Chapter 7

Development

of an Index

Contents:

This chapter presents the process of development of an index and the calculation of the index of the banks.

Development and calculation of an index:

The second objective of the study is to develop an index to measure the service quality of online banking services.

The following flowchart depicts the steps followed in this study to form the index:

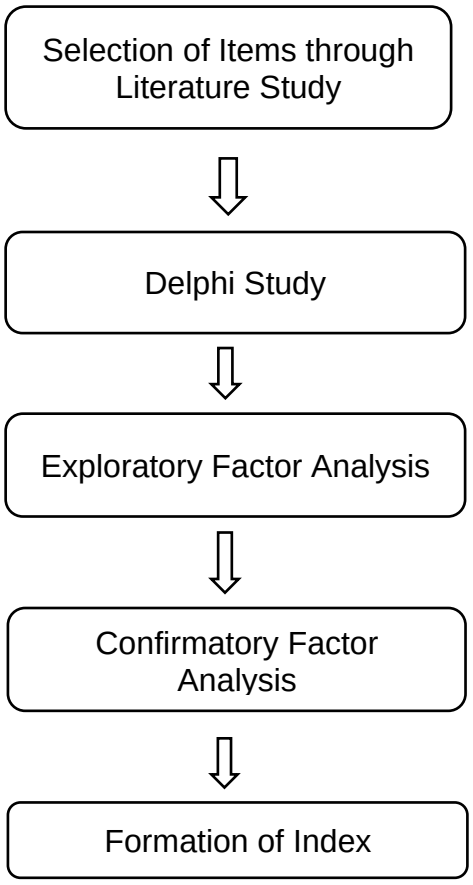

Figure 7.1: Flowchart depicting the flow of analysis followed

7.1 Formation of the index:

To calculate the index value i.e. the Online Banking Service Quality (OBSQ) index, Confirmatory Factor Analysis (CFA) was conducted [Section 6.2]. This was done to determine the level of model fit among the data structure. The squared factor loadings generated from the CFA will be used as the weight of the raw variables in order to calculate the value of the index [Refer to Table 7.1].

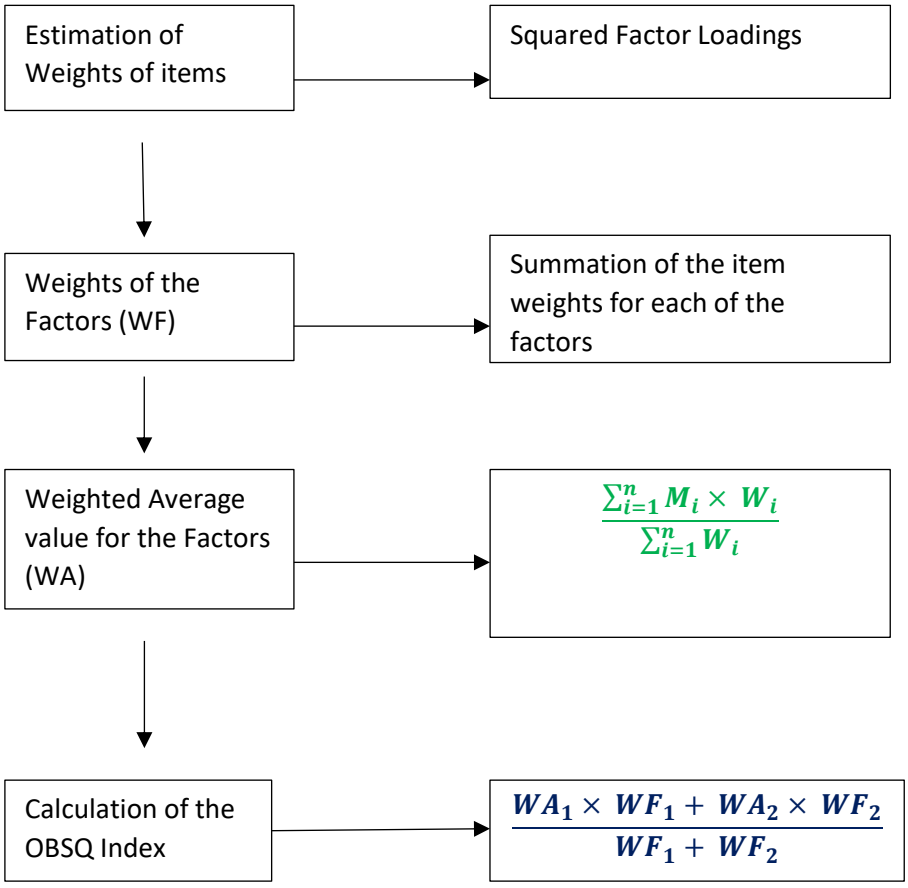

Figure 7.2: Flowchart depicting the formation of the index

For the calculation of the index values of the banks, weighted average formula is applied in this study. The formula applied to calculate the value of the index is given below:

$$OBSQ = \frac{WA_1 \times WF_1 + WA_2 \times WF_2}{WF_1 + WF_2} \quad \text{.....Equation 1}$$

Where,

OBSQ = Online Banking Service Quality Index

WA_1 and WA_2 are the Weighted Average of Factors 1 and 2 (Factor 1 = App/Website Performance; Factor 2 = Aptitude of the User) derived from the EFA done in Chapter 6.

WF_1 and WF_2 are the Weights of the Factors 1 and 2.

The weighted average of each of the factors are calculated using the following formula:

$$\boldsymbol{Weighted\ Average\ (WA) = \frac{\sum_{i=1}^{n} M_i \times W_i}{\sum_{i=1}^{n} W_i}} \text{..... Equation 2}$$

Where,

WA = Weighted Average

n = number of items in the factor

i = i^{th} item of the factor

M_i = Mean value of i^{th} item of the factor

W_i = Standardized regression weight of the i^{th} items of the factor (Can be seen in Table 7.1)

Equation 1 will be used to calculate the index value, and Equation 2 will be used to calculate the weighted average value of the two factors, separately.

The squared factor loadings values for each of the items were generated through Confirmatory Factor Analysis (CFA). These have been used as the weights for each of the items. This was done in accordance with the suggestions that were provided by DiStefano, et al., (2009). Devlieger, et al., (2016), in their study, that validated the use of squared factor loadings as weights of the items under study. The squared factor loadings for each of the items are shown in Table 7.1 and Table 7.2. The values of the respective factor

weights (WF_1 and WF_2) are calculated by summing up the value of squared factor loadings value of the items for each of the factors.

Table 7.1: Squared Factor Loadings value of the items of the factor 'App/Website Performance'

App/Website Performance	Factor loadings/ Standardised regression	Squared Factor Loadings
I feel the bank's website/app has a quick response time.	0.736	0.541696
When faced with any problem with the website/app my problems are handled effectively.	0.712	0.506944
It is easy for me to navigate services on the bank's website/app.	0.749	0.561001
The benefits that I get using the facilities of online banking are more compared to the cost (i.e. internet cost) that I incur.	0.774	0.599076
I feel the fee charged while using online bank services are not high.	0.709	0.502681
The app/website has all the features of offline bank services.	0.723	0.522729
The app/website does not take much time to respond to my request/instruction.	0.794	0.630436
The app/website has the option to solve any problem that the customer is facing.	0.754	0.568516
I get customised attention (eg. shortcuts, a pop-up of previously used services) while using the bank website/app.	0.639	0.408321
I feel satisfied with the speed and ease at which a service is delivered by the online portal of the bank.	0.812	0.659344
I am comfortable with the associated costs involved in online banking (such as the cost of internet connectivity and the cost of a computer/mobile phone).	0.821	0.674041
I am comfortable paying the charges for a service consumed through the bank's website/app.	0.764	0.583696
The app/website allows me to avail all banking services online.	0.829	0.687241
I feel comfortable with the time taken to complete a transaction through the bank's website/app.	0.839	0.703921

My bank is prompt in solving the problems faced by the customer while using the bank's app/website	0.82	0.6724
The bank's website/app always functions properly.	0.781	0.609961
My bank provides customer service assistance regarding banking related queries via telephone.	0.791	0.625681
It is easy to learn to use the services provided in the bank's website/app.	0.831	0.690561
I use online bank services because a section of my friends/colleagues also use them.	0.65	0.4225
I feel the services provided by the bank through its online portal matches my demand.	0.811	0.657721
My bank provides me with information and services according to my preferences.	0.789	0.622521
Weight of the Factor 1 (WF_1)		**12.450988**

A graphical representation of the weights of the items of the factor App/ Website Performance (AWP) is shown in Figure 7.3.

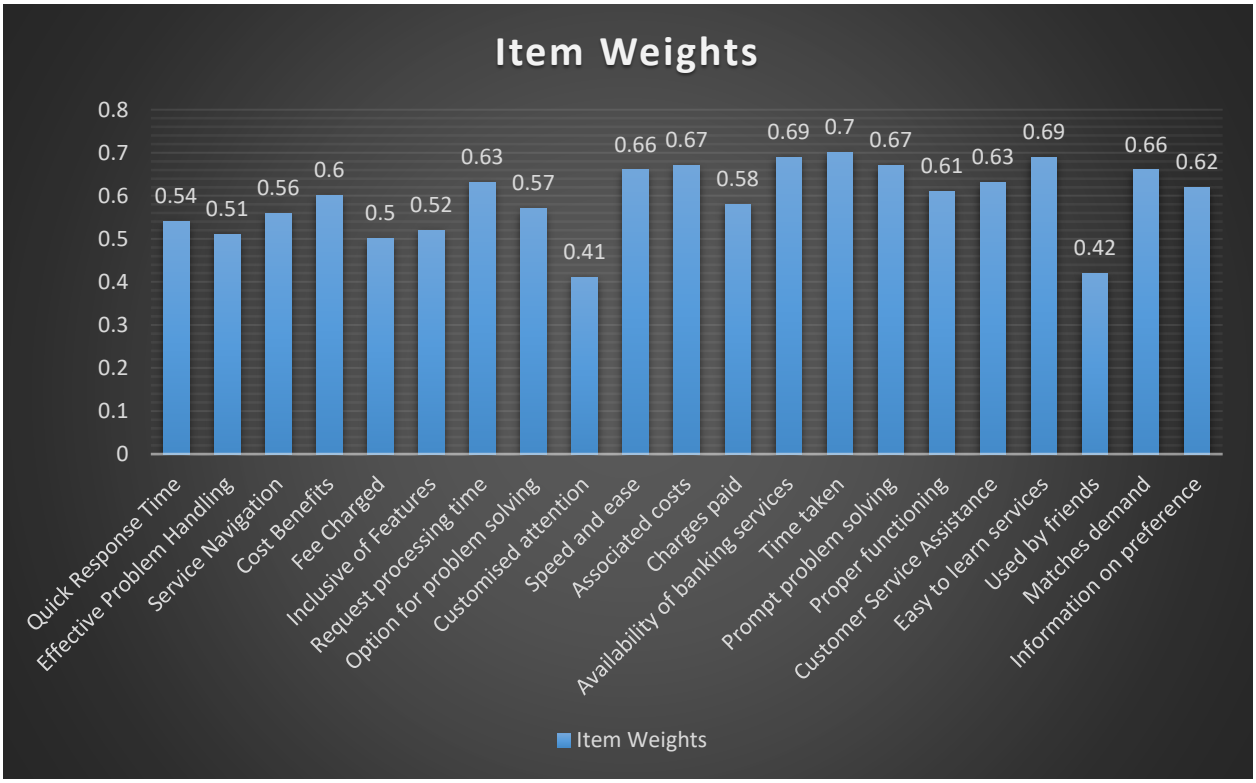

Fig 7.3 Item weights of AWP factor

The items of the factor AWP are coded in order to fit the x-axis of the graph. Figure 7.1 depicts the weights of the items, helping us to easily identify the contribution made by the items towards achieving the factor. Through this figure, it can be observed that the item 'time taken' is observed to have the highest weight. This was followed by the item, 'easy to learn services'. The lowest weights were observed for the item 'customised attention' and influenced to use online banking services due to 'usage by friends'.

Table 7.2: Squared Factor Loadings value of the items of the factor 'Aptitude of the User'

Aptitude of the User	**Factor loadings/ Standardised regression**	**Squared Factor Loadings**
My bank takes care of the personal information collected from me.	0.672	0.451584
I feel that services provided through the online portals of the bank gives me an extra advantage.	0.8	0.64
I intend to use online bank services in the coming future.	0.843	0.710649
I feel that other people expect me to use online banking services.	0.775	0.600625
I feel satisfied after the use of an online service through the bank website/app.	0.847	0.717409
I feel my education qualification has helped me in using the bank's website/app.	0.736	0.541696
I willingly perform online banking activities for my banking needs.	0.824	0.678976
The services delivered by my bank through the online portals are accurate as promised by the bank.	0.837	0.700569
I feel more comfortable using online banking services when the platform is the official banking website/app.	0.828	0.685584
I intend to use online bank services frequently.	0.843	0.710649
People who are important to me think that I should use online bank services.	0.809	0.654481
I feel satisfied with the services provided to me through the online platforms of the bank.	0.831	0.690561
I feel the education qualification of a customer makes it easy to use the bank's website/app.	0.721	0.519841

The instructions provided by the bank are clear and understandable to me.	0.845	0.714025
The clarity of instructions/guidelines to use the bank's website/app has an impact on my perception of online bank service quality.	0.839	0.703921
I intend to use new technology to access online bank service.	0.835	0.697225
My bank keeps me informed in a language that I can understand.	0.771	0.594441
Weight of the Factor 2 (WF_2)		**11.012236**

A graphical representation of the weights of the items of the factor Aptitude of the User (AU) is shown in Figure 7.4.

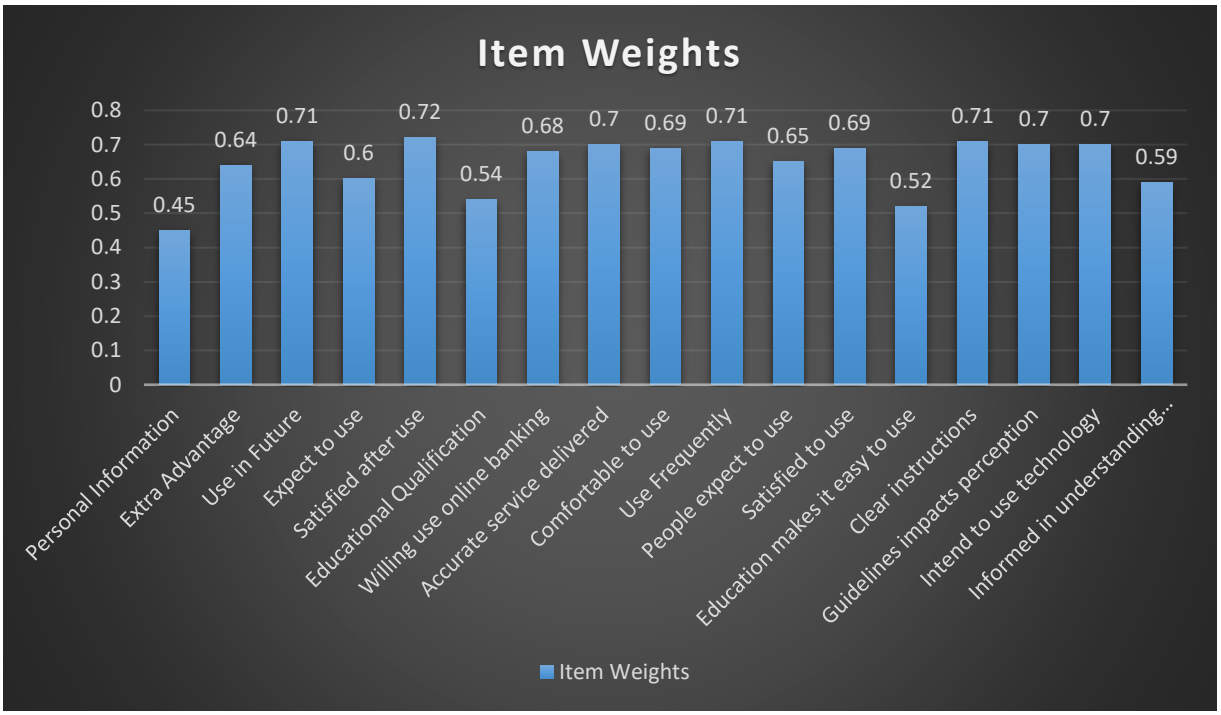

Fig 7.4 Item weights of AU factor

The items of the factor AU are coded in order to fit the x-axis of the graph. Figure 7.2 depicts the weights of the items, helping us to easily identify the contribution made by the items towards achieving the factor. Through this figure, it can be observed that the item 'satisfaction after the use of online banking services' is observed to have the highest weight. This was followed by the items, 'intend to use in future', 'intend to frequently use the online banking services', and 'clear and understandable instructions'. The lowest weights were observed for the item 'handling of personal information' and the influence of 'education in the use of online banking services'.

To calculate the value of the Online Banking Service Quality (OBSQ) Index it is necessary to calculate the value of the mean scores and their respective weights for each of the factors for the selected banks of the study. For example, the squared factor loading of the 1st item of the factor App/Website Performance is 0.541 and the mean value of the scores obtained from the respondents of Bank of Baroda for the same item is 5.958 (Refer Annexure III). The weight of the 1st item is calculated by multiplying the two values i.e. 0.541 x 5.958 = 3.22. (Refer Annexure III). The summations of each of these items for both the factors are shown in Table 7.3 below.

Table 7.3: Summation of the mean scores and their respective weights of the items

Sl. No.	**Bank**	**App/Website Performance** $\sum_{i=1}^{n} M_i \times W_i$	**Aptitude of the User** $\sum_{i=1}^{n} M_i \times W_i$
1.	Bank of Baroda	77.06	71.00
2.	Bank of India	80.21	79.00
3.	Bank of Maharashtra	79.00	72.03
4.	Canara Bank	78.00	77.00
5.	Central Bank of India	88.00	82.16
6.	Punjab and Sind Bank	86.32	82.10
7.	Indian Bank	83.16	77.01
8.	Indian Overseas Bank	77.00	72.00
9.	Punjab National Bank	83.26	77.32
10.	State Bank of India	89.20	84.00
11.	UCO Bank	83.40	79.00
12.	United Bank of India	83.00	76.00
13.	HDFC Bank	94.00	87.13
14.	ICICI Bank	91.00	82.00
15.	Axis Bank	90.41	84.00
16.	IndusInd Bank	87.00	81.00
17.	IDBI Bank	93.00	86.00

The Weighted Average (WA) value of the factors for all the banks are calculated using equation 2. The values for the same are shown in Table 7.4.

Table 7.4 Weighted Average (WA) values for the factors

Sl. No.	**Bank**	**App/Website Based (WA1)** $\frac{\sum_{i=1}^{n} M_i \times W_i}{\sum_{i=1}^{n} W_i}$ ⇨ $\frac{\sum_{i=1}^{n} M_i \times W_i}{WF1}$	**Individual Based (WA2)** $\frac{\sum_{i=1}^{n} M_i \times W_i}{\sum_{i=1}^{n} W_i}$ ⇨ $\frac{\sum_{i=1}^{n} M_i \times W_i}{WF2}$
1.	Bank of Baroda	6.19	6.45
2.	Bank of India	6.44	7.17
3.	Bank of Maharashtra	6.35	6.54
4.	Canara Bank	6.26	6.99
5.	Central Bank of India	7.07	7.46
6.	Punjab and Sind Bank	6.93	7.46
7.	Indian Bank	6.68	6.99
8.	Indian Overseas Bank	6.18	6.54
9.	Punjab National Bank	6.68	7.02
10.	State Bank of India	7.16	7.63
11.	UCO Bank	6.70	7.17
12.	United Bank of India	6.67	6.90
13.	HDFC Bank	7.55	7.91
14.	ICICI Bank	7.31	7.45
15.	Axis Bank	7.26	7.63
16.	IndusInd Bank	6.99	7.36
17.	IDBI Bank	7.47	7.81

After calculating the weighted average value for the banks, the index values for each of the banks are calculated with the help of equation 1, and the values for the same are shown in Table 7.5. The banks are arranged in descending order based on the value of the OBSQ index value.

7.2 Calculation of the index values:

The second objective of the study was to measure the index value of the banks. This is done to calculate the index values for the banks considered in this study. The results of the same are shown in Table 7.5.

For Example, the OBSQ index value for HDFC bank is

$$OBSQ = \frac{7.55\ (WA_1) \times\ 12.45\ (WF_1) +\ 7,91\ (WA_2) \times\ 11.01\ (WF_2)}{12.45\ (WF_1) +\ 11.01\ (WF_2)}$$

Table 7.5: Index value of the banks

Sl. No.	Bank	OBSQ Scores
1.	HDFC Bank	7.72
2.	IDBI Bank	7.63
3.	Axis Bank	7.43
4.	State Bank of India	7.38
5.	ICICI Bank	7.37
6.	Central Bank of India	7.25
7.	Punjab and Sind Bank	7.18
8.	IndusInd Bank	7.16
9.	UCO Bank	6.92
10.	Punjab National Bank	6.84
11.	Indian Bank	6.83
12.	Bank of India	6.78
13.	United Bank of India	6.78
14.	Canara Bank	6.60
15.	Bank of Maharashtra	6.44
16.	Indian Overseas Bank	6.35
17.	Bank of Baroda	6.31

With the help of the OSBQ index value calculated the selected banks were ranked. The ranking was based on the quality of online banking services provided by the respective

banks through their online platforms, i.e. their mobile application and websites. It can be observed that the service quality values of the private sector banks are higher as compared to public sector banks. The only public sector bank that appears in the top five ranks is the State Bank of India. The only private sector bank that does not appear in the top 5 ranks is IndusInd Bank. This gives a clear picture of the state of service quality among the banks. The online banking platforms of the private sector banks are perceived to be superior by the consumers as compared to the service quality of the online banking services of public sector banks.

Out of the public sector banks the State Bank of India, Central Bank of India, Punjab and Sind Bank, UCO Bank, and Punjab National Bank were the banks that appeared in the top ten ranks of the list. The service qualities of these banks are perceived to be higher by the consumers as compared to the remaining public sector banks.

The rating procedure suggested by Pimentel & Pimentel, (2019), is used for grading the banks into high, moderate, and low online banking service quality. The formula for calculating the interval value of the range is (10 – 1)/10 i.e. 0.9. The range value and the verbal description are shown in Table 7.6.

Table 7.6: Interval values and range

Interval	**Range**
1-1.90	R1
1.91-2.80	R2
2.81-3.70	R3
3.71-4.60	R4
4.61-5.50	R5
5.51-6.40	R6
6.41-7.30	R7
7.31-8.20	R8
8.21-9.10	R9
9.11-10	R10

For the purpose of the study, the ranges were clubbed and the final grades of the scale are shown in Table 7.7.

Table 7.7: Grades of the 10 point scale

Interval	Verbal Description
1 - 2.80	Very Low
2.81 – 4.60	Low
4.61 - 6.40	Moderate
6.41 – 8.20	High
8.21 - 10	Very High

The ranking of the banks based on the grading is shown in Table 7.8.

Table 7.8: Ranking of the selected banks

Sl. No.	Bank	Grade
1.	HDFC Bank	High
2.	IDBI Bank	High
3.	Axis Bank	High
4.	ICICI Bank	High
5.	State Bank of India	High
6.	Central Bank of India	High
7.	Punjab and Sind Bank	High
8.	IndusInd Bank	High
9.	UCO Bank	High
10.	Punjab National Bank	High
11.	Indian Bank	High
12.	Bank of India	High
13.	United Bank of India	High
14.	Canara Bank	High
15.	Bank of Maharashtra	High
16.	Indian Overseas Bank	Moderate
17.	Bank of Baroda	Moderate

The ranking given in Table 7.8 suggested the majority of the online banking service quality is high in the range i.e. have a score between 6.41 – 8.20. Only two banks i.e. Indian

Overseas Bank and Bank of Baroda have moderate level online banking service quality i.e. index values ranging from 4.61 – 6.40.

7.3 Comparison between OBSQ and OSQ:

Respondents were asked to rate the online service quality of their banks or a 10 point scale (Refer Annexure I). The mean score were calculated for each bank. This section will compare the means score (referred as Overall Service Quality, OSQ) of the banks and the scores obtained using the OBSQ Index developed in this study. This is done to identify if the perceived service quality scores derived from the OBSQ Index and the mean score (OSQ) of the bank are similar or different.

The respondents were asked to rate the Overall Service Quality (OSQ) of their respective banks on a scale of 1 to 10, with 1 being the lowest degree and 10 being the highest. The mean scores of the rating given by the respondents were calculated for each of the banks and the results of the same are shown in Table 7.9 below:

Table 7.9: Overall SQ Mean scores

Sl. Ro.	Bank Name	OSQ Mean scores
1.	HDFC Bank	7.67
2.	IDBI Bank	7.90
3.	Axis Bank	7.53
4.	State Bank of India	7.28
5.	ICICI Bank	7.43
6.	Central Bank of India	7.90
7.	Punjab and Sind Bank	7.20
8.	IndusInd Bank	6.87
9.	UCO Bank	6.70
10.	Punjab National Bank	6.67

11.	Indian Bank	6.48
12.	Bank of India	6.81
13.	United Bank of India	6.71
14.	Canara Bank	6.65
15.	Bank of Maharashtra	6.88
16.	Indian Overseas Bank	6.03
17.	Bank of Baroda	6.29

The OSQ ratings were derived based on the ratings given by the respondents on their perception of the overall service quality of their respective banks. This was collected from the respondents against a single statement. These scores are compared with the OBSQ scores derived from the scale curated to measure online banking services in this study. This will help in identifying if there exists any discrepancy between the two scores. To compare the values of OSQ and OBSQ scores the following hypothesis was formed.

H_{08}: There exist no significant difference in the mean scores of OSQ scores and OBSQ scores.

A Paired t-test was conducted to identify the difference in the mean scores of the SQ rating given by the respondents and the OBSQ scores derived from the study. This was done because both the scores were derived from the same set of respondents. The results for the same are discussed below:

Table 7.10: Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair1	OBSQ	6.9982	17	.43530	.10558
	OSQ Rating	7.0000	17	.55008	.13341

Table 7.11: Paired Samples Test									
		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	OBSQ – OSQ Rating	-.00176	.26344	.06389	-.13722	.13369	-.028	16	.978

The test was performed at the 5% level of significance, and the p-value derived for the t-test was 0.978. This indicates that there is no statistically significant difference between the mean OBSQ scores produced from the index and the OSQ ratings. This demonstrated that the generated OBSQ scores might predict the respondents' perceptions of their respective banks.

7.4 Summary:

This chapter gives a detailed explanation of the formulation of the Online Banking Service Quality (OBSQ) index. The weighted average method was used for measuring the index values. After the calculation of the scores, the banks were ranked from highest scores to lowest. The ranking of banks provided a picture of the perceived service quality of the online banking services of the banks. Based on the rating procedure suggested by Pimentel & Pimentel, (2019), the scores were segregated among various rating scales. It was observed that none of the banks' perceived service quality excelled, as none of them had scores higher than 8.20; all the scores ranged from 6.31 to 7.72.

The results of this chapter help in confirming the OBSQ scale developed in this study. The OBSQ Index is developed to identify the perception of service quality by the bank consumers. The OBSQ score is calculated based on 38 items that helps in measuring the two identified factors in this research study. The OSQ is the score derived based on the consumer rating of their respective banks on a 10-point rating scale. The same rating scale was used to collect the data for the items of the OBSQ index. A paired t-test was conducted

to compare the mean of both the scores and the results indicated that there exists no difference in the mean score of OBSQ and OSQ. This indicates that the scores that were derived from the OBSQ index were able to predict the consumer perception on the service quality of online banking. The OBSQ index is calculated with the intention to measure the perception of service quality by the users of online banking services. One of the important aspects used in measuring the index is to use the weights of the items of the factors. This was done because all the items of the factors do not have an equal contribution towards determining the factor. The OSQ ratings were derived based on the ratings given by the respondents on their perception of the overall service quality of their respective banks. This was collected from the respondents against a single statement.

References:

Pimentel, J. L., & Pimentel, J. L. (2019). Some biases in Likert scaling usage and its correction. *International Journal of Science: Basic and Applied Research (IJSBAR), 45*(1), 183-191.