

Exploring Digital Leadership for Sustainable School Development in Lembang Junior High Schools

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Abstract

Digital leadership has become a critical factor in supporting sustainable school development in the era of Education 4.0. Schools are required to integrate technology effectively while maintaining organizational adaptability and long-term sustainability. This study aims to examine how digital leadership is implemented by principals to support sustainable school development in public and international junior high schools in Lembang, West Bandung Regency. This research employed a descriptive qualitative approach to explore leadership practices, technology integration, and organizational interactions within the school environment. Data were collected through interviews, observations, document analysis, and Likert-scale questionnaires administered to 415 respondents consisting of teachers, students, and administrative staff. Data analysis was conducted through descriptive and thematic interpretation. The findings indicate that digital leadership implementation in both schools is categorized as high, with an average score of 3.95. The strongest dimension was principals' support for digital innovation (4.06), followed by a clear digital vision (3.99) and effective digital communication (3.92). However, the utilization of digital data for strategic decision-making received the lowest score (3.85), indicating the need to strengthen data-driven leadership practices. The study highlights the role of principals as key agents of digital transformation in schools. The findings contribute theoretically to the discourse on digital leadership and sustainability in education and provide practical implications for developing data-informed digital leadership models to support sustainable school development.

Keywords: Digital leadership, Sustainable school development, Educational transformation, Data-driven decision-making

Introduction

The use of digital technology in education has become an unavoidable necessity in responding to the dynamics of the Industrial Revolution 4.0 and Society 5.0. In this context, educational institutions are required to implement systematic adaptations to remain competitive amid rapid technological disruption. According to [Nasution et al. \(2025\)](#), schools are expected to transform into agile learning organizations rather than merely functioning as spaces for knowledge transmission ([Taktak & Özgenel, 2026](#); [Zhu et al., 2025](#)). The comprehensive implementation of digital tools has proven to enhance administrative efficiency compared to conventional methods. Furthermore, digitalization has transformed interpersonal communication patterns, contributing to stronger organizational culture within secondary schools ([Liu et al., 2025](#); [Tantowi et al., 2025](#)).

Technological changes have revolutionized systems from government to the business world. This requires urgent action regarding technically savvy leaders with various strategies for managing technology integration. In an organizational context, digital leadership is considered a crucial factor in ensuring the success of transformation processes within an organization (Westerman et al., 2014). As a pioneering force in education, a principal navigating technological change must possess sharp digital literacy skills and be bold in making strategic, data-driven decisions (Hasanah and Mustofa, 2024).

). Without digitally literate leadership, technology in schools will lack a tangible impact on all school members, especially students.

Conceptually, digital leadership is a form of modern leadership that focuses on the use of technology to manage organizations in the long term, simplify communication, accelerate bureaucracy, and increase work efficiency in achieving visions and target goals accurately provided by digital systems (Kamal et al., 2025; Kara & Sağbaş, 2025). As stated by Westerman et al., (2014), the ability of digital leaders to continue to combine traditional leadership (such as strategic vision and organizational influence) with new digital skills (such as data management and technology) to ensure strategic alignment and generate organizational success value. A principal with strong digital leadership is expected to encourage innovation, strengthen digital administrative infrastructure, and create an inclusive and innovative organizational culture (Hartanto et al., 2025; Hrytsenchuk et al., 2025; Sterrett & Richardson, 2023).

The education sector plays a crucial role in achieving the Sustainable Development Goals (SDGs) worldwide, particularly the fourth point, which addresses quality education. However, the success of sustainable schools depends heavily on teachers' ability to integrate a digital vision with the support of continuous innovation (Hasanah and Mustofa, 2024). Different patterns are evident in these implementation challenges. Public schools in Indonesia still face challenges in equal access and strengthening digital literacy for teachers (Asqia, 2023). In contrast, international schools tend to be quicker to fully adopt digital transformation into learning systems that meet global standards (Sofiani et al., 2025).

This study investigates how principals implement digital leadership to develop sustainable schools in public and international junior high schools in Lembang. Previous research has primarily examined digital leadership in relation to technology adoption, teacher competence, or organizational performance separately, with limited comparative analysis across different school governance contexts. Addressing this gap, the study proposes a comparative and integrative framework linking digital leadership practices with organizational sustainability and school development outcomes. The findings are expected to contribute theoretically to digital leadership discourse and practically to the development of effective digital leadership models for secondary schools.

Digital Leadership has become a leadership paradigm that is evolving along with digital transformation in organizations. According to Nasution et al. (2025), digital leadership is defined as a leader's ability to utilize digital technology to achieve the organization's vision, mission, and goals, focusing on change in the era of Education 4.0. This approach emphasizes opportunities such as visionary leadership, digital citizenship, and systematic improvements to enhance various knowledge and emotional intelligence in schools. Digital leadership encompasses digital vision, technological literacy, virtual team management, and data-driven decision-making (Westerman et al., 2014). School leaders are expected to build habits and adapt with full innovation to cyber challenges and threats, as well as cultural changes. The main opportunity to improve organizational performance is through the use of technology in continuous learning, while challenges include change management and digitalization readiness.

Digital leadership generally encompasses leadership skills that extend beyond the use of digital technology facilities to fostering innovative and adaptive environments that address challenges such as cyber threats and cultural change. Specifically, digital leadership in schools plays a key role in reducing technological competency disparities through digital literacy programs for teachers (Asqia, 2023). This effort demonstrates that digital leadership goes beyond simply providing facilities and developing human resources to be ready to adapt and play a role in the ever-changing school digital ecosystem.

Based on the review above, it can be concluded that the digital leadership model in the school environment includes five main aspects: (1) a clear digital vision; (2) real facility support; (3) the effectiveness of digital communication; (4) data-based decision making; and (5) empowering digital HR capacity.

Sustainable development programs in education are achieved through a process of improving the education system that aims to ensure consistent, long-term quality and inclusive education. The Ministry of Education, Culture, Research, and Technology of the Republic of Indonesia (2022) places digital transformation as a key pillar for achieving inclusive and sustainable education, thereby supporting the achievement of *Sustainable Development Goal* (SDG) 4. School leaders act as the primary factor linking policies to school conditions, to ensure that technology-based organizational governance is appropriate, effective, and efficient while prioritizing transparency and accountability in continuously improving the quality of education.

The implementation of management information systems, digital platforms, and data analytics enables school leaders to make more informed decisions and respond quickly to changing stakeholder needs. Research findings from Hasanah and Mustofa (2024) suggest that transforming schools into superior institutions requires principals to implement innovative and flexible approaches to school management to address long-term educational challenges.

In realizing the steps of implementing technology, the main foundation of the sustainability of modern digital schools lies in the implementation of the *Smart School concept* supported by facilities and infrastructure. According to Ansori et al., (2025), optimizing these facilities and infrastructure is a very important main foundation so that digital learning innovation does not stop at the initial stage, but continues to run adaptively and sustainably in the digital era. The sustainability of this system can function optimally when the principal plays its role in consistently encouraging infrastructure by evaluating improvements in the quality of technology-based learning in the school environment, thereby forming a quality technology culture that is collaborative and sustainable throughout the school ecosystem (Waruwu et al, 2025).

An indicator of digital leadership maturity is the leader's ability to utilize data as a basis for decision-making. Kane et al. (2019) stated that many organizations experience *technology fallacy*, which occurs when an organization has adopted digital technology but has not been able to effectively integrate it into strategic decision-making processes. In schools, this challenge is reflected in the limited culture of *data-driven leadership* literacy. Therefore, effective digital leadership requires strengthening the capacity of principals and education staff in data literacy and evaluation for planning, evaluation, and continuous improvement of school quality.

Based on the literature review, a comparative overview between public and international schools was identified, particularly in terms of human resource management practices. As presented in Table 1, public schools tend to implement centralized training systems characterized by bureaucratic procedures, whereas international schools emphasize higher autonomy and achievement-oriented management approaches.

Table 1. Comparative Characteristics of Human Resource Management in Public and International Schools

Dimensions of Theory	Public school	International School (Private)	Source
Human Resource Management	Centralized training, bound bureaucratic system, less flexible towards innovation	High autonomy, achievement and competency based intensive	Robbaniyah and Octofrezi (2024)
Digital Literacy	Limited to individual initiative and limited support	Integrated into curriculum and teacher training	Lonika (2023)
Management System	Procedural, regulation-oriented reporting	Participatory for all citizens and based on quality assurance	Malini (2025)
Pedagogical Culture	Traditional, and teacher-centered	Global, collaborative, student-centered	Gusriani et al. (2025)

It can be concluded that public schools need to strengthen policies, training, and support for digital data-based literacy to accelerate digital transformation. Meanwhile, international schools can serve as *best practice models* for data-driven implementation, technological innovation, and globally competitive leadership.

Methodology

This research uses a descriptive qualitative approach and a field study method supported by quantitative data. The research subjects were SMP Negeri 1 Lembang and SMP Darul Hikam Lembang in West Bandung Regency. To obtain comprehensive data, the researcher conducted direct observation of the implementation of technology and digital leadership patterns, in-depth interviews with school principals, a 1-5 Likert scale questionnaire to 415 respondents (teachers, education staff, and students), and documentation and literature studies to analyze relevant data. The questionnaire instrument variables measure six indicators of digital leadership including: (1) digital vision; (2) encouragement of digital use; (3) real support for digital innovation; (4) digital communication systems; (5) use of digital data in decision-making; and (6) impact on the effectiveness of learning and school services. The data analysis technique uses a data analysis model that begins with data collection, filtering and sorting irrelevant data from the qualitative data results, presenting quantitative data in the form of descriptive narratives, and presenting and drawing conclusions from the research findings.

Result And Discussion

Table 2. School Profiles

Profile	State Junior High School 1 Lembang	Darul Hikam Middle School
Address	Jl. Kingdom No. 357, Jayagiri Village, Lembang District, West Bandung Regency	JL. Maribaya No. 89 RT. 03 RW. 01, Lembang District, West Bandung Regency
Status	Country	Private

Stand	January 19, 1965	June 25, 2012
Accreditation	A (superior)	A (Superior)
Curriculum	2013 Curriculum	Independent Curriculum, Cambridge International
Headmaster	Hj. Ai Nurhayati, S.Pd., M.Pd.	Binar Kasih Sejati, M.Pd., Gr
Number of Classes	1,161 students (38 per class) with 30 classes (10 classes per level)	80 students (26 per class) with 3 classes (1 class per level)
Vision Focus	Characterful, healthy, and high achieving	Globally competitive and Islamic

Figura 1. Results Of The Principal's Digital Leadership Questionnaire SMPN 1 Lembang and Darul Hikam International Junior High School

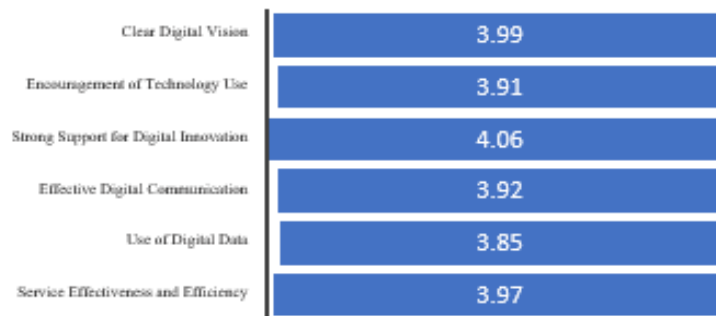


Fig 1. Digital Leadership Questionnaire Results

As shown in Figure 1, the overall questionnaire results showed that digital leadership was in the high category, with an average overall score of 3.95. This indicates that digital leadership in both schools has been implemented effectively to improve the effectiveness of learning and school services, although specific strengthening is needed in the utilization of digital data for strategic decision-making.

Discussion

General Analysis of Digital Leadership Capabilities

The results of data processing indicate that the implementation of digital leadership practices across all public and international junior high schools in Lembang is in the high category with an overall average of 3.95. This finding indicates that school principals have fully understood the importance of digital transformation as a pillar of sustainable school development. [Nasution et al. \(2025\)](#) stated that digital leadership in the Education 4.0 era is not merely the use of facilities, but rather the ability to lead an organization to achieve strategic innovation and its implementation is perceived positively by school stakeholders, indicating a serious effort to align technological vision with daily school activities.

Primary Strength: Tangible Support and Digital Innovation

The indicator of the principal providing real support in the form of facilities, policies and motivation for school digital innovation obtained the highest score with a score of 4.06, which indicates that the principal plays a concrete role as a facilitator to support the development of technology-based innovation in the form of facilities (internet/devices), policies (the existence of SOPs or rules that support digitalization-based work programs) that are considered very adequate by the school community, as well as motivational encouragement

both moral and appreciation for innovative teachers. This finding strengthens the theory of [Westermen et al. \(2014\)](#) that the success of digital leadership is highly dependent on how leaders facilitate cultural change through consistent policies and motivational encouragement. This support indicator is also the strongest basic capital in ensuring the *Smart School program* ([Ansori et al., 2025](#)) so that learning innovation takes place in an inclusive and sustainable manner according to the SDG 4 target, because leaders remain active in maintaining various innovations in improving the quality of learning.

Digital Vision and Service Effectiveness

The indicator for the principal having a clear digital vision that is understood by the school community obtained a score of 3.99, indicating that the principal has successfully formulated and socialized the school's future digital direction. According to [Waruwu et al. \(2025\)](#), digital leadership with a strong vision will direct all school members to understand the school's direction and this full commitment is clearly visible formally towards digitalization. Furthermore, the service effectiveness score reached 3.97, indicating that the digital vision has succeeded in going beyond the concept and has begun to the implementation stage in the implementation of activities including administration and procedures. Thus, school services become more responsive. [Hasanah and Mustofa \(2024\)](#) noted that digital leadership innovation oriented towards excellent schools is strongly influenced by the leader's ability to transform traditional governance into a more efficient and adaptive organization in providing excellent service to students and parents with greater transparency. However, when viewed from the perspective of service effectiveness in international schools, it is often driven by demands for high public accountability and managerial autonomy, while in public schools, the effectiveness of digital services often becomes a complex administrative solution ([Malini, 2025; Robbaniyah and Octofrezi, 2024](#)).

Challenges in Communication and Technology Utilization.

The technology use indicator scored 3.91 and the digital communication system scored 3.92. Both scores indicate areas that still require strengthening. Although already running quite well, the effectiveness of school digital technology is still hampered by a high dependence on human resource readiness. According to [Nasution et al. \(2025\)](#), in the Education 4.0 era, the main challenge for digital leadership is not only the provision of facilities, but also a greater focus on managing change and digitalization readiness for all school members. Unprepared human resources can result in technology becoming merely a rigid administrative instrument. According to [Asqia \(2023\)](#) and [Lonika \(2023\)](#), a study on the success of digital transformation is highly dependent on the sustainability of programs, one of which is digital literacy training for teachers. Without a structured and sustainable program, technology utilization risks becoming a formality, with facilities available but not impacting work efficiency or school quality. The low score on the digital communication system illustrates that a two-way communication ecosystem has not yet been established. [Nasution et al \(2025\)](#) said that one of the challenges of digital leadership is facing the obstacles of organizational culture which tends to use digital technology communication as a formality without becoming an efficient work culture.

The Critical Weakness: Data-Driven Decision Making

The indicator with the lowest score of 3.85 indicates that support for the use of digital data in decision-making has not yet become part of the organizational culture. This finding is the most critical finding in the report because the low score confirms the existence of a *technology fallacy*, which occurs when an

organization has adopted digital technology but has not been able to effectively integrate it into its strategic decision-making process (Kane et al., 2019). Without strong data integration, policies tend to be reactive to emerging issues rather than supporting *data-driven innovation* in education. This factor is a major obstacle to achieving international digital maturity. Studies by Sofiani et al. (2025) and Gusriani et al. (2025) show that in developed countries like Japan, digital data has become a primary instrument for evaluating teacher performance and planning sustainable school quality. In schools, this challenge is reflected in the limited culture of *data-driven leadership literacy*. Therefore, effective digital leadership requires strengthening the capacity of principals and education personnel in data literacy and evaluation for planning, evaluating, and continuously improving school quality. Nasution et al (2025) identified one of the biggest challenges in Education 4.0 is converting raw data into guidance or direction that needs to be applied and followed up for learning planning so that the school's vision can be achieved objectively towards the sustainable education program.

Comparative Implications: Public vs. Public International Schools

The results of a comparative study indicate opposing yet complementary differences between public and international junior high schools in Lembang in implementing digital leadership. Challenges lie in data-driven decision-making and managerial skills, which are more prominent in public schools due to the influence of bureaucratic constraints and rigid administrative standards, which hinder the acceleration of digital innovation. Meanwhile, international schools have greater autonomy to independently implement the latest technological transformations (Malini, 2025; Robbaniyah and Octofrezi, 2024).

Another clear difference is human resource management. In public schools, the management of teaching staff is bound by complex government regulations, while international schools have the flexibility to set more competitive digital competency standards for their teaching staff. This is reinforced by the findings of Robbaniyah and Octofrezi (2024) that human resource management in private/international schools is superior due to a more autonomous, controlled system. However, it is important to note that although international schools have superior facilities and budgets, both schools still face the same weaknesses in human resource readiness for the changing digital culture.

Sofiani et al. (2025) and Gusriani et al. (2025) state that digital maturity is not only about the availability of facilities but also how technology is integrated into the curriculum and organizational culture. In public schools, digital change is often driven by top-down policies, namely the government, while international schools are driven by demands for global accountability and stakeholder satisfaction (Malini, 2025). Differences in digital literacy activities between institutions indicate that digital accessibility remains a significant determinant of development progress (Lonika, 2023).

To achieve sustainable school development, digital leadership must undertake a digital transformation beyond the traditional role of facility provider. Public and international school leaders must continue to evolve into agile leaders capable of connecting data analysis to strategic policies and providing opportunities for ongoing training and human resource empowerment (Nasution et al., 2025; Waruwu et al., 2025). A balanced collaboration between leadership authority and digital literacy is key to schools achieving quality comparable to the best international education (Gusriani et al., 2025).

Conclusion

The success of sustainable school development depends significantly on the presence of a comprehensive digital leadership model. School leaders who effectively integrate vision, data-driven decision-making, innovation, and human resource empowerment are better prepared to address future challenges and ensure schools remain competitive and relevant in the Education 4.0 era. The comparative findings from SMP Negeri 1 Lembang and SMP Darul Hikam International School indicate that digital leadership has been implemented effectively in both institutions and has positively influenced the effectiveness of learning processes and school services. Nevertheless, further strengthening is required, particularly in the utilization of digital data for strategic decision-making and in improving digital literacy among human resources to support sustainable school transformation.

This study has several limitations. First, the research was conducted in only two junior high schools within a specific regional context, which may limit the generalizability of the findings. Second, the study primarily relied on qualitative data, which may not fully capture measurable impacts of digital leadership on long-term school performance. Future research is therefore recommended to involve a larger sample across diverse educational contexts and to employ mixed-method or longitudinal approaches to better examine the relationship between digital leadership practices and sustainable school development outcomes.

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