Efficiency of Commercial Banks in India during Pre and Post E-Banking Period

Dr. Himanshu[1], Dr. Madhur[2]

[1]Assistant Professor, D A V College, Sector 10, Chandigarh (160010)

[2]Assistant Professor, Guru Gobind Singh College for Women, Sector 26, Chandigarh (160019)

ARTICLE INFO	ABSTRACT
Published Online: 29 December 2023 **Corresponding Author:** **Dr. Himanshu**	Banking industry being the knowledge-intensive industry plays an important role in enhancing economic growth of the country. In this whimsical world of technology where Indian Commercial banks are facing intense competition both from domestic as well as international players, the working of this industry have changed drastically with the onset of e-banking period. Such technology-banking or e-banking era is a stimulant to enhance not only economic growth of the country but also efficiency of banks. In this context, this paper is an attempt to study the efficiency of commercial banks in India during pre and post banking period. Also, this study suggests policy recommendations for Indian banking industry to cope the inefficiency and face the competition boldly.

1. INTRODUCTION

The banking industry of India is one of the most skill-based, knowledge-intensive and relationship-rich industries and continues to be the primary engine of economic growth. The role played by banks in mobilization of financial resources to promote investment and enhance economic growth in an emerging economy like India is extremely significant. They provide transaction and payment services which increases the efficiency of economic activities in general. This efficiency is responsible for the lucrative performance of banks, thereby making Indian banking industry a flourishing and secured industry in the banking world.

In India, prior to nationalization, banking was restricted mainly to urban areas and major portion of credit facilities were enjoyed by large industries and well established business houses due to which some of the crucial segments of the economy like agriculture, small scale industries etc. were neglected. Prompted by this drawback and to ensure adequate flow of credit into productive activities, fourteen major banks were nationalized in 1969 and six more got nationalized in 1980. Since then, India has developed a vivacious banking system serving as an instrument of social and economic change. Financial globalization, intense competition, recent development in information and communication technology, regulation and deregulation are the primary drivers for the change. Instigated by this, the banking reforms initiated in

India in 1990 transformed the Indian banking system and elevated it as one of the most efficient, well capitalized and a competitive one.

The changing nature of banking industry where banks are moving from on-balance to off-balance sheet activities together with an increased involvement in capital, have created a need for skills and transaction systems that are quite different from those of traditional lending. These have led to new technological and organizational challenges in the banking industry of India. In other words, the post liberalization era brought innovation in the banking sector of India.

The Commercial Banks of India imparted excellent services to customers with the advent of advanced technology. This facilitated the banks to "go-to- customers" and enabled door-step banking through virtual banking. Banking Technology is a big leap towards facilitating trading in a more secure manner, integrating customer data across banking platforms, developing private clouds and virtual desktops to centralize information through desktops as per the requirement of the employees. Not only this, it enabled speedier transaction processing as well as faster settlements. Thus, usage of technology has led to a paradigm shift in the banking sector from traditional branch banking to net banking.

While experiencing a mounting and competitive environment, banking sector around the globe has grown

from colonial banking to social and development banking and then to market oriented service industry. Against this backdrop, it is essential to understand how the Indian banking industry efficiently responds to the emerging challenges in this era. Thus, the present study attempts to provide an insight into the measurement of efficiency of commercial banks of India.

2. REVIEW OF LITERATURE

Barr et al. (1999) used a constant multiplier, input-output oriented, DEA model to evaluate the productive efficiency and performance of U.S. commercial banks from 1984 to 1998. They found a strong and consistent relationship between efficiency and inputs and outputs as well as independent measures of bank performance. Their results suggested that the impact of varying economic conditions was mediated to some extent by the relative efficiencies of the banks that operate in these conditions. Finally, they found a close relationship between efficiency and soundness as determined by examiner ratings.

Leigh and Hall (2001) analysed technical and scale efficiencies in Japanese Banking sector using DEA analysis. An efficiency analysis was undertaken across individual banks, bank types and bank size groups. The results showed powerful size efficiency relationships with respect to scale and technical efficiency.

Bhattacharya et al. (1997) studied the impact of limited liberalizations initiated before the deregulation of the nineties on the performance of the different categories of banks using DEA. They measured technical efficiency by covering 70 banks in the period 1986-91. The study concluded that publicly owned banks are most efficient, followed by foreign banks and private sector banks. However, PSBs started showing a decline in efficiency after 1987 whereas private sector showed no change and foreign banks showed a sharp rise in efficiency.

Sathaye (2002) measured the productive efficiency of banks in a developing economy like India using DEA analysis. The efficiency scores for publicly owned, privately owned and foreign owned banks were measured. The mean efficiency scores of Indian banks compares well with worlds mean efficiency scores. Also, it was found that the efficiency of private sector banks was less than public and foreign banks. The study recommended that reducing Non-performing assets and rationalization of staff and bank branches may be continued to achieve efficiency gains.

Mohan and Ray (2003) compared the performance of Public Sector Banks with private sector banks in respect of technical efficiency using DEA analysis.

The comparison was made in eight different sectors over the period 1991-92 to 1998-99. No conclusive evidence of superior performance on the part of the private sector was found.

Das and Ghosh (2005) investigated the performance of Indian commercial banks in post reform period from 1992-2002 using DEA analysis. Three different approaches viz., intermediation approach, value-added approach and operating approach were employed. The results showed that medium sized Public Sector Banks performs reasonably well and are more likely to operate at higher levels of technical efficiency. A close relationship was observed between efficiency and soundness as determined by bank's capital adequacy ratio. The empirical results also showed that banks with less non performing loans are technically more efficient on an average.

Himanshu (2007) studied the effects of deregulation on overall efficiency and its measures of Indian banking sector as a whole as well as classified into different groups based on ownership viz., Public Sector Banks and private sector banks using DEA analysis for the period 1981-2004. This study also estimated total factor productivity (TFP) growth of Indian commercial banks. The results showed that efficiency and TFP growth of commercial banks has declined in the reform era. Also, Public Sector Banks are more efficient and have shown consistent and sustained behavior than private sector banks.

Kumar and Gulati (2008) measured the extent of technical, pure technical and scale efficiency by DEA in 27 Public Sector Banks of India for the year 2015. The results showed that PSBs operate at 88.5 percent level of overall technical efficiency. Technical inefficiency is to the tune of 11.5 percent, mainly attributed to pure technical inefficiency. Indian PSBs are more successful in choosing optimal levels of output than adopting best practice technologies.

Shaukat (2009) measured the impact of information technology on profitability and employee productivity of Pakistani Banking sector for the period 1994-2005. The results explained positive impact of information technology on banking sector of Pakistan.

Ray and Das (2010) estimated cost and profit efficiency of Indian banks during post reform period using DEA analysis. The results showed that there are relatively high cost efficiency levels for Indian banks during the post reform period 1997-2003 and there is no definite evidence that privatization enhances efficiency. Further efficiency was found to be low among small banks as they were operating far below the efficient frontier.

Das (2010) analysed the performance of Indian banks after the initiation of financial liberalization and measures the cost efficiency of Indian banks during that period. Stochastic Frontier Approach was used to estimate the cost efficiency by taking 60 Indian commercial banks. The findings suggest that after financial liberalization there is no significant change in cost efficiency of Public Sector Banks. The comparison among different bank groups during post reform period shows that domestic private banks are becoming more efficient than public sector and foreign banks.

Lackey (2011) examined the extent to which investment in information technology may affect profitability of Ghana banking sector. The study used 15 banks for the period 1998-2007 and applied Balanced Score Card approach. The results showed that IT banks have greater tendency towards increased profitability.

Jagwani (2012) measured the efficiency of banks in India for a sample of 42 banks from 2009 to 2011 using Data Envelopment Analysis. The study finds that Public Sector Banks are relatively more efficient than private-domestic and foreign banks. Also, the overall technical inefficiency in banks is primarily due to the managerial inefficiency rather than scale inefficiency. The differences between captured efficiency scores of public, private-domestic and foreign banks were found to be statistically significant and ownership has an impact on the Indian banking industry as far as technical and pure efficiencies of banks are concerned.

Bhattacharya and Pal (2013) estimated technical efficiency of Indian Commercial Banks from 1989 to 2009 using SFA technique and analysed the effects of financial reforms on estimated efficiency. The study found that Indian banks were operating with 64 percent efficiency on an average. It showed that initial phase of reforms had a positive impact while the later phase adversely affected technical efficiency of banks. Also, Public Sector Banks are more efficient than private and foreign banks.

Joshi, Min, Deshmukh and Jaffar (2016) examined the extent of intellectual capital disclosures and the determinants of such disclosures by the Malaysian companies using a disclosure index for the intellectual capital information consisting of 20 items. Multiple regression analysis was used and the results delved that company size, leverage, and industry type significantly affected significantly the intellectual capital disclosure levels.

Thiagarajan, Baul, & Sekkizhar (2018) examined the financial health of a company by measuring the relationship between the intellectual capital (IC) components with the traditional measures of organizational performance for sample of 42 listed companies from the Indian auto-component industry for the period from 2008 – 2013. The findings suggests that the Indian auto component manufacturing companies seemed to be performing effectively by utilizing their IC as seen by the empirical results during the period from 2008 - 2013 in spite of the economic recession of 2008 and its aftermath.

Jain, Metri and Rao (2019) empirically studied the determinants of profitability of Indian Commercial banks using random effect model on 45 commercial banks of india for the period from 2010 to 2016. The results showed poor performance of public sector banks as against private sector banks

Kesse, Irfan and Pattanayak (2019) examined the relationship between intellectual capital (IC) and financial performance of tourism and hospitality services firms in India for a period of 12 years for 720 firms using the value added intellectual coefficient (VAIC) model developed by Pulic (2000). The study applied fixed and random effect models to account for differences (unobserved effects) across firms which confirmed the existence of a positive relationship between VAIC and performance of firms operating in the tourism and hospitality industry in India. Furthermore, human capital was found to be the most influential component of IC, which had a significant impact on both return on assets and sales growth, suggesting that human capital is still the most important tool driving financial performance.

Gupta and Jaiswal (2020) analysed the comparative financial performance of selected public sector and private sector banks of India for the period of five years from 2015 to 2019. The results depicted that public sector banks made a significant progress but were still not able to meet performance benchmark set by private sector banks.

Weqer, Khan and Haque (2020) inspected the effect of Intellectual capital on the financial performance of Indian banks using modified VAIC methodology on 58 Indian banks for the period from 2009 to 2018. The results revealed that efficiency of intellectual capital enhances the profitability and productivity of Indian banks. Also, human capital plays vital role in augmenting the profitability and productivity of Indian Banking sector apart from other components of intellectual capital.

3. RESEARCH GAPS

In view of above review of literature, extensive studies have been conducted on efficiency of commercial

banks in India however, limited number of studies have been executed for providing extensive analysis of variations in cost efficiency and its components in Indian Banking Industry as a whole during pre e-banking and post e-banking period.

4. OBJECTIVES

The major objective of this study is to analyse the efficiency of Commercial Banks in India during pre E-banking period and Post E-banking period.

5. DATA SOURCES

The present study is based on secondary sources. The data for the period 1998 to 2018 is available with the annual reports and publications of the respective banks and of RBI such as Statistical Tables Relating to Banks in India, Basic Statistical Returns of Scheduled Commercial Banks in India, Trends and Progress of Banking in India.

This study uses a balanced panel data of 43 banks for a sample period of 18 years from 1998-2015. Table 1 presents the sample chosen for the study.

Table 1: Sample Banks

S.No.	Sample Banks	Category of Banks
1.	State Bank Of Bikaner & Jaipur	Public Sector Banks
2.	State Bank Of Hyderabad	Public Sector Banks
3.	State Bank Of India	Public Sector Banks
4.	State Bank Of Mysore	Public Sector Banks
5.	State Bank Of Patiala	Public Sector Banks
6.	State Bank Of Travancore	Public Sector Banks
7.	Allahabad Bank	Public Sector Banks
8.	Andhra Bank	Public Sector Banks
9.	Bank Of Baroda	Public Sector Banks
10.	Bank Of India	Public Sector Banks
11.	Bank Of Maharashtra	Public Sector Banks
12.	Canara Bank	Public Sector Banks
13.	Central Bank Of India	Public Sector Banks
14.	Corporation Bank	Public Sector Banks
15.	Dena Bank	Public Sector Banks
16.	Indian Bank	Public Sector Banks
17.	Oriental Bank Of Commerce	Public Sector Banks
18.	Punjab & Sind Bank	Public Sector Banks
19.	Punjab National Bank	Public Sector Banks
20.	Syndicate Bank	Public Sector Banks
21.	UCO Bank	Public Sector Banks
22.	Union Bank Of India	Public Sector Banks
23.	United Bank Of India	Public Sector Banks
24.	Catholic Syrian Bank	Private sector Banks
25.	City Union Bank	Private sector Banks
26.	Dhanalakshmi Bank	Private sector Banks
27.	Federal Bank	Private sector Banks
28.	Jammu & Kashmir Bank	Private sector Banks
29.	Karnataka Bank	Private sector Banks
30.	Karur Vysya Bank	Private sector Banks
31.	Lakshmi Vilas Bank	Private sector Banks
32.	Nainital Bank	Private sector Banks
33.	South Indian Bank	Private sector Banks
34.	Tamilnad Mercantile Bank	Private sector Banks
35.	The Ratnakar Bank	Private sector Banks

36.	Abu Dhabi Commercial Bank	Foreign Banks
37.	Bank Of America	Foreign Banks
38.	Bank Of Bahrain & Kuwait	Foreign Banks
39.	Citibank	Foreign Banks
40.	Deutsche Bank	Foreign Banks
41.	Mashreq Bank	Foreign Banks
42.	Societe Generale	Foreign Banks
43.	Standard Chartered Bank	Foreign Banks

6. RESEARCH METHODOLOGY

To analyse the efficiency of Commercial Banks in India during pre e-banking period (1998-2005) and post e-banking period (2006-2018), this study uses Data Envelopment Analysis (DEA) Model using DEAP software.

6.1 DEA Framework

DEA is a non parametric approach which involves the use of linear programming methods to construct a non-parametric piecewise surface (frontier) over the data. Efficiency measures are then calculated relative to this surface. DEA optimizes each individual observation with the objective of calculating a discrete piecewise linear frontier determined by the set of Pareto-efficient decision making units (DMUs). Using this frontier, DEA computes a maximal performance measure for each DMU relative to that of all other DMUs. The only restriction is that each DMU lies on the efficient (external) frontier or be enveloped within the frontier. The DMUs that lie on the frontier are the best practice units and retain a value of 1; those enveloped by the external surface are scaled against a convex combination of the DMUs on the frontier facet closest to it and have values somewhere between 0 and 1. Several different mathematical programming DEA models have been proposed in the literature. Essentially, these models seek to establish which of n DMUs determine the envelopment surface or best practice frontier or efficient frontier. The geometry of this surface is prescribed by the specific DEA model employed. In the present study, we calculate cost efficiency which is the product of Allocative and technical efficiency. Allocative efficiency or price efficiency reflects the ability of a firm to use the inputs in the optimal proportions, given their respective prices while, Technical efficiency reflects the ability of a firm to obtain maximal output from a given set of inputs. So, we use the CCR (named after its developers Charnes, Cooper and Rhodes, 1978) and BCC (named after its developers Banker, Charnes and Cooper, 1984) models to obtain efficiency measures corresponding to the assumptions of CRS and VRS, respectively. The efficiency measures obtained from CCR model are popularly known as overall technical efficiency (OTE) or technical efficiency (TE) scores. The efficiency measures obtained from BCC model are popularly known as pure technical efficiency (PTE) scores and devoid of scale efficiency effects. Scale efficiency (SE) for each DMU can be obtained by a ratio of OTE score to PTE score (i.e., SE=OTE/PTE).

6.2 Choice of input and output variables

The present study has adopted the intermediation input-oriented approach since it is concerned with the overall costs of banking and is appropriate for addressing questions concerning the economic viability of banks (Ferrier and Lovell, 1990).

The input variables used for computing efficiency measures are:

(i) Labour (proxied by number of employees)
(ii) Physical capital (proxied by fixed assets)
(iii) Loanable funds (proxied by deposits plus borrowings)

The prices of these inputs are worked out as per employee establishment expenses, non-labour operational cost per rupee amount of fixed assets and sum of interest expenses on loanable funds divided by borrowed funds.

The output variable contains

(i) Net interest income (income received by banks from traditional activities)
(ii) Non-interest income (income accounts for income from fee generating off-balance sheet items such as commission, exchange and brokerage, etc.)

The output variables have a fairly standardized pricing mechanism so, this study assumes the price of non interest income and net interest income to be in unity throughout the years of all banks.

6.3 Tools used for calculating Efficiency

The CRS and VRS based efficiency scores has been calculated using DEAP software.

7. EMPIRICAL ANALYSIS

The results of empirical analysis employed to measure efficiency are explained in this section.

7.1 Trends of Mean CE, AE, TE, PTE and SE of Commercial banks (1998- 2005 and 2006-2015)

This sub section delineates the trends in CE, AE, TE, PTE and SE spanning over the period 1998-2005 and 2006-2015. The calculated mean efficiency scores are explained in table 7.1 and figure 7.1 (a) and 7.1 (b).

Table 7.1: Trends of Mean CE, AE, TE, PTE and SE of Commercial banks (1998-2005 and 2006-2015)

Panel A: Year wise Mean Efficiency Scores					
Year	CE	AE	TE	PTE	SE
Pre E- Banking Period					
1998	0.516814	0.750628	0.683767	0.809465	0.853488
1999	0.571256	0.82993	0.68286	0.822721	0.835512
2000	0.597977	0.79986	0.742	0.863116	0.86393
2001	0.622302	0.801302	0.774256	0.919395	0.845419
2002	0.691767	0.843698	0.817488	0.910907	0.89793
2003	0.712674	0.982326	0.72614	0.923349	0.787698
2004	0.685233	0.785419	0.868744	0.932023	0.933674
2005	0.66414	0.801419	0.827605	0.89193	0.929302
Post E- Banking Period					
2006	0.137047	0.408442	0.313581	0.821186	0.392651
2007	0.32493	0.511791	0.607047	0.866186	0.701256
2008	0.546372	0.897256	0.61407	0.857674	0.713349
2009	0.546372	0.897256	0.61407	0.857674	0.713349
2010	0.331767	0.482349	0.665419	0.887465	0.752837
2011	0.34907	0.542093	0.624186	0.892395	0.707047
2012	0.364116	0.540744	0.661605	0.908442	0.733047
2013	0.435419	0.558465	0.774837	0.92993	0.835116
2014	0.469581	0.645767	0.721558	0.914651	0.79193
2015	0.685233	0.785419	0.868744	0.932023	0.933674
2016	0.701274	0.792326	0.722614	0.946349	0.947698
2017	0.716354	0.795482	0.735441	0.958478	0.956480
2018	0.735481	0.805478	0.745912	0.963541	0.967841
Grand Mean Efficiency Score (1998-2018)					
Grand mean	**0.514004**	**0.714676**	**0699332**	**0.88555**	**0.790067**

Source: Authors Calculation

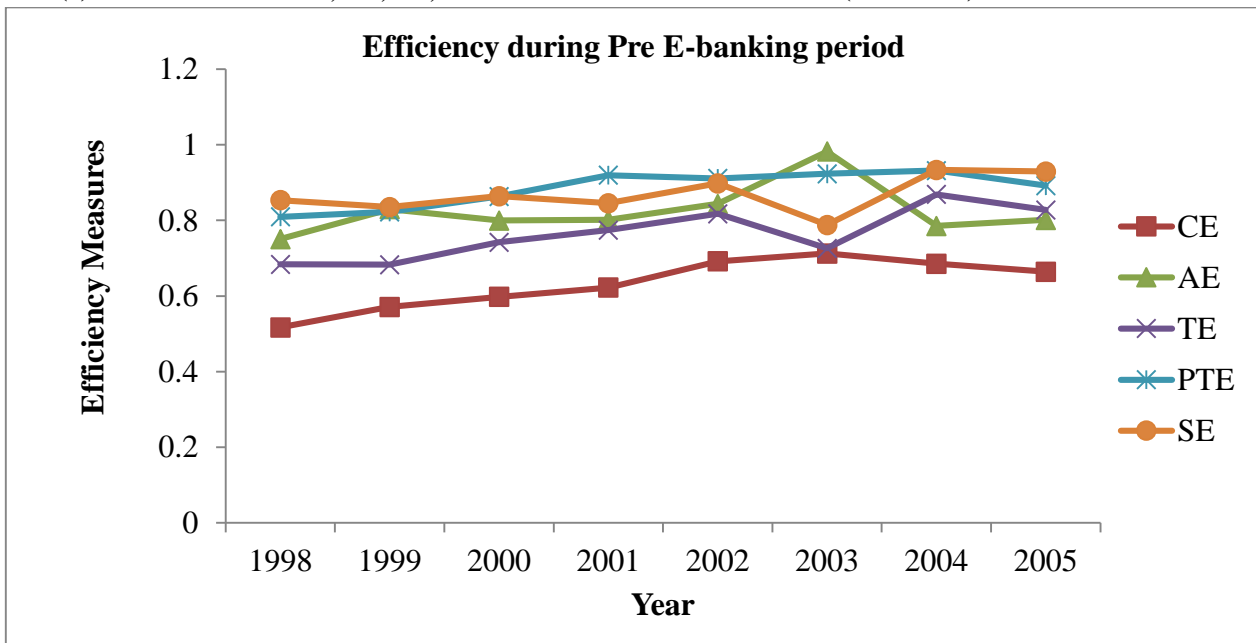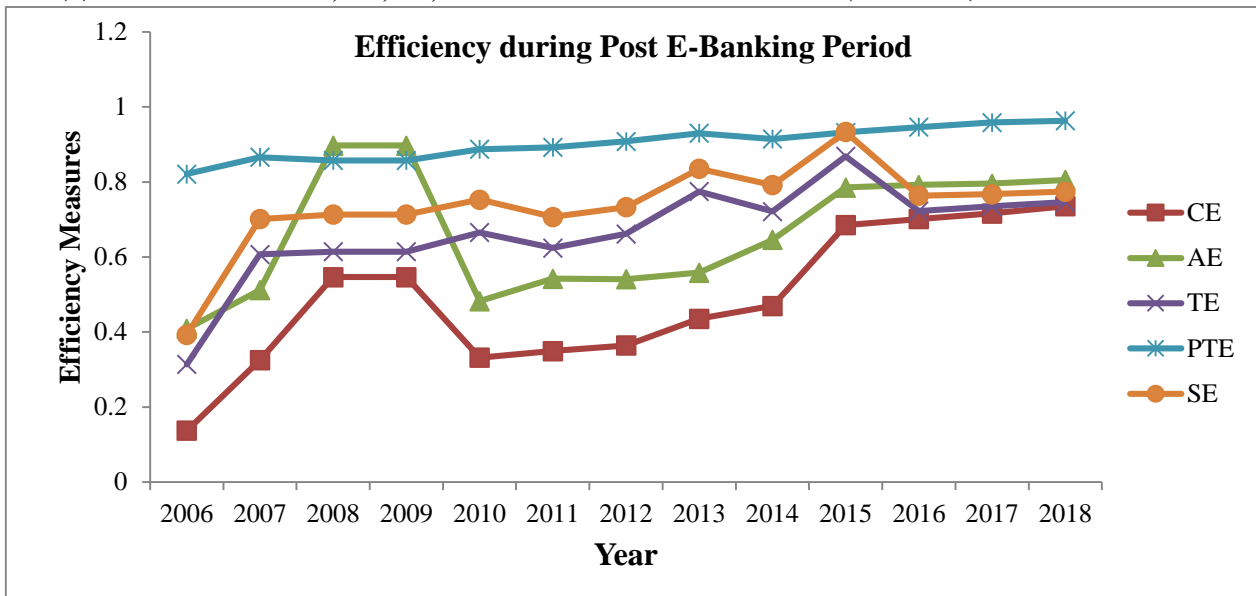**Figure 7.1 (a): Trends of Mean CE, AE, TE, PTE and SE of Commercial banks (1998-2005)**

Figure 7.1 (b): Trends of Mean CE, AE, TE, PTE and SE of Commercial banks (2006-2018)

The results reveal that during the period of study, there are variations in CE levels of commercial banks. CE has increased from 51.68% in 1998 to 71.26% in 2003, followed by a decline in the subsequent year (2005-06). During the post e-banking period, Mean Cost Efficiency has shown an improvement which ultimately stood at 73.54% in 2018. In other words, the improvement in efficiency was significantly more pronounced between 2006- 2018 than between 1998-2005. This implies that technology has definitely improved the performance of commercial banks in India. Also, Computerization needs to go beyond the mere arithmetical calculations and need to be leveraged optimally to achieve and maintain a high service and efficiency standard by remaining cost effective.

As noted above, CE is bifurcated into two components namely AE and TE. From the above table 7.1, we note that Mean AE ranges from minimum 40.84% to maximum 98.23% in both the periods. On an average, a bank requires 28.54% of more production cost by choosing wrong combination of inputs given the input prices. On the other hand, the mean TE of Commercial Banks in India has increased from 68.37% in 1998 to 86.87% in 2004. This increase is principally due to implementation of recommendations of Narasimhan Committee-II which focused more on financial soundness of banks and technology upgradation. During the period 2005-06, mean TE has shown a decreasing trend. During the post e-banking period (2007-15), the mean TE increased from 60.7% in 2007 to 66.54% in 2010. However, in subsequent years, it showed an improvement which stood at 86.87% in the terminal year. According to these estimates, the mean technical inefficiency ranges between minimum 13.13% and maximum 68.65% during the period of study.

From the above, it can be seen that TIE holds greater significance than AIE. This means that CIE occurs due to under utilisation or wastage of inputs rather than the environment in which they operate. Thus, TIE is the predominant source of CIE of banks in India during post and pre e banking periods.

Further, TE is divided into two components namely PTE and SE. This division shows the main sources of TIE in commercial banks of India. The table 6.1 endeavours results for PTE and SE. The mean PTE has shown an increasing trend from 80.94% in 1998 to 93.20% in 2004 followed by a dip during 2005-2006. However, during the post e banking period, the mean PTE showed an improvement followed by a dip in 2014 and then again it rose and stood at 96.78 % in the terminal year. The Mean pure technical inefficiency ranges from 6.8% to 17.81%.

On the other hand, mean SE has also followed the same trend as shown by PTE. Mean scale inefficiency ranges from 6.64% to 60.74% with grand mean of 79.00%.

Moreover as noted from the above table, commercial banks on an average incurs 51.40% of the cost to achieve the same level of output. This entails that Indian bank in the sample on average could have saved 48.6% of their total cost by operating on efficient frontier. This 48.6% of inefficiency is due to 28.54% of Allocative inefficiency and 30.07% of Technical Inefficiency. Thus, major source of observed cost inefficiency in this Industry is Technical inefficiency. Therefore, commercial banks in India are unable to produce maximum output with given set of inputs. Also, the Technical Inefficiency (30.07%) in the Commercial Banks of India is primarily due to 21% of Scale inefficiency and 11.41% of Managerial inefficiency or pure technical inefficiency. Therefore, banks are technically inefficient because they fail to operate at the optimal scale size rather than managerial underperformance in controlling waste of inputs

Thus, the overall result shows that the efficiency scores has improved over the years during post e-banking period and by

integrating technology into the banking system can help banks gain more advantage. Also, Indian Banks in the sample have substantial scale problems. Therefore, enhancing scale of operation in order to attain the benefits of economies of scale is need of the hour.

8. CONCLUSION AND POLICY RECOMMENDATIONS

The empirical results bring out the following main conclusions:

The developments in information technology and the ever increasing globalisation has increased the efficiency levels of commercial banks in India during post e-banking period as compared to pre e-banking period in the above study. But Indian banking industry has been under stress over the years because commercial bank on an average incured 51.40% of the cost to achieve the same level of output. This entails that Indian bank in the sample on average could have saved 48.6% of their total cost by operating on efficient frontier. This 48.6% of inefficiency is due to 28.54% of Allocative inefficiency and 30.07% of Technical Inefficiency. Thus, major source of observed cost inefficiency in this Industry is Technical inefficiency. Therefore, commercial banks in India are unable to produce maximum output with given set of inputs. Also, the Technical Inefficiency (30.07%) in the Commercial Banks of India is primarily due to 21% of Scale inefficiency and 11.41% of Managerial inefficiency or pure technical inefficiency. Therefore, banks are technically inefficient because they fail to operate at the optimal scale size rather than managerial underperformance in controlling waste of inputs. Thus, the result highlights that scale inefficiency is the main cause of technical inefficiency in Commercial Banks of India during the period of study. This means that Indian Banks in the sample have substantial scale problems. Therefore, enhancing scale of operation in order to attain the benefits of economies of scale and upgrading technology is need of the hour.

From the above analysis, following are the policy recommendations:

a) It is not merely spending more on information technology that translates it into higher profitability but more important is that how banks manage information technology and integrate it with business functions to achieve higher profitability. Strong management and good governance of information technology is a need of the hour.

b) It is not just the process of buying the computers and software that gives performance, rather the competitive advantage from introduction of information technology stems from the organizational dynamic capabilities which are defined in terms of timely responsiveness, rapid and flexible product innovation and management capabilities to effectively coordinate internal and external competencies.

c) With investment on information technology, new skills have to be acquired by the employees. It involves not just learning the use of new technology by the operative level personnel. Even the managerial staff also needs training in management of technology because modernization of work technology without ensuring reasonable command and control system can lead to loss of managerial effectiveness.

d) As computer and software are increasingly becoming economical inputs for banks, an overriding feature of the information technology using banks is that they are close to a real time interaction between suppliers, producers, distributors and customers. Interactive processes alone can place new demands and open opportunities for those who can respond to the need for increased flexibility.

e) Computerization needs to go beyond the mere arithmetical calculations and need to be leveraged optimally to achieve and maintain a high service and efficiency standard. Therefore, driving the productivity improvements in banking involves acquiring the right technology, deploying it optimally and remaining cost effective. Each organization needs to compute the optimum dose of information technology that will be compatible with its performance.

f) Banks must revamp their human resource management processes. There should be improvement in the existing practices of recruitment, training and deployment. The focus must shift from generalist orientation of the staff to specialist orientation, i.e., the ability to imbibe and absorb technology. Banks should evolve appropriate policies to make the best use of their primary asset, i.e., human resources.

g) Performance of information technology investment depends on environment, quality service to end users and other partners, which would necessitate a well qualified and robust group of skilled people to meet external and internal commitments. Hence, banking system needs to spend a lot on training.

h) To translate the information technology investment into higher performance, banks need to go beyond the traditional human resources jargon. Present day organization needs intellectual capital that is a function of human capital, structural capital and relationship capital. There needs to be a positive interaction between information technology, skills and work organization. Adopting efficient and

productive methodologies that will foster innovations is need of the time.

Hence, it can be concluded that commercial banks in India are cost inefficient due to Technical inefficiency, which is primarily due to scale inefficiency. Thus, this implies that technology plays vital role in reducing operating cost and keeping in mind the latest updates of e-banking in order to face competition boldly because during post e-banking period, the efficiency scores of commercial banks have increased as compared to the pre e-banking period.

9. LIMITATIONS

The findings of the present study are subjected to limitation that provides initiatives for future research. The study evaluates efficiency of only commercial banks of India. So, the research in this area can be extended to other segments of banking sector in India and to alternate industries in both manufacturing and service-oriented settings.

10. SCOPE FOR FUTURE RESEARCH

The present study focuses only on commercial banks. Further research can be extended to different segments of banking sector. Moreover, banking in any economy is underpinned by cultural concerns and legal concerns and practices. Further scope for this study can be extended to alternative domestic setting and also to alternate industries in both manufacturing and service oriented settings. Also, the methodology used in the study may be refined in future in order to provide useful insights.

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