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The Impact of Digital Leadership on the Acceleration of Digital Transformation in Senior High Schools

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Abstract

This study aims to analyze the influence of digital leadership on the acceleration of digital transformation in Madrasah Aliyah. This study employs a quantitative approach using a survey design. Data were collected through a Likert-scale questionnaire administered to teachers and educational staff. Data analysis was conducted using the Partial Least Squares (PLS) method with the assistance of the SmartPLS application to test validity, reliability, and the relationships among variables. The results indicate that digital leadership has a positive and significant influence on digital transformation, with a path coefficient of 0.829 and an R-Square value of 0.687. This suggests that digital leadership accounts for 68.7% of the variation in digital transformation, while the remainder is influenced by other factors outside the scope of this study. These findings indicate that leadership with digital competencies plays a crucial role in accelerating the digital transformation process within the madrasah environment. The practical implications of this study are the need to enhance the digital leadership capacity of madrasah principals, as well as policy support and technological infrastructure to foster learning innovation and educational management.

Keywords: digital leadership; digital transformation; educational management; educational leadership; senior high school madrasah.

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Introduction

Transformasi Digital transformation can be defined as the process of leveraging existing digital technologies such as virtualization, mobile computing, and cloud computing to integrate all systems within an organization or educational institution (Hadiono & Santi, 2020). In the field of education, digital transformation has become an inevitable necessity in step with technological advancements and the growing demand for fast, flexible, and digital-based educational services. Digital transformation in education is a strategic issue that demands serious attention, particularly with the increasing adoption of artificial intelligence (AI) in the learning process (Kudriani et al., 2023). Digital leadership refers to the ability of leaders to drive digital transformation, foster technology adoption, and enable innovation through strategic vision. It combines leadership skills with digital tools to improve decision-making and overall organizational performance in a rapidly changing environment (Jalil et al., 2025).

However, the implementation of digital transformation in senior high schools still faces various challenges. Some of these include limited technological infrastructure, low digital literacy among educators, and the lack of comprehensive integration of information systems. These conditions indicate that digital transformation has not yet been fully realized and still requires strategic efforts to be effectively implemented.

One of the key factors influencing the success of digital transformation is digital leadership. Digital leadership refers to a leader's ability to leverage digital technology to guide, manage, and drive organizational change in an innovative and adaptive manner (Hadi Wibowo et al., 2025). Leaders with digital competencies are not only capable of understanding technology but also of building a digital vision, fostering a culture of innovation, and mobilizing all organizational members to adapt to change.

The role of digital leadership is particularly crucial in the context of education, as leaders hold a strategic position in determining policy direction and the success of technology implementation. Previous research indicates that digital leadership has a significant influence on the success of digital transformation within organizations (Purwanto et al., 2021). Furthermore, other studies also confirm that the success of digital transformation is not solely determined by technology, but rather by how leadership manages that change (Firdaus & Anisa, 2025).

Nevertheless, there remains a research gap, particularly in the context of Islamic educational institutions such as Madrasah Aliyah. Most previous studies have focused primarily on the business sector or higher education, so research on the influence of digital leadership on digital transformation in Madrasah Aliyah remains limited. Therefore, this study is important to conduct to provide both scientific contributions and practical solutions for the development of digital-based education.

Based on the above, this study aims to identify and analyze the influence of digital leadership on digital transformation in Madrasah Aliyah.

One of the key factors influencing the success of digital transformation is digital leadership. Leadership capable of leveraging digital technology is believed to drive faster and more effective change within educational organizations.

This study is highly relevant to SDG Goal 4, or Quality Education, which aims to ensure inclusive, equitable quality education and promote lifelong learning opportunities for all. Therefore, this study aims to determine the extent to which digital leadership influences the acceleration of digital transformation in Madrasah Aliyah.

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Methods

This study employs a quantitative approach with an explanatory or causal research design and utilizes a survey design to analyze the influence of digital leadership on the acceleration of digital transformation in Madrasah Aliyah. The quantitative approach was chosen because this study aims to test the relationships between variables objectively, systematically, and measurably through numerical data analyzed using statistical techniques. This approach allows researchers to obtain an empirical picture of the degree of influence of the digital leadership variable on digital transformation based on measurement results that can be calculated scientifically. In addition, a quantitative research approach was also chosen because it can produce more structured data that can be used to test research hypotheses accurately.

An explanatory research design was used because this study aims not only to describe phenomena but also to explain the cause-and-effect relationship between the independent and dependent variables. In this study, the independent variable under investigation is digital leadership, while the dependent variable is the acceleration of digital transformation in Madrasah Aliyah. Through this causal design, the researcher seeks to determine the extent to which the digital leadership possessed by madrasah leaders can influence the acceleration of digital transformation in the aspects of administration, learning, communication, and the management of technology-based education systems. Thus, this study not only provides an overview of the state of digitalization in madrasahs but also explains the key factors influencing the success of this digital transformation.

This study also employed a survey design as its data collection method. The survey design was chosen because it is considered effective for obtaining data directly from a specific number of respondents through the distribution of a questionnaire. The use of a survey allowed the researcher to gather information regarding the respondents' perceptions, experiences, and views regarding the implementation of digital leadership and digital transformation in the Madrasah Aliyah environment. Additionally, the survey method is considered more efficient for collecting quantitative data because it can reach a broader range of respondents in a relatively short time. The data obtained from the survey results were then analyzed using the SmartPLS software to test the validity, reliability, and relationships among variables in the research model.

The participants in this study consisted of teachers and school staff at a Madrasah Aliyah, totaling 54 respondents. The respondents were selected because they are directly involved in the implementation of digital transformation within the school environment, including in teaching and learning activities, administrative tasks, and the use of other digital systems. Teachers play a crucial role in the implementation of technology-based learning, while educational staff support digital-based school administration and services. Therefore, both groups of respondents were deemed to possess relevant understanding, experience, and involvement regarding the variables under study.

The selection of respondents in this study was based on their direct involvement with the use of digital technology in the Madrasah Aliyah setting. Teachers and educational staff were considered appropriate sources of information because they have firsthand experience with the changes in work systems and learning processes resulting from digital transformation. Furthermore, they are also the ones experiencing the impact of the digital leadership policies implemented by madrasah administrators. Thus, the data obtained from the respondents is expected to provide an accurate picture of the influence of digital leadership on accelerating digital transformation in educational institutions.

The sample size of 54 respondents was deemed sufficient for quantitative research based on Partial Least Squares Structural Equation Modeling (PLS-SEM), as this method is relatively flexible about smaller sample sizes. The use of the PLS-SEM method is also suitable for

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research aimed at developing predictive models and testing relationships between latent variables. Furthermore, this method can process data with a high level of model complexity even with a limited sample size. Therefore, this study is considered to maintain a good level of accuracy and analytical validity in testing the research hypotheses.

Through a quantitative approach, causal design, and survey method, this study is expected to provide objective, valid, and reliable research results regarding the influence of digital leadership on accelerating digital transformation in Islamic Senior High Schools (Madrasah Aliyah). In addition to providing theoretical contributions to the development of educational management science, this research is also expected to serve as a practical reference for educational institutions in improving the quality of digital leadership to support the success of digital transformation in the current era of technological development. The sampling method used was purposive sampling, which involves selecting a sample based on specific criteria, such as:

1. Being a teacher or educational staff member
2. Having work experience
3. Being involved in the use of digital technology at school

The data collection instrument in this study used a Likert scale-based questionnaire (1–5) ranging from strongly disagree to strongly agree, consisting of 4 indicators for each variable, namely digital leadership (X) and digital transformation (Y). Each indicator is formulated as a statement that is easily understood by respondents. In this study, there are two types of variables: independent variables and dependent variables, as follows:

1. Independent Variable (X)

The independent variable in this study is Digital Leadership.

Digital leadership refers to a leader's ability to utilize digital technology to manage an organization, make decisions, and drive innovation within an educational setting. This variable serves as a factor influencing the acceleration of digital transformation in Madrasah Aliyah.

2. Dependent Variable (Y)

The dependent variable in this study is Digital Transformation.

Digital transformation is a process of change within the education system that involves the use of digital technology to improve the effectiveness, efficiency, and quality of educational services at Madrasah Aliyah. This variable represents the outcome or impact of the implementation of digital leadership.

Data analysis was conducted using the SmartPLS software, following these steps:

1. Entering questionnaire data into the software
2. Conducting an outer model analysis to test the validity and reliability of the instrument
3. Conducting an inner model analysis to test the relationships between variables
4. Performing bootstrapping to test the significance of the hypothesis
5. Interpreting the analysis results to identify patterns of relationships between digital leadership and digital transformation

Through these steps, this study was able to identify the strength of the relationships between variables and provide a clear picture of the impact of digital leadership on the acceleration of digital transformation in Madrasah Aliyah.

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Result and Discussion

Result

Data Description

The study respondents consisted of teachers and educational staff at Madrasah Aliyah, with characteristics based on gender, age, and work experience. By gender, most respondents were women, indicating that women's involvement in educational and administrative activities at the madrasah is quite dominant. In terms of age, the respondents were predominantly in the productive age group, namely between 20 and 45 years old. This age group generally has a higher level of adaptability to developments in digital technology, making it easier for them to accept and implement technology-based innovations in both learning activities and school administration.

Meanwhile, based on work experience, most respondents have worked for less than 1 year. This condition indicates that the respondents are still relatively new to the madrasa work environment, but they still possess a basic understanding of the use of digital technology. In addition, relatively new respondents tend to be more open to changes and the development of digital systems, thereby supporting the digital transformation process in the madrasa environment more effectively.

Evaluation of Measurement Model Results

Table 1. Outer Loadings

Variabel	Kode Indikator	Outer Loading	HTMT	AVE	Description
Digital Leadership (X)	X1	0.869	0.897	0.642	Valid
	X2	0.839	0.897	0.642	Valid
	X3	0.869	0.897	0.642	Valid
	X4	0.886	0.897	0.642	Valid
	X5	0.812	0.897	0.642	Valid
	X6	0.684	0.897	0.642	Valid
	X7	0.640	0.897	0.642	Valid
	X8	0.776	0.897	0.642	Valid
Transformasi Digital (Y)	Y1	0.662	0.897	0.602	Valid
	Y2	0.798	0.897	0.602	Valid
	Y3	0.727	0.897	0.602	Valid
	Y4	0.878	0.897	0.602	Valid
	Y5	0.784	0.897	0.602	Valid
	Y6	0.786	0.897	0.602	Valid
	Y7	0.712	0.897	0.602	Valid

Y8 0.836 0.897 0.602 Valid

From the analysis results of all indicators on the Digital Leadership and Digital Transformation variables, they were declared valid because they met the criteria for convergent and discriminant validity, as indicated by outer loading values that were mostly > 0.70, AVE values > 0.50, and HTMT values < 0.90. In addition, the hypothesis testing results showed that Digital Leadership had a positive and significant effect on Digital Transformation with a path coefficient value of 0.829, a T-statistics value of 13.213 (>1.96), and a P-values value of <0.001 (<0.05), so the research hypothesis was declared accepted (supported).

Source: Processed primary data (2026)

Table 2. Hypothesis Testing Result (*Path Coefficients*)

Hipotesis	Path Coefficients	T-statistics	P-Values	Verdict
Digital Leadership → Transformasi Digital	.829	13.213	<0.001	Supported

A positive coefficient value indicates a positive directional influence, T-statistics > 1.96 and P-values < 0.05, so the influence is significant and the hypothesis is accepted.

Source: Processed primary data (2026)

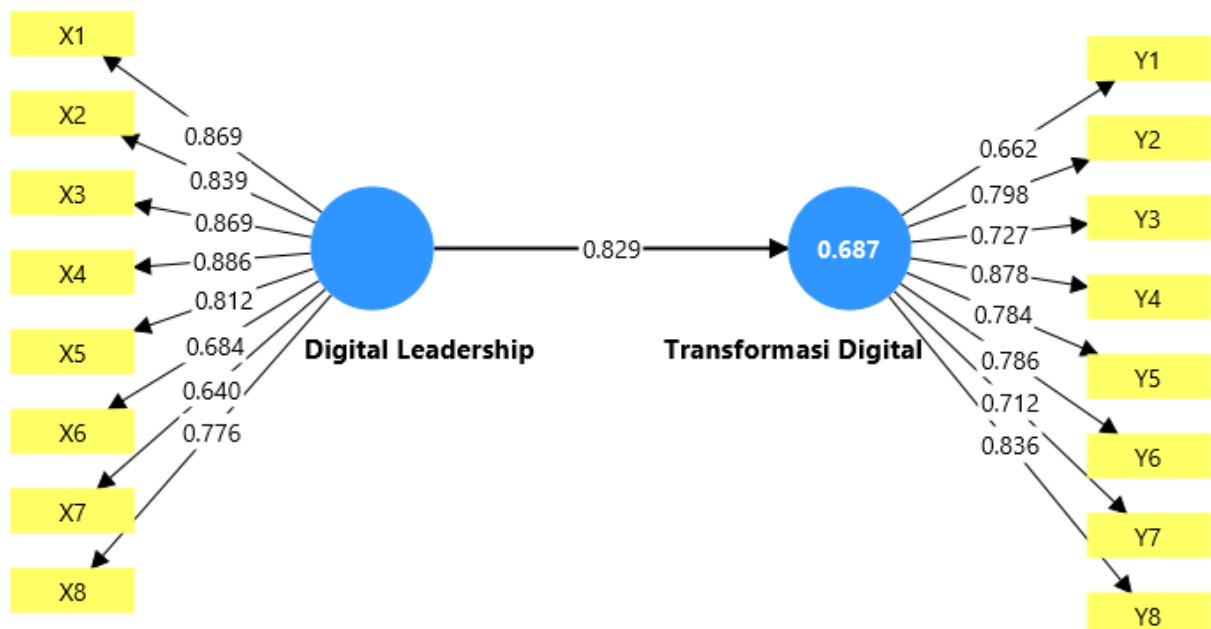


Figure 1. Structural Model Estimation Results (PLS Algorithm)
Source: SmartPLS Data Analysis Results (2026)

Based on the PLS Algorithm model image, Digital Leadership has a positive effect on Digital Transformation with a coefficient value of 0.829. In addition, all indicators are declared valid because they have outer loading values that meet the criteria, and the R-square value of 0.687 indicates that Digital Leadership can explain Digital Transformation by 68.7%.

Based on the bootstrapping model image, the P-values of 0.000 indicate that the influence of Digital Leadership on Digital Transformation is statistically significant. In addition, the R-square value of 0.687 shows that the Digital Leadership variable is able to explain 68.7% of Digital Transformation, so the research model is considered good and the hypothesis is accepted.

Discussion

Based on the results of data analysis using the SmartPLS application, this study shows that the research model used has met the criteria of a good model fit, both in terms of the measurement model (outer model) and the structural model (inner model). The use of the Partial Least Square Structural Equation Modeling (PLS-SEM) method in this study is considered appropriate because it can simultaneously test relationships between latent variables, especially in social and educational research that has complex relationships between constructs. Through this approach, researchers can determine the level of validity and reliability of indicators, while also measuring the strength of the influence relationships between variables in the research model comprehensively.

At the outer model evaluation stage, the analysis results show that all indicators on the digital leadership variable (X) and digital transformation variable (Y) are declared valid and reliable. Indicator validity can be seen from the outer loading values, most of which are above 0.70. These values indicate that the indicators used in the study can represent the variable constructs well and have a strong relationship with the measured latent variables. In SEM-PLS-based research, an outer loading value above 0.70 is considered very good because it indicates that the indicators have a high contribution in explaining the construct. However, several indicators in this study have loading values in the range of 0.60–0.70. These values are still acceptable because this study falls into the category of exploratory social research, so tolerance for indicators with values above 0.60 is still allowed if it does not reduce the overall quality of the model.

These results indicate that the research instrument used has been able to accurately measure the concepts of digital leadership and digital transformation. The digital leadership variable in this study reflects the ability of leaders to utilize digital technology to support decision-making, build effective organizational communication, create innovation, and direct educational organizations toward technology-based change. Meanwhile, the digital transformation variable describes changes in the education system using digital technology in administration, learning, communication, and school or madrasah management. The high outer loading values for each indicator show that all statement items in the questionnaire are appropriate in describing the actual conditions in the field.

In addition, the Average Variance Extracted (AVE) values for both variables have also exceeded the minimum threshold of 0.50. AVE values above 0.50 indicate that the construct can explain more than 50% of the variance of its indicators. In other words, the indicators in this study have a good level of convergent validity because they can adequately explain the measured constructs. Convergent validity is one of the important requirements in SEM-PLS analysis because it indicates that the indicators within the same variable are truly correlated and measure the same concept.

Not only valid, the results of this study also show that the research instrument has a good level of reliability. This can be seen from the composite reliability values, which are above 0.70 for

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each variable. These values indicate that the research instrument has a high level of internal consistency, so the data obtained can be trusted and used to consistently measure the research variables. Good reliability indicates that if the study is conducted again under relatively similar conditions, the results obtained will not differ significantly. Therefore, this research instrument is considered suitable for use as a data collection tool in measuring the influence of digital leadership on digital transformation in Madrasah Aliyah.

At the inner model evaluation stage, the analysis results show an R-Square value of 0.687 for the digital transformation variable. This value falls into the strong category because it approaches 0.70. This indicates that the digital leadership variable has a high ability to explain variations in the digital transformation variable. Statistically, this means that 68.7% of the changes or variations in digital transformation in Madrasah Aliyah can be explained by the digital leadership variable, while the remaining 31.3% is influenced by other variables outside the research model.

The magnitude of this influence shows that digital leadership has a very important position in determining the success of digital transformation in educational institutions. Digital transformation is not only related to the provision of technological devices or digital systems but is also greatly influenced by the leader's ability to manage organizational change. Leaders who possess digital competencies will find it easier to understand technological developments, determine digital-based policy directions, and create an organizational culture that supports innovation and technological adaptation. Therefore, the success of digital transformation in education cannot be separated from the quality of leadership possessed by madrasah principals or leaders of educational institutions.

Meanwhile, the remaining influence of 31.3% indicates that there are other factors outside digital leadership that also affect digital transformation in Madrasah Aliyah. These factors may include organizational culture, teachers' digital competence, human resource readiness, the availability of technological facilities and infrastructure, government policy support, as well as the readiness of internet infrastructure and information technology networks. These factors also play an important role in supporting the success of digital transformation in educational institutions. Therefore, digital transformation should be carried out comprehensively by involving various aspects of educational organizations so that the results achieved can be more optimal.

The results of the hypothesis testing in this study indicate that digital leadership has a positive and significant effect on digital transformation. This is evidenced by a path coefficient value of 0.829 with a P-Value < 0.05. The coefficient value shows a very strong and positive relationship. This means that the higher the digital leadership capability possessed by madrasa leaders, the higher the level of success of digital transformation occurring within the Madrasah Aliyah environment. Conversely, if digital leadership capability is low, the digital transformation process also tends to run less optimally.

The positive effect indicates that leaders have a central role as the main driving force of organizational change in education toward a digital-based system. In the current era of technological development, educational leaders are required not only to possess conventional managerial abilities but also adequate digital competencies. Leaders must be able to understand the use of technology, build a culture of innovation, encourage the utilization of digital systems, and provide support to teachers and educational staff in the process of technological adaptation. Good digital leadership will create a more adaptive, collaborative, and innovative work environment so that digital transformation can be implemented effectively and sustainably.

The results of hypothesis testing in this study indicate that digital leadership has a positive and significant effect on digital transformation. This is evidenced by a path coefficient value of 0.829 with a P-Value < 0.05. The coefficient value indicates a very strong and positive relationship. This means that the higher the digital leadership capability possessed by madrasah leaders, the higher the level of success of digital transformation occurring within the Madrasah Aliyah environment. Conversely, if digital leadership capability is low, the digital transformation process also tends to run less optimally.

Theoretically, the results of this study are in line with educational management theory, particularly the concept of transformational leadership, which positions leaders as agents of change within educational organizations. According to Wang and Rofiq (2019), transformational leaders can influence organizational members through vision, motivation, innovation, and positive change (Afsar et al., 2019). In the context of digital education, this concept has evolved into digital leadership, namely leadership that can integrate technology into the management processes of educational organizations. Leaders who possess digital competencies are not only able to formulate technology-based policies, but are also capable of building a clear, directed, and sustainable digital vision related to the development of digital education systems in schools and madrasahs.

Digital leadership also plays an important role in creating an innovative organizational culture. Leaders who are adaptive to technological developments will find it easier to encourage teachers and educational staff to use digital technology in both learning activities and school administration ((Trimiltn et al., 2025). This is very important because digital transformation is essentially not only a change in work tools, but also a change in work culture and the mindset of educational organizations. Therefore, the success of digital transformation requires leadership support.

The results of this study also show that the success of digital transformation is not only determined by the availability of technology but is also strongly influenced by the quality of leadership. Many educational institutions already have adequate technological facilities yet have not been able to implement digital transformation optimally due to a lack of visionary and adaptive leadership toward technological change. On the other hand, educational institutions with limited facilities are still able to carry out digital innovation when led by leaders who are creative and possess strong digital capabilities.

Leaders with high digital literacy tend to be more flexible and responsive to change, capable of managing organizational resistance, and able to utilize technology to improve work effectiveness and efficiency (Sarjito & Djati, 2025). This is in line with the findings of this study, which show that digital leadership indicators make a significant contribution to improving digital transformation indicators, such as the use of digital administrative systems, technology-based data management, and the implementation of digital learning in Madrasah Aliyah.

In practice, digital transformation in the educational environment can be realized through various forms of innovation, such as the use of academic information systems, school administration applications, e-learning-based learning, document digitalization, online meetings, and the use of digital platforms in school communication. All forms of transformation require the support of leaders who can provide direction, motivation, and policies that support the optimal use of technology.

From an ecotheological perspective, the implementation of digital leadership also carries a broader meaning, namely as a form of human responsibility in maintaining environmental balance through the wise use of technology. According to Anindhyta and Karnati (2024), the use of digital technology in education can become part of efforts to preserve the environment by reducing the excessive use of natural resources. For example, the use of paperless systems,

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document digitalization, and digital-based learning can reduce paper usage and minimize school administrative waste (Anindhyta & Karnati, 2024).

This is in line with the views of Widiastuty and Anwar (2025), who emphasize that humans have a moral and spiritual responsibility to preserve environmental sustainability. In the context of education, digital transformation is not only a form of modernization of the education system, but also part of efforts to build ecological awareness using environmentally friendly and sustainable technology (Widiastuty & Anwar, 2025).

The findings of this study are also relevant to efforts to achieve the Sustainable Development Goals (SDGs), particularly the goal of quality education. Effective digital leadership can improve the quality of educational services through learning innovation, broader access to information, more efficient administrative systems, as well as more modern and transparent educational management. With digital transformation, the learning process becomes more flexible, interactive, and easily accessible to students.

In addition, digital transformation can also improve the quality of educational management through faster, more accurate, and more efficient data management. Madrasah principals can utilize digital technology in decision-making processes, performance evaluation, and the development of educational programs more effectively. Therefore, digital leadership can become one of the important strategies in improving the quality of education in Madrasah Aliyah so that they are able to compete and adapt to current developments in the digital era.

Conclusion

Based on the results of data analysis using SmartPLS, this study concludes that digital leadership (X) has a positive and significant influence on the acceleration of digital transformation (Y) in Madrasah Aliyah. These results indicate that digital leadership is one of the important factors supporting the successful implementation of digital transformation in the educational environment. The positive influence is evidenced by a path coefficient value of 0.829, which shows a very strong relationship between the digital leadership and digital transformation variables. This value indicates that the higher the digital leadership capability possessed by madrasah leaders, the higher the level of success in digital transformation that can be achieved. In addition, the statistical test results show a P-Value < 0.05, meaning that the relationship between the two variables is statistically significant and the research hypothesis is accepted.

The findings of this study confirm that the success of digital transformation in Madrasah Aliyah does not only depend on the availability of technology or digital infrastructure but is also greatly influenced by the leader's ability to manage technology-based change. Leaders with strong digital competencies tend to be more capable of creating innovation, building a digital work culture, and directing educational organizations to become more adaptive to technological developments. In the context of modern education, digital leadership becomes a strategic factor capable of accelerating the use of technology in administration, learning processes, communication, and decision-making within the madrasah environment.

In addition, the study results also show an R-Square value of 0.687 for the digital transformation variable. This value indicates that digital leadership can explain 68.7% of the variation in digital transformation in Madrasah Aliyah. This figure falls into the strong category, so it can be concluded that the digital leadership variable makes a substantial contribution to the success of digital transformation. Meanwhile, the remaining 31.3% is influenced by other factors outside the scope of this research model. These factors may include organizational culture, teachers' digital competence, technological readiness, institutional policy support, the quality of human resources, as well as the availability of information technology facilities and infrastructure.

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The findings of this study also provide practical implications for educational institutions, particularly Madrasah Aliyah, that improving the quality of digital leadership should become a primary concern in facing the era of technological transformation. Madrasa principals and educational leaders need to enhance their digital literacy skills, technology-based managerial abilities, and their capacity to create digital educational innovations so that digital transformation can proceed effectively and sustainably. With strong digital leadership, educational institutions will be better prepared to face the challenges of changing times and will be able to improve the quality of educational services in a more modern, efficient, and adaptive manner.

For future research, it is recommended to include other variables that are also suspected of influencing digital transformation, such as organizational culture, technological readiness, teachers' digital competence, government policy support, and the quality of information technology infrastructure. The inclusion of these variables is expected to provide a more comprehensive understanding of the factors affecting the success of digital transformation in educational institutions. In addition, future studies may also expand the research object to various other levels of education so that the research results become broader and are able to make a greater contribution to the development of educational management science and digital transformation in Indonesia.

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STATEMENT OF AI (ARTIFICIAL INTELLIGENCE) USAGE

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