Journal of Convergence in Technology and Management: Global Nexus

ISSN No.: 3049-1126

Web Page Info: www.jctmg.in

DOI: 10.70965/jctmgn.vol.2.issue1.17

Research Article

DIGITALIZATION, INNOVATION AND MSME-GDP NEXUS: A TECHNO-ECONOMIC CONVERGENCE AND REGRESSION ANALYSIS OF INDIA AND CHINA

Sudipa Chakraborty

Assistant professor, Prajnanananda Institute of Technology & Management, Kolkata, West Bengal India

ARTICLE INFORMATION

Article History

Received: 31th July, 2026

Revised: 23rd August, 2026

Accepted: 30th August, 2026

Keywords:

MSMEs; GDP Contribution; Digitalization; Innovation; India; China; Techno-Economic Convergence; Regression Analysis; Atmanirbhar Bharat.

ABSTRACT

Micro, Small and Medium Enterprises (MSMEs) play significant roles in employment, production, entrepreneurship and value creation; however, their contribution to national output differs significantly among emerging economies. This research paper investigates the India–China MSME-GDP nexus by adopting an integrated Digitalization–Innovation–MSME Performance framework, viewing digital capability and innovation through a techno-economic convergence lens. The research adopted a quantitative comparative research design with 7 observations per country (total 14 observations: India and China). Digitalization was captured by two variables: Internet Penetration and Digital Economy Share of GDP, while innovation was represented by R&D expenditure, number of resident patent filings, and Global Innovation Index (GII) Score. Descriptive statistics, Pearson correlation, independent-samples t-tests, exploratory Principal Component Analysis, and multiple linear regression were used. The results show that there is a statistically significant difference in the contribution of MSMEs to GDP ($p < .001$), as the mean contribution of MSMEs to GDP was 29.629% in India and 60.000% in China. MSME-GDP share was strongly and positively associated with Digital Economy Share ($r = .960$, $p < .001$), R&D expenditure ($r = .981$, $p < .001$), patent filings ($r = .984$, $p < .001$), and GII Score ($r = .964$, $p < .001$). The composite regression model was statistically significant and accounted for 97.4% of the variance in the MSME-GDP share ($R^2 = .974$, $F(2,11) = 207.854$, $p < .001$). The technological dimensions were highly multicollinear. Innovation was a significant positive predictor ($\beta = 1.184$, $p < .001$), whereas digitalization was not independently significant ($\beta = -.214$, $p = .140$). The findings imply that long-term techno-economic convergence between India and China requires a shift in focus from digital adoption to productivity, technological upgrading, skills, finance, and enabling institutional conditions through innovation. But due to the small sample, secondary data at the country level, multicollinearity, and a non-causal design, generalization and causal inference are constrained.

Published by Learnet Publishing, Kolkata, India

1. INTRODUCTION

Micro, Small and Medium Enterprises play an important role in economic development through their contributions to employment, production, entrepreneurship, regional development and value creation. They are particularly important in developing countries, where MSMEs create employment opportunities and link small businesses to domestic and export markets. Similarly, the Indian MSME sector has also emerged as a significant pillar of the country's economic structure and has increasingly become a tool for industrial competitiveness, employment creation, and inclusive development. The previous research evidence highlights the significance of MSMEs to the Indian GDP and shows that the contribution of MSMEs in China is significantly higher. The significance of MSMEs is not just in terms of their sheer numbers, though. Their contribution to the country's output depends on their productivity, access to finance, infrastructure, technological capability and innovation capacity, market connectivity and economic shock resistance. This gives rise to multifaceted dynamics between MSMEs and GDP. Technological change, in particular, has been a key influence on the way in which smaller businesses produce, market, finance and distribute goods and services (**Hassan *et al.* 2024**). This transition has incorporated digitalization as an important element. Digital technologies can lower transaction costs, lower information asymmetries, enhance market reach and automate processes, and enable smaller businesses to have access to markets or platforms that previously were inaccessible. The **OECD (2021)** sees digitalization as a driver of potential improvement in SME performance, innovation, productivity and competitiveness, and identifies a range of constraints to digitalization in smaller companies, such as skills, finance, internal resources and awareness. The interconnection between digitalization and innovation is particularly relevant. Digital technologies can offer enterprises new information, production capabilities, channels of communication, and business models. Thus, digitalization can be used to foster product, process, marketing, and organizational innovations. Recent evidence in China with SMEs clearly shows that there is a strong positive correlation between digital transformation and innovation performance. Studies on Chinese companies also reveal knowledge spillovers, upgrading of digital technologies, and industrial-chain connection as channels for the innovation effect from digital transformation (**Liu, 2025; Ma *et al.,* 2025**). There has also been significant digitization of MSMEs in India. Recent studies on MSMEs in India have shown that MSMEs can improve their competitiveness and growth through the adoption of information technology and digitalization. Technological, organizational, and environmental factors are also determinants of the level of digitalization (**Syal, 2015; Negi and Kumar, 2024; Hannan *et al.* 2025; Martinravi and Krishnasamy, 2025**). Digital financial systems can also enhance financial services availability and even potentially help improve the performance of MSMEs. Meanwhile, technological change is not a stand-alone process. Inflation can make the raw material, energy, transportation, wage, and borrowing costs rise, which can affect the profitability of enterprises and their investment capacity. Although macroeconomic conditions such as inflation can affect MSME operating costs, investment capacity, and profitability, the present study does not empirically estimate the inflation–MSME-GDP relationship. Instead, the revised analysis focuses on the role of digitalization and innovation in explaining differences in MSME economic performance between India and China. It is seen that there is a significant difference between the MSME-GDP contribution of both countries. China also shows significantly less variability, indicating a more stable contribution from MSMEs to GDP during the period. The gap should therefore not be viewed solely through a macroeconomic lens; rather, the MSME-GDP nexus should be understood as an interaction among macroeconomic stability, digitalization, innovation, and structural economic capability. China's more robust manufacturing networks, digital transformation, and technological capabilities can facilitate the integration of MSMEs into productive and export-oriented ecosystems, whereas the persistent infrastructure, financing, technological-adoption, and institutional challenges in India can affect the pace at which MSMEs can convert their technological and digital capabilities into contributions to the GDP. The study hence adopts a techno-economic convergence perspective to examine the extent of structural convergence between India and China in the future, which could be enabled through macroeconomic stabilisation, digitisation, innovation, and enabling institutional conditions.

2. RESEARCH QUESTIONS

- **RQ1:** What differences exist in MSME contribution to GDP between India and China across the matched observations included in the study?

- **RQ2:** What is the relationship between digitalization and MSME contribution to GDP?
- **RQ3:** What is the relationship between innovation and MSME contribution to GDP?
- **RQ4:** To what extent do digitalization and innovation jointly explain variation in MSME contribution to GDP?
- **RQ5:** How do differences in digitalization, innovation and MSME economic performance demonstrate the techno-economic divergence between India and China?
- **RQ6:** What policy conditions could support India's long-term techno-economic convergence with China in MSME performance?

3. RESEARCH OBJECTIVES

The study aims:

- To compare MSME contribution to GDP between India and China across the matched observations included in the study.
- To examine the relationship between digitalization and MSME contribution to GDP.
- To examine the relationship between innovation and MSME contribution to GDP.
- To assess the extent to which digitalization and innovation jointly explain variation in MSME contribution to GDP.
- To develop a techno-economic divergence and convergence perspective for India and China based on differences in digitalization, innovation, and MSME economic performance.
- To identify policy measures capable of strengthening India's MSME productivity, competitiveness and contribution to GDP.

4. RESEARCH HYPOTHESES

- **H_1:** There is a statistically significant difference in MSME contribution to GDP between India and China.
- **H_2:** Digitalization has a statistically significant positive relationship with MSME contribution to GDP.
- **H_3:** Innovation has a statistically significant positive relationship with MSME contribution to GDP.
- **H_4:** Digitalization and innovation jointly have a statistically significant relationship with MSME contribution to GDP.

5. LITERATURE REVIEW

5.1 MSMEs and economic growth

MSMEs can contribute to economic development in the following ways: Employment Generation, Value Addition, Entrepreneurship, Production and Market Development. In developing economies, smaller enterprises, as assumed by **Ayyagari (2007)**, may be able to survive in labor-intensive areas and integrate the informal and formal economic sectors, lending significance to their role in the economy. The previous literature presents the relevance of MSMEs in the Indian economy, their role in industrial development, and for Atmanirbhar Bharat. Previous research conducted by **Syal (2015), Negi and Kumar (2024), Hannan *et al.* (2025),** and **Martinravi and Krishnasamy (2025)** establishes a base for comprehending MSMEs as key drivers of economic growth in India. But the economic importance of MSMEs is not only based on their quantity but also on their productivity and level of technology (**Beck *et al.* 2005**). The shift in production systems from traditional to digitally enabled and innovation-intensive production is therefore becoming increasingly significant to understand the performance of MSMEs.

5.2 Digitalization and MSME performance

Digitalization is an overall term used for the use, application, and embedding of digital technologies in business processes, communication, production, finance, marketing, and decision-making. Digitalization can help MSMEs address some of their disadvantages related to smaller scale. According to **OECD (2021)**, potential benefits of SME digitalization are lower operating and transaction costs, better market outreach, Automation, Product differentiation, and enhanced competitiveness. Meanwhile, poor internal resources, skills, and financing, as well as technological differences, as observed by **Sagala and Őri (2024)**, are barriers to digital adoption. This is especially relevant in emerging economies since digital technologies, as per **Escoz Barragan and Becker (2025)** and **Meier *et al.* (2025)**, may enable smaller firms to gain access to markets without having to be as large as traditional firms. Digital

payments, e-commerce platforms, cloud-based systems, online procurement, digital financial systems, and digital supply-chain systems can enhance the effectiveness of transactions and market participation. This was confirmed by a recent study in India. **Mittal *et al.* (2025)** discuss the role of IT and digitalization in Indian MSMEs and place digitalization as an important factor for competitiveness and growth of MSMEs. Digitalization, in light of the evidence presented by **Khurana *et al.* (2022)**, is thus more than just an adoption of technology. It can be a tool that can help MSMEs to strengthen their resilience, expand markets, and improve productivity.

5.3 Digitalization and innovation

The digitalization-innovation relationship is a key theoretical grounding of the present study. Digital technologies, as argued by **Hassan *et al.* (2024),** can create new information and can lead to reorganizing production, creating new products, and new business models for firms. Thus, Digital Transformation can help reinforce innovation capability. The latest evidence from Chinese SMEs reveals that digital transformation plays a major role in improving innovation performance. Other studies in China by **Liu (2025)** and **Ma *et al.* (2025)** suggest that digital transformation facilitates enterprise innovation via knowledge spillovers and upgrading of digital technologies, and that industrial-chain linkages are an important mechanism. That means that digitalization can have an indirect impact on MSME-GDP contribution in addition to a direct impact.

5.4 Innovation and MSME productivity

Innovation, as argued by **Hall *et al.* (2009)** and **Rahman *et al.* (2025)**, may be product development, process improvement, organizational change and marketing innovation. Innovation can enhance production efficiency and product quality, lower costs, and help firms to stand out in competitive markets for MSMEs. Thus, innovation should have a positive impact on economic performance (**Albis Salas *et al.* 2023; Long & Anh, 2017**). In manufacturing economies, innovation can also enhance the connection between MSMEs and big companies, domestic supply chains and global markets. The China evidence is especially salient because a recent study has found a positive impact of digital transformation on SME innovation and that this impact might be larger for smaller firms.

5.5 Inflation and MSME performance

Inflation, as observed by **Ipinnaiye *et al.* (2017)**, is one of the key macroeconomic factors that affect the performance of MSMEs, as the capacity of smaller firms to absorb or transfer costs to consumers is limited. On the other hand, **Orogbu *et al.* (2017)** argued that inflation is one of the macroeconomic conditions that may impact the MSME operating environment, including the costs of inputs, energy, transportation, wages, borrowing rates, and consumer spending capacity. Smaller firms may have relatively small ability to absorb or pass on such cost pressures, and this can impact profitability, investment, and productivity. In spite of this, inflation, as concluded by **Isola and Mesagan (2019)**, is not considered as an explanatory variable in the present empirical regression model, though conceptually it is relevant in the performance of MSME.

5.6 India–China technological and economic convergence

The growth models of these two nations, India and China, are distinct. India has been working on digital public infrastructure, building up its ecosystem of entrepreneurship and expanding domestic manufacturing through programmes such as Atmanirbhar Bharat, and China has built extensive manufacturing capabilities, industrial networks and digital capabilities (**Singh *et al.* 2010; Hung, 2009**). According to **Chaudhuri (2012)**, technological capability, infrastructure, financial resources, and integration in the value chain are among the structural factors that can affect the performance of MSMEs. One of the terms that is relevant is digital infrastructure. Recent case studies of China indicate that digital infrastructure development can support SME exports by enabling market access, saving transaction costs, and releasing financial constraints (**Bottelier, 2007; Fuller, 2014**). But Techno-economic convergence does not imply that India and China will be the same. Rather, it means that the structural differential in the economic performance of MSMEs can be reduced by enhancing technology, innovation, productivity, and macroeconomic stability.

5.7 Research gap

Although previous research has established the economic importance of MSMEs in India (**Syal, 2015; Negi and Kumar, 2024; Hannan et al., 2025; Martinravi and Krishnasamy, 2025**), examined SME competitiveness comparatively in India and China (**Singh *et al.* 2010)**, and demonstrated positive relationships between digitalization and SME innovation or performance (**Liu, 2025; Ma *et al.* 2025**), the literature remains fragmented.

For instance, a comparative study of China and India conducted by **Singh et al. (2009)** discussed competitiveness, human-resource development, quality improvement, supplier development, relationship management, and cost reduction, but did not discuss joint efforts of digitalization and innovation as the key determinant of MSME economic performance. Likewise, digitalization research has found its link with innovation and performance in SMEs, but the majority of the evidence is not comparative, but instead comes from countries such as Germany or China. Thus, the empirical evidence on the relationship between digitalization and innovation and the economic performance of MSMEs is still limited in India and China. This study takes up this gap by comparatively looking at these relations and situating digitalization and innovation in the broader framework of the economic performance of MSMEs.

6. METHODOLOGY

The study is quantitatively designed, and the comparative research method is used in order to study the relationship between digitalization and innovation and MSME contribution to GDP in India and China. Secondary data of 14 matched country-level observations (with seven observations per country) have been analyzed. The dataset includes digitalization and innovation indicators, as well as indicators of MSME economic performance and overall economic conditions. Digitalization is measured by Internet Penetration and Digital Economy Share of GDP, while innovation is measured by R&D expenditure as a percentage of GDP, resident patent filings, as well as the Global Innovation Index (GII) Score. MSME contribution to GDP (MSME-GDP Share) reflects MSME economic performance.

Descriptive statistics were used to describe the central tendency, dispersion, and distributional characteristics of the study variables (**Panneerselvam, 2004**). The one-sample Kolmogorov–Smirnov test was used to evaluate the distributional properties, and the one-sample binomial and chi-square tests were used where appropriate to evaluate categorical and distributional characteristics (**Panneerselvam, 2004**). Further, Principal Component Analysis (PCA) was used as an exploratory method to analyze the common variance and structure of the study indicators (**Panneerselvam, 2004**). The first three components explained 94.246% of the variance. Since the ratio of observations to variables was low, the PCA results were only considered exploratory and not definitive construct validation.

The bivariate relationships between digitalization, innovation, MSME performance, and selected macroeconomic indicators were examined using Pearson correlation analysis. Independent-samples t-test were conducted to compare the differences between India and China, and Welch t-test are reported where the homogeneity of variance was not met. The analysis then created composite Digitalization and Innovation indices using their indicators, and both indices were put in the multiple linear regression model with MSME-GDP Share as the dependent variable. The regression analysis explored how digitalization and innovation, as a combination, explained the variation in the MSME-GDP contribution (**Panneerselvam, 2004**). The regression diagnostics were performed by examining the model residuals and the multicollinearity of the regressors by calculating tolerance and Variance Inflation Factor (VIF) statistics. The final model accounted for .974 of the variances, and the predictors were quite highly intercorrelated, which called for cautious interpretation of the individual predictors.

With a small sample size (N = 14) and significant intercorrelation of the technological indicators, the results are viewed as exploratory and comparative, not causal. In particular, the explanatory power of the regression model is not viewed as proof of causality, nor is definitive statistical convergence between India and China.

7. FINDINGS

7.1 Descriptive Statistics

Table 1: Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Skewness	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error
InternetPenetration_Pct	14	26.000000000000000	78.600000000000000	56.328571428571436	16.739379115929395	-.138	.597

DigitalEcon_Share_GDP_Pct	14	4.000000000000000	42.000000000000000	23.620000000000000	15.418604147138412	.084	.597
NRI_Rank	14	17	89	48.00	25.014	.220	.597
NRI_Score	14	38.50	74.00	55.9993	12.23349	.094	.597
RD_GDP_Pct	14	.620000000000000	2.680000000000000	1.556428571428572	.907156225565596	.084	.597
RD_Abs_USD_Bn	14	20.80	496.32	248.2036	207.47253	.078	.597
Patent_Filings_Resident	14	42763	1680000	790118.21	773082.041	.085	.597
GII_Rank	14	11	81	32.64	21.284	.804	.597
GII_Score	14	31.700000000000000	57.500000000000000	45.149999999999990	9.960749894537985	.052	.597
Unicorns	14	8	340	149.86	125.990	.460	.597
MSME_Count_Mn	14	20.00	63.40	51.0921	12.71719	-1.166	.597
MSME_GDP_Share_Pct	14	27.3	60.0	44.814	15.7757	-.007	.597
MSME_Employ_Indicator	14	80.0	250.0	114.586	57.4292	2.005	.597
GDP_Growth_Pct	14	-5.800000000000000	9.700000000000000	5.671428571428571	3.910819031162846	-2.151	.597
GDP_USD_Trillion	14	2.10	18.27	9.5043	6.94632	.197	.597
Valid N (listwise)	14						

The above-drawn table shows the descriptive statistics for all 14 observations of the India–China dataset and reveals significant differences among the technological, innovation, MSME and macroeconomic indicators. Internet penetration ranges from 26.00% to 78.60%, with a mean of 56.3286 (SD = 16.7394), while digital-economy share ranges from 4.00% to 42.00%, averaging 23.6200 (SD = 15.4186). NRI rank varies between 17 and 89 (M = 48.00, SD = 25.014), whereas NRI score ranges from 38.50 to 74.00 (M = 55.9993, SD = 12.2335). R&D expenditure varies from 0.62% to 2.68% of GDP (M = 1.5564, SD = 0.9072), while absolute R&D expenditure ranges from USD 20.80 to 496.32 billion (M = 248.2036, SD = 207.4725). Resident patent filings range from 42,763 to 1,680,000 (M = 790,118.21, SD = 773,082.041). GII rank ranges from 11 to 81 (M = 32.64, SD = 21.284), while GII score ranges from 31.70 to 57.50 (M = 45.1500, SD = 9.9607). Unicorns range from 8 to 340 (M = 149.86, SD = 125.990). MSME count ranges from 20.00 to 63.40 million (M = 51.0921, SD = 12.7172), and MSME-GDP share ranges from 27.30% to 60.00% (M = 44.814, SD = 15.7757). MSME employment ranges from 80.00 to 250.00 (M = 114.586, SD = 57.4292). GDP growth ranges from −5.80% to 9.70% (M = 5.6714, SD = 3.9108), while GDP ranges from USD 2.10 to 18.27 trillion (M = 9.5043, SD = 6.9463). Skewness is typically low except for MSME employment (2.005) and GDP growth (−2.151), which exhibit significant asymmetry.

7.2 Pearson Correlations

Table 2: Correlations

		Internet Penetration_Pct	DigitalEcon_Share_GDP_Pct	NRI_Rank	NRI_Score	RD_GDP_Pct	RD_Abs_USD_Bn	Patent_Filings_Resident	GII_Rank	GII_Score	Unicorns	MSME_Count_Mn	MSME_GDP_Share_Pct	MSME_Employ_Indicator	GDP_Growth_Pct	GDP_USD_Trillion
InternetPenetration_Pct	Pearson Correlation	1	.925**	-.928**	.973**	.878**	.880**	.850**	-.952**	.907**	.946**	-.171	.794**	-.283	-.107	.900**
	Sig. (2-tailed)		.000	.000	.000	.000	.000	.000	.000	.000	.000	.560	.001	.326	.717	.000
	N	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14
DigitalEcon_Share_GDP_Pct	Pearson Correlation	.925**	1	-.909**	.967**	.989**	.994**	.986**	-.933**	.994**	.960**	-.405	.960**	-.525	-.094	.993**
	Sig. (2-tailed)	.000		.000	.000	.000	.000	.000	.000	.000	.000	.151	.000	.054	.748	.000
	N	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14
NRI_Rank	Pearson Correlation	-.928**	-.909**	1	-.955**	-.869**	-.875**	-.856**	.898**	-.905**	-.928**	.169	-.807**	.316	-.086	-.894**
	Sig. (2-tailed)	.000	.000		.000	.000	.000	.000	.000	.000	.000	.564	.000	.271	.770	.000
	N	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14
NRI_Score	Pearson Correlation	.973**	.967**	-.955**	1	.941**	.941**	.918**	-.935**	.950**	.970**	-.266	.878**	-.368	-.010	.955**
	Sig. (2-tailed)	.000	.000	.000		.000	.000	.000	.000	.000	.000	.358	.000	.195	.972	.000
	N	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14

RD_GDP_Pct	Pearson Correlation	.878**	.989**	-.869**	.941**	1	.997**	.992**	-.888**	.983**	.932**	-.475	.981**	-.557*	-.088	.991**
	Sig. (2-tailed)	.000	.000	.000	.000		.000	.000	.000	.000	.000	.086	.000	.039	.764	.000
	N	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14
RD_Abs_USD_Bn	Pearson Correlation	.880**	.994**	-.875**	.941**	.997**	1	.997**	-.902**	.990**	.939**	-.459	.982**	-.577*	-.091	.993**
	Sig. (2-tailed)	.000	.000	.000	.000	.000		.000	.000	.000	.000	.098	.000	.031	.758	.000
	N	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14
Patent_Filings_Resident	Pearson Correlation	.850**	.986**	-.856**	.918**	.992**	.997**	1	-.878**	.985**	.929**	-.467	.984**	-.611*	-.096	.989**
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000		.000	.000	.000	.093	.000	.020	.745	.000
	N	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14
GII_Rank	Pearson Correlation	-.952**	-.933**	.898**	-.935**	-.888**	-.902**	-.878**	1	-.935**	-.890**	.328	-.853**	.355	.114	-.897**
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.000		.000	.000	.253	.000	.213	.699	.000
	N	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14

GII_Score	Pearson Correlation	.907**	.994**	-.905**	.950**	.983**	.990**	.985**	-.935**	1	.945**	-.443	.964**	-.519	-.077	.986**
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.000	.000		.000	.112	.000	.057	.795	.000
	N	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14
Unicorns	Pearson Correlation	.946**	.960**	-.928**	.970**	.932**	.939**	.929**	-.890**	.945**	1	-.169	.862**	-.477	-.087	.965**
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.000	.000	.000		.565	.000	.085	.766	.000
	N	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14
MSME_Count_Mn	Pearson Correlation	-.171	-.405	.169	-.266	-.475	-.459	-.467	.328	-.443	-.169	1	-.594*	.185	-.156	-.389
	Sig. (2-tailed)	.560	.151	.564	.358	.086	.098	.093	.253	.112	.565		.025	.528	.594	.169
	N	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14
MSME_GDP_Share_Pct	Pearson Correlation	.794**	.960**	-.807**	.878**	.981**	.982**	.984**	-.853**	.964**	.862**	-.594*	1	-.613*	-.041	.962**
	Sig. (2-tailed)	.001	.000	.000	.000	.000	.000	.000	.000	.000	.000	.025		.020	.888	.000
	N	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14

MSME_Employ_Indicator	Pearson Correlation	-.283	-.525	.316	-.368	-.557*	-.577*	-.611*	.355	-.519	-.477	.185	-.613*	1	.258	-.567*
	Sig. (2-tailed)	.326	.054	.271	.195	.039	.031	.020	.213	.057	.085	.528	.020		.373	.035
	N	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14
GDP_Growth_Pct	Pearson Correlation	-.107	-.094	-.086	-.010	-.088	-.091	-.096	.114	-.077	-.087	-.156	-.041	.258	1	-.079
	Sig. (2-tailed)	.717	.748	.770	.972	.764	.758	.745	.699	.795	.766	.594	.888	.373		.788
	N	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14
GDP_USD_Trillion	Pearson Correlation	.900**	.993**	-.894**	.955**	.991**	.993**	.989**	-.897**	.986**	.965**	-.389	.962**	-.567*	-.079	1
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.169	.000	.035	.788	
	N	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

The Pearson correlation analysis has been done for all 14 observations to understand the relationship between the variables of digitalization, innovation, MSME and macroeconomic indicators. This shows a very dense and cohesive technological system. Internet penetration is strongly positively correlated with digital-economy share ($r = .925$, $p < .001$), NRI score ($r = .973$, $p < .001$), R&D expenditure ($r = .878$, $p < .001$), patents ($r = .850$, $p < .001$), GII score ($r = .907$, $p < .001$), unicorns ($r = .946$, $p < .001$), MSME-GDP share ($r = .794$, $p = .001$) and GDP ($r = .900$, $p < .001$), while it is negatively associated with NRI rank ($r = −.928$, $p < .001$) and GII rank ($r = −.952$, $p < .001$). MSME-GDP share demonstrates particularly strong positive associations with digital-economy share ($r = .960$, $p < .001$), NRI score ($r = .878$, $p < .001$), R&D (% GDP) ($r = .981$, $p < .001$), absolute R&D ($r = .982$, $p < .001$), patent filings ($r = .984$, $p < .001$), GII score ($r = .964$, $p < .001$), unicorns ($r = .862$, $p < .001$) and GDP ($r = .962$, $p < .001$). Conversely, MSME-GDP share is negatively related to NRI rank ($r = −.807$, $p < .001$), GII rank ($r = −.853$, $p < .001$), MSME count ($r = −.594$, $p = .025$) and MSME employment ($r = −.613$, $p = .020$), whereas its association with GDP growth is negligible and non-significant ($r = −.041$, $p = .888$). The very high correlation between the

technological indicators also suggests the possibility of multicollinearity and thus validates the use of composite indices and parsimonious regression models.

7.3 Independent Samples T Test

Table 3: Group Statistics

	Country	N	Mean	Std. Deviation	Std. Error Mean
InternetPenetration_Pct	India	7	43.528571428571425	10.283759734927411	3.886895828765349
	China	7	69.128571428571420	10.911723708274248	4.124243901020167
DigitalEcon_Share_GDP_Pct	India	7	9.354285714285714	3.320054503281822	1.254862650694826
	China	7	37.885714285714286	5.404451428044778	2.042690635904910
NRI_Rank	India	7	67.14	15.529	5.869
	China	7	28.86	16.108	6.088
NRI_Score	India	7	45.7129	5.57942	2.10882
	China	7	66.2857	6.79986	2.57011
RD_GDP_Pct	India	7	.698571428571429	.097370182196360	.036802469600660
	China	7	2.414285714285715	.237476815911023	.089757799577719
RD_Abs_USD_Bn	India	7	51.7900	20.03432	7.57226
	China	7	444.6171	53.35216	20.16522
Patent_Filings_Resident	India	7	56293.86	8056.619	3045.116
	China	7	1523942.57	195857.886	74027.322
GII_Rank	India	7	50.14	15.005	5.671
	China	7	15.14	6.466	2.444
GII_Score	India	7	35.900000000000000	2.216604009139505	.837797566184553
	China	7	54.400000000000000	3.226453160980336	1.219484668678888
Unicorns	India	7	45.29	25.085	9.481
	China	7	254.43	90.816	34.325
MSME_Count_Mn	India	7	58.3271	6.84055	2.58549
	China	7	43.8571	13.47131	5.09168
MSME_GDP_Share_Pct	India	7	29.629	1.0688	.4040
	China	7	60.000	.0000	.0000
MSME_Employ_Indicator	India	7	149.171	65.9913	24.9423
	China	7	80.000	.0000	.0000
GDP_Growth_Pct	India	7	5.971428571428571	5.289207340019322	1.999132464906940
	China	7	5.371428571428572	2.225394561056747	.841120082507414
GDP_USD_Trillion	India	7	3.0657	.61549	.23263
	China	7	15.9429	2.72711	1.03075

Table 4: Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
InternetPenetration_Pct	Equal variances assumed	.063	.807	-4.517	12	.001	-25.599999999999994	5.667216860044753	-37.947804803171910	-13.252195196828078
	Equal variances not assumed			-4.517	11.958	.001	-25.599999999999994	5.667216860044753	-37.952606477965520	-13.247393522034473
DigitalEcon_Share_GDP_Pct	Equal variances assumed	.996	.338	-11.901	12	.000	-28.531428571428570	2.397345470749356	-33.754795640241880	-23.308061502615260
	Equal variances not assumed			-11.901	9.964	.000	-28.531428571428570	2.397345470749356	-33.875658594643710	-23.187198548213430
NRI_Rank	Equal variances assumed	.007	.934	4.527	12	.001	38.286	8.457	19.860	56.711
	Equal variances not assumed			4.527	11.984	.001	38.286	8.457	19.857	56.714

NRI_Score	Equal variances assumed	.199	.664	-6.188	12	.000	-20.57286	3.32454	-27.81641	-13.32930
	Equal variances not assumed			-6.188	11.559	.000	-20.57286	3.32454	-27.84716	-13.29855
RD_GDP_Pct	Equal variances assumed	3.480	.087	-17.686	12	.000	-1.715714285714286	.097009712677347	-1.927080292298022	-1.504348279130550
	Equal variances not assumed			-17.686	7.962	.000	-1.715714285714286	.097009712677347	-1.939605339738165	-1.491823231690407
RD_Abs_USD_Bn	Equal variances assumed	2.769	.122	-18.237	12	.000	-392.82714	21.54008	-439.75896	-345.89533
	Equal variances not assumed			-18.237	7.659	.000	-392.82714	21.54008	-442.88612	-342.76816
Patent_Filings_Resident	Equal variances assumed	5.462	.038	-19.809	12	.000	-1467648.714	74089.926	-1629076.797	-1306220.632
	Equal variances not assumed			-19.809	6.020	.000	-1467648.714	74089.926	-1648792.119	-1286505.310
GII_Rank	Equal variances assumed	2.562	.135	5.668	12	.000	35.000	6.175	21.545	48.455

	Equal variances not assumed			5.668	8.154	.000	35.000	6.175	20.806	49.194
GII_Score	Equal variances assumed	.312	.587	-12.504	12	.000	-18.500000000000000	1.479543043999606	-21.723647366311240	-15.276352633688760
	Equal variances not assumed			-12.504	10.632	.000	-18.500000000000000	1.479543043999605	-21.770259330909592	-15.229740669090408
Unicorns	Equal variances assumed	7.636	.017	-5.873	12	.000	-209.143	35.611	-286.732	-131.554
	Equal variances not assumed			-5.873	6.910	.001	-209.143	35.611	-293.571	-124.715
MSME_Count_Mn	Equal variances assumed	2.005	.182	2.534	12	.026	14.47000	5.71051	2.02787	26.91213
	Equal variances not assumed			2.534	8.901	.032	14.47000	5.71051	1.53006	27.40994
MSME_GDP_Share_Pct	Equal variances assumed	5.177	.042	-75.181	12	.000	-30.3714	.4040	-31.2516	-29.4912

	Equal variances not assumed			-75.181	6.000	.000	-30.3714	.4040	-31.3599	-29.3829
MSME_Employ_Indicator	Equal variances assumed	26.450	.000	2.773	12	.017	69.1714	24.9423	14.8267	123.5161
	Equal variances not assumed			2.773	6.000	.032	69.1714	24.9423	8.1397	130.2032
GDP_Growth_Pct	Equal variances assumed	1.140	.307	.277	12	.787	.599999999999999	2.168873810400728	-4.125570084030350	5.325570084030347
	Equal variances not assumed			.277	8.060	.789	.599999999999999	2.168873810400729	-4.394986116550013	5.594986116550010
GDP_USD_Trillion	Equal variances assumed	17.256	.001	-12.186	12	.000	-12.87714	1.05668	-15.17944	-10.57484
	Equal variances not assumed			-12.186	6.610	.000	-12.87714	1.05668	-15.40601	-10.34827

Independent-samples t-test shows that there are significant differences between India and China in most of the technological, innovation, and MSME measures. Internet penetration was significantly higher in China (M = 69.129) than India (M = 43.529), t(12) = −4.517, p = .001, while digital-economy share was also substantially higher in China (M = 37.886) than India (M = 9.354), t(12) = −11.901, p < .001. China recorded a significantly better NRI rank (M = 28.86 vs. 67.14), t(12) = 4.527, p = .001, and higher NRI score (M = 66.286 vs. 45.713), t(12) = −6.188, p < .001. R&D expenditure was markedly higher in China (M = 2.414%) than India (M = 0.699%), t(12) = −17.686, p < .001; absolute R&D expenditure likewise differed significantly (M = 444.617 vs. 51.790 billion), t(12) = −18.237, p < .001. Patent filings were significantly greater in China (M = 1,523,942.57) than India (M = 56,293.86), Welch's t(6.020) = −19.809, p < .001. China also outperformed India in GII rank (15.14 vs. 50.14), t(12) = 5.668, p < .001, and GII score (54.400 vs. 35.900), t(12) = −12.504, p < .001. Unicorns were higher in China (254.43 vs.

45.29), Welch's t(6.910) = −5.873, p = .001. MSME count was higher in India (58.327 vs. 43.857 million), t(12) = 2.534, p = .026, whereas MSME-GDP share was significantly higher in China (60.000% vs. 29.629%), Welch's t(6.000) = −75.181, p < .001. MSME employment was higher in India (149.171 vs. 80.000), Welch's t(6.000) = 2.773, p = .032. GDP growth did not differ significantly (India M = 5.971; China M = 5.371), t(12) = .277, p = .787, whereas GDP was substantially higher in China (15.943 vs. 3.066 trillion), Welch's t(6.610) = −12.186, p < .001.

7.4 Linear Regression Analysis

Table 5: Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics R Square Change	F Change	df1	df2	Sig. F Change	Durbin-Watson
1	.987[a]	.974	.970	2.7536	.974	207.854	2	11	.000	1.720

a. Predictors: (Constant), Innovation_Index, Digitalization_Index

b. Dependent Variable: MSME_GDP_Share_Pct

Table 6: ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	3151.934	2	1575.967	207.854	.000[b]
	Residual	83.403	11	7.582		
	Total	3235.337	13			

a. Dependent Variable: MSME_GDP_Share_Pct

b. Predictors: (Constant), Innovation_Index, Digitalization_Index

Table 7: Coefficients[a]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.	Collinearity Statistics Tolerance	Collinearity Statistics VIF
1	(Constant)	34.292	3.523		9.733	.000		
	Digitalization_Index	-.107	.067	-.214	-1.592	.140	.129	7.730
	Innovation_Index	2.416E-5	.000	1.184	8.797	.000	.129	7.730

a. Dependent Variable: MSME_GDP_Share_Pct

Table 8: Collinearity Diagnostics[a]

Model	Dimension	Eigenvalue	Condition Index	Variance Proportions (Constant)	Variance Proportions Digitalization_Index	Variance Proportions Innovation_Index
1	1	2.716	1.000	.01	.00	.01
	2	.273	3.153	.07	.00	.12
	3	.010	16.191	.92	1.00	.87

a. Dependent Variable: MSME_GDP_Share_Pct

Table 9: Residuals Statistics[a]

	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	28.546	61.958	44.814	15.5710	14
Residual	-2.8436	7.3698	.0000	2.5329	14
Std. Predicted Value	-1.045	1.101	.000	1.000	14
Std. Residual	-1.033	2.676	.000	.920	14

a. Dependent Variable: MSME_GDP_Share_Pct

To operationalize the technological dimension in the study, two composite indices were developed with the SPSS Transform → Compute Variable. Digitalization Index is the average of Internet Penetration and Digital Economy Share, and the Innovation Index is the average of R&D expenditure, resident patent filings, and GII Score. These indicators, theoretically aligned, were further reduced to composite measures to reduce the dimensionality of the technological variables, and the reduced variables were then used as independent variables in the regression model, while the dependent variable was the MSME-GDP Share.

The overall fit of the resulting multiple regression model is very good, with R = .987, R^2 = .974, and Adjusted R^2 = .970, meaning that the two composite predictors explain 97.4% of the variance in MSME-GDP share. The standard error of the estimate is 2.7536. The overall model is statistically significant, $F(2,11) = 207.854$, $p < .001$, with regression, residual, and total sums of squares of 3151.934, 83.403, and 3235.337, respectively. Digitalization has a negative, but not statistically significant, association with MSME-GDP share (B = −.107, β = −.214, t = −1.592, p = .140), while Innovation has a positive and statistically significant association (B = 2.416E−5, β = 1.184, t = 8.797, p < .001). However, caution must be exercised with the coefficients, as the Tolerance for both predictors is low (Tolerance = .129) and VIF is high (VIF = 7.730), and the maximum condition index is 16.191. The Durbin–Watson statistic of 1.720 does not indicate an immediate problem with the autocorrelation of the residuals. The maximum absolute value of the standardized residuals is 2.676, which is within the usual range of ±3. In general, the results yield statistically significant evidence of a joint relationship between the composite technological dimensions and share of MSME-GDP, but the small sample size (N = 14) and the high levels of collinearity between the predictors warrant caution in interpreting the results for each predictor individually.

7.5 Factor Analysis

Table 10: Communalities

	Initial	Extraction
InternetPenetration_Pct	1.000	.966
DigitalEcon_Share_GDP_Pct	1.000	.998
NRI_Rank	1.000	.954
NRI_Score	1.000	.989
RD_GDP_Pct	1.000	.989
RD_Abs_USD_Bn	1.000	.997
Patent_Filings_Resident	1.000	.991
GII_Rank	1.000	.900
GII_Score	1.000	.991
Unicorns	1.000	.972
MSME_Count_Mn	1.000	.875
MSME_GDP_Share_Pct	1.000	.996
MSME_Employ_Indicator	1.000	.724
GDP_Growth_Pct	1.000	.806
GDP_USD_Trillion	1.000	.988

Extraction Method: Principal Component Analysis.

Table 11: Total Variance Explained

	Initial Eigenvalues			Extraction Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	11.709	78.061	78.061	11.709	78.061	78.061
2	1.230	8.201	86.263	1.230	8.201	86.263
3	1.197	7.983	94.246	1.197	7.983	94.246
4	.637	4.243	98.489			
5	.119	.792	99.281			
6	.058	.385	99.666			

7	.025	.165	99.831			
8	.015	.101	99.932			
9	.004	.029	99.961			
10	.003	.022	99.983			
11	.001	.009	99.993			
12	.001	.007	99.999			
13	8.288E-5	.001	100.000			
14	7.337E-17	4.891E-16	100.000			
15	-1.412E-16	-9.413E-16	100.000			

Extraction Method: Principal Component Analysis.

Table 12: Component Matrix[a]

	Component		
	1	2	3
InternetPenetration_Pct	.923	-.082	.328
DigitalEcon_Share_GDP_Pct	.999	-.007	-.001
NRI_Rank	-.914	-.053	-.341
NRI_Score	.967	.018	.231
RD_GDP_Pct	.990	.028	-.096
RD_Abs_USD_Bn	.994	.012	-.094
Patent_Filings_Resident	.986	.005	-.137
GII_Rank	-.934	.020	-.164
GII_Score	.995	.027	-.025
Unicorns	.960	-.116	.193
MSME_Count_Mn	-.403	-.584	.609
MSME_GDP_Share_Pct	.962	.112	-.241
MSME_Employ_Indicator	-.533	.345	.566
GDP_Growth_Pct	-.080	.855	.261
GDP_USD_Trillion	.994	-.015	-.027

Extraction Method: Principal Component Analysis.
a. 3 components extracted.

Factor Analysis based on Principal Component Analysis (PCA) was performed on 15 indicators to explore the dimensional structure in the indicators. The extracted communalities were high, between .724 and .998, with large amounts of variance accounted for by the extracted components in each variable. Digital Economy Share, Absolute R&D Expenditure, MSME-GDP Share, GII Score, Patent Filings, NRI Score, R&D (% GDP), and GDP had the highest communalities of .998, .997, .996, .991, .991, .989, .989, and .988, respectively, whereas MSME Employment had the lowest communality of .724. These high communalities should not be interpreted as evidence of construct validity given the very small observation-to-variable ratio

Three components had eigenvalues exceeding 1: Component 1 = 11.709, explaining 78.061% of variance; Component 2 = 1.230, explaining 8.201%; and Component 3 = 1.197, explaining 7.983%. In total, these components account for 94.246% of the variance. Component 1 demonstrates strong positive loadings for Digital Economy Share (.999), GDP (.994), GII Score (.995), R&D (.990), patents (.986), NRI Score (.967), MSME-GDP Share (.962), unicorns (.960), and Internet Penetration (.923), while NRI Rank (−.914) and GII Rank (−.934) load negatively. Component 2 has its highest loading on GDP Growth (.855), while Component 3 has its highest loading on MSME Count (.609) and MSME Employment (.566).

7.6 Diagnostic and Distributional Tests (One-Sample Binomial, One Sample Chi-Square and One Sample Kolmogorov-Smirnov)

Table 13: Diagnostic and Distributional Tests Results

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
1	The categories defined by CountryCode = 1 and 2 occur with probabilities 0.5 and 0.5.	One-Sample Binomial Test	1.000[1,1]	Retain the null hypothesis.
2	The categories defined by Country = India and China occur with probabilities 0.5 and 0.5.	One-Sample Binomial Test	1.000[1,1]	Retain the null hypothesis.
3	The categories of Unicorns occur with equal probabilities.	One-Sample Chi-Square Test	1.000[1]	Retain the null hypothesis.
4	The distribution of Year is normal with mean 2,020 and standard deviation 2.980.	One-Sample Kolmogorov-Smirnov Test	.200[1,2]	Retain the null hypothesis.
5	The distribution of InternetPenetration_Pct is normal with mean 56.32857142857140 0 and standard deviation 16.739.	One-Sample Kolmogorov-Smirnov Test	.200[1,2]	Retain the null hypothesis.
6	The distribution of DigitalEcon_Share_GDP_Pct is normal with mean 23.62000000000000 0 and standard deviation 15.419.	One-Sample Kolmogorov-Smirnov Test	.023[1]	Reject the null hypothesis.
7	The distribution of NRI_Rank is normal with mean 48 and standard deviation 25.014.	One-Sample Kolmogorov-Smirnov Test	.200[1,2]	Retain the null hypothesis.
8	The distribution of NRI_Score is normal with mean 56.00 and standard deviation 12.233.	One-Sample Kolmogorov-Smirnov Test	.200[1,2]	Retain the null hypothesis.
9	The distribution of RD_GDP_Pct is normal with mean 1.556428571428570 and standard deviation 0.907.	One-Sample Kolmogorov-Smirnov Test	.003[1]	Reject the null hypothesis.
10	The distribution of RD_Abs_USD_Bn is normal with mean 248.20 and standard deviation 207.473.	One-Sample Kolmogorov-Smirnov Test	.002[1]	Reject the null hypothesis.
11	The distribution of Patent_Filings_Resident is normal with mean 790,118 and standard deviation 773,082.041.	One-Sample Kolmogorov-Smirnov Test	.000[1]	Reject the null hypothesis.
12	The distribution of GII_Rank is normal with mean 33 and standard deviation 21.284.	One-Sample Kolmogorov-Smirnov Test	.145[1]	Retain the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

[1] Exact significance is displayed for this test.

[1] Lilliefors Corrected

[2] This is a lower bound of the true significance.

One-Sample Binomial test, One Sample Chi-Square test and One Sample Kolmogorov-Smirnov test- these one-sample tests were treated as preliminary diagnostic and distributional procedures and were not used to test H1–H4. The distribution of category proportions and the distributional characteristics of the study variables were assessed by the one-sample non-parametric analysis. Results showed that CountryCode and Country were in the expected 0.5–0.5 category probabilities range (p = 1.000 in both one-sample binomial tests) and thus the null hypotheses were accepted. The one-sample chi-square test of the Unicorns category distribution resulted in a p-value of 1.000, which also supports retention of the null. The one-sample Kolmogorov–Smirnov test showed that Year was consistent with the specified normal distribution (p = .200), as was Internet Penetration (p = .200), NRI Rank (p = .200), NRI Score (p = .200), and GII Rank (p = .145) for distributional assessment. Statistically significant deviations from the distributions specified as normal, on the other hand, were found in the Digital Economy Share (% GDP) (p = .023), R&D (% GDP) (p = .003), absolute R&D expenditure (USD billion) (p = .002) and resident patent filings (p < .001; SPSS reports .000). Thus, the null hypothesis of normality was rejected for these four indicators but retained for Year, Internet Penetration, NRI Rank, NRI Score, and GII Rank. These results indicate

that inferential analyses to follow should take into consideration the violation of a normal distribution of several technological and innovation indicators.

7.7 Summary of Hypothesis Testing Results

Table 14: Empirical Assessment of the Study Hypotheses

Hypothesis	Hypothesis Statement	Statistical Evidence	Result	Decision
H_1	There is a significant difference in MSME contribution to GDP between India and China.	Welch's t-test showed a statistically significant difference in MSME-GDP share between India (M = 29.629%) and China (M = 60.000%), t(6.00) = −75.181, p < .001.	A statistically significant difference exists between the two countries.	Supported
H_2	Digitalization has a significant positive relationship with MSME contribution to GDP.	Pearson correlation: r = .794, p = .001. However, in the multiple regression model, Digitalization Index: β = −.214, p = .140, VIF = 7.730.	Digitalization has a significant positive bivariate association, but it is not a significant independent predictor after controlling for innovation.	Partially Supported (*positive bivariate association but non-significant independent regression coefficient*)
H_3	Innovation has a significant positive relationship with MSME contribution to GDP.	Multiple regression: Innovation Index β = 1.184, p < .001; the overall association is strongly positive.	Innovation is a statistically significant positive predictor of MSME contribution to GDP.	Supported
H_4	The combined regression model was statistically significant, indicating	Multiple regression: R = .987, R^2 = .974, Adjusted R^2 = .970; F(2,11)	The combined model is statistically significant and explains 97.4% of the	Supported

	that digitalization and innovation jointly explain a substantial proportion of the observed variation in MSME-GDP share.	= 207.854, p < .001.	observed variation in MSME-GDP share.	

The results of the hypothesis testing show that *H_1, H_3, and H_4 are supported, while H_2 is partially supported.* H_1 indicates that there exists a significant difference between India and China with respect to the contribution of MSMEs to GDP. The result of the regression of H_2 on the other variables only partially confirms that H_2 has a significant positive bivariate association and is non-significant as an independent variable. Innovation is a major positive predictor identified by H_3. The overall model is justified by H_4, which shows that the combined effect of digitalization and innovation can account for significant variation in the contribution of MSMEs to GDP. Also, regarding the partial support for H_2, it is worth mentioning that *H_2 is supported at the bivariate association level but is not supported as an independent predictor in the multivariate regression model.*

8. THEORETICAL FRAMEWORK

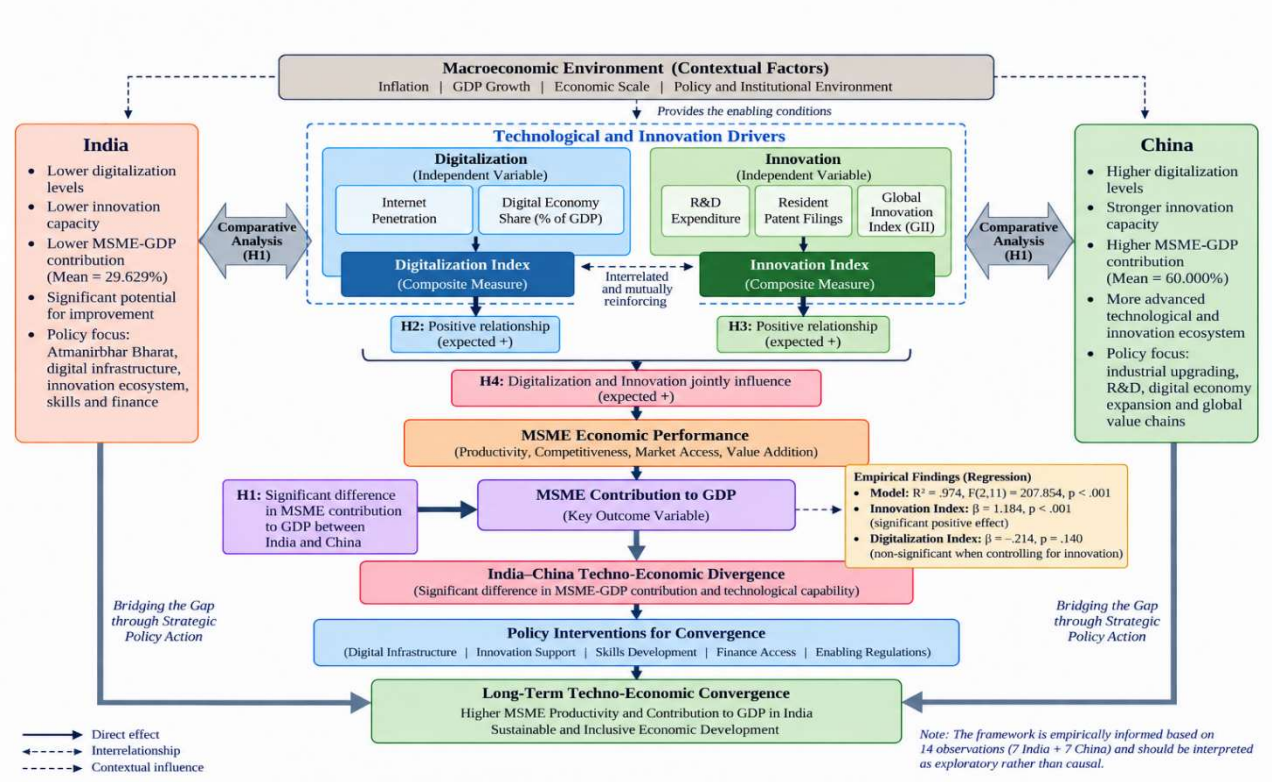

Figure 1: Integrated Digitalization–Innovation–MSME Performance Framework for India–China Techno-Economic Convergence

The proposed framework has introduced a new pathway – "Digitalization-Innovation-MSME Performance" – to understand the techno-economic divergence and potential convergence in India and China. On the top,

macroeconomic conditions (inflation, GDP growth, economic size, policy and institutional conditions) are shown as an environment or context that affects enabling conditions. Digitalization is measured by Internet Penetration and Digital Economy Share, which make up the Digitalization Index, and innovation is measured by R&D expenditure, resident patent filings, and GII, which make up the Innovation Index. The relationship between digitalization and MSME-GDP is suggested to be positive as in the case of H2, and the relationship between innovation and MSME-GDP is suggested to be positive, as in the case of H3. H4 postulates the combined effects of them. The big difference between India and China for MSME-GDP contribution is addressed by H1. The framework subsequently makes the economic performance of MSMEs a link to their contribution to GDP and then techno-economic divergence and policy actions for convergence via digital infrastructure, innovation support, skills, finance, and enabling regulations. Empirically, there is a correlation between the model and the data, such as $R^2 = .974$, where innovation is significant ($\beta = 1.184$, $p < .001$) and digitalization is not significant ($\beta = -.214$, $p = .140$).

9. DISCUSSION

9.1 Summary of Findings

The results offer empirical evidence that the MSME–GDP relationship between India and China is intimately linked to digitalization, innovation capability and technology advancement in general. There are 14 observations, seven for each country, so the analysis is meant as a comparative and exploratory exercise, and no attempt has been made to draw causal conclusions. However, the results give a unified framework to understand the technological and economic aspects of MSME performance and in order to form a techno-economic perspective.

The first significant discovery relates to the fact that there is a significant difference in the contribution of MSMEs to GDP between the two countries. India's MSME-GDP share was 29.629%, which was statistically significantly lower than China's share at 60.000% ($t = -75.181$, $df = 12$, $p < .001$ under the equal-variance specification; Welch's test also gave $p < .001$). This finding directly sets the empirical basis for the comparative argument in the study. The difference is not only confined to MSME-GDP contribution. China also exhibits significantly higher digital and innovation measures. For instance, China had a higher Internet penetration than India (69.129% versus 43.529%, $p = .001$) and the digital-economy share was much higher in China than in India (37.886% versus 9.354%, $p < .001$). These differences indicate that the relative economic contribution of MSMEs has to be viewed not only in terms of the number of enterprises but in the technological and productive environment in which enterprises operate.

The results of the correlation analysis also support this interpretation. Internet penetration showed a high positive association with the share of MSME-GDP ($r = .794$, $p = .001$), and digital-economy share showed an extraordinarily high positive association ($r = .960$, $p < .001$). Further, there was a significant positive relationship between MSME-GDP share and R&D expenditure, patents, GII score, and GDP, suggesting that MSME performance is not stand-alone, but is part of a wider techno-economic system. At the same time, the very high correlations between several technological variables reveal that digitalization, innovation, technological capability, and economic scale are all very much interconnected. This is empirical support for the use of aggregated Digitalization and Innovation indices instead of each of the indicators separately in the regression.

The regression analysis is the key empirical contribution of the study. The values of the composite Digitalization Index (comprising Internet Penetration and Digital Economy Share) and Innovation Index (comprising R&D expenditure, resident patent filings, and GII Score) have been used together as predictors of MSME-GDP share. The model produced $R = .987$, $R^2 = .974$ and Adjusted $R^2 = .970$, with $F(2,11) = 207.854$, $p < .001$. Hence, the two technological dimensions account for 97.4% of the total variation of the share of MSME-GDP in the sample. This finding provides evidence that technological capability is relevant to the MSME-GDP nexus in the sample.

But the individual coefficients need to be interpreted more carefully. The result shows that there is a positive, statistically significant relationship between innovation and MSME-GDP share ($B = 2.416E-5$, $\beta = 1.184$, $t = 8.797$, $p < .001$), hence, it can be inferred that innovation capability is related to the improvement of MSME economic performance. In comparison, the coefficient of Digitalization is negative, but statistically not significant ($B = -.107$, $\beta = -.214$, $t = -1.592$, $p = .140$). The apparent contradiction between the high positive bivariate correlation and the insignificant regression coefficient is important. It implies that when innovation is added to the same model, it is hard to distinguish the independent effect of digitalization. The two predictors had a high VIF (7.730) and low

Tolerance (.129), indicating high multicollinearity. Therefore, the results should not be understood as a negative indicator of the lack of significance of digitalization, but rather as a strong indicator of the high level of integration of digitalization in the broader technological and innovation landscape.

9.2 Findings and Framework in Relation to Previous and Current Literature

The findings in the present study corroborate and qualify the literature on digitalization and innovation and the economic performance of MSMEs. The proposed framework broadly mirrors the modern notion of the technological ecosystem of MSMEs as opposed to a single factor of economic performance. But there is also an important qualification in the empirical results: digitalization illustrates strong positive bivariate associations with MSME-GDP performance but not when innovation is also included in the regression model.

The positive correlation at the bivariate level between digitalization and MSME-GDP performance is similar to the evidence presented by the **OECD (2021)** of the positive effects of digitalization on SME performance, productivity, innovation, market reach, and competitiveness. **OECD (2021)** suggests that digital technologies can help to cut operating and transaction costs, enhance information flows, enable product differentiation, and extend customer access. This is similar to the present results, which give a positive correlation between Internet Penetration and MSME-GDP share ($r = .794$, $p = .001$), and Digital Economy Share is more strongly positively associated ($r = .960$, $p < .001$). This finding hence corroborates the role of digitalization as an important technological pillar for the economic performance of MSMEs, as highlighted by the framework. It is also very much in line with the Indian study conducted recently by Mittal, Sheetal and Soriya on the role of IT and digitalization in boosting the growth and competitiveness of Indian MSMEs.

Literature also backs up the notion that digitalization is a multidimensional phenomenon in the framework. The study uses not only Internet Penetration but also Digital Economy Share to create the Digitalization Index. It aligns with the **OECD (2021)**'s findings that digitalization of SMEs is complex and is about the combination of various technologies and organizational resources, not the implementation of a single technology. The framework thus expands the traditional approach to connectivity in a digital economic capability context.

The results of the regression, however, introduce a great qualification to this literature. This qualification is consistent with evidence that the effects of digitalization on SME innovation can be heterogeneous and modest, depending on firm size, the form of digitalization, and internal R&D activities **(Radicic and Petković, 2023**). Digitalization is strongly associated with MSME-GDP share, but, in the multivariate model, the Digitalization Index becomes negative and non-significant ($\beta = -.214$, $p = .140$). Rather, previous evidence suggests that the performance effects of digitalization depend on complementary organisational resources and capabilities (Eller et al., 2020).” Eller et al. found that digitalization was positively related to financial performance, but digital strategy and employee skills alone did not foster financial performance (**Eller *et al.* 2020**). Rather, it is proposed that the apparent digitalization–MSME relationship might be very much overlapping with the innovation dimension. This interpretation is consistent with the exceptionally high correlation between all technological indicators that were included in the model, and with the regression diagnostics that were obtained for both predictors, which are Tolerance = .129 and VIF = 7.730, respectively. Also, this interpretation is consistent with evidence that business-model innovation partially mediates the relationship between digital transformation and innovative SME performance (**Merín-Rodrigáñez *et al.* 2024**). Therefore, digitalization in the present study is proposed to be less of a standalone determinant and more of a part of a technological capability system of interconnected determinants. This interpretation is consistent with evidence that digitalization operates within a broader set of organisational resources and technological capabilities rather than functioning as an isolated determinant (**Eller *et al.* 2020; Radicic and Petković, 2023**).

This reading is especially consistent with recent research on SMEs in China. There is a systematic association between digital adoption, digital drive, and digital culture as they interact to influence innovation performance, and digital drive is the mediator between digital adoption and innovation performance. This is also supported by evidence that business-model innovation partially mediates the relationship between digital transformation and innovative SME performance (**Merín-Rodrigáñez *et al.* 2024**). The results of this research offer robust theoretical justification for the current framework's approach of linking Digitalization and Innovation and not considering them as separate technological processes. The current study thus builds on this literature from the firm-level innovation outcomes to the MSME-GDP performance relationship.

The pathway of innovation to MSME-GDP is the most supported from an empirical perspective. The coefficient of innovation is statistically significant and positive ($\beta = 1.184$, $t = 8.797$, $p < .001$), and the overall model is highly significant ($F(2,11) = 207.854$, $p < .001$) and accounts for 97.4% of the variance in the MSME-GDP share ($R^2 = .974$). This result confirms the general body of work that shows that innovation capability is associated with productivity, competitiveness, and economic performance (**Hall *et al.* 2009; Albis Salas *et al*. 2023**). **OECD (2021)** explicitly names digital technologies and data capabilities as enablers for product, process, marketing and organisation innovation by firms. The recent Chinese evidence is also of a positive link between digital transformation and innovation performance. As such, the critical innovation pathway identified in this study is a confirmation of the framework's hypothesis that technological resources gain economic relevance through their capacity to become innovative.

Another important area of commonality with previous research is in the comparison of India and China. The study reveals a significant difference in percentage of contribution of MSME-GDP which is 29.629% in India and 60.000% in China ($p < .001$). The Internet penetration rate, as well as the share of the digital economy, R&D, patent, and GII performance, are also significantly higher in China. This is in line with the main tenet of the framework, which calls for a consideration of the overall technological environment as a nation. The comparison is important as the **OECD (2021)** is signaling a close correlation between SMEs' digital adoption and their productivity, innovation and growth performance, and because it is also observed that smaller businesses often lack resources, skills and financing to fully leverage digital technologies.

The policy conditions, skills, finance, and infrastructure approach is also in line with the literature, because of the emphasis placed on these factors in the framework. Skills gaps, lack of internal resources, financial considerations, and lack of awareness are highlighted as key challenges for SMEs in digital transformation in **OECD (2021)** evidence. The present framework continues this argument by putting these enabling conditions below the technological pathway and linking them, finally, to MSME productivity, competitiveness and contribution to GDP (**Eller *et al.* 2020**). This is especially important to the convergence challenge in India, as it can be unrealistic to assume that MSMEs will be able to transform it into innovation and productivity without having the capacities to do so, in terms of organisation, finance and human resources.

The framework also extends the existing literature by explicitly connecting the technological capability to an India-China techno-economic divergence and possible convergence trajectory. While most of the literature focuses on the firm or country level of digital adoption or innovation or competitiveness of SMEs, the proposed framework relates these aspects to MSME-GDP contribution and finally to the strategic target of narrowing the India–China performance gap **(Singh *et al.* 2010; Radicic and Petković. 2023; Merín-Rodrigáñez *et al.* 2024**). The National MSME economic contribution is thus no longer a matter of whether SMEs use technology but whether technological capability is manifested in this contribution.

There are also two important qualifications. First, the framework still includes inflation as a macroeconomic context, but this inflation is not included in the current regression model. Hence, the present results do not provide empirical evidence in support of an inflation - MSME GDP relationship. Secondly, the very strong regression explanatory power must be viewed with a grain of salt due to the limited sample size (14 observations) and significant multicollinearity in the analysis. The factor analysis also reveals high common variance of technological indicators, but the small O-V ratio does not allow the strong factor to function as a definitive construct validation.

The results generally confirm the proposed framework, but specify the causal interpretation. The existing literature has established the role of digitalization and innovation in SME productivity, competitiveness, and innovation, and the current study establishes that the relationship of India–China MSME–GDP is well entrenched with these dimensions. The main empirical finding is that the digitalization coefficient is no longer significant once innovation is accounted for, while the coefficient for innovation remains significant. Hence, the study recommends that the journey toward techno-economic convergence in India should not just be towards digitisation but towards innovation and MSME performance in terms of productivity and competitiveness. This gives an empirically-based interpretation of the Digitalization–Innovation–MSME Performance framework.

9.3 Implications of Results (At Micro and Macro Levels)

The results at the micro level suggest that MSMEs need the capacity to bring technology into productive results. Digital connectivity doesn't necessarily mean more economic contribution. The enterprises require skills, financial

capacity, managerial abilities, an innovation-oriented attitude and organisational infrastructure to transform digital technologies into productivity, market access and competitiveness. The substantial innovation coefficient thus underlines the need to shift from the adoption of technology to product, process and organisational innovation. For individual MSMEs, this means a higher focus on R&D linkages, technology upgrading, digital business systems, data utilization and engaging in technologically-enabled value chains.

On a macro level, the findings show that the performance of MSMEs is related to the overall technological ecosystem. This suggests that technological capability can be an important structural dimension of China's higher contribution of MSMEs to the economy in terms of the GII and MSME-GDP share, which are quite strong in China compared to other countries. So, to improve MSME performance, an integrated policy environment of digital infrastructure and innovation support, along with skills, finance, technological upgrading, and integration into the supply chain, is required for India. This interpretation also reinforces the relevance of the Atmanirbhar Bharat interpretation: self-reliance will be more sustainable if domestic MSMEs have the technological and innovation resources to compete in the ever-changing, increasingly digital and knowledge-intensive markets.

The research also comes with an essential caveat on its techno-economic convergence claim. It highlights the differences between India and China in the performance of MSMEs and various technological indicators, with the conceptual framework based on these differences to identify conditions relevant for longer-term convergence. The study should not, therefore, state that there is statistical proof of convergence. Rather, it is the size and the technological dimensions of the current gap that the evidence suggests, and innovation, digital capability, and supporting institutional conditions are important areas through which India might be able to bridge that gap.

Lastly, the results should be interpreted within the context of the small sample size and multicollinearity. The R^2 of .974 is very high but, given the few observations (14) should not be taken as evidence of causality. Also, the factor analysis produced three components which accounted for 94.246% of the variance; however, the exploratory power is limited because of its very small observation-to-variable ratio. Overall, it was concluded that the evidence points towards a transition from a narrow macro-economic view of MSME performance to an integrated digitalization–innovation–MSME-GDP framework, and that the convergence is more of a technological, productive, and institutional than a mere numerical one, and is a key challenge facing India.

10. CONCLUSION

This study covers the India–China MSME-GDP nexus in an integrated Digitalization-Innovation-MSME Performance framework, which is a techno-economic interpretation of the contribution of MSMEs, rather than a macroeconomic one. The findings show that there is a significant gap in the economic contribution of MSMEs in the two countries. The mean MSME-GDP share ratio for India and China was 29.629% and 60.000%, respectively, and this difference was found to be statistically significant ($p < .001$). It can also be seen that China has significantly higher scores in key measures of the technological environment, such as Internet Penetration and Digital Economy Share, as well as measures of innovation-related performance. The findings here give empirical evidence for considering the differences in MSME economic performance in the broader technological and productive base in which MSMEs are operating.

The correlation results also confirm this holistic interpretation. Strong positive relationships were seen between MSME-GDP share and Internet Penetration ($r = .794$, $p = .001$) and Digital Economy Share ($r = .960$, $p < .001$), and also with R&D expenditure, resident patent filings and GII Score. These relationships show that the performance of the MSME economy is not only related to the number of enterprises, but also closely related to digitalization and innovation or technological capability. Concurrently, the strong intercorrelations between the technological indicators reveal that digitalization and innovation are part of an interrelated technological field.

The multiple regression analysis is the key empirical contribution of the study. The combined Digitalization and Innovation model was statistically significant and accounted for 97.4% of the total variance ($R^2 = .974$; $F(2,11) = 207.854$, $p < .001$). The individual predictors, however, must be carefully interpreted. When Innovation was added to the model, Digitalization was not significant ($\beta = -.214$, $p = .140$); however, Innovation was significant ($\beta = 1.184$, $p < .001$). A non-significant digitalization coefficient does not mean that digitalization decreases the performance of MSMEs. Instead, the strong overlap between digitalization and innovation, as revealed by the high VIF (7.730) and low tolerance (.129), suggests that it is challenging to distinguish the two independent factors statistically within the current sample. Thus, findings indicate that the value of digitalization for the economy is

tightly coupled to the ability of the MSMEs and the overall economy to transform digital resources into innovation, productivity, and competitiveness.

When combined, the evidence reinforces the suggested Digitalization-Innovation-MSME Performance framework and also provides a better understanding of this framework. The study does not imply that closing the gap in the performance of the MSME sector between India and China is only possible if digital technologies are adopted. Rather, there is evidence of an integrated pathway, where digital infrastructure and digital connectivity can offer an enabling technological foundation, and where innovation capability is especially critical in the process of turning technological resources into productive and economic outcomes. In the context of Indian MSMEs, this means that the policy goal should not be to promote digital adoption but to build R&D linkages, improve technology, managerial and digital capacity, access to financial resources, and organisation and participation in technologically enabled value chains.

The India–China comparison thus offers an important foundation to understand techno-economic divergence and the conditions necessary for longer-term convergence. But the study is not claiming to present any statistical evidence of the convergence of India and China. Instead, it pinpoints the current performance shortfall and points to the technological, productive, and institutional potential that can lead India to gradually narrow down the shortfall. Convergence thus does not mean only having a comparable numerical MSME-GDP contribution; it means having the capacity for digitalization, innovation, skills, financing, technological infrastructure, and an enabling institutional environment to boost the productivity and competitiveness of MSMEs. Similarly, this interpretation also brings in the practical relevance of Atmanirbhar Bharat as sustainable self-reliance of India will have to be achieved through the technological and innovation strength of domestic MSMEs to compete in the increasingly knowledge-intensive and digitalized markets.

Overall, the study provides an integrated empirical as well as conceptual understanding of MSME performance, which implies that the India-China difference can't be simply based on the economic contribution. The evidence shows that there is a shift from a macro-economic perspective of MSME performance to a techno-economic perspective, where digitalization and innovation, and the structural capabilities interact and influence the economic contribution of MSMEs. The framework can also serve as a guide for periodic benchmarking of digitalization and innovation indicators and to determine if progress in technological capabilities is followed by progress in MSME economic performance for policymakers. In this context, the framework will serve as a structured foundation for policy formulation to enhance support to India's MSMEs and their techno-economic convergence with better-performing economies in the long run.

11. LIMITATIONS

Several methodological limitations should be taken into consideration when interpreting the findings. The first is that the analysis only has 14 matched country-year observations (7 for India and 7 for China). The small sample significantly restricts the power of the statistics and the generalisability of the results. The regression model has a high explanatory value ($R^2 = .974$), but this does not imply causation, and the contribution of digitalization and innovation to MSME-GDP performance can be clearly estimated. The results are better thought of as comparative and exploratory evidence.

Second, the analysis is based on secondary country-level data, which limits the analysis of firm-level heterogeneity. The size, sector, location, managerial ability, access to finance, and technology adoption differences among the MSMEs cannot be examined directly. Thus, the relationships found are at the country level and should not be assumed to be relationships that apply to any specific MSME.

Third, there is a significant amount of multicollinearity between the Digitalization and Innovation predictors in the regression analysis. The VIF reported was 7.730 and the tolerance was .129, both of which suggest a high degree of overlap between the two dimensions. This restricts the regression model from separating out their independent impact, and this helps us understand why the bivariate coefficient of digitalization and MSME-GDP share is positive but becomes statistically insignificant when it is regressed together with innovation.

Fourth, Principal Component Analysis (PCA) should only be considered exploratory and not definitive construct validation. The observation-to-variable ratio is very small, and the factor structure is not reliable and generalizable despite the fact that the first three components explain 94.246% of the variance.

Finally, inflation is retained in the conceptual framework as a macroeconomic contextual condition but was not incorporated into the final regression model. Thus, from the present analysis, it is not possible to conclude any empirical evidence of an inflation–MSME-GDP relationship. More generally, the non-causal research design and the limited size of the sample and the secondary nature of the country-year data used make it difficult to interpret the relationships observed as causal impacts. Future studies would benefit from larger country panels, firm or sector-level data, and the inclusion of more control variables and longitudinal or panel-data analysis to explore the mechanisms of the relationship between digitalization, innovation, and MSME productivity and economic contribution.

REFERENCES

Albis Salas, N., Mora Holguin, H., Lucio-Arias, D., Sánchez, E. C., & Villarreal, N. (2023). Innovation and productivity in small and medium-sized enterprises: evidence from the Colombian manufacturing sector. *Journal of Small Business and Enterprise Development*, *30*(5), 1011-1034.

Ayyagari, M., Beck, T., & Demirgüç-Kunt, A. (2007). Small and medium enterprises across the globe. *Small Business Economics*, 29, 415–434.

Beck, T., Demirguc-Kunt, A., & Levine, R. (2005). SMEs, growth, and poverty: Cross-country evidence. *Journal of economic growth*, *10*(3), 199-229.

Bottelier, P. (2007). What India can learn from China and vice versa. *China & World Economy*, *15*(3), 52-69.

Chaudhuri, A. (2012). Creeping tiger, soaring dragon: India, China and competition in information technologies. *China & World Economy*, *20*(6), 1-28.

Eller, R., Alford, P., Kallmünzer, A., & Peters, M. (2020). Antecedents, consequences, and challenges of small and medium-sized enterprise digitalization. *Journal of business research*, *112*, 119-127.

Escoz Barragan, K., & Becker, F. S. R. (2025). Keeping pace with the digital transformation—exploring the digital orientation of SMEs: K. Escoz Barragan and FSR Becker. *Small Business Economics*, *64*(3), 1361-1385.

Fuller, D. B. (2014). Chip design in China and India: Multinationals, industry structure and development outcomes in the integrated circuit industry. *Technological Forecasting and Social Change*, *81*, 1-10.

Hall, B. H., Lotti, F., & Mairesse, J. (2009). Innovation and productivity in SMEs: empirical evidence for Italy. *Small business economics*, *33*(1), 13-33.

Hannan, A., Raj, S., Kumari, V., Fatma, R., & Alam, I. (2025). Driving industrial growth through MSMEs: Towards an India's vision of a $5 trillion economy. *The International Tax Journal*, 52(5), 1660–1670.

Hassan, S. S., Meisner, K., Krause, K., Bzhalava, L., & Moog, P. (2024). Is digitalization a source of innovation? Exploring the role of digital diffusion in SME innovation performance. *Small Business Economics*, *62*(4), 1469-1491.

Hung, S. W. (2009). Development and innovation in the IT industries of India and China. *Technology in Society*, *31*(1), 29-41.

Ipinnaiye, O., Dineen, D., & Lenihan, H. (2017). Drivers of SME performance: a holistic and multivariate approach. *Small Business Economics*, *48*(4), 883-911.

Isola, W. A., & Mesagan, E. P. (2019). MONETARY POLICY AND SMALL AND MEDIUM ENTERPRISES'PERFORMANCE IN NIGERIA 1970-2015. *UNILAG Journal of Business*, *5*(2), 56-68.

Khurana, I., Dutta, D. K., & Ghura, A. S. (2022). SMEs and digital transformation during a crisis: The emergence of resilience as a second-order dynamic capability in an entrepreneurial ecosystem. *Journal of business research*, *150*, 623-641.

Liu, B. (2025). How does digital transformation enhance enterprise technological innovation? Evidence from Chinese manufacturing listed companies. *Technology in Society*, *82*, 102884.

Long, P. D., & Anh, H. T. M. (2017). Innovation and productivity of Vietnamese small and medium enterprises: Firm level panel data evidence. *International Journal of Economics and Financial Issues*, *7*(3), 226-232.

Ma, L., Che, Y., & Chen, B. (2025). Digital Transformation and Innovation Performance of SMEs Mediating Role of Dynamic Capabilities and Moderating Effect of Environmental Uncertainty. *Journal of Beijing Institute of Technology (Social Sciences Edition)*, *27*(3), 153-166.

Martinravi, C. P., & Krishnasamy, K. (2025). Unleashing the potential of MSMEs in India: A strategic analysis. *Journal of the International Council for Small Business*, *6*(1), 123-143.
Meier, A., Eller, R., & Peters, M. (2025). Creating competitiveness in incumbent small-and medium-sized enterprises: A revised perspective on digital transformation. *Journal of Business Research*, *186*, 115028.
Merín-Rodrigáñez, J., Dasí, À., & Alegre, J. (2024). Digital transformation and firm performance in innovative SMEs: The mediating role of business model innovation. *Technovation*, *134*, 103027.
Mittal, R., Sheetal, & Soriya, S. (2025). Fostering competitiveness of Indian MSMEs through IT and digitalization. *Information Technology for Development*, *31*(4), 1066-1089.
Negi, C. S., & Kumar, S. (2024). ROLE OF MSMEs IN INDIAN ECONOMY. *RESEARCH JOURNAL OF COMMERCE*, *55*.
OECD (2021), *The Digital Transformation of SMEs*. OECD Studies on SMEs and Entrepreneurship, OECD Publishing, Paris. Retrieved from https://www.oecd.org/en/publications/the-digital-transformation-of-smes_bdb9256a-en/full-report/component-6.html
Orogbu, L., Onyeizugbe, C. U., & Chukwuma, E. (2017). Economic environment of small and medium scale enterprises: Implications on economic growth in Nigeria. *Journal of economics, management and trade*, *19*(4), 1-12.
Panneerselvam, R. (2004). *Research methodology*. PHI Learning Pvt. Ltd..
Radicic, D., & Petković, S. (2023). Impact of digitalization on technological innovations in small and medium-sized enterprises (SMEs). *Technological Forecasting and Social Change*, *191*, 122474.
Rahman P, M., Akhtar, S., Babar Khan, S., Khan, M., M, M., & Afjal, M. (2025). Driving efficiency through innovation: exploring dynamic capabilities in Indian manufacturing small and medium scale enterprise. *Cogent Business & Management*, *12*(1), 2485402.
Sagala, G. H., & Őri, D. (2024). Toward SMEs digital transformation success: a systematic literature review. *Information Systems and e-Business Management*, *22*(4), 667-719.
Singh, R. K., Garg, S. K., & Deshmukh, S. G. (2009). The competitiveness of SMEs in a globalized economy: Observations from China and India. *Management research review*, *33*(1), 54-65.
Syal, S. (2015). Role of MSMEs in the growth of Indian economy. *Global Journal of Commerce and Management Perspective*, 4(5), 40–43.