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# The Role of Digital Transformation in Enhancing Small and Medium Enterprises' (SMEs) Performance and Sustainability

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**Abstract.** Nowadays, technology development is inevitable to enhance business performance. Social media communication and interaction address digital transformation among SMEs. This study investigates how digital transformation influences SMEs' productivity and sustainability directly and indirectly through SMEs' employees' competence. A total of 523 participants filled out the questionnaire. Structural equation modelling (SEM) was used to examine the research hypotheses. Digital transformation has positive effects on SMEs' employees' competence. Furthermore, employees' competence plays an important role in mediating the relationship between SMEs' digital transformation and SMEs' productivity and sustainability. This study was limited to Indonesian SMEs. Therefore, future studies are needed to analyze cross-regional cultures and regions. SMEs stakeholders and government should develop an interactive collaboration for business towards digital transformation. It must be in line with the SMEs needs for competitive advantage. This study contributes to social and economic development by combining the digital transformation and SMEs performance.

## 1. Introduction

Small and Medium Enterprises (SMEs) play a dominant and indispensable role in shaping the structure of economies across the globe [1]. They are widely recognized as crucial engines of economic growth, job creation, and innovation. SMEs account for a significant percentage of total employment, often providing the majority of private sector jobs and creating new opportunities, particularly in emerging industries or underserved regions [2]. Their contribution to national GDP is substantial, typically ranging from 40% to 60% or more in some nations, reflecting their presence across diverse sectors such as manufacturing, services, agriculture, and trade [3,4]. SMEs are also

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known for their flexibility and adaptability, which make them more innovative and responsive to changing market demands compared to larger enterprises. In addition, SMEs are pivotal in supporting regional and community development, as they are often established in smaller cities and rural areas, thus helping to reduce urban-rural economic disparities and stimulate balanced growth.

SMEs contributing to foreign exchange earnings and economic diversification with regard to participate in export markets and global value chains [5]. Furthermore, SMEs promote entrepreneurship and social mobility by offering opportunities for self-employment and business ownership, thereby encouraging a culture of innovation and enterprise. According to the Indonesia Ministry of Cooperatives and SMEs, the number of SMEs more than 64 million units by 2023 [6]. It contributing to 60.5% of the national Gross Domestic Product (GDP) and employing 97% of the workforce in Indonesia. However, despite their significant role, SMEs still face fundamental challenges such as limited access to capital, low product competitiveness due to weak business management and minimal technological proficiency [7]. In addition, digitalization has a profound impact on SMEs sustainability and performance. These advancements allow businesses to reach wider markets, enhance customer engagement, and respond more quickly to changing consumer preferences. Digital tools also facilitate better data management and analytics, empowering SMEs to make informed decisions, optimize supply chains, and improve product or service quality.

SMEs also can enhance competitiveness and sustainability, adapt to market disruptions, and access new business models that support growt towards digitalization [8]. In addition, the transition to digitalization also presents challenges that can hinder SME sustainability and performance. Some SMEs face barriers such as limited financial resources, lack of digital skills, and resistance to change, making it difficult to invest in and effectively implement new technologies. Cybersecurity risks are another significant concern, as inadequate protection can expose businesses to data breaches and operational disruptions. The rapid technological advancements may outpace SMEs' ability to keep up, potentially leading to obsolescence or increased operational complexity. The digital divide between urban and rural areas can further exacerbate inequalities, with some SMEs struggling to access reliable internet or digital infrastructure.

The information technology transformation is key to addressing these various limitations of SMEs. Digital technologies, including the internet, e-commerce platforms, financial applications, big data analytics, and artificial intelligence, have opened up new opportunities for SMEs to expand their markets, increase efficiency, and create innovative business models [9, 10]. Digital transformation is no longer seen as a mere option, but a necessity for SMEs to adapt to the dynamics of globalization, changing consumer behavior, and increasing competition [11]. However, the adoption of digital technology does not automatically guarantee success [12]. The human factor still plays a central role. Human resource (HR) competencies, encompassing knowledge, skills, and attitudes, are a determining variable that bridges the gap between technology utilization and improved business performance [13]. Low digital literacy among SMEs actors remains a

major obstacle, as evidenced by limitations in managing online platforms, processing customer data, or utilizing financial management applications [14]. This condition indicates that without strengthening human resource competencies, digital transformation will only create new gaps between SMEs that are able to adapt to technology and those that are left behind. Furthermore, effective digital transformation requires not only the adoption of technology but also a change in mindset and work culture among SME actors [15, 16]. Digitalization demands openness to innovation, courage to take risks, and cross-sectoral collaboration [17].

The digital transformation must be understood as a holistic process that touches upon technological, human, and organizational aspects. Therefore, it is important to examine how the role of digital transformation in developing human resource competencies can drive both productivity and the sustainability of SMEs. Previous studies have extensively discussed the impact of digital transformation on SME growth, but most have still focused on technological aspects, infrastructure, or market access [14,18]. It shown lack of study investigates the role of digital transformation on human resource competencies in SMEs context. On the other hand, research on the sustainability of SMEs tends to focus on environmental and financial sustainability [5,19], while the link between human resource competence, productivity, and sustainability is still rarely studied, especially in developing countries like Indonesia. Thus, there is still room to deepen understanding of how digital transformation can directly and indirectly shape human resource capacity and its implications for business sustainability.

This study aims to uncover the role of digital transformation in the development of SMEs human resource competencies. How human resource competencies mediate the relationship between digital transformation and SME sustainability. This study contributes conceptually to the development of literature and provide practical recommendations for the government, academics, and business actors in designing sustainable SMEs strengthening strategies towards highlighting the human resource dimension and link the correlation between digitalization and SMEs performance.

## 2. Literature Review

2.1. **Digital transformation among SMEs.** Digital transformation refers to the process of fundamental changes in how organizations create value, operate, and interact with stakeholders through the utilization of digital technologies [8, 20]. In the context of small, and medium enterprises (SMEs), digital transformation not only includes the use of information technology to support administrative activities but also encompasses the adoption of new digital-based business models, the integration of online systems, and the utilization of data in strategic decision-making [15,21,22]. For SMEs, utilizing digital platforms not only expands market access to national and global levels but also reduces reliance on face-to-face interactions, which often limit the scale of business growth [6]. In addition, digital transformation allows SMEs to improve operational efficiency [16]. The implementation of cloud-based accounting applications, electronic payment systems, and digital logistics services helps SME actors minimize transaction costs, accelerate cash flow, and

improve the accuracy of financial record-keeping. This aligns with the World Bank's (2021) finding that SMEs adopting digital technology have 20–30% higher productivity compared to conventional MSMEs. Despite internet penetration reaching over 78%, most SMEs in Indonesia non-urban areas face obstacles such as limited digital infrastructure, high implementation costs, and low digital literacy [14]. Thus, digital transformation for SMEs can be seen as both an opportunity and a challenge. On the one hand, digitalization paves the way for increased competitiveness, product innovation, and access to global markets. However, without policy support, infrastructure, and improved human resource competencies, digitalization has the potential to widen the gap in inequality between SMEs. Therefore, a deep understanding of digital transformation becomes crucial, not only from a technological perspective but also from the standpoint of human, organizational, and business environment readiness. For instance, the shift in consumer behavior towards digital-based services is one of the main drivers of this transformation towards technology development such as e-commerce, social media, and mobile applications [23, 24].

2.2. **SMEs employees' competence.** Human resource (competence refers to the combination of knowledge, skills, and attitudes that individuals possess to perform their jobs effectively [25,26]. In the context of SMEs, human resource competency is a determining factor for the success of digital transformation [27]. For SMEs, digital competencies such as the ability to operate online marketing applications, manage transaction data, understand digital payment systems, and master simple analytics are core skills for survival and growth in the digital age [28, 29]. Recent studies show that digital literacy has a positive correlation with the performance of small businesses [30, 31]. SMEs with employees who have high digital competencies are more adaptable to market changes and faster at innovating. This reinforces the view that human resources are the bridge between technology adoption and business performance.

In Indonesia, the main obstacles faced by SMEs are not only limited capital, but also the low quality of human resources. Besides technical competence, non-technical competence is also important. Critical thinking skills, collaboration, and openness to change are important assets in adopting digital technology [32]. Managerial competencies, such as strategic planning and innovation management, also determine the success of digital transformation [33]. Hence, human resource competency not only serves as a supporting factor but also as a determinant of the success of SMEs in the digital transformation process. Human resource capacity building must be a priority in policies and strategies for developing SMEs, whether through technology-based training, management mentoring, or integrating digital literacy into SME empowerment programs.

2.3. **SMEs sustainability.** Productivity is a key indicator for assessing business performance. In the context of SMEs, productivity not only reflects the efficiency of input utilization but also the ability to generate value-added output through innovation and market adaptation [3,34]. The productivity of SMEs is influenced by several key factors, including the technology used, managerial capacity, workforce skills, and supply chain efficiency [1]. Digital transformation has the potential

to be a catalyst for increased productivity in SMEs [35]. Utilizing e-commerce platforms can expand market share at a relatively low cost, while cloud-based financial applications help accelerate transaction recording and analysis. Additionally, digital technology enables the automation of operational processes, real-time inventory management, and more responsive customer service [36]. The SMEs sustainability is understood as the ability to maintain long-term performance while remaining adaptable to market changes, regulations, and global dynamics [37]. For SMEs, sustainability encompasses aspects of resilience in crisis conditions, the ability to maintain product and service quality, and participation in ethical and environmentally friendly business practices [19,38]. Some SMEs that quickly transitioned to online sales, utilized delivery services, and optimized social media for marketing were able to maintain revenue and even expand their market reach. Therefore, it is important to enhance human resource development as a key strategy in driving the sustainability of SMEs.

## 3. Hypotheses Development

Digital transformation is fundamentally reshaping the core processes of small and medium-sized enterprises (SMEs) by shifting activities from manual to digital, which directly improves operational efficiency and output [39, 40]. The digitalization of the value chain including e-commerce sales, cloud-based financial recording, digital payment integration, and real-time inventory management significantly reduces time-to-serve and error rates. This transition enhances the accuracy and speed of pricing, inventory, and promotional decisions. For SMEs, these changes enable advanced strategies such as micro-targeting and dynamic bundling, which can increase conversion rates and foster repeat purchases. These are often the most immediate productivity gains experienced through business digital transformation. From a theoretical standpoint, the Resource-Based View and dynamic capabilities perspectives suggest that adopting digital technologies enriches a firm's intangible assets, such as data and process knowledge, and boosts its adaptability [41, 42]. This digital enrichment accelerates the operational learning cycle, making SMEs more responsive and resilient in dynamic markets. In practical terms, fewer work hours are wasted on routine manual tasks, inventory turnover becomes faster, and profit margins improve due to lower transaction costs.

H1. Digital transformation has a positive and significant effect on SMEs performance

Sustainability today encompasses much more than the mere survival of a business; it is fundamentally about maintaining consistent, high-quality performance over the long term, regardless of fluctuations in market conditions. For small and medium-sized enterprises (SMEs), digital transformation is a crucial enabler of this kind of resilience, strengthening ability to thrive through three primary pathways [43]. Firstly, digital tools facilitate agility in omnichannel sales and on-demand logistics, allowing SMEs to diversify their revenue streams. This diversification helps reduce the risk associated with overreliance on a single customer or sales channel, thereby making the business less vulnerable to market disruptions. Secondly, the integration of digital systems enhances

governance and transparency. Thirdly, digital transformation drives resource efficiency. Automation and data-driven decision-making reduce material and energy waste while minimizing costly rework. This operational efficiency not only cuts costs but also aligns SMEs with modern environmental and social standards, reinforcing their commitment to sustainability's broader pillars.

H2. Digital transformation has a positive and significant effect on SMEs sustainability

Digital transformation has become a crucial driver in enhancing the competitiveness of small and medium-sized enterprises (SMEs) [44, 45]. By adopting digital technologies, SMEs gain opportunities to expand their market share, optimize their business processes, and build stronger, more personalized relationships with their customers [46]. For example, the use of e-commerce platforms allows SMEs to reach customers beyond their geographic boundaries, while digital tools for data analytics help them better understand market trends and customer preferences. Additionally, digitalization streamlines operations, reducing costs and improving efficiency through automation and better resource management. However, research consistently indicates that merely implementing technology is not enough to secure these benefits. The successful adoption and utilization of digital tools depend heavily on the capabilities and adaptability of human resources within the organization. Employees must possess adequate digital skills, as well as a willingness to embrace continuous learning and change. Without a workforce that is competent and confident in using new technologies, SMEs risk underutilizing their digital investments and falling behind competitors. Therefore, digital transformation is not just a technological shift but also a catalyst for improving human resource capacity.

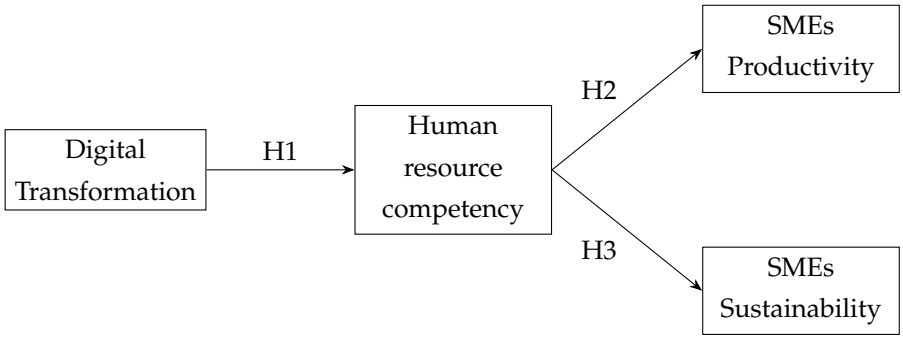
H3. Digital transformation has a positive and significant effect on SMEs employees competence

Human resource competence is crucial driver of productivity within an organization [26]. Employees who possess essential skills such as digital literacy, managerial expertise, and analytical capabilities are better equipped to utilize technology efficiently. This proficiency not only streamlines business processes but also leads to significant gains in operational efficiency, cost reduction, and increase business output [27, 47]. The importance of human resource competence extends beyond productivity, as it is consistently linked to enhanced performance in small and medium-sized enterprises (SMEs) [2, 48]. Furthermore, human resources competent are integral to business sustainability [38, 49]. Their expertise enables businesses not only to maintain stability in the short term but also to foster innovation and adaptability, which are essential for long-term survival and relevance amidst evolving market conditions and technological advancements. Therefore, human resource competence play an important role in mediating the link between digital transformation initiatives and increased SME productivity. SMEs can ensure that digital transformation efforts translate into tangible business outcomes, reinforcing the critical role of human resource competence in supporting both immediate performance gains and sustainable growth towards empowering employees with a good skill.

H4. Employee's competence has a positive role in mediating the relationship between digitalization transformation and SMEs performance

Digital transformation has become imperative for small and medium-sized enterprises (SMEs) striving for long-term sustainability in today's rapidly evolving business environment. While digital technologies offer tools for efficiency, innovation, and market expansion, the actual impact on sustainability largely depends on the competence of SMEs. Competence refers to the skills, knowledge, and capabilities that SMEs possess to effectively adopt, manage, and leverage digital technologies. SMEs' competence acts as a crucial mediating factor in translating digital transformation efforts into sustainable outcomes. First, competent SMEs are better positioned to identify relevant digital tools and technologies that align with their business models and strategic objectives. Moreover, SMEs with higher competence are more likely to foster a culture of continuous learning and innovation. Competence also enables SMEs to navigate potential risks associated with digital transformation, such as cybersecurity threats, data privacy concerns, and technological obsolescence. The SMEs employees' competent can maintain operational resilience and stakeholder trust.

H5. Employee's competence has a positive role in mediating the relationship between digitalization transformation and SMEs sustainability




H4: Digital Transformation - Human resource competency development - SMEs Productivity
H5: Digital Transformation - Human resource competency development - SMEs Sustainability

FIGURE 3.1. Proposed research model.

## 4. METHOD

4.1. **Research design.** This study employed a cross-sectional survey design to examine the relationships among digital transformation, human resource competence development, productivity and sustainability among SMEs employees and owner in Indonesia. The cross-sectional approach was selected because it allows for efficient data collection from a diverse sample and is appropriate for testing theoretically derived hypotheses about relationships among variables [50]. A preliminary test and pilot study were conducted to ensure clarity and appropriateness of the item wording and to reduce potential instrument bias. The purpose of the pretest was to ascertain participants' comprehension of each item and to implement requisite modifications to mitigate common method bias [51]. The questionnaire items were adapted to fit the research context and

underwent twelve rounds of independent pilot testing, with three participants per round, allowing for iterative refinement based on participant feedback. Additionally, a field test was conducted to confirm the comprehensibility of the final questionnaire version. Data was collected through online and offline survey which distributed to SMEs directly in various business sectors (trade, services, and manufacturing) from May to July 2025. The questionnaire was designed with a seven- Likert scale (1 = strongly disagree, 7 = strongly agree) to make it easier for respondents to provide consistent ratings.

The participants are SMEs employees and owners based on the following criteria: (1) SMEs have been operating for at least two years, (2) have adopted digital technology in marketing, finance, or operations, and (3) business managers are directly involved in decision-making. The SMEs were selected to represent diverse business types and geographic locations, enhancing the generalizability of findings. The SMEs officers distributed survey invitations through email lists, social media groups, and bulletin boards. Participants were also encouraged to share the survey link with eligible peers, facilitating snowball recruitment. A total of 536 questionnaires distributed, however, 523 were suitable for analysis, while 13 were eliminated due to incomplete or inconsistent data. This indicates a data feasibility level of 97.6%, which is high enough to guarantee the validity of the research. Data processing was conducted using Structural Equation Modeling (SEM) with the assistance of the AMOS application [50].

4.2. **Measure.** Digital transformation refers to research [46] and consists of 3 indicators: digital interconnection in production and logistics, digital value chain, and big data analysis. Human resource development competency indicators adopted from Piwowar-Sulej et al. (2024) [52], include technology mastery, business management skills, workforce skills and abilities, and leadership. The SME productivity indicator refers to Bravo-Ortega et al. (2023) including product marketing scale, ability to access technology, social media utilization, and the ability to build networks and cooperation among business actors [53]. Business sustainability indicators are measured by competitiveness, the ability to diversify business, the ability to maintain product stability, and the competitiveness of marketed products [1].

4.3. **Data analysis.** This study was conducted using the Structural Equation Modeling (SEM) approach with AMOS and SPSS software to test the causal relationships between latent variables. Hayes approach was used to test the mediating role of human resource competence. This technique allows for testing indirect effects with bias-corrected confidence interval estimation using the bootstrap method. Mediation is considered significant if the 95% confidence interval does not include zero. With this approach, the research not only identifies the direct influence of digital transformation on the productivity and sustainability of SMEs but also ensures the role of human resource competence as a mediator that strengthens this relationship.

## 5. Result

5.1. **Participants demofraphic.** Table 1 shown women (62.1%), indicating the dominance of women's roles in business activities. From an age perspective, the largest group of respondents falls within the productive age range of 31–40 years (47.6%), followed by 21–30 years (33.5%), indicating that the majority of SME actors are in an energetic and adaptable age phase. From an educational perspective, over half of the respondents are high school graduates (42.4%) and university graduates (46.5%), while elementary and junior high school graduates make up only a small portion. This condition reflects a fairly good literacy capacity in managing innovation and technology-based businesses. Based on business type, the culinary sector (30.8%) dominates, followed by fashion (24.4%), automotive (18.1%), agribusiness (12.4%), and other (14.3%). This finding confirms that culinary is the backbone of SMEs, while also highlighting the potential for diversification into other sectors. Overall, the respondent demographics show a dominance of female participants, productive age, secondary to higher education, and concentration in the culinary sector.

Table 5.1. Respondent demographics

| Demographic Items | Frequency | Percentage (%) |
|---|---|---|
| **Gender** | | |
| Male | 198 | 37.9 |
| Female | 325 | 62.1 |
| **Age** | | |
| Under 21 years old | 27 | 5.2 |
| 21-30 years old | 175 | 33.5 |
| 31-40 years old | 249 | 47.6 |
| Over 40 years old | 72 | 13.8 |
| **Education** | | |
| Elementary School | 7 | 1.3 |
| Junior High School | 51 | 9.8 |
| Senior High School | 222 | 42.4 |
| Bachelor | 243 | 46.5 |
| **Type of business** | | |
| Culinary | 149 | 30.8 |
| Fashion | 118 | 24.4 |
| Automotive | 87 | 18.1 |
| Agro Business | 60 | 12.4 |
| Othes | 69 | 14.3 |

5.2. **Measurement Model.** According to Hair Jr. et al. (2019) [50], the CFA model's output accurately reproduces the covariance matrix of the observed variables, and the composite reliability (CR) result indicated an acceptable degree (Table 2 and table 3).

TABLE 5.2. Correlation matrix for measurement scales

| Constructs | Mean | SD | DT | HRCD | MP | SMB |
|---|---|---|---|---|---|---|
| DT | 6.70 | 0.40 | **0.853** | | | |
| HRCD | 6.79 | 0.33 | 0.867** | **0.674** | | |
| MP | 6.73 | 0.37 | 0.955** | 0.904** | **0.747** | |
| SMB | 6.71 | 0.39 | 0.964** | 0.895** | 0.973** | **0.797** |

Table 5.3: Measurement results

| Variables and Item Scales | Factor Loadings | $\alpha$ | CR | AVE |
|---|---|---|---|---|
| **Digital transformation** | | 0.935 | 0.940 | 0.729 |
| DT1: My MSME uses a digital system that is integrated in the production and logistics processes. | 0.922 | | | |
| DT2: The production and logistics processes in my MSME can be monitored in real-time through a connected digital system. | 0.959 | | | |
| DT3: My MSME is connected to digital value chains such as e-commerce and online supply chains. | 0.602 | | | |
| DT4: My MSME utilizes digital platforms to speed up the distribution and supply process of goods. | 0.971 | | | |
| DT5: My MSME utilizes data analysis (big data) to make business decisions. | 0,621 | | | |
| DT6: Decision-making in my MSME is supported by digital analysis of customer data and market trends. | 0.958 | | | |
| **Human Resources Competency Development** | | 0.940 | 0.867 | 0.655 |
| HRCD1: I am able to use digital technology in managing a business. | 0.649 | | | |
| HRCD2: I actively participate in training or independent learning related to digital technology for business development. | 0.671 | | | |
| HRCD3: I have the ability to develop strategies and run business operations efficiently. | 0.608 | | | |
| HRCD4: I am able to utilize digital data and information in planning business development. | 0.778 | | | |
| HRCD5: My employees/workforce have adequate skills in running the business. | 0.636 | | | |
| HRCD6: My employees/workforce can adapt to technological developments in carrying out their duties. | 0.890 | | | |

Table 5.3. (continued)

| Variables and Item Scales | Factor Loadings | $\alpha$ | CR | AVE |
|---|---|---|---|---|
| HRCD7: I am able to lead work teams and make decisions effectively. | 0.626 | | | |
| HRCD8: I encourage the use of digital technology in team work processes to improve business performance. | 0.670 | | | |
| **MSME Productivity** | | 0.935 | 0.904 | 0.758 |
| MP1: My MSME products have been marketed widely through various media. | 0.789 | | | |
| MP2: My MSME products have reached consumers from various regions through digital platforms. | 0.956 | | | |
| MP3: I can easily access the technology needed for my business. | 0.752 | | | |
| MP4: I regularly update the technology devices or systems used in the business. | 0.974 | | | |
| MP5: My MSME actively uses social media for promotion and communication with customers. | 0.596 | | | |
| MP6: I use social media to reach new customers and build customer loyalty. | 0.972 | | | |
| MP7: I collaborate and network with other business actors to improve my business. | 0.604 | | | |
| MP8: I join digital communities or business forums to expand my business network. | 0.734 | | | |
| **Sustainability of MSME Businesses** | | 0.950 | 0.929 | 0.636 |
| SMB1: My MSME is able to compete with other business actors in the same sector. | 0.916 | | | |
| SMB2: My MSME is able to adapt to market changes and customer preferences to remain competitive. | 0.962 | | | |
| SMB3: My MSME is able to diversify the types of products or business services. | 0.561 | | | |
| SMB4: My MSME develops product or service variants based on changing market needs. | 0.991 | | | |
| SMB5: My MSME is able to maintain product stability and availability in the market. | 0.604 | | | |
| SMB6: My MSME has a stock and distribution system that ensures consistent product availability. | 0.990 | | | |
| SMB7: The products I market have advantages over competitors. | 0.613 | | | |
| SMB8: My product has quality and added value that make it more attractive to customers than similar products. | 0.750 | | | |

5.3. **Structural model.** The fit of the data to the proposed model was adequate: $\chi^2$/df = 3.818, GFI = 0.936, NFI = 0.938, CFI = 0.925, IFI = 0.927, and RMSEA= 0.067. The results supported all five research hypotheses, as shown in Figure 2. This study empirically validates that SMEs digital transformation has a significant and positive effect on SMEs employees' employees' competence ($\gamma_{11}$ = 0.569, $p$<0.001) to support H1. Humand resource competence also also has a positive role in enhance SMEs productivity and sustainability ($\beta_{12}$ = 0.358, $p$<0.01; $\beta_{12}$ = 0.335, $p$<0.01), supporting H2 and H3.

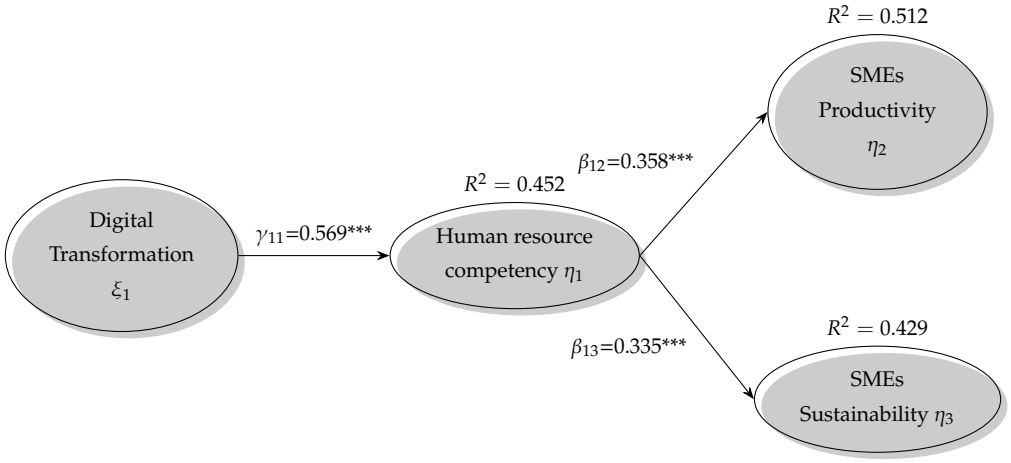



FIGURE 5.1. Structural model.

5.4. **Mediating effect.** In order to validate mediator variables (such as love of money and ethics), this study followed the advice given by Hayes (2018) (see table 5). It was determined that SMEs priductivity and sustainability are significantly impacted both directly and indirectly by digital transformation to support H4 and H5.

TABLE 5.4. Mediation result

| Direct effect | | | $\beta$ | $T$ | 95% CI |
|---|---|---|---|---|---|
| Digital Transformation | → | MSME Productivity | 0.639 | 30.885*** | (0.598, 0.680) |
| Digital Transformation | → | Sustainability of MSME Businesses | 0.742 | 36.092*** | (0.702, 0.782) |

| Indirect effect | | | | $\beta$ | SE | 95% CI |
|---|---|---|---|---|---|---|
| Digital Transformation | → | Human resource competency development | SME Productivity | 0.246 | 0.033 | (0.184, 0.316) |
| Digital Transformation | → | Human resource competency development | Sustainability of MSME Businesses | 0.202 | 0.301 | (0.149, 0.268) |

**Note**: Significant at *: $p < 0.05$, **: $p< 0.\ 01$, ***: $p < 0.001$

## 6. Key Finding

6.1. **Discussion.** Digital transformation is rapidly reshaping the landscape for small and medium-sized enterprises (SMEs), with significant implications for human resource (HR) competency development. This align to prior studies which revealed that SMEs integrate digital technologies into their operations ranging from cloud computing and data analytics to e-commerce and automation the competencies required of their workforce are evolving accordingly [14, 27, 28]. First, digital transformation demands new technical skills. Hence, SMEs must equip employees with digital literacy, data analysis capabilities, and proficiency in using various digital tools. Second, digital transformation encourages a culture of agility and adaptability. As technology evolves, SMEs require employees who are not only skilled but also flexible and open to change. HR strategies are shifting towards recruiting and nurturing talent that demonstrates learning agility, problem-solving abilities, and the capacity to work in multidisciplinary teams. This focus helps SMEs respond quickly to market changes and technological advancements. Moreover, digital transformation enhances remote work opportunities and collaboration through digital platforms. Therefore, SMEs are increasingly looking for competencies related to virtual communication, remote project management, and collaboration tools. HR departments are tasked with developing and supporting these skills, ensuring that productivity and engagement remain high despite physical distances. Finally, the HR function itself is undergoing transformation. Digital HR tools, such as automated payroll systems, online recruitment platforms, and performance management software, are streamlining HR processes. Consequently, HR professionals in SMEs must upgrade their digital competencies to manage these systems effectively.

Human resource competency development is a critical driver of productivity in small and medium-sized enterprises (SMEs). This support preliminary studies which found that SMEs need to investing in workforce skills and capabilities directly influences their overall performance and growth as global competition intensifies and markets evolve [25, 26, 41]. Firstly, competency development enhances employee efficiency. When SMEs invest in training programs whether in technical skills, soft skills, or industry-specific knowledge employees can perform their tasks more effectively and with fewer errors. For example, training employees on the latest technology or process improvements can streamline workflows and increase output per worker. Secondly, competency development fosters innovation and adaptability. Employees who receive ongoing opportunities for skill enhancement are better equipped to adapt to new challenges and propose creative solutions. In SMEs, where resources may be limited, the ability to innovate and quickly respond to market changes is crucial for maintaining competitiveness and productivity. A well-developed workforce can identify and implement improvements, adopt new technologies, and drive organizational change. Moreover, competency development positively impacts employee motivation and engagement. Additionally, competency development supports leadership and succession planning within SMEs. It has pivotal roles for SMEs to ensure continuity and stability, reducing productivity losses during periods of change or growth. Finally, as SMEs increasingly

leverage digital tools and global markets, competency development enables employees to work efficiently in diverse environments, manage cross-functional teams, and communicate across cultures, further boosting productivity.

Human resource (HR) competency development plays a pivotal role in shaping the long-term sustainability of small and medium-sized enterprises (SMEs). As sustainability becomes a core business priority encompassing economic, social, and environmental dimensions SMEs are increasingly aware that developing the right competencies within their workforce is essential for achieving sustainable growth [8, 39, 49]. Firstly, competency development ensures that SMEs possess the skills and knowledge required to implement sustainable business practices. Training employees in areas such as resource efficiency, waste management, and sustainable sourcing enables SMEs to reduce their environmental impact and adhere to regulatory standards. Well-informed employees can drive initiatives that minimize energy consumption, optimize processes, and reduce costs, all of which contribute to long-term business viability. Secondly, employees' competency development fosters a culture of innovation and continuous improvement. Employees equipped with up-to-date knowledge and problem-solving skills are more likely to generate ideas for sustainable products, services, and processes. In SMEs, where agility is often an advantage, a workforce that continuously learns and adapts can quickly respond to new sustainability trends, customer demands, and emerging market opportunities. Moreover, competency development enhances the social aspect of sustainability by promoting inclusive and ethical workplace practices. In addition, employees who understand relevant laws, standards, and ethical guidelines can help SMEs avoid legal issues, manage risks, and ensure business continuity. Effective risk management is a cornerstone of sustainability, especially for SMEs facing limited resources and rapidly evolving market conditions.

The rapid digital transformation, small and medium-sized enterprises (SMEs) face both opportunities and challenges in remaining competitive and sustainable. Digital transformation introduces advanced technologies, streamlined processes, and new business models [15,21,31]. However, the realization of these benefits largely depends on the competencies of the human resources within the organization. Therefore, human resource (HR) competency development serves as a critical mediator in translating digital transformation efforts into tangible improvements in productivity and sustainability. Firstly, digital transformation equips SMEs with tools such as automation, data analytics, and digital communication platforms. Employees become proficient in leveraging new technologies, optimizing workflows, and making data-driven decisions, which directly enhances productivity. Secondly, HR competency development enables SMEs to adopt a culture of continuous learning and adaptability, which is essential for maintaining productivity in a rapidly changing technological landscape. This learning-oriented culture further supports innovation, as employees are empowered to propose and implement process improvements. In terms of sustainability, HR competency development ensures that digital transformation aligns with sustainable business practices. The sustainability principles are more likely to integrate resource-efficient processes,

ethical sourcing, and waste reduction initiatives into their daily operations, enabled by digital tools. This dual focus on technological and sustainability competencies helps SMEs achieve economic, social, and environmental objectives simultaneously. Moreover, HR competency development addresses potential challenges such as resistance to change, skill gaps, and ethical concerns by fostering a workforce that is resilient, inclusive, and responsible.

6.2. **Theoretical implications.** The mediating role of human resource (HR) competency development in the relationship between digital transformation, productivity, and sustainability in SMEs offers significant theoretical implications for organizational studies and management research. It extends the Resource-Based View (RBV) theory, which posits that unique organizational resources such as skilled human capital are critical to achieving competitive advantage. Thus, SMEs can leverage HR as a strategic resource that enhances both productivity and sustainability, supporting the RBV's emphasis on intangible assets. It also demonstrates that integrating HR competency development into the digital transformation discourse aligns with sociotechnical systems theory. This theory suggests that organizational performance stems from the harmonious interaction between people and technology. Moreover, the mediating role of HR competency development contributes to change management and organizational learning theories. It demonstrates that employee training, continuous learning, and adaptability are essential for overcoming resistance to change, closing skill gaps, and ensuring the long-term success of transformation initiatives. In this way, HR competency development is shown to be a dynamic process that supports both incremental and radical organizational change. The findings emphasize the interconnectedness of productivity and sustainability outcomes, suggesting that competency development can serve as a unifying lever for achieving both short-term operational goals and long-term sustainable growth.

6.3. **Practical implications.** The practical implications of recognizing human resource (HR) competency development as a mediator between SME digital transformation, productivity, and sustainability are profound for managers, HR professionals, and policymakers. Firstly, for SME leaders and managers, this perspective underscores the necessity of aligning digital transformation initiatives with strategic HR development. Hence, SMEs should invest in training and upskilling programs that ensure employees can effectively utilize new technologies. The digital marketing platforms, customer relationship management (CRM) systems, or automation tools, concurrent training initiatives enhance operational efficiency and boosting productivity. Secondly, HR professionals are encouraged to design competency frameworks that reflect both digital and sustainability-oriented skills. This includes digital literacy, data analytics, ethical decision-making, and knowledge of sustainable practices. In addition, SMEs can cultivate a workforce capable of driving both technological advancement and sustainability initiatives. For SMEs, practical implementation also means fostering a culture of continuous learning and adaptability. SMEs can mitigate potential challenges such as employee resistance to change, skill gaps, and technology

underutilization. For policymakers and support organizations, these insights highlight the importance of supporting SMEs with accessible training resources, funding for workforce development, and platforms for knowledge sharing.

6.4. **Conclussion.** The dynamic interplay between digital transformation, human resource (HR) competency development, productivity, and sustainability is increasingly shaping the future of small and medium-sized enterprises (SMEs). This discussion demonstrates that HR competency development serves as a vital mediator in ensuring that the adoption of digital technologies translates into meaningful improvements in both productivity and sustainability. Digital transformation offers SMEs unprecedented opportunities to innovate, streamline operations, and expand market reach. Furthermore, employees' competency development fosters a culture of continuous learning, adaptability, and innovation, which is critical in rapidly changing environments. It enables SMEs to respond effectively to emerging challenges, implement sustainable practices, and maintain operational efficiency. In addition, SMEs leaders and policymakers must recognize that competency development is not a one-time event but an ongoing strategic priority. Investments in employee skills and knowledge directly support successful digital transformation initiatives, boost productivity, and embed sustainability into the organizational fabric.

6.5. **Limitations and future study directions.** While this discussion highlights the critical mediating role of human resource (HR) competency development in linking digital transformation to productivity and sustainability in SMEs, several limitations should be acknowledged. Firstly, much of the existing literature and analysis is conceptual or based on case studies, which may limit the generalizability of findings across different industries, regions, or sizes of SMEs. Secondly, there is a lack of longitudinal research examining the long-term effects of HR competency development post-digital transformation. Future research should address these gaps by employing quantitative and mixed-methods approaches to validate and refine the proposed mediation model across diverse SME contexts. Comparative studies between industries and regions would help identify unique barriers and enablers of successful HR competency development. evolve and how these changes affect long-term productivity and sustainability outcomes. Finally, research exploring the role of external support such as government initiatives, educational partnerships, and technology vendors can inform policies and practices that more effectively support SMEs in their digital and sustainable journeys.

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