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TECHNOLOGY AND ITS IMPACT ON THE PROFITABILITY WITH REFERENCE TO INDIAN BANKS

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Abstract

In the present changing scenario, the banking industry has heavily invested in information and communication technology. With the increase in investment in innovative technologies, the challenge related to misbalance in a bank's business operations and its reputation has been raised Therefore, it's requisite for banks to outlay technology in a way to assure productivity of banks. The present study explores the impact of technology on public and private sector banks in India. Using the variables (Net Interest Margin; Return on Assets; Cost of Deposit; Return on Investment and Credit Deposits Ratio) of six public and private sector banks for the last ten years between 2012-2021, the study finds that investment in technology has resulted in enhancement of profitability of public sector banks. The study is carried out using SPSS Software. The research findings provide insight to the bank management to pay more attention to the employment of innovative technologies to ensure greater efficiency and improved performance.

Keywords:

Indian Banking Sector, Public Sector Banks, Private Sector Banks, Technology, Profitability

1. INTRODUCTION

The Financial industry particularly the banking sector is considered a catalyst for the economic growth of the nation. Indian Banking Industry is constantly facing the problems of lack of transparency [22], high operational cost [16], high competition [22], increase in fraudulent transactions [25], complex banking operations [40.] and cost-benefit trade-off [40]. The issues faced by banks globally recognised by various researchers [37] Parmar [36] Beccalli, [9] Khajehdangolani [24] Caballero et al [10] & Vennet, [47]. In a bid to overcome the aforesaid issues, the banks have heavily invested in information and communication technology. The banking sector has been substantially affected by the rapid development of technology [12]. The adoption of technology has pushed the banks to inexorably change the way business was organised, their business strategies, their relationship with consumers, and other functions of the banking business [15].

The employment of advanced technologies will lessen the cost of employees [46], reduce the dependence on banking infrastructure [32], accessibility of financial services [40], transform functions of the banking business (Adrian, 2018); enhance competition within financial system [35][37], in the RBI report on "Report on Trend and Progress of Banking in India" emphasised that investment of Indian banks in technology has raised from 11% to 30% from 2006-07 to 2018-19 and is anticipated to raise to 35% in 2020.[37] With the increase in investment in innovative technologies, the challenge related to misbalance in bank's business operations and their reputation has raised as a result of imprudent investment in technologies by banks [1][2][37][40]. Therefore, it is requisite for banks to outlay technology in a way to assure the productivity of banks known as the profitability paradox.

The research aims to access the impact of technology on the profitability of public sector banks in India. The objective has been constructed based on the reality that imprudent investment in technologies by banks may bring monetary loss to the banking business and adversely affect the operations and resources of banks [40]. Therefore, it's essential for banks to be aware of the impact of technology on their profitability. The current study tries to answer the following research questions:

RQ: How does investment in banking technologies impact the profitability of public sector banks in India?

The present study was organised into eight segments. The first section provides an outline of the study followed by a literature review in the second segment. The hypothesis developed was defined in section three. Section four describes the methodology used in the study. Section five offers the results of the study followed by the conclusion, implications, limitations, and future scope of study in the 6th section.

2. LITERATURE REVIEW

The banking industry has invested a substantial amount of money in technology. Investment in technology has fetched considerable development in the functioning of the banks. The massive investment in technology raises the question of whether the investment has been mirrored in increased bank profitability [5],[31], state that the literature available on the impact of technology on the profitability of banks presents a conflicting result on the correlation between investment in technology and the performance of the bank. The technological impact on the performance of banks was first challenged by the Solow profitability paradox [18], Solow [43] put forth the idea of the profitability paradox means "we see the computer age everywhere but in the productivity Statistics". The study reflects the negative trend of profitability with an increase in investment in technology [43].

The issue addressed by Solow [43] has attracted the attention of various researchers. Strassman, 1990 also supported the theory of Solow [43] stating that "There is no correlation between spending for computers, profits, and profitability". The theory was also confirmed by Appiahenem [6], Gichungu and Oloko, [17], Chae et al. [13], Tambe and Hilt [44], Mithas et al [30] and Hendricks et al. [19] confirms the significant contribution of technology on profitability working with firm-level data. However, the studies have failed to provide a clear-cut picture of the positive impact of technology deployment on the profitability of the firms. Thus, pointing towards the presence of a profitability paradox. Studies were conducted by a few eminent authors revealing the impact on the profitability of banks.

However, not all the studies pointed toward the positive impact of technology on banks. Markus and Soh [27], McKinsey Global Institute [29], Ho and Mallick [20], Gupta et al. [18] conducted a study on the technological impact on banks' profitability and highlighted that banks aren't benefitted from technology deployed by banks. Beccali, 2007; emphasized that the weak link between profitability and technology pointed toward the presence of a profitability paradox. Authors such Shu and Strassmann [42], Ho and Mallick [20], Yoo [48], Iman [21]. Most of the studies related to the link between technology and the performances of banks were conducted in developed countries around the globe. In India, very few empirical works were carried out to establish a link between technology and the performances of banks [18] [39]. Thus, the chapter covers the objective "To measure the impact of technology on the development of the Indian Banking Sector".

3. HYPOTHESIS DEVELOPMENT

The banking industry has invested a substantial amount of money in technology. Investing in technology has fetched considerable advancement in the functioning of banks. Literature based on investment in new banking technologies suggests that the adoption of digital technologies may result in a positive and significant impact on banks' profitability [20], Tunay et al. [45], Gupta et al. [18], Roy and Thangaraj [39].

As a result, the following hypothesis was formulated:

- H1: Technology has a positive impact on the ROA of selected banks
- H2: Technology has a positive impact on the ROI of selected banks
- H3: Technology has a positive impact on the NIM of selected banks
- H4: Technology has a positive impact on the COD of selected banks
- H5: Technology has a positive impact on the CD Ratio of selected banks

4. METHODOLOGY

4.1 DATA SOURCE, SAMPLE SIZE, AND PERIOD OF THE STUDY

The present study relies on secondary data. The profitability variables (ROA, NIM, ROI, COD, and CD Ratio) of six public sector banks (State Bank of India; Canara Bank; Indian Bank; Bank of Baroda, Bank of India, and Central bank of India) and private sector banks (Axis Bank, City Union Bank, Federal Bank, HDFC Bank, ICICI Bank, and IDBI Bank) examined in the study are derived from the reports of Reserve Bank of India available on the website of RBI or dbie (database of Indian Economy) for the period from 2012 to 2021. The top six banks were selected based on the market capitalisation of banks obtained websites of NSC and BSC. The Independent variables (automatic teller machine, mobile banking, credit card, debit card, NEFT and RTGS) are obtained from the website of the Reserve Bank of India. A description of Selected Public and Private Sector Banks was presented in Table.1.

Table.1. Banks Selected for Study

Name of the Bank	Abbreviation	Market Capitalisation (Cr.)	Year of Study
Public Sector Bank of India			
State Bank of India	SBI	482108	10
Canara Bank	CAN	52773	
Indian Bank	IB	35271	
Bank of Baroda	BOB	81346	
Bank of India	BOI	31967	
Central Bank of India	CBI	24784	
Private Sector Bank of India			
Axis Bank	AB	268576	10
City Union Bank	CUB	11228	
Federal Bank	FB	27927	
HDFC Bank	HDFB	901288	
ICICI Bank	ICIB	570509	
IDBI Bank	IDBB	54730	

4.2 VARIABLES

4.2.1 Dependent Variables:

Based on the literature, financial profitability has been taken as a dependent variable ([3] [14] [18] and [33]). There is no consensus measurement on the financial profitability of banks. Different authors provide different variables to measure financial profitability. In the present study, financial profitability was measured through ROA, NIM, ROI, COD, and CD Ratio. The profitability variables examined in the study are derived from the reports of the Reserve Bank of India available on the website of RBI or DBIE. The definition and measurement of performance variables have been given in Table.2.

Table.2. Definition and Measurement of Dependent Variable

Dependent Variables	Symbol	Definition and Measurement
Return on Assets	ROA	Net Profit/Total Assets
Cost of Deposit	COD	Interest Rate*100/Card Rate Payable+Term Deposit
Return on Investment	ROI	Net Return on Investment*100/Cost on Investment
Credit-Deposit Ratio	CD Ratio	Total Advances*100/Total Deposits
Net Interest Margin	NIM	(Net Return on Investment-Interest Paid)/Average Assets

4.2.2 Independent Variables:

Technology has been taken as an independent variable as it's considered one of the essential variables affecting the profitability

of banks [18] [20] [39]. In the present study, the following technologies were taken into consideration namely RTGS, MB, CC, DC, ATM, and NEFT. The Table.3 specifies the definition of technology indicators.

Table.3. Definition of Independent Variables

Dependent Variables	Symbol	Definition and Measurement
Real-time gross settlement	RTGS	Electronic fund transfer from one account to another in which processing of fund transfer takes place in real-time.
Mobile Banking	MB	Performing banking transactions such as paying bills, investments, balance inquiries, and fund transfers using a mobile device.
Credit Card	CB	A plastic card to make payment on the credit
Debit Card	DB	A plastic card to make payments from a bank account
Automatic Teller Machine	ATM	A machine that disperses cash and performs other banking operations when a bank card is inserted.
National Electronic Fund Transfer	NEFT	Electronic fund transfer from one account to another in which processing of fund transfer takes place immediately.

4.3 ECONOMETRIC MODEL

The linear formulation proposed by Bourke, 1989 was employed to analyse the profitability of banks with respect to the variable stated in Table.3 using the SPSS statistics software package. Model proposed:

$$Profitability_{it} = \alpha + \beta X_{it} + \varepsilon_{it}$$

where,

i denotes individual banks.

t denotes time.

$Profitability_{it}$ denotes the profitability of *i* bank at *t* time. It was measured using the ROA of *i* bank at *t* time, NIM of *i* bank at *t* time, ROI of *i* bank at t time, COD of *i* bank at *t* time, and BE of *i* bank at *t* time.

α denotes intercept.

β denotes coefficients.

X_{it} denotes technology adopted by *i* bank at *t* time. It comprises of RTGS, MB, ATM, CC, NEFT, and DC.

ε_{it} denotes the error term

5. ANALYSIS AND RESULTS

5.1 DESCRIPTIVE STATISTICS

The descriptive statistics are performed to have a preliminary understanding of the bank's characteristics enrolled in the sample. The focus of the descriptive study is mainly on the "mean: a measure of the central tendency", "standard deviation: a measure of the dispersion", "Skewness: a measure of shape", and "Kurtosis: a measure of shape". Descriptive statistics of all selected variables namely ROA, NIM, ROI, COD, CD Ratio, RTGS, NEFT, MB, CC, DC, and ATM were demonstrated in Table.4. The variation present among the variables was the result of the varied nature of public and private sector banks.

5.1.1 Skewness:

According to IBM, 2022 skewness (μ3) is "a measure of the asymmetry of a distribution". The distribution is normal or symmetric with a skewness value of 0. The distribution with a coefficient of skewness greater than zero is positively skewed having a longer right tail in a positive direction whereas the distribution with a coefficient of skewness less than zero is negatively skewed having a longer left tail in a negative direction [8]. The Table.4 demonstrates that the coefficient of skewness of ATMs, RTGS, NEFT, Mobile Banking, Credit Card, Debit Card, and ROA is more than zero indicating that the distribution is positively skewed and has a longer right tail in a positive direction whereas NIM, ROI, COD, and CD Ratio is less than zero indicating that the distribution is negatively skewed having a longer left tail in a negative direction.

5.1.2 Kurtosis:

According to IBM, 2022 kurtosis is "a measure of the extent to which there are outliers". Kurtosis is associated with the distribution's peakedness and tail. According to Cain et al., 2017 kurtosis rises with peakedness and falls with flatness. The distribution is normal with a kurtosis value of 3 having a medium peak. The distribution with the coefficient of kurtosis greater than three exhibits the presence of extreme outliers having a sharply high and bell-shaped peak. The distribution with a coefficient of kurtosis less than three exhibits the presence of fewer extreme outliers having a flattened peak. The Table.4 demonstrates that the coefficient of kurtosis of ATMs, NEFT, Mobile Banking, Debit Card, and ROA is more than three indicating the presence of extreme outliers having a sharply high and bell-shaped peak whereas NIM, ROI, COD, and CD Ratio is less than three indicating the presence of fewer extreme outliers having a flattened peak.

5.2 CORRELATION BETWEEN VARIABLES

Correlation explores the degree of relationship between the two variables [23] [41]). Correlation is expressed in the form of a coefficient. Correlation analysis was explained through the diagrammatic method using a scatter diagram and the mathematic method using Karl Pearson's, Spearman's, and Kendal tau. Magnello [26], emphasised that Karl Person is a widely used method for correlation analysis. Coefficient of correlation range between -1 to +1. According to Senthilnathan [41] ideal range for interpreting the coefficient of correlation in social science was shown in Fig.1. The positive sign indicates a positive correlation that shows an increase in one variable, and the other increase as well whereas the negative sign indicates a negative correlation that shows an increase in one variable, and the other decrease [7].

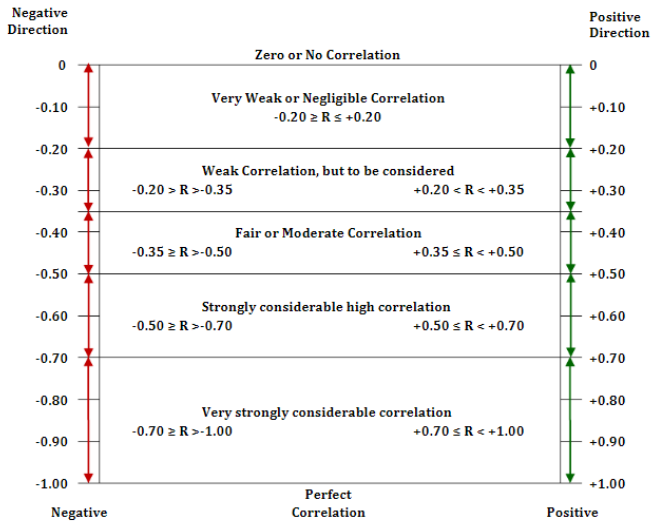

Fig.1. Ideal Range for Interpreting Coefficient of Correlation (Source: Senthilnathan, 2019)

The correlation matrix among variables i.e., NIM, ROA, ROI, COD, CD Ratio, ATM, Mobile banking, Credit Card, Debit Card, RTGS, and NEFT was demonstrated in Table.5. The Pearson correlation of NEFT, RTGS, CC, and DC with NIM is positive and significant whereas the correlation of ATM and MB is positive and insignificant at a p-value>0.05. The correlation of RTGS, NEFT, MB, ATM and DC with ROA is positive and insignificant whereas the correlation of CC with ROA is positive and significant. The correlation of RTGS, NEFT and MB with ROI is negative and significant; the correlation of ATM with ROI is positive and insignificant whereas the correlation of CC and DC with ROI is negative and insignificant. The correlation of RTGS, NEFT, ATM, MB, CC, and DC with COD is negative and significant. The correlation of RTGS and CC with CD Ratio is positive and significant; the correlation of ATM, NEFT, and DC is positive and insignificant whereas MB has a negative and insignificant correlation with the CD Ratio.

Table.4. Descriptive Statistics

	N Statistic	Mean Statistic	Std. Deviation	Skewness		Kurtosis	
				Statistic	Std. Error	Statistic	Std. Error
ATMs	120	10847.36	13451.09	2.595	.221	6.515	.438
RTGS	120	845.15	1077.66	1.689	.221	2.035	.438
NEFT	120	58.27	60.98	1.926	.221	3.944	.438
Mobile Banking	120	4844.89	11697.90	3.861	.221	16.852	.438
Credit Card	120	738.52	1339.84	2.091	.221	3.755	.438
Debit Card	120	914.65	2332.58	6.330	.221	52.828	.438
NIM	120	2.68	.69	.588	.221	-.325	.438
ROA	120	.54	1.10	-1.778	.221	6.057	.438
ROI	120	7.21	.68	.098	.221	-.502	.438
COD	120	5.61	1.07	.448	.221	-.597	.438
CD Ratio	120	75.82	11.47	-.076	.221	.727	.438

Source: Calculated by Authors

Table.5. Correlation Matrix among Variables

	ATM	RTGS	NEFT	MB	CC	DC	NIM	ROA	ROI	COD	CD
ATM	1										

RTGS	.656	1									
	.000*	---									
NEFT	.653	.922	1								
	.000*	.000*	---								
MB	.436	.616	.620	1							
	.000*	.000*	.000*	---							
CC	.556	.924	.916	.529	1						
	.000*	.000*	.000*	.000*	---						
DC	.412	.510	.565	.275	.562	1					

	.000*	.000*	.000*	.002*	.000*	---					
NIM	.074	.408	.359	.124	.496	.277	1				
	.423	.000*	.000*	.178	.000*	.002*	---				
ROA	.044	.163	.172	.010	.296	.166	.688	1			
	.637	.075	.060	.910	.001*	.070	.000*	---			
ROI	.070	-.212	-.199	-.329	-.166	-.158	-.015	.077	1		
	.447	.020**	.029**	.000*	.069	.085	.869	.405	---		
COD	-.218	-.374	-.409	-.374	-.326	-295	.008	.221	.462	1	
	.017**	.000*	.000*	.000*	.000*	.001*	.928	.015**	.000*	---	
CD	.159	.312	.171	-.022	.318	.121	.494	.572	-.157	.156	1
	.083	.001*	.062	.814	.000*	.188	.000*	.000*	.086	.088	---

Source: Calculated by Authors

*Significant at the 0.01 level (2-tailed)

**Significant at the 0.05 level (2-tailed),

5.3 REGRESSION ANALYSIS

The hypothesis tests if technology significantly impacts the profitability of Indian Banks. The dependent variables (NIM, ROA, ROI, COD, and CD Ratio) were regressed on predicting variables (ATM, RTGS, NEFT, MB, CC, and DC) to test the hypothesis. Technological variables significantly predicted profitability variables NIM ($f = 9.565$, $p < .000$); ROA ($f = 4.325$, $p < .001$), ROI ($f = 5.452$, $p < .000$), COD ($f = 5.585$, $p < .000$), and CD Ratio ($f = 7.069$, $p < .000$). The results indicates that technology plays a significant role in shaping profitability of Indian Banks. Moreover, the R-square of model NIM is .337 depicting that the model explains 33.7% of the variance in NIM, the R-square of model ROA is .187 depicting that the model explains 18.7% of the variance in ROA, the R-square of model ROI is .224 depicting that the model explains 22.4% of the variance in ROI, the R-square of model COD is .229 depicting that the model explains 22.9% of the variance in COD, and the R-square of model CD Ratio is .275 depicting that the model explains 27.5% of the variance in CD Ratio.

Table.6. Hypothesis Validation

Models	R-square	f	p-value	Hypothesis
NIM	.337	9.565	.000	Accepted
ROA	.187	4.325	.001	Accepted
ROI	.224	5.452	.000	Accepted
COD	.229	5.585	.000	Accepted
CD Ratio	.275	7.069	.000	Accepted

Source: Calculated by Authors

6. CONCLUSION

6.1 FINDINGS

The study explores the impact of technology on profitability in public-sector banks in India for the period between 2017-2021. The findings revealed that technology (mobile banking, debit card, automatic teller machine, real-time gross settlement, national electronic fund transfer, and debit cards) has a positive and significant relationship with the profitability of Indian banks. In the present study, financial profitability was measured through ROA, NIM, ROI, COD, and CD Ratio. The study confirms the result of past studies by Roy and Thangaraj [39], Appiahene [6], Gichungu and Oloko, [17] and Chae et al. [13]) that technology is positively linked with the profitability of the banks.

6.2 IMPLICATIONS

The findings provide three potential implications. Firstly, from a theoretical perspective, the findings of the study provide additional insight into the existing body of knowledge. The existing literature can be used in improving the competencies of managers and researchers regarding technologies in banks. Secondly, from a practical perspective, bank managers are required to have in-depth knowledge of innovative technology to sustain short-term and long-term growth. Employment of technology maintains competitiveness within the banking industry [34], reduces operating cost [4], reduces the cost of transactions [38], improve customer services [28] and enhance the performance of banks [6] [13] [17] [39]. Lastly, from a societal perspective, the results of the study provide an awareness that employment of technology provides better life to society by offering innovative financial services, reduced costs of transactions, and round-the-clock banking services. However, the path ahead for banks will depend on the injection of technology which undoubtedly has a positive and significant impact on the profitability of the bank.

6.3 LIMITATION AND FUTURE SCOPE OF STUDY

Although the study proposes numerous theoretical and practical implications to the managers and researchers yet it's most important to acknowledge the limitations which may lead to the future agenda for research. The primary drawback of the research is the sample size of the study is relatively small that is 6 out of 12 public sector banks and 6 out of 21 private sector banks registered in India. Therefore, caution must be taken before generalising the findings of the study. In the future, further study can be done with many banks. Secondly, a study has only taken public sector banks into account. In the future, researchers can also conduct similar studies in foreign and private-sector banks. Thirdly, non-financial aspects are totally ignored in the study and

may be taken into consideration in future studies. Further researchers can also conduct similar studies in other emerging countries. The researchers can also modify or diversify the methodology employed in the study to improve the research.

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