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Measurement of service quality in the banking system -A case study of State Bank of India (SBI)

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ABSTRACT

The rapid growth in population and technology in India has led to rapid development in the service industry in the country. The aim of this study is to establish the aspects of the customer's view on the service quality offered at the State Bank of India (SBI). To place customer's need into quality dimension, a Survey questionnaire is developed to obtain customers responses on the level of quality on services offered. Then, Factor analysis (FA) carried out on the customer responses obtained through questionnaire survey. Analytic Hierarchy Process (AHP) basically help to establish the weights of the banking service quality dimensions. Technique for Order Preference Similarity to Ideal Solution (TOPSIS) is employed to obtain the ranking of different branches basing on the weights of quality dimension obtain from AHP.

Keywords: *Survey questionnaire, Service Quality, Factor Analysis (FA), Analytic Hierarchy Process (AHP), Technique for Order Preference Similarity to Ideal Solution (TOPSIS)*

1. INTRODUCTION

State bank of India (SBI) is an Indian multinational, public sector banking and financial services statutory body headquartered in Mumbai, Maharashtra state. SBI is the largest bank in India and also one of the biggest corporations in the world ranked 43rd largest bank in the world and ranked 221st in the *Fortune Global 500* list of the world's biggest corporations of 2020, being the only Indian bank in the list. SBI is the largest national bank in India with a 23% market share of assets and 25% share of total loan and deposits. India banking sector is well regulated, sound and adequately capitalized making it the most preferred cooperation for the citizens seeking employment, banking and other financial services because of its quality services. A service quality is the customers view of the level of which a service offered meet its expectation. This research work shows the results of the study conducted on present service quality of the SBI banking system

1.1 Factor analysis: Factor analysis is an important technique that is used to reduce a large number of variables into fewer numbers of factors. It extracts maximum common variance from variables and collapse them into a common score. As an index of all variables, it can use this score for further analysis. It's used in data reduction by identifying small number of factors that define most of the variance observed in much large number of the manifested variables and explain a relationship among sets of many interrelated variables to be examined and represented in terms of few underlying factors and determine the brand attributes that influences the customer's choices. The technique is applied by identifying dimension that explains the correlation among the set variables. In this research work, Factor Analysis technique has been used to determine the factors that influences the service quality at the SBI bank.

1.2Analytic Hierarchy Process (AHP): It's a structured method for organizing and analyzing complex decisions on the basis of mathematics and psychology knowledge of the experts. It is a multi-criteria decision making (MCDM) method for measurement through pair wise comparisons and relies on the judgement of expert to come up with priority scales. The comparison is made using a scale of absolute judgement that represent how much more one element dominates another with the respect to a given attribute. the derived priority scales are synthesized to obtain the weights of quality dimensions and branches. It was developed by Thomas L. Saaty in the 1970s. AHP has been widely studied and refined from then. It gives an accurate approach to quantifying the weights of decision criteria. One's expert experiences are put to use to estimate the relative magnitudes of factors through pair-wise comparisons. The respondents compares the relative importance each pair of items using the designed questionnaire. In this research work, AHP has been used to determine the weights of customer need and the branches of SBI that survey was conducted in.

1.3Technique for Order Preference Similarity to Ideal Solution (TOPSIS): It's a multi-criteria decision analysis method (MCDM), which was originally developed by Ching-Lai Hwang and Yoon in 1981 with further developments by Yoon in 1987, and Hwang, Lai and Liu in 1993. TOPSIS is based on the concept that the chosen alternative should have the shortest geometric distance from the positive ideal solution and the longest geometric distance from the negative ideal solution. If "n" different alternatives are evaluated by "m" different attributes and these attributes are common to all the alternatives that are being evaluated in the process, TOPSIS methodology helps in the ranking of different alternatives. It's a compensatory aggregation method that asses a set of alternatives in the process and then identify their weight for each criterion, normalize each of the component by dividing each component with the sum of components in that criterion and then determine the ideal alternative which is best in each criterion. TOPSIS allow normalization of the components whereby a poor result in one criterion can be negated by a good result in another criteria a term referred to as compensatory

2. METHODOLOGY

In this entire work, four stages of methodology was involved for it to be complete. They include: Data collection using Survey questionnaire from SBI branches customers for the variables needed, Factor Analysis carried out on the collected data using SPSS v16 software, Analytic hierarchy process (AHP) performed to determine the weights of the quality dimension and overall branches. Finally, Technique for Order Preference Similarity to Ideal Solution (TOPSIS) to help evaluate problem and the result shows the preference order of the different banks.

2.1 Questionnaire survey: In order to determine the service quality level at the SBI bank, a questionnaire was developed to capture the customers feeling on the level of services quality at the SBI bank. The questionnaire would allow the customer to express their views on the banking service quality. The case study was undertaken in four branches of the state bank of India (SBI) that included; Andhra university SBI branch, Siripuram junction SBI branch, MVP SBI branch and Doctors Colony SBI branch. The customers that were engaged span to various professionals both in public and private sectors, University staff and students that have an account with SBI. The customers that were engaged span to various professionals both in public and private sectors, University staff and students that have an account with SBI. After engagement with experts on the quality service, a questionnaire was developed on the expectations of the customers of the bank services from five quality dimensions. The questionnaire was administered to customers from all the four branches from which all the responses that were received were used to carry out the factor analysis.

3. CARRYING OUT FACTOR ANALYSIS USING SPSS V16 SOFTWARE

Factor analysis reduces customers variables into manageable numbers of customer need using SPSS software. The sample adequacy for the response data is examined through KMO and Bartlett's test.

Table 3.1 Result of KMO and Bartlett's test from the SPSS software viewer

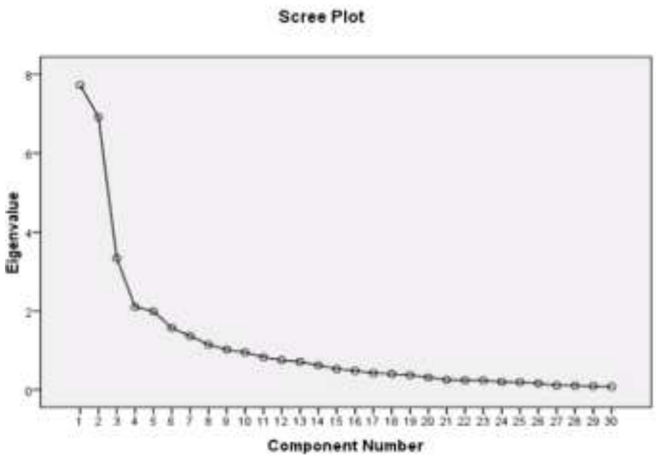
KMO and Bartlett's Test[a]

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.686
Bartlett's Test of Sphericity	Approx. Chi-Square	784.457
	df	435
	Sig.	.000

a. Based on correlations

From the analysis of this study, **approximate Chi-square** was found to be 784.457 and a significance level of 0.000. This figure is less than 0.05 which confirms the adequacy of the sample size further as indicate in the picture of the results attached above.

3.1 Scree plot: It's a simple line segment plot that shows the fraction of total variance in the data. It indicates the Eigen value against the number of factors in order of extraction



3.2 Rotated component matrix

The "Rotated Component Matrix" table, the first column lists the variables that have entered into the analysis. The second column "Component" have sub-columns that are numbered to match the components from "Total Variance Explained" table that had Eigen value greater than 1. These values represent how well each of the original variables fits into each of the new factors. The value ranges from -1 to 1. The closer the number to -1 or to 1, the better the variable fits into the factor. A value if 1 means the factor explains 100% of the information from that variable. A value of -1 means the factor explains 100% of the information from the variable but explain exactly the opposite of that variable. A value of 0zero means that the factor does not explain the information contained in the variable. The value greater than 0.5 or smaller than -0.5 means that the variable fit well with that factor. This help when calculating factor scores.

Table 3.2 Rotated Component Matrix

Rotated Component Matrix[a]

	Raw							Rescaled						
	Component							Component						
	1	2	3	4	5	6	7	1	2	3	4	5	6	7
VAR00012	.647							.709						
VAR00013	.616							.703						
VAR00023	.675		.437					.696		.451				
VAR00005	.626							.650						
VAR00025	.530							.648						
VAR00009	.567							.571						
VAR00018														
VAR00016		.878							.803					
VAR00003		.687							.718					
VAR00019		.655							.706					
VAR00024		.538							.563					
VAR00007		.504				.493			.536				.524	
VAR00022		.422							.499					
VAR00008		.399							.432					
VAR00017			.871							.846				
VAR00015			.855							.782				
VAR00020			.835							.848				
VAR00026			.775							.645				
VAR00002														
VAR00027				.948							.792			
VAR00030				.901		.566					.758		.437	
VAR00011				.626							.598			
VAR00021		.434		.438					.465		.468			
VAR00010					.850							.803		
VAR00004					.465							.494		
VAR00014					.365							.403		
VAR00001														
VAR00029						.758							.807	
VAR00028				.548		.594					.503		.545	

From the table in the figure 5.5. the factors obtained through factor analysis are grouped from 1 to 5 are labeled in both Raw and Rescaled data as Customer service, Physical features, bank system, Banking facilities and Executive innovation. They are summarized as shown in the table below

Table 3.3 The summery of the above-mentioned factors can be tabulated as shown below.

S.NO	VARIABLES IN THE QUESTIONNAIRE	FACTORS Customer needs)
1	Employees attention to customers	Customer service
	Good relationship between employee and customers	
	Understand the customers need perfectly	
	Knowledge and proficiency of employees	
2	Considering the time of customers and reducing the waiting time	
	Sending E-mails and SMS to specific customers	Physical features
	Provision of proper sanitary facilities	
	Availability of receipts and forms(Q8)	
3	Facilities such as chairs, Reception, and Air conditioning(Q)	
	Accordance of branch hours with the requirement of customers in case of emergency	system
	Possibility of direct communication with senior management	
	Efficient security system and customer information security policy	
4	Availability of safe deposit lockers	
	Branch proper position in terms of access and car parking	Banking facility
	Availability of complaint box	
	Attractive branch structure and layout of the different sections	
	Provision of drinking water in bank	
	Special counter for privileged customers	
5	Implementation of green banking facility	Executive innovation
	Modification for the time of loan borrowing and repayment	

4. METHODOLOGY

Analytic Hierarchy process

Steps involved in performing AHP.

Carrying out AHP involve four main steps. They include;

1. Set up a pair-wise comparison matrix
2. Perform pair wise comparison of the all the elements in the matrix
3. Estimate the weights (eigen values) of the matrix
4. Check both consistency index and consistency ratio of the pair wise to help for judgement.

AHP method is applied to determine the weights of the service quality attributes and different branches under study with the help of Saaty's Random indices scale table.

Table 4.1 random indices (Saaty, 1980)

N	RI
1	0
2	0
3	0.58
4	0.90
5	1.12
6	1.24
7	1.32
8	1.41
9	1.45
10	1.49

The service quality attributes are; Customer Service (CS), Physical Features (PF), Bank System (ST), Banking Facilities (BF) and Executive Innovation (EI).

Customer Service (CS)

The decision maker can express the preference between each pair of elements as equally preferred, moderately preferred, strongly preferred, very strongly preferred and absolutely preferred that would then be numerically translated as 1, 3, 5 ,7, 9 respectively. Numeral 2, 4, 6, 8 are intermediate value comparison between two successive judgements. For a matrix if order **n,** n(n-1)/2 comparisons are required.

Table 4.2 Saaty's scale table

Intensity of importance	interpretation
1	Requirement i and j are of equal value
3	Requirement i has a slighter her value than j
5	Requirement i has a stronger value than j
7	Requirement i has a very stronger higher value than j
9	Requirement i has an absolute higher value than j
2,4,6,8	These are intermediate scales between the two adjacent judgements
Reciprocals	If requirement i has lower value than j

Pair-wise comparison matrix of different branches.
Customer service factor

Table 4.3 Pair-wise comparison matrix for the customer service

	B1	B2	B3	B4
B1	1	3	2	5
B2	0.3333	1	3	1
B3	0.5	0.3333	1	0.5
B3	0.2	1	2	1
SUM	**2.0333**	**5.3333**	**8**	**7.5**

To normalize the matrix above, divide each component in the matrix with the sum in the column to enable find the sum of the normalized row.

Table 4.4 The normalized pair-wised comparison matrix is obtained as shown below

	B1	B2	B3	B4	SUM
B1	0.4926	0.5628	0.2500	0.6666	**1.9720**
B2	0.1642	0.1876	0.3750	0.1333	**0.8601**
B3	0.2463	0.0625	0.1250	0.0666	**0.5004**
B4	0.0985	0.1876	0.2500	0.1333	**0.6694**

From the normalized sum of the pair-wise comparison matrix, the weight of the branches can be obtained by finding the average of the sum as illustrated.

Weight (W) = normalized sum ÷ number of branches

$$W = \begin{pmatrix} 0.4930 \\ 0.2150 \\ 0.1251 \\ 0.1674 \end{pmatrix}$$

Table 4.5 The weight of each branch can be tabulated below.

S.NO	Branches	Weight
1	Branch 1	0.4930
2	Branch 2	0.1250
3	Branch 3	0.1251
4	Branch 4	0.1674

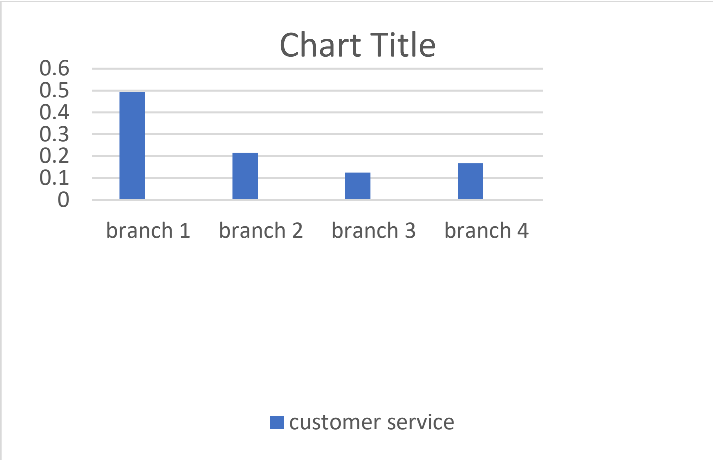


Figure 4.1 The graphical representation of the weight of the customer service

To find the consistency index (CI) and consistency ratio (CR), multiply pair -wise comparison matrix with the weight of the branches as demonstrated below.

$$\begin{pmatrix} 1 & 3 & 2 & 5 \\ 0.333 & 1 & 3 & 1 \\ 0.5 & 0.333 & 1 & 0.5 \\ 0.2 & 1 & 2 & 1 \end{pmatrix} \times \begin{pmatrix} 0.493 \\ 0.215 \\ 0.125 \\ 0.1674 \end{pmatrix} = \begin{pmatrix} 2.2252 \\ 0.9203 \\ 0.5262 \\ 0.7312 \end{pmatrix}$$

$$\lambda = v/w$$

$$\begin{pmatrix} 2.2252/0.493 \\ 0.9203/0.215 \\ 0.5269/0.1251 \\ 0.7312/0.1674 \end{pmatrix} = \begin{pmatrix} 4.5139 \\ 4.2883 \\ 4.2118 \\ 4.36793 \end{pmatrix}$$

λ_{max} is obtained by finding the average of the λ, hence

$$(4.5139 + 4.2883 + 4.2118 + 4.3679) \div 4 = 4.3454$$

Consistency index (CI) = [(λ_{max} - no. of branches) ÷ no. of branches]

$$= [(\lambda_{max} - n) \div n]$$

$$[(4.3454 - 4) \div 4] = 0.0863$$

Consistency ratio (CR) = [Consistency index ÷ Random index]

$$CR = (0.0863 \div 0.90) = 0.095 \quad <0.1$$

The same steps are applied to obtain the overall weights of the other service quality attributes of Physical feature, bank system, banking facilities and Executive Innovation. The overall weight obtained can be tabulated as shown in the table below.

Table 4.6: Pair-wise comparison weights of various quality dimensions

	Customer service (CS)	Physical features (PF)	Bank system (ST)	Banking facilities (BF)	Executive Innovation (IE)
B1	0.493	0.4855	0.2766	0.4189	0.12815
B2	0.215	0.1445	0.2642	0.2237	0.4773
B3	0.125	0.1899	0.2862	0.116	0.2565
B4	0.1674	0.1842	0.1723	0.2415	0.1382

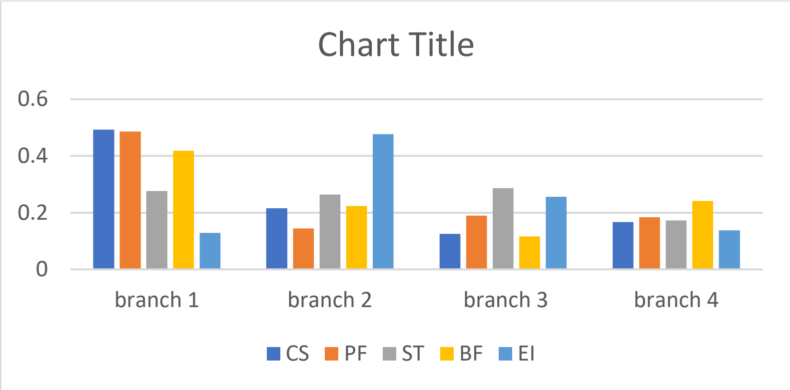


Figure 4.2 Graphical representation of the overall weights obtained through AHP method analysis.

Analytic Hierarchy Process (Quality Dimension)

Table 4.7 Pair-wise comparison matrix for branch 1

	CS	PF	ST	BF	EI
CS	1	3	2	5	1
PF	0.333	1	0.5	1	4
ST	0.5	4	1	2	3
BF	0.2	1	0.5	1	2
ET	1	0.25	0.333	0.5	1
SUM	**3.033**	**9.25**	**4.033**	**9.5**	**11**

To obtain a normalized pair-wise comparison data and get the sum of the component row, divide each component figure in the table by the sum in its column. as illustrated below

Table 4.8 Normalized pair wise comparison matrix

	CS	PF	ST	BF	EI	SUM
CS	0.33	0.3243	0.4901	0.5263	0.0909	**1.7616**
PF	0.11	0.1081	0.0612	0.1052	0.3636	**0.7481**
ST	0.165	0.4324	0.2450	0.2105	0.2727	**1.3256**
BF	0.066	0.1081	0.1225	0.1052	0.1818	**0.3256**
EI	0.333	0.0270	0.0816	0.0526	0.0909	**0.5821**

The weight of service quality dimension is the average of the sum of rows of the banking facilities. Thus,

$$\text{Weight (W)} = \begin{pmatrix} 1.7616 \\ 0.7481 \\ 1.3256 \\ 0.5836 \\ 0.5821 \end{pmatrix} \div 5 = \begin{pmatrix} 0.3523 \\ 0.1496 \\ 0.2651 \\ 0.1167 \\ 0.1164 \end{pmatrix}$$

Table 4.9 the weights of the service quality dimension in the table form,

S.NO	Service quality dimension	Weights
1	Customer service (CS)	**0.3523**
2	Physical features (PF)	**0.1496**
3	Bank system (ST)	**0.2651**
4	Banking facilities (BF)	**0.1167**
5	Executive innovation (EI)	**0.1164**

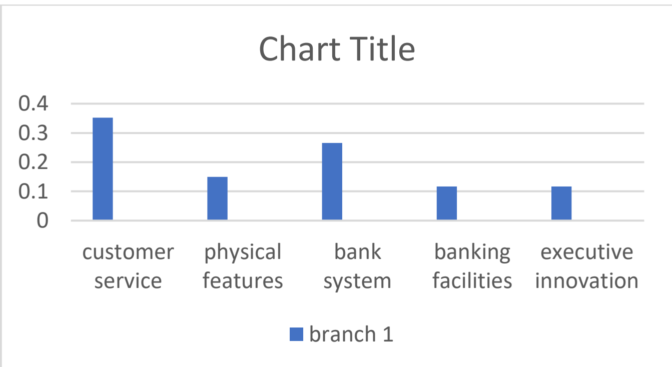


Figure 4.3 Graphical representation of the weights are shown

To find the consistency index (CI) and consistency ratio (CR), multiply the pair -wise comparison matrix with the weights of the branches as demonstrated below.

$$V = \text{Pairwise comparison matrix} * \text{weight}$$

$$\begin{pmatrix} 1 & 3 & 3 & 5 & 1 \\ 0.33 & 1 & 0.25 & 1 & 4 \\ 0.5 & 4 & 1 & 2 & 3 \\ 0.2 & 1 & 0.5 & 1 & 2 \\ 1 & 0.25 & 0.33 & 0.5 & 1 \end{pmatrix} * \begin{pmatrix} 0.3523 \\ 0.1496 \\ 0.2651 \\ 0.1167 \\ 0.1164 \end{pmatrix} = \begin{pmatrix} 2.0314 \\ 0.9157 \\ 1.6224 \\ 0.7028 \\ 0.6528 \end{pmatrix}$$

$$\lambda = V \div W$$

$$\begin{pmatrix} 2.0314/0.3523 \\ 0.9157/0.1496 \\ 1.6224/0.2651 \\ 0.7028/0.1167 \\ 0.6528/0.1164 \end{pmatrix} = \begin{pmatrix} 5.7654 \\ 5.1201 \\ 5.1199 \\ 5.4213 \\ 5.6072 \end{pmatrix}$$

λ_{max} is the average of the λ obtained above. Thus,

$$\lambda_{max} = (\lambda / n)$$

$$(5.7654 + 5.1201 + 5.1199 + 5.4213 + 5.6072) \div 5$$

$$= 5.4067$$

Consistency index (CI) = $[(\lambda_{max}$ - no. of branches) ÷ no. of branches]

$$= [(\lambda_{max} - n) \div n]$$

$$[(5.4067 - 5) \div 5]$$

$$= 0.08134$$

Consistency ratio = (CI ÷ RI)

$$= (0.08134 \div 1.12)$$

$$= 0.0726$$

Table 4.10 The weight summary of the service quality dimension of the four branches.

	B1	**B2**	**B3**	**B4**	**Average weight**
CS	0.35232	0.36672	0.34502	0.43772	**0.37544**
PF	0.14962	0.15650	0.22574	0.22574	**0.18885**
ST	0.26512	0.30308	0.24854	0.20220	**0.25453**
BF	0.11672	0.10584	0.12056	0.08330	**0.10660**
EI	0.11642	0.06772	0.06206	0.0493	**0.07387**

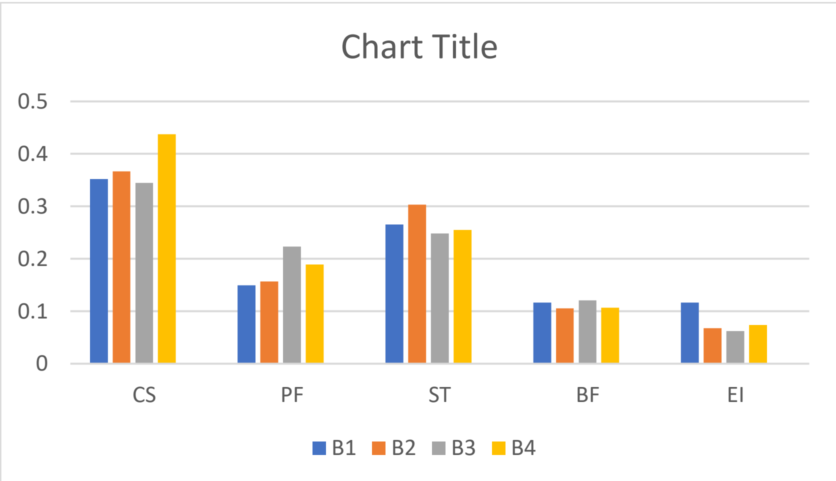


Figure 4.4 Overall graphical representation of the service quality dimension in the four branches

Overall average weight of service quality dimension in the branches can be obtained by sum of individual service quality dimension and divide by the number of branches(four).

Table 4.11 Overall average weight of the service quality dimension

Service quality dimension	Average weights
Customer service	0.3754
Physical features	0.1888
Bank system	0.2547
Banking facility	0.1066
Executive innovation	0.0738

5. TECHNIQUE FOR ORDER PREFERENCE SIMILARITY TO IDEAL SOLUTION (TOPSIS)

Table 4.12 Overall weight of different service quality dimension and branches table.

weight	0.3754	0.1888	0.2547	0.1066	0.0738
Branch	**CS**	**PF**	**ST**	**BF**	**EI**
B1	0.4930	0.4862	0.2766	0.4189	0.1281
B2	0.2150	0.1445	0.2642	0.2237	0.4773
B3	0.1251	0.1899	0.2862	0.1160	0.2565
B4	0.1674	0.1842	0.1723	0.2415	0.1382
$(\sum X^2_{ij})^{1/2}$	**0.5770**	**0.5720**	**0.5078**	**0.5452**	**0.5736**

From the overall weights and branches results, construct a normalized decision matrix using the formular;

$$R_{ij} = (\underline{X_{ij}}) \div (\sum X^2_{ij})^{1/2}. \quad \text{For } i= 1,2\ldots\ldots m,\ j= 1,2\ldots\ldots N$$

Table 5.1 Normalized decision matrix for TOPSIS

Weight	0.3754	0.1888	0.2547	0.1066	0.07738
Branch	**CS**	**PF**	**ST**	**BF**	**EI**
B1	0.8544	0.8499	0.5447	0.7683	0.2234
B2	0.3726	0.2525	0.5202	0.4103	0.8321
B3	0.2168	0.3319	0.5636	0.2127	0.4471
B4	0.2901	0.3219	0.3393	0.4429	0.2409

Weighted normalized decision matrix can be generated by multiplication normalized component above with the associated weight.

Table 5.2 Weighted normalized table for TOPSIS

	CS	**PF**	**ST**	**BF**	**EI**
B1	0.3207	0.1604	0.5447	0.7683	0.2234
B2	0.1398	0.2525	0.5202	0.4103	0.8321
B3	0.0813	0.3319	0.5636	0.2127	0.4471
B4	0.1089	0.3219	0.3393	0.4429	0.2409

Now, determine the positive ideal and negative ideal solution from the weighted normalized decision matrix above.

Positive ideal solution: $V_j^* = [\ (\max V_{ij})]$, $V_j^* = 0.3207, 0.3319, 0.5636, 0.7683, 0.8321$

Negative ideal solution: $V_j = [\ (\min V_{ij})]$, $V_J = 0.0813, 0.1604, 0.3393, 0.2127, 0.2234$

Determine the separation measure for each alternative. The separation from the positive ideal alternative $S_i^* = [\ \sum (V_{ij} - V_j^*)^2\ ]^{1/2}$

Table 5.3 Separation from positive ideal alternative

	CS	**PF**	**ST**	**BF**	**EI**	S_i^*
CS	0	-0.1717	-0.0189	0.	-0.6087	**0.6327**
PF	-0.1809	-0.0794	-0.0434	-0.358	0	**0.4112**
ST	-0.2394	0	0	-0.5556	-0.8392	**1.0345**
BF	-0.2118	-0.01	-0.2243	-0.3254	-0.5912	**0.7421**

Similarly, for separation from the negative ideal alternative

$$S_i = [\ \sum^m_{j=1}(V_{ij} - V_j)^2\ ]^{1/2}$$

Table 5.4 Separation from the negative ideal alternative

	CS	**PF**	**ST**	**BF**	**ET**	S_i
B1	0.2394	0.	0.2054	0.5556	0	**0.6389**
B2	0.0585	0.0921	0.1809	0.1976	0.6087	**0.6739**

B3	0	0.1715	0.2243	0	0.2237	**0.3602**
B4	0.0276	0.1615	0	0.2302	0.0175	**0.2831**

Finally, calculate the relative closeness to the ideal solution C_i^* and corresponding ranks of different branches

$$C_i^* = [\, S_i \div (Si + S_i^{'})];\ 0 < C_i^* < 1$$

Table 5.5 Relative closeness and ranks

Branches	Results	rank
Branch 1	0.5024	2
Branch 2	0.6210	1
Branch 3	0.2582	3
Branch 4	0.2761	4

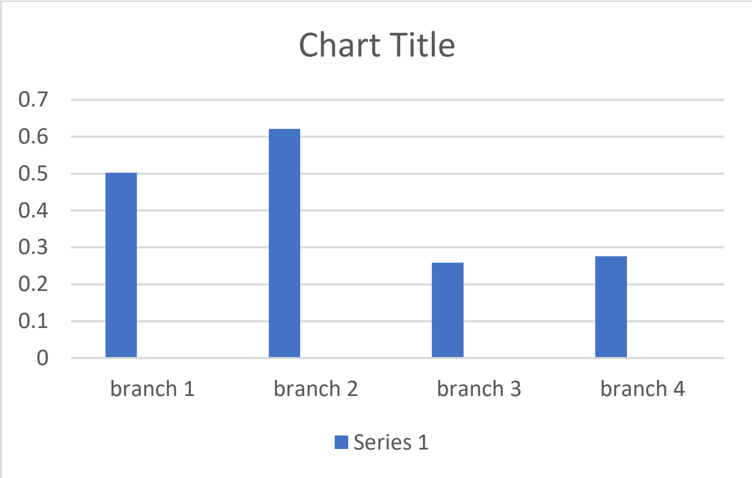


Figure 5.1 Graphical representation of the rank of the branches

6. CONCLUSION

The level of quality of the service at the bank is a key factor and contributes majorly to the number of customers that can hold an account with a given bank. Proper strategy of service quality helps to sustain and improve the consumer trust and also acquire more profits putting a bank in a good position at the competitive market and also helps in expanding its customer base. From this work study it can be concluded that Factor analysis, AHP and TOPSIS can be integrated together to identify the customers need, determine the weight of each attribute and rank accordingly. The ranks help to identify the level of customers' satisfaction of each customer need on a given branch. Consequently, providing the guideline for further assessment, betterment and improvement strategy to be set up at the banking institution

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