



Published By:
Green Publications Services Private LTD.

ISSN(Online):2455-6114
DOI: 10.69980/bma.v11i4.2529
Volume 11 Issue 04 December 2025

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International Journal for Research in Business, Management, and Accounting

Digital Transformation and Macroeconomic Performance: An Empirical Investigation of Digital Payment Expansion and Economic Growth in India

Article History:
Article Type: Review

Received Date: 06/10/2025
Acceptance Date:28/11/2025

Revised Date: 10/11/2025
Published Date:09/12/2025

Abstract

One of the most important structural changes of contemporary emerging economies is the spread of digital technologies. The present research is an attempt to analyze the relationship between digital payment expansion and macroeconomic growth in India using annual time series data from 2017-18 to 2024-25. The conceptual frameworks are based on the endogenous growth theory and transaction cost economics, and the real implementation of digital payment is the concrete indicator of the development of the digital ecosystem. Descriptive statistics reveal that the volume of digital transactions has grown exponentially from 2,070.89 crore transactions in 2017-18 to 22,831 crore transactions in 2024-25, a leap of over ten times in seven years. Conversely, real gross domestic product (GDP) growth was highly volatile, falling by 5.8 per cent during the COVID-19 pandemic (2020-21) and recovering strongly by 9.7 per cent in 2021-22. Bivariate correlations show a positive but not statistically significant relationship between total digital payment volume and annual real GDP growth ($r = .31$, $p = .454$, $N = 8$). This is also confirmed by a simple linear regression with digital payment volume explaining only 9.6% of the variance in GDP growth and not reaching conventional levels of significance ($F = 0.717$, $p = .454$). Such results do not diminish the economic importance of digitalization but rather demonstrate the insufficiency of a simple, one-metric analysis to understand complex, mediated relationships. The results show that digital transformation is not directly and immediately effective on the annual change in output but works through some indirect channels such as financial inclusion, productivity improvement, formalization and reduction in transaction costs. The research finds the benefits of sustainable development drawn from digitalization are dependent on further investments in human capital, cybersecurity frameworks, regulatory systems and inclusive infrastructure design.

Keywords: Digital Economy, Economic Progress, Electronic Payments, UPI, Financial Accessibility, Digital Public Infrastructure, India, Transaction Costs

1. Introduction

The global economy is undergoing a fundamental transformation, with the increasing integration of digital technologies into production, finance and management systems. This shift is widely known as the digital economy, which includes economic activities that are enabled or transformed by information and communication technologies (ICT), digital platforms, cloud computing, artificial intelligence, e-commerce, and data-driven governance systems (Goldfarb & Tucker, 2019). This shift has been theorized to be because digital technologies lower search, copying, moving, monitoring and verifying costs, thereby increasing market efficiency, democratizing access to information and fostering institutional innovation (Brynjolfsson & Hitt, 2000; Goldfarb & Tucker, 2019).

India is a particularly interesting case study of broad digital change in developing market economies. In the last decade, the country has developed a gigantic digital infrastructure through a series of connected institutional innovations, including the Aadhaar biometric identity system, the financial inclusion scheme, the Pradhan Mantri Jan-Dhan Yojana, ubiquitous mobile connectivity and the Unified Payments Interface (UPI), a real-time payment system that has fundamentally changed the architecture of retail financial transactions (Reserve Bank of India, 2024b). The clearest example of this is payment systems. The Government of India reported that the number of retail digital payment transactions increased from 7,176.90 crore in FY 2021-22 to 22,167.90 crore in FY 2024-25, with UPI comprising around 81% of the total retail digital payment volume in the latter period (Department of Financial Services, 2025). The Reserve Bank of India (RBI) Digital Payments Index has gone up to 465.33 in September 2024 from 100 in March 2018, which means that the resilience and efficiency of payment systems have increased almost five-fold (Reserve Bank of India, 2025b). But the macroeconomic implications of this shift reach far beyond the realm of payment methods. The estimated value of digital economy ventures is about INR 31.64 lakh crore (Ministry of Electronics and Information Technology, 2025), which is almost 11.74% of India's GDP for the fiscal year 2022-23 and providing employment to about 14.67 million people (Ministry of Electronics and Information Technology, 2025). It is projected to contribute more than 20 per cent of the national income by 2029-30, indicating its growing structural importance (Ministry of Electronics and Information Technology, 2025).

However, the empirical link between digitalization and macro-economic growth is still controversial and philosophically complex. Digital technologies can contribute to growth through several channels: reducing transaction costs, improving efficiency in resource allocation, enhancing financial inclusion, increasing labor productivity, stimulating entrepreneurial activities, providing better access to markets, improving provision of public services and supporting the formalization of economic activities (Brynjolfsson & Hitt, 2000; Goldfarb & Tucker, 2019). Digital payment systems can contribute to increased consumption and trade by providing faster and more efficient transactions (Shrivastava et al., 2026). These advantages, however, are not automatically or uniformly realized. Growth prospects of digital transformation are significantly reduced or biased by digital exclusion, lack of infrastructure, cybersecurity risks, privacy issues, digital illiteracy, platform monopolies and unequal access to technology (World Bank, 2025).

Therefore, the question for the present study is: How far the proliferation of the digital payment ecosystem in India is related to the macroeconomic growth and what are the channels through which the relationship is established? This paper presents an exploratory empirical study of this correlation by employing digital payment volume as an observable proxy of digitalization and placing the results in a broader theoretical framework of digital-driven development. The data of 8 yearly observations limits the scope of examination, naturally. It limits inferential capability but offers useful perspectives on the temporal evolution of India's digital economy.

2. Theoretical Framework and Literature Review

2.1 Theoretical Background of Digital Technologies and Economic Growth

The theoretical connection between the adoption of digital technologies and economic growth is primarily rooted in the theory of endogenous growth. The theory argues that technical progress rather than external factors is the main engine of long-run economic growth (Romer, 1990). In this sense, digital technologies are general purpose technologies that increase total factor productivity through capital deepening and efficiency gains. For example, Brynjolfsson and Hitt (2000) showed that the productivity effects of IT investment only occurred in the presence of complementary organizational change and human capital development, emphasizing the contextual nature of the technology-growth relationship. Goldfarb and Tucker (2019) have moved the discussion forward by identifying five economic costs that are always reduced by digital technologies: search costs, replication costs, transit costs, tracking costs, and verification costs. Such reductions can create substantial welfare and efficiency gains, especially in a developing country where such prices are often prohibitive barriers to market participation. For example, verification costs could be reduced by the use of digital identity systems, thus increasing access to credit for those previously unbanked, and search costs can be reduced through the aggregation of disparate local markets into wider national and global value chains.

2.2 Digital Payments, Financial Inclusion and Economic Activities

Payment systems are an integral part of financial infrastructure that reduces transaction costs, encourages savings, and helps allocate capital (Levine, 2005), according to the financial development literature. Digital payment systems further enhance this ability to conduct instant and inexpensive transactions that are free from geographical and time constraints. New data from India suggests the explosion in digital payments after the 2016 demonetization resulted in a huge increase in consumer spending. The projections suggest that a 10-percentage-point increase in the use of digital payments was associated with an estimated increase of 2.38% in monthly spending (Shrivastava et al., 2026).

The Reserve Bank of India (2024b) has clearly stated that the development of payment systems is an important component of financial inclusion and inclusive growth agenda. Digital transactions can decrease reliance on physical banking systems and offer formal financial services to rural and economically disadvantaged communities that have been historically left behind by the banking industry. This inclusion mechanism works through several channels: access to government transfers, promotion of digital savings, availability of transaction history for credit scoring and reduction of cash dependence in the informal economy.

2.3 Effect of Digital Public Infrastructure and Ecosystem

India's digital journey is a good example of the embryonic model of digital public infrastructure (DPI) where the government's supply of foundational systems (identity, payments, data interchange) creates the institutional environment for private sector innovation to flourish (World Bank, 2025). Aadhaar, Jan-Dhan bank accounts, mobile connection and UPI are interoperable and create network effects which enhance individual and collective benefits of each of the elements. The ecosystem model might be more inclusive and competition-neutral than the proprietary platform-centric systems that dominate in other regions (World Bank, 2025).

2.4 Empirical evidence and research gaps

However, the literature on digital payments, fintech acceptance and UPI penetration across different econometric lenses like cointegration analysis and vector autoregression models is plagued with several deficiencies (Shrivastava et al., 2026). First, the impact of the diffusion of digital payments on macroeconomic growth is integrated into a broad framework of the digital economy. Some papers incorporate intermediary transmission mechanisms. Secondly, most of the evidence available is based on high frequency or disaggregated data, therefore there is a relative lack of investigation on the macro-level link at annual frequency. Thirdly, endogenous problems in the technology-

growth dynamics where economic growth spurs technology adoption are often under-addressed. The aim of the current research is to overcome these shortcomings by presenting a theoretically grounded, exploratory study of the yearly relationship between the level of digital payments and gross domestic product growth and to explicitly acknowledge the limitations of aggregate correlation analysis in establishing causality.

3. Institutional Context: Digital Transformation in India

In the last decade, a layered framework of government initiatives, technological developments and institutional advancements have laid the foundation of the digital economy in India. The essentials are:

- The Digital India program was started in 2015 to develop the policy framework for broadband development, e-governance and electronics manufacturing.
- The Aadhaar architecture has delivered the identity layer needed for the authenticated delivery of digital services, providing unique biometric IDs to more than 1.3 billion people.
- The financial inclusion framework took off with the launch of the Pradhan Mantri Jan-Dhan Yojana in 2014, which brought over 500 million unbanked people into the fold of official bank account ownership.
- The Direct Benefit Transfer (DBT) system used these frameworks to transfer government subsidies and welfare payments directly into beneficiaries' accounts, thus reducing leakage and improving targeting effectiveness.

The system uses a payment system called the Unified Payments Interface (UPI) developed in 2016 by the National Payments Corporation of India. UPI has broken the traditional barriers to transactions by enabling instant interbank transfers 24x7 through mobile apps. In March 2024 alone, the system crossed 13 billion transactions, which indicates the rate of adoption (Reserve Bank of India, 2024a). The advent of digital payments has been aided by complementary setups such as the Bharat Interface for Money (BHIM), the RuPay card network and a budding fintech app ecosystem. Payments are just one part of Indian digital economy. Other components include e-commerce platforms, digital financing frameworks, cloud computing infrastructure, artificial intelligence applications, information technology and IT-enabled services (IT/ITES), and digitized government service delivery. Digital public infrastructure in India is a critical foundation for the development of the digital economy, with faster growth of digital-enabling sectors compared to the overall economy over the past decade (World Bank, 2025).

4. Research Design and Methods

4.1 Research Methodology and Scope

This research is based on quantitative, descriptive and analytical research design, using only secondary data. The empirical range extends from 2017-18 through 2024-25. This period is selected to capture the post-UPI surge in India's digital payment landscape and as it depicts significant macro-economic fluctuations including a dip during the COVID-19 pandemic and the subsequent rebound. The approach must be exploratory as the limitation of eight annual data does not allow for more sophisticated time-series econometrics but enables a rather extensive descriptive and bivariate inferential analysis.

The independent variable that is the volume of digital payment transactions is measured in terms of crores (10 million) of transactions. It is defined as the total yearly volume of digital payment transactions. The digital economy ranges several activities (e-commerce, cloud services, IT/ITES, digital governance) that do not have consistent standards of annual assessment. This variable is a tangible proxy of the more general digitalization phenomenon. We focus on the digital payment volume as a quantifiable behavioral outcome of digital infrastructure adoption that is reported consistently across authoritative sources.

The dependent variable is economic growth measured by the annual percentage change in real gross

domestic product at constant prices. This is the increase in economic output adjusted for inflation and is the standard macroeconomic

4.2 Data Sources

The information is from responsible and official sources. Information on digital payment has been collected from the Annual Reports of the Reserve Bank of India, Payment Systems Indicators and Publications of the Department of Financial Services. The data on real GDP growth considered the national accounts projections of the Ministry of Statistics and Program Implementation. The contextual data was also collected from the reports of Ministry of Electronics and Information Technology, World Bank assessments and scholarly peer reviewed articles.

4.3 Methods of Analysis

The evaluation process was carried out in several phases. Secondly, the study used frequency and trend analysis to depict the pattern of digital payment dissemination and GDP growth in the time frame. Secondly, distributional features of both variables were described by mean, median, standard deviation and range. Thirdly, Pearson product-moment correlation analysis was applied to measure the strength and direction of the linear relationship between digital payment volume and real GDP growth. Fourth, a simple linear regression analysis was conducted to examine predictive correlation, with real GDP growth as the dependent variable and digital payment volume as the independent variable. Comparative analysis was employed to contextualize the quantitative findings with the broader theoretical framework and existing literature. We must clearly recognize the limits of analysis. With $N = 8$, the statistical power to detect meaningful associations is severely limited. The analysis does not control macroeconomic factors (investment, consumption, exports, inflation, fiscal policy, external shocks) that simultaneously affect GDP growth. Moreover, correlation research is unable to identify the causation and does not control for the possible endogeneity of digital payment acceptance, where the cause of digitalization can be economic growth rather than the effect.

5. Results of Experiments

5.1 Digital Payments and Economic Growth: Trend Analysis

Year	Digital Payments (crore transactions)	Growth in Digital Payments (%)	Real GDP Growth (%)
2017-18	2,070.89		6.6
2018-19	3,133.58	51.32	6.5
2019-20	4,571.74	45.90	3.9
2020-21	5,553.82	21.48	-5.8
2021-22	8,839.08	59.15	9.7
2022-23	13,462.36	52.30	7.0
2023-24	18,736.50	39.18	8.2
2024-25	22,831.00	21.85	6.5

Note. Digital payment data compiled from payment statistics of Government of India and Reserve Bank of India. Growth rate of Real GDP data from Ministry of Statistics and Program Implementation.

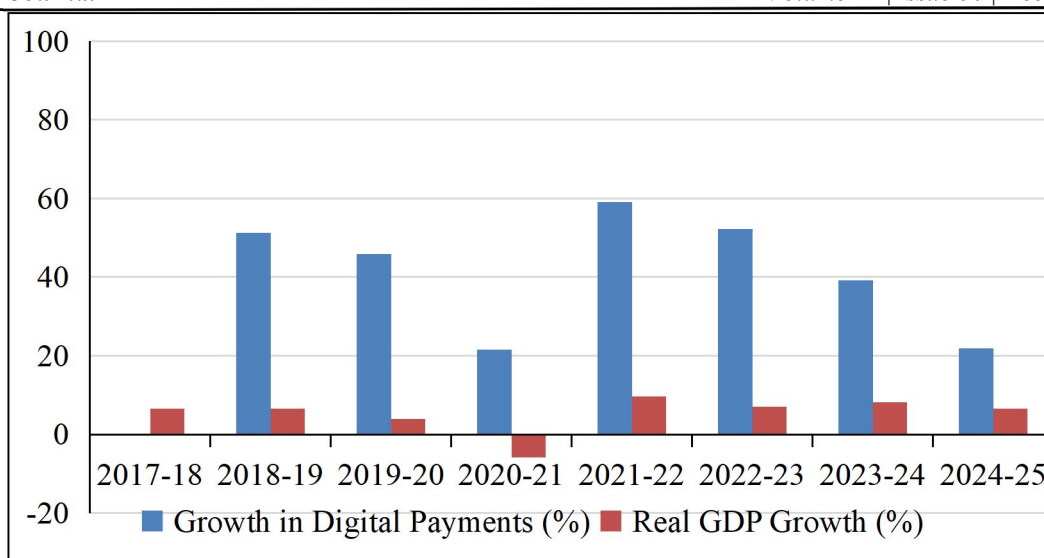


Figure 1; Trend Analysis of Growth in Digital Payments and Real GDP Growth

The tables 1 and other tables show the annual trends of digital payment volume and real GDP growth during the period 2017-18 to 2024-25. Results show a significant imbalance between the two variables. Digital transactions have grown phenomenally and steadily, increasing from 2,070.89 crore transactions in 2017-18 to 22,831.00 crore transactions in 2024-25, a compounded growth of over 1,000%. COVID-19 pandemic led to shift to contactless transactions and witnessed a phenomenal increase of 59.15% in 2021-22. Even in the pandemic year 2020-21, which saw a significant economic downturn, digital payments grew by a significant 21.48%, showing a separation of payment digitalization from prevailing macroeconomic circumstances.

National account projections implementation. Initial estimate. 2024-25. Meanwhile, growth of real GDP was also highly volatile. Growth had already slowed from 6.6% in 2017-18 to 3.9% in 2019-20 before crashing to -5.8% in 2020-21. It was the first occasion in the history of independent India that the economy contracted without being hit by conflict or natural calamity. Then, a V-shaped recovery took place in 2021-22, with a rise of 9.7 per cent, before falling to 6.5 per cent in 2024-25. This volatility stems from a confluence of pandemic-related disruptions, supply chain disruptions, inflationary pressures and global economic uncertainty.

5.2 Descriptive Statistics

Table 2; presents the descriptive statistics for both variables.

Variable	N	M	Median	SD	Minimum	Maximum
Digital Payments (crore)	8	10,900.87	7,196.45	7,824.15	2,070.89	22,831.00
Real GDP Growth (%)	8	5.33	6.55	4.79	-5.80	9.70

M = mean; SD = standard deviation.

The high standard deviation of 7,824.15 against the mean greatly influences the exponential growth path of the mean annual digital payment volume of 10,900.87 crore transactions. The median

(7,196.45) is significantly lower than the mean, confirming the right skew created by rapid growth in the following years. The median (6.55%) is a better indicator of the central tendency of the real GDP growth during non-crisis periods, and the average (5.33%) is negatively affected by the fall recorded in 2020-21. The standard deviation is 4.79, which indicates the extraordinary fluctuation caused by the pandemic shock.

5.3 Correlation Analysis

Table 3; reports the Pearson correlation coefficient between digital payment volume and real GDP growth.

Variables	r	p	95% CI
Digital payment volume ↔ Real GDP growth	.31	.454	[-0.52, 0.83]

Note. N = 8. CI = confidence interval.

A positive, but weak to moderate, linear relationship is indicated by the correlation coefficient of $r = .31$. However, the correlation is not statistically significant at the conventional $\alpha = .05$ level ($p = .454$). The 95% confidence interval is from -0.52 to 0.83. It crosses 0 and there is a lot of uncertainty because the sample size is small. Thus, this complete annual analysis does not permit us to reject the null hypothesis of no linear correlation.

5.4 Regression Analysis

A simple linear regression was run to determine whether the volume of digital payments is a significant predictor of the annual real GDP growth.

Table 4; presents the model statistics.

Statistic	Value
R	.31
R ²	.096
Adjusted R ²	-.055
F	0.717
p	.454
Regression coefficient (B)	0.000193
Constant	3.411

The model output R² of 0.096 indicates that the digital payment volume accounts for 9.6% of the variation in annual real GDP growth. The modified R² is negative (-.055). This means that the model is a poor fit to the data given the number of observations and predictors. The regression coefficient is positive ($B = 0.000193$), which means that with an increase in the digital payment transactions by one crore, there is an increase in the GDP growth by 0.000193 percentage points. However, the model does not reach statistical significance ($F(1, 6) = 0.717$, $p = .454$), suggesting that the association is statistically indistinguishable from zero.

6. Discussion

6.1 Interpreting the Nonsignificant Association

The empirical findings should be taken very seriously. The positive but statistically insignificant association between digital payment volume and year-on-year GDP growth does not mean that digitalization is economically insignificant. In contrast, the results reveal some methodological and theoretical problems that hinder the interpretability of aggregate bivariate analysis.

The digital economy is primarily much more than payment transactions. The large ecosystem includes the IT/ITES exports, improvements in e-commerce, cloud computing services, applications of artificial intelligence, efficiencies in digital governance and productivity gains in traditional

sectors through digital integration. But to reduce this multi-faceted transition to a single volumetric measure necessarily obscures the complex nature of the expanding influence of digitalization. The socio-economic importance of the digital economy is huge, and this is not only in the number of payments. The direct contribution of the digital economy to GDP is estimated at 11.74% based on official estimates (Ministry of Electronics and Information Technology, 2025).

Secondly, the effect of digitalization on growth will likely be mediated by a number of intermediary factors, rather than having a direct and immediate effect. The theoretical model suggests that the setting up of digital infrastructure leads to lower transaction costs, greater financial inclusion, greater productivity and more formalization which in turn affects investment, consumption, entrepreneurial activities and employment decisions that eventually lead to GDP growth. The existence of transmission delays and intermediate stages means that the annual correlations could be lower than the real structural link, especially if the measurement period only includes the first stages of the evolution of the ecosystem.

The problem of endogeneity is important. The adoption of digital payments is not random; rather, it is concentrated in areas and times with higher incomes, better connectivity, higher education, and a more sophisticated financial framework. A case in point is the COVID-19 era. The link between payment digitization and economic output growth was broken, leading to an increase in digital payments even as GDP contracted in 2020-21, due to behavioral changes (desire for contactless transactions and move to digital methods during lockdown). The episode suggests that the growth in transactions may be indicative of shifts in payment practices rather than real economic growth.

Fourth, the sample of eight observations does not have sufficient statistical power to detect relationships of the size usually found in macroeconomic studies of technological change. With few degrees of freedom, even moderate correlations may not be statistically significant. The 95% confidence interval for the correlation (0.52 to 0.83) is wide enough to include any mild negative to extremely strong positive true effect, making for a very imprecise point estimate.

6.2 Theoretical Consistency and Mechanisms

The literature clearly shows the theoretical frameworks in which digitalization could drive progress but with not enough statistical evidence. Transaction cost economics suggests that digital payments reduce time and money spent on monetary transactions, which increases the speed of cash flow for businesses and reduces friction in the consumer buying process (Goldfarb & Tucker, 2019). The theory of financial inclusion claims that the offering of digital financial services can increase access to formal banking services for historically excluded groups, enabling people to save money, access credit and manage risk (Levine, 2005). The endogenous growth theory (Romer, 1990) asserts that digital infrastructure generates positive externalities via knowledge spillovers, network effects, and innovation synergies that enhance total production.

India's special context allows for additional mechanisms. The channel of formalization is very important: digital transactions generate electronic audit trails that increase tax compliance, reduce informality and increase access to formal finance for micro, small and medium companies (MSMEs). The governmental efficiency channel operates by improving the accuracy of welfare distribution, reducing the waste of subsidies, and improving the delivery of public services. The entrepreneurship channel enables small businesses to reach national and international markets through e-commerce channels that traditional physical distribution channels cannot reach.

6.3 Comparative and contextual appraisal

The Indian experience is in line with worldwide research suggesting that benefits of digital transformation are more about continuous structural improvements rather than short-term yearly output fluctuations. Brynjolfsson and Hitt (2000) argued that there is a substantive lag in productivity improvements following investments in information technology, and that these investments need to be supplemented by corporate capital and improving skills. The World Bank (2025) evaluation of India's digital public infrastructure also suggests that it acts as a spur for

private-sector innovation, rather than a direct input into annual production functions.

The differing trajectories of the steady rise in digital payments and the volatile rise in GDP over the study period underscore an important policy-relevant distinction: digitalization should be viewed as a supportive environment that facilitates growth under conducive conditions, rather than a separate growth driver that is immune to macroeconomic fluctuations. The pandemic showed that even economies that have digitized quickly can be hit by supply disruptions, drops in demand and external shocks.

7. Policy Implications

Within the bounds of the theoretical and methodological framework used, the findings suggest several policy pathways to enhance the growth impact of digital economy in India.

7.1 Infrastructure Development

To keep broadband, mobile connections, and rural digital infrastructure affordable, public investment is needed. Digital integration has been achieved at significantly higher levels in urban centers and among the more wealthy socio-economic groups, but there are large geographic and socio-economic disparities. Universal connectivity is a must to ensure that digitalization brings about fair development rather than restrictive outcomes.

7.2 Human capital and digital skills

Digital access without skills to use it has little economic value. Online literacy initiatives should focus on rural populations, senior citizens, economically disadvantaged households, women and owners of micro, small and medium enterprises. Financial literacy is also important. To be able to use digital payment systems safely and effectively, people need to know about risks of fraud, how to manage passwords and how to seek redress.

7.3 Trust and Cybersecurity Framework

As economic activities migrate to the digital realm, cybersecurity vulnerabilities become a basic threat to the growth of the digital economy. To maintain public trust in digital financial entities, it is crucial to improve fraud detection algorithms, implement multi-factor authentication protocols, enhance consumer protection measures and strengthen institutional response capabilities. Such a severe security breach could seriously hinder adoption by risk-averse demographics.

7.4 Support to the Digitalization of MSMEs

Small businesses have their own set of challenges in adopting digital technologies such as technology costs, operational complexities and uncertainty of return on investment. Focused training programs that subsidize digital accounting and payment systems and support for e-commerce integration can accelerate the digital transformation of MSMEs. Micro, Small and Medium Enterprises (MSMEs) are the backbone of employment in India and digital assimilation of this industry has great growth implications.

7.5 Legal structures for competitive practices and data management

However, the concentration of market power in digital platforms raises competitive concerns which may, if ignored, offset the gains in consumer welfare brought about by digitization. Regulations must find a balance between encouraging innovation and a competitive market. At the same time, we need strong data protection laws and ethical standards for data use, to make sure the digital economy works within the limits of privacy and consent.

7.6 Additional Investments

The productivity gains from digitalization should go together with investments at the same time in education, healthcare, physical infrastructure, institutional integrity and governance capabilities.

The threat posed to the development of digital enclaves without the requisite economic transformation by digital infrastructure seen as a substitute for large-scale development investment.

8. Limitations and Future Research Directions

This study has several limitations, which limit the generalizability and strength of its findings. The main limitation is the small sample size (N=8 annual observations) which severely limits statistical power and makes it impossible to use sophisticated time series methods such as cointegration analysis, vector autoregression or autoregressive distributed lag models. Further studies should use higher frequency data (monthly or quarterly observations) to increase the sample considerably and to allow for more sophisticated dynamic analysis. Second, the size of digital transactions is a measurable, relevant but imperfect proxy for the complex digital economy. Further studies should develop more comprehensive measures of digitalization including composite indices such as RBI Digital Payments Index, internet penetration, online literacy rates, e-commerce value addition and IT/ITES production.

Third, the national-level grouping hides a significant regional diversity. Indian states are diverse with large differences in digital infrastructure, income per capita, financial inclusion, industry composition and institutional capability. We would have a panel dataset of states at the level of all 28 states and 8 union territories. This would allow us to get fixed-effects estimates controlling for time-invariant regional attributes and would give much better variation for causal analysis.

Fourth, the research does not tackle endogeneity by employing instrumental variable methods or natural experiments. Future studies could exploit policy shocks such as demonetization in 2016 or the COVID-19 pandemic as quasi-exogenous variations in digital adoption using difference-in-differences or synthetic control methods to better identify causal impacts.

Fifth, the analysis does not control for confounding macroeconomic variables. A multivariate model controlling investment rates, inflation, trade openness, fiscal policy, and human capital metrics would provide a more thorough test of the unique impact of digitalization on growth.

A particularly promising extension would involve specifying a state-level panel model:

$$GSDP_{it} = \alpha + \beta_1 Digitalization_{it} + \beta_2 Financial\ Inclusion_{it} + \beta_3 Internet_{it} + \beta_4 Investment_{it} + \mu_i + \lambda_t + \varepsilon_{it}$$

where i indexes states, t indexes years, μ_i represents state-specific fixed effects, λ_t represents year-specific fixed effects, and ε_{it} represents the error term. Such a specification would substantially advance beyond the exploratory national-level analysis presented here.

9. Conclusion

The digital payment transactions from 2,070.89 crore in 2017-18 to 22,831 crore in 2024-25 is evident of a rapid large-scale implementation of digital financial infrastructure. The importance of the digital economy in the economic structure of India can be gaged from the fact that it is projected to contribute 11.74% to the national GDP and provide employment to over 14 million people. Nevertheless, the empirical analysis carried out in this study fails to support the claims for a direct, statistically significant short-run causal relationship between the volume of total digital payment and annual real GDP growth. There is a trivial correlation ($r = .31$, $p = .454$) and the regression fit is weak ($R^2 = .096$), indicating that the growth of annual digital transactions does not explain current variations in macroeconomic performance.

This result is not to be interpreted as a decrease in the economic importance of digitalization. This emphasizes the complicated relationship between technology and progress, and the limitations of single-indicator analysis. Digital transformation probably works through several indirect channels: lowering transaction costs, improving financial accessibility, increasing productivity, promoting formalization and fostering innovation. These aggregate effects accumulate over long periods and are associated with additional investments in human resources, governance and physical infrastructure.

“Need for the policy is very much clear. India's aim should not just be to increase the volume of

digital transactions, but to build a holistic, safe, efficient and innovation-driven digital ecosystem. This means further investment in connectivity, digital skills, cyber security, MSME integration, competitive marketplaces and data management. Digitalization, when combined with holistic development frameworks, can be a critical enabler of India's productivity growth and structural transformation. It is neither necessary nor sufficient for short-term macroeconomic outcomes by itself.

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