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Influence of Information Technology, Work Environment, Training, and Competence on Employee Productivity

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Abstract

This study investigates the impact of information technology, work environment, training, and competence on employee productivity in the Department of Application Development (DPA) of Institution X. The research addresses the increasing demands of digitalization and the role of human resources in supporting organizational performance. This study employs a quantitative approach and includes all 36 staff-level employees as respondents. Data were collected using a structured questionnaire and analyzed through Structural Equation Modeling using Partial Least Squares (PLS-SEM). The results indicate that competence and training are major drivers of employee productivity, whereas technology and the work environment do not appear to have a direct impact in this context. Overall, the findings highlight the importance of developing human capital through competence-based training to enhance DPA's productivity.

1. Introduction

The Financial Services Authority of Indonesia (hereinafter referred to as Institution X) holds a strategic position in overseeing, regulating, and maintaining the stability of the national financial services industry, which includes the banking, capital market, and non-bank financial sectors. In carrying out this role, the institution has increasingly embraced digital transformation, where the use of application systems has evolved from merely a supporting tool to becoming a core element of its strategic operations.

Amid this digital transformation, the Department of Application Development (DPA) plays a crucial role as an enabler by designing, developing, and maintaining integrated application systems that improve operational efficiency and support data-driven decision-making throughout the organization. As the scope of digital initiatives continues to grow, the

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department's effectiveness increasingly depends on the productivity of its employees, who must manage heavier workloads despite limited organizational resources.

Table 1. *Number of Work Programs*

Year	Number of Work Programs	In-house Work Programs	Outsourced Work Programs	Total DPA Staff	Completed On-Time	Achievement
2022	30	66,67%	33,33%	33	30	100%
2023	77	24,68%	75,32%	34	75	97%
2024	96	16,67%	83,33%	36	88	92%
2025*	139	10,79%	89,21%	36	6	4%

Source: Internal Report of DPA 2022-2025 (2025)

Over the past four years, the DPA workload has increased steadily, as reflected in Table 1. From 2022 to 2025, work programs expanded rapidly from 30 to 139, yet the department continued to operate with the same 36 staff members from 2024. Alongside this growth, the structure of development activities has also evolved. The department now relies heavily on outsourced projects, which represent nearly 90 percent of all work programs by 2025, leaving in-house development with a limited role.

This combination of increasing workloads, stagnant staffing levels, and shifting development structures has been accompanied by a noticeable drop in performance outcomes. After several years of strong performance from 2022 to 2024, completion rates dropped sharply to 4 percent in the first quarter of 2025. These conditions point to clear challenges in employee productivity, coordination, and the effective use of departmental capabilities. Therefore, a thorough investigation into the factors affecting employee productivity (particularly information technology, work environment, training, and competence) is necessary to gain a deeper understanding of productivity dynamics within a digitally driven financial regulatory institution.

Table 2. *Supporting Software at Each Milestones*

Milestones	Number of Supporting Software Tools
System Design	1
Programming	5
Unit Test	0
System Integration Test (SIT)	1
User Acceptance Test (UAT)	1
Deployment	3
Operation	2

Source: Internal Report of DPA 2025 (2025)

The internal review identified several key challenges. First, the utilization of information technology has not yet been fully optimized, especially during the unit testing phase, which plays a crucial role in ensuring the quality and accuracy of application systems. This stage is still carried out without the support of digital tools or specialized software, which can limit efficiency and negatively impact overall work productivity (Table 2). In fact, the use of automated software testing in information system development is widely recognized as an effective way to improve both efficiency and accuracy (Laudon & Laudon, 2022: 544).

Table 3. *Age Distribution of DPA Employees*

Position Level	>50	41-50	31-40	18-30
Head of Department	1	0	0	0
Director	0	0	0	0
Deputy Director	1	2	0	0
Head of Division	0	5	4	0
Head of Subdivision	4	3	22	0
Staff	0	2	23	11

Source: DPA Human Resource Data (2025)

Second, the department's human resource is largely composed of younger generations (Table 3). Millennials and Generation Z employees generally value an adaptive and collaborative work environment (Wibowo, 2022: 45). However, the existing conditions within the DPA are perceived as not yet fully aligned with the expectations and working styles characteristic of these generations.

Table 4. *Employee Training Participation*

Year	Total Staff	Participated in Training	Realization (%)
2022	33	28	84,85
2023	34	29	85,29
2024	36	26	72,22
2025*	36	14	38,89

Source: DPA Human Resource Data (2025)

Third, employee participation in training programs has declined significantly over time (Table 4). After rising slightly from 84.85% in 2022 to 85.29% in 2023, participation rates began to drop, reaching 72.22% in 2024 and falling further to just 38.89% in the first quarter of 2025. This trend suggests that improvements in employee capacity have been inconsistent. Training and development are vital for equipping employees with the necessary skills, improving productivity, and preparing them for future roles within the organization (Noe, 2023: 11).

Table 5. *Competency Gap Analysis*

Competency Indicator	Fulfilled (%)	Gap (%)
Mastery of Technical Knowledge	60	40
Task Completion in Accordance with SOPs	45	55
Effective Communication	35	65
Adaptation to Technology	40	60

Source: DPA Human Resource Data (2025)

Fourth, the competency gap analysis (Table 5) reveals that a significant number of employees have yet to meet the required competency standards. The most notable gaps are found

in technical expertise, technological adaptability, and effective communication skills (Mulder, 2017: 435).

Previous studies have shown that the work environment, training, and competence have a positive influence on employee productivity, either directly or through job satisfaction as an intervening variable (Ingsih et al., 2021). These findings emphasize the importance of human capital and organizational factors in shaping performance outcomes. However, most of these studies have not included information technology as part of their analytical framework. In contrast, research by Prasetyaningtyas, Aishah, and Kuspriandani (2021) demonstrates that technological innovation plays a key role in increasing job satisfaction, reducing burnout, and enhancing employee productivity. This implies that information technology could be an important determinant of productivity, especially within organizations undergoing digital transformation.

Building on these insights, the present study adapts and extends the research model proposed by Ingsih et al. (2021) by incorporating information technology as an additional independent variable. This modification directly addresses the gap in earlier studies, which have not fully examined the impact of digital tools and systems on employee productivity. The inclusion of information technology serves as both the distinguishing element and the main theoretical contribution of this research, emphasizing the growing significance of digital transformation in shaping employee performance. This relevance is particularly evident in the DPA, where information technology forms an essential part of daily operations and productivity expectations.

Alongside these theoretical perspectives, empirical data from the DPA, summarized in the accompanying tables, show variations in productivity outcomes that appear to be associated with differences in information technology usage, work environment conditions, training participation, and competency levels. These findings offer a practical basis for analyzing how these factors collectively influence employee productivity within an application development unit within Institution X.

2. Methods

This study employed a quantitative research design using a cross-sectional survey to examine how information technology, work environment, training, and competence influence employee productivity. The research model (Figure 1) was developed to depict the conceptual relationships among the variables and to guide the formulation of the study's hypotheses. This framework provides a structured representation of how the independent variables are theorized to influence the dependent variable, thereby serving as the analytical basis for subsequent hypothesis testing.

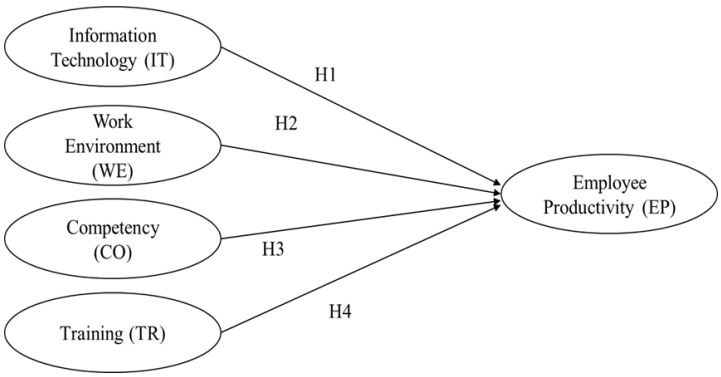


***Figure 1**. Research Model*

The research subjects consisted of 36 staff-level employees in the DPA of Institution X, selected using a survey method. The study was conducted at a single point in time (cross-sectional design) in Jakarta. Data were collected through a structured questionnaire employing a Likert scale that had undergone validity and reliability testing, and were complemented by secondary data derived from internal organizational reports.

Convergent validity was assessed using outer loading values and the Average Variance Extracted (AVE). An indicator is considered adequate when its outer loading exceeds **0.708**, as this threshold indicates that the indicator explains more than 50% of the variance of the underlying construct (Hair et al., 2017: 115). In addition, each construct must achieve an AVE value of ≥ **0.50** to ensure that, on average, the construct explains more than half of the variance of its indicators (Hair et al., 2017: 118).

Internal reliability was evaluated using Composite Reliability (CR) and Cronbach's Alpha. CR values between 0.70 and 0.90 indicate satisfactory construct reliability, while a Cronbach's Alpha value of ≥ 0.70 demonstrates acceptable internal consistency (Hair et al., 2017: 112).

Data analysis was performed using Structural Equation Modelling–Partial Least Squares (SEM-PLS) with SmartPLS version 4 Professional (Ringle, Wende, & Becker, 2024) to estimate both the measurement model and the structural model. The sample size of 36 respondents is appropriate for SEM-PLS, which accommodates smaller samples more effectively than covariance-based SEM while maintaining adequate statistical power for hypothesis testing (Hair et al., 2017: 23–26). Moreover, SEM-PLS was selected for this research because it is well suited for predictive, exploratory, and theory-building research designs, particularly when the research model includes multiple latent variables and complex relationships. Its ability to handle non-normal data and minimize strict assumptions further strengthens its suitability for organizational research involving perceptual measures such as productivity, competence, and technological factors.

3. Results

This study involved 36 respondents, all of whom were staff-level employees in the DPA of Institution X. Staff-level employees were selected because they are directly involved in daily operational activities and therefore provide an appropriate representation for assessing the factors that influence employee productivity. The demographic profile of respondents is summarized in Tables 6.

***Table 6**. Characteristices of Respondents*

Variable	Measurement	Number	Percent
Gender	Male	23	63,89
	Female	13	36,11
Age Group	18-30	11	30,56
	31-40	23	63,89
	41-50	2	5,56
	>50	0	0
Education	Senior High School/Vocational	0	0

	Diploma (D3)	0	0
	Diploma (D4)	0	0
	Bachelor's Degree (S1)	32	88,89
	Master's Degree (S2)	4	11,11
	Doctorate (S3)	0	0
Length of Service	1-3 Years	10	27,78
	4-6 Years	4	11,11
	7-10 Years	22	61,11
	More than 10 Years	0	0

Source: Research Data (2025)

Table 6 shows that the majority of respondents are male (63,89%), while the age distribution indicates that most employees fall within the productive age range of 31–40 years (63,89%). In terms of educational background, most respondents hold a bachelor's degree (88,89%), with a smaller proportion having completed a master's degree (11,11%). This reflects a workforce with strong educational qualifications aligned with the technical nature of DPA's functions. Additionally, most respondents have between seven and ten years of work experience (61,11%), suggesting a relatively mature and stable employee group capable of providing informed insights into organizational processes and performance dynamics.

Table 7. *Validity and Reliability Test Results*

Variable	Indicator	Loading Factor	AVE	Cronbach's Alpha	Composite Reliability
Information Technology (IT)	IT1	0,849	0,680	0,772	0,864
	IT2	0,790			
	IT3	0,833			
Work Environment (WE)	WE1	0,779	0,685	0,862	0,897
	WE2	0,830			
	WE3	0,848			
	WE4	0,852			
Competency (CO)	CO1	0,861	0,712	0,798	0,881
	CO2	0,793			
	CO3	0,875			
Training (TR)	TR1	0,885	0,701	0,788	0,874
	TR3	0,904			
	TR4	0,708			
Employee Performance (EP)	EP1	0,729	0,678	0,840	0,893
	EP2	0,850			
	EP3	0,870			
	EP4	0,837			

Source: Processed Data (2025)

The results of the convergent validity assessment, as presented in Table 7, indicate that all indicators demonstrate satisfactory validity. All loading factor values exceed the recommended threshold of 0.70, confirming that each indicator adequately represents its respective construct. Furthermore, the Average Variance Extracted (AVE) values for Information Technology (IT), Work Environment (WE), Competency (CO), Training (TR), and Employee Performance (EP)

range from 0.678 to 0.712, all of which are above the minimum criterion of 0.50. These results confirm that the constructs explain a substantial proportion of variance in their indicators, thereby establishing adequate convergent validity for the measurement model.

The reliability test results further indicate that the measurement model demonstrates strong internal consistency. Cronbach's Alpha values for all constructs exceed the recommended threshold of 0.70, indicating acceptable reliability. In addition, Composite Reliability values for IT, WE, CO, TR, and EP are all above 0.80, reflecting high consistency among the indicators within each construct. These findings confirm that the measurement instruments used in this study are reliable and suitable for subsequent structural model analysis.

Table 8. *R-Square Value*

Variable	R Square	R Square Adjusted	Percentage
Employee Productivity	0,687	0,647	68,7 %

Source: Processed Data (2025)

The explanatory power of the structural model was first evaluated using the coefficient of determination (R^2), as presented in Table 8. The results show that Employee Productivity has an R^2 value of 0.687 with an adjusted R^2 of 0.647, indicating that Information Technology, Work Environment, Competency, and Training collectively explain 68.7 percent of the variance in employee productivity. This result suggests that the structural model demonstrates substantial explanatory power, while the remaining 31.3 percent of variance is influenced by other factors not included in the model.

Table 9. *Path Coefficient*

Hypothesis	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDDEV)	T Statistics (|O/STDDEV|)	P Values
IT → EP	-0,052	-0,046	0,142	0,366	0,714
WE → EP	0,094	0,107	0,114	0,829	0,407
CO → EP	0,587	0,593	0,099	5,955	0,000
TR → EP	0,449	0,428	0,152	2,947	0,003

Source: Processed Data (2025)

Subsequently, hypothesis testing was conducted using the path coefficient estimates, as summarized in Table 9. The results indicate that Competency has a positive and statistically significant effect on Employee Productivity ($\beta = 0.587$; $t = 5.955$; $p = 0.000$). Training also shows a positive and significant effect on Employee Productivity ($\beta = 0.449$; $t = 2.947$; $p = 0.003$). In contrast, Information Technology does not demonstrate a significant effect on Employee Productivity ($\beta = -0.052$; $t = 0.366$; $p = 0.714$), and the Work Environment likewise does not show a statistically significant effect ($\beta = 0.094$; $t = 0.829$; $p = 0.407$).

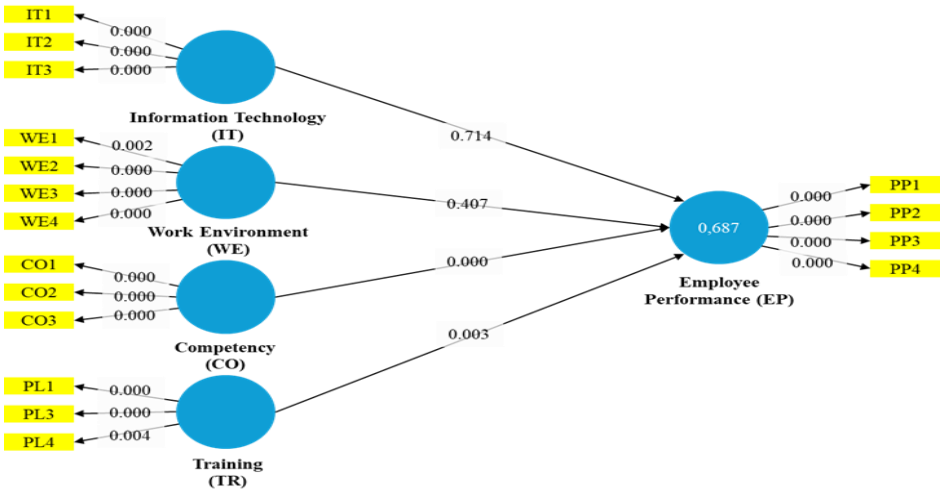


***Figure 2**. Inner Model*

Source: Processed Data (2025)

The results of hypothesis testing in Table 10 shows that two out of four proposed hypotheses were accepted, as they had significance values below 0,050. Competency has a positive and significant effect on Employee Productivity (coefficient 0,587; sig. 0,000), indicating that H3 is supported. Training also shows a positive and significant effect on Employee Productivity (coefficient 0,449; sig. 0,003), thereby supporting H4.

In contrast, the effect of Information Technology on Employee Productivity (H1) is rejected, as the relationship is not statistically significant (coefficient -0,052; sig. 0,714). Neither the effect of Work Environment on Employee Productivity (H2) is not supported (coefficient 0,094; sig. 0,407). These findings confirm that employee productivity in this study is significantly influenced by competence and training, while information technology and work environment do not demonstrate significant direct effects.

***Table 10.** Summary of Hypothesis Results*

Hypothesis	Score	Sig	Conclusion
Information technology influences the employee productivity (H1)	-0.052	0,714	Rejected
Work environment influences the employee productivity (H2)	0,094	0,407	Rejected
Competence influences the employee productivity (H3)	0,587	0,000	Accepted
Training influences the employee productivity (H4)	0,449	0,003	Accepted

Source: Processed Data (2025)

4. Discussion

This study examines how information technology, work environment, training, and competence interact to shape employee productivity within the operational context of the DPA of Institution X. The findings indicate that competence and training significantly influence employee productivity, whereas information technology and work environment do not show significant direct effects. These results reflect the specific organizational and operational characteristics of the DPA and contribute to a more contextual understanding of productivity determinants in a digitally intensive environment. From a managerial perspective, these findings suggest that productivity improvement initiatives within the DPA should prioritize human capital development rather than relying predominantly on technological or environmental interventions.

The empirical results show that information technology does not have a significant direct effect on employee productivity (β = −0.052; p = 0.714), leading to the rejection of Hypothesis 1. This finding contrasts with several prior studies that report a positive relationship between information technology utilization and employee performance, particularly in private-sector and operationally technology-driven contexts (Prasetyaningtyas, Aishah, Kuspriandani, 2021; Maulidina et al., 2021). However, this result highlights an important managerial implication: investments in information technology alone may not automatically translate into higher productivity unless accompanied by appropriate changes in work processes and role design.

The non-significant result observed in this study can be explained by the organizational role of employees within the DPA. As described in the Introduction, the majority of application development activities are outsourced to external vendors, while internal employees primarily perform supervisory, coordination, and compliance-related functions. Consequently, employee's productivity is less dependent on direct interaction with development tools or advanced information systems and more reliant on administrative competence and procedural accuracy. In such conditions, information technology functions as a supporting infrastructure rather than as a direct productivity-enhancing tool at the individual level. Managerially, this implies that technology adoption within the DPA should be oriented toward strengthening monitoring, coordination, and reporting capabilities rather than merely expanding technical development tools.

This pattern is consistent with studies suggesting that the productivity impact of information technology is contingent upon the extent to which employees are directly involved in technology-enabled tasks (Latief & Fauziah, 2022). When technology adoption does not significantly alter individual work processes, its effect on productivity may be indirect or mediated by other factors, such as competence or training. Therefore, the absence of a significant direct relationship in this study reflects contextual limitations rather than the ineffectiveness of information technology itself. For management, this underscores the importance of integrating IT initiatives with competency development and workflow redesign to maximize their productivity impact.

The results further indicate that work environment does not significantly influence employee productivity (β = 0.094; p = 0.407), resulting in the rejection of Hypothesis 2. This finding is consistent with prior studies reporting no significant effect of work environment on performance outcomes in structured and procedurally driven organizations (Latief & Fauziah, 2022; Apriani & Sinambela, 2023). Nevertheless, from a managerial standpoint, the work environment should still be viewed as a foundational condition that supports employee well-being and work continuity rather than as a primary driver of productivity.

In the DPA context, work activities are largely governed by standard operating procedures, regulatory requirements, and predefined workflows, which may reduce the relative importance of environmental factors in shaping productivity. Although prior research has shown that supportive physical and psychosocial work environments can enhance performance (Cahyani, Rahmawati, and Milwan, 2021; Widjaja, Wijayadne, and Renz, 2023), such effects may be more pronounced in service-oriented or customer-facing roles than in technical and administrative units.

Additionally, despite the dominance of Millennials and Generation Z employees, the findings suggest that environmental conditions may influence job satisfaction or engagement rather than immediate productivity outcomes. This implies that the work environment may operate as a baseline enabling condition rather than a differentiating factor of productivity within the DPA.

Management should therefore position environmental improvements as part of a broader employee experience strategy rather than as a standalone productivity intervention.

The analysis reveals that competence has the strongest positive and significant effect on employee productivity ($\beta = 0.587$; $p < 0.001$), supporting Hypothesis 3. This finding highlights the central role of employee's technical knowledge, procedural understanding, and adaptive skills in determining productivity outcomes within the DPA. From a managerial perspective, this result emphasizes the strategic importance of systematic competency mapping and continuous capability assessment to ensure alignment between employee skills and evolving job demands.

This result is consistent with empirical studies demonstrating that competence significantly enhances employee performance, particularly in knowledge-intensive and regulated environments (Kotamena et al., 2020; Ingsih et al., 2021). In the DPA, where employees are required to manage system coordination, vendor oversight, and compliance with regulatory standards, productivity is closely linked to individual competence rather than situational factors. Accordingly, management should focus on strengthening both technical and behavioral competencies, including communication, analytical thinking, and technological adaptability.

Furthermore, the significant effect of competence suggests that productivity challenges identified in the Introduction, such as increasing workload and stagnant staffing levels, are more effectively addressed through capability enhancement rather than through environmental or technological adjustments alone. Competence enables employees to manage task complexity, reduce errors, and maintain performance consistency under increasing pressure. This finding implies that targeted upskilling initiatives can serve as a cost-effective managerial response to workload escalation.

The findings also demonstrate that training has a positive and significant effect on employee productivity ($\beta = 0.449$; $p = 0.003$), confirming Hypothesis 4. This result underscores the importance of structured learning and development initiatives in strengthening employees' ability to perform effectively in dynamic organizational settings. Managerially, training should be viewed not as a routine administrative activity but as a strategic investment directly linked to productivity outcomes.

This finding aligns with prior research showing that training enhances employee performance by improving technical capability, work readiness, and adaptability (Syahruddin, Hermanto, and Wardini, 2020; Ingsih et al., 2021). Kotamena et al. (2020) further emphasize that training-related competence development allows employees to apply acquired skills more effectively, thereby translating learning outcomes into improved performance. In practical terms, management should ensure that training programs are closely aligned with actual job requirements and emerging digital challenges.

In the context of the DPA, where training participation has declined substantially in recent years, the significant role of training highlights a critical organizational gap. Reduced access to training may limit employee's ability to cope with increasing digital demands and workload complexity, thereby constraining productivity. The results suggest that revitalizing training programs could serve as a strategic intervention to enhance employee productivity.

Taken together, the findings indicate that employee productivity within the DPA is primarily driven by individual capability factors (competence and training) rather than by contextual or infrastructural factors such as information technology and work environment. This pattern reflects the nature of work in technical units, where standardized processes, regulatory constraints, and outsourcing arrangements limit the direct productivity impact of technology and environmental conditions. For management, this underscores the need to rebalance strategic focus toward human capital development as the main lever of productivity improvement.

The rejection of Hypotheses 1 and 2 does not imply that information technology and work environment are unimportant, but rather that their influence on productivity may be indirect, conditional, or mediated by other variables not examined in this study. Future research may explore these indirect pathways to provide a more comprehensive understanding of productivity dynamics in digitally transforming financial regulatory institution.

5. Conclusion

This study, through a systematic examination of the influence of information technology, work environment, training, and competence on employee productivity in the DPA of Institution X, has produced several important findings. Based on the results of the data analysis, competence and training were found to have a positive and significant influence on employee productivity. These findings indicate that improvements in individual capability and structured skill development play a critical role in enhancing productivity, particularly in a digitally intensive public-sector environment. In contrast, information technology and the work environment did not demonstrate a significant direct effect on productivity, suggesting that their impact may be conditional on organizational context and job characteristics.

The findings of this study reinforce the relevance of Human Capital Theory by confirming that productivity is primarily driven by human-capital-related factors rather than technological or environmental conditions alone. In the context of the DPA, where work processes are highly structured and many technical tasks are outsourced, employee productivity is more closely associated with competence in coordination, supervision, and compliance, as well as access to effective training programs. These results provide empirical support for the importance of competency-based training as a strategic instrument for sustaining productivity amid increasing workload and digital demands.

The contribution of this study lies in its ability to extend prior productivity models by integrating information technology alongside traditional human resource variables within a public-sector digital transformation context. The findings offer practical insights for management practitioners, highlighting the need to prioritize systematic competency development and continuous training rather than relying solely on technological investments or workplace conditions to improve productivity. The originality of this research is reflected in its application to a technical government unit that has received limited attention in previous empirical studies.

Despite its contributions, this study has several limitations. First, it focuses on a single organizational unit, DPA, which limits the generalizability of the findings to other organizational contexts. Second, the use of self-reported questionnaire data may introduce response bias, as employee's perceptions may not fully reflect actual performance. Third, the cross-sectional design restricts the ability to capture changes in competence, training effectiveness, and productivity over time. Finally, this study examines only direct relationships among variables and does not account for potential mediating or moderating factors that may influence productivity.

Future research may extend this study by involving multiple units or institutions to enhance generalizability. Longitudinal designs are recommended to better capture dynamic changes in competence development, training outcomes, and productivity over time. In addition, future studies should explore indirect relationships, such as the mediating roles of job satisfaction or work engagement, to provide a more comprehensive understanding of productivity dynamics. Qualitative or mixed-method approaches may also be employed to enrich contextual insights, particularly in regulated and digitally intensive organizational settings.

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