A Predictive Model for Evaluating Mobile Number Portability in Nigeria

Odii Juliet N[1], Ejiofor V.E[2], Osuagwu O.E[3]

[1]Department of Computer Science, FUTO, Nigeria
[2]Department of Computer Science, NAU AWKA, Nigeria
[3]Department of Computer Science, Alvan Ikoku College of Edu, Nigeria

Abstract - *Mobile Number Portability (MNP) is not necessarily a new development in the mobile Telecommunications industry as it has been in existence since its initial implementation in Singapore in 1990. This novel technology was launched in Nigeria in 2013 and was expected to improve the quality of service by deepening competition among telecom service providers by but has unfortunately failed to produce the desired impact due to some restrictions as identified in this research. The objective of this research therefore is to design a predictive model that simulates the behaviour of these restrictive policies on MNP so as to ascertain their current impact on the non expansion of MNP adoption in Nigeria and also assess the future possibility of MNP expansion if government decides to retain the restrictions, improve on those restrictions, and also if the restrictions get worse. The methodologies that were deployed in packaging the model include the statistical methodology, Structured Systems Analysis and design Methodology (SSADM), Object Oriented Design Methodology (OODM) and prototyping. A model called Mobile Number Portability Growth Trend Trajectory Simulator/Predictor(MNPGTTS) was developed using Visual Basic.Net version 10 and Microsoft Access as the DBMS engine. The MNPGTTS is capable of forecasting the impact of the MNP restrictions in the next 10-50 years. The MNPGTTS model was test run using the beta coefficients derived from SPSS multiple regressions and ANOVA of collected field data as our indices and later adjusted values of the indices were plugged into the program that enabled us assess the future possibility of MNP expansion. The result demonstrated that if government still allows the existing restrictions, subscribers may not be motivated to port. Also that if government can remove or improve on most of the restrictions towards the adoption of MNP in Nigeria, MNP will receive a boost in terms of patronage, and should government further stiffen the restrictions, MNP will totally collapse.*

Keywords: *MNP, Subscriber, Service Provider, Donor Network, Recipient Network.*

I. INTRODUCTION

There has been rapid growth in the penetration of mobile telephony services in the last few years. But the growth has neither been exponential in the quality of service offered nor has it provided an open platform for fair competition for smaller telecommunication operators. Subscribers are not satisfied with the operators' services and their frequent derailment from meeting their service level agreements has become more challenging. Before the advent of MNP, subscribers are required to give up their mobile numbers on changing service providers. This has not only led to untold inconveniences to subscribers but also the service providers have capitalized on this lapse to either exploit the subscribers or impose unreasonable charges to subscribers. In addition, when mobile numbers have been used in multiple important correspondences, it becomes nearly impossible to give up the number for fear of missing important calls from old contacts. The picture has now changed dramatically with the introduction of mobile number portability (MNP) technology. Mobile Number Portability gives the subscribers the privilege to easily change from networks that are not serving them well and also return when the network improves, ensuring greater flexibility and mobility across networks. The essence of this number portability is to further stiffen competition among network providers and at the same time ensure better quality of service. In MNP terminology, the operator who loses a customer is known as the Donor Operator while the one receiving a ported number is referred to as the Recipient Operator. As an illustration, before the introduction of MNP in Nigeria, all numbers prefixed with 0805 were routed to Globacom, 0803 to MTN and 0802 to Airtel, 0809 to Etisalat. With the implementation of MNP, 0803 numbers for example, can now be ported to any network. The Nigerian Communication Commission (NCC) launched MNP in Nigeria in 22 April 2013 making Nigeria the 64th country of the world to embrace the scheme. This much awaited scheme at last came to be four years after the initial target [1].

However, contrary to expectations, GSM service providers have latched on to the MNP scheme just to

broaden the scope of their promos and advertisements rather than improve services as earlier envisaged [1]. From observations thus far, little has changed in terms of network coverage and the volume of dropped calls and intermittent service seizures, and other quality of service concerns. Thus the expectations raised by the MNP scheme are not being fulfilled and Nigerians again are looking to the NCC to rein on the GSM operators who have merely capitalized on the scheme to indulge in a wild medley of promos without improving their services. Indeed, MNP seems not to be recording expected success in Nigeria with only a handful of subscribers that switched networks within two months of its launch [1]. Subscribers' lamentations on the traffic lull in the process of porting seem to be hindering the scheme. Hence, it is pertinent to state that up till date the launch of MNP in Nigeria seemed not to have recorded expected success. The scheme is meant to compel the mobile network operators to be more accountable to subscribers and treat them as kings. It is expected to enhance billing integrity, since operators would not want to lose customers who may be willing to shift to another network if they feel short-changed by the network's billing system. In spite of these envisaged benefits of MNP, most subscribers have not embraced the scheme. This work therefore tries to explore some of the factors why MNP is yet to succeed in Nigeria and also develop a model that can be used to check the viability of MNP as it stands now while at same time peep into the future of MNP in Nigeria.

II. RELATED LITERATURES

The history of MNP started in 1990s with Singapore implementing a limited version of this functionality in 1997, Hongkong implemented in 1999, Spain in 2000, and Australia in 2001 and so on and so forth that as at September 2008, a total of 48 countries around the world had launched MNP [5]. The number of countries implementing MNP continued to increase rapidly that by 2011 also there were 63 countries that had implemented MNP [6]. This wind of the MNP, which was only blowing in Europe and America over a decade ago has even cut across the African continent andNigeria in order not to be left behind the wheel joined   in April 22nd, 2013 to become the 64th country of the world to embrace the MNP scheme,[1].

Mobile Number Portability (MNP) can be defined as the ability of subscribers to retain their phone numbers when changing from one mobile service provider to another [8]. It allows customers who wish to switch mobile operator to keep their mobile numbers, avoiding the costs of switching to new numbers [4]. MNP entails a lot of processes such as porting processes, code of conduct between Donor Operator and Recipient Operator, technology used

for porting, competition, and customer standards to determine the success or failure of MNP depending on how they are implemented by mobile operators. Mobile number portability is simply keeping mobile phone number when moving from the existing service provider to a new service provider [3]. There are basically three (3) types of number portability currently being implemented around the world as identified by [2]and they include:

1)*Location portability:* This is the ability of a subscriber to retain his/her number when changing from one physical location to another within the same calling area.

2)*Service Portability:*This is the ability of the subscriber to retain his number as he changes from service provider to another, example from mobile to fixed services or from PSTN to ISDN services.

3)*Service Provider Portability (SPP):*The most commonly deployed number portability type, service provider portability enables end users to retain their telephones numbers when changing service providers. This allows a subscriber to retain his /her number when changing from one provider to another. Service provider portability can be Introduce in three ways: geographic, mobile and non-geographic.

III. MOBILE NUMBER PORTABILITY IN NIGERIA

The Nigeria Communications Commission (NCC) on April, 22nd 2013 launched the take-off of the Mobile Number Portability (MNP) scheme [1]. This is the most collaborative programme embarked upon by both the NCC and GSM service providers. The scheme is meant to deepen competition among telecoms companies and challenge them to offer improved and affordable services. The GSM companies bristled with excitement and Nigerians were full of expectations. The policy took off three years after the initial target set in 2009.

MNP considered a revolutionary step in the development of telecommunications services in Nigeria, the policy in a nutshell, enables phone subscribers in a multi-network environment to change from one network to the other without changing their telephone numbers, following the granting of a porting request. It was meant to make GSM companies sit up and raise their standards, failure of which they risk losing their customers. So far, however, the porting game is yet to spiral into a full-scale competitive storm. The excitement and expectation which trailed the launch of the scheme has all but died out. On their part, GSM service providers have merely used the MNP scheme to

broadened the scope of their promos and advertisements, changed in terms network coverage and the volume of dropped calls and intermittent service seizures, and other quality of service concerns.

But the importance of MNP cannot be over emphasized in the development of effective competition in telecommunication sector. [10] stressed that the importance of MNP is very paramount, if any country's telecommunication must grow.On Evaluation of Subscriber Attitude to Mobile Number Portability Implementation in Nigeria, [9] assessed the attitude of mobile telephone subscribers to the implementation of mobile number portability (MNP) in Nigeria. Findings revealed that while most subscribers supported the implementation of MNP in Nigeria, a significant proportion believed that tariffs would not drop as long as the power problem continued. Furthermore, it was found that of the demographic variables, age had the strongest influence on subscriber attitudes and this was identified as a strategic focus for network operators and the regulatory authority.

In another research, [7]developed a conceptual framework on user perspective on factors of quality of service (QoS) for Mobile SIM networks using 3D fuzzy logic approach as a means of enhancing the MNP scheme in Nigeria. They presented a chronological procedure for the implementation for both the network integration and the customer perspective on quality of service. The work was designed as an initial exploration to demonstrate the feasibility of a flexible trusted platform. However, the study did not explore or empirically determine extent of improvement. Another limitation is that the study did not capture the Key Performance Indices (KPIs) of the network regulators for switching as a result of mobile Number Portability availability. And as such they suggested that these shortcomings could be examined in further studies.

IV. THE RESEARCH PROBLEM

Despite the fact that MNP has been introduced in the Nigerian telecommunication industry, it has neither produced the desired effect nor provided the needed impact on the sector. Subscribers are still unwilling or reluctant to embrace the MNP scheme. And as a result, subscribers are still facing switching costs associated with informing people about new number change, printing new business cards, missing valuable calls from people that do not have the new numbers, etc. Some subscribers for fear of losing contacts are forced to stay with a particular service provider irrespective of the cost, or poor service.

V. OBJECTIVES OF THE RESEARCH

The objective of this research is to explore the factors responsible for the non expansion of MNP in Nigeria and design a model that predicts the future of MNP in Nigeria visa-vis the identified factors.

VI. SIGNIFICANCE OF THE RESEARCH

The importance and the inevitability of this research are very obvious. Though there is a growing disillusionment by Nigerians on MNP because of the prevailing poor quality of service, network failure, increment in call tariffs etc. and the inability of MNP to help resolve these issues which is affecting business transactions that are dependent on communication. And as such many subscribers and operators have kicked against MNP in different ways. For instance, some subscribers believe that instead of waiting for 48hrs to port their numbers, they would rather purchase a new SIM and start using almost immediately. They have forgotten that a new SIM implies a new identity and cost of informing friends and business associates about a new number change will at the end of the day be more than the cost of porting a number.

Operators on the other hand have claimed that Mobile Number Portability is unnecessary and that it is an unwarranted expense, using assertions that the sector is already highly competitive and have suggested alternatives such as personal numbering and Universal Personal Telephony (UPT). But, these are not substitutes to MNP, but are rather expensive, value-added services. The sector may be competitive as they claim but with Mobile Number Portability in place, the remaining barriers to competition among operators would be removed thus paving way for a more dynamic and fully competitive market. Mobile Number Portability has a lot of advantages to offer. If not, why would both the developed and developing economies of the world embrace it? Embracing the MNP will position Nigeria to catch up with other developing economies like Ghana already investing in the scheme. And since other countries of the world are trying to keep pace with ever growing technological innovations, Nigeria should not be left behind.

VII. RESEARCH QUESTIONS AND HYPOTHESES

In a research of this nature the importance of hypothesis cannot be over emphasized. And in this research the following research questions were formulated.

I.   Why have Nigerians not fully embraced the deployed Mobile Number portability?

II.   What are the factors responsible for why MNP is yet to succeed in Nigeria?

III.   What can be done to enhance MNP adoption in Nigeria?

IV.   Finally, the ultimate question: Is it possible to design a predictive model that will predict the growth trend of MNP in Nigeria giving the prevailing circumstances.

To answer the above questions, data needed to be gathered, and to gather these data questionnaires are distributed to a total of 500 subscribers in Imo State Nigeria. And out of the 500 questionnaires only 356 were returned. From the data, the following factors were identified as the factors hindering the non expansion of MNP in Nigeria.

They are:

- I. No formal education to the public on the benefits of MNP,
- II. Clumsy porting administrative procedure,
- III. Poor quality of service,
- IV. Switching costs,
- V. Difficulty in porting,
- VI. Loss of contact due to migration,
- VII. 48hr duration for porting to be achieved,
- VIII. 90-days lock-in period,
- IX. The need to be physically present in any of the network outlets in order to initiate a port.

And to test the data the following the hypothesis was postulated.

H_{01}: MNP failure in Nigeria has no relationship with the inhibiting factors: lack of formal education to the public on the benefits of MNP, clumsy porting administrative procedure, poor quality of service, switching costs, difficulty in porting, 48hr duration for porting to be achieved, 90-days lock-in period, and the need to be physically present in any of the network outlets in order to initiate a port.

H_{A1}: The above factors in the null hypothesis have relationships with the failure of MNP in Nigeria.

VIII.   DATA COLLECTION AND ANALYSIS

Questionnaires were distributed to five hundred (500) respondents in all the 27 Local Government Areas in Imo State, out of which a total of 356 respondents returned their questionnaires. The questionnaire was meant to carry out a survey that identifies the demographic profile of subscribers in Nigeria, find out the factors responsible for why Mobile Number Portability is yet to succeed in Nigeria, all these factors were identified as shown above are the factors responsible for why Mobile Number Portability is yet to Succeed in Nigeria and they were subsequently subjected to a five point Likert scale 0-4 comprising 0=> not important; 1=> less important; 2 => marginally important; 3 => important; 4 => very important.

The data collected were analysed using multiple regressions (ANOVA) and the results is as shown in the table below:

Table 1:ResultofRegressionAnalysis

From table above the f-cal $\alpha 0.05$ = 4.63609013 is greater than F-critical = 2.102384 and the P-value of 0.000108001 being less than α= 0.05indicates that the null hypothesis which says that "MNP has no relationship with the factors…" is rejected and we then accept the alternative which states that "MNP non adoption in Nigeria has relationship with factors…". This has empirically shown that the above factors are actually responsible for non-workability of MNP in Nigeria. And based on this the NCC, in collaboration with the government should look into these factors in order to achieve functional porting of numbers in Nigeria.

Also, the data were again subjected to further analysis to enable us extract the beta coefficients of these factors that are responsible for non-adoption of MNP in Nigeria. Their beta coefficients are to be plugged into the software to be designed and they will be used as predictors of MNP progress when adequate measures are taken to either improve or remove them. This analysis was done using SPSS multiple regression

From the report of the analysis we were able to deduce from the predictive model:

$$Y = a + \beta_1 X_1 + \beta_2 X_2 + ... + \beta_n X_n$$

Where Y = MNP = dependent variable,
a = the intercept, and
β = the beta coefficients obtained from the SPSS result,
X_1-X_n= represent our variables.
Which is translated into

$$Y = a + \beta_{m1} X_1 + \beta_{m2} X_2 + ...\beta_{mn} X_n$$

WhereYis the predicted or expected value of MNP, X_1 through X_p are predictor variables, a = constant; m_1- m_n are the government policiesand **β**$_1$ through **β**$_p$ are the estimated beta coefficients. Each regression coefficient represents the change in Y relative to a one unit change in the respective independent variable. In the multiple regression situations, b_1, for

example, is the change in Y relative to a one unit change in X_1, holding all other independent variables constant (i.e., when the remaining independent variables are held at the same value or are fixed).

The Inhibiting factors M1-M9 are manipulated in the model to observe changes (positive or negative) that may occur due to changes in their beta coefficients. Hence, in this research we deployed the nine (9) factors identified to be slowing down MNP growth in Nigeria are being referred to as Inhibiting factors [M1-M9]. Multiple Regression indices emanating from a generic linear function are used to manipulate/simulate the behaviour of the model. For instance, taking the first factor M1 which is lack of formal education for the subscribers, suppose there is an increase by number of literate subscribers via government policy on literacy, will this influence MNP patronage? The model shows what the growth level is now and then forecast what will happen to the MNP growth if government policy on education has increased literacy rate. The same approach is followed for M2 to M9 respectively so that government may be well advised on new policy trust if the MNP will make any future impact if it is retained.

IX. INHIBITING FACTORS IDENTIFICATION NUMBERS

For the purpose of this research, the following numbers or acronyms are used for the identification the nine Inhibiting factors for simulation, coding and manipulation.

- No formal education to the public on the benefits of MNP [M1].
- Clumsy porting administrative procedure [M2].
- Switching Costs [M3].
- Poor Quality of service even with the new network being ported to [M4].
- Loss of contacts due to migration [M5].
- Difficulty in practically switching numbers [M6].
- The 48hr duration before a complete porting is achieved [M7].
- The 90 days lock-in period before the next migration [M8].
- The need to be physically present in any of the network's outlets in order to initiate a port [M9].

ΔM1 = Increase in literacy rate due to government policy on education

▼M1 = decrease in literacy rate due to government policy trust

This will be same for M2-M9 and each equation will carry statistical values such that:

a = constant or b_0.

β = Beta coefficient which measures growth index.

X = Independent variable (years of forecast).

Y = Dependent Variable (value for the year being predicted).

Resulting to the production of the MNP predictive model (MNPPM).

$$Y = a + \beta_{m1}X_1 + \beta_{m2}X_2 + \ldots + \beta_{mn}X_n$$

This model is used to forecast the future of MNP in Nigeria under three scenarios:

I. If the inhibiting factors (prevailing conditions) that are identified during field work are left as they are.

II. If government removes the prevailing conditions that are discouraging MNP patronage in Nigeria.

III. If government further stiffens the prevailing conditions on MNP.

X. RESULTS

The first scenario tested the system with the beta coefficients of the inhibiting factors as obtained from the SPSS analysis and the results are as shown in tables and graphs below.

Scenario 1: Using prevailing indices gotten from statistical analysis.

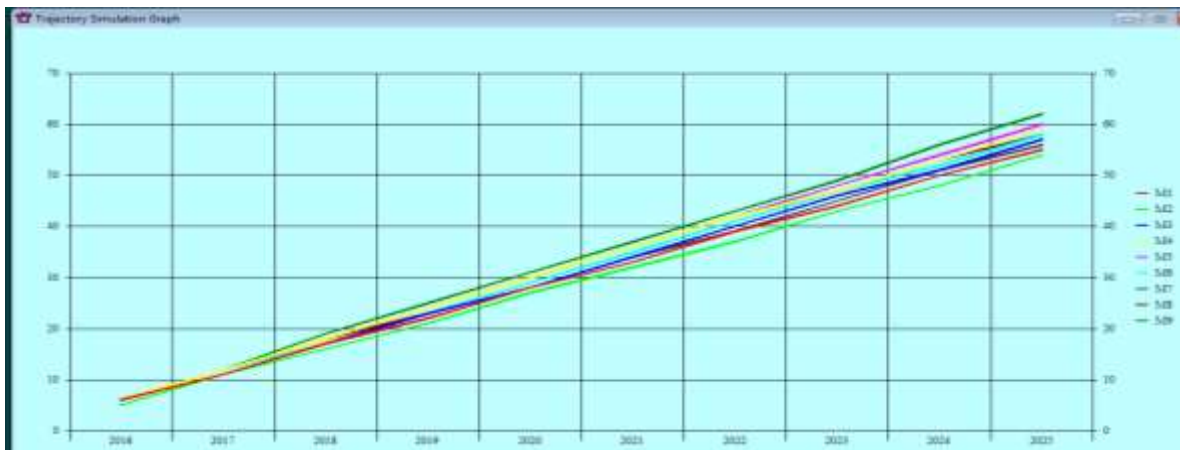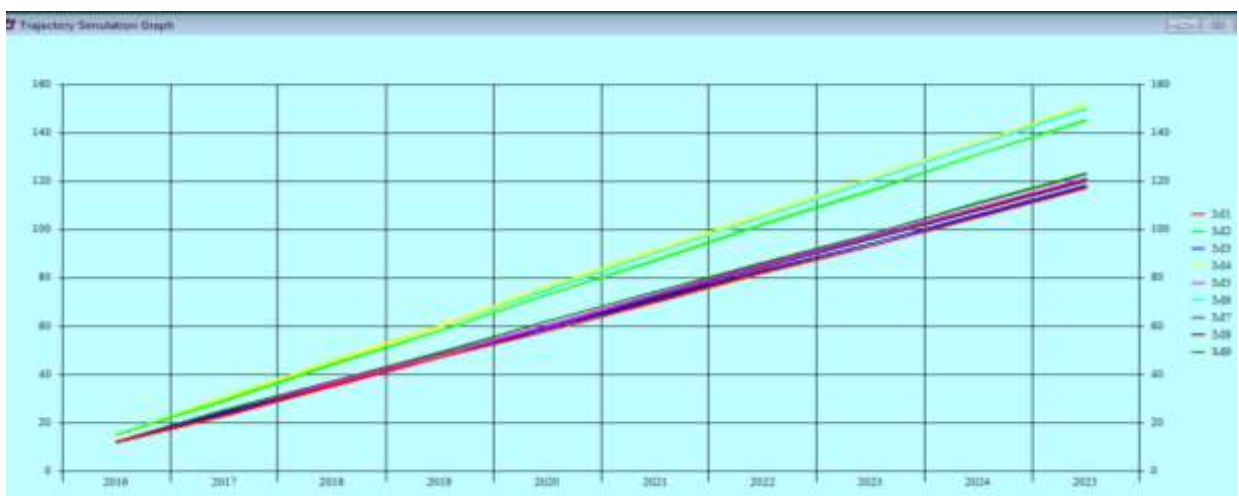National Communications Commission, Abuja
Simulation of MNP Growth Trajectory

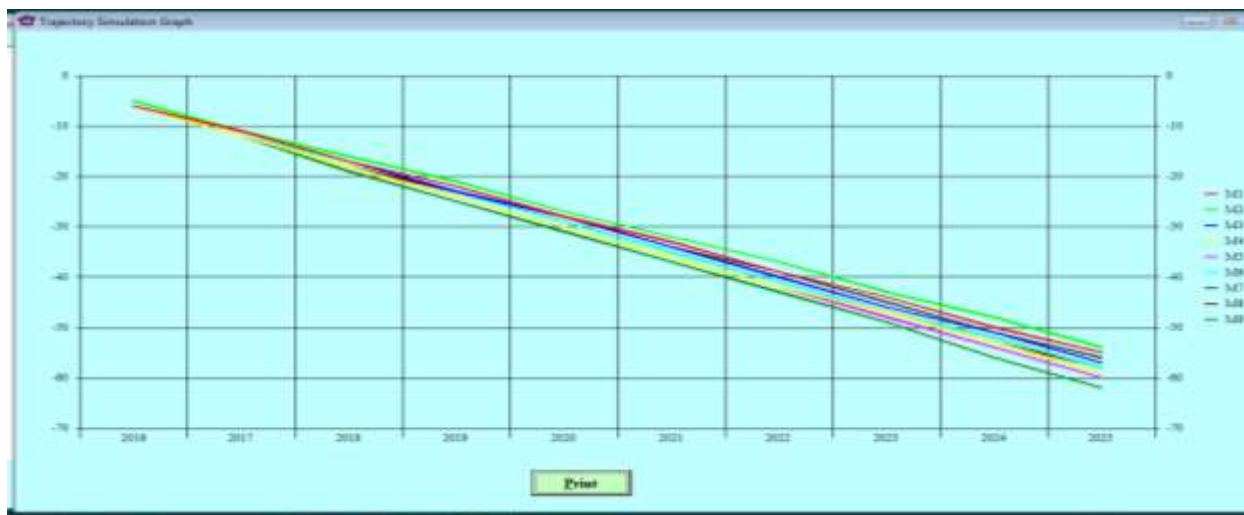Base Growth Year: 2015 To 2025 (10) Years
Simulation/Trajectory:

Scenario: Inhibiting Factors from (M1 - M9).

Year	M1	M2	M3	M4	M5	M6	M7	M8	M9
2016	6	5	6	6	6	6	6	6	6
2017	11	11	11	12	12	12	11	12	12
2018	17	16	17	18	18	17	17	18	19
2019	22	21	23	24	24	23	23	23	25
2020	28	27	28	30	30	29	28	29	31
2021	33	32	34	36	36	35	34	35	37
2022	39	37	40	42	42	41	39	41	43
2023	44	43	46	47	48	47	45	47	49
2024	50	48	51	53	54	52	51	53	56
2025	55	54	57	59	60	58	56	58	62

M1 = No formal education to the public on the benefits of MNP.
M2 = Clumsy administrative procedure.
M3 = Switching Costs.
M4 = Poor Quality of service even with the new network being ported to.
M5 = Loss of contacts due to migration.
M6 = Difficulty in practically switching Numbers.
M7 = The 48hrs duration before a complete porting is achieved.
M8 = The 90 days lock-in period before the next migration.
M9 = The need to be physically present in any of the network's Outlets in order to initiate a port.

Scenario 1: Data output/Graph

Scenario 2: Showing when inhibiting factors are improved or adjusted positively.

Scenario 2:Data output / Graph

Scenario 3 Showing when the inhibiting factors get worse or negatively adjusted.

Scenario 3: Data output / Graph

XI. DISCUSSION OF RESULTS

In scenario 1, the result shows that MNP non expansion in Nigeria has a relationship with the government policies like the 90-days lock-in period, 48hr duration before a successful port, need to be physically present in any of the network's outlet, clumsy porting administrative procedure, no formal education to the public on the benefits of MNP and other policies as identified during systems analysis, thus justifying the rejection of our first hypothesis (H_{01}) which stated that MNP has no relationship with the above factors. See the graph of scenario one above.

Secondly, adjusting the indices in scenario 1 positively (scenario 2) indicating the removal or improvement on the above policies shows that MNP improved, and this is as expected. The result is as shown in graph of scenario 2 above and shown also in the sample output. Finally, in scenario 3, when the indices were adjusted negatively to test the future of MNP if government policies worsened, the result also indicates that if government still stiffens their policies that MNP will collapse completely.

XII. CONCLUSION

Mobile Number portability is undoubtedly the concept that can bring about the desired growth in the Nigeria`s telecommunication market, not only because it can provide improvements in the quality of services but also, as uncovered in this dissertation, it will proliferate creativity among service operators to embrace value added services to remain competitive. As Nigeria is playing catch-up in the evolution of the MNP scheme already successful in many countries, the government has a strategic role to play. Government's role should focus on providing strategic directives using functional by-laws that will provide enlightenment and trust by the members of the public. The research has indicated that subscribers are more privy to embrace the MNP scheme if the government

ameliorates the bottlenecks in the mobile number portability process. There is also increasing likelihood that the subscribers will embrace the MNP scheme if members of the public understand that the mobile operators are dependent on government policies. This is where the predictive model proposed in this research highlighted and identified the significance of these impending parameters as the incumbent factors inhibiting the success of the MNP scheme in Nigeria.

But if government allows the existing restrictions on MNP adoption to remain, subscribers may not be motivated to embrace MNP. The reduction or elimination of most of the restrictions makes MNP feasible and viable. And of course, should government further stiffen the current restrictions, MNP will totally die in the not distant future.

XIII. SUGGESTION FOR FUTURE WORK

A framework for predicting the impact of MNP adoption in Nigeria was developed in this research as a guide to other type of predictions of any new technology, before, during and after adoption both in and outside Nigeria. The researchers therefore wish to make the following suggestions for future research in communication industry.

I.   A statistical framework should be developed as part of the simulator which will accept field data as input and use the result of the analysis as input to the simulator/ predictor.

II. There should be development of a framework for migrating from GSM to CDMA type of networks. This will further cut down on the tariffs since CDMA networks are known for their cheap rates.

III. Another research can delve into developing a framework that can pull NPDB for every Mobile to Mobile call and report back to NCC. This will equally ensure no gross misconduct by the mobile operators.

IV. Develop an application that should monitor quality of service and subscriber in the telecommunication industry.

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