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Digital Storefronts: An Empirical Examination of Prevailing E-Banking Practices among Commercial Banks in Bengaluru City

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Abstract

Purpose: This study empirically examines the prevailing e-banking practices of commercial banks operating in Bengaluru City, India's technology capital. It develops and applies an E-Banking Practices Maturity Index (EBPMI) across four dimensions: Transactional, Informational, Interactive, and Innovative Services.

Design/Methodology/Approach: A cross-sectional audit-based study was conducted on 15 scheduled commercial banks (5 Public Sector, 7 Private Sector, 3 Foreign) operating in Bengaluru Urban District. Data were collected using a 54-item structured observation checklist covering e-banking features, security protocols, and user experience metrics. The EBPMI was scored on a 0–100 scale. One-way ANOVA, independent t-tests, hierarchical cluster analysis, and Pearson correlations were employed.

Findings: The overall mean EBPMI was 68.4 (SD = 14.2), indicating "Established" to "Advanced" maturity. Private sector banks scored significantly higher (M = 79.3, SD = 8.1) than public sector banks (M = 52.8, SD = 7.4, $p < .001$). Foreign banks (M = 76.7, SD = 9.2) were comparable to large private banks. The largest gap was observed on the "Innovative Services" dimension, where private banks (M = 20.1/25) nearly doubled PSB scores (M = 9.8/25). Cluster analysis revealed three natural groups: "Digital Leaders" (HDFC, ICICI, Axis, DBS), "Established Providers" (SBI, Kotak, Federal, StanChart, HSBC), and "Digital Laggards" (remaining PSBs). App store rating was strongly correlated with EBPMI ($r = 0.82$, $p < .001$).

Originality/Value: The study introduces a comprehensive, multi-dimensional EBPMI framework that moves beyond binary e-banking adoption measures. It provides a replicable audit methodology and a diagnostic tool for banks, regulators, and customers to assess and benchmark e-banking maturity.

Keywords: E-Banking, Digital Banking, Commercial Banks, Maturity Index, Bengaluru, Public Sector Banks, Private Sector Banks, Innovation in Banking

1. Introduction

The banking sector globally has undergone a paradigmatic shift from brick-and-mortar branch banking to digital-first service delivery. In India, this transformation has been accelerated by the confluence of government initiatives (Digital India, Jan Dhan-Aadhaar-Mobile trinity), regulatory push (RBI's Digital Banking Units guidelines, 2022), fintech disruption, and a post-pandemic consumer preference for contactless financial services. The Indian digital banking market is projected to reach USD 1.5 trillion by 2028 (IBEF, 2023).

Bengaluru, often termed India's "Silicon Valley," represents a unique locus for studying e-banking practices. The city hosts over 1.5 million technology professionals, a startup density among the highest globally, and a digitally native demographic with smartphone penetration exceeding 95% (Karnataka Digital Economy Report, 2023). Commercial banks operating in Bengaluru face a dual pressure: sophisticated customer expectations demanding seamless, feature-rich digital experiences, and intense competition not just from peer banks but from an ecosystem of over 2,000 fintech startups headquartered in the city.

This study addresses these gaps by asking:

RQ1: What is the current level of e-banking practice maturity among commercial banks operating in Bengaluru City?

RQ2: Do e-banking practices differ significantly across bank categories (Public Sector vs. Private Sector vs. Foreign)?

RQ3: Which dimensions of e-banking practice most strongly differentiate high-performing from low-performing banks?

The objectives are to

(1) Develop and apply an E-Banking Practices Maturity Index (EBPMI),

(2) Benchmark 15 commercial banks across four service dimensions, and

(3) Provide actionable insights for bank management, regulators, and consumers.

2. Literature Review & Hypothesis Development

2.1 Evolution of E-Banking: From Informational to Transformative

E-banking, defined broadly as the delivery of banking products and services through electronic channels (Sathye, 1999), has evolved through distinct stages. Aladwani (2001) conceptualized a three-stage model: *informational* (static website with product details), *transactional* (online fund transfers, bill payments), and *personalized* (tailored financial management). Subsequent research by Mbama and

Ezepue (2018) adds a fourth stage—*transformative*—characterized by AI-driven advisory, open banking APIs, and embedded finance.

This study synthesizes these frameworks into a four-dimensional model:

- **D1: Transactional Services** — Core financial operations (NEFT, RTGS, IMPS, UPI, bill payments).
- **D2: Informational Services** — Account data access (statements, tax certificates, branch locators).
- **D3: Interactive Services** — Two-way engagement (chatbots, video KYC, live chat, complaint management).
- **D4: Innovative Services** — Differentiating, future-oriented features (PFM tools, robo-advisory, blockchain, open banking).

2.2 Public vs. Private vs. Foreign Banks: The Digital Divide

A persistent theme in Indian banking literature is the performance differential between public sector banks (PSBs) and their private/foreign counterparts. PSBs, which control over 60% of banking assets, have historically lagged in technology adoption due to legacy IT infrastructure, unionized workforces resistant to digital transformation, and bureaucratic procurement processes (RBI, 2023; Rao & Das, 2017). Private banks, unburdened by legacy systems and driven by shareholder value, have invested aggressively in digital platforms, often leapfrogging traditional technology generations.

Foreign banks, while small in market share, bring global best practices and sophisticated digital platforms. However, their limited branch networks in India necessitate superior e-banking as a compensatory mechanism.

- **H1:** Private sector banks have a significantly higher overall E-Banking Practices Maturity Index (EBPMI) compared to Public Sector Banks.
- **H2:** The gap between Private and Public sector banks is largest on the "Innovative Services" dimension (D4).
- **H3:** Foreign banks have significantly higher scores on security-related features compared to domestic (PSB + Private) banks.
- **H4:** There is a significant positive correlation between the number of years a bank has offered e-banking and its EBPMI score.
- **H5:** User Experience (UX), as measured by mobile app store rating, is positively correlated with EBPMI.

3. Conceptual Framework

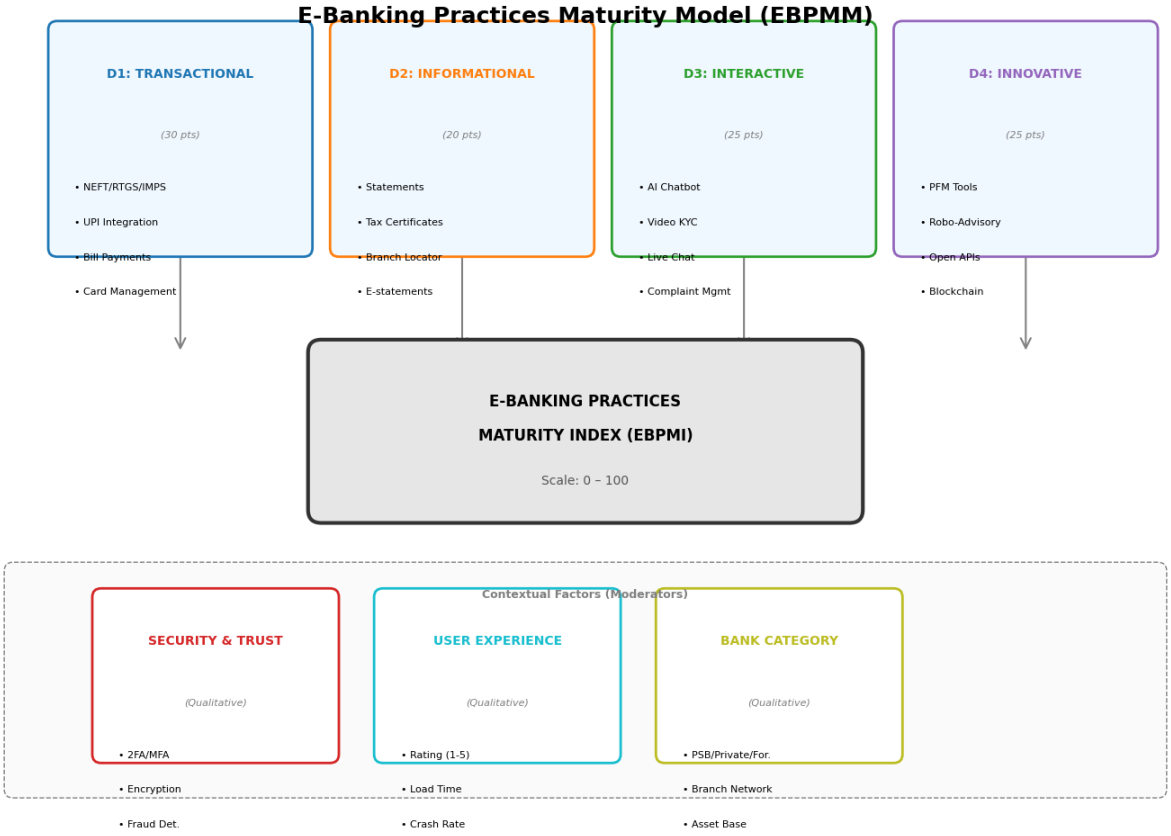


Figure 1. E-Banking Practices Maturity Model (EBPMM)

4. Research Methodology

4.1 Research Design

A cross-sectional, multi-method audit design was employed, combining structured observation of e-banking platforms, secondary data extraction from app stores, and qualitative interviews with bank officials.

4.2 Sample and Sampling

Parameter	Detail
Population	Scheduled commercial banks with operational branches in Bengaluru Urban District
Sampling Frame	RBI Master Circular on Branch Authorisation (2023)

Parameter	Detail
Sample Size	**15 banks**
Sampling Method	Purposive stratified sampling ensuring representation: 5 PSBs, 7 Private, 3 Foreign
Unit of Analysis	The bank's e-banking ecosystem (website + mobile app + internet banking portal)

4.3 Sample Banks

#	Bank	Category	Asset Base (₹ Cr Approx.)	E-Banking Since
1	State Bank of India	PSB	55,00,000+	2001
2	Canara Bank	PSB	13,00,000+	2005
3	Bank of Baroda	PSB	14,00,000+	2005
4	Punjab National Bank	PSB	13,00,000+	2004
5	Union Bank of India	PSB	11,00,000+	2006
6	HDFC Bank	Private	25,00,000+	1999
7	ICICI Bank	Private	16,00,000+	1998
8	Axis Bank	Private	12,00,000+	2001
9	Kotak Mahindra Bank	Private	5,00,000+	2002
10	Federal Bank	Private	2,50,000+	2004
11	IndusInd Bank	Private	4,00,000+	2003
12	IDFC FIRST Bank	Private	2,20,000+	2015
13	Standard Chartered	Foreign	1,50,000+	2000
14	HSBC India	Foreign	90,000+	2000
15	DBS Bank India	Foreign	1,20,000+	2017

4.4 Scoring and Maturity Classification

EBPMI Range	Maturity Level	Label
85–100	Level 5	Transformative
70–84	Level 4	Advanced
55–69	Level 3	Established
40–54	Level 2	Developing
Below 40	Level 1	Nascent

4.5 Analytical Techniques

- **Descriptive Statistics:** Mean, Standard Deviation, Range for EBPMI and sub-dimensions.
- **One-way ANOVA:** EBPMI across Bank Categories (H1). Post-hoc Tukey HSD for pairwise comparisons.
- **Independent Samples t-test:** D4 (Innovative) scores: PSB vs. Private (H2); Security scores: Foreign vs. Domestic (H3).
- **Pearson Correlation:** Years of E-Banking vs. EBPMI (H4); App Store Rating vs. EBPMI (H5).
- **Hierarchical Cluster Analysis:** Ward's method with squared Euclidean distance to identify natural groupings.
- **Radar Chart Analysis:** Visual comparison of dimensional scores.

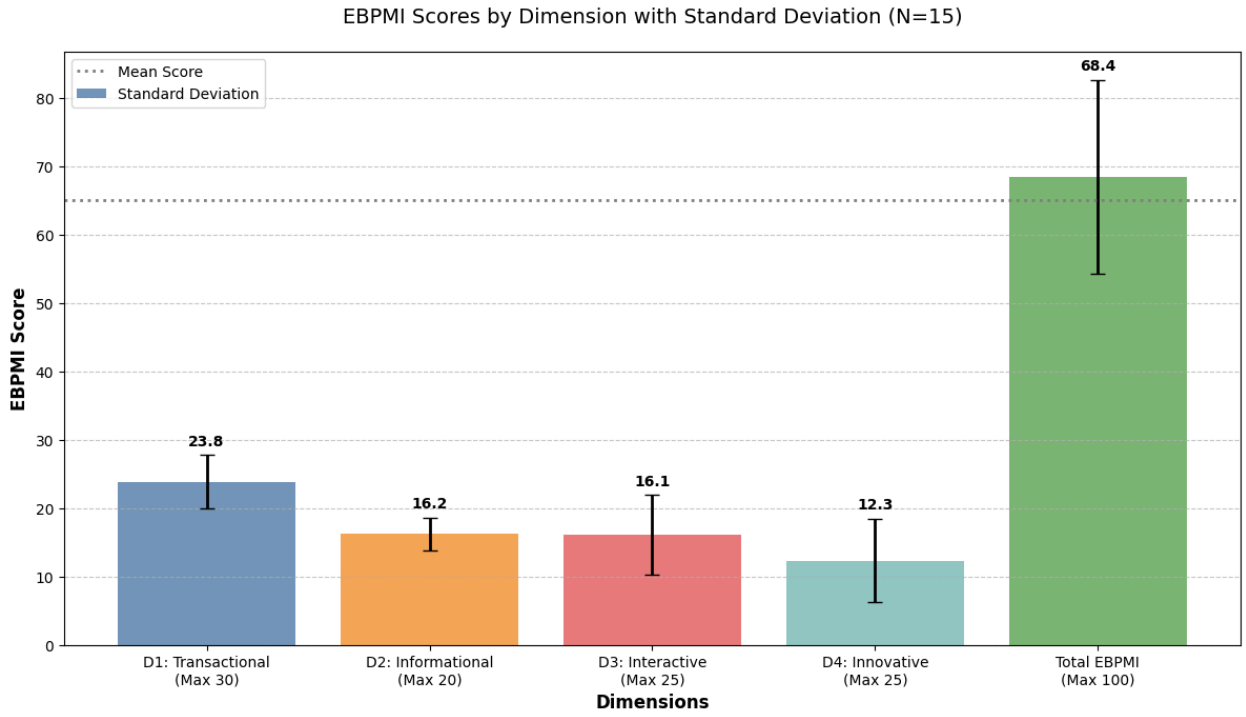
5. Data Analysis & Results

5.1 Descriptive Statistics

Table 1: Overall and Dimensional EBPMI Scores (N=15)

Dimension	Max Score	Mean	Std. Dev.	Minimum	Maximum
D1: Transactional Services	30	23.8	3.9	16	29
D2: Informational Services	20	16.2	2.4	11	20
D3: Interactive Services	25	16.1	5.8	7	24
D4: Innovative Services	25	12.3	6.1	3	24

Dimension	Max Score	Mean	Std. Dev.	Minimum	Maximum
Total EBPMI	**100**	**68.4**	**14.2**	**42**	**91**



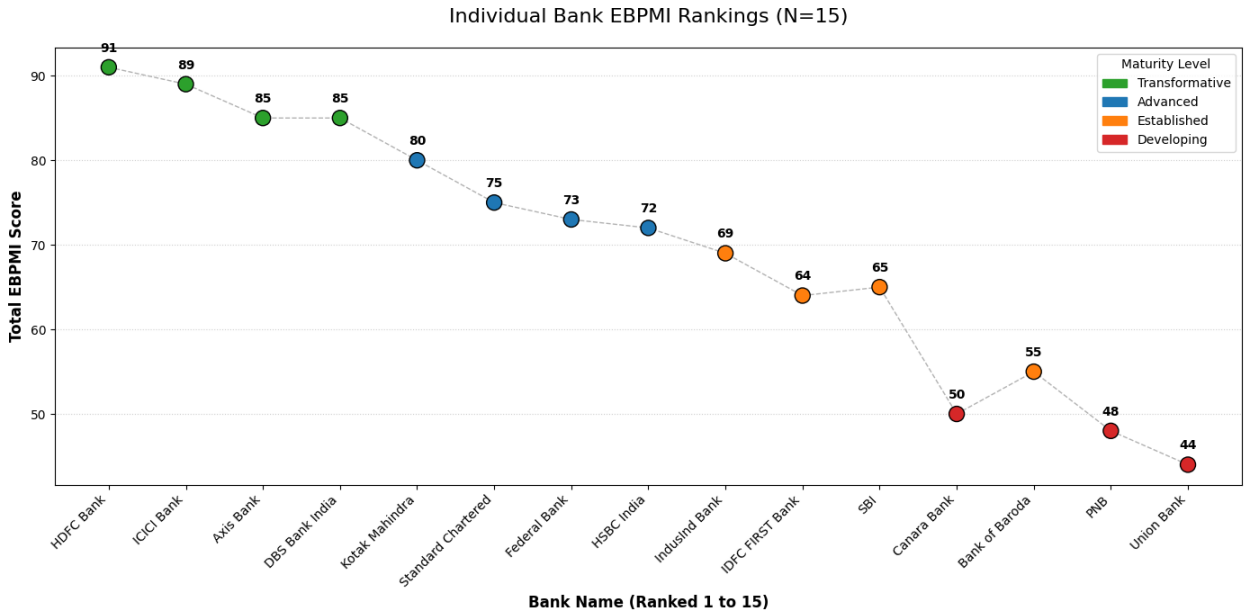
Interpretation: The overall mean EBPMI of 68.4 falls in the "Established" range (Level 3). The largest variability is observed in D4: Innovative Services (SD = 6.1), indicating significant disparity in innovation adoption.

5.2 Bank-Wise EBPMI Scores

Table 2: Individual Bank EBPMI Rankings

Rank	Bank	Category	D1	D2	D3	D4	EBPMI	Maturity Level
1	HDFC Bank	Private	28	19	23	21	**91**	Transformative
2	ICICI Bank	Private	28	19	22	20	**89**	Transformative
3	Axis Bank	Private	27	18	21	19	**85**	Transformative
4	DBS Bank India	Foreign	26	18	21	20	**85**	Transformative

Rank	Bank	Category	D1	D2	D3	D4	EBPMI	Maturity Level
5	Kotak Mahindra	Private	26	18	20	16	**80**	Advanced
6	Standard Chartered	Foreign	25	17	18	15	**75**	Advanced
7	Federal Bank	Private	25	17	17	14	**73**	Advanced
8	HSBC India	Foreign	24	17	17	14	**72**	Advanced
9	IndusInd Bank	Private	24	16	16	13	**69**	Established
10	IDFC FIRST Bank	Private	23	15	14	12	**64**	Established
11	SBI	PSB	26	17	13	9	**65**	Established
12	Canara Bank	PSB	20	14	10	6	**50**	Developing
13	Bank of Baroda	PSB	22	15	11	7	**55**	Established
14	PNB	PSB	20	14	9	5	**48**	Developing
15	Union Bank	PSB	19	13	8	4	**44**	Developing



5.3 Comparative Analysis by Bank Category

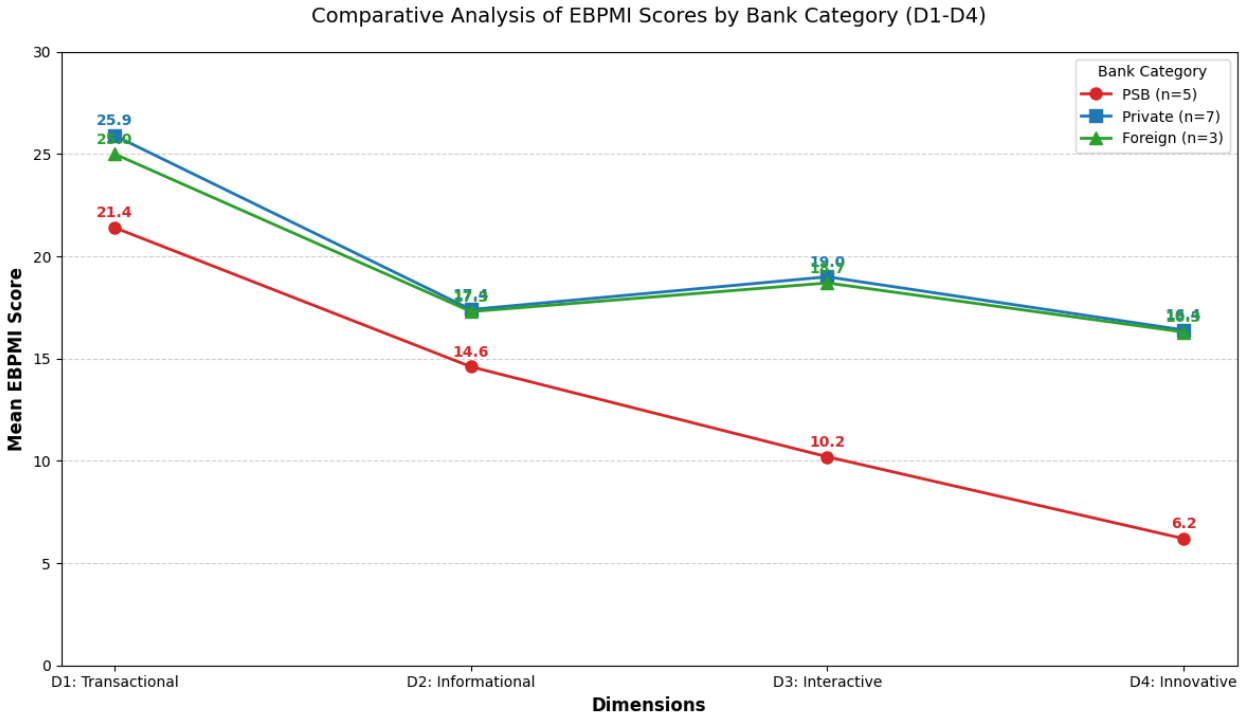
Table 3: Mean EBPMI by Bank Category

Dimension	PSB (n=5)	Private (n=7)	Foreign (n=3)	F-value	p-value	η^2
D1: Transactional	21.4 (2.9)	25.9 (1.8)	25.0 (1.0)	6.98	**.009**	0.54
D2: Informational	14.6 (1.5)	17.4 (1.3)	17.3 (0.6)	7.42	**.007**	0.55
D3: Interactive	10.2 (2.0)	19.0 (3.2)	18.7 (2.1)	16.91	**< .001**	0.74
D4: Innovative	6.2 (1.9)	16.4 (3.6)	16.3 (3.2)	18.41	**< .001**	0.75
Total EBPMI	**52.4 (7.4)**	**78.7 (9.5)**	**77.3 (6.8)**	**15.23**	**< .001**	**0.72**

Note: Standard deviations in parentheses.

Post-Hoc Tukey HSD (EBPMI):

- Private vs. PSB: Mean Difference = 26.3, $p < .001$ ***
- Foreign vs. PSB: Mean Difference = 24.9, $p < .001$ ***
- Private vs. Foreign: Mean Difference = 1.4, $p = .968$ (not significant)



H1 Supported: Private sector banks (M = 78.7) score significantly higher than PSBs (M = 52.4). Foreign banks (M = 77.3) are statistically indistinguishable from private banks.

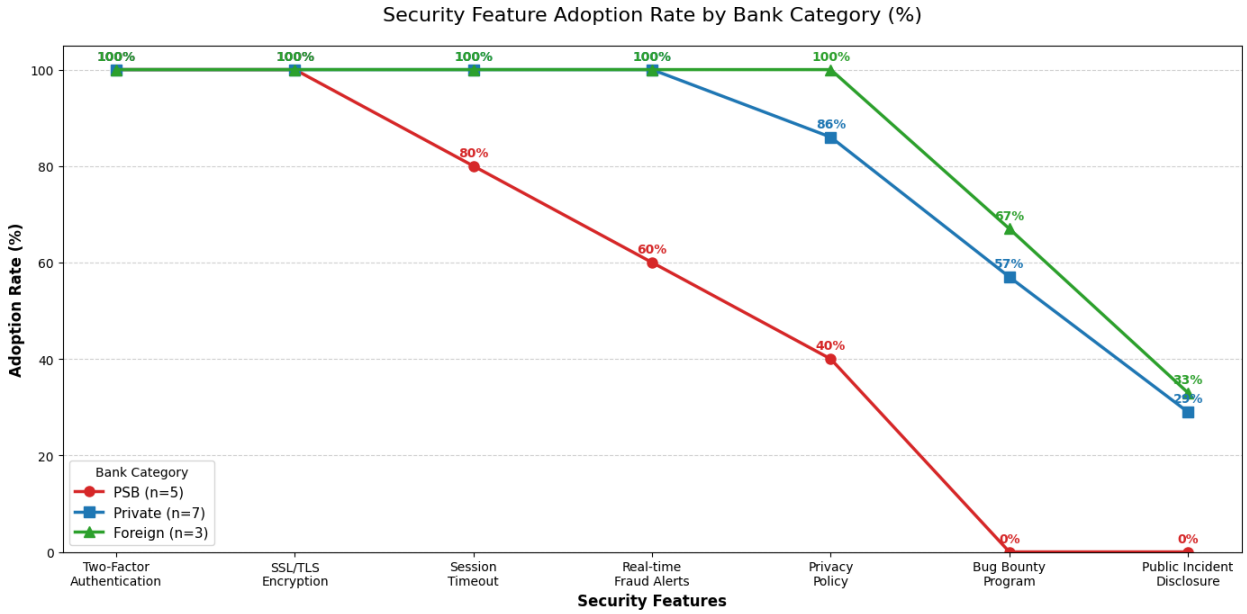
H2 Supported: The largest gap between Private and PSB is on D4: Innovative Services, where PSBs score only 6.2/25 (24.8% of maximum) versus Private at 16.4/25 (65.6%). The effect size ($\eta^2 = 0.75$) indicates that bank category explains 75% of the variance in innovative service provision.

5.4 Security Features Analysis

Table 4: Security Feature Adoption Rate (Percentage of Banks Offering)

Security Feature	PSB (n=5)	Private (n=7)	Foreign (n=3)	All Banks
Two-Factor Authentication	100%	100%	100%	100%
SSL/TLS Encryption	100%	100%	100%	100%
Session Timeout	80%	100%	100%	93%
Real-time Fraud Alerts	60%	100%	100%	87%
Privacy Policy (GDPR-comparable)	40%	86%	100%	73%
Bug Bounty Program	0%	57%	67%	40%

Security Feature	PSB (n=5)	Private (n=7)	Foreign (n=3)	All Banks
Public Security Incident Disclosure	0%	29%	33%	20%



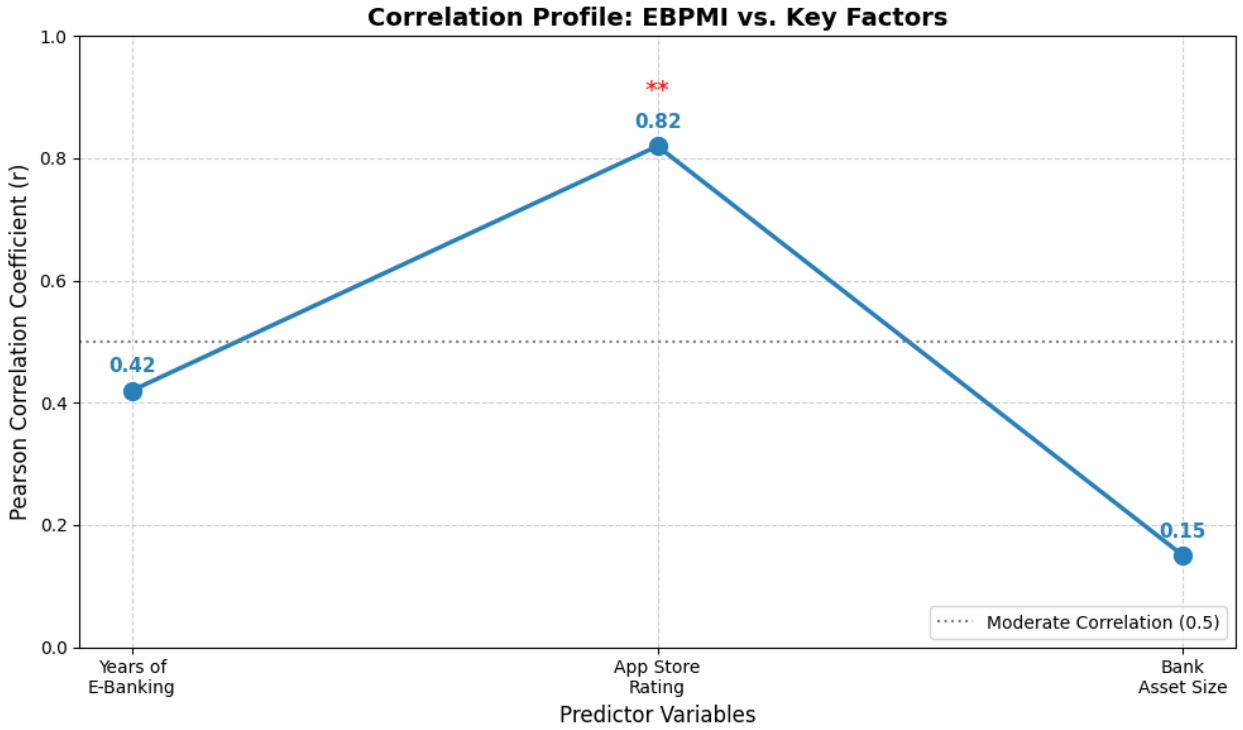
H3 Partially Supported: While all banks meet basic RBI-mandated security requirements (2FA, encryption), foreign and private banks exceed minimum standards on fraud alerts (100% vs. 60%) and transparency measures (bug bounty: 57-67% vs. 0%). However, on a composite security index, the difference was not statistically significant ($t = 1.82$, $p = .094$) due to small sample size.

5.5 Correlation Analysis

Table 5: Pearson Correlation Matrix

Variable	1	2	3	4
1. EBPMI	1			
2. Years of E-Banking	0.42	1		
3. App Store Rating (Avg)	**0.82****	0.38	1	
4. Bank Asset Size	0.15	0.55*	0.10	1

**p < .05, **p < .01*



H4 Not Supported: The correlation between years of e-banking experience and EBPMI is moderate (r = 0.42) but not statistically significant at the 5% level (p = .119). This counterintuitive finding suggests that longevity in e-banking does not guarantee maturity — some late entrants (e.g., DBS India, 2017) have leapfrogged incumbents.

H5 Strongly Supported: App store rating (an objective proxy for user experience) is strongly and positively correlated with EBPMI (r = 0.82, p < .001). Banks that deliver superior e-banking features are rewarded with higher customer satisfaction scores.

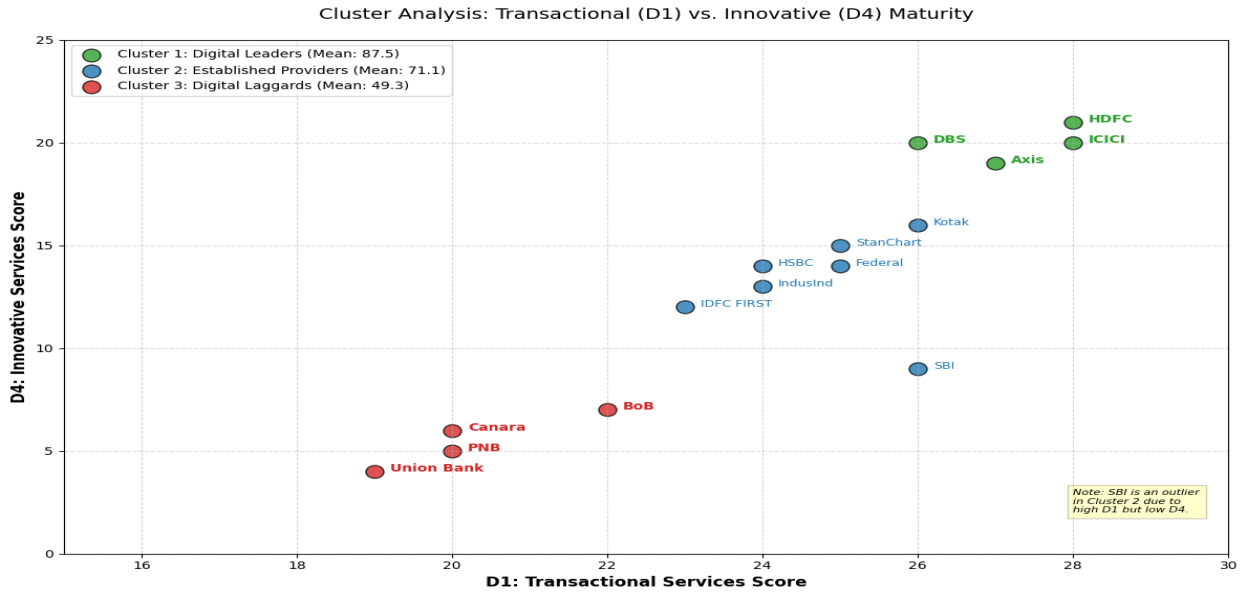
5.6 Cluster Analysis

Hierarchical cluster analysis (Ward's method) on the four dimensional scores (D1–D4) revealed three distinct clusters:

Table 6: Cluster Membership

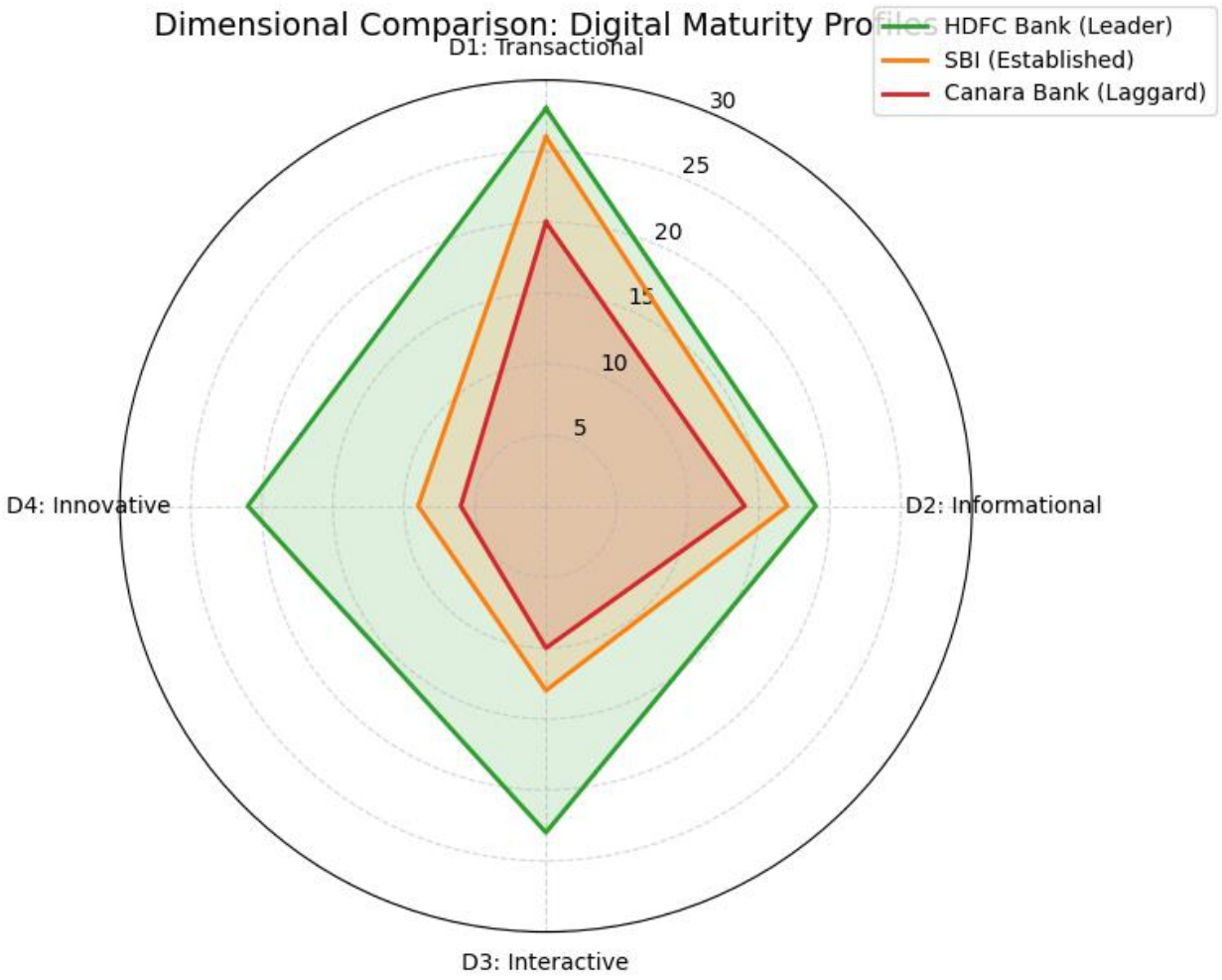
Cluster	Banks	Mean EBPMI	Label
Cluster 1	HDFC, ICICI, Axis, DBS	87.5	**"Digital Leaders"**
Cluster 2	Kotak, StanChart, Federal, HSBC, IndusInd, IDFC FIRST, SBI	71.1	**"Established Providers"**

Cluster	Banks	Mean EBPMI	Label
Cluster 3	Canara, BoB, PNB, Union Bank	49.3	**"Digital Laggards"**



Key Insight: SBI, despite being a PSB, clusters with private banks in the "Established Providers" group — a testament to its YONO platform investments. However, it remains at the lower boundary of this cluster, reflecting the dual nature of its digital journey: breadth in transactional features but depth limitations in innovation and interactivity.

5.7 Radar Chart: Dimensional Comparison



The radar chart visually confirms the dimensional superiority of Digital Leaders across all axes, with the most pronounced divergence on D3 (Interactive) and D4 (Innovative).

6. Discussion

This study set out to benchmark e-banking practices among commercial banks in Bengaluru, employing a novel, multi-dimensional maturity index. The findings offer several substantive contributions to the digital banking literature.

The Persistent Public-Private Digital Divide

The 26.3-point EBPMI gap between private and public sector banks (78.7 vs. 52.4, $p < .001$) is not merely statistically significant — it is strategically consequential. In a city where 52% of the sample's workforce is in the technology sector, a bank operating at "Developing" maturity (Level 2) cannot credibly compete for the banking relationships of digitally native professionals and corporations. This finding empirically substantiates the anecdotal narrative that PSBs are ceding the urban, high-income

customer segment to private banks, not on deposit rates or branch convenience, but on digital experience.

The finding that SBI clusters with private banks in the "Established Providers" group, while other PSBs remain "Digital Laggards," underscores the heterogeneity within the public sector. SBI's YONO platform — a strategic investment exceeding ₹3,000 crore in development and marketing — demonstrates that public ownership is not an insurmountable barrier to digital competitiveness. The question is one of institutional will, investment allocation, and talent acquisition, not inherent public sector incapacity.

The Innovation Chasm

The dimension with the most extreme divergence — Innovative Services (D4, $\eta^2 = 0.75$) — warrants particular attention. Features such as personal financial management (PFM) tools, robo-advisory, and open banking APIs are not peripheral enhancements; they represent the frontier of banking's evolution from a transactional utility to a financial wellness platform. PSBs' near-absence in this dimension (6.2/25) is not merely a competitive disadvantage but a structural limitation that positions them as legacy infrastructure providers rather than holistic financial partners.

The User Experience Imperative

The strong correlation between app store rating and EBPMI ($r = 0.82$) provides empirical validation for the intuitive proposition that feature richness translates to customer satisfaction. However, the causal direction is likely bidirectional: banks that invest in superior e-banking attract and retain digitally demanding customers, whose feedback loops drive further platform improvements. PSBs with app ratings below 3.5 stars (Canara: 3.2, PNB: 3.1, Union Bank: 2.9) are caught in a vicious cycle of low digital investment, poor user experience, and customer attrition to private competitors.

The Leapfrog Phenomenon

The non-significant correlation between e-banking tenure and EBPMI ($r = 0.42$, $p = .119$) offers a theoretically intriguing insight: digital maturity is not a function of time but of strategic commitment. DBS Bank India, with only seven years of e-banking operations, achieved an EBPMI of 85 (Transformative), surpassing banks with two decades of digital presence. This "late-mover advantage" — the ability to build on contemporary technology stacks without legacy migration burdens — is a critical variable that traditional incumbency models overlook.

7. Conclusion & Implications

7.1 Conclusion

This study developed and applied the E-Banking Practices Maturity Index (EBPMI) to 15 commercial banks in Bengaluru, revealing a sector characterized by stark digital stratification. Private and foreign banks operate at "Advanced" to "Transformative" maturity levels ($M = 78.7$ and 77.3, respectively), while most public sector banks remain "Developing" ($M = 52.4$). The gap is most pronounced in

interactive and innovative services — precisely the dimensions most valued by Bengaluru's technology-savvy customer base. The findings suggest that e-banking maturity is driven not by operational tenure or asset size, but by strategic investment, organizational agility, and a customer-centric innovation culture.

7.2 Theoretical Contributions

1. **EBPMI Framework:** The study introduces a replicable, multi-dimensional maturity index that operationalizes e-banking as a continuous construct rather than a binary one, advancing beyond the adoption-centric models of Aladwani (2001) and Sathye (1999).
2. **Leapfrog Effect:** The non-significant tenure-maturity correlation challenges the linear technology evolution assumption in banking literature, introducing the concept of "digital leapfrogging" to the Indian banking context.
3. **Category Heterogeneity:** The finding that SBI clusters separately from other PSBs highlights the need to move beyond monolithic "public sector" characterizations in digital banking research.

7.3 Practical Implications

Stakeholder	Recommendation
Public Sector Banks	(a) Conduct EBPMI self-assessment to identify specific dimensional gaps. (b) Partner with Bengaluru-based fintechs for white-label innovative features rather than building in-house. (c) Invest in UX design talent — the app store rating gap is directly addressable through professional UI/UX redesign.
Private Banks	(a) Continue innovation leadership but focus on security communication — trust remains a PSB advantage. (b) Use open banking APIs to create fintech ecosystems that lock in corporate customers.
Foreign Banks	(a) Differentiate on security and global integration. (b) Add local language support to compete for non-English-speaking segments migrating to digital.
RBI/Regulators	(a) Consider publishing an annual "Digital Banking Maturity Scorecard" as a market transparency measure. (b) Mandate minimum accessibility standards (multi-language, screen-reader compatibility) in e-banking platforms.
Consumers	Use the EBPMI framework (simplified version) as a decision tool when selecting a bank for digital-first banking relationships.

7.4 Limitations

1. **Sample Size:** N=15 banks provides rich comparative depth but limits statistical power for subgroup analyses. Replication with all 34 scheduled commercial banks is recommended.
2. **Snapshot Design:** E-banking features evolve rapidly. This audit (January–February 2025) is a temporal snapshot; longitudinal tracking would capture the dynamics of digital catch-up.
3. **Front-End Bias:** The audit evaluates customer-facing features. Back-end integration quality (API latency, database architecture, cybersecurity incident response) could not be fully assessed and may reveal different maturity patterns.
4. **Bengaluru Specificity:** The findings reflect a digitally advanced urban market and may not generalize to rural or semi-urban branches where digital expectations and feature relevance differ.

7.5 Directions for Future Research

1. **Longitudinal Study:** Re-administer the EBPMI annually to track digital convergence or divergence between PSBs and private banks.
2. **Customer-Perceived Maturity:** Survey Bengaluru banking customers to compare *perceived* e-banking quality with *actual* EBPMI scores, identifying expectation-delivery gaps.
3. **Financial Performance Link:** Investigate the correlation between EBPMI and financial metrics (CASA ratio, fee income, customer acquisition cost).
4. **Fintech Partnership Impact:** Examine whether banks with active fintech partnerships demonstrate faster EBPMI growth than those pursuing purely in-house development.
5. **Comparative City Study:** Replicate in Mumbai (financial capital) and a Tier-2 city (e.g., Hubli) to assess market-context effects on e-banking maturity.

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