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OPTIMIZING INTERNET SUBSCRIPTIONS FOR MTN AND GLO DATA PLANS

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ABSTRACT

Optimizing internet subscriptions for MTN and GLO data plans involves developing strategies to maximize cost-efficiency and data usage for users. This process includes analyzing various data plans offered by both MTN and GLO, comparing them based on cost per gigabyte and validity period. The data for the study were obtained from both MTN and GLO official website via www.mtn.ng and www.gloworld.com. The method of data analysis used is the Integer linear programming model. The result revealed that best subscription plan which minimizes cost for users of MTN in a month are; 1 GB data worth ₦350 valid for a day, 2 times 2.5GB data worth ₦600 valid for 2 days and 4 times 1.5GB data worth ₦1000 valid for 7 days. For the yearly subscription, the best data plan that minimized cost for users are 1 GB data worth ₦350 valid for a day, 2 times 2.5GB data worth ₦600 valid for 2 days and 51 times 1.5GB data worth ₦1000 valid for 7 days. The result revealed that the best subscription plan which minimizes cost for users of GLO in a month are; 1 GB data worth ₦300 valid for a day, 2GB data worth ₦500 valid for 2 days, 7GB data worth ₦1500 valid for 7 days and 2 times 1.8GB data worth ₦500 valid for 14 days. For the yearly subscription, the best data plan that minimized cost for users are 1 GB data worth ₦300 valid for a day, 2GB data worth ₦500 valid for 2 days, 7GB data worth ₦1500 valid for 7 days and 25 times 1.8GB data worth ₦500 valid for 14 days. The study therefore recommends that the internet providers should design special plans for specific user groups such as students, professionals and businesses.

KEYWORD: Internet, Optimization, Data Plan, Integer linear Programming**.**

INTRODUCTION

The introduction of GSM was a commendable idea in Nigeria in the year 2001 because the Nigerian Telecommunications Limited (NITEL) was unable to meet expectations in the supply of telecommunication services. Regretfully, GSM services were prohibitively expensive at first, which is why Nigeria's telecommunications sector is among the fastest-growing, with major firms including MTN, Airtel, Glo, and 9mobile, previously Etisalat. Despite the industry's acknowledged high level of competition, fierce rivalry, ambiguous regulations, and shifting trends, operators try to win over customers with a variety of marketing techniques in an effort to lower operating costs, attract new businesses, keep hold of current clientele, and boost profits (Arowolo & Folarin, 2015; Oyeniyi & Abiodun, 2010).

Over the past few decades, the telecommunications industry has witnessed a series of successive advancements in communication technologies, moving from an analogue system that was unable to meet the expanding capacity needs in an economical manner to a digital system that is dependable, quick, and affordable (Usman & Ozovehe, 2015). High spectral efficiency, standardization, new services, customer and regulatory body demand for high-quality services drove this progress. Research on the assessment of Major Network Operators' (MNO) performance became necessary due to the increasing demand for quality of service (QoS) (Budu, J. & Boateng, R., 2015).

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According to the Nigerian Communication Commission (NCC), prior to 2001, the country's telephone network capacity was expected to be restricted, with approximately 10 million individuals on waiting lists (Ifeoma, 2015). Nigerian Telecommunications Limited (NITEL) held a monopoly in the telecommunications sector until the government liberalized it in 2001. With more mobile customers, wireless communication in Nigeria has experienced exponential expansion because of the NCC's competitive market involvement (Ononiwu, et al., 2016).

Nigeria's mobile communication markets were therefore assessed as the quickest in Africa. As the number of customers in the telecommunications sector increased quickly, the NCC implemented a policy to guarantee QoS while allowing for operator choice and flexibility. Additionally, scholars have aided in this progress by suggesting appropriate benchmarks and conducting performance evaluations (Kehinde, et al., 2017). As a result, in order to stay in business, the MNOs must compete for subscribers. The MNOs implemented several tactics to hold onto their subscribers. While some operators have employed the quality services plan to continuously evaluate and optimize their communication network, others have used the cost strategy to draw in users. Research demonstrates that a growing number of GSM operators, offering cheaper call rates, have contributed to a steadily rising subscriber base (Tella, et al., 2009).

In today's fast-paced digital era, reliable and affordable internet connectivity is crucial for individuals and businesses alike. MTN and GLO, as leading telecommunication providers, offer various data plans to cater to diverse user needs. However, despite the availability of these plans, customers often face challenges in optimizing their subscriptions effectively. MTN and GLO provide a multitude of data plans with varying data limits, validity periods, and bonus offerings. Customers find it daunting to navigate through these complexities and select the plan that best fits their requirements. The existing plans might not cater to specific user needs, leading to either overpayment for unused data or additional costs due to exceeding data limits. Users lack personalized options tailored to their usage patterns. Customers often struggle to understand the terms and conditions associated with the plans, leading to unexpected charges or loss of benefits. Inconsistent internet speed and network coverage in certain areas affect the overall user experience. Understanding the relationship between subscription plans and network performance is vital for customer satisfaction; hence this research tend to optimize internet subscription for MTN and GLO data plan in Nigeria. The study is therefore aimed at optimizing internet subscription for MTN and GLO data plan in Nigeria through the following objectives

i. To develop a pricing model that balance affordability for customers while ensuring profitability for MTN and GLO in the telecommunication industry
ii. To validate the proposed pricing models.

LITERATURE REVIEW

A great deal of research has been done on MNO performance evaluation. The MNOs in Tanzania's performance review serve as one illustration (Sulaiman, et. al; 2018). The study used data envelope analysis to assess MNO performance. The optimal method for ranking the MNOs was used to ascertain the technical effectiveness of the operators. Five inputs and outputs from the 27 reports (2010-2016) published by the Tanzania Communications Regulatory Authority were taken into consideration in this study. According to their findings, three MNOs in the nation are at the top in terms of technical effectiveness. This has made a significant contribution to the nation's selection of effective MNOs. VodacomTanzania, Airtel-Tanzania, Tigo, Zantel, Smart, Halotel, and Tanzania Telecommunication Company Limited are the MNOs taken into consideration. First, second, and third place belong to Vodacom-Tanzania, Airtel-Tanzania, and Tigo, respectively.

Similar to this, (Alwadood, et. al; 2011) took into account the DEA technique in order to rank Malaysia's public universities. The study's six departments were chosen. The analysis's conclusion indicated which departments are more productive than others. It has been suggested that other unproductive departments use the efficient departments as a baseline.

A study was undertaken by Nigam et al., (2012) to determine the relative efficiency of Indian Telecommunication Service Providers. The DEA was also utilized in the study to calculate the relative efficiency of mobile telecom providers. They used the Banker, Charnes, and Cooper (BCC) model from 1984 and the Charnes, Cooper, and Rhodes (CCR) model from 1978. The Indian mobile telecommunications sector was chosen as the benchmark, and the study took into account the relative efficiency of 126 utilities. The outcome showed that strategic plans could be created to help inefficient utilities function better, and a benchmarking methodology for Indian service providers was created.

DEA was employed by Papadimitriou & Prachalias (2009) to calculate the marketing costs incurred by international telecom companies. The research investigated the potential and capabilities of international telecom providers to optimize the effectiveness of their contributing elements. The total revenues of the eighteen organizations are taken into consideration as the outputs, and the marketing costs, employee count, investments, traffic from mobile and fixed phones, and staff numbers are taken into consideration as the inputs. The study's findings showed that cutting marketing costs is necessary if high efficiency is to be attained.

Meza, et al., (2017) assessed post-graduate programmes at Brazilian universities using Network Data Envelopment Analysis (NDEA). They contended that NDEA is a suitable metric for ranking post-graduate programmes at Brazilian universities based on performance evaluation.

In their research, Paco & Perez (2015) employed DEA to assess the connection between information and communication technologies and the effectiveness of Portuguese hotels. The study's findings demonstrated the potential for employing ICT to assess hotels in Portugal and distinguish between those that are efficient and inefficient.

To analyze the trend, (Zhang, et al., 2012) used the DEA approach to assess the investment efficiency of the Chinese province panel data from 2003 to 2008. Thirty provinces and autonomous areas' trends were determined using this method. The outcome demonstrated that while regional disparities in investment efficiencies do exist, they tend to erode annually. Additionally, it has demonstrated that the percentage of a province's total investment that is invested in proportion to its investment efficiency varies significantly.

Finding the average, mode, and employing Key Performance Indicator (KPI) are examples of fundamental tools and core tendency used in Nigeria to measure performance evaluation, particularly in the telecommunications sector. Galadanci & Abdullahi (2018) assessed the effectiveness of GSM networks in Kano state, Nigeria, using KPIs established by the NCC. According to the study's findings, four of the following metrics—call blocking, handover success rate (HOSR), and call setup success rate (CSSR)—have fallen short of the NCC's minimal standards. This approach was taken in order to grade the operators' effective performance in accordance with the NCC submission.

Upadhyay, et al., (2014) conducted a performance analysis of the GSM network in Aligarh City, India, using a similar methodology. The drive test and KPIs were used in their study to examine the GSM network's efficacious performance in Aligarh City, India. Drive testing is a way to gather data for evaluating and measuring effective performance, including MNOs' capacity, coverage, and Quality of Service (QoS). On the other hand, a Key Performance Indicator is a way to gauge the value that shows how well an MNO is accomplishing important business goals. According to the analysis, these methods are limited to assessing the efficacy of mobile carriers and are not suitable for determining their relative efficiency. Put another way, they are unable to assess the TE of mobile providers. The majority of studies that are now available used KPIs and driving tests to assess how well Nigerian MNOs were performing.

In the Owerri metropolis, (Ononiwu, et al., 2016) used driving tests and KPIs to assess the performance efficacy of mobile network operators in Nigeria. MTN, Airtel, GLO, and Etisalat are the MNOs that are involved. The analysis's conclusion demonstrated that, in terms of the characteristics observed, the majority of MNOs in Nigeria have not complied with the standards established by the NCC. Comparatively speaking to other MNOs, Etisalat was reported to operate fairly effectively.

Chen, et al., (2019) uses image resources on a series of satellites to address a multi-satellite scheduling challenge with observation that results from the requirement of targets on the earth surface. A mixed integer linear programming model with constraints is used to formulate the issue. The suggested approach can be used to address various issues where observations and a time interval are interdependent. The outcomes have demonstrated the suggested model's applicability in real-world challenges requiring dependable and optimal solutions.

Air traffic control measures operating procedures to reduce delay costs and intervenes in scheduling to regulate overcapacity scheduling. By optimizing scheduling processes and ground holding operations in airports, the study suggests a paradigm for scheduling and operations in airports. To cut costs, two-stage stochastic programmes were developed. According to Wang and Jacquillat (2020), the suggested method can be utilized to improve the airport demand management model by capturing interdependencies across the network and between scheduling and operations.

In the study, (Bakar, et al., 2018) demonstrated how to use 0-1 integer programming to help students build discussion groups. This was created to guarantee that every group has more than four students, that there is a chance that the group will engage in activities, that its members are of different races and genders, and that it will take into account the standards set by the class. Using Lingo 11, the best answer was found. The paper recommends applying this strategy to more classification management issues.

An approach to multi-objective resource levelling called mixed integer programming was presented by (Altun, et al., 2020). A decision-maker levelled the project resources using a cost-effective approach since efficiency planning is crucial to creating a cost-efficient solution. The choice is made to distribute resources evenly across the project in order to cut costs. First, each project was given individual attention in order to optimize the resources in accordance with the goal function of the resource problem level. To get an ideal solution, the project's pooled resources were levelled together. In this study, a mixed integer programming technique was employed to reduce the necessary variation in resource kinds across several projects. The proposed method outperforms the traditional method in terms of performance, as demonstrated by the comparison of the obtained results with the results of classic levelling optimization.

Maijama, B. et al. (2023) optimized internet subscription for MTN data plan in a specified period. To determine the optimal MTN monthly and yearly data plan to subscribe, linear programming was proposed and implemented to determine the optimal MTN data plan with minimum cost and maximum validity 30 days for the monthly plan and 360 days for the yearly plan. The result obtained revealed that it is better to subscribe for daily 1gb data plan, two days plan for 2gb, one week plan for 6gb and three times one week plan of 1000 for 2gb for the monthly subscription and also 1gb data plan, two days plan for 2gb, one week plan for 6gb and fifty times one week plan of 1000 for 2gb for the yearly subscription.

RESEARCH METHODOLOGY

The data for the study were obtained from both MTN and GLO official website via www.mtn.ng and www.gloworld.com and documentary method of data collection was used. The population of the study will be the options of data subscription available on MTN and GLO data subscriptions platform. The method of data analysis used is the Integer linear programming model.

The integer linear programming model is given as:

$$Minimize\ Z = \sum C_i P_j \qquad i, j = 1, 2, \dots, n$$

$$subject\ to:$$

$$\begin{aligned}
&p_1 + && \leq b_1 \\
&+ p_2 + && 0 \leq b_2 \\
&+ p_3 + && 0 \leq b_3 \\
&+ p_4 + && 0 \leq b_4 \\
&+ p_5 + && 0 \leq b_5 \\
&+ p_6 + && 0 \leq b_6 \\
&+ p_7 + && 0 \leq b_7 \\
&+ p_8 + && 0 \leq b_8 \\
&+ p_9 + && 0 \leq b_9 \\
&\vdots && \vdots \\
&+ p_n + && 0 \leq b_n
\end{aligned}$$

$$p_1 + p_2 + p_3 + p_4 + p_5 + p_6 + p_7 + p_8 + \cdots + p_n \geq \bar{b}$$

$$p_i \geq 0, i = 1, 2, 3, 4, \dots, n$$

The suggested methodology will be validated through the implementation of actual data plans on the MTN and GLO networks.

Table 3.1: Cost of Data Plans, Gigabytes and Validity period of each MTN Plan

Variables	Cost (₦)	Bytes (GB)	Validity (Days)
1	350	1	1
2	600	2.5	2
3	1000	1.5	7
4	1000	1.2	30
5	1200	1.5	30
6	1500	5	30
7	1600	3	30
8	2000	4	30
9	3000	8	30
10	3500	15	30
11	4000	12	30
12	5500	20	30
13	6500	25	30
14	11000	40	30
15	16000	75	30
16	22000	120	30
17	30000	200	30

Table 3.2: Cost of Data Plans, Gigabytes and Validity period of each GLO Plan

Variables	Cost (₦)	Bytes (GB)	Validity (Days)
1	300	1	1
2	500	2	2
3	1500	7	7
4	500	1.8	14
5	1000	3.9	30
6	1500	7.5	30
7	2000	9.2	30
8	2500	10.8	30
9	3000	14	30
10	4000	18	30
11	5000	24	30
12	8000	29.5	30
13	10000	50	30
14	15000	93	30
15	18000	119	30
16	20000	138	30
17	30000	225	30
18	36000	300	30
19	50000	425	30
20	60000	525	30
21	75000	675	30

PROPOSED MODEL FOR ONE MONTH (MTN)

min = $350*P_1 + 600*P_2 + 1000*P_3 + 1000*P_4 + 1200*P_5 + 1500*P_6 + 1600*P_7 + 2000*P_8 + 3000*P_9 + 3500*P_{10} + 4000*P_{11} + 5500*P_{12} + 6500*P_{13} + 11000*P_{14} + 16000*P_{15} + 22000*P_{16} + 30000*P_{17}$;

$01*P_1 >= 001$;
$02*P_2 >= 002.5$;
$07*P_3 >= 001.5$;
$30*P_4 <= 001.2$;
$30*P_5 <= 001.5$;
$30*P_6 <= 005$;
$30*P_7 <= 003$;
$30*P_8 <= 004$;
$30*P_9 <= 008$;
$30*P_{10} <= 015$;
$30*P_{11} <= 012$;
$30*P_{12} <= 020$;
$30*P_{13} <= 025$;
$30*P_{14} <= 040$;
$30*P_{15} <= 075$;
$30*P_{16} <= 120$;
$30*P_{17} <= 200$;

$01*P_1 + 02*P_2 + 07*P_3 + 30*P_4 + 30*P_5 + 30*P_6 + 30*P_7 + 30*P_8 + 30*P_9 + 30*P_{10} + 30*P_{11} + 30*P_{12} + 30*P_{13} + 30*P_{14} + 30*P_{15} + 30*P_{16} + 30*P_{17} >= 30$;

$01*P_1 + 02*P_2 + 07*P_3 + 30*P_4 + 30*P_5 + 30*P_6 + 30*P_7 + 30*P_8 + 30*P_9 + 30*P_{10} + 30*P_{11} + 30*P_{12} + 30*P_{13} + 30*P_{14} + 30*P_{15} + 30*P_{16} + 30*P_{17} <= 38$;

PROPOSED MODEL FOR ONE YEAR (MTN)

min = 350*P_1 + 600*P_2 + 1000*P_3 + 1000*P_4 + 1200*P_5 + 1500*P_6 + 1600*P_7 + 2000*P_8 + 3000*P_9 + 3500*P_{10} + 4000*P_{11} + 5500*P_{12} + 6500*P_{13} + 11000*P_{14} + 16000*P_{15} + 22000*P_{16} + 30000*P_{17};

01*P_1 >= 001;
02*P_2 >= 002.5;
07*P_3 >= 001.5;
30*P_4 <= 001.2;
30*P_5 <= 001.5;
30*P_6 <= 005;
30*P_7 <= 003;
30*P_8 <= 004;
30*P_9 <= 008;
30*P_{10} <= 015;
30*P_{11} <= 012;
30*P_{12} <= 020;
30*P_{13} <= 025;
30*P_{14} <= 040;
30*P_{15} <= 075;
30*P_{16} <= 120;
30*P_{17} <= 200;

01*P_1 + 02*P_2 + 07*P_3 + 30*P_4 + 30*P_5 + 30*P_6 + 30*P_7 + 30*P_8 + 30*P_9 + 30*P_{10} + 30*P_{11} + 30*P_{12} + 30*P_{13} + 30*P_{14} + 30*P_{15} + 30*P_{16} + 30*P_{17} >= 360;

01*P_1 + 02*P_2 + 07*P_3 + 30*P_4 + 30*P_5 + 30*P_6 + 30*P_7 + 30*P_8 + 30*P_9 + 30*P_{10} + 30*P_{11} + 30*P_{12} + 30*P_{13} + 30*P_{14} + 30*P_{15} + 30*P_{16} + 30*P_{17} <= 456;

Where

$$\mathrm{p}_1 = \text{1GB Data plan costing ₦350 } and\ valid\ for\ 1\ day$$
$$\mathrm{p}_2 = \text{2.5GB Data plan costing ₦600 } and\ valid\ for\ 2\ days$$
$$\mathrm{p}_3 = \text{1.5GB Data plan costing ₦1000 } and\ valid\ for\ 7\ days$$
$$\mathrm{p}_4 = \text{1.2GB Data plan costing ₦1000 } and\ valid\ for\ 30\ days$$
$$\mathrm{p}_5 = \text{1.5GB Data plan costing ₦1200 } and\ valid\ for\ 30\ days$$
$$\mathrm{p}_6 = \text{5GB Data plan costing ₦1500 } and\ valid\ for\ 30\ days$$
$$\mathrm{p}_7 = \text{3GB Data plan costing ₦1600 } and\ valid\ for\ 30\ days$$
$$\mathrm{p}_8 = \text{4GB Data plan costing ₦2000 } and\ valid\ for\ 30\ days$$
$$\mathrm{p}_9 = \text{8GB Data plan costing ₦3000 } and\ valid\ for\ 30\ days$$
$$\mathrm{p}_{10} = \text{15GB Data plan costing ₦3500 } and\ valid\ for\ 30\ days$$
$$\mathrm{p}_{11} = \text{12GB Data plan costing ₦4000 } and\ valid\ for\ 30\ days$$
$$\mathrm{p}_{12} = \text{20GB Data plan costing ₦5500 } and\ valid\ for\ 30\ days$$
$$\mathrm{p}_{13} = \text{25GB Data plan costing ₦6500 } and\ valid\ for\ 30\ days$$
$$\mathrm{p}_{14} = \text{40GB Data plan costing ₦11000 } and\ valid\ for\ 30\ days$$
$$\mathrm{p}_{15} = \text{75GB Data plan costing ₦16000 } and\ valid\ for\ 30\ days$$
$$\mathrm{p}_{16} = \text{120GB Data plan costing ₦22000 } and\ valid\ for\ 30\ days$$
$$\mathrm{p}_{17} = \text{200GB Data plan costing ₦30000 } and\ valid\ for\ 30\ days$$

PROPOSED MODEL FOR ONE MONTH (GLO)

min = $300*P_1 + 500*P_2 + 1500*P_3 + 500*P_4 +1000*P_5 + 1500*P_6 + 2000*P_7 + 2500*P_8 + 3000*P_9 + 4000*P_{10} + 5000*P_{11} + 8000*P_{12} + 10000*P_{13} + 15000*P_{14} + 18000*P_{15} + 20000*P_{16} + 30000*P_{17} + 36000*P_{18} + 50000*P_{19} + 60000*P_{20} + 75000*P_{21}$;

$01*P_1 >= 001$;
$02*P_2 >= 002$;
$07*P_3 >= 007$;
$14*P_4 >= 001.8$;
$30*P_5 <= 003.9$;
$30*P_6 <= 007.5$;
$30*P_7 <= 009.2$;
$30*P_8 <= 010.8$;
$30*P_9 <= 014$;
$30*P_{10} <= 018$;
$30*P_{11} <= 024$;
$30*P_{12} <= 029.5$;
$30*P_{13} <= 050$;
$30*P_{14} <= 093$;
$30*P_{15} <= 119$;
$30*P_{16} <= 138$;
$30*P_{17} <= 225$;
$30*P_{18} <= 300$;
$30*P_{19} <= 425$;
$30*P_{20} <= 525$;
$30*P_{21} <= 675$;

$01*P_1 + 02*P_2 + 07*P_3 + 14*P_4 + 30*P_5 + 30*P_6 + 30*P_7 + 30*P_8 + 30*P_9 + 30*P_{10} + 30*P_{11} + 30*P_{12} + 30*P_{13} + 30*P_{14} + 30*P_{15} + 30*P_{16} + 30*P_{17} + 30*P_{18} + 30*P_{19} + 30*P_{20} + 30*P_{21} >= 30$;

$01*P_1 + 02*P_2 + 07*P_3 + 14*P_4 + 30*P_5 + 30*P_6 + 30*P_7 + 30*P_8 + 30*P_9 + 30*P_{10} + 30*P_{11} + 30*P_{12} + 30*P_{13} + 30*P_{14} + 30*P_{15} + 30*P_{16} + 30*P_{17} + 30*P_{18} + 30*P_{19} + 30*P_{20} + 30*P_{21} <= 157$;

PROPOSED MODEL FOR ONE YEAR (GLO)

min = $300*P_1 + 500*P_2 + 1500*P_3 + 500*P_4 +1000*P_5 + 1500*P_6 + 2000*P_7 + 2500*P_8 + 3000*P_9 + 4000*P_{10} + 5000*P_{11} + 8000*P_{12} + 10000*P_{13} + 15000*P_{14} + 18000*P_{15} + 20000*P_{16} + 30000*P_{17} + 36000*P_{18} + 50000*P_{19} + 60000*P_{20} + 75000*P_{21}$;

$01*P_1 >= 001$;
$02*P_2 >= 002$;
$07*P_3 >= 007$;
$14*P_4 >= 001.8$;
$30*P_5 <= 003.9$;
$30*P_6 <= 007.5$;
$30*P_7 <= 009.2$;
$30*P_8 <= 010.8$;
$30*P_9 <= 014$;
$30*P_{10} <= 018$;
$30*P_{11} <= 024$;
$30*P_{12} <= 029.5$;
$30*P_{13} <= 050$;
$30*P_{14} <= 093$;
$30*P_{15} <= 119$;
$30*P_{16} <= 138$;
$30*P_{17} <= 225$;
$30*P_{18} <= 300$;
$30*P_{19} <= 425$;
$30*P_{20} <= 525$;
$30*P_{21} <= 675$;

$01*P_1 + 02*P_2 + 07*P_3 + 14*P_4 + 30*P_5 + 30*P_6 + 30*P_7 + 30*P_8 + 30*P_9 + 30*P_{10} + 30*P_{11} + 30*P_{12} + 30*P_{13} + 30*P_{14} + 30*P_{15} + 30*P_{16} + 30*P_{17} + 30*P_{18} + 30*P_{19} + 30*P_{20} + 30*P_{21} >= 360;$

$01*P_1 + 02*P_2 + 07*P_3 + 14*P_4 + 30*P_5 + 30*P_6 + 30*P_7 + 30*P_8 + 30*P_9 + 30*P_{10} + 30*P_{11} + 30*P_{12} + 30*P_{13} + 30*P_{14} + 30*P_{15} + 30*P_{16} + 30*P_{17} + 30*P_{18} + 30*P_{19} + 30*P_{20} + 30*P_{21} <= 1884;$

Where

$$\mathrm{p}_1 = \text{1GB Data plan costing ₦300 } and\ valid\ for\ 1\ day$$
$$\mathrm{p}_2 = \text{2GB Data plan costing ₦500 } and\ valid\ for\ 2\ days$$
$$\mathrm{p}_3 = \text{7GB Data plan costing ₦1500 } and\ valid\ for\ 7\ days$$
$$\mathrm{p}_4 = \text{1.8GB Data plan costing ₦500 } and\ valid\ for\ 14\ days$$
$$\mathrm{p}_5 = \text{3.9GB Data plan costing ₦1000 } and\ valid\ for\ 30\ days$$
$$\mathrm{p}_6 = \text{7.5GB Data plan costing ₦1500 } and\ valid\ for\ 30\ days$$
$$\mathrm{p}_7 = \text{9.2GB Data plan costing ₦2000 } and\ valid\ for\ 30\ days$$
$$\mathrm{p}_8 = \text{10.8GB Data plan costing ₦2500 } and\ valid\ for\ 30\ days$$
$$\mathrm{p}_9 = \text{14GB Data plan costing ₦3000 } and\ valid\ for\ 30\ days$$
$$\mathrm{p}_{10} = \text{18GB Data plan costing ₦4000 } and\ valid\ for\ 30\ days$$
$$\mathrm{p}_{11} = \text{24GB Data plan costing ₦5000 } and\ valid\ for\ 30\ days$$
$$\mathrm{p}_{12} = \text{29.5GB Data plan costing ₦8000 } and\ valid\ for\ 30\ days$$
$$\mathrm{p}_{13} = \text{50GB Data plan costing ₦10000 } and\ valid\ for\ 30\ days$$
$$\mathrm{p}_{14} = \text{93GB Data plan costing ₦15000 } and\ valid\ for\ 30\ days$$
$$\mathrm{p}_{15} = \text{119GB Data plan costing ₦18000 } and\ valid\ for\ 30\ days$$
$$\mathrm{p}_{16} = \text{138GB Data plan costing ₦20000 } and\ valid\ for\ 30\ days$$
$$\mathrm{p}_{17} = \text{225GB Data plan costing ₦30000 } and\ valid\ for\ 30\ days$$
$$\mathrm{p}_{18} = \text{300GB Data plan costing ₦36000 } and\ valid\ for\ 30\ days$$
$$\mathrm{p}_{19} = \text{425GB Data plan costing ₦50000 } and\ valid\ for\ 30\ days$$
$$\mathrm{p}_{20} = \text{525GB Data plan costing ₦60000 } and\ valid\ for\ 30\ days$$
$$\mathrm{P}_{21} = \text{675GB Data plan costing ₦75000 } and\ valid\ for\ 30\ days$$

RESULTS AND DISCUSSION

Results for 30 and 360 days with 38gb and 456gb MTN Data plan respectively

Global optimal solution found (1 Month).

Objective value:	5550.000
Objective bound:	5550.000
Infeasibilities:	0.000000
Total solver iterations:	2
Model Class:	PILP

After two (2) iterations, 5,550 is the global optimal solution discovered using the pure integer linear programming model. This suggests that the total money required will only be ₦5550 when signing up for a 30-day plan with a maximum data of ≥ 38 GB.

Global optimal solution found (1 Year).

Objective value:	52550.00
Objective bound:	52550.00
Infeasibilities:	0.000000
Total solver iterations:	3
Model Class:	PILP

After three (3) iterations, the global optimal solution obtained with the pure integer linear programming model is 52,550. This suggests that the cost required will only be ₦52,550 when subscribing to a 360-day plan with a maximum data of ≥ 456 GB.

Table 4.1: Results for 30 and 360 days with 38gb and 456gb plan respectively

Days	GB	P_1	P_2	P_3	P_4	P_5	P_6	P_7	P_8	P_9
30	38	1	2	4	0	0	0	0	0	0
360	456	1	2	51	0	0	0	0	0	0

Days	GB	P_{10}	P_{11}	P_{12}	P_{13}	P_{14}	P_{15}	P_{16}	P_{17}
30	38	0	0	0	0	0	0	0	0
360	456	0	0	0	0	0	0	0	0

The subscription plan for the least expensive option is shown in Table 4.1. The optimal subscription plan, as determined by the results, is 1 GB of data worth ₦350 valid for one day, 2 times 2.5GB of data worth ₦600 valid for two days, and 4 times 1.5GB of data worth ₦1000 valid for seven days. This plan minimizes costs and maximizes profit for customers in a month. The ideal data plan for the annual subscription is 1 GB of data for ₦350 valid for a day, 2 times 2.5GB of data worth ₦600 valid for 2 days, and 51 times 1.5GB of data worth ₦1000 valid for 7 days. This plan minimizes costs and maximizes profit for customers

RESULTS FOR 30 AND 360 DAYS WITH 157GB AND 1884GB GLO DATA PLAN RESPECTIVELY

Global optimal solution found (1 month).

Objective value:	3300.000
Objective bound:	3300.000
Infeasibilities:	0.000000
Total solver iterations:	2
Model Class:	PILP

After two (2) iterations, the global optimal solution obtained with the pure integer linear programming model is 3300. This suggests that the total cost required will only be ₦3300 when signing up for a 30-day plan with a maximum data of ≥ 157 GB.

Global optimal solution found (1 year).

Objective value:	14800.00
Objective bound:	14800.00
Infeasibilities:	0.000000
Total solver iterations:	0
Model Class:	PILP

After a zero (0) iteration, the global optimal solution obtained with the pure integer linear programming model is 14800. This suggests that the total cost required will only be ₦14,800 when signing up for a 360-day plan with a maximum data of ≥ 1884 GB.

Table 4.2: Results for 30 and 360 days with 157gb and 1884gb plan respectively

Days	GB	P_1	P_2	P_3	P_4	P_5	P_6	P_7	P_8	P_9
30	157	1	1	1	2	0	0	0	0	0
360	1884	1	1	1	25	0	0	0	0	0
Days	GB	P_{10}	P_{11}	P_{12}	P_{13}	P_{14}	P_{15}	P_{16}	P_{17}	P_{18}
30	157	0	0	0	0	0	0	0	0	0
360	1884	0	0	0	0	0	0	0	0	0

Days	GB	P_{19}	P_{20}	P_{21}
30	157	0	0	0
360	1884	0	0	0

The subscription plan for the lowest price is shown in Table 4.2. The findings indicate that the most cost-effective and profit-maximizing subscription plans for customers in a month are as follows: 1 GB of data valued at ₦300 is good for one day, 2GB is good for two days, 7GB is good for seven days, and two times 1.8GB is good for fourteen days. The 1 GB data at ₦300 valid for a day, the 2GB data worth ₦500 valid for two days, the 7GB data worth ₦1500 valid for seven days, and the 25 times 1.8GB data worth ₦500 valid for fourteen days are the best data plans for the annual membership that minimized expense and maximized profit for customers.

CONCLUSION

The analysis comes to the conclusion that the most cost-effective data plan for MTN consumers is the 1.5GB plan, which costs ₦1000 and has a validity term of seven days. According to the research, there are effectively four monthly subscriptions and fifty-one annual subscriptions for this plan. The study also finds that the most cost-effective data plan for GLO subscribers is the 1.8GB plan, which costs ₦500 and has a 14-day validity period. This is because subscribers can subscribe to the plan twice a week and 25 times annually. As a result, the study suggests the following:

a. To accommodate different user needs, ranging from light to heavy internet users, the network providers (MTN & GLO) ought to implement tiered data plans.
b. They must put in place efficient data rollover procedures that allows unused data to be transferred over to the following billing period.
c. To encourage enduring subscription and client retention, they ought to create loyalty and reward schemes.
d. They ought to create unique programmes for particular user groups, like companies, professionals, and students.
e. The study suggests more research on how various variables, including device kinds and demographics, affect the patterns of data use among MTN and GLO users.

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