

Performance Evaluation of Telecommunication Sector in Bangladesh: A Case Study of Three Mobile Phone Companies

D. N. R. Paul

Professor, Dept. of Business Administration
Uttara University
Email: dnrpaul@gmail.com

Mohammad Tanveer Alam

Lecturer, Dept. of Business Administration
Atish Dipankar University of Science and Technology
Email:tanveer@excellencelted.net

Badal Kumar Ghosh

Associate. Prof., Dept. of Business Administration.
Uttara University
Email: badalkumarghosh@hotmail.com

***Abstract** - Telecommunication is an important sector of the economy of Bangladesh. Once it was growing really fast but market is getting saturated with time. Hence to remain in business and to tract and retain more customers, the companies are fighting to provide better service to their customers. This study attempts to analyze the major factors that influence the quality of customer services using ridge regression technique in predicting performance of the telecommunication companies. The study then evaluates the performance of three top ranking mobile companies namely, Grameen Phone, Robi and BanglaLink. Prediction model developed for service quality was quite adequate and responsiveness of the employees to customers and privacy in transactions are identified as the major determinant of service quality of the telecommunication sector.*

Key Words: Services quality, Empathy, Privacy,

Variance Inflation Factor (VIF) and Ridge Regression

JEL classification: L96; P47

1. INTRODUCTION

Telecommunication is an inseparable part of our everyday life. Besides telephone, now-a-days mobile phones are playing a great role to communicate from one place to another place. It is not only used for making calls, among many other functions it is used for communicating through text-messages, multi-media messages, as well as to connect us to the internet. Mobile telephony systems is creating a world-wide market. In Bangladesh, mobile phone services are a fast growing service sector in telecommunication industry. This sector has been showing a tremendous growth for the last few years. The number of mobile phone subscribers has progressively increased and now mobile phone is thought to be a necessary, not a luxury item.(Hossain, 2010). The total number of Mobile Phone Active Subscribers has reached 85.455 million at the end of December 2011 (BTRC, 2011) and 98.593 million at the end of February 2013 (BTRC, 2013).

At present, there are six mobile phone service providers namely, Citycell, GrameenPhone, Robi (Aktel), Banglalink, Teletalk (state-owned company), and Airtel (Warid) are the mobile phone service providers in Bangladesh. Citycell (Pacific Bangladesh Telecom Limited) is the first mobile phone operator of Bangladesh which, obtained a license to operate cellular, paging, and other wireless communication networks in 1989 started its commercial operation from 1993. Grameenphone launched its service on March 26, 1997 has built the largest cellular network in the country. Aktel started its journey 1997 and changed its brand name as Robi on 28th March, 2008. Teletalk entered in the telecommunication market on 26 December, 2004 as a public limited company in February 2005, Banglalink entered the telecommunication market of Bangladesh and it became one of the fastest growing mobile operators. Warid Telecom started its operation in Bangladesh in July 2007 and now it is providing service with the name Airtel. Mobile phone operators provide voice service and value added services including SMS (short message service), MMS (multimedia message service), ringtone, games, electronic transaction, and web browsing etc. All of these mobile phone operators in Bangladesh are competing with each other to capture a major portion of market share. The present market share of these companies is shown in the following table.

Mobile phone subscribers of different companies at the end of February 2013

Operators	Active subscribers (in millions)
Grameen Phone Ltd. (GP)	41.003
Banglalink	25.848
Robi	21.291
Airtel	07.300
Citycell	01.459
Teletalk	01.692
Total	98.593

2. OBJECTIVE OF THE STUDY

Multiple regression is the most common statistical technique used in developing mathematical model to explain nature and extent of dependency of a variable of interest (in the present study, the service quality) on a number of explanatory variables. The objectives of this study, therefore, were:

1. to develop a quantitative model for service quality of the selected telecommunication companies based on customers' satisfaction and
2. to identify the major determinants of, and their relative contribution to the service quality

3. REVIEW OF LITERATURE

Service quality is very important especially for the growth and development of service sector business enterprises (Powell, 1995). Customer satisfaction is influenced by service quality. Service quality is the determinant of customer satisfaction (Cronin and Taylor, 1992) and by ensuring quality service telecom operators can enrich customer satisfaction (Kuo et al., 2009).

When customers get expected service quality, it leads to higher satisfaction (Hutchinson et al., 2009). It works as an antecedent of customer satisfaction (Ruyter and Bloemer, 1995). In the past, quality was measured only for the tangible products because of less dominance of service sector in the economy. Due to the increasing importance of service sector in the economy; the measurement of service quality became essential. ISO standards are one of the measurement tools of service quality, where quality is defined as the totality of features and characteristics of a product, process or service. Crosby (1979) defined quality as the conformance to requirements.

The improvement of service quality, perceived value, and satisfaction ensure customer loyalty (Kuo et al., 2009; Lai et al., 2009; Wu and Liang, 2009). These are the key success criteria in the business and competitive advantages.

Mathematical and statistical tools can help the decision makers make reliable predictions and face the challenges in this sector. In this light, it is important to find out the determinants of, and their relative importance to the service quality that can help the management take necessary steps to improve the service quality. Multiple linear regression is one of the most widely used method in statistics to develop models that can be employed to predict the values of dependent variable from known values of independent variables. Athanasoglou et al (2008);, Haron (2004); Sanusi and Mohamed (2007); and Bakar and Mohd (2009) used multiple linear regression in

predicting bank performance. The method however, has its limitations because its underlying assumptions are often violated when using real data. Violations of the underlying assumptions require remedial measures such as data transformation, robust regression and ridge regression.

Presence of multicollinearity is the violation of assumption that the independent variables are uncorrelated. Presence of multicollinearity, the Ordinary Least Squares (OLS) estimates of the regression coefficients may perform worse because the variances of OLS estimator are usually inflated. This implies that the values of the least squares estimates are very unstable, that is, their magnitudes and signs may change considerably given a different sample. In such a situation, ridge regression introduced by Hoerl and Kennard (1970a, 1970b) that produces a biased estimator but may be more efficient in terms of variance inflation.

Jamal and Rind (2007) used Ridge regression to forecast wheat area and production in Pakistan in presence of multicollinearity among the explanatory variables while developing the forecasting models. Following the work of Jamal and Rind (2007), Paul *et al*(2010.) applied the same tool in developing prediction model for service quality of commercial banks in Bangladesh.

Usually, information gathered relative to attitudes involves the use of Likert-type scales. Rensis Likert (1931) described this technique for the assessment of attitudes. When using Likert-type scales, it is imperative to calculate and report Cronbach's alpha (α) coefficient (L. J. Cronbach, 1951) for internal consistency or reliability for any scales or subscales (J. A. Gliem and R. R. Gliem, 2003). George and Mallery (2003) provide the following rules of thumb for Cronbach's α :

Value of Cronbach's α	Consistency
$\alpha \geq 0.9$	Excellent
$0.8 \leq \alpha < 0.9$	Good
$0.7 \leq \alpha < 0.8$	Acceptable
$0.6 \leq \alpha < 0.7$	Questionable
$0.5 \leq \alpha < 0.6$	Poor
$\alpha < 0.5$	Unacceptable

4. DATA DESCRIPTION AND METHODOLOGY

4.1. The Respondents:

The study was conducted on three top ranking telecommunication companies namely, Grameen Phone (GP), Robi and BanglaLink. For each company, two customer service centers having relatively large transactions were selected

purposively. The respondents were the customers coming out of the service centers after receiving services.

4.2. Sampling Technique

Convenience sampling was used to select the respondents from the pool of customers who came to the service centers for various services. A total of 30 customers willing to provide information were interviewed for each company using a structured questionnaire. In the questionnaire, there were seven items namely, Service Quality, Responsiveness, Reliability, Assurance, Empathy, Logistic Support and Privacy.

4.3. Scaling Technique

The scaling technique followed was the nine pointer Likert scale. The respondents were provided with the questionnaire where they wrote down their degree of agreement or disagreement to each statement. For positive statement pointer for extreme agreement was 9 and pointer for extreme disagreement was 1, while, for a negative statement, pointer for extreme disagreement was 9 and that for extreme agreement was 1. The respondents were asked to choose the right option based on their judgments.

4.4. Development of Questionnaire

A structured questionnaire was first developed to record responses on a number of issues that are presumed to affect the service quality of a mobile phone company. The questionnaire was pre - tested on a small number of customers. After analyzing the data of pre-tested questionnaire, it was modified with addition and deletion of some questions and only seven questions were kept in the final questionnaire (Appendix 1) that the customer could answer freely, without confusion or hesitation and with reasonable confidence.

4.5. Data Collection

The authors themselves collected data from the respondents. The respondents were briefed about the objective of the study and then provided with a questionnaire on which they were asked to circle or check the appropriate boxes they thought to be correct without bias and emotion. The respondents were also assured confidentiality of their answers.

4.6. Test of Internal Consistency of the Measurement Scale of Attitudes

Cronbach's alpha coefficient (α) was used to test the internal consistency and reliability for the measurement scale (Likert scale) for recording customers' response. SPSS Ver. 16 was used to compute Cronbach's alpha coefficient, which is defined as

$$\alpha = \frac{N \cdot \bar{c}}{\bar{v} + (N - 1) \cdot \bar{c}}$$

Where, N is equal to the number of items (Customers' response variable in the present study), c-bar is the average inter-item covariance among the items and v-bar equals the average variance. Value of α ranges from 0 to 1. An α value of 0.70 or higher is considered "acceptable" suggesting that the items have relatively high internal consistency (George and Mallery, 2003).

4.7. Data Representation and Analysis

The detail of variables used in developing prediction model for the service quality of the mobile phone companies is given below:

Dependent variable : Y = Service Quality
 Independent variables : X₁ = Responsiveness, X₂ = Reliability, X₃ = Assurance,
 X₄ = Empathy, X₅ = Logistic Support and, X₆ = Privacy

The ordinary least square (OLS) model of multiple linear regressions is represented by

$$Y_i = \alpha + \beta_1 X_{1i} + \beta_2 X_{2i} + \beta_3 X_{3i} + \beta_4 X_{4i} + \beta_5 X_{5i} + \beta_6 X_{6i} + \epsilon_i$$

Where, Y_i is the ith value of dependent variable Y
 B_j is the partial regression coefficient of ith independent variable X_j
 X_{ij} is the ith value of jth independent variable X_j
 ϵ_i is the random error associated with Y_i distributed as N(0, σ^2)
 i = 1, 2, 3,n; j = 1, 2, 3,6
 n is the sample size

In matrix notation,

$$\underline{Y} = \underline{X}\underline{\beta} + \underline{\epsilon}$$

Where,

\underline{Y} = vector of dependent variable to be explained

\underline{X} = matrix of explanatory or independent variables with a column of 1's

$\underline{\beta}$ = vector of parameters (regression coefficient) to be estimated

$\underline{\epsilon}$ = vector of random errors distributed as N(0, $\sigma^2 I$)

The OLS estimate of $\underline{\beta}$ is given by

$$\underline{\hat{\beta}} = (\underline{X}'\underline{X})^{-1}\underline{X}'\underline{Y}$$

Under the model assumptions, the OLS estimator is the best linear unbiased estimator by the Gauss-Markov Theorem. When there is a perfect linear relationship among the regressors in a linear model, the least-squares coefficients are not uniquely defined. A strong, but less than perfect, linear relationship among the X's causes the least-squares coefficients to be unstable.

In case of near multicollinearity, where the matrix $\underline{X}'\underline{X}$ is nearly non-singular, the OLS estimates of the regression coefficients may perform worse because the variance of OLS may be considerably inflated. This implies that the values of the least squares estimates are very unstable, that is, their magnitudes and signs may change considerably given a different sample. Ridge regression introduced by Hoerl and Kennard (1970a, 1970b) that produces a biased estimator may in that case be more efficient in terms of variance inflation. If X's are standardized, then $(\underline{X}'\underline{X})^{-1}$ is in the form of a correlation matrix and the diagonal elements of $(\underline{X}'\underline{X})^{-1}$ are variance inflation factor (VIF) representing degree of collinearity between variables (Marquardt and Snee, 1975). Ridge regression decreases these inflation factors by introducing a small quantities 'k' to the diagonal elements of $\underline{X}'\underline{X}$ after it has been standardized. The ridge regression is then represented by

$$\underline{\tilde{\beta}}^* = (\underline{X}'\underline{X} + k\underline{I})^{-1} \underline{X}'\underline{Y}, \quad 0 \leq k \leq 1$$

Where, $\underline{\tilde{\beta}}^*$ = vector of estimated ridge coefficients

\underline{I} = Identity matrix

A commonly used method for determining the biasing constant k explained by Kutner et al. (2005) is based on ridge trace and the variance inflation factor (VIF). The VIF is defined by Gruber (1998) as:

$$(VIF)_k = (\underline{r}_{xx} + k\underline{I})^{-1} \underline{r}_{xx} (\underline{r}_{xx} + k\underline{I})^{-1}$$

Where, \underline{r}_{xx} is the correlation matrix of independent variables and k is the value of ridge coefficient.

The ridge trace is simultaneous plot of the values of the estimated ridge regression coefficients for the different values of k between 0 and 1. The estimated ridge coefficients may fluctuate widely as k is changed slightly from 0, which then tends to stabilize with the increase in the value of k and some coefficients may change sign, and VIF value for each independent variable becomes approximately equal to one for some value of the biasing factor k (Jamal and Rind, 2007). The value of k was, therefore, determined using following criteria

- Variance Inflation Factors (VIF) close to 1
- Estimated coefficients should be stable
- Modest change in R^2 , the coefficient of determination

Standard partial regression coefficient was used to measure the relative importance of various independent variables in relation to dependent variable (Steel and Torrie, 1960). For OLS estimates of regression coefficients, the standard partial regression coefficient usually denoted by “beta coefficient” is computed as follows:

Let b_i is the estimated partial regression coefficient of the dependent variable Y on the independent variable X_i , then standard partial regression coefficient b'_i of Y on X_i is given by

$$b'_j = b_j \frac{s_j}{s_y}$$

where, s_j = estimated standard deviation of X_j and s_y = estimated standard deviation of Y.

b_j is used to measure the contribution of the independent variable X_j to the dependent variable Y. Since, In ridge regression model b_j is biased and the corresponding b'_j is also biased. Computer software “STATISKA Ver. 5” was employed to analyze data. Coefficient of determination (R^2) was used as a measure of adequacy of the estimated model.

5. RESULTS AND DISCUSSION

5.1. Test of Internal Consistency of the Measurement Scale of Attitudes

Cronbach’s alpha coefficient was used to test the internal consistency and reliability of recording customers’ response to questions (Items) measured in Likert scale.

Table 1. Computed Cronbach’s α for testing internal consistency of questions (Items) under study.

Items	Cronbach's α if Item Deleted		
	Robi	GP	Bangla Link
Responsiveness	.168	-.271 ^a	.351
Reliability	.304	-.036 ^a	.436
Assurance	.469	.535	.460
Empathy	.425	.657	.489
Logistic	.169	.051	.309
Privacy	.025	-.265 ^a	.222
Service Quality	.165	-.441 ^a	.298

The value of α (Table 1) was very low with all items ranging from 0.224 for

Cronbach's α keeping all items	0.292	0.224	0.410
Cronbach's α after removal of items Assurance and Empathy	0.819	0.872	0.735

a. Violates reliability model assumptions.

GP to 0.410 for Blink indicating inconsistency among the items. That means the customers failed to provide proper answers to the questions on some items. Results revealed that internal consistency of the items would improve with the deletion of some items. For example, for GP, the value of α would increase from 0.222 to 0.657 if Empathy was deleted, and would increase to 0.535 if Assurance was deleted. It was seen in all cases of Robi, GP and Blink, Internal consistency of the items could greatly be achieved by removing items Assurance and Empathy. Results showed that removing these two items the value of α was obtained as 0.819, 0.872 and 0.735 respectively, for Robi, GP and Blink indicating that internal consistency can very well be accepted for all other items except Assurance and Empathy. These two items were, therefore, deleted from the subsequent analyses.

5.2. Check for Existence of Multicollinearity

From now on the Items would be designated as variables. Presence of Multicollinearity among the independent variables was checked for each mobile phone company by computing pair-wise correlation coefficient. Results of correlation analysis are presented in Table 2. In case of Robi, out of six, three pair-wise correlation coefficient of independent variables was significant at 1% probability level and for GP, this was five out of six. In case of Blink, correlation coefficient of two pairs was significant at 1% level and that of two pairs was significant at 5% level. The significant pair-wise correlation coefficients among the independent variables indicated existence of multicollinearity among the independent variables.

Table 2. Correlation matrix of variables

Variable	X ₁	X ₂	X ₅	X ₆
Robi				
X ₂	0.607**			
X ₅	0.352 ^{ns}	0.604**		
X ₆	0.350 ^{ns}	0.226 ^{ns}	0.543**	
Y	0.685**	0.582**	0.543**	0.546**
GP				
X ₂	0.600**			
X ₅	0.507**	0.463**		

Y	0.836**	0.738**	0.546**	0.700**
Blink				
X ₂	0.158 ^{ns}			
X ₅	0.294 ^{ns}	0.746**		
X ₆	0.532**	0.310*	0.356*	
Y	0.283 ^{ns}	0.383*	0.166 ^{ns}	0.440**

**.: significant at the 0.01 level, *: significant at the 0.05 level, ns: not significant at the 0.05 level

Due to presence of multicollinearity among the independent variables, the ordinary least squares principle would not yield stable estimates of parameters and hence reliable estimates of the model relating service quality with Responsiveness, Reliability, Logistic and Privacy..Hence, ridge regression technique was employed for estimating model parameters.

5.3. Ridge Regression

The ridge regression was employed to correct the multicollinearity problem to model the service quality of mobile phone companies on Responsiveness, Reliability, Logistic and Privacy. For each company, ridge regression coefficients were determined for different values of the biasing factor k ($0 \leq k \leq 1$). The ridge traces (the graphical representation of ridge regression coefficients) are shown in Figs. 1a, 1b and 1c respectively, for Robi, GP and Blink. The figures showed that the ridge coefficients were relatively unstable for low value of k , which tended to be stabilized with the increase in the value of k . Instability was demonstrated by the large change in the value of $\hat{\beta}_i$'s. Ridge traces (Fig.1a - Fig. 1c) revealed that the ridge coefficients tended to be stabilized with increase in the value of the biasing coefficient k for all independent variables and for different mobile companies

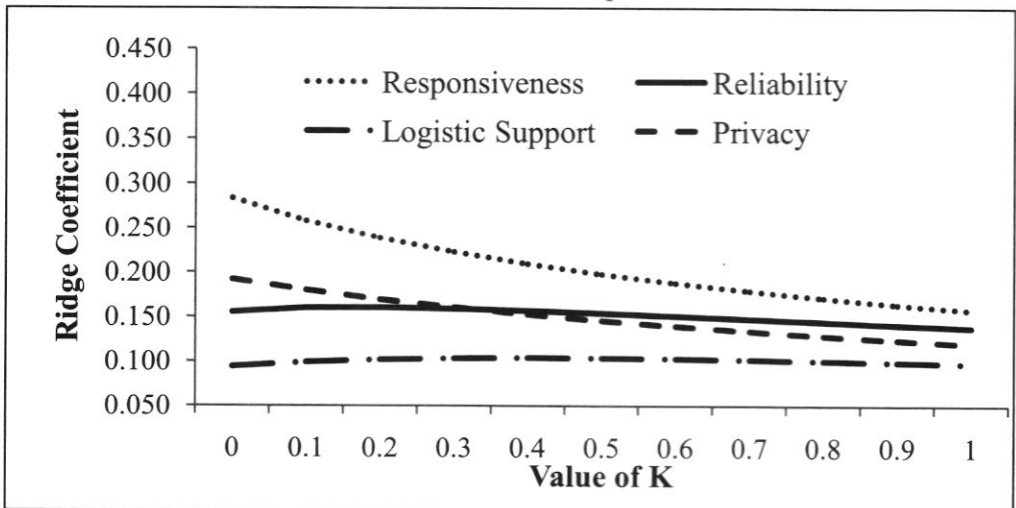


Fig. 1a. Ridge trace for different values of biasing coefficient k, Robi.

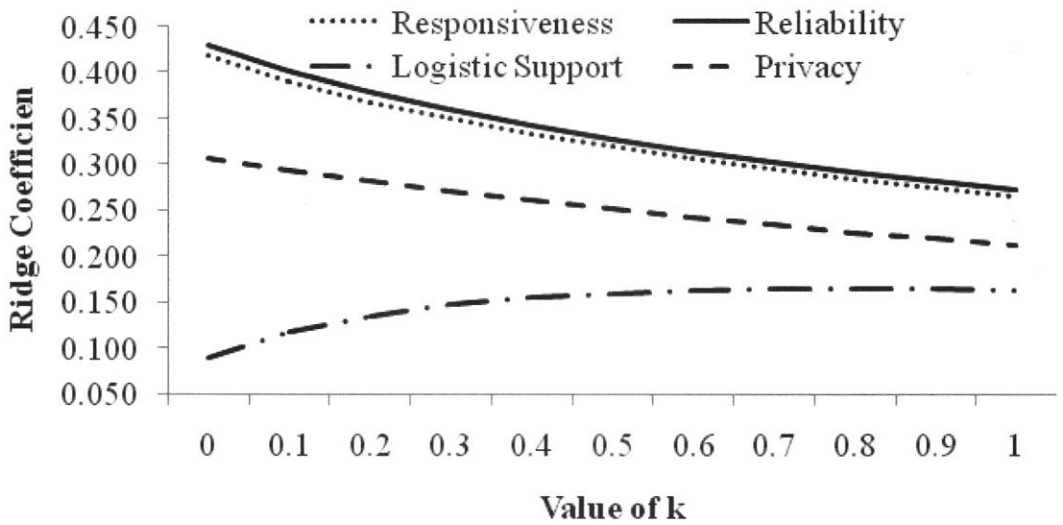


Fig. 1b. Ridge trace for different values of biasing coefficient k. GP

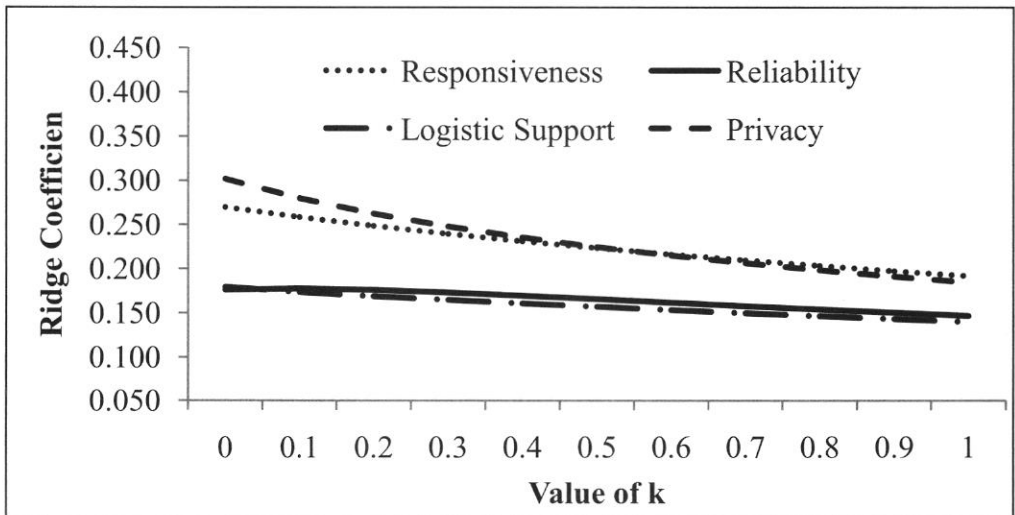


Fig. 1c. Ridge trace for different values of biasing coefficient k. Blink

For Robi, ridge coefficients of reliability and logistic support remained almost stable (Fig. 1a) for all values of k, while, the same decreased gradually with the increase in the value of k for reliability and privacy almost at the same rate. The result of Blink (Fig. 1c) showed a similar trend as that of Robi, but the scenario was different for GP (Fig. 1b). In case of GP, the value of ridge coefficient of logistic

support gradually increased with the increase in k-value where as, the result was reverse for reliability, responsiveness and privacy. The results, however, did not show an absolutely stable value of ridge coefficient for any value of k within the range 0 to 1 in most cases.

VIFs for the ridge coefficients at different values of k for each of the mobile company were computed and are presented in Tables 3a – 3c. The VIFs revealed that estimates of k ranged 0.3 - 0.4 for Robi, 0.3-0.5 for GP and 0.3-0.5 for Blink. Thus, no unique value of k could be found for all mobile phone companies even for all independent variables in each company. Based on the VIF criteria, value of k could very well be chosen as 0.4 for all mobile phone companies that would yield more stable estimates of regression coefficients compared to those obtainable using ordinary least squares principle . Using value of k as 0.4, the estimated model of Service Quality (Y) on Responsiveness (X₁), Reliability (X₂), Logistic Support (X₅) and Privacy (X₆) are obtained as in following box.

$$\text{For Robi: } \tilde{Y} = 2.718 + 0.209^{**}X_1 + 0.157^{*}X_2 + 0.104^{ns}X_5 + 0.153^{ns}X_6 \text{ (Adj } R^2 = 45\%)$$

$$(0.805) \quad (0.087) \quad (0.122) \quad (0.101) \quad (0.087)$$

$$\text{For GP } \tilde{Y} = -0.970 + 0.333X^{**}_1 + 0.343^{**}X_2 + 0.156^{ns}X_5 + 0.261^{*}X_6 \text{ (adj } R^2 = 68\%)$$

$$(0.967) \quad (0.113) \quad (0.121) \quad (0.138) \quad (0.101)$$

$$\text{For Blink: } \tilde{Y} = 1.649 + 0.231^{ns}X_1 + 0.170^{ns}X_2 + 0.161^{ns}X_5 + 0.236^{*}X_6 \text{ (adj } R^2 = 50\%)$$

$$(1.096) \quad (0.132) \quad (0.110) \quad (0.112) \quad (0.114)$$

Figures in parenthesis are the respective standard errors,adj R² stands for R² adjusted for independent variables

Although significant, the low value of Adj R² indicated that the four variables: Responsiveness (X₁), Reliability (X₂), Logistic Support (X₅) and Privacy (X₆) did not adequately explained the variation in the service quality (Y). Only for GP, the fitted model was fairly good with an adj R² of 68%. The low value of Adj R² was due to the fact that two variables were omitted in estimating the model due to their structural inconsistency and that there could be many other factors that might have impact on the service quality. It was also found that for the same independent variable, the ridge coefficient varied considerably among the mobile companies.

The results seem to reveal lack of consistency of some customers in grading the questions under different parameters in the questionnaire. Careful and proper interpretation of each item in the questionnaire to the customers, motivating them to pay adequate attention and time for answering the questions may help reduce such

inconsistency. Besides, the investigators should be careful in structuring, particularly scaling and sequencing the questions for easy understanding by the customers through adequate pre-testing of the questionnaire.

Table 3a. Variance Inflation Factor (VIF) at different values of biasing factor k for Robi

Value of k	Independent Variables			
	Responsiveness (X ₁)	Reliability (X ₂)	Logistic Support (X ₅)	Privacy (X ₆)
0.00	1.788	2.422	2.265	1.640
0.10	1.412	1.760	1.682	1.309
0.20	1.187	1.406	1.361	1.111
0.30	1.032	1.182	1.154	0.974
0.40	0.917	1.025	1.006	0.871
0.50	0.828	0.909	0.895	0.791
0.60	0.756	0.818	0.809	0.725
0.70	0.696	0.745	0.738	0.671
0.80	0.646	0.685	0.680	0.625
0.90	0.602	0.635	0.631	0.585
1.00	0.565	0.592	0.589	0.550

Table 3b. Variance Inflation Factor (VIF) at different values of biasing factor k for Blink

Value of k	Independent Variables			
	Responsiveness (X ₁)	Reliability (X ₂)	Logistic Support (X ₅)	Privacy (X ₆)
0.00	2.32	1.65	1.43	1.62
0.10	1.78	1.36	1.23	1.33
0.20	1.45	1.17	1.08	1.14
0.30	1.22	1.03	0.96	1.01
0.40	1.06	0.92	0.87	0.90
0.50	0.94	0.83	0.79	0.82
0.60	0.85	0.76	0.73	0.75
0.70	0.77	0.70	0.68	0.69
0.80	0.71	0.65	0.63	0.64
0.90	0.65	0.61	0.59	0.60
1.00	0.61	0.57	0.56	0.56

Table 3c. Variance Inflation Factor (VIF) at different values of biasing factor k for GP

Value of k	Independent Variables			
	Responsiveness (X ₁)	Reliability (X ₂)	Logistic Support (X ₅)	Privacy (X ₆)
0.00	2.423	2.332	1.694	1.645
0.10	1.845	1.795	1.384	1.352
0.20	1.496	1.465	1.179	1.156
0.30	1.262	1.240	1.031	1.015
0.40	1.094	1.078	0.920	0.907
0.50	0.967	0.955	0.831	0.821
0.60	0.867	0.858	0.759	0.751
0.70	0.787	0.780	0.700	0.693
0.80	0.721	0.716	0.649	0.644
0.90	0.666	0.662	0.606	0.601
1.00	0.619	0.616	0.568	0.564

Standardized partial regression coefficients i.e., β -coefficients measure the contribution of independent variables in explaining dependent variable. Table 3 shows the relative contribution of Responsiveness, Reliability, Logistic Support and Privacy in explaining the Service Quality.

Results revealed that the contribution of different parameters to service quality differed considerably among the mobile phone companies and that none of the parameters came out to be equally important in explaining the service quality. For example, Contribution of company's Responsiveness to the customers' queries was the highest for Robi and GP and for Blink, the highest contribution was due to Privacy. Contribution of Privacy, on the other hand, was 30% less than that of Responsiveness in case of Robi and this figure, in case of GP was 20%. While, in case of Blink, Privacy and Responsiveness contributed to service quality almost equally. Among the parameters, Logistic Support appeared to be the least contributing parameter to service quality in all mobile companies.

The results, however, give a clear indication that to enhance service quality of the mobile phone companies, the management should pay relatively more attention on creating responsiveness of the employees to customers' queries on their wants and needs, ensuring privacy in transactions and reliability of services offered to the customers than on logistic support.

Table 4. Relative Contribution of Independent Variables to Dependent variable (Service Quality)

Independent variables	Robi		GP		Blink	
	Standardized partial regression coefficient	Relative Contribution of Independent Variables to Dependent variable	Standardized partial regression coefficient	Relative Contribution of Independent Variables to Dependent variable	Standardized partial regression coefficient	Relative Contribution of Independent Variables to Dependent variable
Responsiveness	0.319	1.00	0.321	1.00	0.241	1.00
Reliability	0.180	0.56	0.288	0.90	0.210	0.87
Logistic Support	0.143	0.45	0.111	0.34	0.154	0.64
Privacy	0.226	0.71	0.258	0.80	0.258	1.07

It was found that the customers' satisfaction level in terms of service quality was the highest for BanglaLink followed by Robi and lowest for GrameenPhone (Table 5). Mean scores of customers' response on different parameters of Service Quality was also highest for BanglaLink compared to other two, while, these were more or less similar for Robi and GrameenPhone. These facts have been reflected on the market share of the mobile phone companies as depicted in Table-5. The market share of GrameenPhone dropped from over 55% in 2010 to nearly 41% in 2012 but during the same period, market share of BanglaLink increased from 10% to more than 26%, while, for Robi, this was about 26% in 2010 and remained almost at the same level over the years. It was noted that the market share of Robi, GrameenPhone and BanglaLink remained almost unchanged after 2012. The results indicated that although the number of subscribers of GrameenPhone increased over the years, the relative market share did not increase probably, due to low level of service quality (Table 5).

Table 5. Mean score of customers' response on Service Quality and parameters of Service Quality.

Items	Mobile Phone Company		
	Robi	GP	Blink
Responsiveness	6.80	6.23	7.53
Reliability	6.33	6.20	7.00
Logistic Support	6.17	6.40	7.43
Privacy	6.30	6.17	7.17
Service quality	6.73	5.83	7.47

6. LIMITATIONS OF THE STUDY

During the preparation of this report we have faced several problems which we have failed to overcome. Hence these have turned out as limitations for the report. They are:

1. Due to time limitation many aspects could not be included in the present study and the sample size was quite small.
2. Reluctance of the customers to respond has also been a major problem as in many occasions they were in real hurry and did not put much attention in answering questions.
3. Rush hours also acted as an obstacle while gathering data.

7. CONCLUSIONS

Ridge regression can be used to develop prediction model for mobile phone services where different services are usually correlated.

This research has been able to identify responsiveness of the employees to customers and privacy in managing information as the major determinant of service quality of the mobile phone companies.

Careful and proper interpretation of each item in the questionnaire to the customers, motivating the customers to pay adequate attention and time for answering the questions may help reduce inconsistency in answering the questions.

The investigators should be careful in structuring and sequencing the questions for easy understanding by the customers.

8. RECOMENDATIONS

In order to enhance service quality of the mobile phone companies, the management should pay more attention to create responsiveness among the employees to customers' queries on their wants and needs, ensuring privacy in managing information maintaining and increasing reliability of services offered to the customers.

REFERENCES

- [1] Athanasoglou P. P., S. N. Brissimis and M. D. Delis (2008). Bank-specific, Industry-specific and Macroeconomic Determinants of Bank Profitability, *International Financial Markets, Institutions & Money*, Vol. 18.:121-136.
- [2] Bakar N. M. A. and Mohd, Izah (2009). Applying Multiple Linear Regression and Neural Network to Predict Bank Performance, *International Business Research*, www.pp176-183 Cesent.org/journal.html, Vol 2(4)
- [3] Bitner, M. J. and V. A. Zeithaml (2003). *Service Marketing* (Third ed.): New Delhi: Tata McGraw Hill.
- [4] BTRC, 2011 Bangladesh - Telecoms, Mobile, Broadband and Forecasts (<https://www.budde.com.au/Research/2011-Bangladesh-Telecoms-Mobile-Broadband-and-Forecasts.html>)
- [5] BTRC, 2013. Mobile phone subscribers in Bangladesh. Bangladesh Telecommunication Regulatory Commission.
- [6] Cronbatch, L. J., 1951. *Coefficient Alpha and the Internal Structure of Tests*, *Psychometrika*, Vol. 16, No. 3
- [7] Cronin, J. J., and Taylor, S. A. (1992), "Measuring service quality: A reexamination and Extension", *Journal of Marketing*, 56(3), 55-68.
- [8] Gliem, J. A. and R.R. Gliem, 2003. Calculating, Interpreting, and Reporting Cronbach's Alpha Reliability Coefficient for Likert-Type Scales. 2003 Midwest Research to Practice Conference in Adult, Continuing, and Community Education
- [9] George, D., & Mallery, P. (2003). *SPSS for Windows step by step: A simple guide and reference*. 11.0 update (4th ed.). Boston: Allyn & Bacon.

- [10] Haron, S. (2004). Determinants of Islamic Bank Profitability, *Global Journal of Finance & Economics*, USA, 1 (1):11-33.
- [11] Hasan, M. (2008), "Mobile phone operators in Bangladesh", *The Daily Star*, 1st July
- [12] Hossain, M.M., 2010. Role of technology in consumption and everyday life in rural Bangladesh. *Technol. Soc.*, 32: 130-136. DOI: 10.1016/j.techsoc.2010.03.004
- [13] Jamal, N and M. Q. Rind (2007). Ridge Regression: A Tool to forecast wheat area and production. *Pak. j. stat. oper. res.* 3(2): 126-134.
- [14] Kuo, Y-F., Wu, C-M., and Deng, W-J. (2009), "The relationships among service quality, perceived value, customer satisfaction, and post-purchase intention in mobile value-added services", *Computers in Human Behavior*, 25, 887-896.
- [15] Kotler, P. Armstrong, G., and Cunningham, P. G. (2002). *Principles of Marketing* (6th ed.), Prentice-Hall, Englewood Cliffs, NJ.
- [16] Kutner, M. H., C. J. Nachtsheim, J. Neter and W. Li (2005), *Applied Linear statistical Models*, 5th Edition, McGraw-Hill, Inc., New York, pp 411-414.
- [17] Likert, R. (1931). A technique for the measurement of attitudes. *Archives of Psychology*. New York: Columbia University Press.
- [18] Marquardt, W. W. and R. D. Snee (1975). Ridge Regression in Practice. *The American Statistician*. 29: 3-20.
- [19] Parasuraman, A., and D. Grewal (2000). The impact of technology on the quality-value-loyalty chain: a research agenda. *Journal of the Academy of Marketing Science*, 34(4), 372-382.
- [20] Parasuraman, A., V. Zeithaml and L. L. Berry (1994). Alternative scales for measuring service quality: a comparative assessment based on psychometric and diagnostic criteria. *Journal of Retailing*, 70(3), 201-230.
- [21] Parasuraman, A., V. Zeithaml and L. L. Berry (1985). A conceptual model of service quality and its implications for future research. *Journal of Marketing*, 49(Fall), 41-50. customer satisfaction for business-to-business professional services. *Journal of the Academy of Marketing Science*, 25(1), 4-17.
- [22] Paul, D. N. R., B. K. Ghose and M. T. Alam 2010. Determining Service Quality of Commercial Banks in Bangladesh using Ridge Regression, *The Business Review*, Vol. 1 (2) 49-61.

- [23] Samuelson, B. M., and K. Sandvik (1997). The concept of customer loyalty", in Arnott, D. et al. (Eds), *Marketing: Progress, EMAC Proceedings*, Warwick Business School, Coventry. *Prospects, Perspectives* (3), 1122-1140.
- [24] Sanusi, N.A., and N. Mohammed (2007). Profitability of an Islamic Bank: Panel Evidence from Malaysia, *Readings in Islamic Economics & Finance*, Chapter 6:97-116.
- [25] Steel, R. G. D. and James H. Torrie (1960). *Principles and Procedures of Statistics*. McGraw-HILL Book Company, INC, 481p.
- [26] Zeithaml, V. A., A. Parasuraman, and L. L. Berry (1990). "Delivering Quality Service: Balancing Customer Perceptions and Expectations". New York, NY: The Free Press.
- [27] Zikmund, W. G. (1994). *Exploring Marketing Research* (5th ed.). Orlando: The Dryden Press.

Appendix 1. Questionnaire

1) The employees of the bank show responsiveness to my problems.

Extremely Agree	Strongly Agree	Agree	Somewhat Agree	Neither Agree Or Disagree	Somewhat Disagree	Disagree	Strongly Disagree	Extremely Disagree
9	8	7	6	5	4	3	2	1

2) I have reliability on the employees of the bank.

Extremely Agree	Strongly Agree	Agree	Somewhat Agree	Neither Agree Or Disagree	Somewhat Disagree	Disagree	Strongly Disagree	Extremely Disagree
9	8	7	6	5	4	3	2	1

3) The employees of the bank fail to give me assurance regarding my problem.

Extremely Agree	Strongly Agree	Agree	Somewhat Agree	Neither Agree Or Disagree	Somewhat Disagree	Disagree	Strongly Disagree	Extremely Disagree
1	2	3	4	5	6	7	8	9

4) The employees of the bank do not show empathy to my problem.

Extremely Agree	Strongly Agree	Agree	Somewhat Agree	Neither Agree Or Disagree	Somewhat Disagree	Disagree	Strongly Disagree	Extremely Disagree
1	2	3	4	5	6	7	8	9

5) The bank has good logistic support.

Extremely Agree	Strongly Agree	Agree	Somewhat Agree	Neither Agree Or Disagree	Somewhat Disagree	Disagree	Strongly Disagree	Extremely Disagree
9	8	7	6	5	4	3	2	1

6) The bank has maintained my privacy.

Extremely Agree	Strongly Agree	Agree	Somewhat Agree	Neither Agree Or Disagree	Somewhat Disagree	Disagree	Strongly Disagree	Extremely Disagree
9	8	7	6	5	4	3	2	1

7) The service quality of the bank is good.

Extremely Agree	Strongly Agree	Agree	Somewhat Agree	Neither Agree Or Disagree	Somewhat Disagree	Disagree	Strongly Disagree	Extremely Disagree
9	8	7	6	5	4	3	2	1