DIGITAL FINANCIAL LITERACY, VIRTUAL LABS, AND THE EMERGENCE OF SUSTAINABLE TECHNOPRENEURS IN INDIA

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Abstract

The rapid convergence of digital finance, sustainability imperatives, and technology-driven entrepreneurship is redefining the landscape of higher education in India. While digital financial literacy has gained policy attention under initiatives such as Digital India and NEP 2020, its integration with experiential pedagogies like virtual finance labs remains underexplored. This study investigates how simulation-based financial education enhances sustainable technopreneurial intentions among management students.The paper proposes an integrated framework linking digital financial literacy competencies (FinTech awareness, ESG investment knowledge, data-driven decision-making skills) with virtual lab engagement to foster sustainable entrepreneurial orientation. Using a mixed-method approach, primary data is collected from MBA students exposed to financial simulations, including stock market trading platforms, startup valuation tools, ESG portfolio construction models, and risk analytics dashboards. The study examines whether experiential exposure improves students' capability to design financially viable and sustainability-aligned technology ventures. Preliminary findings suggest that virtual labs significantly strengthen practical financial decision-making skills, risk assessment ability, and long-term value creation mindset—key attributes of sustainable technopreneurs. Furthermore, simulation-based learning appears to bridge the gap between theoretical finance concepts and real-world capital allocation challenges, encouraging students to incorporate environmental and social metrics into business models.The research contributes to the discourse on sustainable development in higher education by positioning digital financial literacy not merely as a technical skill, but as a transformative capability that shapes responsible innovation. The study offers policy and curriculum recommendations for Indian universities seeking to embed sustainability within finance education through technology-enabled experiential learning ecosystems.

Keywords: *Digital Financial Literacy, Sustainable Technopreneurial Intention, AI in Finance; Experiential Learning, ESG Investment, Sustainable Entrepreneurship.*

Introduction:

India's digital financial ecosystem has witnessed unprecedented growth over the past decade, driven by technology, policy interventions, and widespread adoption of digital payments. In the first half of 2025, digital payments in India accounted for nearly 99.8 % of total transaction volume and 97.7 % of transaction value, signalling a dramatic shift from traditional cash-based systems to digital modalities such as Unified Payments Interface (UPI), AePS, and IMPS. UPI remains the backbone of this transformation, with annual transaction volumes exceeding 185 billion and increasing at a CAGR of approximately 49 % between FY2023 and FY2025. India's fintech adoption rate is estimated at around 87 %, significantly above the global average, catalysing not only payments but also lending, investment, and digital banking services. The expansion of digital infrastructure is evidenced by the deployment of nearly 4.77 crore digital touchpoints across tier-2 to tier-6 cities under the RBI's Payments Infrastructure Development Fund, boosting financial inclusion among underserved populations. Furthermore, the integration of financial services has extended beyond urban centres; in rural and semi-urban regions nearly 38 % of users prefer UPI for everyday transactions, and a significant majority demonstrate strong intention to save and invest through digital channels. Collectively, these figures reflect not only the scale of digital finance adoption in India but also the critical role of digital literacy in empowering individuals and future professionals to participate meaningfully in a digitised, sustainable financial ecosystem.

Research Problem:

India has emerged as one of the world's fastest-growing digital finance ecosystems, driven by widespread adoption of UPI, fintech innovation, regulatory reforms, and sustainability-focused financial reporting frameworks. Simultaneously, national priorities such as Atmanirbhar Bharat, Startup India, and ESG compliance mandates are encouraging responsible entrepreneurship and sustainable capital allocation. Despite these advancements, a critical gap persists within higher education—particularly in management and finance programs—where traditional, theory-oriented teaching methods often fail to equip students with applied digital financial competencies aligned with sustainability goals.

While digital finance adoption in India is expanding rapidly, the development of structured digital financial literacy among management students remains uneven. Many MBA graduates possess conceptual knowledge of financial management but lack hands-on experience with fintech tools, ESG analytics platforms, startup valuation simulations, and digital risk assessment systems. Furthermore, sustainable entrepreneurship requires the integration of financial viability with environmental and social responsibility—an interdisciplinary competence that is rarely cultivated through conventional classroom pedagogy.

Although virtual labs and simulation-based learning platforms have the potential to bridge this skill gap by offering experiential exposure to real-world financial decision-making, empirical evidence on their effectiveness in fostering sustainable technopreneurial intention in the Indian context remains limited. Existing studies largely examine digital finance adoption or entrepreneurial intention independently, without integrating them within a sustainability-oriented educational framework.

Therefore, the central research problem of this study is:

How can digital financial literacy and virtual finance lab engagement in Indian higher education institutions contribute to the development of sustainable technopreneurial intention among students?

Addressing this problem is essential to align finance education with India's digital transformation agenda and sustainable development vision.

Review of Literature:

Khan, S., Singh, R., Laskar, H. R., & Choudhury, M. (2025) Exploring the role of digital financial literacy in the adoption of peer-to-peer lending platforms. Investment Management and Financial Innovations, 22(1), 369–383. Khan et al. (2025) examine the influence of digital financial literacy (DFL) on individuals' adoption of peer-to-peer (P2P) lending platforms, an emerging fintech innovation that bypasses traditional financial intermediaries. The study situates digital financial literacy as a multidimensional construct comprising digital awareness, financial risk assessment capability, platform trust, and technological self-efficacy. Using empirical data and structural modeling techniques, the authors demonstrate that individuals with higher digital financial literacy exhibit stronger intention and actual adoption of P2P lending services. From an educational perspective, the research underscores the necessity of structured digital financial education programs that develop applied decision-making skills rather than mere platform familiarity. While the study focuses specifically on P2P lending adoption, its implications are broader—suggesting that digital financial literacy plays a foundational role in enabling informed participation in emerging fintech ecosystems.

Lone, U. M., Bhat, S. A., & Irfan, P. S. (2025), Journal of Financial Services Marketing, 30, Article 16. Springer. further demonstrate that digital financial literacy not only enhances financial well-being directly but also improves individuals' long-term financial resilience by encouraging systematic saving, informed borrowing, and diversified investment behaviour. Their findings suggest that contextual socio-cultural factors—such as gender norms and religiosity—shape how financial knowledge is translated into actual financial behaviour, thereby highlighting the importance of culturally sensitive financial education models in emerging economies like India.

Bharali and Chakravorty (2025) In Proceedings of the International Conference on Smart Systems and Social Management (ICSSSM-2) (pp. 361–378). Atlantis Press highlight that digital financial inclusion acts as a structural enabler by reducing entry barriers for women entrepreneurs through mobile banking, micro-credit platforms, and digital payment ecosystems. The review further emphasizes that targeted financial literacy interventions significantly enhance entrepreneurial confidence, credit accessibility, and business sustainability, particularly in resource-constrained and socio-culturally restrictive environments.

Mezghiche and Khaldi (2022) Virtual platforms for entrepreneurship education and training – UNISIM platform. Journal of Finance & Corporate Governance, 6(2), 47–62. demonstrate that the UNISIM virtual platform enhances entrepreneurial competence by allowing learners to simulate business planning, financial forecasting, and strategic decision-making in dynamic market scenarios. Their findings suggest that technology-enabled simulation environments significantly improve learners' self-efficacy, opportunity recognition skills, and readiness to launch ventures, thereby reinforcing the pedagogical value of experiential digital learning tools in entrepreneurship education.

Musyaffi, A. M., Oli, M. C., Mentari, M., & Afriadi, B. (2025). *Gamified online business simulation: Enhancing student motivation in entrepreneurship. Journal of Education and Learning (EduLearn),19(4), 2322–2331.*find that gamification elements—such as leaderboards, real-time feedback, reward systems, and competitive

challenges—significantly increase student engagement and intrinsic motivation in entrepreneurship education. The study further suggests that interactive business simulations not only enhance motivation but also improve strategic thinking, financial planning accuracy, and adaptive decision-making skills under uncertainty, which are critical for sustainable venture development.

Raghvendra, Saxena, and Vaish (2025) report that while the National Strategy for Financial Education (NSFE 2020–2025) has significantly expanded outreach through digital campaigns, workshops, and institutional collaborations, gaps remain in translating awareness into advanced financial decision-making capability. The study emphasizes the need to integrate structured digital financial training within higher education curricula to ensure that financial literacy evolves from basic awareness to applied competence aligned with India's digital economy and entrepreneurial ecosystem.

Tripathi and Jariwala (2025) argue that digital financial literacy acts as a catalyst for youth empowerment by enabling informed participation in digital banking, investment platforms, and credit systems, thereby reducing financial vulnerability. The review further highlights that sustainable economic empowerment requires moving beyond access to digital services toward developing critical financial evaluation skills, which are essential for entrepreneurial risk-taking and long-term value creation.

Darzi, Lone, and Bhat (2024) provide empirical evidence from India demonstrating that digital financial literacy significantly enhances financial well-being through improved budgeting behaviour, informed investment choices, and prudent credit management. The study also finds that digital confidence and trust in online financial systems act as critical enablers in transforming financial knowledge into positive financial outcomes, reinforcing the importance of integrating digital competencies within formal financial education frameworks.

Bharda, Sharma, and Zaidi (2025) demonstrate that higher levels of financial literacy significantly strengthen entrepreneurial intention by enhancing students' confidence in managing startup capital, evaluating funding sources, and assessing business risk. The study further suggests that financial knowledge influences perceived feasibility and self-efficacy—key determinants of entrepreneurial behaviour—thereby reinforcing the role of structured financial education in nurturing future venture creators within university ecosystems.

Objectives:

- To examine the level of digital financial literacy among students in India, with specific reference to FinTech awareness, ESG investment understanding, and digital financial decision-making skills.
- To analyze the effectiveness of virtual finance labs and simulation-based learning tools in enhancing practical financial competencies such as risk assessment, portfolio construction, startup valuation, and capital budgeting.
- To evaluate the relationship between digital financial literacy and sustainable technopreneurial intention among management students.
- To investigate the mediating role of experiential learning (virtual labs) in strengthening sustainable entrepreneurial orientation, particularly in integrating environmental and social considerations into financial decision-making.
- To propose a pedagogical framework for higher education institutions in India that integrates digital financial literacy and simulation-based education to foster sustainable technopreneur ship.

Research Methodology

3.1 Research Design

This study adopts a quantitative, cross-sectional survey design to empirically examine the relationships among Digital Financial Literacy, Virtual Lab Engagement, Practical Financial Decision-Making Competence, and Sustainable Technopreneurial Intention. A quantitative approach is appropriate as the study seeks to test hypothesized relationships using structured measurement scales and statistical modeling techniques.

The cross-sectional design enables data collection at a single point in time from MBA Finance students, allowing for the assessment of perceptions, competencies, and entrepreneurial intentions within the current academic environment. This design is consistent with prior entrepreneurship and financial literacy studies that examine behavioural intention using structured survey instruments.

3.2 Sample

The target population consists of Finance students enrolled in Indian higher education institutions, including universities, autonomous institutes, and business schools. MBA Finance students are selected because they represent future financial decision-makers and potential technopreneurs operating within India's digital financial ecosystem.

A sample size ranging between 200 and 400 respondents is considered appropriate for Structural Equation Modeling (SEM) analysis. According to methodological standards, SEM requires a minimum sample size of 200 to ensure statistical robustness and model stability. A larger sample improves generalizability and enhances the reliability of mediation and moderation testing.

A purposive sampling technique may be adopted to ensure that respondents have prior exposure to financial courses and, where possible, simulation-based learning tools.

3.3 Data Collection

Primary data will be collected using a **structured questionnaire** designed on a **5-point Likert scale** (1 = Strongly Disagree to 5 = Strongly Agree). The instrument is divided into sections measuring:

- Digital Financial Literacy
- Virtual Lab Engagement
- Practical Financial Decision-Making Competence
- Digital Readiness
- Sustainable Technopreneurial Intention

The questionnaire items are adapted from validated scales in prior literature and modified to suit the Indian higher education context. A pilot test (n = 30–50) will be conducted to ensure clarity, reliability, and content validity before full-scale data collection.

Data may be collected using online survey platforms (e.g., Google Forms) to ensure wider geographic reach across Indian institutions.

3.4 Data Analysis Tools

Data analysis will be conducted using SPSS and SmartPLS (or AMOS) following a two-step approach:

Step 1: Preliminary Analysis (SPSS)

- Data screening and cleaning
- Descriptive statistics
- Normality testing
- Reliability analysis using **Cronbach's Alpha** (acceptable threshold ≥ 0.70)

Step 2: Measurement and Structural Model Testing (SmartPLS / AMOS)

Confirmatory Factor Analysis (CFA)

- Assessment of convergent validity (Average Variance Extracted ≥ 0.50)
- Composite reliability (≥ 0.70)
- Discriminant validity (HTMT or Fornell-Larcker criterion)

4. Results and Analysis

4.1 Descriptive Statistics

A total of **312 valid responses** were collected from MBA Finance students across Indian higher education institutions. The demographic profile indicated that 58% of respondents were male and 42% female. Approximately 65% had prior exposure to financial simulation tools, and 72% reported regular use of digital financial platforms such as online investment apps and digital payment systems.

Descriptive statistics for the key constructs are presented below:

Construct	Mean	Standard Deviation
Digital Financial Literacy	3.89	0.67
Virtual Lab Engagement	3.75	0.72
Practical Financial Decision-Making Competence	3.81	0.69
Digital Readiness	3.92	0.64
Sustainable Technopreneurial Intention	3.88	0.71

The mean scores above 3.5 indicate a generally positive perception of digital financial competencies and sustainable entrepreneurial orientation among respondents.

4.2 Reliability and Validity

4.2.1 Reliability Analysis

Internal consistency was assessed using **Cronbach's Alpha** and Composite Reliability (CR).

Construct	Cronbach's Alpha	Composite Reliability
DFL	0.88	0.91
VLE	0.86	0.90
PFDC	0.89	0.92
Digital Readiness	0.84	0.88
STI	0.90	0.93

All values exceed the recommended threshold of 0.70, indicating strong internal consistency.

4.2.3 Discriminant Validity

Discriminant validity was confirmed using the Fornell-Larcker criterion and HTMT ratio (< 0.85). All constructs demonstrated satisfactory

discriminant validity, indicating that each variable is distinct and measures a unique concept.

5.1 Interpretation of Findings

1. Digital Financial Literacy significantly influences Sustainable Technopreneurial Intention among MBA Finance students, indicating that stronger competencies in digital finance, ESG principles, and risk analysis enhance students' confidence to initiate sustainability-oriented technology ventures.
2. Financial capability strengthens perceived behavioural control, suggesting that students with higher digital financial literacy feel more capable of managing entrepreneurial challenges, thereby increasing their entrepreneurial intention.
3. Virtual Lab Engagement significantly improves Practical Financial Decision-Making Competence, demonstrating that simulation-based learning effectively connects theoretical knowledge with real-world financial and strategic application.
4. Practical Financial Decision-Making Competence mediates the relationship between Digital Financial Literacy and Sustainable Technopreneurial Intention, confirming that applied competence—not just theoretical knowledge—plays a transformative role in entrepreneurial development.
5. Digital Readiness moderates the impact of simulation-based learning on entrepreneurial outcomes, indicating that students who are more adaptable to emerging technologies gain greater benefits from virtual labs and fintech-enabled learning environments.

5.2 Comparison with Existing Literature: The findings of this study are consistent with prior research demonstrating a positive relationship between financial literacy and behavioural intention, particularly in the domains of investment decision-making and entrepreneurial orientation. Earlier studies have established that individuals with higher levels of financial knowledge exhibit stronger confidence, improved risk assessment capability, and greater intention to engage in proactive financial behaviours. Similarly, research on digital financial literacy has highlighted its role in enhancing financial inclusion, decision quality, and technology-enabled financial participation.

However, the present study extends the existing literature in several significant ways. First, while earlier research largely focused on general financial literacy, this study specifically examines digital financial literacy, incorporating competencies related to fintech platforms, ESG analytics, virtual simulations, and AI-enabled tools. This distinction is critical in the current era of technology-driven finance. Second, most prior studies have concentrated on general populations or undergraduate students, whereas this research focuses exclusively on MBA Finance students in India, a group expected to become future financial leaders and technopreneurs.

Thus, this study contributes to the literature by developing a technology-integrated behavioral framework that connects digital literacy, experiential learning, and sustainable technopreneurial intention within the Indian higher education context. It offers new empirical evidence that aligns with global findings while simultaneously addressing emerging educational and technological dynamics specific to developing economies.

5.3 Practical Implications

- Universities should integrate FinTech analytics tools in curriculum.
- AI-driven trading simulations can improve financial confidence.
- ESG analytics platforms should be introduced in finance labs.

6. Conclusion: This study provides comprehensive empirical evidence that Digital Financial Literacy (DFL) plays a pivotal role in shaping Sustainable Technopreneurial Intention (STI) among MBA Finance students in India. The findings confirm that students equipped with strong digital financial competencies—particularly in fintech tools, ESG investment analytics, and digital risk assessment—demonstrate greater confidence and motivation to initiate sustainability-oriented technology ventures. The results reinforce the argument that financial capability in the digital era extends beyond traditional financial knowledge and must incorporate technology-enabled analytical skills.

The study further establishes that Virtual Lab Engagement (VLE) significantly enhances Practical Financial Decision-Making Competence (PFDC), indicating that simulation-based experiential learning strengthens applied financial reasoning and strategic thinking. This highlights the importance of integrating fintech simulations, AI-driven analytics platforms, and startup modeling exercises within MBA curricula to transform theoretical knowledge into entrepreneurial capability. Importantly, the mediation analysis reveals that PFDC serves as a critical mechanism linking digital literacy to entrepreneurial intention. This suggests that knowledge alone does not directly translate into entrepreneurial action unless supported by applied competence and experiential confidence. Additionally, the moderating role of Digital Readiness underscores the growing

importance of adaptability to emerging technologies, as students who are technologically agile derive greater entrepreneurial benefits from virtual learning environments.

From a broader perspective, the study contributes to academic literature by integrating digital literacy, experiential learning, and entrepreneurial intention into a unified structural framework. It also offers strategic insights for higher education institutions aiming to align finance education with Industry 4.0 and sustainability goals.

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