

## **Principal Component Analysis of Customer Churns in Ghanaian Telecommunication Industry**

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### **Abstract**

*This paper presents the major factors that influence clients in the telecommunication network to switch from one telecommunication network to another. Based on principal component analysis (PCA), correlation and descriptive statistical analysis of the factors believed to influence switching behavior of client and therefore clustered into principal component. The sampling test conducted using Bartlett's test of sphericity and KMO measure of sampling adequacy (MSA) to ascertain the level relationship and the pattern between variables was found to be very significant with MSA (0.737). The result of the analysis found to have five components displayed eigenvalues greater than 1. Therefore, the entire factor can be put into five principal components which accounted for 73.254% of the total variance. Statistically there was strong interrelationship among the variables in the (PCA) with  $p$ -value  $< 0.05$ . The principal component are ethical and service failure, knowledge gap, innovation social influence and inconvenience*

**Key words:** Churn, factors, Telecommunication, Principal Component Analysis (PCA)

### **1.0 Introduction**

The Mobile Telecommunications industry in Ghana has over the years seen telecommunication firms such as Ghana Telecom (GT) now Vodafone Ghana, as the incumbent and the sole provider of telecommunication access to both its colleagues in the industry and the general public. NCA, (1997) Vodafone Ghana provides operations in both fixed telephone and mobile communication across the entire country. They had the necessary infrastructures to function as a network operator and a service provider. It also saw the private sector come into active participation in the Telecommunication industry of Ghana in the year 1992. Millicom Ghana limited (now trading under the brand name Tigo) was the first mobile company. Followed by Scancom Ghana (now trading under the brand name MTN); CellTel Ghana (now trading under the brand name Espresso) and Westel Ghana (now trading under the brand name Airtel) were established under the approval of NCA who supervised and controlled the activities of all these operators. NCA, (2010) .The truth remains that, other key players like MTN had already started enjoying the competitiveness of the market with TIGO, EXPRESSO, and AIRTEL on the market, GLO a new occurrence on the market is putting the necessary structures, infrastructures and technology in place to aid its emergence into the telecommunication market of Ghana. With this changing environment in the industry, more is therefore desired from the operators than just the traditional way of providing services and product unto the Ghanaian market by NCA, (2010).

Hamel and Prahalad (1994), argued that companies do not only compete within the boundaries of their existing industries but they compete to shape up the future structure of that industry taking strategy of the firm as the key indicator in considering strategic architecture in relation to competition. Saunders, et al (2009) helped the researcher to asked questions and seek insight into how those firms created their lead on the mobile telecommunication market.

The problem of identifying the major key factors that influence churning is will be in the best interest of the telecommunication industry to curb churn.

## **2.0 Material and Methods**

The factors that contribute to customer churn in the Ghanaian telecommunication industry was studied based on the reviewed relevant literature and the factors mentioned in Susan Kenaveny's (1995) study of the service industry and personal knowledge in Ghanaian cellular industry, the author wishes to explain the principal component in which the switching behavior of client in cellular industry of Ghana can be grouped. The paper focuses on clustering the factor that influence churn in Ghanaian telecommunication industry into principal component. This will reduced the factors that contribute to churn in principal component which can be further used in predicting the likelihood of switching and the correlation among the variables which influences switching. Categorizing the churn variables in the cellular industry in Ghana with intention to help manage the problem of churn. It will also help reduce churn and maintaining effective customer retention techniques. Paper will also inform Telecommunication companies in devising effective methods of client acquisition by concentrating on the variables that matter the most to clients in the cellular industry in Ghana. Non-Probabilistic convenience sampling method was deployed as the researcher intended to have an in-depth analysis of the case. Also a structured interviews were conducted which generated qualitative data. Random sampling was used to sample executives across the firms in the industry. Sample sizes of two hundred and sixty one mobile phone users were interview from the Kumasi Metropolis in Ghana.

The paper begins with sampling test conducted using Bartlett's test of sphericity and KMO measure of sampling adequacy (MSA) to ascertain the level relationship and the pattern between variables. The methods are based on principal component analysis, correlation and regression analysis and descriptive statistical analysis given rise to their respective relative important index of the factors believed to influence switching behavior of client and therefore clustered into principal component.

## **3.0 Data analysis, finding and discussion**

Responses to the fifteen-item questionnaire were subjected to a principal component analysis using ones as prior communality estimates. The author uses Bartlett's test of sphericity and KMO measure of sampling adequacy (MSA) to ascertain the level relationship and the pattern between variables. The result of the MSA for this paper was found to fall above the acceptable value ie above 0.5 with overall MSA value of 0.737. table ...display show the value of the test. The examination of MSA value for each variable confirms that all the value are acceptable which indicate that the data meet the fundamental requirement for factor analysis. Finally examining the partial correlation analysis reveals that thirty six values are greater than 0.5

$$\left( X_1 - X_{2,3,10,13}, X_2 - X_{3,13,14}, X_3 - X_{7,8,10,13,14,17}, X_4 - X_{7,8,14}, X_6 - X_{12}, X_7 - X_{10,13,14}, X_9 - X_{12}, \right. \\ \left. X_{10} - X_{14,15}, X_{12} - X_{14,15,16,17}, X_{13} - X_{3,14,15,16,17}, X_{14} - X_{15,16,17}, X_{15} - X_{16} \text{ and } X_{17} - X_{16} \right)$$

and statistically significant with p-value <0.05 which is an indication of strong interrelationship among the variables in the principal component analysis (PCA). The principal axis method was used to extract the components, and this was followed by a varimax (orthogonal) rotation. Only the first five components displayed eigenvalues greater than 1, and the results of a scree test also suggested that only the first five components were meaningful. Therefore, only the first five components were retained for rotation. Combined, components 1, 2, 3, 4 and 5 accounted for 73.254% of the total variance. Questionnaire items representing the switching factors and corresponding factor loadings are presented in Table 3.3. In interpreting the rotated factor pattern, an item was said to load on a given component if the factor loading was .40 or greater for that component, and was less than .40 for the other.

Using these criteria, six items were found to load on the first component, which was subsequently labeled ethical and core service inadequacies. Giving component. Three items also loaded on the second component, which was labeled the knowledge gap Component, two items also loaded on the third, fourth and the fifth component which were labeled as innovation, social influence and inconvenience respectively.

**4.0 Conclusion and Recommendation.** 1

Many factors actually describing the factors that contribute to the switching of client from one telecommunication industry to another can further be clustered. This paper deals with the problem of putting the factors that contribute to customer switching in Ghanaian telecommunication industry into principal component thereby reducing the factor into major factors. The paper finally presented five principal component which are stipulated in the proposed model for the Ghanaian telecommunication industry which does not agree with the model proposed by Susan Keaveney (1995), the paper recommend that for purpose of prediction of customer churn, using any multivariate approach, this classification and for that matter the five principal component which summaries the churn behavior of client in the Ghanaian telecommunication industry.

**Table 3.1**

Switching Factors Correlation Matrix									
	X1	X2	X3	X4	X5	X6	X7	X8	X9
X <sub>1</sub>	1.00								
X <sub>2</sub>	0.70	1.00							
X <sub>3</sub>	0.54	0.61	1.00						
X <sub>4</sub>	0.15	0.18	0.41	1.00					
X <sub>5</sub>	-0.18	-0.19	0.11	0.15	1.00				
X <sub>6</sub>	0.42	0.39	0.30	0.28	0.15	1.00			
X <sub>7</sub>	0.34	0.36	0.56	0.58	(-0.004)*	0.43	1.00		
X <sub>8</sub>	0.25	0.34	0.57	0.57	(-0.01)*	0.14	0.43	1.00	
X <sub>9</sub>	0.17	0.16	(0.105)*	(0.046)*	0.22	0.40	0.23	-0.15	1.00
X <sub>10</sub>	0.49	0.43	0.60	0.47	0.30	0.37	0.50	0.30	0.20
X <sub>11</sub>	(-0.033)*	0.15	(0.053)*	(0.084)*	0.21	0.22	(0.017)*	(0.02)*	0.21
X <sub>12</sub>	0.23	0.27	0.21	0.35	0.20	0.52	0.32	0.20	0.53
X <sub>13</sub>	0.55	0.46	0.58	0.40	(-0.012)*	0.48	0.60	0.35	0.40
X <sub>14</sub>	0.28	0.49	0.51	0.54	(0.027)*	0.43	0.63	0.41	0.28
X <sub>15</sub>	0.21	0.39	0.46	0.41	0.21	0.28	0.45	0.27	0.23
X <sub>16</sub>	0.22	0.31	0.42	0.33	0.25	0.31	0.40	0.48	0.32
X <sub>17</sub>	0.34	0.34	0.53	0.19	(0.068)*	0.27	0.41	0.45	0.33

	X10	X11	X12	X13	X14	X15	X16	X17
X <sub>10</sub>	1.00							
X <sub>11</sub>	0.26	1.00						
X <sub>12</sub>	0.27	0.44	1.00					
X <sub>13</sub>	0.48	(-0.051)*	0.43	1.00				
X <sub>14</sub>	0.55	0.25	0.63	0.58	1.00			
X <sub>15</sub>	0.61	0.25	0.49	0.53	0.61	1.00		
X <sub>16</sub>	0.47	0.22	0.55	0.51	0.53	0.60	1.00	
X <sub>17</sub>	0.27	0.38	0.51	0.49	0.50	0.30	0.53	1.00

Correlation coefficient for the switching factor with \* against their values are not significant at 5%. thus P-value > 0.05

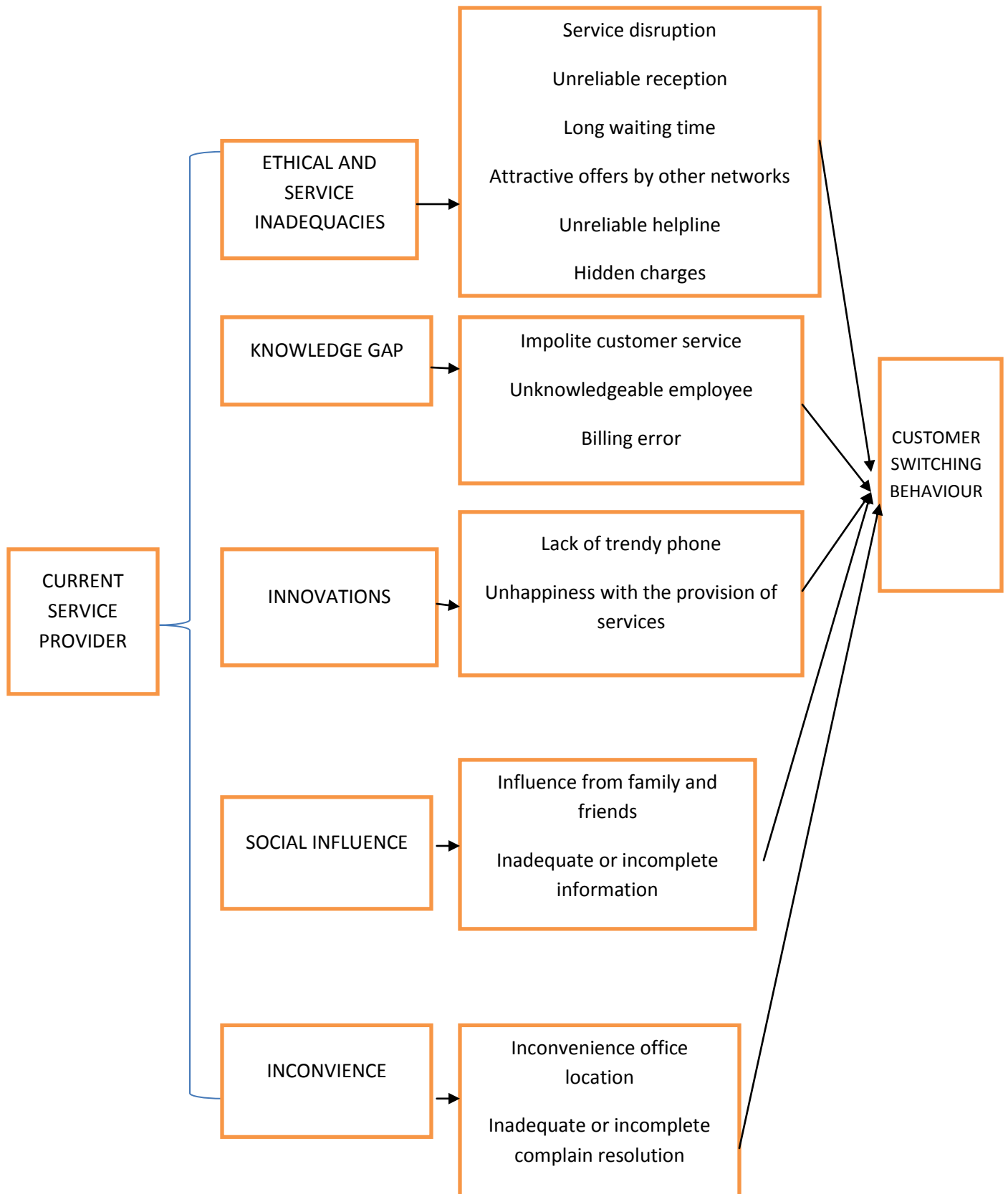
Table 3.2

KMO and Bartlett's Test		
KMO Measure of Sampling Adequacy.		0.737
Bartlett's Test of Sphericity	Approx. Chi-Square	2402
	Df	136
	P-value	0.00

**Table 3.3 Principal component**

<b>SWITCHING FACTORS</b>	<b>PRINCIPAL COMPONENTS</b>					
	<b>C1</b>	<b>C2</b>	<b>C3</b>	<b>C4</b>	<b>C5</b>	<b>RII</b>
Service disruptions like network upgrade and cell site breakdown	<b>0.54</b>					<b>0.664</b>
Unreliable reception	<b>0.654</b>					<b>0.660</b>
Long waiting time at customer service centers	<b>0.495</b>					<b>0.625</b>
Unreliable help lines	<b>0.533</b>					<b>0.660</b>
Attractive features offered by other networks	<b>0.725</b>					<b>0.636</b>
Hidden charges	<b>0.758</b>					<b>0.672</b>
Impolite service customer		<b>0.879</b>				<b>0.477</b>
Unknowledgeable employees		<b>0.835</b>				<b>0.497</b>
Billing Errors		<b>0.669</b>				<b>0.596</b>
Lack of trendy phones			<b>0.83</b>			<b>0.532</b>
Unhappiness with the provision of services like Internet and VAS			<b>0.65</b>			<b>0.542</b>
Influence from family and friends				<b>0.8</b>		<b>0.528</b>
Inadequate or incomplete information provided by service provider				<b>0.7</b>		<b>0.639</b>
Inconvenient office location					<b>0.82</b>	<b>0.547</b>
Inadequate or incomplete complaint resolution					<b>0.6</b>	<b>0.570</b>

Fig 1.0 Proposed Factormodel



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