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Evaluation of E-Leadership in Realizing Village 4.0 Through A Combination of Leadership and Digital Transformation in Village-Owned Enterprise

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Abstract. Village-owned Enterprise (VOE) or *BUMDes* must have human resources with digital competencies to compete in the current business environment. Overall, digitalization has brought significant changes in three areas related to leadership and organizational governance. In the digital era, digital leaders need a different mindset and set of qualities than those of traditional leadership styles. This study examines the role of digital leadership (e-leadership) in employee performance through innovative work behavior and digital culture in village-owned enterprises in Malang Regency. This research targets employees/personnel from active Village-owned Enterprises in Malang Regency. The data analysis technique used is the Structural Equation Model (SEM). The researcher used 50 employee in village-owned enterprises active in Malang Regency. Based on the hypothesis-testing results, this study concludes that e-leadership plays a central role as the primary driver of organizational capabilities in the digital age. Digital leadership has proven effective in encouraging innovative work behavior, building a solid digital culture, fostering intrapreneurship within the company, and directly improving employee performance.

Keywords: e-leadership, digital culture, innovative work behavior, village-owned enterprise

1. INTRODUCTION

Digital technology, now an important part of improving business efficiency, has not been fully adopted. One group that struggles with digital transformation in rural areas is Village-Owned Enterprises (*BUMDes).* According to Government Regulation of the Republic of Indonesia Number 11 of 2019 concerning Village-Owned Enterprises, Village-owned Enterprises are business entities that are established, regulated, and managed by villages to improve the village economy and the welfare of village communities. The main challenge faced by Village-owned Enterprises is their limited use of digital technology in daily operations [1]. According to data from the Village Information System, 71,553 Village-owned Enterprises operate throughout Indonesia. In 2024, the largest number of village-owned enterprises were in Central Java (6,695 units), East Java (2,863 units), and West Java (2,690 units). Village-owned Enterprises can play a concrete role in reviving village economies and advancing villages toward prosperity.

Digital transformation remains a tough challenge in rural Indonesia. In contrast, digital technology is better implemented in urban areas because of supporting resources such as internet infrastructure and adequate human resources [2]. Overall, digitalization has significantly changed three areas related to leadership and organizational governance [3]. Organizational leaders are expected to adapt more easily to new technologies and, through their leadership style, help employees adapt to current developments [4].

There are several previous studies, including those conducted by [5] stating that digital leadership positively influences employee performance. For example, [6] highlight the role of digital leadership in encouraging innovation in the business sector, but they do not address the concept's application in public service providers. In addition, many studies examine only the linkage between two variables, such as innovative work behavior and employee engagement [7] or the determinants of innovative work behavior [8]. Therefore, this study aims to fill the gap by exploring how digital leadership can improve intrapreneurship intention and employee performance through the mediating role of innovative work behavior.

Although many studies have examined e-leadership in large or stable companies [4], [5], [9]–[13], no research to date has addressed e-leadership in the context of Village-Owned Enterprises. This study examines how digital leadership (e-leadership) shapes intrapreneurial intention and employee performance through innovative work behavior and digital culture in Village-owned Enterprises in Malang Regency. This research targets employees/personnel from active Village-owned Enterprises in Malang Regency. The Malang Regency Government noted that 376 Village-owned Enterprises operate across various business fields in Malang Regency.

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The Malang Regency Government is optimistic it can build independent, competitive villages and create a strong foundation for regional economic growth by strengthening digitalization, village innovation, and cross-sector collaboration.

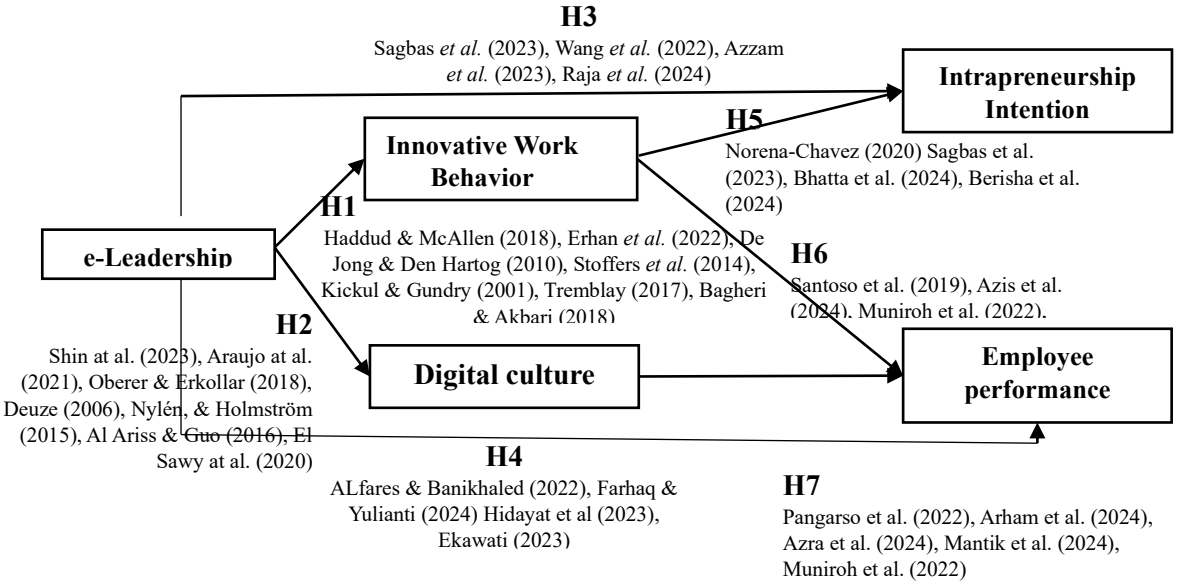


Figure 1. Conceptual Model of the Study; *Source:* Authors

2. METHODOLOGY

This study uses descriptive and explanatory research. Descriptive research aims to identify and describe variables related to the unit of analysis. Explanatory research aims to explain causal relationships between variables and test hypotheses to draw conclusions. This research aims to obtain empirical evidence and explain and test the influence of e-leadership on employee performance and intrapreneurship intention through digital culture and innovative work behavior. This study uses questionnaires, literature reviews, and observations to collect data relevant to the research problem. According to [14], a questionnaire is a tool containing a series of questions about certain rights to be answered in writing. Secondary data collection methods draw on literature, journals, books, theses, and previous research results obtained through the internet or libraries. This study used purposive sampling with some criteria: (1) Indonesian, (2) active employee in Village-owned Enterprises in Malang Regency, (3) worked for more than 6 months, and (4) at least 17 years old

The questionnaire will be distributed to all personnel at Village-owned Enterprises in Malang Regency. The researcher selected up to 50 employees from Village-owned Enterprises active in Malang Regency. The data analysis method used is the Structural Equation Model based on Partial Least Squares (SEM-PLS). Data processing uses SmartPLS 4.0 software. Digital leadership was measured by 6 items from [15]. Digital culture was measured by 5 items from [16]–[18]. In measuring employee performance, the researchers used 13 items from [19]. This study uses a 5 Point Likert scale from 1=strongly disagree to 5=strongly agree.

3. RESULTS AND DISCUSSION

3.1 Validity and Reliability Test

The first step in this study's analysis is to conduct validity and feasibility testing. Begin with construct validity, including convergent validity, by examining the standardized loading factor. In this study, we assess convergent validity using the loading factor for each variable indicator. In research on the development of measurement scales, a loading factor value above 0.70 indicates a valid indicator, but a value of 0.50–0.60 is still acceptable [20]. Next, examine the internal consistency reliability using Cronbach's Alpha and Composite Reliability (CR). Cronbach's alpha is >0.7. A limit value of ≥ 0.7 is acceptable, and a ≥ value of 0.8 is very satisfactory [21]. According to Abdillah & Hartono, (2015) the general rule is that the value of Cronbach's alpha or composite reliability must exceed 0.7, although a value of 0.6 can still be used.

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Table 1. Cronbach's Alpha, Composite Reliability, and AVE

Variable	CA	CR	AVE	Decision
Digital culture	0.902	0.905	0.773	Reliable
E-Leadership	0.957	0.958	0.855	Reliable
Employee performance	0.950	0.954	0.801	Reliable
Intrapreneurship intention	0.940	0.942	0.675	Reliable
Innovative work behavior	0.950	0.958	0.803	Reliable

Note: CA=Cronbach's alphaCR=Composite Reliability AVE=Average Variance Extracted

In more detail, the digital culture variable has a CA value of 0.902, a CR of 0.905, and AVE of 0.773. These results show that the digital culture indicators have excellent consistency and strongly represent the construct. Furthermore, e-leadership showed a CA of 0.957, a CR of 0.958, and an AVE of 0.855, the highest among the constructs. This indicates that the e-leadership indicator has very high reliability and explains the digital leadership constructs well.

For the employee performance variable, the CA value is 0.950, CR is 0.954, and AVE is 0.801, indicating strong reliability in measuring respondents' perceptions of employee performance. Meanwhile, intrapreneurship intention has a CA of 0.940, a CR of 0.942, and an AVE of 0.675, indicating that the indicator explains the construct well, although its AVE is relatively lower than that of some other constructs. Innovative work behavior has a CA of 0.950, a CR of 0.958, and an AVE of 0.803, indicating excellent reliability and convergent validity.

3.2 R-Square

The coefficient of determination (R-square) results showed that the research model had different predictive capabilities for each endogenous variable. Based on the adjusted R-square value, digital culture has a value of 0.768, indicating that e-leadership explains 76.8% of the variation in digital culture, while other factors outside the research model explain the remaining 23.2%. This value indicates that the model's predictive power for digital culture is relatively strong. Furthermore, intrapreneurship intention had an adjusted R-square of 0.695, meaning the predictor variables in the study model explain 69.5% of the variation in intrapreneurship intention, while the remaining 30.5% is influenced by other factors not analyzed. For innovative work behavior, an adjusted R-square of 0.497 indicates that e-leadership explains 49.7% of the variation in innovative work behavior, while the remaining 50.3% is influenced by external factors outside the research model. Meanwhile, employee performance had an adjusted R-square of 0.340, indicating that variables in the study model explain 34.0% of the variation in employee performance, while factors not included in this study explain the remaining 66.0%.

Table 2. R-squared

Variable	R-square	R-square adjusted
Digital culture	0.772	0.768
Employee performance	0.376	0.340
Intrapreneurship intention	0.706	0.695
Innovative work behavior	0.506	0.497

Source: Data Processed with SmartPLS

3.3 Hypothesis Test

Based on the results of data processing using SmartPLS, hypothesis testing was carried out by referring to the p-value of ≤ 0.05 and the t-statistic value of > 1.96 as the basis for decision-making. The results of the hypothesis test showed that all relationships between variables in the research model had a significant influence because the overall p-value was below 0.05 and the t-statistical value was greater than 1.96. The results of the test are presented in the table of the results of the research hypothesis.

Table 3. Hypothesis Test

Paths	b	T statistics	P values	Conclusion
H1: e-leadership → Innovative work behavior	0.711	5.782	0.000	S
H2: e-leadership → Digital culture	0.879	15.922	0.000	S
H3: e-leadership → Intrapreneurship intention	0.696	5.652	0.000	S
H4: e-leadership → Employee performance	0.559	3.216	0.001	S
H5: Innovative work behavior → Intrapreneurship intention	0.669	5.327	0.000	S

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H6: Innovative work behavior → Employee performance	0.273	1.178	0.239	NS
H7: Digital culture → Employee performance	0.190	0.754	0.451	NS

Source: Data Processed with SmartPLS

The hypothesis test results in Table 3 show that e-leadership significantly improves various organizational capabilities in the digital era. Based on the results, e-leadership had a positive and significant influence on innovative work behavior (β=0.711; p<0.001; t-value=5.782), so H1 was supported. These findings show that the more leaders can manage organizational activities through digital technology, build digital communication, and create a work environment that supports innovation, the more employees tend to generate and implement new ideas. These results reinforce [23], who explain that digital leadership plays an important role in driving organizational innovation by enabling leaders to manage technological change and create an adaptive work environment. In addition, [24] stated that e-leadership can increase digital collaboration and innovative behavior by using technology in organizational work processes.

Furthermore, e-leadership has a positive and significant influence on digital culture (β=0.879; p<0.001; t-value=15.922), supporting H2. The high path coefficient shows that e-leadership is an important factor in building an organization's digital culture. Leaders with digital competencies can shape values, norms, and work habits that support technology use, digital-based collaboration, and organizational readiness to face changes in the business environment. This finding aligns with Dynamic Capability Theory, proposed by [25], which states that organizational success in responding to environmental changes depends on leaders' ability to develop and integrate organizational resources. [26] also confirm that digital transformation requires not only technology investment but also leadership that can build a digital culture as the basis for organizational change.

The results also showed that e-leadership had a positive and significant effect on intrapreneurship intention (β=0.696; p<0.001; t-value=5.652), so H3 was supported. This shows that leaders who adopt a digital approach can increase employees' desire to create new opportunities, develop innovative ideas, and carry out entrepreneurial activities within the organization. Leader support, work freedom, and access to digital information encourage intrapreneurial intention. The results support [27], who explain that leadership that supports creativity and innovation can increase employees' tendency to carry out entrepreneurial activities in the organization.

In addition, e-leadership has been shown to positively and significantly influence employee performance (β=0.559; p<0.01; t-value=3.216), so H4 is supported. These findings indicate that leaders who leverage digital technology in the leadership process can increase employee effectiveness and productivity. Through faster communication, more effective coordination, and greater flexibility in the work system, e-leadership can create conditions that support improved employee performance. These results are consistent with [28], which state that e-leadership is an important competency in the digital work environment because it can improve communication, coordination, and the achievement of organizational goals.

In the next intervariable relationship, innovative work behavior had a positive and significant effect on intrapreneurship intention (β=0.669; p<0.001; t-value=5.327), so H5 was supported. These results show that employees who can create, develop, and implement new ideas are more likely to exhibit entrepreneurial behavior in the organization. This finding supports the concept of innovative work behavior developed by [29], who explain that innovative behavior involves finding, developing, and implementing ideas that can form the basis for internal entrepreneurial activities. In addition, [30] show that innovative work behavior plays an important role in improving employee proactive behavior and encouraging positive organizational change.

However, the results showed that innovative work behavior did not significantly affect employee performance (β=0.273; p=0.239; t-value=1.178), so H6 was not supported. Although the relationship is positive, the results show that increases in innovative work behavior have not directly led to increases in employee performance. These findings differ from some previous studies that found that innovative behaviors can improve employee performance [31], [32]. One possible reason is that innovation requires organizational support, adequate resources, an effective implementation system, and management support to meaningfully affect employee performance. Thus, innovative work behavior likely serves as an initial mechanism in the value-creation process, rather than a direct factor that automatically improves performance.

Furthermore, digital culture did not significantly influence employee performance (β=0.190; p=0.451; t-value=0.754), so H7 was not supported. These results show that a strong digital culture does not necessarily improve employee performance directly. Digital culture can improve an organization's ability to adapt to technology and environmental changes, but its impact on performance depends on other factors such as digital competence, leadership quality, employee readiness, and the suitability of technology to work needs. These findings support [33], who explain that digital transformation requires a combination of organizational capabilities and does not depend solely on a digital culture.

Overall, this study provides empirical evidence that e-leadership is a major factor in supporting organizational digital transformation by influencing innovative work behavior, digital culture, intrapreneurship intention, and employee performance. The results reinforce the view that digital transformation success depends

not only on technology adoption, but also on leadership's ability to build a digital culture and encourage innovative employee behavior. However, the insignificant relationship between innovative work behavior and employee performance, and between digital culture and employee performance, shows that organizations need to build supporting mechanisms so innovation and digitalization can translate into sustainable performance improvement.

4. CONCLUSIONS

Based on the hypothesis-testing results, this study concludes that e-leadership plays a central role in driving organizational capabilities in the digital age. Digital leadership has proven effective in encouraging innovative work behavior, building a strong digital culture, fostering intrapreneurship, and directly improving employee performance. A leader's ability to leverage technology, foster adaptive communication, and provide space for creativity is key to sparking new ideas and creating a work environment ready to embrace change. Furthermore, innovative work behavior among employees has also been shown to strengthen their desire to create new business opportunities within the organization. However, this study also found that digital culture and innovative work behavior do not automatically and directly improve employee performance. Innovation plays a greater role in the initial stage of value creation, while digital culture provides the foundation for adaptation. For innovation and digital culture to tangibly affect work productivity, organizations cannot rely solely on technology adoption; they must also provide supporting mechanisms such as adequate infrastructure, individual digital competencies, and effective implementation systems.

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