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The Moderating Role of Digital Culture in the Relationship between Physical Ergonomics and Organizational Culture in SMI

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Abstract. This study investigates the moderating role of digital culture in the relationship between physical ergonomics, organizational culture, and the performance of Small and Medium Industries (SMI). Using survey data from 123 manufacturing SME employees in Tegal, Indonesia, the analysis employed Structural Equation Modeling (SEM-AMOS). The findings reveal that digital culture significantly moderates the relationship between physical ergonomics and organizational culture ($\beta = 0.083$; CR = 12.126; $p < 0.001$). However, physical ergonomics demonstrated an unexpected negative effect ($\beta = -1.031$; CR = –5.958; $p < 0.001$). In addition, organizational culture was found to have no significant influence on performance ($\beta = 0.113$; CR = 1.038; $p = 0.299$). These counterintuitive results highlight digital culture as a key moderator that strengthens the adaptive role of ergonomics. The study contributes by demonstrating the complex interplay between ergonomics, organizational culture, and digitalization, offering practical insights for SME managers to integrate ergonomic practices with digital initiatives to enhance competitiveness.

Key word: digital culture, physical ergonomics, organizational culture, performance, small and medium industries

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1. Introduction

Small and Medium Enterprises (SMEs) play an important role in driving economic growth in developing countries by contributing significantly to Gross Domestic Product (GDP), employing a large proportion of the workforce, and strengthening local economies. In Indonesia, small and medium enterprises (SMEs), most of which are SMEs, account for around 99% of all business units, employ approximately 97% of the workforce, and contribute up to 60% of GDP [1] [2]. This strategic role requires SMEs to continuously adapt through engineering-based interventions that can improve performance and competitiveness amid the challenges of globalization and digitalization.

Performance transformation necessitates not only managerial improvements but also technical and engineering solutions to optimize organizational systems in response to these demands. One such solution is the creation of an organizational culture. Engineering-based changes can only be successful if they are supported by a strong organizational culture. Organizational culture has long been recognized as a key driver of satisfaction, loyalty and performance [3][4]. Culture shapes behavior, values, and communication patterns that directly influence productivity and effectiveness [5] [6]. However, its impact is often limited, so that the design of work systems and the physical environment are not taken into account resulting in discomfort [7]. A workplace that lacks ergonomics can reduce motivation, disrupt health, and decrease productivity [8]. According to Schein's framework, an organizational culture that reflects shared assumptions, values, and artefacts needs to be translated into the design of socio-technical systems so that it is in line with daily operations [9].

In this context, ergonomics plays an important role in bridging the gap between work system design and organizational culture. As part of industrial engineering, ergonomics emphasizes the design and optimization of work systems, equipment, and the physical environment to improve both well-being and performance[10]. Ergonomics is not merely a matter of comfort, but rather an engineering intervention that encompasses the redesign of workstations, the adjustment of equipment dimensions, the arrangement of production lines, and the development of facilities that support workers' posture and visibility[11]. These interventions can reduce musculoskeletal heatlh [12], improve operator safety, and improve process efficiency and product quality [13]. Thus, ergonomically engineered workplaces have the potential to become the foundation for sustainable performance improvement in SMEs [14]. For this reason, it is necessary to apply physical ergonomics to organizations.

At this point, in today's digital age, ergonomics alone is not enough; organizations must also integrate digitalization into their work systems to remain competitive. Digital culture serves as a factor that can strengthen the link between physical ergonomics and organizational culture. Digital culture, as defined by various organizational studies, encompasses shared values, beliefs, and practices that enable organizations to adopt and utilize digital technology effectively [15][16]. Digitalization is not only understood as managerial support, but also as an engineering intervention through the implementation of integrated digital workflow systems, computer-based production planning, Internet of Things (IoT)-based machine monitoring, and Human Machine Interface (HMI) platforms for real-time decision making. These systems reorganize work processes, enhance collaboration, and strengthen transparency. When supported by a strong digital culture, employees are more receptive to these technologies, thereby accelerating organizational transformation and increasing competitiveness [17]. Empirical research also shows that digital culture is closely related to higher creativity, participation, and innovation capacity [18].

Although they have made important contributions, previous studies have mostly examined organizational culture, ergonomics, and digitalization separately. There have not been many studies investigating the simultaneous interaction of these three factors, especially in the context of SMEs in developing countries that face resource constraints and uneven technology adoption. This has led to a research gap regarding how digital culture can act as a moderator in the relationship between ergonomics and organizational culture in influencing performance. Therefore, this study attempts to address this gap by analysing the moderating role of digital culture in linking physical ergonomics and organizational culture to the performance of SMEs in Indonesia. By positioning ergonomics and digitalization as engineering interventions, this study contributes theoretically by expanding the Resource-Based View (RBV), Technology–Organization Environment (TOE) framework, and Contingency Theory. Practically, this study offers design-based insights to help SMEs optimize their socio-technical systems to remain competitive in the digital era. The proposed integrative model emphasises how ergonomics and digital culture can act as drivers of sustainable performance, with digital culture serving as a force multiplier that ensures ergonomic and cultural interventions translate into tangible organizational improvements

This gap emphasises the need for research that examines the integration of these three factors. By placing digital culture as a moderating variable, this study aims to understand how the interaction between physical ergonomics and organizational culture can be strengthened through digital culture, so that SME performance transformation strategies can be more effective, comprehensive, and sustainable. This approach is expected to provide theoretical and practical contributions to SMEs in designing performance interventions that consider physical, social, and digital factors simultaneously.

2. Method

2.1. Conceptual Model and Hypothesis

The conceptual model of this study was developed to illustrate the theoretical relationships among key variables and to guide the formulation of hypotheses. Figure 1 shows a conceptual picture of the study model, illustrating the interrelations among the variables of SMI performance, organizational culture, physical ergonomics, and moderating digital culture.

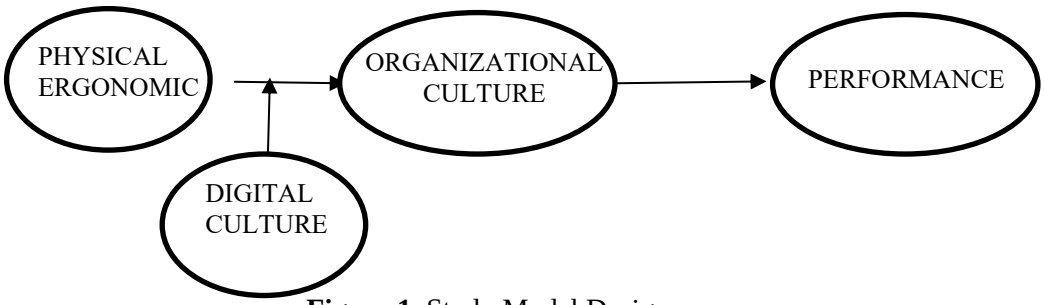

Figure 1. Study Model Design

Based on the conceptual framework and theoretical foundation discussed previously, the following hypotheses are proposed to examine the relationships among physical ergonomics, organizational culture, digital culture, and SMIs performance: H1: Physical ergonomics positively influences organizational culture in SMI, H2: Organizational culture positively influences SMIs performance, H3: Digital culture positively moderates the relationship between physical ergonomics and organizational culture, strengthening the impact of ergonomics when digital culture is high.

Building upon the conceptual framework and the formulated hypotheses, the next step is to design an empirical approach capable of testing the proposed relationships. Since the focus of this study lies in examining direct, indirect, and moderating effects among key constructs, a rigorous methodological design is required to ensure valid and reliable findings. Therefore, a quantitative explanatory approach was adopted, supported by Structural Equation Modeling (SEM), which is well suited for analyzing complex causal relationships in organizational and technological studies. The following section describes the research design, context, sampling strategy, data collection, and measurement instruments employed in this study.

This study employed a quantitative explanatory design to examine the causal relationships among physical ergonomics, organizational culture, digital culture, and SMI performance. Structural Equation Modeling (SEM) with AMOS was applied as the analytical technique because of its ability to evaluate direct, indirect, and moderating effects simultaneously, while model fit was assessed using indices such as RMSEA, CFI, and TLI [19].

This study was conducted in Tegal, Central Java, Indonesia, involving 123 valid respondents selected purposively from employees with at least one year of experience, direct involvement in production, and engagement with digital processes. Although various scholars propose different guidelines for SEM sample size, most agree that between 100 and 200 respondents are generally adequate, with recommendations ranging from ratios of five to ten respondents per indicator or parameter [20]. Empirical reviews also show an average of 148 samples in applied SEM studies [21], while Kusrini

(2022) employed 167 samples in a related model [22] . Based on these references, the sample size in this study is considered sufficient and representative for SEM analysis.

A structured questionnaire was used to measure four constructs: physical ergonomics, organizational culture, digital culture, and SMI performance. Table 1 presents a summary of these constructs and their indicators.. All items were measured on a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree), a method widely used in organizational behavior research for its simplicity, clarity, and reliability. The Likert scale method was chosen for its simplicity, ease of interpretation, and well-established effectiveness in capturing organizational behavior in quantitative research.

Table 1. Research Constructs and Indicators

Construct	**Indicators**	**Number of Items**
Physical Ergonomics	1. Duration 2. Body posture 3. Temperature 4. Humidity 5. Lighting 6. Noise 7. Design conditions of tools and machines 8. Workstation layout 9. Machine layout position	8
Organizational Culture	1. Innovation and risk-taking 2. Result orientation 3. People orientation 4. Team orientation 5. Aggressiveness 6. Stability	6
Digital Culture	1. Innovation 2. Data-driven decision making 3. Collaboration 4. Open culture 5. Digital first mindset 6. Agility and flexibility 7. Customer centricity 8. Human capability 9. Capability	9
SMEs Performance	1. Increase in user retention. 2. Accelerate the use of information. 3. Improve data-to-information conversion. 4. Experience revenue growth. 5. Achieve cost reduction. 6. Improve asset utilization. 7. Comply with environmental regulations. 8. Prevent and mitigate environmental crises. 9. The company limits its environmental impact beyond regulatory compliance. 10. The company educates employees and the public 11. Occupational safety 12. Occupational health	12

Each item was adapted from validated scales from previous studies to ensure contextual relevance to Indonesian SMIs. Pre-testing and expert evaluation were conducted to improve language clarity and cultural appropriateness. Confirmatory factor analysis was conducted to evaluate construct validity. Composite Reliability (CR) and Average Variance Extracted (AVE) thresholds (>0.70 and >0.50, respectively) were used to assess internal consistency.

Data collection in the current study was conducted using online and paper questionnaires distributed from January to February 2025. Respondents were informed of the purpose of the study, and their confidentiality was guaranteed. Before SEM analysis, outlier detection, multicollinearity test, and normality tests were conducted to ensure conformity with SEM assumptions.

Data analysis was conducted using Structural Equation Modeling (SEM) with AMOS 24.0. Preliminary diagnostics addressed missing values, normality, multicollinearity, and outliers. The measurement model was assessed through factor loadings (≥0.50), Composite Reliability (CR > 0.70), and Average Variance Extracted (AVE > 0.50). Structural relationships, including direct, indirect, and moderating effects, were examined using bootstrapping. Model fit was evaluated using RMSEA (<0.08), CFI (>0.90), GFI (>0.90), and TLI (>0.90), while hypotheses were tested based on Critical Ratio values (CR > 1.96) with significance at $p < 0.05$.

This comprehensive analysis enabled the examination of the mediating role of organizational culture and the moderating role of digital culture in the relationship between physical ergonomics and SMEs' performances, offering theoretical and practical insights relevant to Industry 4.0.

3. Results and Discussion

3.1. Descriptive Analytics

This study gathered primary data using standardized questionnaires for small and medium-sized businesses (SMEs) running manufacturing operations, in this study is the industrial manufacturing business. The successful acquisition of 123 valid responses offered a strong basis for the subsequent investigation. For a better understanding of the context of the study participants, a demographic analysis was conducted.

The following tables provide an overview of the respondents' age distribution, organizational roles, and educational backgrounds, offering valuable insights into the diversity of the samples. This demographic breakdown helps contextualize the findings and ensures a well-rounded perspective on the workplace culture and performance in SMIs.

Table 2 presents the age distribution of the participants in this study. This information is essential for understanding the demographic characteristics of the respondents, which may influence their perceptions and experiences within the organizational or workplace context. As shown below, the majority of respondents are in their productive age range, specifically 31–40 years (36%) and 41–50 years (28%). Meanwhile, participants aged 20–30 years account for 24% of the total respondents, and only 12% are over 51 years old. This distribution reflects age diversity within the study population, which can provide a broader perspective on the variables analyzed in this research.

Table 2. Age distribution of participants

Age	**Percentage**
20-30 years old	24%
31-40 years old	36%
41-50 years old	28%
51 years and older	12%

Table 3 presents the organizational roles of the participants in this study. Understanding the respondents' positions within the organizational hierarchy is crucial for assessing how their responsibilities and levels of authority may influence their perceptions and experiences. As shown below, the majority of respondents (55%) are operational-level employees, followed by 27% in

supervisory roles, and 18% in managerial positions. This composition indicates that most participants are directly involved in daily operational activities, offering practical insights into the organizational dynamics under study.

Table 3. Organizational Role of Participants

Organizational Role	Percentage
Manager	18%
Supervisor	27%
Operational-level employee	55%

Table 4 shows the educational levels of the participants in this study. This information provides insight into the academic backgrounds of the respondents, which may influence how they understand and respond to workplace conditions. The majority of respondents hold a bachelor's degree (48%), followed by those with a master's degree or higher at 37%, and 15% with a high school education. This composition reflects a relatively high educational level, which may contribute to the quality of responses and a deeper understanding of the organizational issues examined.

Table 4. Educational Level of Participants

Educational Level	Percentage
High school	35%
Bachelor's degree	48%
Master's degree or higher	17%

Furthermore, the relatively homogeneous distribution of answers throughout the questionnaire shows constant interaction with the research tool, confirming the data's dependability.

3.2. Validity Assessment

Validity testing leveraged the results of the factor loading evaluation. The Physical Ergonomics construct was measured by five indicators: Duration (x1), Humidity (x4), Lighting (x5), Equipment and Machine Design Conditions (x7), and Workstation Layout (x8), with estimated factor loadings ranging from 0.353 to 0.757. These values indicated that several indicators possess moderate to strong contributions, although *Work Posture* and *Manual Handling* might require further examination due to lower loadings.

In the Digital Culture construct, the indicators included Digital First Mindset (x23), Customer Centricity (x25), Human Capability (x26), and Innovation Capability (x27). These indicators exhibited consistently high loadings between 0.754 and 0.810, suggesting a strong and reliable representation of the construct.

Conversely, the indicators for Organizational Culture which consisted of Encouragement to Innovate (x31), Motivation to Face Challenges (x32), Result Orientation (x33), People Orientation (x34), and Team Orientation (x35) showed significant variation, with factor loadings ranging from 0.041 to 0.739. This indicated inconsistencies in the measurement model and suggests that some indicators, particularly those with low estimates, might not adequately capture the intended construct.

The Performance construct was assessed through five indicators: User retention improvement (y1), Improvement of data conversion into information (y3), Revenue growth (y4), Environmental performance (y6), and Ergonomic performance (y7), which presented varying levels of validity, with the highest factor loading observed at 0.864, confirming the resilience of certain indicators within the construct.

The findings confirmed that the majority of indicators across constructs fulfilled the criteria for convergent validity, particularly within Digital Culture and Performance, where consistently high factor loadings were observed. The Physical Ergonomics construct was generally well-represented, although some indicators showed weaker loadings that might benefit from further refinement. On the other hand, the Organizational Culture construct revealed substantial variability in indicator validity, with one indicator falling far below the acceptable threshold. This indicated the need for a re-evaluation of the

indicator set to ensure conceptual alignment and measurement precision. Overall, the measurement model demonstrated strong validity in several key constructs, while highlighting areas for potential improvement in indicator quality and construct operationalization.

3.3. Measurement Model Evaluation

The measurement model was assessed using Confirmatory Factor Analysis (CFA) to ensure the validity and reliability of the latent constructs. As shown in Table 5, all constructs met the recommended thresholds for composite reliability (CR > 0.70) and average variance extracted (AVE > 0.50), indicating strong internal consistency and convergent validity. Each construct was measured using multiple items adapted from established sources and adjusted for relevance to the Indonesian SMIs. Table 5 presents the results of the measurement model assessment, including factor loadings, composite reliability (CR), average variance extracted (AVE), and Cronbach's alpha for each construct.

Table 5. Measurement Model Results

Construct	Number of Items	CR	AVE
Physical Ergonomics	5	0.843	>0.50
Organizational Culture	5	0.844	>0.50
Digital Culture	4	0.743	>0.50
SMIs Performances	5	0.776	>0.50

The measurement model demonstrated acceptable fit across reliability and validity metrics, supporting its use in the subsequent structural model analysis.

3.4. Model Fit Assessment (Goodness of Fit Indices)

The measurement model fit to study data was evaluated using Goodness of Fit Indices, including Chi-square, RMSEA (< 0.08), GFI (> 0.90), and CFI (> 0.90). The results of the model evaluation indicated that most of the model's feasibility indicators had been met. The Probability (PROP) value of 0.718 exceeded the cut-off limit of > 0.05; thus, the model was declared fit. The RMSEA value of 0.000 also indicated a very good fit because it was far below the maximum limit of 0.08. The GFI index of 0.905 had met the requirement of ≥ 0.90, while the AGFI of 0.860 was slightly below the required threshold, thus categorized as a marginal fit. The CMIN/DF ratio of 0.929 indicated a good fit because it was below the maximum value of 2.0. Additionally, the Tucker Lewis Index (TLI) value of 1.012 and the CFI value of 1.000, both exceeding the standard of ≥ 0.90, affirmed the compatibility of the model used with the data. Overall, this model can be considered suitable for further study.

Based on the result, all indications show that the model performs a good suitability with the data, with RMSEA at 0.000, TLI at 1.012, and CFI at 1.000. Although AGFI is relatively lower than the benchmark (0.860), it is still in a reasonably good range. This model can be used for additional research because it meets the overall fit criteria

3.5. Structural model evaluation

The structural model was tested using Structural Equation Modeling (SEM) with AMOS 24.0 to evaluate the hypothesized relationships among the constructs, including the mediating and moderating effects. Table 6 presents the standardized path coefficients, p-values, and interpretation of the structural paths.

Table 6. Structural Model Results

Hypothesized Path	Standardized Coefficient (β)	p-value	Interpretation
Physical Ergonomics → Organizational Culture (H1)	-1.031	< 0.001	Negative and significant effect

Organizational Culture → SMI Performance (H2)	0.113	.229	Positive but not statistically significant effect

3.6. Moderation Test

Built on the proposed conceptual framework, this study investigated the moderating effect of digital culture on the relationship between physical ergonomics and organizational culture. The analysis tested whether digital culture significantly strengthens the effect of physical ergonomics on organizational culture. Table 7 summarizes the standardized coefficients, significance levels, and interpretations of the hypothesized moderating effects.

Table 7. Moderation Test Result

Hypothesized Path	**Standardized Coefficient (β)**	**p-value**	**Interpretation**
Physical Ergonomics X Digital Culture → Organizational Culture (H3)	0.083	<0.001	Digital culture significantly and positively moderates the relationship between physical ergonomics and organizational culture

3.7. Hypothesis Test

The results of hypothesis testing revealed mixed support for the proposed relationships. Hypothesis 1 (H1) was not supported, as physical ergonomics demonstrated a negative and statistically significant effect on organizational culture ($\beta = -1.031$, $p < 0.001$). This finding suggests that improvements in physical ergonomics within SMIs do not necessarily strengthen organizational culture. Instead, top-down ergonomic interventions may reduce participation and flexibility, thereby weakening cultural values unless complemented by digital or participatory approaches. Similarly, Hypothesis 2 (H2) was not supported. Organizational culture did not exert a statistically significant influence on performance ($p > 0.05$). Although the relationship was positive in direction, the high p-value indicated insufficient evidence to conclude that organizational culture directly enhances performance in this context. This result may reflect the presence of other, more dominant mediating or moderating variables influencing the relationship. In contrast, Hypothesis 3 (H3) was supported. Digital culture was found to positively and significantly moderate the relationship between physical ergonomics and organizational culture ($\beta = 0.083$, $p < 0.001$). This result highlights the role of digital culture in amplifying the impact of ergonomic practices, fostering adaptability, collaboration, and innovation within the organizational environment.

These findings highlight the nuanced and sometimes paradoxical relationship between physical and digital workplace elements in shaping organizational culture. They underscore the importance of holistic design and strategic alignment in workplace improvement efforts

Discussion

The Impact of Physical Ergonomics on Organizational Culture

The findings demonstrate that physical ergonomics exerts a significant yet negative effect on organizational culture. This result challenges the dominant view in ergonomics and organizational studies, where workplace improvements are generally expected to enhance employee well-being, engagement, and shared values [23] . In the context of Indonesian manufacturing SMIs, however, ergonomic interventions are often introduced in a top-down manner, emphasizing compliance with physical standards rather than fostering participatory practices [24]. This finding diverges from much of the recent ergonomics and organizational literature, which emphasizes that workplace design

generally enhances employee well-being, collaboration, and shared values [25]. Comparative evidence from industrial engineering research suggests that while ergonomic redesigns of tools, workstations, and environments can reduce physical strain and increase efficiency, their cultural impact depends heavily on managerial style and organizational context [26]. Conversely, evidence from healthcare and nursing sectors demonstrates that when ergonomic changes are implemented in a purely technical manner, they may improve physical conditions without reducing stress or fostering engagement [27]. In the field of ergonomic design can improve complaints of violin users [28] . This comparison highlights that the cultural impact of ergonomics is context-dependent and strongly shaped by managerial style and organizational environment.

In the case of Indonesian manufacturing SMEs, ergonomic interventions are often introduced as compliance-driven measures rather than participatory practices [29]. Such a top-down approach tends to restrict collaboration, reduce flexibility, and weaken the development of shared organizational norms, thereby explaining the negative relationship identified in this study. Supporting evidence from systematic reviews indicates that participatory ergonomics faces barriers such as financial constraints, cultural resistance, and unequal power relations, which limit its effectiveness in fostering organizational values when interventions are narrowly focused on technical adjustments [30] [31]. These findings suggest that physical ergonomics alone cannot be assumed to strengthen organizational culture without managerial support and socio-cultural integration.

The results emphasize the importance of contextualizing ergonomic practices within socio-organizational frameworks rather than treating them as isolated technical fixes. Future interventions should integrate physical ergonomics with organizational development initiatives, including mechanisms that promote open communication, teamwork, and digital collaboration platforms. In doing so, ergonomics may serve not only to improve physical working conditions but also to strengthen collective identity and engagement [32]. For SMEs, participatory design and digital tools can provide cost-effective pathways to ensure that ergonomics contributes to both efficiency and cultural cohesion.

This study has limitations, particularly its focus on physical ergonomics without incorporating cognitive or organizational ergonomics. Such a limited scope may partly explain why ergonomic improvements did not translate into stronger cultural outcomes. In addition, the hierarchical and resource-constrained nature of SMEs in developing economies may further restrict the potential of ergonomics to foster shared values, thereby reinforcing the negative coefficient observed. Future research should therefore adopt a more holistic approach by integrating multiple dimensions of ergonomics and examining their interplay with organizational culture in diverse contexts.

The Impact of Organizational Culture on SMIs' Performance

The second major finding is that organizational culture did not significantly predict performance. While earlier research widely linked culture to improved outcomes, recent evidence shows that the impact of culture is contingent on how deeply values are embedded into daily routines and practices. For instance, Yasue et al. (2025) reported that culture strengthens resilience only when institutionalized into formal procedures [33], while Alriyami et al. (2024) found that cultural values improve performance primarily when coupled with autonomy and fairness [34]. Hung (2022) showed that organizational culture significantly influences individual performance, with dimensions such as clan culture and adhocracy culture affecting task performance and counterproductive behaviors [35]. Several recent studies have also found that organizational culture does not always significantly influence performance. For example, Palumbo (2024) reported that organizational culture did not have a significant effect on the relationship between quality management and organizational performance [36]. Similarly, Trisnayanthi (2024) found that organizational culture had a positive but non-significant effect on job satisfaction in the education sector [37].

These results suggest that other factors may be more dominant in influencing performance. Mediating or moderating variables, such as leadership, motivation, or work environment, may play a more significant role. For example, Hung (2022) indicated that organizational culture significantly

affects individual performance through clan culture and adhocracy culture dimensions, which influence task performance and counterproductive behaviors[35].

Limitations of this study include a relatively small sample size and the use of a cross-sectional design, which limits the ability to draw causal conclusions. Future research using longitudinal designs and larger samples is needed to examine causal relationships between organizational culture and performance. Additionally, further exploration of mediating and moderating variables can provide a deeper understanding of these dynamics.

Overall, although organizational culture has the potential to influence performance, this study highlights the importance of considering other factors that may play a more dominant role in affecting performance in the studied context.

Digital culture moderates the relationship between physical ergonomics and organizational culture

This study confirmed H3 by demonstrating that digital culture moderates the relationship between physical ergonomics and organizational culture, such that higher levels of digital maturity reduce the negative influence of ergonomics on organizational norms and cohesion. This finding helps explain the counterintuitive direct effect in H1, where ergonomics alone appeared to weaken organizational culture. Several recent studies have explored the interplay between digital culture, physical ergonomics, and organizational culture in SMEs. For instance, a study by Honglan Jie, et al. (2025) developed an adaptive digital maturity model for industrial SMEs, highlighting the importance of digital maturity in enhancing organizational capabilities and performance. While this model does not directly address the moderating role of digital culture on ergonomics, it underscores the significance of digital maturity in organizational development [38].

The moderating effect of digital culture aligns with prior evidence showing that organizational enablers such as autonomy, fairness, and supportive practices condition the influence of culture on performance [39]. Studies also indicate that innovative organizations with strong digital culture can enhance well-being, collaboration, and engagement [40], reinforcing the argument that digital culture provides mechanisms to transform ergonomic adjustments into enacted routines. Baojing et al. (2025) discussed the mediating role of digital organizational culture in the relationship between digital transformation and the development of new business models in SMEs [41].

The moderating effect of digital culture suggests that in SMEs, the integration of digital tools and practices can mitigate potential negative effects of physical ergonomics on organizational culture. This finding aligns with the notion that digital transformation can reshape organizational norms and cohesion, fostering a more adaptable and resilient culture. This study's limitations include a relatively small sample size and the use of a cross-sectional design, which limits the ability to draw causal conclusions. Future research could employ longitudinal designs and explore different organizational contexts to further investigate the complex relationships between digital culture, physical ergonomics, and organizational culture.

Implication

This study highlights that, unlike previous findings, physical ergonomics may negatively influence organizational culture in Indonesian SMIs. Ergonomic interventions centered on individual comfort can reduce social interaction and shared values, underscoring the need to integrate local social and cultural elements into ergonomics design.

The results also show that organizational culture alone does not significantly improve performance without strong support from work systems, training, and management structures. Therefore, managers should adopt culture-strengthening strategies that emphasize practical outcomes aligned with workforce characteristics rather than symbolic values.

Furthermore, digital culture was found to moderate the link between physical ergonomics and organizational culture, indicating its strategic role in bridging workplace improvements with communal values. Integrating digital transformation through basic technologies, inclusive platforms, and digital

literacy can strengthen cooperation and communication. Future research should broaden industry contexts, apply mixed methods, and consider moderators such.

4. Conclusion

This study demonstrates a counterintuitive but important finding: when implemented in isolation, physical ergonomics can weaken rather than strengthen organizational culture in SMIs, undermining cohesion and shared values. This challenges the dominant narrative in ergonomics literature that physical improvements inherently promote positive outcomes. The unique contribution of this research lies in showing that digital culture can mitigate these adverse effects, transforming ergonomics into a constructive force when aligned with organizational practices and values. Equally notable is the non-significant link between organizational culture and performance, which underscores the contextual complexity of SMIs operating in resource-constrained settings. Taken together, these results highlight that ergonomic interventions must not stand alone but be embedded within a broader framework of digital readiness and participatory practices. For practitioners, this means that fostering a strong digital culture is essential to ensure that ergonomics enhances rather than disrupts organizational cohesion, thereby creating more adaptive and sustainable work systems. Future research should examine how factors such as leadership style, digital maturity, and sectoral variation further shape this moderating mechanism.

Authors' Contributions:

The authors collectively contributed to the conception and design of the study, development of the application, data collection and analysis, interpretation of the results, drafting of the manuscript, and final approval of the version to be published.

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