saves considerable time (KPMG, 2023). Technologies like Enterprise Resource Planning (ERP) systems enable real-time integration and synchronization of various operational activities, which reduces time spent on administrative tasks and improves data accuracy.

3.1.2 Accuracy and Reliability in Internal Control

Internal control technologies such as accounting software and inventory management platforms facilitate better data integration and more accurate information processing (Afriansyah, Hade, 2019). With this software, it is possible to minimize the risks of data errors and work duplication, while also enabling the automation of complex processes. For example, common mistakes in tax calculations or inventory stock can be reduced through the automated settings available in these systems. Thus, technology-based internal control not only enhances efficiency but also ensures higher accuracy and reliability of data in organizational operations.

3.1.3 Enhanced Accountability and Transparency

The use of technology-based internal control facilitates a significant increase in accountability (Kumala et al., 2023). Digital tools offer the capability for real-time tracking of financial transactions and resource allocation, greatly enhancing operational transparency. This is particularly crucial in school contexts, where funds must be managed carefully and in accordance with strict regulations. Additionally, the decision-making process in educational institutions becomes more data-driven, thanks to advanced analytics. This capability allows schools to identify important trends, project future budgets, and assess risks more accurately and effectively. Thus, technology not only supports more precise decisions but also ensures that these decisions can be verified and held accountable to stakeholders.

3.1.4 Improved Good Governance

Research by Afiah and Rahmatika (2014) investigated the relationship between the competency of officials, the effectiveness of internal control systems, and the quality of financial reporting in 70 local government units in the former residency of Pekalongan, Central Java. Using the Partial Least Squares (PLS) method applied to questionnaire data, the study found that the competency of officials and the effectiveness of internal control systems had a significant impact, both partially and simultaneously, on the quality of financial reporting. Furthermore, the quality of this financial reporting had a moderately positive impact on the implementation of good governance principles. Nevertheless, the study also indicated that there are other factors affecting governance that were not further investigated. From these findings, the authors suggest the need for enhanced training, accounting education, and the strengthening of ethical standards for officials to support improvements in financial reporting quality.

3.1.5 Enhancing the Quality of Financial Information

Research by Al-Dmour, Abbod, and Al-Qadi (2021) explored the impact of internal control and accounting systems on the usefulness of financial information, focusing on the importance of information quality. The results of this study indicate that effective internal control and reliable accounting systems are crucial in enhancing the quality of financial information. Aspects of information quality such as accuracy, relevance, timeliness, and reliability play a vital role in facilitating more accurate decision-making by management and external parties. Furthermore, the study emphasizes that the implementation of technology in accounting and internal control systems not only improves operational efficiency but also helps reduce errors and increase transparency in

financial management. These findings affirm the need for investment in advanced technology to support more efficient and transparent accounting and internal control systems.

3.2 Challenges in Implementation

In the effort to enhance technology-based internal control systems, several significant barriers must be confronted. Below are the three main challenges that often act as obstacles in the implementation of internal control technologies across various educational institutions and organizations. A deep understanding of these challenges is essential for designing effective strategies to overcome these barriers.

3.2.1 High Implementation Costs

One of the primary challenges in implementing technology-based internal control is the significant cost. Procuring advanced technologies such as Enterprise Resource Planning (ERP) software, cybersecurity systems, and automation tools often requires a substantial initial investment. This investment not only includes the costs of hardware and software licenses but also encompasses training for teachers and educational staff to ensure they can effectively use the new technologies. For smaller-scale schools, this can pose a heavy financial burden, often preventing them from adopting technologies that could enhance their operational efficiency. Research conducted by Utammy & Hambani (2023) at SMPIT Bina Masyarakat Mandiri in Bogor Regency shows that although internal control in the use of School Operational Assistance (BOS) funds has been effectively implemented, there is a need for improvement through teacher staff participation in the supervision of fund management. This indicates that without an adequate internal control system, the risk of fraud in fund management increases. This challenge demands a more adaptive approach and creative financing solutions to facilitate the transition to more automated and integrated systems.

3.2.2 Initial Investment Barriers in Technology-Based Internal Control

Significant initial investments in internal control technology often pose a barrier, especially for organizations with limited resources, as described by Al-Dmour, Abbod, and Al-Qadi (2021). These constraints include various aspects that require substantial financial investment, such as the procurement of hardware including computers, servers, and other network infrastructure; software licenses for accounting systems or Enterprise Resource Planning (ERP) platforms that necessitate initial licensing fees and regular updates; and training and development of human resources, which are essential to ensure that employees can effectively utilize the new technology. Further research indicates that without effective funding strategies, these costs can delay or even prevent the implementation of more sophisticated internal control systems, thus limiting the organization's ability to enhance accountability and operational efficiency.

3.2.3 Financial Constraints in Remote Area Schools

Schools in remote or underdeveloped areas often face significant financial constraints in providing resources for technology acquisition. The costs of maintenance and technology updates become a long-term financial burden that is difficult to overcome, especially since benefits such as improved efficiency and reduced risks take time to materialize. The Financial and Development Supervision Agency (2025) states that evaluations in the use of technology show that its implementation is hindered by limitations in human resources and infrastructure at the village level, particularly in remote areas. These limitations make schools hesitant to make initial investments without guarantees of short-term results.

3.3 Case Studies

Case studies of schools in Indonesia and other developing countries demonstrate how cloud-based systems and mobile applications have been successfully used to manage financial records and track attendance.

3.3.1 Penerapan Sistem Informasi Manajemen Sekolah di Indonesia

Fauzi, A., & Suharyanto, A. (2020) describe how several schools in Indonesia have implemented a technology-based School Information Management System (SIM Sekolah) to manage finances, inventory, and student attendance. This system plays a crucial role in ensuring the transparency of the management of School Operational Assistance (BOS) funds and financial reporting to the government. For example, in Yogyakarta, several schools utilize cloud-based applications such as E-Sekolah to strengthen financial accountability. The use of SIM has proven to enhance school administrative efficiency, reduce the risk of errors from manual record-keeping, and provide real-time access to information for stakeholders, including teachers, principals, and the government. The School Procurement Information System (SIPLah) is a digital platform developed by the Ministry of Education, Culture, Research, and Technology (Kemendikbud Ristek). SIPLah is designed to facilitate the procurement process of goods and services in school environments using BOS funds. Mukmin & Dongoran (2024) explain that the implementation of SIPLah at SMA Negeri 2 Gunung Meriah supports transparency and efficiency in the management of BOS funds, although it still faces some technical and operational challenges. With features like a helpdesk, electronic documentation, and access to a broader range of suppliers, SIPLah contributes to improving the quality of school management and education overall.

3.3.2 Use of Digital Systems in School Administration in Kenya

The Kenyan government has implemented the National Education Management Information System (NEMIS), a digital platform designed to track government funds, student data, and school inventory. This system is intended to ensure that government subsidy funds are used according to set purposes. According to Wambua, P., & Kiruja, L. (2019), NEMIS has successfully provided transparency in the distribution of educational funds, reduced corruption practices in the education sector, and facilitated the government in effectively monitoring school performance nationwide.

3.3.3 Application-Based Financial Monitoring Systems in Schools in India

India has introduced the Sarva Shiksha Abhiyan (SSA) application, which aims to monitor the use of education budgets in primary schools. This application digitizes the budget reporting system, facilitating online audits. According to Sharma, R., & Singh, A. (2020), the SSA application has successfully reduced fund misappropriation at the school level, accelerated financial reporting and monitoring processes, and provided direct access for local and national governments to relevant data.

Strategic Recommendations

Based on the findings outlined, several strategies are recommended to enhance the implementation of technology-based internal control in organizations. First, organizations can leverage cloud-based technology to reduce the initial costs associated with procuring traditional IT infrastructure. Second, the development of modular systems allows organizations, particularly smaller-scale ones, to adopt only the features that are truly necessary, thereby reducing the initial investment burden. Third, forming partnerships with technology providers can help design more affordable and effective solutions. Additionally, it is important for schools to formulate a comprehensive digital strategy, including clear goals and implementation schedules. Investing in

staff training to effectively use technology will ensure the optimal utilization of resources. Cybersecurity must be prioritized by implementing measures such as encryption and regular security audits to protect data. Finally, seeking partnerships with both technology providers and government agencies can provide the financial and technical support needed for successful implementation.

4. CONCLUSION

The implementation of technology-based internal control in schools, particularly in Indonesia and other developing countries, has successfully improved operational efficiency, accountability, and transparency. The results from systems such as SIM Sekolah in Indonesia and NEMIS in Kenya have demonstrated significant enhancements in financial management transparency, inventory oversight, and educational supervision. This aligns with the expected potential of digital internal control to improve administrative performance in schools.

Despite challenges such as inadequate infrastructure, high initial investment costs, and user resistance to change, this study shows that with the right strategies, these obstacles can be overcome. Therefore, future research can focus on developing more affordable and flexible technological solutions, as well as effective training strategies to reduce resistance from school staff. Additionally, the development of supportive policies and improvements in infrastructure will be essential to ensuring the sustainability and effectiveness of technology-based internal control systems in increasingly complex educational environments.

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