Exploring the Determinants of Financial Innovation: The Moderating Role of Risk

Sonia Peter*[1] and Chetna Mahaur[2]
[1] Gitarattan International Business School, Delhi, India
[2] Gitarattan International Business School, Delhi, India

Corresponding Author: sonia.researchdesk@gmail.com

Abstract. The financial services industry's ability depends more on innovation as customer demands evolve continuously. Research on financial innovation is relatively limited and fragmented in India. This study focuses on the determinants of financial innovation in India, with risk as a moderating factor. Data were collected through a structured questionnaire administered to professionals in fintech firms and financial institutions. Validity, reliability, and confirmatory factor analysis were conducted to validate the constructs. Structural equation modeling (SEM) was used to test the hypotheses, followed by moderation analysis to assess the risk's influence. Results have suggested that demand for financial services, regulatory framework, market competition, technological advancement, capital input, employee skill significantly drive financial innovation, with capital input exhibiting higher impact. According to the study, risk is a critical moderator which is affecting the relationship between innovation and regulatory environment, market competition, and employee skill. The findings provide valuable input for building strong financial innovation ecosystems in developing countries like India.

Keywords: Financial Innovation, Financial Markets, Risk.

1 Introduction

The development of a country is not merely increasing the productivity of the manufacturing sector; growth and development also depend on innovation and technological advancements across sectors [1]. Financial development is seen as a catalyst for sustained economic growth by mobilizing resources toward profitable investments [2]. Further, innovation is considered critical in facilitating economic, societal growth, and competitiveness among countries by transforming the financial system [3].

In literature, the concept of financial innovation has evolved. In broad sense, it includes new products, processes, and services to improve efficiency, reduce risk, and enhance access to capital. As explained by Sokolowska, "financial innovation is the act of creating and then popularizing new financial instruments, as well as new financial

R. Nagariya et al. (eds.), *Proceedings of the International Conference on Sustainable Business Practices and Innovative Models (ICSBPIM-2025)*, Advances in Economics, Business and Management Research 349,
https://doi.org/10.2991/978-94-6463-872-1_10

technologies, institutions, and markets" [4]. Examples like phone banking, online banking, capital market activity, and other information and communication technology (ICT) applications have improved both performance and productivity by depending on financial innovation [5]. The World Economic Forum has also addressed the importance of financial innovation in consistently meeting the evolving needs of society and corporations, as well as improving living standards [6]. India has witnessed significant growth and transformation following the liberalization and deregulation of financial services. Regulatory changes related to digital infrastructure in India, such as the Aadhaar revolution and UPI, along with financial inclusion programs like Jan Dhan-Aadhaar-Mobile, have enhanced services for investors. Additionally, a growing middle class has positioned India as the fastest-growing economy. Furthermore, the government has launched several initiatives to promote innovation, including Atal Tinkering Labs, a new intellectual property rights (IPR) policy, Startup India, and others. India has recorded 26 fintech unicorns, including one decacorn, making it the third-largest fintech industry in the world. Thus, the role of financial innovation is indisputable.

However, risk is an inherent aspect of financial innovation that cannot be overlooked [7]. Risk not only raises new concerns but also threatens the entire financial system. Innovations like the Internet of Things (IoT) have brought a plethora of opportunities, but they also introduce risks such as cybersecurity and increased risk of industrial operations. A recent study reported that IoT-based threats will be ramped more, and significant risk management practices will be required at various levels [8]. Thus, risk management practices are given significant importance to avert any damage to financial institutions and investors. In spite of this, evading the regulations of the state due to unclear regulatory guidelines has also become pronounced with the introduction of digitalization in financial services. For instance, the bitcoin market has managed to bypass government regulation mainly due to its complexity and limited transparency, which makes it more prone to fraud and market manipulation [9].

India's growing middle-class population and transformation after liberalization and deregulation of financial services have prompted financial institutions to reconsider their marketing strategies of financial products and develop innovative financial products [10]. In this context, financial innovation has become a highly relevant topic for both academic and industrial research due to its potential to achieve sustainable development [11]. Keeping this in mind, this study focuses on the following research questions: (1) What are the benefits associated with financial innovation? (2) How is risk associated with financial innovation? (3) What are the key determinants driving financial innovation? (4) To what extent does risk moderate the relationship between various determinants and financial innovation?

The literature review was conducted to explore the advantages and risks associated with financial innovation, aligning with the first two research objectives. For the rest of the two questions, empirical studies have been conducted to identify factors of financial innovation and also how risk moderates this relationship. Considering India's growth and its highest ranking in the FinTech adoption rate, understanding the role of risk here becomes imperative [12]. The structure of the paper is as follows: The second segment discusses the literature review and the formulation of hypotheses; research

methodology and data analysis are covered in the third section, while the findings and discussion are shown in the fourth. Lastly, the fifth segment wraps up with conclusions and implications.

2. Literature review

India is undergoing transformative changes and emerging as a global leader in the Fintech sector. Fintech, which is also referred to as financial technology, has enabled access to a wide variety of financial services through mobile banking applications, cloud computing, digital wallets, blockchain, AI robo-advisors, peer-to-peer lending, etc. These all together have transformed financial operations, services, and products, which have positioned Fintech as a key enabler of financial innovation. Government of India initiatives like Pradhan Mantri Jan Dhan Yojana (PMJDY), Aadhaar (biometric identification system), UPI (Unified Payments Interface), IndiaAI, etc., have fuelled innovation, which has influenced all the sectors and empowered millions of dreams with a promising future. These financial initiatives together have revolutionized India's financial landscape and is expected to contribute to $355 billion to $435 billion economic value by 2025 [13].

India's financial markets hold immense potential. Today, due to a surge in financial innovation, a broad array of subsegments such as crowdfunding, peer-to-peer lending, WealthTech, InsurTech, neobanking, blockchain, and others have emerged. These innovations have also led to a rise in FinTech unicorns [14]. This dynamic evolution has fostered India's economic growth and has given customers access to diversified services at their fingertips, which is leading to a more inclusive financial ecosystem. However, experts are of the view that although technology advancement has broadened the realm of financial markets, it has also broadened risk with increased volatility and introduced new types of risk like operational risk, tail risk counter-party risk, etc. [15]. These risks are so complex that even sophisticated market participants have difficulty understanding their nature, which leads to underestimation of the risk. Seminal work by Raghuram G. Rajan, mentions that although institutions focus more on financial innovation, customization, and risk management practices this has not reduced the risk faced by traditional institutions as now new types of risk has emerged and spread more widely [16]. For example, a crisis like the global financial crisis of 2008 was byproduct of innovative financial tools like mortgage-backed securities (MBS), which regulatory forces were not able to grasp the full implications of leading to significant damage to the global economy. Study by researchers like Mazzucato and Tancioni [17] and Duppati et al. [18] also highlighted risk as an integral aspect in studying financial innovation, concluding that innovation can't be studied without considering risk.

Financial innovation theory can be examined from the demand-side and the supply-side perspective [19]. According to the demand theory, external as well as internal factors can spur demand driven innovation. On the other hand, supply-side theory focuses on supply-side incentives of financial intermediaries. This perspective links to the “technology-push” premise where innovative financial products are offered to end

users to increase competitive advantage, like advanced transactional tools, alternative funding mechanisms, wealth management, etc. [20].

Demand has been focal point of research across domains, including finance, economics, and marketing. The demand of financial products and services have an undeniable influence on innovation [21]. Studies have consistently shown that demand is collectively influenced by combination of demographic and socioeconomic conditions. Income level, particularly, is the primary driver of demand, which leads to the creation of sophisticated financial products. Conversely, if the demography is represented by the low-income groups, this will lead to more dependence on the informal financial systems and basic financial products [22].

Another factor that significantly influences financial innovation is regulation regimes, which is considered to be a two-edged sword [23]. Studies have pointed out that on one hand, the regulatory framework can limit the innovation activity by increasing cost or compliance burden. Contrariwise, regulatory regimes can also encourage institutions to develop more responsible and socially beneficial financial innovation [24]. With growing complexity in the financial markets, regulators are now looking for more accurate, real-time tools to assess risk and monitor for the detection of fraud. This has led to the development of RegTech solutions to meet the needs of regulators and evolving financial markets to provide more stability.

Competition is another factor in compelling firms to innovate and adopt financial innovation [25]. We live in an era where competition in financial services is not restricted within the traditional boundaries, which are identical in structure, style of management, and skills. Greater competition has compelled financial institutions to respond to competitive forces that almost threatens their existence. This has encouraged firms to be more watchful, combat inertia, and enhance their efficiency by spending more on research and development, which leads to customer benefit [26]. The influence of competition on performance is widely studied, and several scientific studies have found a positive relationship between market competitiveness and performance. Alternatively, some studies like of Ko et al. [27] have also shown a U-shape or negative relationship. This highlights that new technologies like AI, blockchain, cloud computing, and big data analytics have accelerated competition, which has led to benefits for customers by lowering costs and improving services. However, it has also led to potential negative consequences, such as unethical practices due to intense competition. This dual aspect of competition makes it the essential driver of financial innovation.

In India, environmental, social, and governance (ESG) is also considered another key demand-side factor influencing financial innovation apart from competition [28]. The increased awareness about ethical practices and sustainability has brought more attention to ESG, especially in addressing issues like climate change, waste management, and resource shortages. Innovative financial solutions, like green bonds, blue bonds, ESG funds, sustainable lending, circular economy, and carbon credits, are promoting long-term sustainability. ESG has evolved with time from a risk management strategy to a key driver for innovation and sustainable growth [29]. Incorporating ESG helps to meet investor demand for responsible investments and

comply with sustainability regulations. Thus, ESG and financial innovation together can drive inclusive growth and draw ethical capital.

Based on the above discussion, the following hypotheses have been formulated for this study:

H_1 Demand for financial services has a significant influence on financial innovation.

H_2 Regulatory framework has a significant influence on financial innovation.

H_3 Market competition has a significant influence on financial innovation.

H_4 ESG factors have a significant influence on financial innovation.

Switching to the supply-side perspective of financial innovation, the use of technology has grown from a niche to a mainstream force, transforming the global landscape by offering innovative products and services like digital KYC, digital payment, and paperless solutions. Studies done by Batool et al. [30] and Liu et al. [31] have highlighted the significance of technology in improving efficiency, accessibility, and reducing the cost, thus making financial products and services more inclusive. By leveraging financial technology, regulators can now assess the creditworthiness of clients more efficiently, thereby improving transparency. However, the adoption and development of these technologies requires substantial capital input. Capital input is significant, as firms have to allocate significant resources not just in R&D but also for the adoption of advance technologies and infrastructure, which is a key measure of capital input [32]. Additionally, innovation in finance is not just capital intensive but a long development cycle and highly risky. Over the last few years, capital contributed by venture capital investors have also substantially increased [33]. The growth in venture capital have played a pivotal role in enabling disruptive technologies like AI, blockchain, the internet of things (IoT), and others. Together, these findings suggest that capital input is indispensable for the growth of the global innovation landscape.

Another factor identified as influencing financial innovation is employee skill. Studies have identified skilled employees as the engine of financial innovation [34]. Employee creative and cognitive skills help to grab opportunities, interpret information, and develop innovative solutions. Additionally, teamwork and collaboration foster a dynamic environment and act as a backbone to give a competitive advantage [35, 36]. Furthermore, the integration of technical skills, problem-solving, and a collaborative spirit enables employees to act as a fuel for innovation.

Based on the above discussion, we propose the following hypotheses:

H_5 Technological advancement has a significant influence on financial innovation.

H_6 Capital input has a significant influence on financial innovation.

H_7 Employee skill has a significant influence on financial innovation.

2.1 Moderating role of Risk

The relationship between risk and innovation in the literature remains complex and context-dependent. Risk is an inherent feature of innovation activities, as firms commit financial resources to long-gestation projects with uncertain outcomes. This investment is necessary to enhance business offerings and remain competitive in dynamic markets.

However, it is well established that not all innovation activity yields the desired results, as firm is exposed to multiple risk dimensions like liquidity, reputation risk, operational risk, legal risk, compliance arbitrage [37].

Some studies have also mentioned the firm displays an inherent bias towards risk taking, despite the long-term advantage, favoring short term potential gains [38]. Conversely, some studies have established that higher risk firms are more driven toward R&D activity to enhance their innovation since innovation has a positive impact on performance, leading to an increase in revenue. Others have also found firms that invest substantially in R&D are less vulnerable than those with minimum R&D investment [39]. The above discussion shows that there a mixed results regarding the association between risk and innovation. Hence, based on that, we propose the following hypotheses for this study:

H_{8a} Risk moderates the relationship between financial innovation and demand for financial services.

H_{8b} Risk moderates the relationship between financial innovation and regulatory environment.

H_{8c} Risk moderates the relationship between financial innovation and market competition.

H_{8d} Risk moderates the relationship between financial innovation and ESG factors.

H_{8e} Risk moderates the relationship between financial innovation and technological advancement.

H_{8f} Risk moderates the relationship between financial innovation and capital input.

H_{8g} Risk moderates the relationship between financial innovation and employee skill.

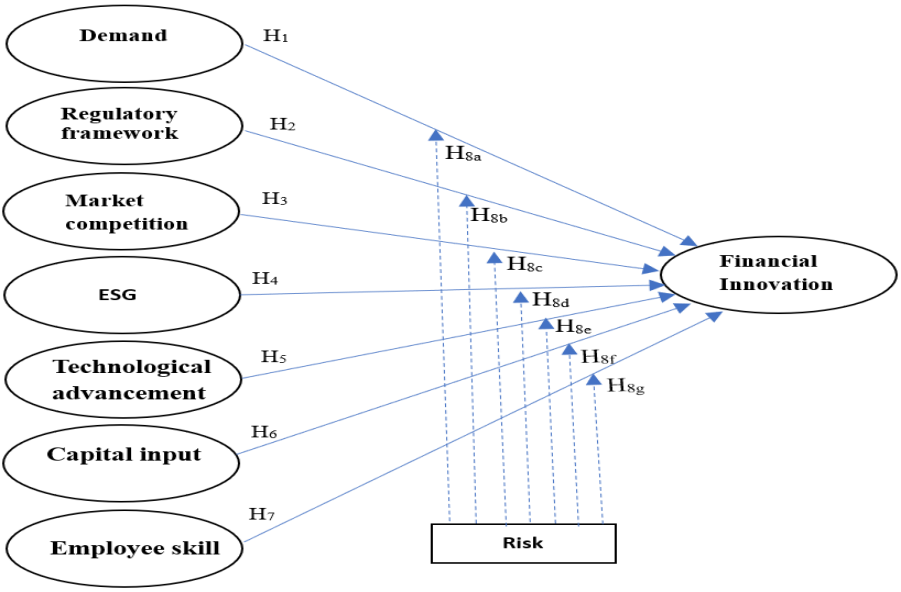

Fig.1. Conceptual model

Need for the study. India's digital platform is expected to be a key driver of national growth. Recent global disruptions, like geopolitical tensions and emergence of new technologies such as UPI, neobanks, and decentralized finance, have increased risks. Risk not only threatens the long-term sustainability of financial innovation, but it can also make innovation harder, and at the same time, it can also push companies to find new ways to stay profitable and competitive. This dichotomy highlights the complex relationship between innovation and risk, which is not fully explored in existing research.

Studies across economies have prioritized different factors of financial innovation, yet the literature lacks the uniformity to synthesize these findings [43]. The study aims to fill this gap by identifying the determinants of financial innovation in growing economies like India, where financial innovation has accelerated at a rapid pace. The findings of this study hold significant implications for policymakers and financial institutions for understanding the dynamics between innovation and risk. This understanding can help in the formation of balanced policies that can foster innovation without compromising financial stability.

3. Research methodology

3.1 Survey items and questionnaire development

For this study, we used a purposive sampling technique to target managers of SMEs, fintech firms, and asset management companies as respondents. SMS represents India's engine of growth; it promotes innovation through technological advancements and operational dealings. The fintech industry is central to India's ecosystem, encouraging financial inclusion through innovation. Lastly, we chose AMC as they are experts in financial products and have a good understanding of the financial markets. Professionals from this industry are well-informed about both the internal operations and the external environment, and they are at the helm of decision-making, making them ideal candidates to provide insights into the determinants of financial innovation.

To test the hypotheses, closed-ended questionnaire was created using Google Forms, which is considered an efficient way to connect to a large number of respondents [40]. This involved adapting measurement scales from prior studies to ensure the questions were relevant and applicable. These items were measured using a seven-point Likert scale, ranging from 1 ("strongly disagree") to 7 ("strongly agree"). This scale allowed respondents to express their level of agreement, providing nuanced data. Before conducting the main analysis, the questionnaire underwent a rigorous review by two experts in marketing and finance. This step was crucial for clarifying ambiguous questions and ensuring the survey was user-friendly. The revised survey was then pilot-tested with 50 respondents. This pilot test established that the survey was valid and ready for broader use in the main study (For the adapted scale, refer appendix 1).

4. Finding and Discussion

4.1 Descriptive information.

The data collection was conducted over a six-month period. The Google form was distributed to 650 respondents. However, the valid responses were 400, resulting in a response rate of 61.5 %. Out of 400 respondents, 275 were male, and rest 31.25% were female. Nearly 31.5% were aged less than 35 years, and the remaining were above 35 years. Regarding education, majority held master's degree (60%), followed by undergraduate (22.5%) and smaller proportion (17.5%) reported "Other". The majority of respondents held managerial positions, i.e., 52.5%, while nearly half identified as executives (45%). A small fraction (2.5%) were senior managers. Regarding company size, 8 had 11 to 50 employees, 215 had between 51 to 250, and the rest had more than 250 employees (refer table 1).

Table 1. Respondent demographics

Respondents	Items	Frequency	Percentage
Gender	Male	275	68.75
	Female	125	31.25
Age	<26	6	1.5
	26–35	120	30
	36–45	220	55
	Over 50	54	13.5
Education	Basic/secondary	0	0
	Undergraduate	90	22.5
	Master's	240	60
	Other	70	17.5
Position	Owner	0	0
	Executive	180	45
	Manager	210	52.5
	Sr. Manager	10	2.5
No. of employees	<10	0	0
	11–50	8	2
	51–250	215	53.75
	Above 250	177	44.25

Data analysis. SPSS and AMOS software were used to analyze the data collected. First, in order to determine construct validity and find items for latent variables, exploratory factor analysis (EFA) was carried out using SPSS. Principal component approach, in addition to Kaiser Normalization and varimax rotation, was used to accomplish this. The next step involved using AMOS to do Structural Equation Modelling (SEM).

Common method biases (CMB). The study used an online self-report survey using a single instrument for data collection, which may introduce CMB. To evaluate this concern, the researcher applied Harman's single-factor analysis, which is an established

technique for identifying CMB [41]. The results showed that a single factor explained only 19.424% of the total variance, which is under the benchmark limit of 50 %, suggesting the absence of CMB.

Factor Analysis and Measurement Model Validation. As the literature does not directly provide a scale to measure financial innovation, items were formulated based on theoretical parameters from the literature. To ensure clarity and reliability, the items were reviewed by experts and pilot tested. The data was later checked for suitability for factor analysis using Kaiser–Meyer–Olkin (KMO) test and Bartlett's test of sphericity. The overall KMO value was 0.788 (above the threshold of 0.60), and Bartlett's test was significant as $p < 0.001$, confirming the data's appropriateness [42]. The construct-wise KMO was also calculated and found to be above the threshold limits, indicating the suitability of each construct for factor analysis (Refer table 2).

The model of the study has a total of 9 factors, each factor has at least 4 items, hence the sample size was determined to be 400 [43]. Overall, 40 items were included in the questionnaire. During data analysis, some items were excluded due to low factor loadings, and 36 items were retained for the final analysis. The 9 factors collectively explain 81.146% of variance. For the evaluation of the measurement model, the reliability of the data was checked using Cronbach's Alpha. All the item factors loading was found to be above the acceptance threshold of .70, thus establishing constructs' internal consistency and reliability [44]. Additionally, Variance Inflation Factor (VIF) values are checked to assess multicollinearity. All the VIF scores were below 10, confirming no significant multicollinearity issues [45]; refer table 2.

Confirmatory factor analysis. The validity of the measurement model was evaluated using Confirmatory Factor Analysis (CFA), which focused on construct consistency by verifying convergent validity, discriminant validity, and overall model fit. As explained by [46], convergent validity refers to "the degree to which dimensional measures of the same concept are correlated," which is evaluated through composite reliability (CR) and Average Variance Extracted (AVE). The results of the analysis show that all constructs CR values exceed .70 [47], and the AVE value is surpassing 0.50 [48], which confirms convergent validity (refer table 2).

Discriminant validity, which measures the distinctiveness of a construct from others [43]. This is validated using the Fornell-Larcker criterion [49]. The results show that the square roots of AVE (diagonal values) exceeded inter-construct correlations (off-diagonal values), ensuring adequate discriminant validity [50]; refer table 3. Afterward, the structural model indices were evaluated. It was found that structural equation model demonstrated a good fit to the data, with CMIN/DF ratio of 1.250 (<3), RMSEA of 0.025 (<0.05), CFI of 0.999 (>0.95), TLI of 0.989 (>0.95), and IFI of 0.999 (>0.95). Additionally, the GFI (0.922) and AGFI (0.908) exceeded the 0.90 threshold, supporting the model's adequacy [43]; refer table 4.

Hypothesis testing. After the validation of the measurement model, the structural relationships and hypotheses were tested. The model's adequacy was assessed through

beta coefficients (β), standard error, critical ratios, and p-values (see Table 5). The research model explains 73.9% of the variance in financial innovation (FI), demonstrating strong explanatory power. As predicted by hypothesis H_1, demand for financial products (β=.390, p<.001) positively influences financial innovation. This reflects the growing demand of India's middle-class population, driving the firms to innovate. The more ingrained demand becomes in the strategic priorities of firms, the more likely they are to pioneer innovative products and services. Second, the regulatory framework (β = 0.398, p < .001), hypothesis H_2 is supported by the positive and significant influence on financial innovation. This shows that a supportive and robust regulation is a catalyst for an innovative environment like Digital India, Startup India. Third, market competition (β = 0.497, p < .001) exhibits the strongest positive impact on financial innovation. This suggests that financial firms' investment in innovative activities is an intensifying market competition. Fourth, as predicted by hypothesis H_4, ESG factors (β = 0.303, p < .001) contribute positively to financial innovation. This finding aligns with the focus on sustainable practices, which paves the way for increasing efficiency, thereby fostering long-term innovative strategies. The next two hypotheses, i.e. H_5 (β = 0.393, p < .001) & H_6 (β = 0.541, p < .001), significantly drives financial innovation. Technology gives companies the platforms required to develop innovative financial products, and on the other hand, capital input helps companies to grow and invest more in R&D, which helps them to expand. Surprisingly, the study found that employee skill (β = -0.456, p < .001) has a negative influence on financial innovation. Despite, employee skills being considered an enabler of new technologies in literature [35]. The results suggest a paradox in the context of the financial sector in India as skilled workers lack relevance to cutting-edge financial innovation due to inadequate foundation resources, a shortage of quality trainers, and absence of labor market information systems. This creates a workforce that is risk-averse and practically unequipped to drive innovation [51].

Based on our results, capital input (CI) is the most contributing factor to financial innovation, followed by competition. The findings resonate with studies by Gomber et al. [7], Tang et al. [52] that innovation involves a large amount of capital investment and in general is often considered as one of the most important factors in innovative activities. Capital investment give firm the edge to experiment with the disruptive technologies and keep pace with the rapid shift in demand. As a result, venture funding, government grants, and strategic alliances are considered critical for accelerating financial innovation. In the Indian context, venture funding has boomed startups like Paytm, PhonePe, and Razorpay. Strategic alliance between banks and fintech firm has led to launch of products like instant loan. Government grants under Digital India and Startup India have further fueled this innovation process which has transformed India as a global hub for innovation. Our findings align with other Indian studies, such as [53,54], which highlights that India's financial innovation ecosystem thrives with capital infusion.

Table 2. Reliability and validity assessments for the constructs.

Constructs	Indicator	VIF	Factor loadings	KMO	Cronbach alpha	Composite reliability	AVE
DD	DD1	3.418	0.892	0.856	0.923	0.923	0.751
	DD2	5.384	0.924				
	DD3	4.999	0.903				
	DD4	3.345	0.898				
RE	RE1	3.973	0.881	0.867	0.935	0.935	0.782
	RE2	5.537	0.894				
	RE3	4.952	0.904				
	RE4	5.913	0.900				
TA	TA1	3.805	0.873	0.859	0.936	0.937	0.788
	TA2	8.037	0.868				
	TA3	4.453	0.877				
	TA4	7.165	0.860				
CI	CI1	5.488	0.917	0.864	0.936	0.937	0.787
	CI2	6.912	0.901				
	CI3	3.436	0.901				
	CI4	4.634	0.920				
COM	COM1	5.075	0.895	0.859	0.929	0.929	0.766
	COM2	3.202	0.906				
	COM3	5.552	0.900				
	COM4	3.471	0.899				
ES	ES1	3.548	0.868	0.861	0.934	0.935	0.784
	ES2	3.870	0.883				
	ES3	6.167	0.877				
	ES4	4.771	0.883				
ESG	ESG1	3.471	0.918	0.844	0.912	0.913	0.724
	ESG2	4.010	0.908				
	ESG3	2.902	0.890				
	ESG4	3.757	0.917				
FI	FI1	8.890	0.857	0.854	0.927	0.966	0.878
	FI2	8.669	0.899				
	FI3	7.811	0.872				
	FI4	8.082	0.860				
Risk	Risk1	6.711	0.879	0.89	0.93	0.906	0.852

Risk2	9.200	0.868
Risk3	8.946	0.859
Risk4	8.406	0.872

DD -Demand, RE - Regulatory Environment, TA -Technological Advancement, CI -Capital Input, COM - Competition, ES -Employee Skills, ESG-Environmental, Social, and Governance, FI -Financial Innovation, and Risk-Risk. Source: Authors' Calculations

Table 3. Discriminant validity.

Construct	1	2	3	4	5	6	7	8	9
1-Risk	**0.923**								
2-DD	-0.060	**0.867**							
3-RE	-0.128	-0.012	**0.884**						
4-TA	-0.092	-0.013	-0.018	**0.887**					
5-CI	-0.387	-0.117	-0.031	-0.054	**0.887**				
6-COM	-0.013	-0.106	-0.107	-0.127	-0.064	**0.875**			
7-ES	-0.037	-0.085	-0.025	-0.044	-0.127	-0.011	**0.885**		
8-ESG	-0.015	-0.010	-0.016	-0.005	-0.012	-0.018	-0.037	**0.851**	
9-FI	-0.089	-0.307	-0.208	-0.332	-0.452	-0.069	-0.209	-0.208	**0.937**

Source: Authors' Calculations

Table 4 Model fit indices.

Measures	Estimate	Threshold Limit	Interpretation
CMIN/DF	1.25	< 3.0	Excellent
GFI	0.922	≥ 0.90	Good
CFI	0.99	≥ 0.90	Excellent
TLI	0.989	≥ 0.90	Excellent
IFI	0.99	≥ 0.90	Excellent
RMSEA	0.025	≤ 0.06	Excellent
AGFI	0.908	≥ 0.90	Good

Source: Authors' Calculations

Moderation Analysis. This study further explored whether risk moderates the relationship between financial innovation and its drivers, i.e., demand, regulatory

environment, market competition, ESG factors, technology, capital input, and employee skill. Table 5: exhibits the interaction of risk with these predictors. The full model, including direct predictors and moderation effects, explains 73.9% of the variance in financial innovation ($R^2 = 0.739$), demonstrating strong explanatory power. As predicted by hypothesis H_{8b}, risk weakens the positive effect of regulatory environment on financial innovation ($\beta = -0.124$, $p = .040$). In the complex ecosystem, regulatory benefits can diminish in high-risk scenarios. Similarly, hypotheses H_{8c} & H_{8g} are found to be supported, as their respective values are ($\beta = -0.181$, $p = .004$; $\beta = 0.162$, $p = .008$). This suggests that risk reduces the positive influence of market competition and employee skill on financial innovation. When markets are risky, companies focus more on survival than innovation. For example, instead of launching new products, firms might cut costs or avoid risks, slowing innovation. Additionally, in high-risk environments, employees, fearing failure or potential negative consequences, stick to conventional approaches. Surprisingly, we found that risk does not moderate the relation between demand for financial services and financial innovation ($\beta = -0.032$, $p = .599$). This aligns with the established literature that demand is a non-negotiable driver in emerging economies [55]. Similarly, it was found that risk does not moderate the relationship between ESG factors and financial innovation ($\beta = 0.099$, $p = .084$). ESG driven innovation is more long-term focused. Patel et.al [56], reported that investors understand that firms working on ESG projects may grow more slowly in short term, which might delay in profits but it will benefit company in long term. This finding aligns with the view that ESG initiatives are less influenced by risk. Moving to H_{8e}, it's revealed that risk does not moderate the relationship between technology and financial innovation ($\beta = -0.027$, $p = .681$). India's is fast-growing digital economy due to various government initiatives; this has created huge demand for digital financial services by billions of investors using smartphones which have normalized technological risk-taking. Lastly, H_{8f} was not supported as it was found that risk does not moderate the relationship between capital input and financial innovation ($\beta = -0.025$, $p = .694$). This supports the finding that India's fast-growing economy, because of the high demand for financial services, makes innovation the top priority for

the firm, hence even in risky market conditions, companies keep pumping funds into innovation [57,58,59].

Table 5. Structural model path coefficients.

Hypothesis	Relationship	Coefficient	Standard Error	Critical Ratio	P value	Decision
Path coefficients						
H_1	FI <---DD	0.39	0.045	8.720	.000	Supported
H_2	FI<---RE	0.398	0.046	8.606	.000	Supported
H_3	FI<---COM	0.497	0.04	12.421	.000	Supported
H_4	FI<---ESG	0.303	0.045	6.743	.000	Supported
H_5	FI<---TA	0.393	0.044	8.866	.000	Supported
H_6	FI<---CI	0.541	0.041	13.127	.000	Supported
H_7	FI<---ES	-0.456	0.045	-10.222	.000	Supported
Moderating effect						
H_{8a}	FI <---DD*Risk	-0.032	0.061	-0.526	0.59	Not Supported
H_{8b}	FI<---RE*Risk	-0.124	0.060	-2.061	0.04	Supported
H_{8c}	FI<--COM*Risk	-0.181	0.062	-2.938	0.004	Supported
H_{8d}	FI<---ESG*Risk	0.099	0.057	1.737	0.084	Not Supported
H_{8e}	FI<---TA*Risk	-0.027	0.066	-0.411	0.681	Not Supported
H_{8f}	FI<---CI*Risk	-0.025	0.063	-0.393	0.694	Not Supported
H_{8g}	FI<---ES*Risk	0.162	0.060	2.686	0.008	Supported

R^2 (FI): .739 (Source: Authors' Calculations)

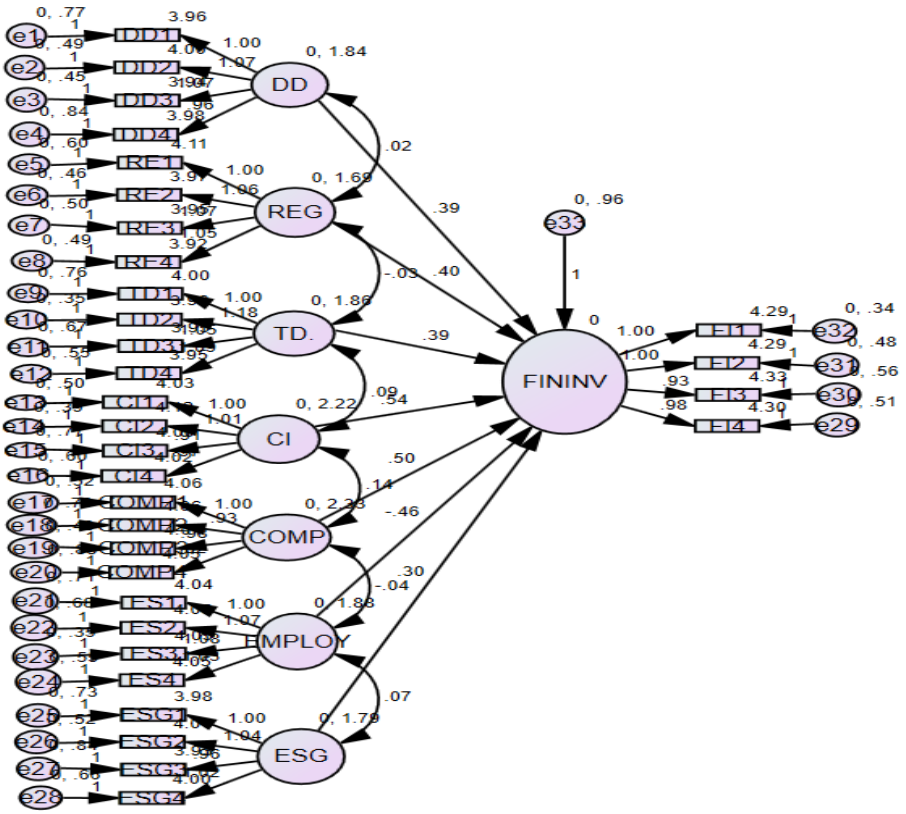

Fig. 2. Structural Model with Estimates

5. Conclusion.

The purpose of this study was to determine the factors influencing financial innovation in India and to evaluate the ways in which risk moderates these relationships. The existing literature has studied various factors influencing financial innovation in the context of different economies, whereas the present study attempts to assess how risk affects these key elements driving financial innovation. The following are the study's main findings (refer to fig. 2): First, capital input and market competition are the strongest drivers of financial innovation. This aligns with India's fast-growing fintech sector, where giant companies like Paytm and UPI are experiencing transformative growth. India has one of the world's top fintech systems. The country is pushing financial inclusion, particularly in rural areas, to bridge the gap for people who did not have access before. Secondly, we found that employee skills emerged as a hindrance, meaning that skilled employees do not meet the requirements of fintech. For this,

government intervention is imperative, so that efforts can be made to train employees in more industry-relevant skills or partner with fintech platforms to design curricula aligned with the needs of the fintech industry. To cope with the next generation financial solutions, India needs to prioritize technical skill programmes to reap the demographic dividend.

Third, we found that risk significantly weakens the positive effects of the regulatory environment, market competition, and employee skills. These findings are particularly relevant in India, because regulatory bodies are cautiously balancing innovation with stability amid volatile market conditions. As banks and other digital platforms integrate new technologies, cybersecurity risks have become significant threats to the financial ecosystem. To mitigate the potential negative influence of financial innovation, regulatory bodies have to implement stringent rules, which may suppress stifling innovation for the time being.

We also found that, in a high-risk environment and strict regulatory rules, the positive influence of market competition is found to diminish the innovation. The firm under such conditions may prioritize stability or survival-first approach, more than aggressive innovation, which might stagnate the innovation. Finally, study revealed that the negative influence of employee skill on financial innovation amplifies during high-risk environment. This underscores the need to align the workforce capabilities to match fintech jobs and rules to handle risk better.

5.1 Implication

Theoretical Implication. This study expands our understanding of what drives financial innovation in developing economies like India. By exploring how factors like employee skills, market competition, and risk interact, it challenges traditional views that assume employee skills always boost innovation. The finding that skilled employees might slow innovation under high risk adds a new layer of understanding of workforce roles in tech-driven sectors.

This research is especially relevant in emerging markets, where rapid changes in rules and economic shifts are observed. Finally, while most studies focus on financial innovation, this work highlights how risk reshapes innovation over time, which helps explain why some projects thrive while others fail, even with skilled teams and capital funding. This offers a roadmap for future research on building resilient financial systems in volatile environments.

Practical Implication. This study gives some clear takeaways for policymakers, financial institutions, and educators in India. First, companies and banks must pump in cash and compete hard in aggressive market conditions, as they drive financial innovation the most. This will help India achieve its goal of inclusive banking, especially in small cities, which require more capital investment. Secondly, universities should collaborate with industries to design fintech courses, and at the school level, basic fintech literacy should be integrated into the curriculum. This will also align with the National Education Policy (NEP), which emphasizes skill-based education learning. Next, the Ministry of Education can organize frequent national-level workshops to train

in various fintech tools and collaborate with educational institutions for certification. Together, these initiatives will prepare the future workforce to meet industry needs, turning India's youth into drivers of innovation.

Managerial Implication. Managers should direct their investment toward capital enhancement and strengthening market positioning, making most of the country's mature digital-payments landscape. Another challenge for the organizations is workforce capability. Firms must roll out wide-ranging upskilling programs in fintech, collaborating with academic institutions to design courses that keep talent industry-ready. Effective risk oversight is vital for sustainable growth. managers should build thorough risk evaluation system that safeguard compliance and cyber-security. When the business climate turns uncertain, managers are required to follow an adaptive innovation approach, which favors gradual roll-outs.

Limitations and Future Scope. Although this research offers valuable contribution, it has a few limitations that open doors for future research. First, it focuses on few key factors to explain what drives financial innovation. Future studies can consider other factors also like cross-border partnerships and global market integration to examine how they shape fintech growth. Second, the study examines financial innovation broadly and does not narrow down to any specific sector. Since financial innovation is applicable in almost all sectors, future research can focus on a specific sector for in-depth study. Third, risk can be categorized into various types, each with unique characteristics. Future work can focus on specific categories of risk and their influence on financial innovation. Fourth, the sample size in limited in our study. Larger data collection across India could paint a bigger picture. Finally, this study focuses on the determinants of financial innovation; it does not examine the outcomes when these gaps are filled. Thus, there's more to explore in India's fast-moving fintech world.

Funding. The authors have no funding support to declare.

Declarations

Conflict of interest. The authors have no conflicts of interest to declare.

References

1. Heffernan, S.A., Fu, X., Fu, X.: Financial innovation in the UK. Applied Economics 45(24), 3400–3411 (2013)

2. Levine, R.: Finance and growth: theory and evidence. Handbook of Economic Growth 1, 865–934 (2005)

3. Ul Haq, I., Pardaev, J., Allayarov, P., Munir, S.: The impact of financial innovation and infrastructure on inbound tourism in Central Asia. Journal of Open Innovation: Technology, Market, and Complexity 10(1), 100175 (2024)

4. Sokołowska, E., Sokołowska, E.: The Evolution of the Financial Innovation Market. Alternative Investments in Wealth Management: A Comprehensive Study of the Central and East European Market 1, 1–22 (2014)

5. Edwards-Schachter, M.: The nature and variety of innovation. International Journal of Innovation Studies 2(2), 65–79 (2018)

6. World Economic Forum: The Role of Financial Services in Society: Towards Responsible Financial Innovation. World Economic Forum (2014)

7. Gomber, P., Kauffman, R.J., Parker, C., Weber, B.W.: On the fintech revolution: Interpreting the forces of innovation, disruption, and transformation in financial services. Journal of Management Information Systems 35(1), 220–265 (2018)

8. Lee, I.: Internet of Things (IoT) cybersecurity: Literature review and IoT cyber risk management. Future Internet 12(9), 157 (2020)

9. Gupta, K., Wajid, A., Gaur, D.: Determinants of continuous intention to use FinTech services: the moderating role of COVID-19. Journal of Financial Services Marketing 1, 1–15 (2023)

10. Kaushik, A.K., Rahman, Z.: Innovation adoption across self-service banking technologies in India. International Journal of Bank Marketing 33(2), 96–121 (2015)

11. Lupu, I., Criste, A.: Motivations and determinants of innovation in financial markets. Annals of Constantin Brancusi University of Targu-Jiu. Economy Series 1, 1–15 (2021)

12. Srivastava, K., Dhamija, S.: FinTech: Application of Artificial Intelligence in Indian banking. In: Proceedings of International Conference on Communication and Artificial Intelligence: ICCAI 2021, pp. 601–613. Springer Nature Singapore (2022)

13. McKinsey Global Institute: Digital India: Technology to transform a connected nation. McKinsey & Company (2019)

14. PwC India: The changing face of financial services: Growth of FinTech in India. PwC India (2022)

15. Blommestein, H.J.: Financial Innovations and the Risk Paradox. SSRN 1–36 (2012)

16. Rajan, R.G.: Has finance made the world riskier? European Financial Management 12(4), 499–533 (2006)

17. Mazzucato, M., Tancioni, M.: Innovation and idiosyncratic risk: An industry- and firm-level analysis. Industrial and Corporate Change 17, 779–811 (2008)

18. Duppati, G., Kijkasiwat, P., Hunjra, A.I., Liew, C.Y.: Do institutional ownership and innovation influence idiosyncratic risk? Global Finance Journal 56, 100770 (2022)

19. Błach, J.: Barriers to financial innovation—corporate finance perspective. Journal of Risk and Financial Management 13(11), 273 (2020)

20. Drucker, P.F.: The discipline of innovation. Harvard Business Review 80(8), 95–102 (2002)

21. Gunday, G., Ulusoy, G., Kilic, K., Alpkan, L.: Modeling innovation: determinants of innovativeness and the impact of innovation on firm performance. In: 2008 4th IEEE International Conference on Management of Innovation and Technology, pp. 766–771. IEEE (2008)

22. Fernández-Olit, B., Paredes-Gázquez, J.D., de la Cuesta-González, M.: Are social and financial exclusion two sides of the same coin? An analysis of the financial integration of vulnerable people. Social Indicators Research 135, 245–268 (2018)

23. Frame, W.S., White, L.J.: Empirical studies of financial innovation: lots of talk, little action? Journal of Economic Literature 42(1), 116–144 (2004)

24. White, L.J.: Technological change, financial innovation, and financial regulation in the US: The challenges for public policy. In: Performance of Financial Institutions: Efficiency, Innovation, Regulation, pp. 388–415 (2000)

25. Nejad, M.G.: Research on financial innovations: an interdisciplinary review. International Journal of Bank Marketing 40(3), 578–612 (2022)

26. Czinkota, M.R., Kotabe, M., Vrontis, D., Shams, S.M.R.: Understanding the market environment and the competition. Marketing Management. 2nd edn. Springer (2021)

27. Ko, H.-C., Tong, Y.J., Zhang, F.F., Zheng, G.: Corporate governance, product market competition and managerial incentives: Evidence from four Pacific Basin countries. Pacific-Basin Finance Journal 40, 491–502 (2016)

28. Alqudah, M.Z., Sierra-García, L., Garcia-Benau, M.A.: Influence of ESG among Jordanian fintech businesses: the moderating role of sustainable finance technology. Discover Sustainability 5(1), 496 (2024)

29. Al-Okaily, M., Al Natour, A.R., Shishan, F., Al-Dmour, A., Alghazzawi, R., Alsharairi, M.: Sustainable FinTech innovation orientation: a moderated model. Sustainability 13(24), 13591 (2021)

30. Batool, K., Zhao, Z.Y., Atif, F., Dilanchiev, A.: Nexus between energy poverty and technological innovations: a pathway for addressing energy sustainability. Frontiers in Environmental Science 10, 888080 (2022)

31. Liu, Q., Qu, X., Wang, D., Abbas, J., Mubeen, R.: Product market competition and firm performance: Business survival through innovation and entrepreneurial orientation amid COVID-19 financial crisis. Frontiers in Psychology 12, 1-12 (2022)

32. Piao, Z., Miao, B., Zheng, Z., Xu, F.: Technological innovation efficiency and its impact factors: An investigation of China's listed energy companies. Energy Economics 112, 106140 (2022)

33. Bloom, N., Jones, C.I., Van Reenen, J., Webb, M.: Are ideas getting harder to find? American Economic Review 110, 1104–1144 (2020)

34. Barman, R.D., Hanfy, F.B., Rajendran, R., Masood, G., Dias, B., Maroor, J.P.: A critical review of determinants of financial innovation in global perspective. Materials Today: Proceedings 51, 88–94 (2022)

35. Poon, J., Chow, Y.W., Ewers, M., Ramli, R.: The role of skills in Islamic financial innovation: Evidence from Bahrain and Malaysia. Journal of Open Innovation: Technology, Market, and Complexity 6(3), 47 (2020)

36. Mahoney, J.T., Kor, Y.Y.: Advancing the human capital perspective on value creation by joining capabilities and governance approaches. Academy of Management Perspectives 29(3), 296–308 (2015)

37. Adeniran, I.A., Abhulimen, A.O., Obiki-Osafiele, A.N., Osundare, O.S., Agu, E.E., Efunniyi, C.P.: Strategic risk management in financial institutions: Ensuring robust regulatory compliance. Finance & Accounting Research Journal 6(8), 1582–1596 (2024)

38. Agarwal, N., Oehler, J., Brem, A.: Constraint-based thinking: A structured approach for developing frugal innovations. IEEE Transactions on Engineering Management 68(3), 739–751 (2021)

39. da Silva, R.B., Klotzle, M.C., Pinto, A.C.F., Motta, L.F.J.: R&D investment and risk in Brazil. Global Finance Journal 35, 106–114 (2018)

40. Fan, M., Qalati, S.A., Khan, M.A.S., Shah, S.M.M., Ramzan, M., Khan, R.S.: Effects of entrepreneurial orientation on social media adoption and SME performance: The moderating role of innovation capabilities. *PloS one* 16(4), 1-24 (2021)

41. Malhotra, N.K., Birks, D.: Marketing research: An applied approach. 3rd edn. Prentice Hall (2006)

42. Kaiser, H.F.: An index of factorial simplicity. Psychometrika 39(1), 31–36 (1974)

43. Hair, J.F., Anderson, R.E., Babin, B.J., Black, W.C.: Multivariate data analysis: A global perspective. Pearson Education International (2010)

44. Hair, J.F., Black, W.C., Babin, B.J., Anderson, R.E., Tatham, R.L.: Multivariate data analysis. 6th edn. Pearson Prentice Hall, New Jersey (2006)

45. Neter, J., Wasserman, W., Kutner, M.H.: Applied linear regression models. Irwin, Homewood (1989)

46. Byrne, B.M.: Structural equation modeling with EQS and EQS/Windows. Sage, Thousand Oaks (1994)

47. Nunnally, J.C.: Psychometric theory. Tata McGraw-Hill, London (1994)

48. Kline, R.B.: Principles and practice of structural equation modeling. 1st edn. Guilford Press, New York (1998)

49. Fornell, C., Larcker, D.F.: Evaluating structural equation models with unobservable variables and measurement error. Journal of Marketing Research 18(1), 39–50 (1981)

50. Kesharwani, I.B.S., Tiwari, H.R.: Exploration of internet banking website quality in India: A webqual approach. Great Lakes Herald 5(1), 40–58 (2011)

51. Shrotriya, S., Dhir, S.: Innovation driven ecosystem for quality skill development in India. Benchmarking: An International Journal 25(8), 2997–3020 (2018)

52. Tang, M., Wang, X., Niu, W., Fu, J., Zhu, M.: How financial development scale and R&D influence regional innovation efficiency: empirical evidence from the financial industry. Environmental Science and Pollution Research 1, 1–14 (2021)

53. Kaur, P., Kaur, N., Kanojia, P.: Firm innovation and access to finance: firm-level evidence from India. Journal of Financial Economic Policy 14(1), 93–112 (2022)

54. Gupta, J., Rathore, P., Kashiramka, S.: Impact of intellectual capital on the financial performance of innovation-driven pharmaceutical firms: Empirical evidence from India. Journal of the Knowledge Economy 14(2), 1052–1076 (2023)

55. Narlikar, A.: India's foreign economic policy under Modi: negotiations and narratives in the WTO and beyond. International Politics 59(1), 148–166 (2022)

56. Patel, P.C., Pearce, J.A. II, Oghazi, P.: Not so myopic: Investors lowering short-term growth expectations under high industry ESG-sales-related dynamism and predictability. Journal of Business Research 128, 551–563 (2021)

57. Kandpal, V., Mehrotra, R.: Financial inclusion: The role of fintech and digital financial services in India. Indian Journal of Economics & Business 19(1), 85–93 (2019)

58. Kumar, M., Pandey, N., Tripathi, A.P.: Does the Bias Towards Under and Overconfidence Affect Investment Decisions?: Proof From India. In *Unveiling Investor Biases That Shape Market Dynamics*, pp. 87–122. IGI Global Scientific Publishing (2025)

59. Dhaundiyal, P., Tripathi, A.P., Kateria, D.A., Kumar, M., Jha, D.: The Effect of Sustainable Development Goals (SDG's) on the Financial Performance of Listed Companies. *Grenze International Journal of Engineering & Technology (GIJET)* 10, (2024)

60. Anning-Dorson, T.: Moderation-mediation effect of market demand and organization culture on innovation and performance relationship. Marketing Intelligence & Planning 35(2), 222–242 (2017)

61. Lumpkin, S.A.: Regulatory issues related to financial innovation. OECD (2010)

62. Distanont, A.: The role of innovation in creating a competitive advantage. Kasetsart Journal of Social Sciences 41(1), 15–21 (2020)

63. Mukhtar, B., Shad, M.K., Lai, F.W., Waqas, A.: Empirical analysis of ESG-driven green innovation: the moderating role of innovation orientation. Management & Sustainability: An Arab Review 3(4), 361–384 (2024)

64. Ali, M.A.S., Elshaer, I.A., Montash, A.A., Metwally, A.B.M.: The Role of Technological Readiness in Enhancing the Quality of Audit Work: Evidence from an Emerging Market. Journal of Risk & Financial Management 17(11), (2024)

65. Wang, C.L., Ahmed, P.K.: The development and validation of the organisational innovativeness construct using confirmatory factor analysis. European Journal of Innovation Management 7(4), 303–313 (2004)

66. Thomas, A., Khatri, P., Dabas, V., Coniglio, I.M.: Capturing innovation orientation in knowledge workers: development and validation of a measurement scale. Journal of Knowledge Management 28(7), 1-30 (2024)

67. Dellana, S., Rowe, W.J., Liao, Y.: A scale for measuring organizational risk management maturity in the supply chain. Benchmarking: An International Journal 29(3), 905–930 (2022)

68. Calik, E., Calisir, F., Cetinguc, B.: A scale development for innovation capability measurement. Journal of Advanced Management Science 5(2), 69–76 (2017)

Appendix

Appendix 1: Scales Adopted

Variables	No. of Statement	Adapted from
Demand	4	[60]
Regulatory framework	4	[61]
Market competition	4	[62]
ESG	4	[63]
Technological advancement	4	[64]
Capital input	4	[65]
Workforce skill	4	[66]
Risk	4	[67]
Financial Innovation	4	[68]