Efficiency and Productivity Analysis of Puducherry Cooperative Banks by Using DEA APPROACH

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ABSTRACT
The Banking sector plays a vital role in economic development of a country. The Efficient and effective banking system brings rapid growth in various sectors. Therefore, its efficiency and productivity has to be compared and analyzed for better performance. Through analyses it is very important to set a bench mark for every bank for the continual improvement. The aim of this study is to analyze and describe the existing scenario of banking sector. It also aims to analyze the performance and efficiency of Pondicherry Co-operative Urban Bank Ltd which consists of 6 branches. The study has used a separate tool (DEA APPROACH) for analyzing efficiency and productivity of banks.
The study was purely based on the Secondary Data. Only secondary data are used for making interpretations and conclusions. The second hand information used in this research has been collected from the Audited Financial results published by Reserve Bank of India in its website for the Period 2010-11 to 2011-12 and 2011-12 Annual report of Pondicherry Co-operative Urban Bank Ltd published in website

Introduction
The Pondicherry Co-operative Urban Bank is the Urban Co-operative Banks (UCBs) are a unique form of organization. They are registered under the Co-operative Societies Act of the concerned state, which empowers the register of Co-operative Societies to register and liquidate the societies.The bank accepts various kinds of deposits like Fixed Deposit, Recurring, Savings and Current. Similarly the bank extends various types of Loans such as Salary Earners Loans to the Government servants, Consumer Loan, Jewel Loan, Cash Credit Loan, Housing Loan to the members. The Loan Section, Deposit Section at Head Office is partly computerized with a power server and 13 nodes are working in LAN environment. Recently our Muthialpet Branch is fully computerized. The Pondicherry Co-operative Urban Bank has been brought under the category insured bank. The minimum insurance cover given to a depositor is   Rs. 1,00,000/- and the same is made with the Deposit Insurance and Credit Guarantee Corporation of India. By its performance the Pondicherry Co-operative Urban Bank has been brought under "A" class audit classification for more than 20 yearsAt present the bank has Five Branches such as: Jawaharlal Nehru Street,(Main Branch), Muthialpet, Mudaliarpet, Nellithope, Villianur and Lawspet.

EFFICIENCY MEASUREMENT TECHNIQUES:
Technical efficiency
Cost efficiency

Total factor productivity change:
Reflects the ability of the firm to obtain maximal output from given set of inputs. The **Technical Efficiency (TE)** of a firm is most commonly measured by means of a ratio. It will take a value between zero and one, and hence provides an indicator of the degree of technical efficiency of the firm. A value of one indicates the firm is fully technically efficient.

Cost Efficiency: The cost efficiency is a mix of technical and allocative efficiencies. **Technical efficiency (TE)** is just the proportional reduction in inputs possible for a given level of output in order to obtain the efficient use of inputs. **Allocative efficiency (AE)** reflects the ability of a firm to use the inputs in optimal proportions, given their respective prices. The two measures could be combined to give a measure of **Total Economic Efficiency (EE), or Overall Efficiency (OE),** or cost efficiency, which is a product of two efficiency measures **(OE = TE x AE).**

Total Productivity Change: The Malmquist TFP index calculates the change in productivity between two points by estimating the ratio of the distances of each point relative to a common technology. The Malmquist input oriented TFP change index between the base period t and the following period t+1 is defined as:

$$M(y_t, x_t, y_{t+1}, x_{t+1}) = \left[\frac{d_{t+1}(Y_{t+1}, X_{t+1})}{d_t(Y_t, X_t)} \times \frac{d_t(Y_{t+1}, X_{t+1})}{d_{t+1}(Y_{t+1}, X_{t+1})} \right]^{1/2}$$

A value of M greater than unity implies a positive TFP growth from the period t to period t+1. Otherwise, a value of M less than one indicates a TFP decline. The total factor productivity change (M) can be decomposed into technical efficiency change (TEC), as how much closer a firm gets to the efficient frontier and technological change (TC), and how much the benchmark production frontier moves at each firm's observed input mix.

DATA ENVELOPMENT ANALYSIS (DEA): Data envelopment analysis is a performance measurement technique which can be used for analyzing the relative efficiency of productive units, having the multiple inputs and multiple outputs. It is a non-parametric analytic technique which allows us to compare the relative efficiency of decision making units (DMU's) as benchmark and by measuring the inefficiencies in input combinations in other units relative to the benchmark.DEA benchmarks firms are only against the best producers. It can be characterized as an extreme point method that assumes that if a firm can produce a certain level of output utilizing specific input levels, another firm of equal scale should be capable of doing the same. The most efficient producers can form a 'composite producer', allowing the computation of an efficient solution for every level of input or output. Where there is no actual corresponding firm, 'virtual producers' are identified to make comparisons. Data envelopment analysis (DEA) is a linear programming methodology to measure the efficiency of multiple decision-making units (DMUs) when the production process presents a structure of multiple inputs and outputs.

Objectives of the Study
- To estimate the technical, cost and productivity efficiency of various branches of Pondicherry Co-operative Urban banks in Puducherry region by using DEA model.
- To identify the factors which discriminate the efficiency of the banks by above average and below average by using technical analysis
- To suggest a bench mark (Model Bank) to compare and improve the present banking practices of Pondicherry Co-operative Urban Banks.

Review of Literature
Several studies have addressed the question of bank efficiency, especially in developed economies; in contrast, studies analyzing the efficiency of banks in emerging economies such as India are far fewer. However, the literature on the restructuring and development of the financial sector in the transitional

economies and emerging markets are abundant. Ownership issues, especially the impact of the entry of foreign banks in transitional economies, are most documented. These studies generally find evidence that ownership matters. Buch (1997) asserts that foreign-owned banks use modern technology from and rely on the human capital of their parent banks, so that they would be expected to perform better than government-owned or domestic private banks in transitional economies. On similar lines, private banks would be expected to perform better than government-owned banks.

Berg, Forsund and Clausssen (1993) introduced the Malmquist index as a measurement of the productivity change in the banking industry. They focused on the Norwegian banking system during the deregulation period 1980-1989. Their results indicated that deregulation lead into a more competitive environment. The increase of productivity was faster for larger banks, due to the increased antagonism they faced.

Favero and Papi (1995) used the non-parametric Data Envelopment Analysis on a cross section of 174 Italian banks in 1991 to measure the technical and the scale efficiencies of the Italian banking industry. In implementing both the intermediation and the asset approach the traditional specification of inputs was modified to allow for an explicit role of financial capital. In addition, regression analysis was used on a bank specific measure of inefficiency to investigate determinants of banks' efficiency. According to the empirical results, efficiency was best explained by productivity specialisation by bank size and to a lesser extent by location (north-Italian banks were more efficient than south-Italian banks).

Drake and Weyman-Jones (1996) used non-parametric DEA techniques and a translog stochastic frontier approach to estimate scale and technical and allocative inefficiencies. They used data of 46 UK building societies and employed an intermediation approach in their study. Using the non-parametric DEA technique, they found considerable variability in inefficiencies across building societies in the sample, with allocative inefficiency dominating the technical and scale inefficiencies. The cost frontier results, on the other hand, suggested very little allocative or technical inefficiency with constant returns to scale. However, the efficiency rankings provided by the two approaches were found to be remarkably identical.

Pastor, Perez and Quesada (1997) analysed the productivity, efficiency and differences in technology in the banking systems of United States, Spain, Germany, Italy, Austria, United Kingdom, France and Belgium for the year 1992. Using the non-parametric approach DEA together with the Malmquist index, they compared the efficiency and differences in technology of several banking systems. Their study used the value added approach. According to the results France had the banking system with the highest efficiency level followed by Spain, while UK presented the lowest level of efficiency.

Bhattacharya (1997) used DEA to measure the productive efficiency of Indian commercial banks in the late 1980's to early 1990's and to study the impact of policy of liberalizing measures taken in 1980's on the performance of various categories of banks. They found that the Indian public sector banks were the best performing banks, as the banking sector was overwhelmingly dominated by the Indian public sector banks, while the new private sector banks were yet to emerge fully in the Indian banking scenario.

Chen and Yeh (1998), measured the operating efficiency of 33 banks in Taiwan. Applying the DEA approach in their study, they used variables like loan services, portfolio investment, interest income and non-interest income as the output of banks, while the number of staff employed, bank assets, the number of bank branches, operating costs, and deposits were used as the input variables.

Aziz Ponary Mlima and Lennart Hjalmarsson (2002) reviewed various definitions of input and output measurement in the banking industry and, conduct an experiment on the sensitivity of efficiency scores based on the choice of variables. The results suggest that efficiency score are very sensitive to the choice of input and output variables. which is mainly attributable to technological improvement (innovations in banking technology).

Casu and Molyneux (2003) employed DEA to investigate whether the productivity efficiency of European banking systems had improved and converged towards a common European frontier between 1993 and 97. The geographical coverage of the study was France, Germany, Italy, and the United Kingdom. All data were reported in ECU as the reference currency. Their results indicated relatively low average efficiency levels. Nevertheless, it was possible to detect a slight improvement in the average efficiency scores over the period of analysis for almost all banking systems in the sample, with the exception of Italy.

Schure, Wagenvoort and O'Brien (2004) estimated the productivity of the European banking sector for the period 1993-1997. They found that larger commercial banks were more productive on average than smaller banks. However, the Italian and the Spanish banks were found to be the least efficient.

Casu, Girardone and Molyneux (2004) for the period 1994-2000, in an efficiency analysis of the European banking institutions found that Italian banks had an 8,9% productivity increase, Spanish banks had a 9,5% increase, while German, French and English banks had 1,8%, 0,6% and 0,1% productivity increase, respectively. The main reason for such improvement in efficiency for the Italian and Spanish banks was the cost reduction that these institutions managed to achieve.

Dimitrios Angelidis and Katerina Lyroudi (2006) examined the productivity of the 100 larger Italians banks for the period 2001-2002. Inputs and outputs are used as nominal values (millions of euros) and as the natural logarithms of these values. The mean error between the actually total factor productivity and the estimated one is calculated according to both approaches. Moreover, the weighted arithmetic mean of the Malmquist productivity index is calculated in addition to the geometric mean. Also, the correlation coefficient and the ranking correlation coefficient are computed to shed more lights to the relationship between bank' size and its performance. The empirical results revealed that the use of natural logarithms and neural networks regression reduces the errors in the estimates. Finally, there is rather an inverse relationship between size and productivity growth, in contrast to the literature. However, this relationship is not statistically significant for our sample firms.

Jenifer Daley and Kent Matthews (2008) explored the results and relationships between bank efficiency estimates using accounting ratios and non-parametric DEA with bootstrap among Jamaican banks between 1998 and 2007. The results indicate different outcomes for the traditional accounting ratios and the sophisticated DEA methodology in the measurement of bank efficiency. GLS random effects two-variable regression tests for superiority using a risk index for insolvency suggest an advantage in favour of the DEA.

Christos Floros and Georgia Giordani (2008) showed how useful the number of ATMs is for modelling and estimating banking efficiency. They examined banking efficiency for Greece using data from top 10 commercial banks. To estimate banking efficiency they employed DEA and FDH using three inputs (number of employees, number of branches and number of ATMs) and one output (loans). They found that large banks are more efficient than medium and small sized banks. Furthermore, they report that banks with a large number of ATMs are more efficient than those with a less number of ATMs.

Analysis & Interpretation
TECHNICAL EFFICIENCY:
The inputs and outputs used are:

Output 1 - Advances or loans created in Indian rupees

Output 2 - Investments made in Indian rupees
Input 1 - Deposits accepted in Indian rupees
Input 2 - Total number of employees employed

TECHNICAL EFFICIENCY SCORE OF PONDICHERRY CO-OPERATIVE BANKS

BANKS	TE	RANK
1. PCUB J.N Street (Main Branch)	0.925	2
2. PCUB Muthialpet (Branch)	0.946	3
3. PCUB Mudaliarpet (Branch)	0.858	4
4. PCUB Nellithope (Branch)	0.978	1
5. PCUB Villianur (Branch)	0.800	6
	0.803	5

PCUB BRANCHES LEVEL:
COST EFFICIENCY
(Annexure 2 and 3)

The inputs and outputs used are:

Output 1 - Advances or loans created in Indian rupees

Output 2 - Investments made in Indian rupees

Input 1 - Deposits accepted in Indian rupees

Input 2 - Total number of employees employed

Input price 1 - Price of deposits in Indian rupees*

Input price 2 - Price of labour in Indian rupees**

* Price of deposits - Interest paid on deposits divided by the total value of deposits

** Price of labour - Amount of salaries and wages paid to employees divided by the number of employees at each bank

COST EFFICIENCY SCORE OF PONDICHERRY CO-OPERATIVE URBAN BANK LTD BRANCHES FOR THE YEAR 2011-2012
Table No: 5.2.1

BANKS	CE	Rank
1. PCUB J.N Street (Main Branch)	0.997	3
2. PCUB Muthialpet (Branch)	0.997	3
3. PCUB Mudaliarpet (Branch)	0.953	5
4. PCUB Nellithope (Branch)	1.000	1
5. PCUB Villianur (Branch)	0.930	6
6. PCUB Lawspet (Branch)	1.000	1
AVERAGE	0.979	

From the study, it has been found that PCUB Nellithope Bank's cost efficiency (1) is greater than other branches of PCUB and cost efficiency of Villianur Bank found to be least one (0.930)

INFERENCE:
From the above table it can be inferred that **PCUB Nellithope (Branch) and Lawspet (Branch)** is the only cost efficient bank among the Pondicherry Co-operative Urban Banks for the year 2011-12. The average cost efficiency score of Pondicherry Co-operative Urban Banks is 0.979. It seems to be low due to the out-performance of PCUB Nellithope (Branch) and Lawspet (Branch) which affects the relative efficiency of other banks. Though we saw that PCUB J.N Street (Main Branch) and Mudaliarpet (Branch) was technically efficient for the same time period, it is not cost efficient due to its allocative inefficiency.

TOTAL FACTOR PRODUCTIVITY CHANGE OF PONDICHERRY CO-OPERATIVE URBAN BANKS LTD IN INDIA FOR THE PERIOD 2010-2012

Table No: 5.3.1

Effch	-	TECHNICAL EFFICIENCY CHANGE
Techch	-	TECHNOLOGICAL CHANGE
Tfpch	-	TOTAL FACTOR PRODUCTIVITY CHANGE

BANKS	effch	techch	tfpch
1. PCUB J.N Street (Main Branch)	1.000	0.925	0.925
2. PCUB Muthialpet (Branch)	1.000	0.946	0.945
3. PCUB Mudaliarpet (Branch)	1.000	0.858	0.858
4. PCUB Nellithope (Branch)	1.000	0.978	0.978
5. PCUB Villianur (Branch)	0.990	0.800	0.792
6. PCUB Lawspet (Branch)	1.000	0.803	0.803

INFERENCE:
From the above table it can be inferred that only 5 banks i.e. 80% of the banks have shown a growth in total factor productivity in the year 2011-12 compared to 2010-11. A growth in technological change can be witnessed in most of the banks.

PCUB AND ALL COMMERCIAL BANKS:
TECHNICAL EFFICIENCY SCORE OF PONDICHERRY CO-OPERATIVE BANKS
Table No: 5.1.2

BANKS	TE	RANK
1. PCUB J.N Street (Main Branch)	0.925	2
2. PCUB Muthialpet (Branch)	0.946	3
3. PCUB Mudaliarpet (Branch)	0.858	4
4. PCUB Nellithope (Branch)	0.978	1
5. PCUB Villianur (Branch)	0.800	6
	0.803	5

Suggestions and Recommendations
The technical efficiency of Nellithope Branch has dominated the technical efficiency of other branches. This is due to more number of deposits (banks accounts) with less number of employees. Therefore these deposits have assisted the bank in making maximum advances and loans. The nearest rank to Nellitope Branch is PCUB JN Street Branch which is considered as the main branch among all the branches but it lacks few step away from Nelltope branch due to increased cost in the total number of employees. Therefore it has been suggested to other banks to reduce its cost in terms of minimum employees and increase the inflows in terms of accepting which will enable the other branch to improve technical efficiency.

The cost efficiency is based on two factors such as Price of the Deposits and Prices of the Labor. The bank with minimum labor cost and maximum deposits is termed as the Cost efficient bank. In the study, it is clear that the Nellitope and Lawspet branches banks have more amounts of deposits with less labor cost. Hence other banks must concentrate on labor cost on one hand and maximize the public deposit on other hand. This can be done with the help of providing efficient training, recruiting the talents with moderate pay.

The total factor productivity of Nellitope branch has found to the most efficient one. Therefore this bank has proved that less

abor cost and maximum deposit can help the bank is providing mazimum loans and advances and also in investment.

Conclusion

In this study, the researcher has taken 6 branches of Pondicherry Cooperative Bank for the purpose of analyzing the Technical, Cost and Productivity efficiencies. For this the researcher has used DEA model for evaluating the efficiency. The DEA model is a non-parametric linear programming efficiency measurement technique which can be used for analyzing the relative efficiency of productive units, having the same multiple inputs and multiple outputs. From the study, the researcher concludes that labor cost and accepting maximum deposits are the key factor for any bank to improve Technical , Cost and Productivity efficiency. Hence, from the study it can be concluded that Nellitope bank is found to be the best in all required aspects. Thus, all other branches may take Nellitope branch bank as the benchmark bank in order to improve their efficiencies.

ANNEXURE :
BRANCH LEVEL INPUT AND OUTPUT VARIABLES CONSIDERED FOR THE YEAR 2011-12
(Amount in rupees Lakhs)

BANKS	Advances	Investments	Deposits	No. Of Employees
1. PCUB J.N Street (Main Branch)	5370.31	2210.7	5953.18	66
2. PCUB Muthialpet (Branch)	1073.25	974.2	2608.43	28
3. PCUB Mudaliarpet (Branch)	1440.04	449.6	1297.97	20
4. PCUB Nellithope (Branch)	1451.74	637	1700.86	17
5. PCUB Villianur (Branch)	524.87	224.8	639.04	15
6. PCUB Lawspet (Branch)	556.06	149.8	405.64	22

BRANCH LEVEL PRICE OF INPUTS CONSIDERED FOR THE YEAR 2011-12
(Amount in rupees crore)

BANKS	Price of Deposits	Price of Labour
1. PCUB J.N Street (Main Branch)	0.052759	0.058571
2. PCUB Muthialpet (Branch)	0.054325	0.047938
3. PCUB Mudaliarpet (Branch)	0.055704	0.050569
4. PCUB Nellithope (Branch)	0.05872	0.048046
5. PCUB Villianur (Branch)	0.054823	0.048061
6. PCUB Lawspet (Branch)	0.056677	0.048601

BRANCH LEVEL INPUT AND OUTPUT VARIABLES CONSIDERED FOR THE YEAR 2010-11
(Amount in rupees Lakhs)

BANKS	Advances	Investments	Deposits	No. Of Employees
1. PCUB J.N Street (Main Branch)	4833	1842.2	3968.6	66
2. PCUB Muthialpet (Branch)	966	811.8	1738.6	28
3. PCUB Mudaliarpet (Branch)	1296	374.6	865.3	20
4. PCUB Nellithope (Branch)	1306	530.8	1133.9	17
5. PCUB Villianur (Branch)	472	189	426.0	15
6. PCUB Lawspet (Branch)	501	105	270.4	22

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