

# A Multiple Comparison of E-banking Quality Dimensions using Tukey's Post Hoc test : A Study on Selected Banks

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## Abstract

The study attempts to investigate and compare the selected banks on Electronic Banking Quality attributes. Later the study prepares an index based on the performance of banks. A sample of 400 respondents were collected from the districts of Southern Assam, India based on post stratified random sampling. Descriptive statistics were used to measure the performance mean scores. For developing the overall performance index simple arithmetic calculations were conducted. Later to find out whether the means obtained are significantly different, one way ANOVA have been calculated and further investigation is done with the help of Tukey's Post Hoc Test. The results revealed that there is a significant difference of performances of the selected banks on different quality attributes. As a result indexing of the banks based on performance was possible. An overall performance index has been computed to find the overall position of the banks under study based on the quality dimensions .The index obtained is very helpful in identifying the position or overall status of E-banking service of a particular bank under study. From the mean scores obtained the banking organizations can identify and measure the difference in scores from the top position and differences of scores with its competitors.

**Keywords:** E-banking, Performance, Index, Qualitative Dimensions, Post Hoc Test

## Introduction

Banking customers get satisfied with the system when it provides them maximum convenience and comfort while transacting with the bank (Singhal & Padhmanabhan, 2008). The perception on the performance of electronic banking of corresponding bank of a customer is obtained through experience. Thus there is a growing interest to find out the customer experience as regards to E-banking as customer experience is broader then customer satisfaction (Hiltunen, Laukka, & Luomala, 2002). Hence assessing the users experience is essential for technological products and services (Wilson & Sasse, 2004). Here in this paper user experiences are tapped to find out the performance of banks based on quality dimensions of the E-banking delivery channels.

In the context of banking, the distribution channel is known as delivery channel. According to (Kotler & Armstong, 1999), a distribution channel is a set of interdependent organizations (intermediaries)

involved in the process of making a product or service available for use or consumption by the consumer or business user.

Electronic banking is a bigger platform than just banking via the Internet (Nasri, 2011). The definition of Electronic Banking varied from time to time. (Nitsure, 2003) defined Electronic Banking as provision of banking products and services through electronic delivery channels. E-banking is defined as the automated delivery of new and traditional banking products and services directly to customers through

electronic, interactive communication channels (Salehi, 2010). The different types of E-banking are internet banking, mobile banking, debit card, credit card, telephone banking, TV based banking etc.

### Concept of performance based on quality dimensions

Based on the conceptualization of E- Banking quality dimensions derived from literature review, the closely related parameters are grouped together into four dimensions i.e. E-banking Channel Design, Reliability, Responsiveness and Security.

**Table 1: Electronic Banking Services Performance Dimensions**

Dimensions	Closely related dimensions	Reference
E-banking channel Design	Website interactivity, Website in-formativeness, website ease of use, Navigation structure ,Information content, richness, Graphic style, website usability, Website aesthetics	(Gupta & Bansal, 2012), (Molapo, 2008), (Costas, Vasiliki, & Dimitriou), (Swaid & Wigand, 2009), (Jun & Cai, 2001), (Montoya-Weiss, Voss, & Grewal, Fall 2003), (Yang, Jun, & Peterson, 2004), (Rahman, Cripps, Salo, Hussain, & Zaheer, 2013), (Barnes & Vidgen, 2002), (Lee & Lin, 2005), (Wolfinbarger & Gilly, 2003).
Reliability	Security, Privacy, Trust, Accuracy	(Wolfinbarger & Gilly, 2003), (Lee & Lin, 2005), (Barnes & Vidgen, 2002), (Rahman, Cripps, Salo, Hussain, & Zaheer, 2013), (Yang, Jun, & Peterson, 2004), (Woldie, Hinson, Iddrisu, & Boateng, 2008), (Jun & Cai, 2001), (Bauer, Hammerschmidt, & Falk, 2005), (Swaid & Wigand, 2009), (Gupta & Bansal, 2012)
Responsiveness	Timeliness, Queue management	(Lee & Lin, 2005), (Yang, Jun, & Peterson, 2004), (Woldie, Hinson, Iddrisu, & Boateng, 2008), (Jun & Cai, 2001), (Joseph, McClure, & Joseph, 1999), (Bauer, Hammerschmidt, & Falk, 2005), (Swaid & Wigand, 2009), (Molapo, 2008), (Gupta & Bansal, 2012)
Service	Site contact, transaction support, Feedback/compliant Management	(Wolfinbarger & Gilly, 2003), (Rahman, Cripps, Salo, Hussain, & Zaheer, 2013), (Molapo, 2008), (Bauer, Hammerschmidt, & Falk, 2005), (Joseph, McClure, & Joseph, 1999)

### Objective of the study

The objective of the current study is to measure the performance of banks in different dimensions, develop an overall performance index and conduct multiple comparisons from the responses of E-banking users specifically the salaried employees.

### Methodology

Here in this paper performance is measured under quality dimensions stated above. Descriptive statistics were used to measure the performance mean scores. For developing the overall performance index simple arithmetic calculations

were conducted in excel. Later to find out whether the means obtained are significantly different, one way ANOVA have been calculated to test the difference of means.

Since ANOVA can only tell whether groups in the sample differ, it cannot tell which groups differ, hence to further investigate which pair of groups in the sample are differing, TUKEYS PostHoc Test is conducted. Tukey's method (also known as Tukey's honestly significant difference) is commonly used to determine the minimum difference between means of any two groups before they can be considered significantly different.

### Tools used

The study involved both primary and secondary sources. For primary sources structured questionnaires were used. Self administered questionnaire is developed based on relevant statements from (Kenova & Jonasson, 2006), (Bauer, Hammerschmidt, & Falk, 2005), (Barnes & Vidgen, 2002), (Lee & Lin, Customer perceptions of e-service quality in online shopping, 2005), (OLAYINKA, 2012), (Wolfenbarger & Gilly, 2003), (Swaid & Wigand, 2009), (Jun & Cai, 2001), (Joseph, McClure, & Joseph, 1999). To measure the reliability of the applied questionnaire Cronbach's Alpha ( $\alpha$ ) test is conducted. For scaling techniques 7 Point likert scale were used.

### The data

A survey was conducted keeping in mind the study area i.e. Cachar, Hailakandi and Karimganj districts of Assam, India. The top eleven banks were selected based on their presence in the surveyed area. Considering an error of 5 %, sample of 400 units were taken into study based on post stratified random sampling. The sample consists of persons who are salaried employees at the same time E-banking users of their respective banks. The number of respondents collected from each bank was based on proportional allocation that they contribute in the total population.

**Table 2: Bank wise sample size collected**

Slno .	Name of bank	Total no of Customers(Population) as on 2014	Sample collected out of 400
1	STATE BANK OF INDIA	399206	246
2	ICICI BANK LTD	7800	5
3	AXIS BANK LTD	20000	12
4	HDFC BANK LTD.	7374	5
5	UNION BANK OF INDIA	67239	41
6	BANK OF BARODA	16429	10
7	CANARA BANK	25688	16
8	VIJAYA BANK	14500	9
9	UCO BANK	54593	34
10	INDUSIND BANK LTD	3000	2
11	PUNJAB NATIONAL BANK	32843	20
	<b>Total</b>	<b>648672</b>	<b>400</b>

### Analysis and Results

This section deals with the analysis and results about performance obtained from responses.

### Reliability tests

Reliability tests were conducted to ensure the validity and precision of the statistical analysis and accordingly Cronbach's Alpha( $\alpha$ ) for the main dimensions were calculated as below:

**Table 3: Reliability Statistics of the dimensions**

No.	Constructs	No of Items	Coefficient
1	E-Banking Channel design	6	0.850
2	Reliability	5	0.801
3	Responsiveness	4	0.816
4	Service	4	0.834
	Overall	19	0.891

### Performance of banks based on responses

The following tables have been obtained by calculating the mean of the responses separately for each bank under

consideration for the four individual dimensions. Hence for different dimensions we had different mean scores of different banks under study.

**Table 4: Performance on E- Banking Channel Design**

<b>BANK</b>	<b>E Banking Channel Design(Mean Scores)</b>
SBI	5.927
ICICI	6.067
AXIS	6.556
HDFC	5.767
UNION	5.959
BOB	6.167
CANARA	5.719
VIAJAYA	5.870
UCO	5.549
INDUSIND	5.500
PNB	5.750

**Table 5: Performance on Reliability**

<b>BANK</b>	<b>Reliability (Mean Scores)</b>
SBI	5.928
ICICI	5.840
AXIS	6.383
HDFC	5.600
UNION	5.863
BOB	6.220
CANARA	4.988
VIAJAYA	5.356
UCO	5.735
INDUSIND	6.200
PNB	5.923

**Table 6: Performance on Responsiveness**

<b>BANK</b>	<b>Responsiveness (Mean Scores)</b>
SBI	5.933
ICICI	6.300
AXIS	6.292
HDFC	5.650
UNION	6.012
BOB	6.225
CANARA	5.969
VIAJAYA	5.472
UCO	5.507
INDUSIND	6.000
PNB	5.438

**Table 7: Performance on Service**

<b>BANK</b>	<b>Service (Mean Scores)</b>
SBI	5.821
ICICI	5.650
AXIS	6.229
HDFC	5.050
UNION	4.927
BOB	5.525
CANARA	5.406
VIAJAYA	5.083
UCO	5.522
INDUSIND	4.875
PNB	4.900

**Table 8: Overall Performance Index**

No.	Bank	E-Banking Channel design (Mean Value)	Rank in Design	Reliability (Mean Value)	Rank in reliability	Responsiveness (Mean Value)	Rank in responsiveness	Service (Mean Value)	Rank in Service	Overall performance (Mean Value)	Overall Performance Rank
1	AXIS	6.556	1	6.383	1	6.292	2	6.229	1	6.365	1
2	BOB	6.167	2	6.22	2	6.225	3	5.525	4	6.034	2
3	ICICI	6.067	3	5.84	6	6.3	1	5.65	3	5.964	3
4	SBI	5.927	5	5.928	4	5.933	7	5.821	2	5.902	4
5	UNION	5.959	4	5.863	5	6.012	4	4.927	9	5.69	5
6	INDUSIND	5.5	11	6.2	3	6	5	4.875	11	5.643	6
7	UCO	5.549	10	5.735	7	5.507	9	5.522	5	5.578	7
8	CANARA	5.719	9	4.988	11	5.969	6	5.406	6	5.52	8
9	HDFC	5.767	7	5.6	9	5.65	8	5.05	8	5.517	9
10	VIAJAYA	5.87	6	5.356	10	5.472	10	5.083	7	5.445	10
11	PNB	5.75	8	5.64	8	5.438	11	4.9	10	5.432	11

The overall performance index Table 8: suggests that as per the overall ranking of performance is concerned, AXIS bank tops the list with score 6.365 out of 7, which is followed by Bank of Baroda with score 6.034. In the third position is ICICI bank with SBI in fourth position. At the bottom we have Punjab National Bank.

Now we need to find out whether the means obtained are significantly different. Thus we use one way ANOVA to test the difference of means.

After conducting the one way ANOVA we obtain the following result.

**Table 9: One Way ANOVA for difference of means**

ANOVA						
Source of Variation	SS	Df	MS	F	P-value	F crit
Between Groups	3.485123	10	0.348512	2.795071	0.012706	2.132504
Within Groups	4.114709	33	0.124688			
Total	7.599832	43				

Here since p value is less than 0.05 and at the same time F (Critical value) is less than F value, we reject the null hypothesis and state that the mean scores obtained are not equal, i.e. the differences in mean scores are significant.

Now to further investigate which pair of groups in the sample are differing TUKEYS PostHoc Test is conducted. The table below shows the multiple comparisons of means each of different banks

**Table 10: Multiple Comparisons**

Scores Tukey HSD						
(I) Banks	(J) Banks	Mean Difference (I- J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
SBI	ICICI	-.062000	.249688	1.000	-.92411	.80011
	AXIS	-.462750	.249688	.741	-1.32486	.39936
	HDFC	.385500	.249688	.894	-.47661	1.24761
	UNION	.212000	.249688	.998	-.65011	1.07411
	BOB	-.132000	.249688	1.000	-.99411	.73011
	CANARA	.381750	.249688	.899	-.48036	1.24386
	VIJAYA	.457000	.249688	.754	-.40511	1.31911

	UCO	.324000	.249688	.963	-.53811	1.18611
	INDUSIND	.258500	.249688	.993	-.60361	1.12061
	PNB	.470250	.249688	.723	-.39186	1.33236
ICICI	SBI	.062000	.249688	1.000	-.80011	.92411
	AXIS	-.400750	.249688	.869	-1.26286	.46136
	HDFC	.447500	.249688	.776	-.41461	1.30961
	UNION	.274000	.249688	.988	-.58811	1.13611
	BOB	-.070000	.249688	1.000	-.93211	.79211
	CANARA	.443750	.249688	.784	-.41836	1.30586
	VIJAYA	.519000	.249688	.599	-.34311	1.38111
	UCO	.386000	.249688	.893	-.47611	1.24811
	INDUSIND	.320500	.249688	.965	-.54161	1.18261
	PNB	.532250	.249688	.565	-.32986	1.39436
AXIS	SBI	.462750	.249688	.741	-.39936	1.32486
	ICICI	.400750	.249688	.869	-.46136	1.26286
	HDFC	.848250	.249688	** .057	-.01386	1.71036
	UNION	.674750	.249688	.242	-.18736	1.53686
	BOB	.330750	.249688	.957	-.53136	1.19286
	CANARA	.844500	.249688	** .059	-.01761	1.70661
	VIJAYA	.919750*	.249688	* .029	.05764	1.78186
	UCO	.786750	.249688	** .099	-.07536	1.64886
	INDUSIND	.721250	.249688	.170	-.14086	1.58336
	PNB	.933000*	.249688	* .025	.07089	1.79511
HDFC	SBI	-.385500	.249688	.894	-1.24761	.47661
	ICICI	-.447500	.249688	.776	-1.30961	.41461
	AXIS	-.848250	.249688	** .057	-1.71036	.01386
	UNION	-.173500	.249688	1.000	-1.03561	.68861
	BOB	-.517500	.249688	.603	-1.37961	.34461
	CANARA	-.003750	.249688	1.000	-.86586	.85836
	VIJAYA	.071500	.249688	1.000	-.79061	.93361
	UCO	-.061500	.249688	1.000	-.92361	.80061
	INDUSIND	-.127000	.249688	1.000	-.98911	.73511
	PNB	.084750	.249688	1.000	-.77736	.94686
UNION	SBI	-.212000	.249688	.998	-1.07411	.65011
	ICICI	-.274000	.249688	.988	-1.13611	.58811
	AXIS	-.674750	.249688	.242	-1.53686	.18736
	HDFC	.173500	.249688	1.000	-.68861	1.03561
	BOB	-.344000	.249688	.945	-1.20611	.51811
	CANARA	.169750	.249688	1.000	-.69236	1.03186
	VIJAYA	.245000	.249688	.995	-.61711	1.10711
	UCO	.112000	.249688	1.000	-.75011	.97411
	INDUSIND	.046500	.249688	1.000	-.81561	.90861

	PNB	.258250	.249688	.993	-.60386	1.12036
BOB	SBI	.132000	.249688	1.000	-.73011	.99411
	ICICI	.070000	.249688	1.000	-.79211	.93211
	AXIS	-.330750	.249688	.957	-1.19286	.53136
	HDFC	.517500	.249688	.603	-.34461	1.37961
	UNION	.344000	.249688	.945	-.51811	1.20611
	CANARA	.513750	.249688	.613	-.34836	1.37586
	VIJAYA	.589000	.249688	.421	-.27311	1.45111
	UCO	.456000	.249688	.757	-.40611	1.31811
	INDUSIN D	.390500	.249688	.886	-.47161	1.25261
	PNB	.602250	.249688	.390	-.25986	1.46436
CANARA	SBI	-.381750	.249688	.899	-1.24386	.48036
	ICICI	-.443750	.249688	.784	-1.30586	.41836
	AXIS	-.844500	.249688	** .059	-1.70661	.01761
	HDFC	.003750	.249688	1.000	-.85836	.86586
	UNION	-.169750	.249688	1.000	-1.03186	.69236
	BOB	-.513750	.249688	.613	-1.37586	.34836
	VIJAYA	.075250	.249688	1.000	-.78686	.93736
	UCO	-.057750	.249688	1.000	-.91986	.80436
	INDUSIN D	-.123250	.249688	1.000	-.98536	.73886
	PNB	.088500	.249688	1.000	-.77361	.95061
VIJAYA	SBI	-.457000	.249688	.754	-1.31911	.40511
	ICICI	-.519000	.249688	.599	-1.38111	.34311
	AXIS	-.919750*	.249688	*.029	-1.78186	-.05764
	HDFC	-.071500	.249688	1.000	-.93361	.79061
	UNION	-.245000	.249688	.995	-1.10711	.61711
	BOB	-.589000	.249688	.421	-1.45111	.27311
	CANARA	-.075250	.249688	1.000	-.93736	.78686
	UCO	-.133000	.249688	1.000	-.99511	.72911
	INDUSIN D	-.198500	.249688	.999	-1.06061	.66361
	PNB	.013250	.249688	1.000	-.84886	.87536
UCO	SBI	-.324000	.249688	.963	-1.18611	.53811
	ICICI	-.386000	.249688	.893	-1.24811	.47611
	AXIS	-.786750	.249688	** .099	-1.64886	.07536
	HDFC	.061500	.249688	1.000	-.80061	.92361
	UNION	-.112000	.249688	1.000	-.97411	.75011
	BOB	-.456000	.249688	.757	-1.31811	.40611
	CANARA	.057750	.249688	1.000	-.80436	.91986
	VIJAYA	.133000	.249688	1.000	-.72911	.99511
	INDUSIND	-.065500	.249688	1.000	-.92761	.79661



	PNB	.146250	.249688	1.000	-.71586	1.00836
INDUSIND	SBI	-.258500	.249688	.993	-1.12061	.60361
	ICICI	-.320500	.249688	.965	-1.18261	.54161
	AXIS	-.721250	.249688	.170	-1.58336	.14086
	HDFC	.127000	.249688	1.000	-.73511	.98911
	UNION	-.046500	.249688	1.000	-.90861	.81561
	BOB	-.390500	.249688	.886	-1.25261	.47161
	CANARA	.123250	.249688	1.000	-.73886	.98536
	VIJAYA	.198500	.249688	.999	-.66361	1.06061
	UCO	.065500	.249688	1.000	-.79661	.92761
	PNB	.211750	.249688	.998	-.65036	1.07386
PNB	SBI	-.470250	.249688	.723	-1.33236	.39186
	ICICI	-.532250	.249688	.565	-1.39436	.32986
	AXIS	-.933000*	.249688	*.025	-1.79511	-.07089
	HDFC	-.084750	.249688	1.000	-.94686	.77736
	UNION	-.258250	.249688	.993	-1.12036	.60386
	BOB	-.602250	.249688	.390	-1.46436	.25986
	CANARA	-.088500	.249688	1.000	-.95061	.77361
	VIJAYA	-.013250	.249688	1.000	-.87536	.84886
	UCO	-.146250	.249688	1.000	-1.00836	.71586
	INDUSIND	-.211750	.249688	.998	-1.07386	.65036
*. The mean difference is significant at the 0.05 level.						
** The mean difference is significant at the 0.1 level.						

From the Table 10 it is clear that the differences of means are significant for the pairs such as AXIS-HDFC, AXIS-CANARA, AXIS-VIJAYA, AXIS-UCO and AXIS-PNB. The differences of means in rest of the pairs are insignificant.

### Conclusion

The user responses in a likert scale were tapped to identify the performance score of banks in different dimensions. Finally an overall performance index has been computed to find the overall position of the banks under study based on the quality dimensions of electronic banking services. The computation is made by combining the performance of the banks in each category or dimensions of E-banking services. The overall performance index suggests that as per the overall ranking of performance is concerned, AXIS bank tops the list with score 6.365 out of 7, which is followed by Bank of Baroda with score 6.034. In the third position is ICICI bank with SBI in fourth position. At the bottom we have Punjab National Bank. The index obtained is very helpful in identifying the position or overall status of E-banking service of a particular bank under study. From the mean scores obtained the banking organizations can identify and measure the difference in scores from the top position and differences of scores with its competitors. Since the

index is developed based on sample from each bank under proportional allocation of number of customers, hence few banks have very low respondents as population is very low. As such the index cannot be generalized and the results may be different with larger respondents, location and many other factors.

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