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Research Article

Digital Training Components and Civil Servants' Digital Productivity: The Mediating Role of Adaptive Competence

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Abstract. Digital transformation in the public sector encourages civil servants to utilize technology not only for administrative purposes but also to improve efficiency, accuracy, and work performance. This study examines the influence of Intelligent Learning-Based Training and Digital Training Components on the Digital Productivity of civil servants at the Bureau of Economic Affairs of the Regional Secretariat of Lampung Province, with Adaptive Competence serving as a mediating variable. A quantitative approach with a non-experimental survey design was applied, and data were collected through structured questionnaires distributed to employees engaged in digital-based work activities. The data were analyzed using structural model testing procedures. The findings reveal that Intelligent Learning-Based Training does not significantly influence Adaptive Competence or Digital Productivity. Conversely, Digital Training Components positively and significantly affect both Adaptive Competence and Digital Productivity. Adaptive Competence also has a positive impact on Digital Productivity and mediates the relationship between Digital Training Components and Digital Productivity. However, Adaptive Competence does not mediate the relationship between Intelligent Learning-Based Training and Digital Productivity. These results indicate that civil servants' digital productivity is more effectively improved through practical, relevant, accessible, and well-evaluated digital training programs than through intelligent learning systems alone. Therefore, public institutions are encouraged to develop digital training initiatives that align with employees' daily work demands while strengthening their adaptive competence in responding to technological changes.

Keywords: Adaptive Competence; Civil Servants; Digital Productivity; Digital Training Components; Public Sector.

1. Introduction

Digital transformation has become a strategic agenda in public sector reform because government institutions are increasingly required to deliver faster, more integrated, transparent, and data-driven public services (Stark et al., 2025). In Indonesia, the implementation of digital government is reflected in the national Electronic-Based Government System index, which reached 3.12 in 2024 and was categorized as good (Kementerian PANRB, 2025). Although this achievement indicates progress in digital governance, it does not automatically ensure that every government work unit has achieved optimal digital productivity. Digital productivity depends on the ability of civil servants to use digital systems effectively in completing tasks, improving work accuracy, and supporting public service performance.

Digital transformation is not merely a technological change because it also requires organizational readiness, employee capability, and changes in work behavior (Verhoef et al., 2021). Employee-related factors are important because digital transformation requires workers to adapt to new systems, new procedures, and new patterns of collaboration (Trenerry et al., 2021). In the public sector, digital transformation can become complex when employees have insufficient digital skills to support technology-based work processes (Lopes et al., 2023). Therefore, civil servants are expected not only to operate digital applications but also to transform digital tools into productive work practices.

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Digital training is an important mechanism for improving employee readiness in technology-based organizations. Employee ICT training can strengthen human capital and support digital transformation by improving employees' knowledge and organizational commitment toward change (Nicolás et al., 2025). In the Indonesian public organization context, performance improvement is also related to how organizations measure performance, strengthen motivation, and build organizational commitment (Mufahamah & Wuryanti, 2021). Employee training and work discipline are also relevant human resource practices because they support employees in developing work capability and improving work behavior (Maulana et al., 2023).

Recent developments in learning technology have introduced Intelligent Learning-Based Training as a modern approach to employee development. Artificial intelligence-enabled adaptive learning platforms can adjust instructional content and learning pathways based on learner data to provide more personalized learning experiences (Meidi & Tannia, 2025). This approach is relevant for civil servants because employees may have different levels of digital competence, learning speed, and job-related technology needs. However, the effectiveness of intelligent learning systems depends on whether the training is connected to real work needs, accessible to users, and supported by meaningful feedback.

Digital training components are also important because training effectiveness is influenced by content relevance, system accessibility, evaluation mechanisms, and learning feedback. Technology adaptation has been shown to contribute to human resource quality development, especially when individuals are encouraged to improve their readiness toward technological change (Suganda et al., 2012). Practical digital training using office applications can also help users improve their ability to apply digital tools in work-related activities (Wibowo et al., 2024). Digital financial training using LibreOffice Calc also shows that application-based training can increase participants' enthusiasm and practical technology readiness (Wibowo et al., 2025).

Adaptive competence becomes an important factor in explaining how digital training can improve digital productivity. Adaptive performance reflects an employee's ability to respond effectively to changing work situations, new technologies, and uncertain work demands (Park & Park, 2021). In digital work environments, employees with strong adaptive competence are more capable of converting training outcomes into productive digital work behavior. The learning and growth perspective in non-financial performance assessment also emphasizes the importance of employee development as part of organizational performance improvement (Mufahamah & Wuryanti, 2012).

Previous studies have examined digital transformation, digital training, adaptive capability, and employee performance. However, limited studies have integrated Intelligent Learning-Based Training, digital training components, adaptive competence, and digital productivity in one empirical model in the context of local government organizations. Studies on IT capability and digital transformation show that human capability remains an important mechanism in improving technology-based performance (Barba et al., 2024). This indicates that employee-level adaptive competence still needs further investigation as a mediating mechanism in public sector digital productivity.

Based on these gaps, this study aims to examine the effect of Intelligent Learning-Based Training and digital training components on civil servants' digital productivity. This study also examines the mediating role of adaptive competence in the relationship between digital training and digital productivity. The research is conducted on civil servants at the Bureau of Economic Affairs of the Regional Secretariat of Lampung Province. The novelty of this study lies in the development of an integrated model that positions adaptive competence as a mediating mechanism between digital training and digital productivity in a local government context.

2. Literature Review

Human Capital Theory explains that employee knowledge, skills, and capabilities are strategic assets that can improve organizational performance when developed through structured training. Human capital development contributes to organizational performance because it strengthens employees' ability to create value in work processes (Aman et al., 2022). In digital transformation, employee competence becomes important because technology adoption requires individuals who are ready to learn, adapt, and apply digital tools in daily work (Blanka et al., 2022).

Intelligent Learning-Based Training is a digital training approach that uses intelligent systems, learning analytics, and adaptive mechanisms to personalize learning processes. Artificial intelligence can support professional development by identifying learning needs and providing more personalized training experiences (Zheng et al., 2022). This approach is relevant for civil servants because employees may have different levels of digital skills, work experience, and learning speed. Therefore, Intelligent Learning-Based Training is expected to improve adaptive competence and digital productivity through more responsive learning.

Digital training components refer to the quality of training content, accessibility, evaluation, and feedback mechanisms. Digital workforce training can improve employee performance because it supports digital behavior, motivation, and work effectiveness (Dao et al., 2025). In public organizations, training must be connected to real work needs so that employees can apply digital knowledge in their daily tasks. Digital HR transformation also requires employee readiness because technology implementation will not be effective without employees who are prepared to use it (Triranti et al., 2026).

Adaptive competence refers to the ability of employees to adjust to new technologies, changing procedures, and dynamic work demands. Technology readiness can influence employees' adaptability in responding to workplace changes (Kumi et al., 2024). In the public sector, digital competence is closely related to employee readiness in facing future work demands (Lajante & Remisch, 2023). Employees with strong adaptive competence are more capable of transforming digital training outcomes into productive work behavior.

Digital productivity reflects employees' ability to use digital technology efficiently, accurately, and effectively in completing work. Digital technology can enhance job performance because it supports communication, coordination, and decision-making in digital work environments (Duan et al., 2024). Human resource factors such as work environment, motivation, workload, and compensation also influence employee behavior and loyalty (Febriani & Mufahamah, 2024). Thus, digital productivity is influenced not only by training quality but also by employees' adaptive competence.

Based on the theoretical and empirical explanation, this study proposes the following hypotheses:

H1: Intelligent Learning-Based Training has a positive effect on civil servants' adaptive competence.

H2: Digital training components have a positive effect on civil servants' adaptive competence.

H3: Intelligent Learning-Based Training has a positive effect on civil servants' digital productivity.

H4: Digital training components have a positive effect on civil servants' digital productivity.

H5: Adaptive competence has a positive effect on civil servants' digital productivity.

Adaptive competence is also expected to mediate the relationship between digital training and digital productivity. Intelligent Learning-Based Training and digital training components may improve digital productivity more effectively when employees are able to adapt training outcomes to real work situations.

H6: Adaptive competence mediates the effect of Intelligent Learning-Based Training on civil servants' digital productivity.

H7: Adaptive competence mediates the effect of digital training components on civil servants' digital productivity.

3. Materials and Method

The analytical procedure in this study is presented in Algorithm 1. This algorithm explains the step-by-step process from questionnaire distribution to hypothesis testing.

Algorithm 1. Research Data Analysis Procedure

INPUT: Questionnaire responses, research indicators, Likert-scale data

OUTPUT: Validity results, reliability results, structural model results, direct effect results, and mediation effect results

Step 1: Distribute the questionnaire to civil servants at the Bureau of Economic Affairs of the Regional Secretariat of Lampung Province.

Step 2: Collect all questionnaire responses from respondents.

Step 3: Screen the data by excluding incomplete and invalid responses.

Step 4: Code all valid responses using a five-point Likert scale.

Step 5: Calculate descriptive statistics for each indicator and variable.

Step 6: Evaluate the measurement model by testing convergent validity, discriminant validity, and construct reliability.
Step 7: Evaluate the structural model using coefficient of determination, effect size, and predictive relevance.
Step 8: Conduct bootstrapping to test the direct effects among variables.
Step 9: Conduct bootstrapping to test the indirect effects through Adaptive Competence.
Step 10: Interpret the results and determine whether each hypothesis is accepted or rejected.
The research model consists of two main structural equations. Eq. (1) is used to explain the effect of Intelligent Learning-Based Training and Digital Training Components on Adaptive Competence:

$$Z = \beta_1 X_1 + \beta_2 X_2 + \varepsilon_1 \quad \text{(i)}$$

where Zrepresents Adaptive Competence, X_1represents Intelligent Learning-Based Training, X_2represents Digital Training Components, $\beta_1$and $\beta_2$represent path coefficients, and $\varepsilon_1$represents the error term.
Eq. (2) is used to explain the effect of Intelligent Learning-Based Training, Digital Training Components, and Adaptive Competence on Civil Servants' Digital Productivity:

$$Y = \beta_3 X_1 + \beta_4 X_2 + \beta_5 Z + \varepsilon_2 \quad \text{(ii)}$$

where Yrepresents Civil Servants' Digital Productivity, Zrepresents Adaptive Competence, and $\varepsilon_2$represents the error term.

The mediation effect was calculated using the product of path coefficients. Eq. (3) is used to calculate the indirect effect of Intelligent Learning-Based Training on Civil Servants' Digital Productivity through Adaptive Competence:

$$IE_{X_1} = \beta_1 \times \beta_5 \quad \text{(iii)}$$

Eq. (4) is used to calculate the indirect effect of Digital Training Components on Civil Servants' Digital Productivity through Adaptive Competence:

$$IE_{X_2} = \beta_2 \times \beta_5 \quad \text{(iv)}$$

The measurement model was evaluated using outer loading, Average Variance Extracted, discriminant validity, Cronbach's Alpha, and Composite Reliability. The structural model was evaluated using R-square, f-square, predictive relevance, path coefficient, t-statistic, and p-value. A relationship was considered significant when the t-statistic was greater than 1.96 and the p-value was lower than 0.05.

4. Results and Discussion

This section presents the dataset source, initial data analysis, measurement model evaluation, structural model results, and discussion of the hypothesis testing. The data were obtained from civil servants at the Bureau of Economic Affairs of the Regional Secretariat of Lampung Province. The questionnaire was distributed through Google Forms and WhatsApp, and 120 responses were returned. After the data screening process, 20 responses were excluded because they were incomplete or did not meet the research criteria, so 100 valid responses were analyzed. The study used a computer-based data processing procedure with SmartPLS for structural model testing through bootstrapping. The research model consisted of four variables: Intelligent Learning-Based Training, Digital Training Components, Adaptive Competence, and Civil Servants' Digital Productivity. The model structure and the list of tables in the thesis show that the analysis included descriptive statistics, validity testing, reliability testing, R-square, f-square, Q^2predict, direct effects, and indirect effects.

Initial Data Analysis

The initial analysis showed that the final dataset consisted of 100 valid respondents. Most respondents were female, with 60 respondents, while male respondents accounted for 40 respondents. Based on age, most respondents were in the productive age group, especially 25–34 years and 35–44 years. Based on education, most respondents held a bachelor's degree. Based on position, the largest group consisted of staff members and administrative officers. These characteristics indicate that the respondents were relevant for evaluating digital

training, adaptive competence, and digital productivity because they were involved in administrative and digital work activities.

The descriptive analysis showed that respondents generally gave positive responses to all research variables. The indicators of Intelligent Learning-Based Training, Digital Training Components, Adaptive Competence, and Digital Productivity mostly had median values of 4, indicating that respondents tended to agree with the statements in the questionnaire. This means that, descriptively, civil servants perceived digital training, adaptive competence, and digital work productivity as relatively well implemented in the institution.

Measurement Model Evaluation

The measurement model was evaluated through convergent validity, discriminant validity, and construct reliability. Convergent validity was assessed using outer loading and Average Variance Extracted. The evaluation criterion used in this study required outer loading values above 0.70 and Average Variance Extracted values above 0.50. The Average Variance Extracted was calculated using Eq. (1).

$$AVE = \frac{\sum \lambda_i^2}{n} \qquad \text{(i)}$$

where $\lambda_i$represents the standardized loading of each indicator and $n$represents the number of indicators. The results showed that all indicators met the validity criteria because the outer loading values were above 0.70. The Average Variance Extracted values were also above 0.50 for all variables, namely Intelligent Learning-Based Training, Digital Training Components, Adaptive Competence, and Digital Productivity. Therefore, the indicators were considered valid in measuring their respective constructs.

Construct reliability was evaluated using Cronbach's Alpha and Composite Reliability. The reliability criterion required values above 0.70. Composite Reliability was calculated using Eq. (2).

$$CR = \frac{(\sum \lambda_i)^2}{(\sum \lambda_i)^2 + \sum \theta_i} \qquad \text{(ii)}$$

where $\lambda_i$represents the standardized loading and $\theta_i$represents the error variance. The results showed that all variables had Cronbach's Alpha and Composite Reliability values above 0.70. This indicates that all constructs were reliable and internally consistent. In addition, discriminant validity was confirmed using the Heterotrait–Monotrait Ratio and Fornell–Larcker criterion, showing that each construct was empirically different from the others.

Figure 1. Research model of Intelligent Learning-Based Training, Digital Training Components, Adaptive Competence, and Digital Productivity.

Structural Model Results

The structural model was evaluated using coefficient of determination, effect size, predictive relevance, direct effects, and indirect effects. The coefficient of determination was used to examine the ability of exogenous variables to explain endogenous variables. The R-square formula is presented in Eq. (3).

$$R^2 = 1 - \frac{SS_{res}}{SS_{tot}} \qquad \text{(iii)}$$

The R-square value for Digital Productivity was 0.696, meaning that Intelligent Learning-Based Training, Digital Training Components, and Adaptive Competence explained 69.6% of the variation in Digital Productivity. Meanwhile, the R-square value for Adaptive Competence was 0.491, meaning that Intelligent Learning-Based Training and Digital Training Components explained 49.1% of the variation in Adaptive Competence. These values indicate that the structural model had a moderate to strong explanatory power.

The hypothesis testing was conducted using bootstrapping. A relationship was considered significant when the t-statistic was greater than 1.96 and the p-value was lower than 0.05. The direct effect results are presented in Table 1. The results show that Intelligent Learning-Based Training did not significantly affect either Adaptive Competence or Digital Productivity. In contrast, Digital Training Components had a positive and significant effect on Adaptive Competence and Digital Productivity. Adaptive Competence also had a positive and significant effect on Digital Productivity.

Table 1. Direct Effect Results.

Relationship	Original Sample	T-Statistic	P-Value	Decision
Intelligent Learning-Based Training → Digital Productivity	-0.051	0.424	0.671	Not significant
Intelligent Learning-Based Training → Adaptive Competence	0.139	0.779	0.436	Not significant
Digital Training Components → Digital Productivity	0.387	3.816	0.000	Significant
Digital Training Components → Adaptive Competence	0.593	3.931	0.000	Significant
Adaptive Competence → Digital Productivity	0.554	5.804	0.000	Significant

The indirect effect was examined to determine whether Adaptive Competence mediated the relationship between the independent variables and Digital Productivity. The indirect effect was calculated using Eq. (4).

$$IE = \beta_a \times \beta_b \quad \text{(iv)}$$

where $\beta_a$represents the path from the independent variable to Adaptive Competence, and $\beta_b$represents the path from Adaptive Competence to Digital Productivity. The indirect effect results are presented in Table 2.

Table 2. Indirect Effect Results.

Mediation Path	Indirect Coefficient	T-Statistic	P-Value	Decision
Intelligent Learning-Based Training → Adaptive Competence → Digital Productivity	0.077	0.860	0.390	Not significant
Digital Training Components → Adaptive Competence → Digital Productivity	0.328	2.965	0.003	Significant

The mediation results show that Adaptive Competence did not mediate the relationship between Intelligent Learning-Based Training and Digital Productivity. However, Adaptive Competence significantly mediated the relationship between Digital Training Components and Digital Productivity. This means that Digital Training Components improved Digital Productivity both directly and indirectly through Adaptive Competence. The abstract and findings of the thesis also confirm that Adaptive Competence did not mediate Intelligent Learning-Based Training but partially mediated Digital Training Components toward Digital Productivity.

Discussion

The result shows that Intelligent Learning-Based Training does not significantly affect Adaptive Competence and Digital Productivity. This finding indicates that the presence of intelligent or AI-supported learning technology is not automatically able to change employees' adaptive behavior or improve digital work outcomes. In public sector work, intelligent learning systems may provide personalization, flexibility, and digital feedback, but these features will not produce productivity gains when they are not strongly connected to daily tasks, post-training practice, and organizational support. (Liu et al., 2026a) explained that organizational AI adoption can produce different employee responses through approach and avoidance motivation, meaning that AI-based systems may encourage proactive behavior only when employees have sufficient autonomy, knowledge sharing, and readiness. This finding is also relevant to Pratama et al. (2026), who emphasized the importance of digital literacy in preventing risky digital behavior, suggesting that technology-based programs need user readiness and digital awareness before they can create productive outcomes.

Digital Training Components have a positive and significant effect on Adaptive Competence. This result shows that training quality, content relevance, ease of access, evaluation, and feedback are more effective in strengthening employees' ability to adapt to technological change than the intelligent learning label itself. Practical training components

help civil servants understand digital tasks, learn work-related applications, and adjust their behavior to new work procedures. Dao et al. (2025) found that digital workforce training supports employee performance through motivation, job satisfaction, and digital behavior, indicating that training must shape work-related behavior rather than only deliver digital material. Anita et al. (2024) also showed that literacy-based education can improve participants' understanding of information-based products, which supports the view that training effectiveness depends on how well users understand and apply the learning content.

Digital Training Components also have a positive and significant effect on Digital Productivity. This finding confirms that civil servants' digital productivity is more likely to improve when training is practical, accessible, relevant, and supported by clear feedback. In the context of the Bureau of Economic Affairs of the Regional Secretariat of Lampung Province, digital training components help employees use applications more effectively, reduce work errors, and produce more accurate digital outputs. Li et al. (2025) found that digital transformation improves employee performance through employee competence, motivation to learn, job autonomy, and unlearning, which supports the argument that productivity improvement requires employees to transform learning into new work behavior. Normasyhuri et al. (2025) also emphasized the role of information media in decision-making, suggesting that access to relevant digital information can strengthen the quality of work-related decisions.

Adaptive Competence has a positive and significant effect on Digital Productivity. This result indicates that civil servants who are able to adapt to new technologies, solve digital problems, and adjust their work behavior are more productive in digital work environments. Adaptive competence becomes important because digital public-sector work often involves changes in applications, data systems, reporting procedures, and coordination patterns. (Dewi et al., 2025) found that digital competence improves employee performance in Regional Apparatus Organizations, especially when supported by self-efficacy and organizational support. Pratama et al. (2024) also highlighted the importance of self-development and personal potential, which is relevant because adaptive competence requires employees to keep learning and develop themselves in response to changing work demands.

Adaptive Competence does not mediate the relationship between Intelligent Learning-Based Training and Digital Productivity. This finding suggests that Intelligent Learning-Based Training has not yet created a strong learning transfer mechanism that can develop adaptive competence and then improve productivity. In other words, the system may be intelligent, but the learning process may not be sufficiently embedded in real work routines. This is consistent with (Liu et al., 2026b), who showed that AI adoption influences employee behavior through motivational mechanisms, meaning that AI-based tools do not automatically generate proactive work changes. This result also aligns with Alfredo et al. (2025), who showed the importance of risk-based evaluation and moderating conditions in performance-related outcomes, implying that technological or informational systems require contextual support before producing meaningful performance effects.

Adaptive Competence mediates the relationship between Digital Training Components and Digital Productivity. This finding means that practical and relevant digital training improves productivity partly because it strengthens employees' adaptive competence. Digital training components provide work-related content, accessibility, evaluation, and feedback, while adaptive competence enables civil servants to apply those learning outcomes into digital work practices. Zhou et al. (2024) explained that digital transformation affects performance through employee competence and learning motivation, which supports the mediating role of adaptive competence in this study. In line with this, Pratama and Alfredo (2024) showed that knowledge, ability, attitude, and trust influence decision-making, suggesting that individual capability and readiness are important mechanisms in converting learning into productive behavior.

Overall, the findings show that the main driver of Digital Productivity is not merely the use of intelligent learning technology, but the quality of Digital Training Components and the development of Adaptive Competence. The rejected effect of Intelligent Learning-Based Training provides an important contribution because it shows that AI-supported training is not automatically effective unless it is practical, contextual, and integrated with real work activities. The accepted mediation effect of Adaptive Competence in the relationship between Digital Training Components and Digital Productivity strengthens the argument that training outcomes must pass through employee adaptability before becoming productive digital work behavior. This finding is consistent with the public sector digital transformation literature, which emphasizes that digital transformation improves organizational performance when it

is supported by employee motivation and capability (Hammad et al., 2025). It also supports Alfredo et al. (2025), who showed that organizational outcomes depend on how internal factors and contextual conditions shape the final performance effect.

5. Comparison

Compared with recent state-of-the-art studies, this research provides a more specific contribution in the context of civil servants' digital productivity. Haesevoets et al. (2025) show that AI adoption in public administration depends on how public managers and employees accept AI roles in internal management practices, while (Nadeem et al., 2024) emphasize that digital transformation affects employee attitudes, psychology, resilience, self-efficacy, engagement, and autonomy. Namatovu & Kyambade. (2025) also found that digital transformation mediates the relationship between digital leadership and public sector performance. Different from these studies, the present research shows that Intelligent Learning-Based Training does not automatically improve Adaptive Competence or Digital Productivity; instead, the effect of digitalization becomes meaningful when training is practical, relevant to work, and supported by employee adaptability. This finding strengthens the argument that public sector digital transformation is not only a technological issue, but also a human capability and training-design issue.

This study is also different from recent research on digital HR, digital skill gaps, and public sector digital competence. Zhang et al. (2024) found that digital HR practices improve work productivity through digital transformation and innovative work behavior, while Mhaske et al. (2025) highlight that digital skill gaps require targeted skilling, inclusive digital infrastructure, and organizational digital maturity. Sulaiman et al. (2025) further show that digital competence improves civil servants' performance directly and indirectly through work motivation. Compared with these studies, this research contributes by positioning Adaptive Competence as the key mechanism that converts Digital Training Components into Digital Productivity among civil servants at the Bureau of Economic Affairs of the Regional Secretariat of Lampung Province. Thus, the novelty of this study lies in showing that the quality of digital training components is more decisive than the sophistication of intelligent learning technology alone in improving digital productivity.

6. Conclusion

This study concludes that Digital Training Components and Adaptive Competence play a more important role in improving Civil Servants' Digital Productivity than Intelligent Learning-Based Training. The findings show that Intelligent Learning-Based Training does not directly improve Adaptive Competence or Digital Productivity, indicating that intelligent learning technology alone is not sufficient when it is not strongly connected to practical work needs. In contrast, Digital Training Components have a positive effect on Adaptive Competence and Digital Productivity, while Adaptive Competence also improves Digital Productivity and mediates the relationship between Digital Training Components and Digital Productivity. These findings support the research objective by showing that digital productivity among civil servants is strengthened when training is practical, relevant, accessible, and supported by evaluation and feedback that help employees adapt to technological changes. The study contributes to digital human resource management literature by emphasizing Adaptive Competence as a key mechanism in transforming digital training into productive digital work behavior. Practically, public institutions should design digital training programs that are work-based, continuous, and aligned with employees' daily tasks. This study is limited to one government work unit and uses survey-based data, so future research should involve broader public institutions, larger samples, longitudinal designs, and additional variables such as digital leadership, organizational support, digital culture, and post-training implementation.

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