

Clients Attitudes toward WiMAX Services In Bangladesh: A Multivariate Analysis

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ABSTRACT:

The goal of this research is to identify key variables that can be used to evaluate WiMax internet services from the clients' perspective. Two hundred twenty one respondents were selected by convenience sampling procedure for the study. A multivariate analysis technique like "Factor Analysis" was used to identify the factors. The results shows that operating system and promotion, signal and speed, availability of cards and service and network and usage limit have emerged important factors for selecting WiMax internet services**.**

Keywords: wimax internet services, clients' experience, factor analysis

1. INTRODUCTION

Our current connectivity age and the future like third generation or fourth generation systems are coexisted with different radio access technologies (RAT), such as Global System for Mobile communications (GSM)/GPRS, Universal Mobile Telecommunications System (UMTS), Wireless Fidelity (Wi-Fi), and Worldwide Interoperability for Microwave Access (WiMAX). Integration and interoperability of these access technologies will be necessary to provide mobile and small device users with ubiquitous access to a large range of services. For that reason, one multi-mode or multi-RAT mobile station (MS) can seamlessly and perfectly roam among these heterogeneous networks without disrupting and distorting ongoing communications, sessions or connections (Liu et al, 2014).

Though cable less or wireless service providers are competitors for their market shares and growth, they also mutually and collaboratively provide Internet connectivity to the users. Wi-Fi and WiMAX are the two important promising technologies that have been implemented by wire or cable less service providers. Wi-Fi technology is mostly used in small pc like tab, pad, smart phones & laptops today and it is commonly available in snacks & coffee shops and other public places throughout the world. The most fundamental difference between WiMAX and Wi-Fi is they are designed for totally different applications. Wi-Fi is a local network technology designed to add mobility to private wired LANs. WiMAX on the other hand, was designed to deliver a metro area broadband wireless access (BWA) service. The idea behind BWA is to provide a fixed location wireless internet access service to compete with cable modems and DSL. So, while Wi-Fi supports transmission ranges up to few hundred meters, WiMAX systems could support users at ranges up to 30 miles (Michael F. Finneran, 2014). Here we have seen the basic & main problem and disadvantage of using Wi-Fi networks is insufficient service and signals are fairly weak.

In this situation WiMAX, an emerging and quality technology, which is offer quality signal and faster data speeds than current wireless networks and over much longer distances than comparably fast Wi-Fi technology; so, WiMAX can be a long term solution to fill the gaps in the insufficient coverage provided by Wi-Fi hotspots and to enable wireless connectivity on public transportation (Li and Li, 2013). The goal of this research is to identify key variables that can be used to evaluate WiMAX internet services from the clients' perspective.

2. REVIEW OF RELATED LITERATURE

After long time study, so far we have seen a large number of research studies, articles relating to various aspects of Wimax services have been published different research journals and books in home and abroad. However, critical reviews of some of the important research studies/articles have been made in this study.

Liu et al (2014) proposed a novel layer 2 multihoming approach for inter-radio access technology handover between Universal Mobile Telecommunications System (UMTS) and Worldwide Interoperability for Microwave Access (WiMAX) in both integrated and tight coupling architectures and infrastructure. Here, this layer 2 multihoming approach has the ability to enable either soft handover or make-before-break handover to adapt for the mobility scenarios for sake of a lossless and short latency handover procedure. Their simulation and test results show that, in case of handover from UMTS to WiMAX for transmission control protocol (TCP) traffics, the layer 2 multihoming approach can achieve a lossless and zero latency handover procedure by enabling soft handover.

Li and Li (2013) explore a wireless service market where mainly two wireless service providers operating and doing their job properly like Wi-Fi and WiMAX. They found bandwidth sharing can provide benefit for WiMAX service providers; on the other hand Wi-Fi service provider would make no significant value addition or savings under a pricing situation. Here, the gain and profit of WiMAX service providers could be higher with Wi-Fi service providers. Furthermore, the WiMAX service providers can assure more capacity when the average usage and customer rate increases.

Kim et al (2012) implemented a practical test-bed system, including both WiMAX and WiFi systems, and used it to conduct extensive experiments indoor and outdoor. Experimental results confirm that airtime-balance can achieve an improved flow split to reduce the waiting packets at the reorder buffer of the receiver. Moreover, it could realize a more rapid adaptation to link variations with local measurements, when compared to the RTT-based method, which also requires extra system overhead due to the use of probe packets.

Rezaei et al (2013) provided an in-depth comparison analysis of LTE and Mobile WiMAX at the physical (PHY) layer by studying the most similar PHY configuration scenarios for these two technologies. The study includes a throughput analysis of downlink (DL) and uplink (UL) transmissions in time division duplex with the least overhead possible and different antenna schemes as well as modulation and code rates. This study also performs an overhead analysis in both protocols to provide a more in-depth understanding of the PHY layer capacity in various PHY layer configurations. Their simulation results generally show higher performance for LTE in both DL and UL transmission with 7 Mbps in DL and 5 Mbps in UL, when using one antenna port. However, by increasing the number of antennas for multiple-input/multiple-output configurations, the results illustrate a reduction in the performance of LTE compared to Mobile WiMAX. This arises from the increase in reference signal overhead in LTE from 4.7% in single-input/single-output (SISO) to 14.28% in 4x 4 multiple-input/multiple-output (MIMO).

Nath et al (2012) attempted to identify the factors that influence students' preference for using Wimax service from Banglalion. The study concluded that Banglalion WiMax should put more focus on high speed, initial price and more value added services. Thus it appears from the preceding discussions those clients' attitudes towards WiMax internet services have not been addressed in Bangladesh. It would, therefore, not be unjustified to state that present study is the first of its kind in Bangladesh and can be used for guidelines for the similar studies in years ahead.

3. OBJECTIVES OF THE STUDY

The study has been conducted keeping the following objectives in mind:
i) It aims to document variables and services perceived to be important by clients when using WiMax internet services.
ii) This study aims to rank the level of importance of key variables and WiMax internet services.

4. RESEARCH DESIGN

4.1 Sampling Procedure

The sample for the study consisted of 221 clients. They were selected by convenience sampling procedure.

4.2 Questionnaire Development and Pre-testing

To achieve the objectives of the study, a structured interview schedule was developed to collect information from the remaining sample population. Here we introduce 'Likert Scale' for measuring the attitude of the clients. Initially draft questionnaire was prepared. The initial questionnaire was pre-tested and necessary correction was made before being finalized.

4.3 Data Collection

The study is compiled with the help of primary data. Primary data were collected from the clients on the basis of interview schedule through personal interview. The study was conducted during the period from January 2014 to May 2014. Moreover, the desk study covered various published and unpublished materials on the subject.

4.4 Data Analysis

In the present paper, we analyze our data by employing descriptive statistics and factor analysis. For the study, the entire analysis is done by personal computer (PC). A well known statistical package SPSS (Statistical Package for Social Sciences) 20 Version was used in order to analyze the data.

4.4.1Factor Analysis

Factor analysis is a generic term for a family of statistical techniques concerned with the reduction of a set of observable variables in terms of a small number of latent factors. It has been developed primarily for analyzing relationships among a number of measurable entities (such as survey items or test scores). The underlying assumption of factor analysis is that there exist a number of unobservable latent variables (or "factors") that account for the correlations among observed variables, such as, if the latent variables are partial led out or held constant, the partial correlations among observed variables all become zero. In other words, the latent factors determine the values of the observed variables (The University of Texas at Austin 1995).
Each observed variable (y) can be expressed as a weighted composite of a set of latent variables (f's) such as
$y_i = a_{i1}f_1 + a_{i2}f_2 + \text{----------} + a_{ik}f_k + e_i$
Where, y_i is the i^{th} observed variable on the factors, and e_i is the residual of y_i on the factors.

5. RESULTS

Table1: Mean Age of the Respondents

	N	Minimum	Maximum	Mean
AGE	221	18	56	33.03
Valid N (list wise)	221			

Source: (Authors)

Table1 depicts that mean age of the respondents was 33.

Table 2: Gender of the Respondents

	Frequency	Percent	Valid Percent	Cumulative Percent
Female	82	37.1	37.1	37.1
Male	139	62.9	62.9	100.0
Total	221	100.0	100.0	

Source: (Authors)

Table 2 shows that 63 percent of the respondents were male and only 37 percent of the respondents were female.

Table3:Respondents Prefer Internet Service Providers				
	Frequency	**Percent**	**Valid Percent**	**Cumulative Percent**
Banglalion	10	4.5	4.5	4.5
Qubee	25	11.3	11.3	15.8
Ollo	45	20.4	20.4	36.2
Grameenphone	68	30.8	30.8	67.0
Robi Axiata	12	5.4	5.4	72.4
City Cell Zoom Ultra	18	8.1	8.1	80.5
Banglalink	9	4.1	4.1	84.6
Airtel	10	4.5	4.5	89.1
Teletalk	24	10.9	10.9	100.0
Total	221	100.0	100.0	

Source: (Authors)

Table 3 indicates that 31 percent respondents prefer Grameenphone internet services, 20 percent respondents use Ollo wimax services, 11 percent respondents choose Qubee wimax services, 11 percent respondents choose Teletalk internet services and only 9 percent respondents use Banglalion and Airtel.

Table 4: Scale Reliability(Cronbach Alpha Test)

N of Cases = 221.0

Inter-item Correlations: Mean .2343 | Minimum -.6032 | Maximum .7111 | Range 1.3143 | Max/Min -1.1789 | Variance .0932

Item-total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Alpha if Item Deleted
NETWORK	44.7828	67.0253	-.2513	.7249	.8255
DCITIES	44.3213	54.1281	.6672	.7812	.7514
SPEED	44.6742	50.0116	.6661	.7170	.7416
CHARGES	44.8054	48.9029	.7763	.7927	.7307
SUITABLE	44.0950	57.4500	.5908	.7632	.7640
CUSCARE	44.7330	52.7693	.3514	.8349	.7803
USALIMIT	44.9050	56.0318	.3028	.7388	.7806
SISTRENG	44.2670	56.3966	.4848	.7923	.7650
PROMOTIO	44.4434	51.6934	.6306	.7883	.7475
REASPRIC	44.7873	49.2227	.6552	.8608	.7414
BILLSYST	44.3710	55.0344	.5496	.8935	.7591
VALADSER	44.0271	64.8720	-.1403	.8567	.8108
AVAICARD	44.7738	53.8577	.3960	.8252	.7713

Reliability Coefficients 13 items

Alpha = .7831 Standardized item alpha = .7991

Source: (Authors)

Table 4 demonstrates the high internal consistency of the constructs and their stability (Nunnally and Bernstein 1994). In each case, Cronbach's alpha far exceeded Nunnally and Bernstein's (1994) recommendation of 0.7 and Bagozzi and Yi's (1988) of 0.6.Thus, the scales are sufficiently reliable for data analysis.

Table 5: Correlation Matrix (Correlation among Independent Variables)

	1	2	3	4	5	6	7	8	9	10	11	12	13
1.Dedicated Network	1.000												
2.Strong Presence in All the Divisional Cities	.109	1.000											
3.Stable and High Speed Internet	-.106	.533	1.000										
4.Charges are on Actual Usage	-.216	.602	.565	1.000									
5.Suitable for both Windows and Mac Operating System	.001	.299	.275	.604	1.000								
6.Customer Care Service	-.123	.296	.315	.468	.313	1.000							
7.Usage Limit	**-.603**	.254	.270	.228	.127	.418	1.000						
8.Signal Strength	-.238	.404	.531	.400	.085	-.089	.298	1.000					
9.Promotion	-.102	.550	.349	**.711**	.654	.230	.134	.469	1.000				
10.Reasonable Pricing	-.091	.246	.564	.563	.599	.335	.225	.441	.417	1.000			
11.Billing System	-.354	.658	.585	.585	.241	-.003	.342	**.684**	.636	.193	1.000		
12.Value Added Service	.265	.221	-.055	-.018	.211	-.592	-.301	.062	.196	-.076	.278	1.000	
13.Availability of Cards	-.183	.146	.362	.369	.270	.482	.444	.177	.082	.646	-.025	-.567	1.000

Source: (Authors)

Table 5 shows that there is highly positive correlation between promotion and charges are on actual usage and there is highly negative correlation between usage limit and dedicated network.

Table 6: Kaiser-Meyer-Olkin and Bartlett's Test of Sphericity

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.578
Bartlett's Test of Sphericity	**Approx. Chi-Square**	2377.887
	df	78
	Sig.	.000

Source: (Authors)

Table 6 depicts that the factors underlying the original variables affected the analysis as demonstrated through the Kaiser, Meyer and Olkin (KMO) sampling criterion (0.578) and the statistically significant Bartlett sphericity criterion.

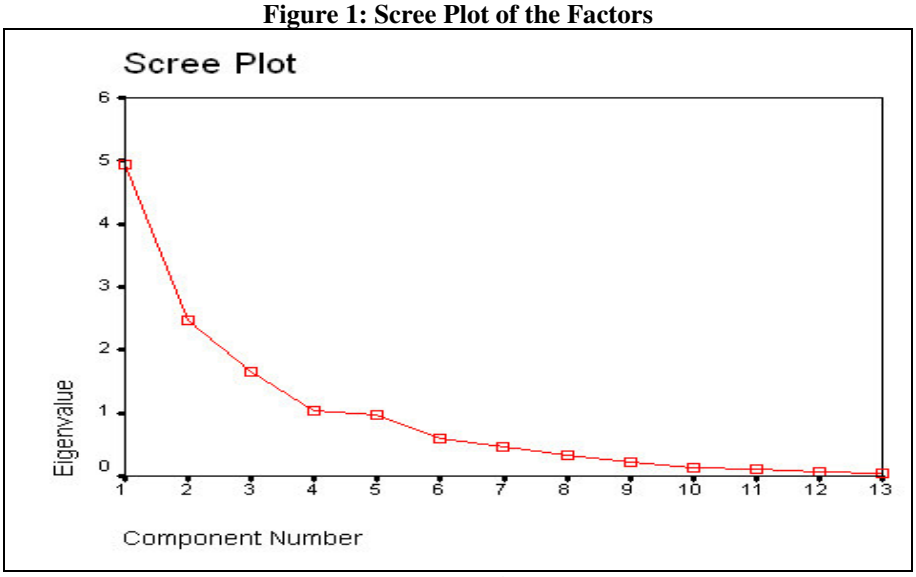
Table7: Eigenvalues of Each Factors

Factor	**Initial Eigenvalues**		
	Total	**% of Variance**	**Cumulative %**
Operating System and Promotion	4.946	38.048	38.048
Signal and Speed	2.466	18.969	57.017
Availability of Cards and Service	1.648	12.679	69.695
Network and Usage Limit	1.028	7.909	77.604

Source: (Authors)

Table 7 shows all the factors extractable from the analysis along with their eigenvalues, the percent of variance attributable to each factor, and the cumulative variance of the factor. Notice that the first factor accounts for 38.048% of the variance, the second 18.969%, the third 12.679%, and the fourth 7.909%.Results also show that there are four factors that influence to select wimax service providers. The factors are: Operating System and Promotion (4.95), Signal and Speed (2.47), Availability of Cards and Service (1.65), and Network and Usage Limit (1.03).Thus, only the factors having latent roots or eigen values greater than 1 are considered significant; all factors with latent roots less than 1 are considered insignificant and are disregarded (Hair et al, 2003).These factors together explain about 77 percent of the variance indicating higher level of importance of the factors (Table 7).

Figure 1: Scree Plot of the Factors



Source: (Authors)

The scree plot is a graph of the eigenvalues against all the factors. The graph is useful for determining how many factors to retain. The point of interest is where the curve starts to flatten. It can be seen that the curve begins to flatten between factors 5 to 13. Note also that factor 5 has an eigenvalue of less than 1, so only four factors have been retained (Figure 1).

Table 8: Rotated Component Matrix (a) of the Factors

	Component			
	1	**2**	**3**	**4**
Suitable for both Windows and Mac Operating System	**.873**	.006	.170	-.100
Promotion	**.817**	.337	-.098	.115
Charges are on Actual Usage	**.756**	.390	.243	.151
Strong Presence in All the Divisional Cities	**.540**	.539	-.036	.032
Signal Strength	.063	**.880**	-.014	.183
Stable and High Speed Internet	.253	**.753**	.329	.005
Billing System	.405	**.719**	-.293	.394
Availability of Cards	.095	.212	**.869**	.083
Value Added Service	.265	.167	**-.765**	-.318
Customer Care Service	.421	-.147	**.693**	.247
Reasonable Pricing	.419	.453	**.582**	-.165
Dedicated Network	.011	-.091	-.075	**-.882**
Usage Limit	.096	.200	.336	**.761**
Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.				
a Rotation converged in 7 iterations.				

Source: (Authors)

Principal component factor analysis with rotated factor loadings (Table 8) was performed on the survey data. Principal Component Analysis (PCA) is the commonly used method for grouping the variables under few unrelated factors. Variables with a factor loading of higher than 0.5 are grouped under a factor. A factor loading is the correlation between the original variable with the specific factor and the key to understanding the nature of

that particular factor (Debasish, 2004). Table 8 provides the rotated factor loadings against the 13 observed variables. Moreover, Factor analysis using Varimax rotation finds four derived factors. Factor 1 named as 'Operating System and Promotion' consisted of four variables. The names of the variables are Suitable for both Windows and Mac Operating System (0.873), Promotion (0.817), Charges are on Actual Usage (0.756), and Strong Presence in All the Divisional Cities (0.540). Factor 2 named as 'Signal and Speed'. The factor is constituted by three variables including Signal Strength (0.880), Stable and High Speed Internet (0.753), and Billing System (0.719) .Factor 3 named as 'Availability of Cards and Service'. . The factor is constituted by four variables including Availability of Cards (0.869), Value Added Service (-0.765), Customer Care Service (0.693) and Reasonable Pricing (0.582). Factor 4 named as 'Network and Usage Limit'. This factor consists of two variables. The variables are Dedicated Network (-0.882), and Usage Limit (0.761).

6. CONCLUSIONS AND RECOMMENDATIONS

From the above analysis, it is clear that operating system and promotion, signal and speed, availability of cards and service and network and usage limit have emerged important factors for selecting WiMax internet services. From the factor analysis, it identified four factors, which are responsible for selecting WiMax internet services. These four factors can be used as guideline for the concerned investors. Among the four factors, operating system and promotion are the most important factor for selecting WiMax internet services because it reveals higher eigen values than any other factors.

Investors should understand the various factors that influence clients' choice behavior. The variables that are affecting the selection of WiMax internet services revealed in the study should be given due consideration by respective investors. The findings of the study may be used as an index for an improvement in their services for wider acceptance and formulating marketing strategies accordingly. Also the findings of this investigation have implications for consumer research by both academics and practitioners.

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