PREDICTIVE INFLUENCE OF ENTREPRENEURSHIP EDUCATION IN THE DIGITAL ERA ON BUSINESS PERFORMANCE AND INNOVATION ADOPTION AMONG SMALL AND MEDIUM ENTERPRISES IN NORTH CENTRAL NIGERIA

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Abstract

This paper examined the predictive influence of entrepreneurship education in the digital era on business performance and innovative adoption among small and medium enterprises in North Central Nigeria. Three research questions were answered, and three null hypotheses were formulated. This study employed a correlation research design. The target population comprised 21,537 SME operators registered with state branches of the Small and Medium Enterprises Development Agency of Nigeria (SMEDAN) and affiliated trade and cooperative associations within the six selected states, namely: Benue, Kogi, Kwara, Nasarawa, Niger and Plateau States. The sample of the study was 424 SME operators selected using a proportionate stratified sampling technique. Data for this study were collected using three structured researcher-

developed questionnaires designed to measure the major constructs of the study. To ensure content validity, the three instruments were subjected to expert review. Reliability of the instruments was determined using the Cronbach's alpha method, and coefficients of 0.89 for QEEDE, 0.86 for BPQ) and 0.71 for IAQ were obtained. Regression analysis was used for data analysis. Linear regression was used to answer research questions 1 and 2 and test null hypotheses 1 and 2. More so, multiple regression was used to answer research question 3 and test null hypothesis 3 at 0.05 alpha level. The finding revealed that entrepreneurship education in the digital age significantly predicted innovative adoption and business performance among SMES in North Central Nigeria. It was also found that entrepreneurship education in the digital era jointly predicted innovation adoption and business performance among SMEs in North Central Nigeria. It was recommended amongst others that federal and state governments should implement Digital Entrepreneurship Clusters, where SMEs receive integrated support combining digital training, innovation financing, and technical assistance.

Keywords: Entrepreneurship Education, Digital Era, Business Performance, Innovative Adoption, SMEs

Introduction

In the twenty-first century, the world has witnessed a profound shift toward the digital economy, a transformation that reshapes how businesses are conceived, operated, scaled and sustained. As digital tools, platforms and connectivity become ubiquitous, the conditions under which firms compete have changed dramatically. In this environment, entrepreneurship education (EE) emerges as a vital mechanism for equipping entrepreneurs and small business owners with the knowledge, mindset and capabilities required to navigate increasingly complex technological ecosystems (Nwabuatu, 2024). Indeed, EE is no longer simply about starting a business, it now involves mastering digital literacy, platform-economy logics, innovation management, and the leverage of technology for strategic advantage.

In North Central Nigeria which comprises Plateau, Benue, Kogi, Kwara, Nasarawa, Niger, and the Federal Capital Territory (FCT), small and medium enterprises (SMEs) remain the cornerstone of regional economic development, contributing significantly to employment generation and poverty reduction. Yet, despite their crucial role, SMEs in this region face persistent challenges that hinder their growth and competitiveness in the digital era. Recent data reveal that SMEs in Nigeria contribute about 46.3% to the national GDP and employ over 84% of the workforce, but many remain digitally excluded due to infrastructural deficits, poor internet penetration, inadequate access to technology-based training, and fragmented policy frameworks (PwC, 2024; SMEDAN, 2025). These constraints not only limit SMEs' operational efficiency but also restrict their ability to leverage digital innovations, thereby widening the technological gap between them and larger enterprises that can better afford digital transformation.

Given this reality, entrepreneurship education (EE) must evolve from its traditional focus on business creation and management to one that integrates digital literacy, innovation adoption, and platform-economy dynamics. In the digital era, entrepreneurs require competencies that go beyond basic management to include skills in e-commerce, cloud computing, data analytics, and digital marketing. Recognizing this, the Nigerian government's 2025 initiative to "build digital bridges" for MSMEs underscores a growing national commitment to enhance digital inclusion and improve SME competitiveness across African markets (MSME Africa, 2025). By embedding such digital competencies within entrepreneurship education frameworks, SMEs in North Central

Nigeria can be better positioned to adopt innovative tools, expand their market reach, and enhance overall business performance in a fast-evolving digital economy.

Within that context, the performance of SMEs understood in terms of growth, profitability, market share and resilience has been studied widely across regions, reflecting the crucial role these firms play in economic development. Their ability to innovate or process introduction, adaptation of business models and use of digital tools enables them to capture and sustain competitive advantage (Su et al. 2020). However, the rapidly evolving digital environment poses new hurdles: many SMEs struggle to adopt and integrate digital technologies, remain stuck at basic broadband usage or static web presence, and thus fall behind in the digital evolution. This is problematic because evidence shows that when firms lag in digital uptake, they are less able to participate in future-oriented digital business models; the resulting "digital divide" can translate into lower innovation and weaker performance (Organisation for Economic Co-operation and Development, (OECD) 2021).

For example, the use of cloud computing provides SMEs access to digital services via the Internet. It enables flexibility, scalability and a pay-as-you-go model for storage, processing, and software without large upfront hardware investments (OECD, 2021). Yet despite this promise, SMEs in Nigeria and similar contexts often face a triple barrier: lack of digital infrastructure, limited digital skills/training, and weak integration of digital technologies into their business processes. Together these barriers contribute to lower competitive capacity and sub-optimal performance outcomes. Indeed, a recent report indicated that SMEs in many under-developed countries saw an average revenue drop of 20 % during the COVID-19 pandemic, and a large proportion of small firms closed permanently between 2020 and 2023 (World Bank, 2023; International Labour Organization [ILO]). The pandemic thereby accelerated the digital business-model shift SMEs that were unable to move online or adopt digital operations suffered disproportionately (GlobalData, 2020; OECD, 2020).

In Nigeria, SMEs remain crucial to the national economy but are hindered by structural constraints: inadequate digital skills, limited reliable internet access, and poor integration of digital technologies despite government programmes promoting SME development. These obstacles create a business environment that is unfavourable for the digital-entrepreneurship model to thrive. Accordingly, this study sought to examine how entrepreneurship education when contextualized for the digital era can act as a predictor of two key outcomes among SMEs in North Central Nigeria are business performance, and innovation adoption. The choice of innovation adoption as a dependent variable reflects recognition that SMEs' ability to take up digital tools, new processes and platforms is a critical mediating step toward improved performance.

Business performance denotes measurable outcomes that capture the economic and operational health of SMEs. That includes financial indicators (sales/revenue growth, profit margins), market indicators (market share, customer growth), and operational/strategic indicators (productivity, cost efficiency, and business resilience). Conceptually, business performance is the outcome that entrepreneurship education aims to influence EE that successfully builds digital competencies, strategic use of platforms, and managerial capabilities should translate into improved sales, profitability, efficiency and longer-term viability for SMEs (Fayolle & Gailly, 2015; OECD, 2021). On the other hand, innovation adoption refers to the uptake and effective use of new technologies, digital tools, processes, or business models by SMEs. In the digital era this covers activities such as adopting cloud services, e-commerce platforms, digital payment systems, customer analytics, or digitally enabled business models (platform or subscription models) (Su et al. 2020). Innovation adoption is treated as an intermediary/dependent outcome because it is the proximate way EE can change firm behaviour: EE increases digital literacy, awareness of

platform-economy opportunities, and innovation management skills, which then raise the likelihood that firms will adopt and integrate digital innovations an essential step toward improved performance (OECD, 2021).

A growing body of empirical research shows that entrepreneurship education can shape entrepreneurial attitudes, intentions and capabilities that are necessary for digital innovation uptake. Studies of SMEs' internationalisation and innovation also show that network capabilities and exposure to global value chains raise firms' willingness and ability to adopt new processes and technologies (Su et al. 2020), suggesting that EE which incorporates network-building, practical digital skills, and innovation management can increase uptake. Conversely, reports from Nigeria (Small and Medium Enterprises Development Agency of Nigeria, 2021) and continental summaries show that infrastructural gaps, low digital skills penetration, and fragmented policy environments have constrained SMEs' adoption of digital tools limiting the ability of EE to deliver performance gains unless it is explicitly reframed to include digital literacies and platform strategies.

Entrepreneurship education is seen as a key way to help people gain the skills, knowledge, and digital abilities they need to be successful in starting and running businesses in today's world. As technology changes how businesses operate and new ideas are used around the globe, learning about entrepreneurship has become more important than ever. Studies show that when entrepreneurship education includes digital tools, managing innovation, and hands-on learning experiences, it helps learners and new entrepreneurs develop stronger intentions to start businesses, build their skills, and get ready to use new technologies and business models in ever-changing environments (Lopes, Gomes & Nogueira, 2025). In Nigeria, research has found that having strong skills in information and communication technology is closely linked to how effective entrepreneurship education is in polytechnics. This means adding digital skills to entrepreneurship programs makes students better prepared for the digital economy (Chinwe Edozie, 2024). Similar findings from Nigeria show a strong link between digital skills and the ability to start and run businesses, suggesting that training in digital literacy and entrepreneurship leads to better business results for graduates (Awoniyi & Owolabi, 2025). In Delta State, Nigeria, research also shows that teaching digital literacy and digital citizenship helps entrepreneurs be more successful, showing how important it is to include digital skills in entrepreneurship education to improve the performance of small and medium businesses (Ikenga & Egbule, 2025). Globally, studies show that digital entrepreneurship education helps students develop better attitudes toward using digital tools in business and makes them more likely to start digital businesses. This shows that entrepreneurship education plays a key role in helping people turn their interest in technology into successful business outcomes in a world driven by digital innovation (Lopes et al., 2025). Therefore, teaching entrepreneurship with digital literacy, innovation skills, and awareness of new technologies is essential to help entrepreneurs stay competitive, adopt new ideas, and improve the performance of their businesses in a fast-changing digital world.

Despite the growing empirical evidence that entrepreneurship education can promote digital innovation and better firm outcomes, SMEs in North Central Nigeria continue to under-perform relative to their potential because EE programs in the region largely retain traditional curricula and fail to embed digital literacies, platform-economy strategies and hands-on innovation management (Yusuf, 2017). Coupled with persistent infrastructural constraints (weak internet and digital infrastructure), limited access to technology-based training, and fragmented policy support, this curricular gap restricts SMEs' innovation adoption and ultimately their business performance. Therefore, there is an urgent need to empirically test the predictive influence of entrepreneurship

education in the digital era on innovation adoption and business performance among SMEs in North Central Nigeria. Specifically, the study determined:

1. Entrepreneurship education in the digital era as a predictor of innovative adoption among SMES in North Central Nigeria.
2. Entrepreneurship education in the digital era as a predictor of business performance among SMES in North Central Nigeria.
3. Joint prediction of entrepreneurship education in the digital era on innovative adoption and business performance among SMES in North Central Nigeria.

Research Questions

The following research questions were raised to guide the study:

1. How does Entrepreneurship education in the digital era predict innovative adoption among SMES in North Central Nigeria?
2. How does Entrepreneurship education in the digital era predict business performance among SMES in North Central Nigeria?
3. How does entrepreneurship education jointly predict in the digital era innovative adoption and business performance among SMES in North Central Nigeria?

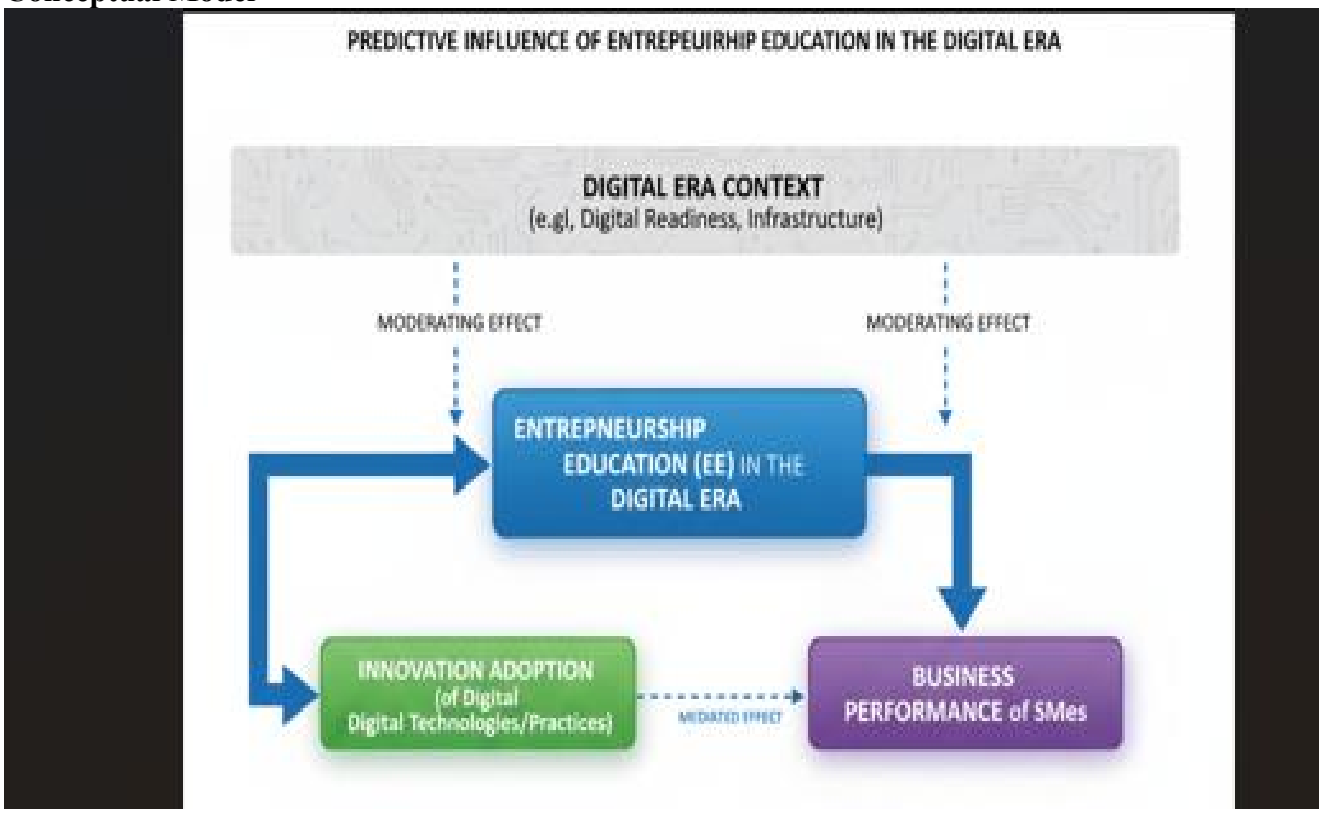
Hypotheses

Ho1: Entrepreneurship education in the digital does not significantly predict innovative adoption among SMES in North Central Nigeria

Ho2: Entrepreneurship education in the digital era does not significantly predict business performance among SMES in North Central Nigeria

Ho3: Entrepreneurship education in the digital era does not jointly predict innovative adoption and business performance among SMES in North Central Nigeria

Conceptual Model



The diagram illustrates the core relationships in studying the Predictive Influence of Entrepreneurship Education in the Digital Era on SMEs in North Central Nigeria. At its heart, Entrepreneurship Education (EE) acts as the independent variable, driving change. This education is hypothesized to directly enhance Business Performance by equipping SME owners with better managerial and financial skills (the direct effect). Crucially, EE also fosters the mindset and competence required for Innovation Adoption, particularly concerning digital technologies. This adoption, in turn, is expected to be a major catalyst for improved Business Performance, serving as a mediating variable that transmits the education's influence. Finally, the Digital Era Context (including factors like digital readiness and infrastructure) acts as a moderating variable. This context doesn't cause the performance improvement but rather strengthens or weakens the effectiveness of the education and the subsequent innovation efforts. In essence, the diagram shows how digital-focused education leads to innovation, which ultimately boosts performance, all within the constraints and opportunities of the current digital environment.

Methods

This study employed a correlation research design. The target population comprised 21,537 SME operators registered with state branches of the Small and Medium Enterprises Development Agency of Nigeria (SMEDAN) and affiliated trade and cooperative associations within the six selected states namely: Benue, Kogi, Kwara, Nasarawa, Niger and Plateau States. The sample size of 424 SME operators was determined using the Taro Yamane (1967) formula. Following this, the proportionate stratified sampling technique was employed to ensure fair representation of SME operators across the six states. This method was adopted because SME distributions vary across states, and proportionate stratification ensures that states with larger SME populations contribute more respondents to the total sample.

Data for this study were collected using three structured researcher-developed questionnaires designed to measure the major constructs of the study. The first instrument, titled "Questionnaire on Entrepreneurship Education in the Digital Era (QEEDE)", comprised 20 items designed to measure the extent to which SME operators have acquired and applied entrepreneurial knowledge, skills, and digital competencies necessary for business survival and innovation in the contemporary marketplace.

The second instrument, titled "Business Performance Questionnaire (BPQ)", contained 15 items that assessed SME performance outcomes in both financial and non-financial terms. The items covered indicators such as profitability, sales growth, market expansion, customer satisfaction, and operational efficiency, consistent with prior models by Kaplan and Norton (1996) and later adaptations for SME contexts. Respondents were asked to evaluate their enterprise's performance over the past three years relative to their industry peers. The five-point Likert scale (ranging from Very Low to Very High) was used to measure perceived levels of business performance.

The third instrument, titled "Innovation Adoption Questionnaire (IAQ)", consisted of 18 items aimed at examining the extent to which SMEs have embraced digital innovations, including new technologies, processes, products, and platforms in their operations. The items were adapted from innovation diffusion frameworks (Rogers, 2003; OECD, 2020) and tailored to reflect contextual realities of SMEs in the region. The IAQ measured dimensions such as technology readiness, rate of adoption, process improvement, and openness to digital transformation. Responses were recorded on a five-point Likert scale ranging from 1 = Not at all adopted to 5 = Fully adopted.

To ensure content validity, the three instruments were subjected to expert review. Reliability of the instruments was determined using the Cronbach's alpha method after the pilot study. The analysis yielded high internal consistency coefficients across all scales: 0.89 for QEEDE, 0.86 for (BPQ), and 0.71 for IAQ. These reliability coefficients exceed the 0.70 benchmark recommended by Nunnally and Bernstein (1994), thereby affirming that the instruments were reliable for full-scale administration.

The data collection process was carried out systematically to ensure accuracy, ethical integrity, and representativeness across the six states in North Central Nigeria; Benue, Kogi, Kwara, Nasarawa, Niger, and Plateau. The administration of the three structured questionnaires was conducted both physically and electronically, using a mixed-mode survey approach to enhance coverage and response rate. Regression analysis was used to for data analysis. Linear regression was used to answer research questions 1 and 2 and test null hypotheses 1 and 2. More so, multiple regression was used to answer research question 3 and test null hypothesis 3 at 0.05 alpha level.

Results

Table 1 Summary of Linear Regression Analysis Predicting Innovation Adoption from Entrepreneurship Education

Predictors	B	SE B	β	t	P
Constant	1.087	0.184	-	5.91	.000
EE and innovation adoption	0.713	0.038	0.691	18.76	.000

Model Summary: R = .691, R^2 = .478, Adjusted R^2 = .476
ANOVA: F(1,422) = 351.71, p < .005

The result of the regression analysis indicated that entrepreneurship education in the digital era significantly predicted innovation adoption among SMEs in North Central Nigeria, $R^2 = .48$, $F(1,422) = 351.71$, $p < .001$. This means that approximately 48% of the variance in innovation adoption is explained by entrepreneurship education. The standardized beta coefficient ($\beta = .691$, $p < .001$) suggests that as entrepreneurship education in the digital era increases, innovation adoption among SMEs also increases significantly. Therefore, the null hypothesis (Ho_1) was rejected. This implies that entrepreneurship education in the digital significantly predicted innovative adoption among SMES in North Central Nigeria

Table 2: Summary of Linear Regression Analysis Predicting Business Performance from Entrepreneurship Education

Predictors	B	SE B	β	t	P
Constant	1.226	0.193	-	6.35	.000
EE and business performance	0.642	0.041	0.648	15.63	.000

Model Summary: $R = .648$, $R^2 = .420$, Adjusted $R^2 = .418$
ANOVA: $F(1,422) = 244.39$, $p < .005$

The analysis in Table 3 revealed that entrepreneurship education in the digital era significantly predicted business performance among SMEs, $R^2 = .42$, $F(1,422) = 244.39$, $p < .005$. This indicates that entrepreneurship education explains 42% of the variance in business performance. The standardized beta value ($\beta = .648$, $p < .001$) shows a strong positive predictive relationship, meaning that improvements in digital-era entrepreneurship education correspond to higher levels of business performance. Hence, the null hypothesis (Ho_2) was rejected. This means that entrepreneurship education in the digital era significantly predicted business performance among SMES in North Central Nigeria

Table 3: Summary of Multiple Regression Analysis Predicting Innovation Adoption and Business Performance Jointly from Entrepreneurship Education

Predictors	B	SE B	β	t	P
Constant	7.776	1.705	-	4.561	.000
Innovation adoption	0.698	0.035	0.701	19.97	.000
Business performance	0.633	0.037	0.664	17.11	.000

Model Summary: $R = .726$, $R^2 = .528$, Adjusted $R^2 = .526$
ANOVA: $F(1,421) = 440.87$, $p < .005$

The results in Table 4 indicates the multiple regression analysis showing that entrepreneurship education in the digital era jointly and significantly predicted innovation adoption and business performance among SMEs, $R = .726$, $R^2 = .528$, $F(2,421) = 440.87$, $p < .001$. This implies that approximately 52.8% of the combined variance in innovation adoption and business performance is explained by entrepreneurship education. Both dependent variables exhibited strong and statistically significant beta weights ($\beta = .701$ and $\beta = .664$, respectively). Consequently, the null hypothesis (Ho_3) was rejected, confirming that entrepreneurship education in the digital era jointly predicted innovation adoption and business performance among SMEs in North Central Nigeria.

Discussion of Findings

It was found that there was a strong, positive predictive relationship between entrepreneurship education (re-designed for the digital era) and SMEs' adoption of digital

innovations. In practical terms, SME operators who reported higher exposure to digitally-oriented entrepreneurship training (digital literacy, platform strategy, cloud and e-commerce skills, experiential exercises) were substantially more likely to report uptake and sustained use of digital tools, platforms, and digitally enabled processes. This finding aligned with findings of Wibowo et al. (2023) that digital entrepreneurship education increases digital entrepreneurial intentions and social media usage mechanisms that facilitate later technology adoption in small ventures. Putro and Takahashi (2024) demonstrated that entrepreneurs' creativity and perceived usefulness/ease of use mediate IT adoption, implying that training that enhances digital competence and perceived benefits raises adoption likelihood.

The finding also revealed that entrepreneurship education in the digital era significantly predicted business performance among SMES in North Central Nigeria. This is plausible because digital competencies can translate into better marketing (online visibility), more efficient operations (cloud accounting, inventory automation), wider customer reach (e-commerce), and new revenue streams (platform sales or digital services) all of which can lift sales, profitability and resilience. This finding aligns with that of Fayolle and Gailly (2015) that well-designed entrepreneurship education positively affects entrepreneurial behaviours and capacities that matter for firm outcomes. Nabi et al. (2017) reported that entrepreneurship education especially experiential and skills-based variants produce learning outcomes that map onto firm routines and capabilities that improve performance. More specifically, Petropoulou et al. (2024) showed that digital transformation capabilities in SMEs are associated with tangible productivity and strategic gains in the post-COVID era. These sources reinforce the interpretation that EE in the digital era can yield measurable performance benefits.

The finding also revealed that entrepreneurship education in the digital era jointly predicted innovation adoption and business performance among SMEs in North Central Nigeria. This result supports a sequential, capability-building logic: digital-focused EE increases SME capacity and willingness to adopt innovations (proximal outcome), and those adoptions then contribute to enhanced business performance (distal outcome). In other words, EE operates both directly on performance and indirectly via innovation adoption as a key enabling mechanism. This finding is in line with that of Nabi et al.. (2017) and Fayolle and Gailly (2015) that education improves entrepreneurial competencies that are important both for innovation behaviour and for firm outcomes; Petropoulou et al.. (2024) reported that digital capability building correlates with both innovation-related activity and post-pandemic performance improvements in SMEs.

Conclusion

It was concluded from the findings of the study that entrepreneurship education in the digital era significantly predicts both innovation adoption and business performance among SMEs in North Central Nigeria. Specifically, SME operators exposed to digitally oriented training were more likely to integrate emerging technologies, embrace innovative practices, and achieve superior performance outcomes. The results affirm that entrepreneurial learning serves as a catalyst for sustainable development, productivity, and adaptability. However, the study also underscores the need for supportive infrastructure, policy coherence, and access to digital resources to fully translate educational gains into measurable enterprise success.

Recommendations

Based on the findings of the study, the following recommendations were made:

1. Educational institutions, and SME development agencies should integrate digital literacy and innovation management modules into entrepreneurship training programmes.

Curricula should emphasize hands-on exposure to emerging technologies such as e-commerce platforms, cloud computing, digital marketing, and data analytics.

2. Since entrepreneurship education in the digital era significantly predicts business performance, continuous professional development for SME operators should be institutionalized. Training should focus on digital business strategy, financial technology (FinTech) utilization, customer analytics, and online brand management to drive operational efficiency and profitability.
3. Federal and state governments should implement Digital Entrepreneurship Clusters where SMEs receive integrated support combining digital training, innovation financing, and technical assistance

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