

Digital Transformation of School Administration: The Influence of Mobile, Web Based Management Applications, and Leadership in Elementary Schools

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Abstract: Digital transformation in educational management requires schools to strengthen administrative efficiency through technology utilization and adaptive leadership. This study examines the contribution of mobile-based management applications, web-based management applications, and leadership to school administrative efficiency in elementary schools in Jumo District, Temanggung Regency. A quantitative ex post facto design involved 90 teachers selected through proportional random sampling. Data were collected using questionnaires and analyzed with simple linear regression for each predictor and multiple linear regression for their joint contribution using SPSS 26. Simple regression showed significant positive contributions from mobile-based management ($B = 0.558$, $R^2 = 0.607$, $t = 11.670$, $p < 0.001$), web-based management ($B = 0.611$, $R^2 = 0.567$, $t = 10.733$, $p < 0.001$), and leadership ($B = 0.704$, $R^2 = 0.611$, $t = 11.745$, $p < 0.001$). Simultaneously, the three predictors explained 67.5% of the variance in administrative efficiency ($R^2 = 0.675$, $F = 59.532$, $p < 0.001$). These findings highlight the contribution of digital management systems and leadership to school administrative governance.

Keywords: administrative efficiency; digital transformation; mobile-based management application; school leadership; web-based management application.

Abstrak: Transformasi digital dalam manajemen pendidikan menuntut sekolah memperkuat efisiensi administrasi melalui pemanfaatan teknologi dan kepemimpinan yang adaptif. Penelitian ini menganalisis kontribusi aplikasi manajemen berbasis mobile, aplikasi manajemen berbasis web, dan kepemimpinan terhadap efisiensi administrasi sekolah pada Sekolah Dasar Negeri se-Kecamatan Jumo, Kabupaten Temanggung. Penelitian menggunakan pendekatan kuantitatif dengan desain ex post facto dan melibatkan 90 guru yang dipilih melalui proportional random sampling. Data dikumpulkan menggunakan kuesioner dan dianalisis dengan regresi linier sederhana untuk setiap prediktor serta regresi linier berganda untuk menguji kontribusi bersama menggunakan SPSS 26. Hasil regresi sederhana menunjukkan kontribusi positif dan signifikan dari manajemen berbasis mobile ($B = 0,558$; $R^2 = 0,607$; $t = 11,670$; $p < 0,001$), manajemen berbasis web ($B = 0,611$; $R^2 = 0,567$; $t = 10,733$; $p < 0,001$), dan kepemimpinan ($B = 0,704$; $R^2 = 0,611$; $t = 11,745$; $p < 0,001$). Secara simultan, ketiga prediktor menjelaskan 67,5% variasi efisiensi administrasi ($R^2 = 0,675$; $F = 59,532$; $p < 0,001$). Temuan ini menegaskan kontribusi sistem manajemen digital dan kepemimpinan dalam mendukung tata kelola administrasi sekolah.

Kata kunci: aplikasi manajemen berbasis mobile; aplikasi manajemen berbasis web; efisiensi administrasi; kepemimpinan sekolah; transformasi digital.

Introduction

The development of digital technology has brought significant changes to the management of educational institutions. Schools are no longer only required to perform academic functions but are also expected to implement effective, rapid, accurate, and data-driven administrative governance. Digital transformation in education encourages changes in work systems from conventional administration toward integrated management information systems. The utilization of information technology in educational management has become one of the strategies to improve service quality, work efficiency, and support information-based decision-making processes (Ibrohim & Hidayati, 2024; Widiastuti et al., 2025).

School administration is an essential component of educational management because it involves the management of student data, teaching personnel, learning documents, reporting activities, and various information required for decision-making. However, many schools still encounter challenges, particularly when administrative processes are conducted manually. High administrative workloads may reduce the effectiveness of educators in carrying out their primary teaching responsibilities. Therefore, the implementation of educational management information systems has become a strategic necessity for improving school administrative efficiency (Sari et al., 2024; Kristanti & Ramadhan Putra, 2025).

Digital-based management information systems provide opportunities for schools to automate administrative tasks, integrate data, and provide information more efficiently. Sari et al. (2024) demonstrated that digital-based management information systems improve administrative efficiency through more structured data management and reduced repetitive tasks, while Kristanti and Ramadhan Putra (2025) reported improvements in administrative effectiveness and information accessibility. However, these studies generally treat digital systems as a broad construct and do not clearly distinguish the specific contribution of mobile-based and web-based management applications or integrate leadership within the same explanatory model.

The use of mobile-based applications has expanded because they allow users to access administrative services through portable devices anytime and anywhere. In educational settings, mobile applications can support communication, data management, and monitoring of school activities. Subiyakto et al. (2021) explained that mobile system performance is influenced by ease of use, system quality, and users' technological capability. However, their emphasis is primarily on system performance and user acceptance rather than the direct effect of mobile-based management applications on school administrative efficiency.

Web-based applications also support centralized data storage and processing, improve information accessibility, and facilitate more systematic administrative work. Sunarya et al. (2025) emphasized the importance of evaluating educational information systems to ensure effective data management and decision-making, while Wandri et al. (2025) showed that web-based school information systems can optimize data management through integrated work processes. Nevertheless, these studies focus mainly on system evaluation and data management, leaving limited evidence on the contribution of web-based applications when analyzed simultaneously with mobile-based applications and leadership.

The implementation of school management applications also faces challenges related to infrastructure, digital literacy, data security, and organizational readiness. Coalliani et al. (2025) emphasized data security and management as important factors in implementing school information systems, while Aminah et al. (2025) showed that teachers' digital literacy plays an important role in optimizing school management information systems. These findings suggest

that technological implementation depends not only on system availability but also on human and organizational readiness.

Leadership is therefore an important factor in the digital transformation of school administration. School principals determine digitalization policies, support innovation, develop staff capacity, and create an organizational culture that is adaptive to technological change. Okunlola (2025) found that digital leadership is associated with school effectiveness through leaders' ability to direct technology utilization, while Mizova et al. (2026) emphasized the strategic role of principals in leading educational digital transformation. However, these studies do not specifically test leadership together with mobile-based and web-based management applications as predictors of school administrative efficiency.

Preliminary observations in the research setting, consisting of 14 public elementary schools with 117 teachers in Jumo District, Temanggung Regency, indicated that administrative digitalization had not been implemented uniformly. Manual administrative practices were still encountered, while the utilization of digital management applications varied among users. These conditions indicate a practical gap between the need for efficient digital administration and the actual implementation of technology in elementary schools.

Based on the literature above, three research gaps can be identified. First, previous studies tend to examine management information systems, mobile applications, web-based systems, or digital leadership separately. Second, empirical evidence on the simultaneous contribution of technological and leadership factors to administrative efficiency remains limited. Third, research specifically addressing these relationships in public elementary schools is still relatively scarce.

The novelty of this study lies in simultaneously examining mobile-based management applications, web-based management applications, and leadership as three distinct predictors of school administrative efficiency within one empirical model in public elementary schools. This study therefore conceptualizes digital transformation not merely as technology adoption, but as an integration of mobile technology, web-based technology, and organizational leadership.

Accordingly, this study addresses whether and to what extent mobile-based management applications, web-based management applications, and leadership influence school administrative efficiency, both partially and simultaneously, in public elementary schools in Jumo District. The study aims to analyze the partial effects of each predictor and their simultaneous effect on administrative efficiency. Theoretically, this study extends educational management research by integrating technological and leadership dimensions in one model. Empirically, it provides evidence from the public elementary school context. Practically, the findings are expected to support school principals and educational policymakers in developing digital administration strategies that balance technology utilization, system integration, and leadership capacity.

Methods

This study employed a quantitative approach using an ex post facto design. The quantitative approach was selected because the study aimed to examine relationships among variables objectively through statistical analysis. The ex post facto design was applied because the researcher did not provide treatment or intervention to the research subjects; instead, the study analyzed conditions that had already occurred based on empirical data obtained from respondents. Accordingly, the statistical relationships identified in this study are interpreted as associations and predictive effects rather than evidence of absolute causality. Because the independent variables were not experimentally manipulated and respondents were not randomly assigned to treatment conditions, causal conclusions should be interpreted cautiously.

This study also adopted an explanatory research design to explain the relationships among the variables formulated in the research hypotheses. The independent variables were mobile-based management applications (X1), web-based management applications (X2), and leadership (X3), while the dependent variable was school administrative efficiency (Y). The analysis examined both the partial and simultaneous effects of the three independent variables on school administrative efficiency. Within this framework, the term “effect” refers to a statistically estimated contribution based on regression analysis and does not imply experimentally established causation.

The research was conducted at public elementary schools in Jumo District, Temanggung Regency, Indonesia. The location was selected because schools in the area have implemented digital-based management systems to support administrative activities. The research was conducted from May 2025 to February 2026, covering instrument preparation, data collection, data processing, data analysis, and report preparation. The population consisted of all 117 teachers from 14 public elementary schools in Jumo District, Temanggung Regency. Thus, the target population was characterized by teachers working at the same educational level, under public school administration, and within the same district context. Including teachers from all 14 schools allowed the study to represent variations in administrative and digital management practices across schools in the district.

The sample size was determined using the Slovin formula with a 5% margin of error, resulting in 90 teachers. Proportional random sampling was employed so that each school contributed respondents in proportion to its number of teachers. This procedure was intended to maintain proportional representation across the 14 schools and reduce overrepresentation or underrepresentation of schools with different staff sizes. All 90 selected teachers returned usable questionnaires, resulting in a 100% response rate from the targeted sample. The final sample represented approximately 76.9% of the total population of 117 teachers. The research instrument was a questionnaire developed from the indicators of four variables: school administrative efficiency, mobile-based management applications, web-based management applications, and leadership. Each item was measured using a five-point Likert scale consisting of Strongly Agree (SA), Agree (A), Neutral (N), Disagree (D), and Strongly Disagree (SD).

School administrative efficiency was measured through time efficiency, labor efficiency, cost and facility efficiency, and technology utilization efficiency. Mobile-based management applications were measured through performance expectancy, effort expectancy, social influence, and facilitating conditions. Web-based management applications were measured through system usability and security, service quality and system performance, operational efficiency, and technological and human resource readiness. Leadership was measured through educational leadership, managerial leadership, supervisory leadership, visionary leadership, social relations, and human resource development. Data were collected by distributing questionnaires to the selected teachers. The 90 returned questionnaires were included in the analysis. Before data collection, the instrument was tested for validity and reliability. Validity was examined through correlations between individual item scores and total scores, while reliability was assessed using Cronbach’s Alpha. The instrument was considered reliable when the Cronbach’s Alpha value met the predetermined criterion.

Data were analyzed using descriptive statistics and multiple linear regression with SPSS version 26 for Windows. Descriptive statistics included the mean, median, mode, standard deviation, and data distribution. Before hypothesis testing, prerequisite analyses included normality, multicollinearity, heteroscedasticity, and linearity tests. Hypothesis testing used multiple linear regression, t-tests for partial effects, an F-test for the simultaneous effect, and the coefficient of determination to estimate the contribution of the independent variables in

explaining variation in school administrative efficiency. Given the non-experimental ex post facto design, the regression findings were interpreted as statistical relationships and contributions within the observed context rather than definitive causal evidence.

Result and Discussion

This study involved 90 teachers from public elementary schools in Jumo District, Temanggung Regency. Descriptive results showed variations in school administrative efficiency, mobile-based management, web-based management, and leadership. The One-Sample Kolmogorov-Smirnov test produced $p < .001$ for mobile-based management, web-based management, and leadership, and $p = .001$ for administrative efficiency, indicating non-normal distributions of the observed scores. Because the normality assumption in linear regression primarily concerns residuals rather than raw variables, these findings do not automatically invalidate the regression model. However, inferential results should be interpreted cautiously because residual-normality diagnostics or bootstrap correction were not reported. The heteroscedasticity test showed no systematic residual pattern, while the predictor-outcome relationships met the linearity criterion ($p < .001$).

Multicollinearity diagnostics also require cautious interpretation. Mobile-based management had tolerance = 0.198 and VIF = 5.062, web-based management tolerance = 0.171 and VIF = 5.852, and leadership tolerance = 0.284 and VIF = 3.525. Although these values remain within the tolerance > 0.10 and VIF < 10 criteria, the relatively high VIF values for mobile and web management indicate substantial shared variance and possible conceptual overlap.

The Effect of Mobile-Based Management on School Administrative Efficiency

Mobile-based management was positively and significantly associated with school administrative efficiency ($R = 0.779$, $F = 136.199$, $t = 11.670$, $p < .001$), supporting H1. The coefficient was $B = 0.558$, with $R^2 = 0.607$ and Adjusted $R^2 = 0.603$. Thus, mobile-based management explained approximately 60.3% of the adjusted variance in administrative efficiency when examined separately.

Table 1. Regression Test Results of Mobile-Based Management on School Administrative Efficiency

Independent Variable	R	R ²	Adjusted R ²	F-value	Sig. F	B	t-value	Sig. t	Decision
Mobile-Based Management (X1)	0.779	0.607	0.603	136.199	<.001	0.558	11.670	<.001	H1 Accepted

Source: Research data processed using SPSS 26.0

Mobile technology can support faster and more flexible administrative work through easier access to information and communication. This finding is consistent with Subiyakto et al. (2021), who emphasized system quality, ease of use, and user acceptance. The dimensions measured in this study help explain the finding. Performance expectancy represents perceived usefulness, effort expectancy reflects ease of use, social influence represents support from colleagues and leaders, and facilitating conditions concern devices, connectivity, and technical support. Weakness in any dimension may reduce the administrative benefits of mobile applications.

Teachers' digital competence is essential so that applications function as working instruments rather than additional burdens (Hizam et al., 2021). Management information system transformation can simplify administrative processes and support teacher performance management (Faizah et al., 2025), while digital literacy strengthens adaptation to technology-

based work systems (Aminah et al., 2025). Schools should therefore combine mobile applications with user training, reliable connectivity, technical assistance, and clear administrative procedures.

The Effect of Web-Based Management on School Administrative Efficiency

Web-based management also had a positive and significant relationship with administrative efficiency ($R = 0.753$, $F = 115.201$, $t = 10.733$, $p < .001$), supporting H2. The coefficient was $B = 0.611$, with $R^2 = 0.567$ and Adjusted $R^2 = 0.562$, indicating approximately 56.2% adjusted explained variance when analyzed separately.

Table 2. Regression Test Results of Web-Based Management on School Administrative Efficiency

Independent Variable	R	R ²	Adjusted R ²	F-value	Sig. F	B	t-value	Sig. t	Decision
Web-Based Management (X2)	0.753	0.567	0.562	115.201	<.001	0.611	10.733	<.001	H2 Accepted

Source: Research data processed using SPSS 26.0

Web-based systems support centralized data storage, information access, and systematic administrative processes. Digital management information systems can improve data collection, storage, and presentation (Sari et al., 2024), while integrated systems support administrative effectiveness and decision-making (Kristanti & Ramadhan Putra, 2025). Similar benefits have been identified at the elementary-school level through structured academic data management (Toonao et al., 2023). The dimensions of web-based management show that system availability alone is insufficient. System usability and security determine accessibility and data protection; service quality and performance influence reliability; operational efficiency determines whether duplicated work is reduced; and technological and human-resource readiness influence sustainability. These interpretations are consistent with research emphasizing data-driven governance (Rahman & Prabowo, 2025), system evaluation (Sunarya et al., 2025), strategic system development (Nurhayati & Purwaningsih, 2026), data security and user readiness (Coalliani et al., 2025), and structured web-based data management (Wandri et al., 2025). The VIF values of 5.852 for web management and 5.062 for mobile management indicate possible overlapping functions. Both platforms may access similar administrative information and processes. Therefore, future instruments should distinguish platform-specific functions more clearly.

The Effect of Leadership on School Administrative Efficiency

Leadership had a positive and significant relationship with administrative efficiency ($R = 0.781$, $F = 137.936$, $t = 11.745$, $p < .001$), supporting H3. The coefficient was $B = 0.704$, with $R^2 = 0.611$ and Adjusted $R^2 = 0.607$, indicating approximately 60.7% adjusted explained variance when examined separately.

Table 3. Regression Test Results of Leadership on School Administrative Efficiency

Independent Variable	R	R ²	Adjusted R ²	F-value	Sig. F	B	t-value	Sig. t	Decision
Leadership (X3)	0.781	0.611	0.607	137.936	<.001	0.704	11.745	<.001	H3 Accepted

Source: Research data processed using SPSS 26.0

Leadership influences efficiency through policy direction, resource coordination, innovation support, supervision, and staff development. Digital leadership requires principals to integrate technology into school management strategies (Okunlola, 2025), while principals play a strategic role in developing vision, managing change, and strengthening human-resource readiness (Mizova et al., 2026). The educational, managerial, supervisory, visionary, social-relational, and human-resource-development dimensions provide several mechanisms through which principals can shape technology adoption and administrative work.

Leadership produced the largest unstandardized coefficient ($B = 0.704$), compared with web-based management ($B = 0.611$) and mobile-based management ($B = 0.558$). A plausible explanation is that leadership operates across multiple organizational mechanisms, including technology adoption, resource allocation, coordination, supervision, and competency development. However, these B values are unstandardized coefficients based on predictors with different measurement structures. Therefore, they should not be interpreted as definitive evidence that leadership is the most dominant variable. A valid comparison of predictor strength would require standardized beta coefficients from the same multiple-regression model.

Successful technology implementation also requires strategic planning and adaptive organizational support (Azis, 2026), while managerial support helps ensure that information systems improve educational services (Shobri, 2024). Principals should establish digital administrative standards, clarify data-management responsibilities, provide competency development, and monitor administrative workload and technology utilization.

The Simultaneous Effects of Mobile-Based Management, Web-Based Management, and Leadership on School Administrative Efficiency

The simultaneous model showed a very strong relationship with administrative efficiency ($R = 0.822$, $F = 59.532$, $p < .001$), supporting H4. The model produced $R^2 = 0.675$ and Adjusted $R^2 = 0.664$, indicating that the three predictors jointly explained approximately 66.4% of the adjusted variance. The remaining 33.6% may be associated with factors outside the model.

Table 4. Multiple Linear Regression Results

Predictor Variables	R	R ²	Adjusted R ²	F-value	Sig.	Decision
X1 (Mobile-Based Management), X2 (Web-Based Management), X3 (Leadership) → Administrative Efficiency	0.822	0.675	0.664	59.532	<.001	H4 Accepted

Source: Research data processed using SPSS 26.0

The result indicates that administrative efficiency is related to the integration of technological systems and organizational leadership. Educational management information systems support data-based decision-making and educational governance (Ibrohim & Hidayati, 2024), improve administrative processes and educational services (Chili et al., 2025), and strengthen school-based management functions (Noviyanti et al., 2025). Their effectiveness also depends on schools' ability to manage and utilize information for decision-making (Prayoga, 2024). The combined R^2 should not be interpreted as the sum of individual R^2 values because mobile and web variables share substantial variance. Mobile applications provide flexible access, web systems provide centralized data management, and leadership aligns both technologies with staff capability and administrative procedures. Thus, digitalization should be managed as an integrated organizational process rather than as separate technology adoption.

Practically, schools should define distinct functions for mobile and web platforms, establish common data-management and security standards, provide continuous digital competency development, and strengthen principals' responsibility for monitoring technology use, data quality, administrative workload, and service efficiency. Evaluation should use operational indicators such as processing time, duplicated data entry, manual documentation, and administrative service completion time.

Research Limitations and Implications

Several limitations should be considered. First, the ex post facto design does not permit absolute causal conclusions because the variables were not experimentally manipulated. Second, the study was limited to public elementary schools in Jumo District; therefore, generalization to different geographical, institutional, and technological contexts should be made cautiously. Third, the relatively high VIF values for mobile and web management indicate potential conceptual overlap that may affect estimates of their unique contributions. Fourth, the observed scores did not meet the Kolmogorov-Smirnov normality criterion, while residual-normality or bootstrap diagnostics were not reported. Finally, the study relied on teachers' questionnaire responses rather than objective indicators such as administrative processing time, system logs, or administrative costs. Future research should distinguish mobile- and web-specific administrative functions more clearly, report standardized beta coefficients, apply residual diagnostics and robust or bootstrap inference when appropriate, expand the geographical scope, and combine perception-based measures with objective indicators of administrative efficiency.

Conclusion

The findings indicate that mobile-based management applications, web-based management applications, and leadership are positively and significantly associated with school administrative efficiency in public elementary schools in Jumo District. When examined separately, mobile-based management showed $R = 0.779$, $R^2 = 0.607$, and Adjusted $R^2 = 0.603$; web-based management showed $R = 0.753$, $R^2 = 0.567$, and Adjusted $R^2 = 0.562$; while leadership showed $R = 0.781$, $R^2 = 0.611$, and Adjusted $R^2 = 0.607$. In the simultaneous model, the three predictors showed a strong collective relationship with administrative efficiency ($R = 0.822$, $R^2 = 0.675$, Adjusted $R^2 = 0.664$, $F = 59.532$, $p < .001$), indicating that they jointly accounted for approximately 66.4% of the adjusted variance in school administrative efficiency. These results support the view that administrative digitalization is associated with the integration of mobile access, web-based data management, and leadership capacity rather than with technology utilization alone.

These findings should be interpreted within several limitations. The ex post facto design does not permit definitive causal conclusions because the variables were observed without experimental manipulation. The study was also limited to public elementary schools in Jumo District, which restricts generalization to schools with different institutional, geographical, and technological conditions. In addition, the relatively high VIF values for mobile- and web-based management indicate potential overlap between the two constructs, while the non-normality indicated by the Kolmogorov-Smirnov test requires caution in interpreting statistical inference. Practically, schools should clarify the distinct administrative functions of mobile and web platforms, establish shared data-management and security standards, provide continuous digital competency training for teachers, and strengthen principals' responsibility for monitoring system use, data quality, administrative workload, and service efficiency. Future research should

examine broader school contexts, distinguish mobile- and web-specific functions more clearly, employ residual diagnostics and robust or bootstrap procedures where appropriate, and combine questionnaire data with objective indicators such as processing time, system usage records, duplicated data entry, and administrative service completion rates.

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