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India's Digitalization–Inclusion Link: An Empirical Study

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Abstract
This study examines the extent to which India's technological innovation—captured through the Reserve Bank of India's Digital Payments Index (DPI)—has influenced national financial inclusion outcomes, measured through the Financial Inclusion Index (FI-Index). Although digitalization and inclusion are frequently discussed in Indian policy discourse, empirical evidence linking their national-level indices remains scarce. Using secondary data from RBI's annual DPI and FI-Index values for the period 2018–2023, the study quantifies the digitalization–inclusion relationship through trend analysis, Pearson correlation, and simple linear regression. While both indices show consistent growth over the period, 295.6%DPI expanded nearly 300% compared to FI-Index's 30% growth. Statistical results reveal a weak, negative, and non-significant correlation between DPI and FI-Index ($r = –0.316$, $p > 0.05$). Regression analysis similarly states that Digital Payments Index has no significant impact on Financial Inclusion Index.The findings suggest even though digital payments (as measured by the Reserve Bank of India's Digital Payments Index-DPI) increased strongly, that increase did not correspond to a similar increase in broad financial inclusion (as measured by the Financial Inclusion Index-FI-Index) highlighting the need for complementary interventions in digital literacy, service accessibility, behavioural awareness, and infrastructure quality. The study contributes macro-level empirical evidence using nationally standardized indices and provides insights relevant for India's forthcoming National Strategy for Financial Inclusion (NSFI) 2025–2030.

Keywords: *Digital Payments Index, Financial Inclusion Index, Digital Transformation, Inclusive Growth, RBI, India.*

1. Introduction

In the last ten years, technology has become a major force transforming India's economy. The build-up of digital infrastructure due to programs such as Digital India, authentication using Aadhaar, Pradhan Mantri Jan Dhan Yojana (PMJDY), and payment systems like Unified Payments Interface (UPI) has changed how people interact with banks and financial services. These efforts have lowered the cost of transactions, sped up banking operations, reduced leakages, and helped millions of people join the formal financial system. The Reserve Bank of India (RBI) has been central to this shift. By encouraging secure, affordable digital payment options and making financial inclusion a national goal, RBI has supported this transformation. Yet, despite these advances, financial inclusion is still uneven across India; many people face challenges because of low digital literacy, lack of infrastructure, economic inequalities, and social or behavioural barriers.

Since digital payments are now a major part of financial activity in India, it's important to check whether these digital advances as measured by RBI's Digital Payments Index (DPI) are actually helping expand real financial inclusion, measured via the Financial Inclusion Index (FI-Index). Although many believe digitalisation should lead to more inclusion, there are very few studies that analyze this relationship using national-level data.

This paper tries to fill this gap. It uses RBI's data from 2018 to 2023 to see whether improvements in digital payment infrastructure, more digital payment usage, and better performance have helped increase people's access to banking, their use of financial services, and the quality of those services. The findings are important especially as India prepares for its next phase of national financial-inclusion policy under NSFI 2025–2030.

2. Research Objectives:

1. To analyze trends in the Digital Payments Index and Financial Inclusion Index from 2018 to 2023.
2. To estimate the impact of DPI on FI-Index using statistical methods.
3. To interpret how digital transformation contributes to inclusive economic development.

3. Review of Literature

Technological Innovation and Inclusive Economic Growth

The relationship between technological innovation and inclusive growth is well-established in theory but uneven in empirical evidence. Foundational frameworks such as Rogers' Diffusion of Innovations and the Technology Acceptance Model (TAM) explain how users adopt digital systems, yet these models largely focus on micro-behaviour rather than macro-level financial outcomes.

Empirical studies in developing economies (Andrianaivo & Kpodar, 2011; Suri & Jack, 2016) consistently show that digital finance improves access, reduces transaction frictions, and enhances welfare. However, these studies rely heavily on mobile money penetration data and lack national digitalization metrics comparable across countries. Thus, the broader structural effect of nationwide digital infrastructure on inclusive economic growth remains under-examined. These studies establish the broader role of technology in promoting inclusion however they do not directly connect technological innovation with national-level digital payment indicators.

Digital Payments and Financial Inclusion

Existing literature identifies digital payments as a catalyst for inclusion by enhancing efficiency, transparency, and formal financial participation (Mehrotra & Yetman, 2021). RBI reports reinforce this by linking digitalization with improved access and usage.
However, most studies treat digital payments as isolated variables and seldom examine the aggregated digital payments ecosystem, as represented by the Digital Payments Index (DPI). Moreover, disparities in digital adoption across regions, genders, income groups, and rural–urban segments are acknowledged but rarely quantified in relation to the FI-Index. This results in a fragmented understanding of how digital payment intensity correlates with overall financial inclusion.

Despite these insights, the literature often treats digital payments and financial inclusion as parallel themes rather than integrated constructs. This signals the need to review India-specific evidence, where digital infrastructure and policy reforms have evolved rapidly.

India-Specific Evidence

Micro-level evidence from Aadhaar-enabled systems (Gulati & Chaturvedi, 2022), AEPS usage (Kumar & Gupta, 2020), and digital credit analytics (Maiti, 2022) demonstrates that India's digital public infrastructure significantly expands access and usage. While global studies highlight digital finance's impact on inclusion, India-specific evidence emphasizes unique policy-driven infrastructure developments. Together, these perspectives illustrate the potential but not guaranteed effect of digitalization on inclusive growth.

Research Gap:

The existing body of research does not fully explain the aggregate relationship between digital payment growth and financial inclusion at the national scale.. This gap motivates the present study, which systematically analyzes the DPI–FI relationship using RBI's official indices. This study addresses these gaps through empirical analysis and comparative trend analysis.

4. Hypotheses

H_0: There is no significant relationship between the Digital Payments Index and the Financial Inclusion Index.
H1: There is significant relationship between the Digital Payments Index and the Financial Inclusion Index.
H_0: Digital Payments Index has no significant impact on Financial Inclusion Index.

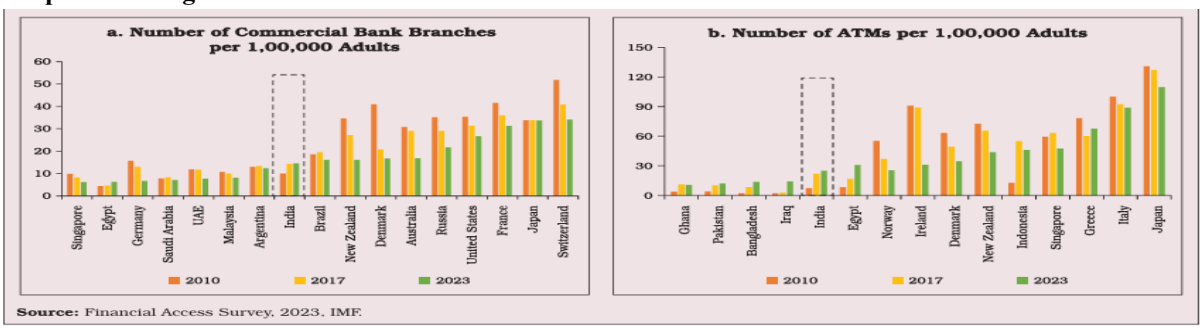
H1: Digital Payments Index has significant impact on Financial Inclusion Index.

5. Research Methodology

This study employs a quantitative approach to examine the relationship between the Digital Payments Index (DPI) and the Financial Inclusion Index (FI-Index) for the period 2018–2023. Growth percentages for both indices are first computed to observe year-on-year changes. Trend analysis is then conducted to compare the long-term movement of digital payment adoption and financial inclusion.

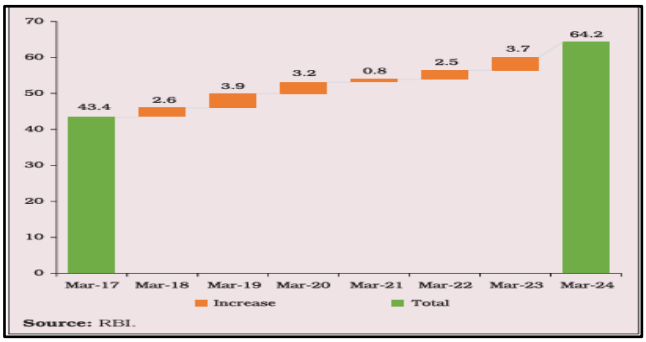
To assess the association between the two indices, Pearson's correlation coefficient is applied. Finally, simple linear regression is used to measure the impact of DPI on the FI-Index, providing an estimate of how changes in digital payment penetration influence financial inclusion outcomes. This sequential analytical framework ensures clarity, coherence, and alignment with the study's objectives.

Graph No 1 Progress of Financial Inclusion in Select Countries:



Graph No 1 illustrates India's progress in financial inclusion through trends in physical banking infrastructure compared with select countries over 2010, 2017, and 2023. Panel (a) shows that the number of commercial bank branches per 100,000 adults in India has increased steadily across the three periods, reflecting sustained expansion of formal banking access. This aligns with the RBI's observation that branch density in India increased nearly 1.5 times between 2010 and 2023, driven by initiatives such as PMJDY and the Financial Inclusion Plans. Panel (b) shows a similar upward trend in ATM penetration, with India registering consistent growth, though at a more moderate pace compared to advanced economies such as Japan, Italy, and Singapore. India nevertheless outperforms several developing countries including Bangladesh, Pakistan, and Ghana. While ATM density has expanded, its slower rise relative to branches may reflect India's rapid shift toward digital payment systems, particularly UPI and AEPS, reducing the demand for cash-based transactions. Above Graph presents the annual movement of the Digital Payments Index (DPI), highlighting the steady rise in digital transaction penetration over the study period. This upward trend provides the foundation for examining whether similar progress is reflected in financial inclusion.

Graph No 2 Reserve Bank's Financial Inclusion Index



Graph No 2 illustrates the steady improvement in India's Financial Inclusion Index (FI-Index) from March 2017 to March 2024, reflecting sustained progress in access, usage, and quality of financial services. The FI-Index, which stood at 43.4 in March 2017, has increased consistently each year, with notable increments of 2.6 points in 2018, 3.9 points in 2019, and 3.2 points in 2020. Growth slowed during the pandemic period, with a smaller increase of 0.8 points in 2021, but accelerated again thereafter, rising by 2.5 points in 2022 and 3.7 points in 2023. By March 2024, the FI-Index reached 64.2, indicating significant enhancement in financial inclusion over seven years. This upward trajectory reflects deeper account usage, stronger digital financial adoption, and improved service quality consistent with RBI's policy emphasis on digitalization, financial literacy, and expansion of formal financial services across rural and urban regions. When viewed together, Graphs 1 and 2 illustrate how both digitalization and inclusion have progressed in parallel, suggesting a possible relationship between the two indicators.

Table No1: India: Payment system indicator

	Volume (lakh)			Value (₹ crore)		
	2021-22	2022-23	2023-24	2021-22	2022-23	2023-24
1	2	3	4	5	6	7
1. Large Value Credit Transfers – RTGS	2,078	2,426	2,700	12,86,57,516	14,99,46,286	17,08,86,670
2. Credit Transfers	5,77,935	9,83,621	14,86,107	4,27,28,006	5,50,09,620	6,75,42,859
2.1 AePS (Fund Transfers)	10	6	4	575	356	261
2.2 APBS	12,573	17,834	25,888	1,33,345	2,47,535	3,90,743
2.3 ECS	-	-	-	-	-	-
2.4 IMPS	46,625	56,533	60,053	41,71,037	55,85,441	64,95,652
2.5 NACH	18,758	19,257	16,227	12,81,685	15,41,815	15,25,104
2.6 NEFT	40,407	52,847	72,640	2,87,25,463	3,37,19,541	3,91,36,014
2.7 UPI	4,59,561	8,37,144	13,11,295	84,15,900	1,39,14,932	1,99,95,086
3. Debit Transfers and Direct Debits	12,189	15,343	18,250	10,34,444	12,89,611	16,87,658
3.1 BHIM Aadhaar Pay	228	214	194	6,113	6,791	6,112
3.2 ECS Dr	-	-	-	-	-	-
3.3 NACH	10,755	13,503	16,426	10,26,641	12,80,219	16,78,769
3.4 NETC (linked to bank account)	1,207	1,626	1,629	1,689	2,601	2,777
4. Card Payments	61,783	63,325	58,470	17,01,851	21,52,245	24,23,563
4.1 Credit Cards	22,399	29,145	35,610	9,71,638	14,32,255	18,31,134
4.2 Debit Cards	39,384	34,179	22,860	7,30,213	7,19,989	5,92,429
5. Prepaid Payment Instruments	65,783	74,667	78,775	2,79,416	2,87,111	2,83,048
6. Paper-based Instruments	6,999	7,109	6,632	66,50,333	71,72,904	72,12,333
Total Digital Payments (1+2+3+4+5)	**7,19,768**	**11,39,382**	**16,44,302**	**17,44,01,233**	**20,86,84,872**	**24,28,23,799**
Total Retail Payments (2+3+4+5+6)	**7,24,689**	**11,44,065**	**16,48,234**	**5,23,94,049**	**6,59,11,490**	**7,91,49,461**
Total Payments (1+2+3+4+5+6)	**7,26,767**	**11,46,491**	**16,50,934**	**18,10,51,565**	**21,58,57,776**	**25,00,36,131**

Source: RBI.

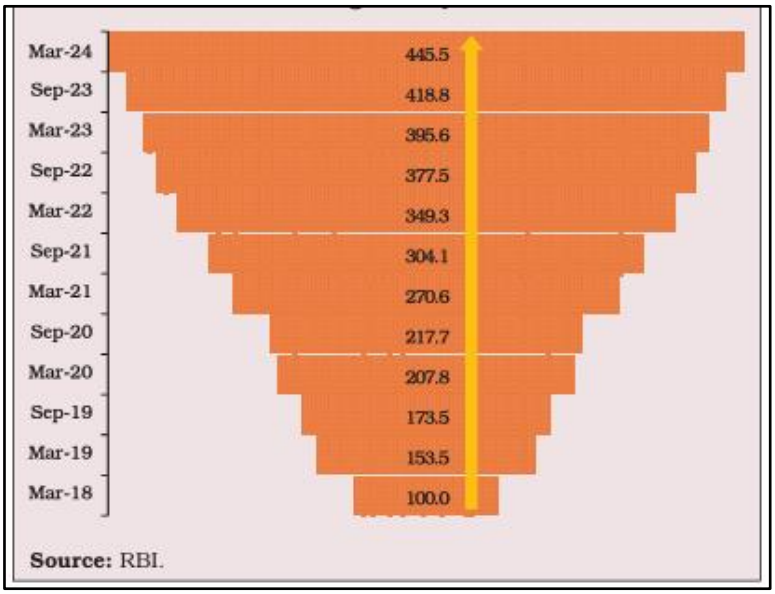
Above data provides a comprehensive overview of India's payment system activity across major digital and paper-based channels from 2021–22 to 2023–24, highlighting significant expansion in both transaction volume and value. The data show a sharp growth in total digital payments, with volumes rising from 7,19,766 lakh transactions in 2021–22 to 11,39,382 lakh in 2023–24, and corresponding values increasing from ₹17,44,01,233 crore to ₹24,28,23,799 crore, reflecting India's accelerating shift toward digital financial transactions. Among digital channels, UPI dominates, with its transaction volume nearly tripling from 4,59,561 lakh in 2021–22 to 11,31,295 lakh in 2023–24, and value rising from ₹84,15,900 crore to ₹1,99,95,086 crore, underscoring its central role in India's retail payments ecosystem. IMPS, NEFT, and NACH also exhibit steady growth in both volume and value, indicating wider adoption of interoperable real-time payments. Card payments and prepaid payment instruments show moderate but consistent expansion. In contrast, paper-based instruments continue to decline, with volumes dropping from 6,909 lakh to 6,632 lakh, reflecting a structural shift away from traditional modes. Overall, the table demonstrates India's strong digital payment momentum, driven by UPI, AEPS, and other interoperable systems, aligning with the broader RBI narrative of rapid digitalization and deepening financial inclusion. Table 1 summarizes the yearly values of DPI and FI-Index along with their calculated growth percentages. By

consolidating the numerical data underlying both graphs, the table reinforces the visual trends and provides a clearer basis for subsequent correlation and regression analysis.

Reserve Bank's Digital Payment Index

The Reserve Bank launched a composite Digital Payments Index in January 2021 It includes five parameters i.e. payment performance, consumer centricity, payment enablers, payment infrastructure (demand-side factors) and payment infrastructure (supply-side factors). Base year for the index is March 2018.

Graph No 3 Digital Payment Index



The graph above shows that the index has risen sharply over the years, reaching 445.5 at end-March 2024, compared with 395.6 a year earlier, driven primarily by significant improvements in payment performance and infrastructure. This steady upward movement demonstrates the rapid digitalisation of India's payment ecosystem and reflects increasing consumer adoption, wider availability of digital payment channels, and continuous strengthening of digital infrastructure nationwide. Overall, the chart underscores India's accelerating transition toward a robust, technology-enabled payment landscape supported by the Reserve Bank's policy and regulatory initiatives.

Analysis and Interpretations

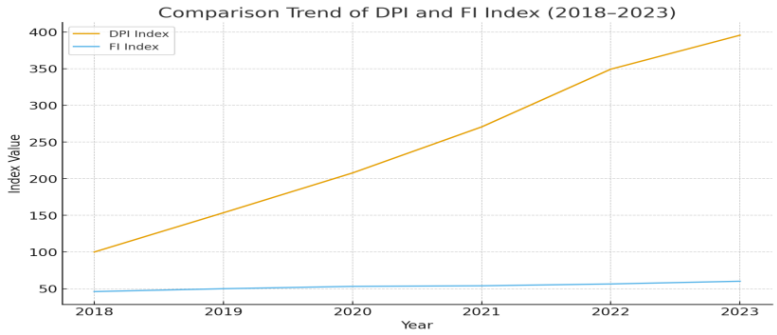
Table No 2:Combined Dataset for Statistical Analysis

Year	DPI	FII
2018	100.0	46.0
2019	153.5	49.9
2020	207.8	53.1
2021	270.6	53.9
2022	349.3	56.4
2023	395.6	60.1

Source: RBI Reports 24-25

Based on above analysis, consolidated data trends are plotted as below.

Graph No 4:



The trend analysis shows that financial inclusion growth is steady but slower growth**,** reflecting persistent barriers in access, usage, and service quality whereas we can see digital payment index is growing rapidly.The payment enablers, infrastructure, adoption, and performance metrics have lead to rapid growth in DPI whereas access, usage, and quality indicators of FI are not align with the growth of DPI.
Representing this growth in percentages:

DPI Growth (2018–2023): Growth=395.6−100/100 = 295.6%

FII Growth (2018–2023): Growth=60.1−46/46 =30.65%

This implicate that Digital payments grew 10× faster than financial inclusion.

Further in order to understand the relationship between DPI and FII a statistical test of correlation was applied in SPSS to test the hypothesis mentioned below:

H_0: There is no significant relationship between the Digital Payments Index and the Financial Inclusion Index.

Correlations

		FI INDEX	DPI INDEX
FI INDEX	Pearson Correlation	1	-.316
	Sig. (2-tailed)		.542
	N	6	6
DPI INDEX	Pearson Correlation	-.316	1
	Sig. (2-tailed)	.542	
	N	6	6

A Pearson correlation analysis was conducted to examine the relationship between the Digital Payments Index (DPI) and the Financial Inclusion Index (FI) for the period 2018–2023. The results revealed a weak negative correlation ($r = –0.316$), Also the p-value (.542) indicates that the correlation is not statistically significant.Because $p > 0.05$, we fail to reject the null hypothesis.This indicates that changes in the Digital Payments Index are not meaningfully associated with changes in the Financial Inclusion Index during the study period. Therefore, the null hypothesis of *no significant relationship* is retained. It was found that the relationship between DPI and FI is weak and negative.

Though the growth trends of Digital payments grew 10× faster than financial inclusion trend analysis and correlation test signifies that there is no significant relationship between the Digital Payments Index and the Financial Inclusion Index.

In addition to relationship the impact of Digital Payments Index on Financial Inclusion Index was also studied for which another null hypothesis was set as **H0:** Digital Payments Index has no significant impact on Financial Inclusion Index.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.316[a]	.100	-.125	6513.8476

A linear regression was estimated with the Digital Payments Index (DPI) as the dependent variable and the Financial Inclusion Index (FII) as the sole predictor. The model yielded $R = 0.316$, $R^2 = 0.10$ and an adjusted R^2 of –0.125, indicating that only about 10 % of the variation in DPI is explained by FII in the sample, and that after adjusting for model degrees of freedom the explanatory power is effectively below that of the null model. The coefficient on FII was $\beta = 0$ (non-significant), indicating no statistically meaningful linear effect of DPI on FII. Therefore, we conclude that in this dataset there is *no evidence* that Digital Payments Index has significant impact on Financial Inclusion Index. Therefore, we retain the null hypothesis and conclude that the Digital Payments Index does not have a significant impact on the Financial Inclusion Index.

6. Results and Discussions

1. The Digital Payments Index (DPI) recorded substantial growth over the study period, rising from 100.0 in 2018 to 395.6 in 2023, reflecting a large expansion in digital payment infrastructure, adoption and performance.The Financial Inclusion Index (FI-Index) also increased during the same period, from 46.0 in 2018 to 60.1 in 2023**,** indicating steady improvements in access, usage and quality of financial services.Thus, both indices exhibit an upward trajectory between 2018 and 2023, with DPI showing a notably steeper rise relative to the FI-Index.Resulting DPI registered strong growth, but FI-Index improved at a modest pace.
2. A Pearson correlation analysis ($N = 6$) produced a correlation coefficient of $r = -0.316$ with a two-tailed significance value of $p = 0.542$**.**The observed correlation is weakly negative and not statistically significant at conventional levels ($p > 0.05$).
3. Although both indices increased over time, the Pearson result indicates no evidence of a significant linear association between annual DPI values and annual FI-Index values in the 2018–2023 sample.The weak negative coefficient suggests that, for the sampled years, higher DPI values do not translate directly or immediately into higher FI-Index values in a simple linear manner.
4. The strong growth in DPI over time confirms that India has made considerable progress in digital payment adoption, infrastructure, and performance.The more modest rise in FI-Index shows that financial inclusion is improving but not at the same blistering pace.The lack of a statistically significant correlation and the non-significant regression coefficient together suggest that digital payments expansion (DPI) did not, in a straightforward linear fashion, drive financial inclusion (FII) over the years examined.
5. The divergence in paths fast DPI growth vs. slower FI-Index increase indicates a potential "decoupling" of digital payments growth from inclusive financial development. While payment systems are scaling rapidly, these gains are not directly translating into proportionate improvements in financial inclusion metrics.
6. Despite the rapid expansion of digital payments in India, as reflected in the steep rise of the DPI, this growth has not automatically translated into proportional improvements in financial inclusion, particularly in access, usage, and service quality. Several factors contribute to this divergence, including gaps in digital literacy, behavioural barriers, and uneven infrastructure across regions. These persistent constraints indicate that technological advancement alone is insufficient to achieve inclusive financial development. Therefore, policymakers must complement the expansion of digital payment systems with targeted interventions, such as digital literacy programs, rural outreach initiatives, service quality enhancement, and behavioural nudges, to ensure that the benefits of digitalization are effectively realized across all segments of the population.

7. Conclusions

Between 2018 and 2023, India experienced rapid growth in digital payments, as reflected by the steep rise in DPI, but this did not result in a proportionate increase in the FI-Index. Statistical analysis confirms a weak, non-significant association between the two indices, demonstrating that digital payment expansion alone is insufficient to drive inclusive financial development. Persistent challenges—such as digital literacy gaps, uneven infrastructure, and behavioral barriers—must be addressed through complementary policy interventions. Strengthening access, improving service quality, and promoting targeted digital literacy programs are essential to ensure that technological growth translates into broad-based financial inclusion. These findings directly address the research gap identified in this study and provide actionable guidance for India's forthcoming NSFI 2025–2030.

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