



Evaluation of Private Banks using PROMETHEE Method

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Abstract. In this study, a range of multi-criteria decision-making approaches is used to analyze the performance of Indian private-sector banks. Data was collected and performance was evaluated by taking into account a variety of inputs and outputs using annual reports from the relevant banks. For data analysis, PROMETHEE, a crucial multi-criteria decision-making (MCDM) technique, is employed. The research indicates that HDFC is the private sector bank with the best performance and establishes a standard. By the implementation of MCDM techniques i.e. PROMETHEE ICICI is ranked first followed by HDFC at the second spot. Different methodologies have led to different rankings for other institutions. To extend the time range of analysis after the PROMETHEE rankings have been obtained, future studies on the performance of banks may compare various bank types. According to the findings, private sector banks should invest in areas that will provide income to improve their performance. Efficiency needs to be raised if businesses are to survive in the market and compete with the government and foreign institutions. These findings are beneficial to a wide range of participants, especially investors who want to comprehend the value of banks as possible investment targets. For the first time, scientists have combined MCDM strategies like PROMETHEE. MCDM techniques have been used to examine specific inputs and outputs for private sector banks to determine performance.

Key words: Axis Bank, City Union Bank, ICICI Bank, HDFC Bank, MCDM

1. Introduction

The banking sector supports a nation's economy. In a developing nation like India, banks are crucial to the economy's expansion. Increased disposable incomes and population growth have contributed to the high demand for banking services and related products. Ten years ago, public sector banks dominated the banking sector. Private sector banks were given the chance to function and increase their part of the Indian economy; however inefficiency and a lack of technology made this possible [1]. The emergence of private banks facilitated the adoption of technology in the banking industry. Which improved the general functioning of the financial system? Return on assets (RoA) and return on equity are acknowledged as crucial indicators for assessing the performance of banks (RoE). For the fiscal year 2018–2019, banks in the private and public sectors had different returns on assets (RoAs), but for the public and private sectors, it is 0.65 and 0.63 respectively. Referring to RBI draws attention to the expanding role played by private sector banks in the growth of the Indian economy [2]. The goal of the current study is to develop techniques for evaluating bank performance in light of the complex and unstable environment that currently exists in the banking industry. Since numerous factors affect how well banks perform, while assessing performance, several factors should be taken into consideration. Additionally, not every factor may be equally significant. As a result, any qualitative decision or preference based on subjective evaluation may result in a biased result. In such a crucial setting, to increase one's ability to choose the best option among a variety of options based on a predetermined set of characteristics or criteria, MCDM techniques can be utilized [3-7]. In MCDM, a variety of approaches are used to tackle complex issues, yet even when the issues are similar, the approaches will produce diverse results. To assess how well private sector banks are performing, we advise adopting several cutting-edge MCDM approaches. As a result, the current study's goal is to talk about the following areas of inquiry [8].

2. Banking Sector

Axis Bank, City Union Bank, ICICI Bank, HDFC Bank, and Karur Vysya are some of India's top private banks at the moment. Each year, the asset base of private banks like Axis Bank and ICICI Bank is growing quickly. Compared to public sector banks. The current study's objective is to assess the financial health of these two sizable private-sector banks. A comparison of Axis Bank and ICICI Bank's financial performance metrics or indicators is also included in the study. An important part of a nation's economic growth is played by banks [13]. They rely on a strong banking system to help them contribute positively to accelerating the development process. The goal of banking sector reforms was to increase the profitability and efficiency of banks [9-10]. We can attest that the transitional era was not easy as someone who assisted at the beginning of these reforms. However, these changes have improved the banking system's dependability and security. Indian banks currently meet or exceed international norms for capital adequacy. Net NPAs have decreased to a more tolerable level. Currently, one of the main problems with banking reforms is bank consolidation [11]. Examining the financial consequences of ICICI Bank and HDFC Bank is the purpose of the current study. Being positioned as a creative,

technologically advanced, and customer-focused bank was the key to ICICI Bank's explosive expansion. The management performed a thorough assessment of several international vendors after realizing they needed a solid core technology platform to meet their business objectives. In the end, they chose Infosys' Finacle global banking system [12]. The system used an open system design and had a low total cost of ownership. It included contact centers, online debit, credit cards, consumer banking, corporate e-banking, text message alerts, and mobile. It also included e-broking. From the moment its first branch in Chennai was opened, unlike the majority of Indian banks at the time, ICICI Bank was fully automated. The bank was able to rapidly service multiple consumer categories thanks to Finacle's core banking products [5].

3. PROMETHEE

PROMETHEE Techniques are the most famous of the surpassing techniques worldwide. One factor contributing to this popularity is the availability of the remarkably user-friendly software application known as PROMCALC-PROMETHEE computation. PROMCALC is being used more frequently by professionals to address multi-criteria situations [14]. The implications of the model assumptions used in PROMETHEE approaches are not known to all users, though. In this article, various PROMETHEE technique flaws that users should be aware of and steer clear of are briefly discussed. Manufacturing technologies continue to undergo slow but innovative changes [15]. Manufacturing technology is evolving quickly, prompting a need for manufacturing businesses to respond more quickly [16]. Manufacturing industries must choose the right production plans, To meet the problems, product designs, production procedures, work piece and tool materials, machinery, and equipment used. Today, there are many challenging selections to choose from, and the selection processes are hard. Understanding the conditions required to make green choices, actions being taken now and in the future, as well as variables affecting the entire production environment, individual selection methods, and exploring the style of various types of techniques and techniques, will help you make the best decision [17-19]. Develop methods primarily based on large-scale problems related to design, planning, and handling manufacturing structures. This study's objective is to demonstrate and validate the PROMETHEE technique while taking into account flexible and ambiguous standards. An estimated cost judgment is included in the fuzzy transition degree for first-rate requirements, and to ascertain the relative significance of standards, this method is employed along with the analytical hierarchy process (AHP) [20]. An enhanced PROMETHEE approach for prioritization in a manufacturing context is shown in the following section. PROMETHEE is a significant scale method for evaluating options based on criteria in multi-criteria choice problems. It is characterized by the use of several non-binding abilities, which are used to assign versions between options in judgments. This paper proposes the application of PROMETHEE below to the selection of inexperienced carriers for equally ancient scale preference functions [21]. Comparative results are presented to verify the impact of different aspiration capacities on final aspiration. Seven economic and environmental requirements, four suppliers, and 5 choice makers are the main systems in the green supplier priority problem. Data were collected through personal interaction with desire makers using a five-item Likert scale. Prometheu's set of rules has been completed under a uniform vintage standard feature, and the results show that Dealer A1 is a highly sought-after prospect [22]. The comparison results show that supplier A1 is the most preferred alternative, regardless of the difference in preference capabilities used. Data is used from the annual reports of various private sector banks to achieve the work's unique goals. To achieve the specific goals of the current work, data is acquired from the annual reports of individual private sector banks. Bank employees contributed primary data for the study. I.e. PROMETHEE. Using the PROMETHEE approach, the variables' arbitrary weights were determined. The performance of banks was calculated and ranked using the PROMETHEE methodology [23]. These methods can be used to cope with various factors and accomplish objectives. The banks were chosen following Ramanathan's recommendations based on the homogeneity of the institutions and the number of decision-making units (2001). The decision-making bodies for the current study were 18 private-sector banks. Following a thorough assessment of the literature, four input variables and four outcome variables were taken into account [25]. Total assets, deposits, cash, investments, and advances are examples of input variables. Taking information from the annual reports of HDFC Bank, ICICI Bank, Axis Bank, Karur Vysya, and City Union Bank information on various characteristics of chosen banks has been gathered (2019). In Table 1, a result matrix is used to show the data for the input and output variables. The Wilcoxon signed rank test, a non-parametric analysis, is used to compare PROMETHEE's rank results. We'll give a thorough rundown of the analytical MCDM methods that were employed in this study [24].

Table 1 Data Set Decision matrix

	Total Assets	Deposits	Cash	Investments	Advances
HDFC Bank	12,44,54,06,906	45,25,88,883	81,34,76,392	2,90,58,78,784	1,74,96,92,759
ICICI Bank	9,64,45,91,478	6,52,91,96,711	80,29,62,860	2,07,73,26,800	5,86,64,65,827
Axis Bank	8,00,99,65,316	5,48,47,13,409	67,20,46,353	1,74,96,92,759	5,86,64,65,827
Karur Vysya	69,34,01,144	59,86,79,519	3,69,70,455	14,88,15,854	48,58,08,140
City Union Bank	45,25,88,883	38,44,79,485	2,96,32,845	7,71,22,006	32,67,33,408
Max	12445406906	6529196711	813476392	2905878784	5866465827
Min	452588883	384479485	29632845	77122006	326733408
max-Min	11992818023	6144717226	783843547	2828756778	5539732419

Table 1 shows the Total Assets, Deposits, Cash, Investments, Advances of each of the five ICICI Bank, Axis Bank, Karur Vysya, HDFC Bank and City Union Bank shows the maximum and minimum output of each value.

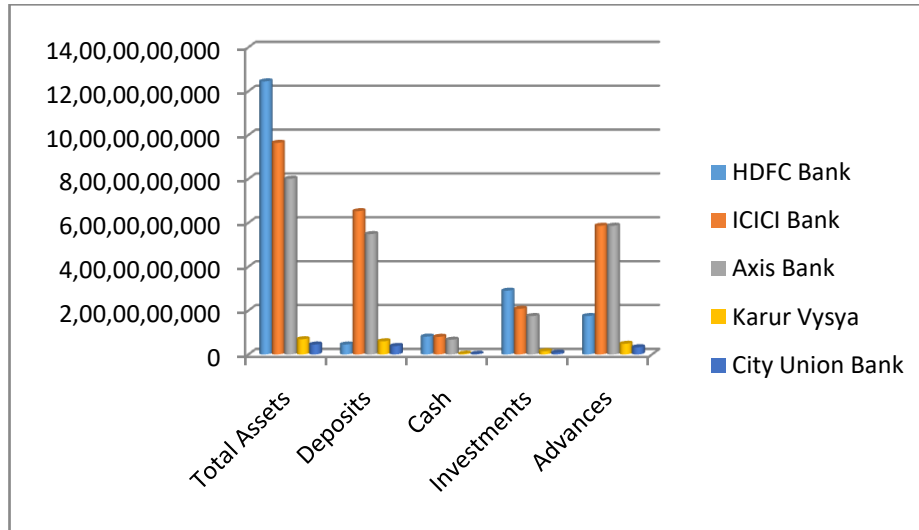


FIGURE 1. Banking

Figure 1 shows that the Total assets of all the bank is high and the Total assets of the bank are very important. HDFC and ICICI bank is high in deposits, Total assets and advances.

TABLE 2. Normalized decision matrixes with PROMETHEE method

	Total Assets	Deposits	Cash	Investments	Advances
HDFC Bank	1	0.01108422	1	1	0.256864275
ICICI Bank	0.76645894	1	0.986587206	0.707096775	1
Axis Bank	0.630158518	0.830019305	0.819568536	0.591274148	1
Karur Vysya	0.020079706	0.034859217	0.009361064	0.025344649	0.028715237
City Union Bank	0	0	0	0	0

Table 2 shows the Normalized matrix of Sensitivity analysis PROMETHEE the ICICI Bank, Axis Bank, Karur Vysya, HDFC Bank and City Union Bank normalization are shown in the above tabulation. Table 2 shows the default matrix of PROMETHEE us for the sensitivity analysis shown in the table above.

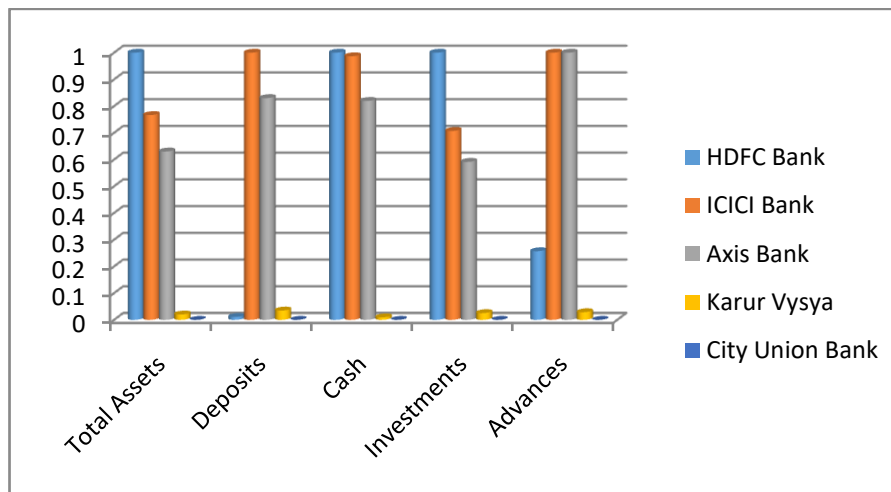


FIGURE 2. Normalized matrix of Sensitivity analysis PROMETHEE

A graphic illustration of the sensitivity analysis's normal matrix is shown in Figure 2. HDFC Bank and ICICI Bank have a high rating compared to the others. The City Union Bank default is the lowest rating of all.

TABLE 3. Pair Wise Comparison

	Total Assets	Deposits	Cash	Investments	Advances
D12	0.23354106	-0.98891578	0.013412794	0.292903225	-0.743135725
D13	0.369841482	-0.818935085	0.180431464	0.408725852	-0.743135725
D14	0.979920294	-0.023774997	0.990638936	0.974655351	0.228149037
D15	1	0.01108422	1	1	0.256864275
D21	-0.23354106	0.98891578	-0.013412794	-0.292903225	0.743135725
D23	0.136300422	0.169980695	0.16701867	0.115822627	0
D24	0.746379234	0.965140783	0.977226142	0.681752126	0.971284763
D25	0.76645894	1	0.986587206	0.707096775	1
D31	-0.369841482	0.818935085	-0.180431464	-0.408725852	0.743135725
D32	-0.136300422	-0.169980695	-0.16701867	-0.115822627	0
D34	0.610078812	0.795160088	0.810207471	0.565929499	0.971284763
D35	0.630158518	0.830019305	0.819568536	0.591274148	1
D41	-0.979920294	0.023774997	-0.990638936	-0.974655351	-0.228149037
D42	-0.746379234	-0.965140783	-0.977226142	-0.681752126	-0.971284763
D43	-0.610078812	-0.795160088	-0.810207471	-0.565929499	-0.971284763
D45	0.020079706	0.034859217	0.009361064	0.025344649	0.028715237
D51	-1	-0.01108422	-1	-1	-0.256864275
D52	-0.76645894	-1	-0.986587206	-0.707096775	-1
D53	-0.630158518	-0.830019305	-0.819568536	-0.591274148	-1
D54	-0.020079706	-0.034859217	-0.009361064	-0.025344649	-0.028715237

Table 3 displays the Pair-Wise Comparison of Table 2, comparing each row on the tabulation with the adjacent row for ICICI Bank, Axis Bank, Karur Vysya, HDFC Bank, and City Union Bank.

TABLE 4 Preference value

Preference value	0.2336	0.1652	0.3355	0.1021	0.0424	SUM
D12	0.05455519	0	0.004499992	0.029905419	0	0.088960603
D13	0.08639497	0	0.060534756	0.04173091	0	0.188660636
D14	0.22890938	0	0.332359363	0.099512311	0.009673519	0.670454574
D15	0.2336	0.001831113	0.3355	0.1021	0.010891045	0.683922158
D21	0	0.163368887	0	0	0.031508955	0.194877842
D23	0.03183978	0.028080811	0.056034764	0.01182549	0	0.127780844
D24	0.17435419	0.159441257	0.32785937	0.069606892	0.041182474	0.772444183
D25	0.17904481	0.1652	0.331000008	0.072194581	0.0424	0.789839397
D31	0	0.135288076	0	0	0.031508955	0.166797031
D32	0	0	0	0	0	0
D34	0.14251441	0.131360447	0.271824607	0.057781402	0.041182474	0.644663339
D35	0.14720503	0.137119189	0.274965244	0.06036909	0.0424	0.662058553
D41	0	0.00392763	0	0	0	0.00392763
D42	0	0	0	0	0	0
D43	0	0	0	0	0	0
D45	0.00469062	0.005758743	0.003140637	0.002587689	0.001217526	0.017395214
D51	0	0	0	0	0	0
D52	0	0	0	0	0	0
D53	0	0	0	0	0	0
D54	0	0	0	0	0	0

Table 4 shows the Performance value of the ICICI Bank, Axis Bank, Karur Vysya, HDFC Bank and City Union Bank. When compare to all others. The total of the similar row makes up the last one.

TABLE 5. Sum of Performance Value

	HDFC Bank	ICICI Bank	Axis Bank	Karur Vysya	City Union Bank	SUM	
HDFC Bank	0	0.088960603	0.188660636	0.670454574	0.683922158	1.63199797	0.326399594
ICICI Bank	0.194877842	0	0.127780844	0.772444183	0.789839397	1.88494226	0.376988453
Axis Bank	0.166797031	0	0	0.644663339	0.662058553	1.47351892	0.294703785
Karur Vysya	0.00392763	0	0	0	0.017395214	0.02132284	0.004264569
City Union Bank	0	0	0	0	0	0	0
SUM	0.365602502	0.088960603	0.31644148	2.087562096	2.153215322		
	0.0731205	0.017792121	0.063288296	0.417512419	0.430643064		

Table 5 shows the sum of all rows and column are applied on the last row. The sum of all row of performance value is arranged above tabulation and the diagonal value is zero.

TABLE 6. Positive flow, Negative flow, Net flow

	positive flow	Negative Flow	Net flow
HDFC Bank	0.32639959	0.0731205	0.253279094
ICICI Bank	0.37698845	0.017792121	0.359196332
Axis Bank	0.29470378	0.063288296	0.231415489
Karur Vysya	0.00426457	0.417512419	-0.413247851
City Union Bank	0	0.430643064	-0.430643064

In Table 6, the positions of ICICI Bank, Axis Bank, Karur Vysya, HDFC Bank, and City Union Bank are displayed. In the aforementioned ranking, ICICI Bank is in top place, followed by HDFC Bank in second place, and City Union Bank in third place showed in figure 3.

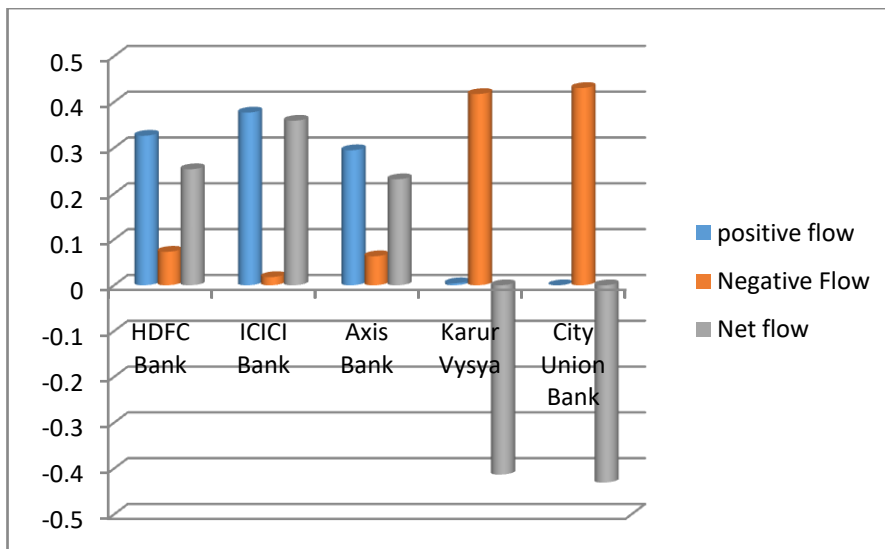


FIGURE 2. Positive flow, Negative flow, and Net flow

TABLE 7. Ranks

	Rank
HDFC Bank	2
ICICI Bank	1
Axis Bank	3
Karur Vysya	4
City Union Bank	5

Table 7 shows the rank for the camera depend on the Total Assets, Deposits, Cash, Investments, Advances ranking for the ICICI Bank, Axis Bank, Karur Vysya, HDFC Bank and City Union Bank . In the above tabulation the ICICI Bank is in the first rank and the second rank is HDFC Bank and the last rank is City Union Bank.

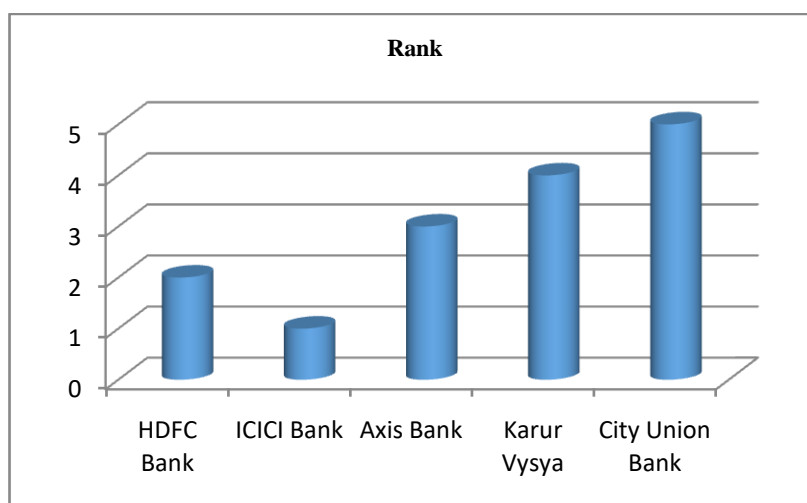


FIGURE 3. Rank

Figure 3 shows the rank for the camera depend on the Total Assets, Deposits, Cash, Investments, Advances ranking for the ICICI Bank, Axis Bank, Karur Vysya, HDFC Bank and City Union Bank . In the above tabulation the ICICI Bank is in the first rank and the second rank is HDFC Bank and the last rank is City Union Bank.

4. Conclusion

Total assets, deposits, cash, investments, and advances are examples of input variables. Information on various traits of selected banks has been gathered from the annual reports of HDFC Bank, ICICI Bank, Axis Bank, Karur Vysya, and City Union Bank (2019). The data for these input and output variables are shown as a result matrix in Table 1. A non-parametric test called the Wilcoxon signed rank test is used to compare ranks obtained with PROMETHEE. We will go into great detail on the analytical MCDM methods employed in this study. These methods are also employed in India to rate the performance of the private sector banks. The system used an open system design and had a low total cost of ownership. It included contact centers, online debit, credit cards, consumer banking, corporate e-banking, text message alerts, and mobile. It also included e-broking. From the moment its first branch in Chennai was opened, unlike the majority of Indian banks at the time, ICICI Bank was fully automated. The empirical results of our study identified top-performing banks that can be utilized as a benchmark for other banks to improve their efficiency based on the similarity of the ranks generated by PROMETHEE. The findings indicate that ICICI and HDFC banks were ranked first and second, respectively, by both approaches. Due to variations in approach, there was a small discrepancy for the remaining ranks.

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