Optimizing Internet Subscription for MTN Data Plan in a Specified Period

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Abstract

Optimizing internet subscription is the ability of an individual to be able to make decision of subscribing to a data plan with maximum benefit and minimum cost. 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. This study has shown it is better to subscribe for one daily of 1gb data plan, two days plan for 2gb, one week plan for 6gb and three times one week plan of 1000 naira for 2gb for the monthly subscription and also one daily of 1gb data plan, two days plan for 2gb, one week plan for 6gb and fifty times one week plan of 1000 naira for 2gb for the monthly subscription. This study will assist individuals as well as organizations is making decision of the data plan to subscribe to at a minimized rate. Individuals or organizations can gain insights on how to improve subscription of data plan for a specified period of time and also keeping track of the maximum gigabyte that can be affordable.

Keywords: *Data Plan, Subscription, Optimization, Gigabyte.*

1. Introduction

MTN Nigeria was lunched in Nigeria around august 2001. It was part of MTN group, South Africa. MTN group is a multinational telecommunication company offering mobile communication and related product and services to individuals, businesses and companies. The MTN group operates in three continents, Africa, Europe and Middle East. With a subscription of over 164.5 million. Its market are found in countries like Nigeria, Iran, Ghana and Syria. Nigeria alone has over 41641 million subscribers hence controlling 50% of the market shares. Its major competitors in Nigeria are Airtel, Globalcom, Etislate and Mtel (mtn 2011). International research on optimization such as, Chen, et.al (2021), Edge intelligent networking optimization for internet of things in smart city, Tang, X., Bi, S., & Zhang, Y. J. A. (2018) on Distributed routing and charging scheduling optimization for internet of electric vehicles, Nuara, A. et. al, (2022) a study on Online joint bid/daily budget optimization of internet advertising campaigns. Haibeh, L. A., et. al, (2022) study on survey on mobile edge computing infrastructure: Design, resource management, and optimization approaches. To mention a few studies on the application optimization processes. Although this study slims down its study to optimization of airtime subscription, MTN network to be precise.

MTN was established in South Africa, dawn of democracy as a leader in transformation. It has rapidly grown to offer voice, data and digital services to retail customers in 21 countries, where the operations have telecoms licenses. MTN brands is among the most widely spread brand in Africa among most valuable brands in Africa. Connecting communities and people across the Middle East and Africa with voice, data services as well as changing lives for the digital world.

There is hardly any successful individual or business in Nigeria that can function well without the use of internet services. Internet access for individuals and organizations to connect to the world, browsing, sending email, trading online and many more using gadgets such as mobile phones, computer, laptops, game consoles and mobile devices in accessing services worldwide and so on. Hence internet services is highly in demand, not only providing a good internet service but a plan that is optimal with regards to cost and also validity of the data plan.

MTN data plans provides internet access and related services to individuals and organizations. It provides more internet services, it provides services such as broadband, Wi-Fi and also data services. It cannot be said to be the best internet service provider In Nigeria, or the internet provider with the cheapest charge.

1.1 Problem Statement

With advert exposure and large patronage by customers for MTN services, customer awareness of MTN product and services among its competing internet service providers More so, the challenges of cost, modern technology and signal coverage pose to be the greatest areas that should be addressed in the drive for an internet enabled society in Nigeria.

Over the years there is high demand of mobile internet and has increased substantially. Due to the demand of mobile internet. The data size and validity has become a great concern to individuals as well as businesses using internet connectivity. This research focuses on MTN because it has the largest accessibility in Nigeria in both rural and urban Nigeria. It will be slimed down to only MTN as it is the most effective and accessible in Abuja. The data goes for variety of prices with rage of variability. A major problem is which of the data is most cost effect within the rage of the data. This research applies optimization model to determine which of the data plan is has a minimized cost with maximum benefit.The optimization model will be for a month and also annually.

This research will not say that MTN provides the best data plans but it can be classified as being ok. To enjoy internet facilities in Nigeria it comes with a price in order to get a clearer view of the data plans and deciding on which to go for. MTN has different data plans with its validity and also gigabits, deciding on which of the plans should be done using a procedure that will help in getting a maximized benefit with a minimized price.

2. Literature Review

Chen, X., Reinelt, G., Dai, G., & Spitz, A. (2019). Addresses a multi-satellite scheduling problem with observation which arises from the necessity of targets on the earth surface using image resources on set of satellites. The problem is formulated using a mixed integer

linear programming model with constrains. The proposed model can be applied to different problems with interdependency betweena time interval and observations. The results obtained has shown the applicability of the proposed model in real life problems seeking optimal solution with reliability.

With limitation on hospital facilities and infrastructure, lack of qualified medical personnel and shortage of resources. Capacity planning is done I the hospital to enable a balance between the quality of healthcare provided and the cost for providing it. The instrument used for calculations of availability of resources, aimed at calculating the amount of resources needed by a patient to recovery. The concept of the smart health is how to provide quick services to patient within limited available resources, the model proposed by this study is expected to minimize travel cost, service cost and also other cost incurred by the patient while minimizing the time spent (Pardede, A. M. H. et.al, 2019).

Air traffic management measuring the operating procedure to minimize delay cost and scheduling intervention for the control of overcapacity scheduling. The study proposes a model scheduling and operations in airports through optimizing scheduling procedure and ground holding operations in airports. Two-stage stochastic programs was formulated to reduce cost. The proposed approach can be used to enhance airport demand management model for capturing network-wide interdependencies and capturing interdependencies between scheduling and operations (Wang, K., &Jacquillat, A. 2020).

Bakar, E. M. N. E. A., Hashim, Z., &Bidin, S. J. 2018, the study illustrated an application of 0-1 integer programming in forming a discussion group among students. The was developed to ensure that each group has more than four students, with the probability of group having activities and consisting of mixed gender and race as well as putting into consideration set by the class. An optimal solution was obtained using lingo 11. The study suggest the extension of this approach in other classification management problems.

Altun, M., Sonmez, R., &Akcamete, A. (2020). Proposed a mixed integer programming for a multi-objective resource leveling. Efficiency planning is very important in developing a cost-efficient solution; hence a decision maker leveled the project resources with a cost-

effective procedure. The decision is to level the resources with respect to the planned project aimed at reducing the cost. Firstly, the focus was on each project separately for optimization of the resources according to the objective function of the resources problem level. The project using shared resources were leveled together to achieve an optimal solution. A mixed integer programming was used in this research to minimize the required difference in resource types of multiple projects. The results were achieved and compared to the traditional leveling optimization results and the result shows that the proposed method is the best by improving the performances compared to the traditional method.

With limited available resources, (Maijama, B., &Nazri, E. M. 2019) proposed an approach to moderate finances with transparency and quality. The budget was allocated for a better decision making using the preemptive integer programming model. Form the programming model proposed, the marginal analysis was estimated in form of rating each strategy with regards to the amount of money needed on the strategy in the previous year, used as the base year. Optimal result was obtained and compared with previous year budget which makes the proposed model a suitable model for priotizing decision making. This result shows the importance of this method in organizations that are strategically oriented for improved output within limited available resources.

The major objective of optimization is to find a solution for which an objective function is obtained with minimal cost and maximum benefit. Within limited availability of resources, mostly most individuals resort to using trial and error in managing their finances, especially when it comes to purchasing product and services. This study provides LP model using lingo software to determine the most economical data plan mix to be purchased by MTN services providers' hence providing and optimal solution of purchase of data plans

Used optimization procedure on energy storage system integrating in residential buildings using solar power generators in compares to the electrical power grid. Using linear programming as the optimization method, the result obtained shows and improvement on individual household self-consumption through the use of the optimal configurational strategies. It shows that storage system configuration should be increased for independence of independent households.

3. Research Methodology

The material needed for this study of optimizing data subscription at a minimized rate will be proposing a linear programming model. The research design is application of linear programming on optimization of MTN internet data subscription. The population of the study will be the options of data subscription available on MTN data subscriptions platform. Sample and sampling technique used will be all data plans available on MTN data plan with the validity of each subscribed data plan. The data analysis will be done using the proposed linear programming model.

The general IP model for planning and resource allocation may appear as follows:

Decision Variables:

$$X_i = \ the\ number\ of\ times\ strategy\ i\ to\ be\ implemented$$

Where $i = 1 \ldots i_1, i_{1+1} \ldots i_2 \ldots I,$

With $1 \ldots i_1$ = strategies to achieve KPI 1, $i_{1+1} \ldots i_2$ = strategies to achieve KPI 2, and so on.

Objective function:

$$Min\ f(x) = \sum_{i=1}^{I} \beta_i x_i \quad \text{Equation 3.1}$$

Where f(x) = total budget needed

βi = total budget needed to implement each strategy i.

Constraints:

Constraint 1: Total points to be accumulated for each KPI

$$\sum_{i=1}^{i_1} p_1 x_i \ \geq Point_1 \quad \text{Equation 3.2}$$

Where,

p_1 = expected points that can be accumulated by each strategy 1 to achieve KPI 1.

$Point_1$ = total points needed for KPI 1

$$\sum_{i=1+1}^{i_2} p_i x_i \geq Point_2$$

Equation 3.3

And so on.

$x_i \geq 0$ and integer

Validating of the proposed model will be validated by applying the real life data plans on MTN network and the results from the analysis is presented in the results section.

Table 3.1 Data Plans Cost, Gigabits And Validity For Each Plan

variables	Cost (naira)	Bites (gigabits)	Validity (days)
1	300	1	1
2	500	2	2
3	1500	6	7
4	1000	2	7
5	1200	2	30
6	1500	3	30
7	2000	4.5	30
8	2500	6	30
9	3500	10	30
10	5000	15	30
11	10000	40	30
12	15000	75	30

3.1 Proposed Model for One month

Min = 300*x1 + 500*x2 + 1500*x3 + 1000*x4 +1200*x5 + 1500*x6 + 2000*x7 + 2500*x8 + 3500*x9 + 5000*x10 + 10000*x11 + 15000*x12;

01*x1 >= 01;

02*x2 >= 02;

07*x3 >= 06;

07*x4 >= 02;

30*x5 <= 02;

30*x6 <= 03;

30*x7 <= 04.5;

30*x8 <= 06;

30*x9 <= 10;

30*x10 <= 15;

30*x11 <= 40;

30*x12 <= 70;

01*x1 + 02*x2 + 07*x3 + 07*x4 + 30*x5 + 30*x6 + 30*x7 + 30*x8 + 30*x9 + 30*x10 + 30*x11 + 30*x12

>= 30;

01*x1 + 02*x2 + 06*x3 + 02*x4 + 02*x5 + 03*x6 + 0.45*x7 + 06*x8 + 10*x9 + 15*x10 + 40*x11 + 70*x12

<= 20;

3.2 Proposed Model for One Year

Min = 300*x1 + 500*x2 + 1500*x3 + 1000*x4 +1200*x5 + 1500*x6 + 2000*x7 + 2500*x8 + 3500*x9 + 5000*x10 + 10000*x11 + 15000*x12;

01*x1 >= 01;

02*x2 >= 02;

07*x3 >= 06;

07*x4 >= 02;

30*x5 <= 02;

30*x6 <= 03;

30*x7 <= 04.5;

30*x8 <= 06;

30*x9 <= 10;

30*x10 <= 15;

30*x11 <= 40;

30*x12 <= 70;

01*x1 + 02*x2 + 07*x3 + 07*x4 + 30*x5 + 30*x6 + 30*x7 + 30*x8 + 30*x9 + 30*x10 + 30*x11 + 30*x12

>= 360;

01*x1 + 02*x2 + 06*x3 + 02*x4 + 02*x5 + 03*x6 + 0.45*x7 + 06*x8 + 10*x9 + 15*x10 + 40*x11 + 70*x12

<= 240;

4. Results and Findings of the Study

Table 4.1 result for 30 and 360 days with 20gb and 240gb data plan respectively.

Days	Gig	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9	x_{10}	x_{11}	x_{12}
30	20	1	1	1	3	0	0	0	0	0	0	0	0
360	240	1	1	1	50	0	0	0	0	0	0	1	2

Interpretation of result as summarized on table 4.1

X_1 is a subscription plan that cost 300 naira with 1gigabyte and validity of one day.

X_2 is a subscription plan that cost 500 naira with 2gigabyte and validity of two days.

X_3 is a subscription plan that cost 1500 naira with 6 gigabyte and validity of seven days.

X_4 is a subscription plan that cost 1000 naira with 2 gigabyte and validity of seven days.

X_5 is a subscription plan that cost 1200 naira with 2 gigabyte and validity of thirty days.

X_6 is a subscription plan that cost 1500 naira with 3 gigabyte and validity of thirty days.

X_7 is a subscription plan that cost 2000 naira with 4.5 gigabyte and validity of thirty days.

X_8 is a subscription plan that cost 2500 naira with 6 gigabyte and validity of thirty days.

X_9 is a subscription plan that cost 3500 naira with 10 gigabyte and validity of thirty days.

X_{10} is a subscription plan that cost 5000 naira with 15 gigabyte and validity of thirty days.

X_{11} is a subscription plan that cost 10,000 naira with 40 gigabyte and validity of thirty days.

X_{12} is a subscription plan that cost 15,000 naira with 75 gigabyte and validity of thirty days.

4.1 Discussion of results

From the result of the analysis, when subscribing for a 30 days plan with a maximum data of greater than or equal to 20 gigabyte. The amount needed will be 5300 naira only 5300 and the subscription for the minimized cost is 1 gigabyte worth 300 naira valid for one day, 2 gigabyte data worth 500 naira valid for two days, 6 gigabyte data worth 1500 naira valid for one week, and three times 2 gigabyte data worth 1000 naira valid for seven days. This makes a total of 30 days subscription with a maximum of 20 gigabyte data at a minimized cost with a maximized profit.

When subscribing for a 360 days plan with a maximum data of greater than or equal to 20 gigabytes. The amount needed will be 52300 naira only and the subscription for the minimized cost is 1 gigabyte worth 300 naira valid for one day, 2 gigabyte data worth 500 naira valid for two days, 6 gigabyte data worth 1500 naira valid for one week, fifty times 2 gigabyte data worth 1000 naira valid for seven days, 40 gigabyte data valid for 30 days at the cost of 10,000 naira and lastly two times 75 gigabyte data valid for 30 days. This makes a total of 360 days subscription with a maximum of 240 gigabyte data at a minimized cost with a maximized profit.

5. Conclusion

Result from this study concludes that data subscription plan that cost 1000 naira with 2 gigabyte and validity of seven days is most effective with minimized cost and maximized profit. Since it has shown to be subscribed 3 times for the 30 days plan and fifty times for

the yearly plan. Generally, we can see from the summary result table presented on table 4.1 and the analized result presented on the appendix, that the subscription of lower gigabyte and the extreme higher gigabyte are more economical as it has shown for the 20 and 240 gigabytes with 1 gigabyte, 2 gigabyte, 6 gigabyte and 2 gigabyte for both and 40 and 75 gigabyte plan for the 240 gigabyte plan yearly. Hence from this study we can make an effective decision on data plan subscription with minimized cost and maximized profit.

5.1 Recommendations

This study can be applied to different networks for data subscription. Depending on the network coverage available in location of study. Keeping into consideration the available data plans available in other networks, similar analysis can be made for a data plan with a maximized benefit of more data and comfortable span for the duration or validity of the data plan and minimized cost. A study on comparing the different available network can also be considered, using multi-objective linear programming process.

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APPENDIX

Min = 300*x1 + 500*x2 + 1500*x3 + 1000*x4 +1200*x5 + 1500*x6 + 2000*x7 + 2500*x8 + 3500*x9 + 5000*x10 + 10000*x11 + 15000*x12;

01*x1 >= 01;

02*x2 >= 02;

07*x3 >= 06;

07*x4 >= 02;

30*x5 <= 02;

30*x6 <= 03;

30*x7 <= 04.5;

30*x8 <= 06;

30*x9 <= 10;

30*x10 <= 15;

30*x11 <= 40;

30*x12 <= 70;

01*x1 + 02*x2 + 07*x3 + 07*x4 + 30*x5 + 30*x6 + 30*x7 + 30*x8 + 30*x9 + 30*x10 + 30*x11 + 30*x12

>= 30;

01*x1 + 02*x2 + 06*x3 + 02*x4 + 02*x5 + 03*x6 + 0.45*x7 + 06*x8 + 10*x9 + 15*x10 + 40*x11 + 70*x12

<= 20;

@GIN (x1);

@GIN (x2);

@GIN (x3);

@GIN (x4);

@GIN (x5);

@GIN (x6);

@GIN (x7);

@GIN (x8);

@GIN (x9);

@GIN (x10);

@GIN (x11);

@GIN (x12);

Global optimal solution found.

Objective value:	5300.000
Objective bound:	5300.000
Infeasibilities:	0.000000
Extended solver steps:	0
Total solver iterations:	2
Elapsed runtime seconds:	0.03

Model Class:	PILP

Total variables:	12
Nonlinear variables:	0
Integer variables:	12

Total constraints:	15
Nonlinear constraints:	0

Total nonzeros: 48

Nonlinear nonzeros: 0

Variable	Value	Reduced Cost
X1	1.000000	300.0000
X2	1.000000	500.0000
X3	1.000000	1500.000
X4	3.000000	1000.000
X5	0.000000	1200.000
X6	0.000000	1500.000
X7	0.000000	2000.000
X8	0.000000	2500.000
X9	0.000000	3500.000
X10	0.000000	5000.000
X11	0.000000	10000.00
X12	0.000000	15000.00

Row	Slack or Surplus	Dual Price
1	5300.000	-1.000000
2	0.000000	0.000000
3	0.000000	0.000000
4	1.000000	0.000000
5	19.00000	0.000000
6	2.000000	0.000000
7	3.000000	0.000000
8	4.500000	0.000000
9	6.000000	0.000000
10	10.00000	0.000000
11	15.00000	0.000000
12	40.00000	0.000000

13	70.00000	0.000000
14	1.000000	0.000000
15	5.000000	0.000000

Min = 300*x1 + 500*x2 + 1500*x3 + 1000*x4 +1200*x5 + 1500*x6 + 2000*x7 + 2500*x8 + 3500*x9 + 5000*x10 + 10000*x11 + 15000*x12;

01*x1 >= 01;

02*x2 >= 02;

07*x3 >= 06;

07*x4 >= 02;

30*x5 <= 02;

30*x6 <= 03;

30*x7 <= 04.5;

30*x8 <= 06;

30*x9 <= 10;

30*x10 <= 15;

30*x11 <= 40;

30*x12 <= 70;

01*x1 + 02*x2 + 07*x3 + 07*x4 + 30*x5 + 30*x6 + 30*x7 + 30*x8 + 30*x9 + 30*x10 + 30*x11 + 30*x12

>= 360;

01*x1 + 02*x2 + 06*x3 + 02*x4 + 02*x5 + 03*x6 + 0.45*x7 + 06*x8 + 10*x9 + 15*x10 + 40*x11 + 70*x12

<= 240;

@GIN (x1);

@GIN (x2);

@GIN (x3);

@GIN (x4);

@GIN (x5);

@GIN (x6);

@GIN (x7);

@GIN (x8);

@GIN (x9);

@GIN (x10);

@GIN (x11);

@GIN (x12);

Global optimal solution found.

Objective value:	52300.00
Objective bound:	52300.00
Infeasibilities:	0.000000
Extended solver steps:	0
Total solver iterations:	1
Elapsed runtime seconds:	0.05

Model Class:	PILP

Total variables:	12
Nonlinear variables:	0
Integer variables:	12

Total constraints:	15
Nonlinear constraints:	0
Total nonzeros:	48
Nonlinear nonzeros:	0

Variable	Value	Reduced Cost
X1	1.000000	300.0000
X2	1.000000	500.0000
X3	1.000000	1500.000
X4	50.00000	1000.000
X5	0.000000	1200.000
X6	0.000000	1500.000
X7	0.000000	2000.000
X8	0.000000	2500.000
X9	0.000000	3500.000
X10	0.000000	5000.000
X11	0.000000	10000.00
X12	0.000000	15000.00

Row	Slack or Surplus	Dual Price
1	52300.00	-1.000000
2	0.000000	0.000000
3	0.000000	0.000000
4	1.000000	0.000000
5	348.0000	0.000000
6	2.000000	0.000000
7	3.000000	0.000000
8	4.500000	0.000000
9	6.000000	0.000000

10	10.00000	0.000000
11	15.00000	0.000000
12	40.00000	0.000000
13	70.00000	0.000000
14	0.000000	0.000000
15	131.0000	0.000000