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RESEARCH ARTICLE

Digital Transformation of Data-Driven School Management for Improving Education Quality in the Thousand Islands, Indonesia

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Abstract
This study examines the digital transformation of data-driven school management and its contribution to improving education quality in the Thousand Islands, Indonesia. The research addresses three objectives: assessing the level of digital readiness among island-based schools, analyzing current data management and utilization practices, and developing a contextual model of digital, data-driven school governance suitable for geographically isolated regions. A mixed-method explanatory sequential design was employed. Quantitative data were collected from 78 school leaders and administrative staff across 24 public elementary and junior secondary schools using structured questionnaires. Qualitative data were obtained through semi-structured interviews, observations, and document analysis to enrich statistical findings. Descriptive statistics indicated moderate levels of digital infrastructure readiness and data utilization. Pearson correlation and multiple regression analyses revealed that digital infrastructure readiness, data-driven management practices, and leadership support significantly predicted perceived improvements in education quality, with data-driven practices emerging as the strongest predictor. Qualitative findings highlighted adaptive leadership strategies, emerging digital governance roles, and evolving organizational cultures that support evidence-based decision making despite infrastructural limitations. The study concludes that digital transformation enhances education quality not merely through technological adoption but through the institutionalization of systematic data use and leadership-driven governance reform. The findings offer theoretical contributions to digital governance scholarship and practical guidance for policymakers seeking to strengthen education management in remote island contexts.

Keywords
Digital Transformation; Data-Driven Decision Making; School Management; Education Quality; Digital Divide.

1 | INTRODUCTION

Digital transformation has become a key priority in public sector governance, particularly within the education sector (Haetami, 2025). The rapid advancement of digital technologies, information systems, and data analytics has allowed institutions to optimize resource management and make decisions grounded in empirical evidence (Abdurrahman, 2025). In the educational field, data-driven school management is recognized as an essential tool for enhancing education quality through improved planning, monitoring, and evaluation processes (Nurbani *et al*., 2025). By integrating data into school management, institutions can not only improve learning outcomes but also contribute to human capital development, which is crucial for both regional and national economic growth. This approach emphasizes the need for educational systems to move beyond traditional methods and embrace technologies that enable data collection and analysis, allowing for more informed decision-making. Such strategies not only enhance the efficiency of school operations but also create opportunities for long-term educational improvements that are aligned with broader economic development goals. Thus, data-driven school management plays a pivotal role in supporting sustainable growth and development.

Data-driven school management focuses on the systematic collection, integration, and application of educational data to support evidence-based decision-making (Harahap *et al*., 2025). Research has demonstrated that schools adopting data-driven management practices often experience improvements in administrative efficiency, transparency, and accountability (Oktoviano & Hadiningrat, 2025). These improvements are essential for optimizing the management and operation of educational institutions. However, the majority of studies on this topic have been conducted in urban or well-connected regions where digital infrastructure and institutional capacities are more developed (Akilandeswari, 2025). This leaves a significant gap in understanding how digital transformation in school management operates in geographically isolated and infrastructure-limited regions. In particular, there is limited empirical evidence on how schools in remote or underdeveloped areas can implement data-driven management effectively given their unique challenges (Z. Hidayat & Hidayat, 2020). This gap highlights the need for further research on how digital transformation strategies can be adapted to fit the constraints and opportunities presented by less connected and resource-limited environments. Exploring this aspect is crucial for improving education management in such contexts.

Indonesia's archipelagic geography poses significant challenges for the digital transformation of education management (Wahyudiati, 2022). Regional disparities in connectivity, transportation, and technological readiness often obstruct the implementation of digital governance in education. The Thousand Islands present a unique case where schools operate with limited digital infrastructure, logistical constraints, and unequal human resource capacity. These conditions create a gap between the ideal expectations of data-driven school management and the practical realities faced by schools in island regions. Despite national policies advocating for digitalization in education, the effectiveness of these initiatives in enhancing education quality in island settings has not been fully explored. This lack of empirical research highlights the need to better understand how digital transformation can be adapted to the specific challenges of remote areas and to assess its impact on improving educational outcomes in such contexts.

This study explores how the digital transformation of data-driven school management can improve education quality in the Thousand Islands. It is guided by three main research questions: (1) What is the level of readiness among schools in the Thousand Islands to adopt data-driven digital management? (2) How is educational data currently managed and utilized in school governance? (3) How can a contextual model of digital, data-driven school management support improvements in education quality? These questions aim to analyze both the managerial practices and structural constraints that affect the digital transformation of schools in island regions (Imansyah, 2025). By addressing these questions, the study seeks to provide valuable insights into how digital transformation can be effectively implemented in remote areas and contribute to the enhancement of education quality. This research will also offer practical solutions for overcoming the challenges schools in isolated areas face when adopting digital management systems.

The aim of this research is to analyze current school management practices and create a data-driven school management model tailored to the unique conditions of the Thousand Islands. To achieve this, the study utilizes a descriptive-analytical and developmental research approach, integrating qualitative methods with limited quantitative analysis. Data are gathered through various instruments, including questionnaires, observations, and document analysis, involving school principals, teachers, and administrative staff. This mixed-method approach enables a thorough evaluation of digital readiness, the use of educational data, and governance practices within the schools. By combining these methods, the study provides a comprehensive understanding of how schools in remote areas can adopt and utilize data-driven management systems. It also identifies the challenges and opportunities specific to the Thousand Islands, offering insights into how school management can be improved in such geographically and infrastructurally constrained settings.

While this study does not aim to generalize its findings to all regions of Indonesia, it offers valuable empirical insights into how digital transformation can enhance education quality in island regions. Theoretically, the study contributes to the existing literature on digital transformation and data-driven educational governance by introducing evidence from geographically constrained settings. This perspective is important because it adds depth to the understanding of digital

education management in areas with limited resources and infrastructure. Practically, the findings provide essential guidance for policymakers and education practitioners, helping them design digital school management strategies that are more inclusive and adaptable. These strategies can be better aligned with the unique conditions of regional contexts, ensuring that digital transformation efforts in education address local challenges and opportunities. The study thus serves as a resource for developing more effective, region-specific education policies and practices in remote areas.

This paper is structured as follows. The next section provides a review of relevant theories and prior studies on digital transformation and data-driven school management, offering a foundation for understanding the key concepts. The third section details the research methodology used in the study, including data collection methods and analysis techniques. In the fourth section, the research findings are presented and discussed, focusing on their implications for improving education quality and governance. The final section concludes with key takeaways, highlighting the limitations of the study and offering recommendations for future research and policy development. This structure ensures a comprehensive examination of the topic, from theory to practical applications.

2 | BACKGROUND THEORY

Digital Transformation in Public and Educational Governance

Digital transformation refers to the integration of digital technologies into organizational processes, which fundamentally reshapes governance structures, service delivery, and decision-making systems (Vial, 2019). In the public sector, digital transformation is closely tied to the evolution of e-government and digital governance frameworks that enhance transparency, efficiency, and accountability (Mergel *et al*., 2019). Rather than merely digitizing existing procedures, digital transformation entails institutional change, cultural adaptation, and the development of new competencies. In the education sector, digital transformation extends beyond the integration of classroom technologies. It includes digital administrative systems, data management platforms, performance monitoring dashboards, and digital communication networks (N. Hidayat, 2015). Research suggests that digitally transformed educational institutions exhibit improved organizational responsiveness and strategic alignment (Lisa *et al*., 2026). However, scholars continue to debate whether digital transformation inherently improves performance or if outcomes depend on contextual readiness and leadership capacity (Andriyani *et al*., 2021). In geographically constrained regions, such as island territories, digital transformation faces significant structural limitations, including infrastructure gaps, bandwidth issues, and uneven digital literacy (UNESCO, 2023). These limitations suggest that digital transformation needs to be contextualized rather than standardized across all regions.

Data-Driven Decision Making (DDDM) in School Management

Data-Driven Decision Making (DDDM) has emerged as a dominant paradigm in educational management theory. DDDM involves the systematic collection, analysis, and use of data to inform organizational decisions (Mandinach & Gummer, 2016). In school contexts, data may include student achievement records, attendance rates, teacher performance evaluations, financial reports, and community feedback. The theoretical foundation of DDDM is rooted in evidence-based management theory, which asserts that managerial decisions should rely on empirical evidence rather than intuition (Amalia Yunia Rahmawati, 2020). Empirical studies show that schools effectively utilizing data tend to demonstrate improvements in instructional planning and student performance (Yurinda & Widyasari, 2022). However, challenges such as data overload, lack of analytical skills, and superficial compliance with reporting systems have been highlighted in research (Schildkamp, 2019). A key debate within DDDM scholarship concerns the distinction between data availability and data utilization. The mere presence of digital systems does not guarantee meaningful data use. Effective DDDM requires organizational culture change, leadership commitment, and ongoing professional development. In island-based schools, DDDM faces additional challenges, such as limited digital infrastructure and resource scarcity. Implementing data-driven management in such regions requires adaptive frameworks, not simply the replication of urban models.

School Management and Education Quality

School management theory emphasizes leadership effectiveness, organizational structure, resource allocation, and stakeholder engagement as critical determinants of education quality (Mustika & Temarwut, 2022). Education quality is multidimensional, encompassing learning outcomes, equity, institutional governance, and student well-being (UNESCO, 2015). Educational quality improvement models often incorporate Total Quality Management (TQM) principles, which emphasize continuous improvement, performance monitoring, and stakeholder participation. Data-driven school management aligns with TQM by enabling performance measurement and feedback mechanisms. However, scholars debate whether managerial efficiency directly leads to improved student outcomes. Some argue that managerial reform without pedagogical innovation has limited impact, while others assert that strong leadership and data-informed governance create the environment needed for instructional excellence. In peripheral regions like the Thousand Islands, school management quality may be affected by logistical isolation, teacher rotation patterns, and limited oversight. As

such, digital transformation in school management may serve as a compensatory mechanism to enhance coordination and monitoring.

Digital Divide and Regional Inequality

The digital divide theory explains disparities in access to technology, digital skills, and meaningful use of digital tools (Purnomo *et al*., 2025). In Indonesia, regional disparities persist between urban centers and remote island communities. Infrastructure limitations impact connectivity reliability and access to digital platforms. Scholars differentiate between first-level (access), second-level (skills), and third-level (outcomes) digital divides. In educational settings, these divides influence both administrative efficiency and instructional quality. Addressing digital transformation in the Thousand Islands requires considering infrastructural readiness, human resource capacity, and institutional support systems. Without addressing these structural inequalities, digital reform risks worsening disparities rather than reducing them.

Theoretical Synthesis and Conceptual Positioning

This study integrates four major theoretical perspectives. Digital Transformation Theory, Data-Driven Decision Making (DDDM), School Management and Education Quality Theory, and Digital Divide Theory. By combining these frameworks, the study offers a multidimensional approach to understanding how digital transformation in data-driven school management can influence education quality, particularly in geographically isolated regions. While previous research has focused on digital governance and school management in urban settings, there has been limited exploration of these aspects within island-based educational systems. This study extends the theoretical discussion by placing digital transformation within an archipelagic governance context, thus contributing to both digital governance theory and educational management scholarship. The conceptual framework posits that digital transformation enhances data accessibility and managerial transparency, data-driven management supports evidence-based decision-making, and effective management leads to improvements in education quality. However, the strength of these relationships is contingent on factors such as infrastructural readiness and digital literacy levels, which can influence the success of digital transformation efforts.

3 | METHOD

This study employed a mixed-method explanatory sequential design to examine the digital transformation of data-driven school management and its contribution to improving education quality in the Thousand Islands, Indonesia. The mixed-method approach was chosen to integrate quantitative measurement of digital readiness and managerial performance with qualitative insights into the contextual constraints faced by schools in geographically isolated areas (Junaedah *et al*., 2020). The quantitative phase was conducted first to identify patterns and relationships among variables, followed by a qualitative phase aimed at explaining and enriching the statistical findings.

The population of this research included all public elementary and junior secondary schools in the Thousand Islands administrative region, totaling 24 schools. Participants were selected using purposive sampling, focusing on individuals directly involved in school governance and digital administrative processes, such as principals, vice principals, administrative officers, and senior teachers responsible for educational data reporting. A total of 78 respondents participated in the quantitative survey. For the qualitative phase, 12 key informants were selected based on a minimum of three years of managerial experience to ensure the relevance and depth of insights. The sample size met the minimum requirements for regression-based statistical analysis, which recommends at least 10–15 cases per independent variable.

Quantitative data were collected using a structured questionnaire designed to measure four main constructs: digital infrastructure readiness, data-driven management practices, leadership support for digital transformation, and perceived improvement in education quality. All items were measured using a five-point Likert scale ranging from strongly disagree (1) to strongly agree (5). The instrument was adapted from established frameworks on digital transformation and data-driven decision-making, contextualized to reflect the administrative realities of island-based schools. Content validity was assessed through expert review by three scholars in educational management, while construct validity was evaluated using exploratory factor analysis. Reliability testing using Cronbach's Alpha showed that all constructs exceeded the recommended threshold of 0.70, indicating acceptable internal consistency.

Qualitative data were collected through semi-structured interviews, direct observation of digital administrative practices, and document analysis of school reports and digital records. Interviews were conducted over a three-month period (March–May 2025), lasting between 45 and 60 minutes. An interview protocol was developed to explore themes related to digital adoption challenges, managerial adaptation strategies, infrastructure limitations, and leadership roles in facilitating data-driven governance. The qualitative data were analyzed using thematic analysis procedures following Braun and Clarke (2006), which involved data familiarization, initial coding, theme

development, and interpretive synthesis. NVivo software supported data organization and coding.

Quantitative data were analyzed using SPSS version 27. Descriptive statistics were used to describe digital readiness and data utilization across schools. Pearson correlation analysis examined associations among variables, and multiple linear regression analysis was applied to test the influence of digital transformation dimensions on perceived education quality. Prior to regression analysis, diagnostic tests for normality, multicollinearity, and heteroscedasticity were conducted to ensure compliance with statistical assumptions.

Ethical considerations were strictly observed throughout the research process. Formal approval was obtained from the relevant regional education authority. All participants provided informed consent, were informed of the voluntary nature of the study, their right to withdraw, and the confidentiality of their responses. Data were anonymized, and institutional identifiers were coded to protect participant privacy. Several methodological limitations were identified. First, the study relied partly on self-reported perceptions of education quality, which may introduce subjective bias. Second, logistical constraints and weather conditions occasionally limited on-site observation in some islands. Third, internet instability affected the distribution of the digital survey in remote locations. To mitigate these limitations, methodological triangulation was employed through the integration of survey data, interviews, and document analysis, enhancing the credibility and robustness of the findings.

4 | RESULTS AND DISCUSSION

4.1 Results

4.1.1 Level of Digital Readiness

Descriptive statistical analysis was conducted to assess the level of digital infrastructure readiness in schools across the Thousand Islands. This analysis aimed to evaluate how prepared schools are to adopt digital technologies, taking into account various factors such as internet connectivity, available hardware, and technical support. By examining these aspects, the study provides a clear picture of the digital infrastructure in place within these schools, identifying any gaps or challenges that may hinder effective digital transformation. The results from this analysis are presented in Table 1, offering valuable insights into the current state of digital readiness across the schools in this geographically isolated region. This information is essential for understanding the capacity of these schools to implement digital management practices and to identify areas that may require additional support or investment.

Table 1. Descriptive statistics of digital readiness and management variables

Variable	n	Mean	SD	Min	Max
Digital infrastructure readiness	78	3.12	0.74	1.80	4.60
Data-driven management practices	78	3.28	0.69	2.00	4.70
Leadership support for digitalization	78	3.45	0.72	2.10	4.80
Perceived education quality improvement	78	3.36	0.66	2.20	4.75

The data reveal moderate levels of digital readiness and the implementation of management practices across the schools. Notably, leadership support achieved the highest mean score among the measured constructs, suggesting that strong leadership plays a crucial role in facilitating digital transformation. This finding highlights the importance of leadership commitment in driving the adoption of digital technologies in school management.

4.1.2 Correlation Analysis

Pearson correlation analysis was performed to explore the relationships among key variables, including digital readiness, data-driven management practices, leadership support, and perceived education quality. This analysis aimed to identify the strength and direction of associations between these factors, providing insights into how they interact and influence each other. By assessing these correlations, the study seeks to understand the underlying dynamics that affect digital transformation and educational outcomes in the Thousand Islands. The findings from this analysis are presented in Table 2, which shows the statistical significance of the relationships between the variables. These results help to clarify the role of leadership, infrastructure, and management practices in driving improvements in education quality and governance within the region.

Table 2. Correlation matrix of research variables

Variable	1	2	3	4
1. Digital infrastructure readiness	—	.54**	.48**	.51**
2. Data-driven management practices		—	.63**	.67**
3. Leadership support			—	.59**

4. Perceived education quality	—

All independent variables demonstrated positive and statistically significant correlations with perceived improvements in education quality. This indicates that factors such as digital readiness, data-driven management practices, and leadership support play a meaningful role in enhancing the overall educational experience. The positive relationships suggest that strengthening these variables could lead to better educational outcomes in the Thousand Islands.

4.1.3 Regression Analysis

Multiple linear regression analysis was conducted to examine the influence of digital transformation variables on perceived improvements in education quality. The regression model used is expressed as follows.

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \varepsilon$$

In this equation, Y represents the perceived improvement in education quality, while X_1, X_2, and X_3 represent digital infrastructure readiness, data-driven management practices, and leadership support, respectively. The error term (ε) accounts for unexplained variation. This analysis helps to understand how each of these variables contributes to the overall quality of education in the Thousand Islands. The results provide insights into the impact of digital transformation on educational outcomes in geographically isolated regions.

Table 3. Multiple regression results predicting perceived education quality

Predictor	B	SE	β	t	p
Constant	0.842	0.411	—	2.05	.044
Digital infrastructure readiness	0.218	0.089	.23	2.45	.017*
Data-driven management practices	0.364	0.094	.39	3.87	.000**
Leadership support	0.271	0.082	.29	3.30	.002**

Note. *p < .05, **p < .01. R^2 = .56.

The model accounts for 56% of the variance in perceived education quality improvement, indicating a significant contribution from the digital transformation variables. This suggests that factors such as digital infrastructure readiness, data-driven management practices, and leadership support have a substantial impact on education quality.

4.1.4 Qualitative Findings

The qualitative phase identified four dominant themes.

1) Infrastructure Constraints and Adaptive Innovation
   Schools reported unstable internet connectivity and limited hardware availability. However, principals implemented rotational data-upload systems and offline data archiving strategies.
2) Emergence of Digital Leadership Roles
   Informal digital coordinators emerged within schools, often senior teachers with basic ICT skills. This represents institutional adaptation beyond formal policy structures.
3) Cultural Shift Toward Evidence-Based Governance
   Participants reported increased reliance on attendance analytics, performance dashboards, and digital reporting tools for decision making.
4) Community Engagement and Accountability
   Digital reporting systems increased transparency toward parents and local education authorities, fostering trust and participatory oversight.

4.2 Discussion

This study explored how digital transformation in school management, particularly through the adoption of data-driven practices, can contribute to improving education quality in the Thousand Islands, Indonesia. The findings reveal significant relationships between digital readiness, data-driven management practices, leadership support, and the perceived improvement in education quality. These results highlight the pivotal role that digital transformation plays in enhancing educational outcomes, especially in geographically isolated regions with unique challenges such as limited infrastructure, connectivity issues, and uneven access to resources.

The descriptive statistical analysis provided a comprehensive view of the current state of digital readiness in the Thousand Islands' schools. The moderate levels of digital infrastructure readiness, data-driven management practices, and leadership support suggest that while schools have begun to embrace digital technologies, they still face considerable gaps in fully integrating these systems. Leadership support, in particular, emerged as the strongest factor, indicating that school leaders who are committed to digital transformation play a crucial role in facilitating its adoption. This finding aligns with Arif, & Gupta, (2024), who emphasize the importance of leadership in strengthening digital skills and talent within

educational systems. The role of leadership is even more critical in remote areas like the Thousand Islands, where logistical challenges and infrastructural limitations often make the integration of new technologies more difficult.

One of the key findings of this study is that the variables examined digital infrastructure readiness, data-driven management practices, and leadership support are all positively correlated with perceived improvements in education quality. This reinforces the importance of integrating these elements into the educational management framework. These results echo Abdurrahman's (2025) assertion that digital transformation in the education sector can lead to more efficient resource management, better decision-making, and enhanced transparency. Similarly, the positive relationship between data-driven management practices and education quality supports Agustin *et al*. (2025), who argue that the systematic use of data in decision-making significantly improves administrative efficiency and educational outcomes.

Furthermore, the Pearson correlation analysis confirmed that leadership support, digital readiness, and data-driven practices are critical for enhancing the quality of education. The positive and statistically significant correlations found in the analysis indicate that these variables work together to drive improvements in education. Leadership support, in particular, showed the highest correlation with perceived education quality, suggesting that when school leaders actively promote digital tools and data-driven management, educational quality improves significantly. This finding underscores the need for strong leadership to guide schools through the complexities of digital transformation, particularly in remote and under-resourced areas like the Thousand Islands.

In line with the findings from Al-Omari *et al*. (2025), this study shows that strategic leadership is essential for successfully implementing digital management practices. The analysis revealed that leadership support plays a vital role in ensuring that digital tools and data-driven strategies are effectively utilized. The emergence of informal digital coordinators within schools, as observed during the qualitative phase, further supports the idea that leadership can foster an environment of collaboration and adaptation, even in the absence of formal structures. These coordinators, often senior teachers with basic ICT skills, represent an adaptive response to the challenges of limited resources, showing that leadership can take various forms depending on the context.

The regression analysis provided additional insights into the relationship between digital transformation variables and education quality. The model explained 56% of the variance in perceived education quality improvement, suggesting that the combination of digital infrastructure readiness, data-driven management practices, and leadership support accounts for a substantial portion of the improvements observed. This finding highlights the importance of addressing all three factors to ensure the success of digital transformation in schools. It also aligns with Wahyudiati's (2022) findings on the need for an integrated approach to educational digitalization that considers both infrastructure and leadership.

The qualitative findings identified several key themes that shed light on the specific challenges and strategies schools in the Thousand Islands use to overcome limitations in digital transformation. One significant theme that emerged was the infrastructure constraints faced by schools, particularly unstable internet connectivity and limited hardware. Despite these challenges, schools showed remarkable adaptability by implementing rotational data-upload systems and offline data archiving strategies, ensuring continuity in data management. This adaptive innovation underscores the resilience of schools in remote areas, which often rely on creative solutions to bridge the infrastructure gap.

Another key theme was the emergence of digital leadership roles, with senior teachers taking on informal digital coordinator responsibilities. This shift highlights the importance of distributed leadership in driving digital transformation, particularly when formal leadership structures are not fully equipped to handle technological challenges. The presence of informal digital leaders not only supports the adoption of digital tools but also fosters a culture of collaboration and innovation within schools, as noted by Imansyah (2025). Additionally, the study found that there was a cultural shift toward evidence-based governance, with increased reliance on digital tools for decision-making. The use of performance dashboards, attendance analytics, and other data-driven tools became more common, reflecting a broader acceptance of data-driven management in schools. This shift is crucial for fostering a culture of continuous improvement and accountability, as emphasized by Adenubi, & Samuel (2024) in their work on data-driven decision-making.

The findings also highlight the growing importance of community engagement and accountability. Digital reporting systems have increased transparency, enabling schools to engage parents and local authorities in the educational process. This transparency fosters trust and encourages participatory oversight, which is essential for building strong school-community partnerships. Ajuwon *et al*. (2024) also discuss the importance of community involvement in digital governance, noting that such partnerships are critical for ensuring the sustainability of educational reforms. Despite these positive developments, the study also identified several limitations. The reliance on self-reported perceptions of education quality could introduce subjective bias, which may affect the accuracy of the findings. Additionally, logistical challenges and internet instability in remote locations affected the distribution of surveys and on-site observations. To mitigate these limitations, the study employed methodological triangulation, combining quantitative and qualitative data to enhance the credibility and robustness of the findings.

5 | CONCLUSIONS AND FUTURE WORK

This study examined how the digital transformation of data-driven school management contributes to improving education quality in the Thousand Islands, Indonesia. The findings directly address the three research questions posed at the outset. First, the level of digital readiness among schools in the Thousand Islands was found to be moderate, indicating that while basic digital infrastructure and systems are present, significant disparities in connectivity and technical capacity remain. Second, educational data are increasingly managed through structured digital reporting systems, yet the depth of data utilization varies across institutions. Schools that demonstrate stronger leadership support and a more systematic approach to data-driven management tend to use data not only for administrative compliance but also for instructional planning and performance monitoring. Third, the regression results confirm that digital infrastructure readiness, data-driven management practices, and leadership support significantly predict perceived improvements in education quality, with data-driven practices emerging as the strongest predictor. These findings suggest that digital transformation contributes to education quality not merely through technological adoption, but through the institutionalization of evidence-based governance practices. Theoretically, this research advances the literature on digital transformation and educational governance by contextualizing Digital Transformation Theory, Data-Driven Decision Making, School Management Theory, and Digital Divide Theory (van Dijk, 2020) within a geographically isolated archipelagic setting. While prior studies have predominantly examined digitally advanced urban contexts, this study demonstrates that digital transformation in peripheral regions is shaped by infrastructural constraints, leadership adaptation, and organizational culture. The findings extend digital divide scholarship by showing that leadership capacity can partially mitigate infrastructural limitations, thereby moderating first- and second-level digital divides. Moreover, the study reinforces the argument that data availability alone does not guarantee improved educational outcomes; rather, meaningful data utilization and leadership commitment are decisive factors in translating digital systems into quality enhancement. From a practical perspective, the results carry important implications for policymakers and educational administrators. First, investments in digital infrastructure must be accompanied by systematic leadership development programs that enhance principals' and administrators' data literacy and strategic management competencies. Second, regional education authorities should design context-sensitive digital governance frameworks that accommodate bandwidth instability and logistical isolation in island-based schools. Third, professional development initiatives should focus on cultivating a data-driven organizational culture, ensuring that teachers and staff possess the analytical skills necessary to interpret and act upon educational data. These measures may support more equitable implementation of national digitalization policies across remote and mainland regions. Several limitations should be acknowledged while recognizing the study's contributions. The reliance on partially perception-based indicators of education quality may introduce subjective bias, and the cross-sectional design limits causal inference. Additionally, the focus on a single administrative region constrains generalizability. However, these limitations provide opportunities for future research rather than diminishing the value of the findings. Subsequent studies may employ longitudinal designs to examine whether digital transformation leads to measurable improvements in student achievement outcomes over time. The integration of objective performance indicators, such as standardized assessment scores or graduation rates, would further strengthen empirical validity.

Future research may also apply structural equation modeling to explore mediating and moderating relationships among digital infrastructure, leadership capacity, organizational culture, and education quality. Comparative studies between island and mainland schools would provide deeper insight into contextual differences in digital governance implementation. Additionally, alternative theoretical perspectives, such as socio-technical systems theory or institutional theory, may offer richer explanations of how technological and social dimensions interact in shaping school management reform. Emerging questions from this research include how sustainable digital transformation initiatives are in regions with fluctuating infrastructure stability, and how local leadership succession affects the continuity of data-driven practices. Follow-up studies could investigate long-term institutionalization processes and explore collaborative digital ecosystems involving schools, local governments, and community stakeholders. Continued engagement with education authorities in the Thousand Islands may also support pilot interventions aimed at strengthening digital governance capacity. In conclusion, this study contributes to a growing body of scholarship on digital transformation in education by demonstrating that data-driven school management can enhance perceived education quality even within infrastructurally constrained island contexts. By highlighting the central role of leadership and organizational culture, the research underscores that digital reform is fundamentally a governance transformation rather than a purely technological upgrade. The findings position island-based schools not as passive recipients of digital policy, but as adaptive institutions capable of contextual innovation. As digitalization continues to reshape public sector governance, understanding its dynamics in peripheral regions becomes essential for promoting equitable and sustainable education quality improvement.

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