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Factor Analytic Approach to Internet Usage in South–Western Nigeria

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Abstract

This study was designed to investigate Internet usage using a factor analytical approach with principal factoring. Through the study, it was discovered that many latent constructs actually influence the Internet usage and that there is an underlying relationship between them. The work also investigated whether there is any regularity and order in Internet usage. The study was carried in South-Western Nigeria.

Keywords: Africa, National IT Policy, cyber cafés, principal factoring.

Introduction

Background

The Internet appears to be everywhere these days. Web addresses appear on Television, Radio, billboards, Newspaper advertisements and numerous other places. Most software programs being introduced into the market have Internet features. The world market is gradually being shifted to the Internet. Even some professional Examinations are now being taking place on the Internet.

This global village is a Library of fun, a shopping mall, a compendium of information, a health institute of a kind, research institute, an archive, musical studio or a pornographic shop. The Internet contains all these and many more. The vast information on the Internet that covers almost all areas of human endeavors has made Internet the greatest achievement of the century. This Internet is fast becoming a necessity for every economy.

Motivation for the Research

The world economy today is increasingly becoming information and knowledge based. The emerging information and knowledge economy is enhanced by ability to identify the source of information, quick and easy access to the source, and swift translation of the acquired information into production, creative ventures and wealth.

The Nigerian National Policy for Information Technology (IT) has the vision:

> *To make Nigeria an IT super power in Africa and a key player in the information society by the year 2006. To position Nigeria as a technologically active nation and Key player in the information age, using software as the engine for development, sustainable growth and global competitiveness.*

The country also desires to use IT to create wealth, alleviate poverty, job creation and global competitiveness. As part of its mission, the policy is designed to encourage massive acquisition of both local and global IT skills. This aims at achieving at least 500,000 IT skilled personnel by the year 2004

Between 1999 and to date, a great deal impetus has been put to IT development in Nigeria. Some state governments are embarking on e-government (Orhuozee, 2002). Also e-commerce is fast expanding. Banks in their bids to deliver quality services and expand their reach are taken giant strides into e-banking (Otokhine, 2002).

In the recent times particularly after the exit of Military dictatorship in Nigeria, Internet Service Providers have increased in number tremendously. Also, many of cyber cafés have sprung up to avail Nigerians the benefits of Internet. In order to stop the decline of the Nigerian educational system, occasioned by the introduction of satellite campuses, the satellite campuses were cancelled and replaced with Distance Learning. A major pivot of the Distance Learning is E-learning.

It is therefore pertinent to examine the responses of Nigerian to this stimulus in the world of communications. There is the need to investigate the attitude of Nigerians to the Internet particularly the use to which the Internet is being put. The web is one of the fastest growing Internet resources, yet because of its distributed global nature, very little is known about its users, their characteristics and the reason for using the Web. Thus this study is geared towards examining the Internet usage in Nigeria. Its focus is primarily to study the pattern of usage of Internet in the target population.

Scope and Coverage

The target populations are the Internet users in the states of the Western part of Nigeria. They are Edo, Ondo, Ekiti, Osun, Oyo, Ogun, and Lagos States. Most of the cyber cafés are in the state capitals for now, therefore our coverage is limited to the state capitals and the entire State of Lagos. Samples are selected at random among callers at various cyber cafés located in the enumeration area. The sampling units are confirmed to be Internet users before questionnaires are administered on them.

Significant of the Study

In the implementation of the National Policy on Information Technology the pattern of usage of Internet for education, health, business, consultancy, entertainment, employment, sports, research, news and so on and the effect such usage pattern can have on development of information technology is desirable to be investigated.

Therefore this study will significantly expose the focal areas in the Internet to be developed. It will assist to a great extent in the achievement of IT policy of making Nigeria a key player in information society by the year 2006. The result of the study will assist in accelerating the massive acquisition of IT skills in the country.

Research Methods

Surveys And Sample Designs

The target population was stratified into zones within each state. In each state cyber cafés are selected in the town covered. At the time of this research the cyber cafés were located mainly in the state capitals except Lagos. For effective coverage and convenience Lagos was stratified into 5 blocks namely Lagos Island/Apapa, Yaba/Akoka, Surulere/Mushin, Ojoo/Festac/Agege and Ikeja/Maryland/Ketu.

In each enumeration area the cyber cafés were selected and the sampling units are identified and confirmed to be Internet users before administering the questionnaire. Nobody is enumerated twice. The survey time was selected at random so as to minimize errors due to periodicity. This is because the working class comes to cyber cafés mostly in the evenings. A total of 775 respondents were enumerated.

Questionnaire Design

The questionnaire items are divided into two sections. The first section requests information on the locality, sex, profession and age of the Internet users. The second aspect consists of 36 questions on some various usages of Internet. The Internet users are required to indicate their frequency of using the Internet for the 36 different purposes. The frequency of usage is based on 5-point Likert scale of 1 – very uncommon 2 – uncommon 3 – occasionally 4 – often and 5 – very often as in appendix 1.

Validity and Reliability of the Questionnaire

The questionnaire was pre-tested through a pilot survey using 165 Internet users in three cyber cafés in Akure and Benin City. The results of the pilot survey was analyzed and showed no ambiguity or misinterpretation of the concepts. Cronbach alpha, a model of internal consistency gave a reliability Coefficient of 0.9164.

Methodology

The responses were collected and subjected to factor analysis using Varimax rotation criterion (with Kaiser Normalization). Principal Component's method of factoring was used while Kaiser-Mayer-Olkin (KMO) measure of sampling adequacy was applied to test whether the partial correlations among variables are small. Bartlett's Test of Sphericity was carried out to confirm multicolinearity between the variables. It examined whether the correlation matrix is an identity matrix.

The principal components extracted were rotated to the terminal solution. The Varimax criterion was applied so as to delineate the pattern of variation in the variables rather than among users. Absolute values of coefficients that are less than 0.445 were suppressed. Thus only factor loadings of 0.445 and above are assumed to be interpretable. This parameter sets the minimum total variance in a variable accounted for by a factor at about 20% before the factor can be regarded as being important to the variable. The rotation converged in 14 iterations

Results and Discussion

This section presents the results of the factor analysis.

Kaiser-Meyer-Olkin (KMO), Bartlett's Tests and Underlining Assumptions

The KMO measure of Sampling Adequacy is 0.726 and the Bartlett's Test is not significant. Thus the matrix of the battery of test is not an identity matrix and hence it is invertible and the factor model is suitable. For the validity of factor analytic approach, it is assumed that observations are independent and errors are uncorrelated between usage profiles. The scales are additive and each pair of usages are a bivariate normal distribution. The Pearson Correlation Coefficient test indicates a linear association between all pairs of usage variables. Most of the correlation coefficients are significant at 0.01 level except for Email that is significant at only 5% level.

The tables below give the results of extracted communalities of all the variables (Tables 1-8). The variables are classified according to the percentage of variation that can be produced (predicted, accounted for, generated or explained) for that variable from all others.

Tables Of Communalities

Table 1. Group A (40%)

Internet Usage	Extraction	% of variation explained by other variables
Email	0.398	39.8
Religion	0.385	38.5

Table 2. Group B (40-44.99%)

Internet Usage	Extraction	% of variation explained by other variables
Emigrant	0.403	40.3

Table 3. Group C (45-49.99%)

Internet Usage	Extraction	% of variation explained by other variables
Phone	0.457	45.7
Debates	0.464	46.4
News	0.484	48.4
Periodicals	0.499	49.9

Table 4. Group D (50-54.99%)

Internet Usage	Extraction	% of variation explained by other variables
Employment	0.505	50.5
Pornographic	0.513	51.3
FTP	0.514	51.4
Tourism	0.514	51.4
Health	0.542	54.2

Table 5. Group E (55-59.99%)

Internet Usage	Extraction	% of variation explained by other variables
Examination	0.553	55.3
Entertainment	0.557	55.7
Hacking	0.566	56.6
Teaching	0.566	56.6
Advertisement	0.567	56.7
Sports	0.573	57.3
Military	0.583	58.3
Knowledge	0.586	58.6
Legal Works	0.595	59.5

Table 6. Group F (60-64.99%)

Internet Usage	Extraction	% of variation explained by other variables
Library	0.602	60.2
Lottery	0.607	60.7
Hotel	0.620	62.0
AIDS & Grants	0.624	62.4
Engineering	0.629	62.9
Aviation	0.631	63.1
Weather	0.634	63.4
Teleconferencing	0.639	63.9
Retail	0.644	64.4
Telnet	0.649	64.9

Table 7. Group G (65-69.99%)

Internet Usage	Extraction	% of variation explained by other variables
Research	0.65	65.0
WEB Design	0.668	66.8
Building	0.686	68.6
School	0.697	67.7

Table 8. Group H (≥ 70%)

Internet Usage	Extraction	% of variation explained by other variables
Purchasing	0.739	73.9

From the above Table 1.0 it is very clear that both Religious use (38.5%) and E-mail (39.8%) have the least percentage of variance that can be predicted or explained by the other 35 variables. Also Online Purchasing (73.9%) on the Net has the highest variation that can be accounted for by the other 35 variables.

A comparison of the responses of the users on the Likert scale (Table 9) indicates that e-mail is negatively skewed while purchasing is positively skewed. Thus while the use of the Net for E-mail and Religion is less influenced by other 35 factors, purchasing use is greatly determined by the other 35 factors.

Table 9. Comparisons of Responses on Religion, E-mail, and Purchasing

Rate of Usage	**Likert**	**No of users**			**% of users**		
	Scale	**Religion**	**E-mail**	**Purchasing**	**Religion**	**E-mail**	**Purchasing**
Very Common	1	166	39	264	21.42	5.03	34.06
Uncommon	2	202	43	237	26.06	5.55	30.58
Occasionally	3	197	77	154	25.42	9.94	19.87
Often	4	129	130	84	16.65	10.84	16.77
Very Often	5	82	486	36	10.58	4.65	62.71

These results reveal the importance attached to e-mail by Nigerians. The findings corroborate NUA (May/June 1997) survey in which 57.6% of the respondents rated e-mail as very important. Moreover, the sign of online shopping is very positive and encouraging as a total of 10.084% and 4.65% of the respondents use the Internet often and very often respectively.

The communality indicates that 73.9% of the variation in Online Shopping can be predicted by the usage of other variables studied. Thus improvement in the usage of other variables will have corresponding effect on online purchases. This trend does not depart radically from the world's trend. The seventh annual Retail Technology Study conducted by Computer Sciences Corporation and Retail Information System News say 20% of respondents offer online shopping programs (NUA, 1997). Moreover, 45-49.9% of the variation in the News and Communication can be accounted for by all other variables. This is a good sign of progress in News and Communication in Africa particularly in Nigeria the most populous country in Africa.

This healthy development is evident in the comments of Lane Smith, a US Agency for International Development (USAID) official.

> "African telecommunication policymakers are proving vigorous and courageous in their efforts to expand the benefits of information technology (IT) to their citizens" and "I'm struck by the tremendous success Africa has experienced with the application of the Internet … " (http://usinfo.state.gov/af/)

It is also apparent from the data that while Religion and E-mail have greater measures of uniqueness 61.5% and 60.2% respectively, online purchase has the least 26.1%. News and Communication variables have almost a ratio of 1:1 measures of communalities to uniqueness.

Table 1 below gives the result of the extracted factors. Eight factors are extracted using principal component analysis. The factors accounted for 57.061% of the total variance. This implies that there are eight substantively meaningful uncorrelated pattern of relationship among

the variables. Effectively, we say there are 8 different kinds of influence on the data, which presents eight categories in which Internet usage in these localities can be classified.

This preliminary result of the extraction is confirmed by the Scree plot, the plot of the characteristic roots (Eigenvalues) against component factors that can be extracted from the correlation matrix and testing for a break in the resultant curve, Figure1.0

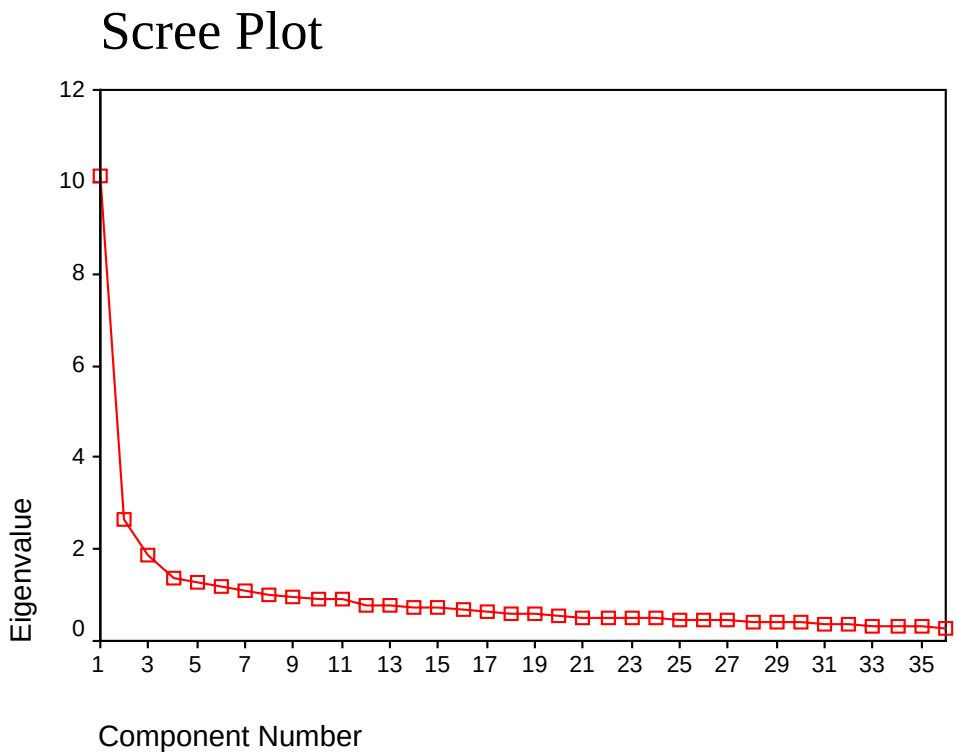

Figure 1. Scree Plot of the rotated factors from the Internet usage profile.

As can be seen from Table 10, eight patterns involve 57.061% of the variation in the data. The 8 factors are rotated to the terminal solution. The percentage % of variance from the Rotation sums of squared loading shows that factor 1 has 10.62% degree of comprehensiveness and strength while factor 8 has 4.221%.

Analysis of the high loadings items on each of the 8 factors was undertaking in Table 11 to determine the underlying relationships that exist among the loaded items on the factors.

Table 10. Total Variance Explained For Internet Usage

	Initial Eigenvalues			Extraction Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	10.119	28.108	28.108	3.823	10.620	10.620
2	2.649	7.358	35.466	3.276	9.100	19.719
3	1.884	5.234	40.700	3.026	8.404	28.124
4	1.365	3.792	44.491	2.350	6.528	34.652
5	1.262	3.505	47.996	2.324	6.456	41.108
6	1.173	3.258	51.254	2.318	6.438	47.546
7	1.073	2.981	54.235	1.906	5.295	52.840
8	1.017	2.826	57.061	1.519	4.221	57.061
9	0.951	2.64	59.701			
10	0.933	2.592	62.293			
11	0.893	2.481	64.774			
12	0.796	2.212	66.986			
13	0.777	2.159	69.145			
14	0.750	2.084	71.229			
15	0.710	1.973	73.203			
16	0.699	1.942	75.145			
17	0.647	1.799	76.943			
18	0.615	1.709	78.652			
19	0.583	1.618	80.270			
20	0.534	1.485	81.755			
21	0.519	1.441	83.196			
22	0.513	1.425	84.621			
23	0.508	1.411	86.032			
24	0.482	1.339	87.371			
25	0.476	1.323	88.694			
26	0.463	1.286	89.980			
27	0.447	1.242	91.222			
28	0.426	1.184	92.406			
29	0.397	1.102	93.508			
30	0.395	1.097	94.605			
31	0.379	1.053	95.658			
32	0.353	0.980	96.638			
33	0.316	0.876	97.515			
34	0.309	0.859	98.374			
35	0.305	0.848	99.222			
36	0.208	0.778	100.000			

Table 11. Rotated Component Matrix[a] for Internet Usage

	Component							
	1	2	3	4	5	6	7	8
Advert	0.574							
Aids					7.320			
Aviation			0.630					
Building			0.740					
Debates								
Email								
Emigrant							0.484	
Employ					0.501			
Engineering			0.634					
Entertain							0.657	
Exam					0.454			
Ftp	0.592							
Hack				0.507				
Health								
Hotel			0.560					
Knowledge		0.652						
Legal								0.737
Library		0.627						
Lottery				0.661				
Military				0.616				
News		0.470						
Periodical		0.537						
Phone	0.481							
Porno				0.509				
Purchase						0.785		
Religious								
Research		0.785						
Retail						0.737		
School					0.772			
Sports							0.585	
Teach		0.653						
Tele	0.741							
Telnet	0.749							
Tour								
Weather			0.645					
Web	0.774							

[a] Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 14 iterations.

An analysis of each of the 8 factors clusters of items proffers a recipe for naming the factors. These clusters of items are given in Tables 12 to 19

Clusters Of Loadings For Internet Usage Profile

Table 12. Factor 1

Loadings	**Internet Usage**
0.574	Advertising on the Internet
0.592	File Transfer Protocols (FTP)
0.481	Internet Phoning
0.741	Teleconferencing
0.749	Telnet
0.774	Web development

Table 13. Factor 2

Loadings	**Internet Usage**
0.652	Learning and Broadening Knowledge
0.627	Use as Library
0.470	Use for News items
0.537	Rending & Consultation of Periodicals

Table 14. Factor 3

Loadings	**Internet Usage**
0.630	Browsing for Aviation Information
0.740	Building and Construction Information
0.634	Design and Engineering Information
0.560	Hotel Bookings (Reservation)
0.645	Weather Forecast

Table 15. Factor 4

Loadings	**Internet Usage**
0.507	Hacking for top Secret Information
0.661	Gambling/Lottery
0.616	Military
0.509	Watch Pornographic Films

Table 16. Factor 5

Loadings	**Internet Usage**
0.732	Seek for Aid, Scholarships, or Assistantships
0.501	Seek for Employment
0.454	Taking Examination
0.772	Seek Information for Admission into School

Table 17. Factor 6

Loadings	**Internet Usage**
0.785	Online Purchase from Shops (Merchandising)
0.737	Seek for Information in Retail Stores

Table 18. Factor 7

Loadings	**Internet Usage**
0.484	Emigrant Information
0.657	Music, Movies and General Entertainment
0.585	Watching Sports

Table 19. Factor 8

Loadings	**Internet Usage**
0.737	Legal Consultation

From Tables 12 – 19, it is very easy to name the factors based on the variables that load on them.

Factor 1: Web Development and Real – Time Communication

The variables that load significantly high on this factor are mostly the usages that deal with real time communication or Web development. Web Development has a loading of 0.774 and the common factor accounted for 59.91% of the variance in Web Development. The factor also accounts for 56.10%, 54.91%, 32.95%, 35.05% and 23.14%, of the variances in Telnet, Teleconferencing, Advertising on the Internet, FTP and Internet phoning respectively.

This common factor, which produced the highest variance in the data set, explained 10.620% of the total variance in usage pattern of the Internet. Each of the variables that load on the factor has a correlation(r): $0.481 \leq r \leq 0.774$ with the factor.

The fact that this factor accounted for the highest proportion of variance is not by accident. Though International communication traffic continues to grow, between 1995 and 2000 the total outbound international traffic from Africa increased from 1.34 billion minutes to 2.06 billion minutes (Hamilton, June/July 2002), Nigeria Internet situation is still problematic (Inyiama and Nwodo, 2002).

Inyiama and Nwodo (2002) averred that the reliability and speed of operation of Nigeria's telephone lines leaves much to be desired with respect to Internet Usage. Browsing the net is unbearably slow and thus boring.

According to International Telecommunication, Nigeria has the poorest Internet Service Provision in Africa. In theory, Internet provides cheap, versatile and efficient means of communication in Africa. However, Internet also relies on telephone lines which are poorly maintained, and unavailable in most African communities. The satellite communication that does not rely on telephone is very expensive. The cost of subscribing to Internet Service Providers is prohibitive for most Africans, (Adebayo, 2002)

Factor 2: Teaching and Research

This factor accounted for 9.1% of the total variance explained. There are six variables that load significantly high on the factor. All the variables deal with teaching and research. The factor generated 78.5% of the variation in Research Work, and 65.3% in collecting information for the purpose of teaching. It has correlation(r): $0.47 \leq r \leq 0.785$ with the variables that load on it.

This result is akin to Sherry (1999), in his study of online tools; Internet, E-mail and the WWW at the University of Colorado, Denver Graduate School of Education. The study articulated the individual conceptual changes as they learn the basic of mediated communication, deal with their concerns and learning anxieties develop expertise, adopt, and eventually reaffirm or reject the use of the Internet to support teaching and learning. In his finding the primary reasons for Internet use are finding information, communicating with colleagues, sharing information and collaboration varied greatly in importance between programs. The use of the

internet for sharing information accounted for 44% of the variance while collaborations, i.e. sharing information to carry out an intentional activity, explained 8% of the total variance.

Internet provides a wide range of opportunities for teaching and research. It is a mechanism for information dissemination and a medium of collaboration and interaction between individuals and their computers without regard for geographic location (Lainer et al., 2000). Jagboro (2003) evaluated the level of utilization of Internet for academic research at the Obafemi Awolowo University, Ile-Ife, Nigeria. The study revealed that the benefits of Internet as a tool for learning, teaching and research is hampered by low level of Internet connectivity and the high cost of Cyber cafés. This actually accounts for low level of utilization by postgraduate students of the University

Factor 3: Works, Housing and Transportation

Factor 3 accounted for 8.404% of the total variance explained. Four of the variables deal specifically with either housing construction or aviation information. The fifth variable is weather forecast which has a correlation r = 0.645 with the factor.

Factor 4: Military and Unwholesome Activities

This Latent factor explained 6.528% of the total variance in all the battery of 36 tests. It has strong correlations r : $0.507 \leq r \leq 0.667$ with Military (0.616) and three unwholesome activities viz: Hacking (0.507), pornographic films (0.509) and Gambling/Lottery (0.661) on the Internet. The factor also generated 37.95%, 25.70%, 25.91% and 43.69% of the variances in the variables respectively.

Internet as a tool is not free from criminal usage. Inyiama and Nwodo (2002) reported that Internet is a very powerful tool of brainwashing, monitoring and organizing effective attack against individuals or groups. Unscrupulous and criminally minded individuals exploit the Internet as an avenue through which they could perpetrate their evil intentions. Fraudsters and unscrupulous people can clandestinely intercept your correspondences without your knowledge. They also reported that sexual perverts use Internet to hunt for victims, while so many pornographic materials are available on the Internet to corrupt good manners. Computer hackers and virus-writers have doubled their activity over the past 12 months. A survey by British Government showed that twice as many cyber-criminals broke through electronic defenses of business in the last year (IME, 2002)

Factor 5: Studies, Grants and Employment

The total variance explained by this factor is 6.456%. All the variables on the factor are concerned with schooling and employment. Admission into school has a correlation of 0.772 with the factor while Aids, Scholarships and Assistantships has correlation r = 0.732 and the factor generated 59.60% and 53.58% of variances in the variables respectively. Also the variable "Taking Examination" has a correlation of 0.454 with the factor.

Factor 6: Merchandising

The common factor "Merchandising" has very strong correlations with Online Purchasing (OP) (0.785) and Seek Information on Retail Stores (RS) (0.737). The construct explained 6.438% of the total variance in the usage profile. It also accounted for 61.62% and 54.32% of the variances in the two variables OP and RS respectively. Zetter and Tweney (2003) reports that of all activities people love to do on the net, shopping ranks among the highest

Factor 7: Entertainment and Travel

Entertainment and Travel construct is in the 7th rank among the 8 underlining factors influencing the Internet Usage in Western Nigeria. The factor accounted for 5.595% of the total variance explained in the usage profile. Three variables loaded on the factor. Music, Movies and General Entertainment has a correlation of 0.657 with the factor while Watching sports and Emigrant Information have correlations of 0.585 and 0.484 respectively with this factor. The construct accounted for 43.16% of the variations in Music, Movies and General Entertainment and 34.22% of the variance in watching sports.

From the extracted communalities 40.3% of the variation in the variable Emigrant Information can be explained by the other variables in the battery of tests. This shows that 59.7% of the variance is unique and not due to the other 35 variables. These variations in Entertainment therefore can be traced to so many factors. Crumlish (1998) said the biggest handicap holding back multimedia development on the web has been bandwidth – people connecting to the Net via modems just can't be expected to wait long enough for huge media files to download. When you use a modem, your telephone line is transferring the data, and this can result in slow loading of Web pages or playback of video and audio clips. He further emphasized that line capacity, traffic, modem speed can interfere with smooth browsing.

Factor 8: Legal Consultation

The variable legal consultation has a high significant loading (0.737) on this factor. It is the only variable and with a very high correlation. The factor explains 4.221% of the total variance in the usage profile.

The use of Internet for Legal Consultation is of one of the prominent use by professionals. Ned (1995) mentions that lawyers consult the catalog of Columbia University's Law Library, or the Library of Washington and Lee University, which includes the text of federal and state laws. Supreme Court decisions and legal journal are consulted on the Internet.

Conclusion

The study revealed that 8 factors determine and influence the usage of Internet. Of these 8 factors Web Development and Real –Time communication exhibits the greatest variability and individual differences. The variables that load on this factor are really the computer professional use of the Net. This factor and the rest 7 need to be seriously focused if Nigeria is to achieve its National policy on IT.

The users are consistent mainly in the usage of Internet for Religious information and e-mail. The findings also revealed that users are not having the right attitude towards Teaching and Research as latent construct show a very high degree of variability. There is low level of utilization of Internet for Teaching and Research. However, unwholesome activities and criminal tendencies takes prominence than expected. Activities like Hacking, Watching of Pornographic films and Gambling on the Net puts up a better show than Teaching and Research. Thus Internet is not free from criminal usage in Nigeria. Online purchasing and seeking information from Retail stores ranks better in steady usage, thus improvement on usage of all other variables will improve merchandising in Western Nigeria.

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