

NCC Mobile Termination Rate (MTR) Cost Modelling

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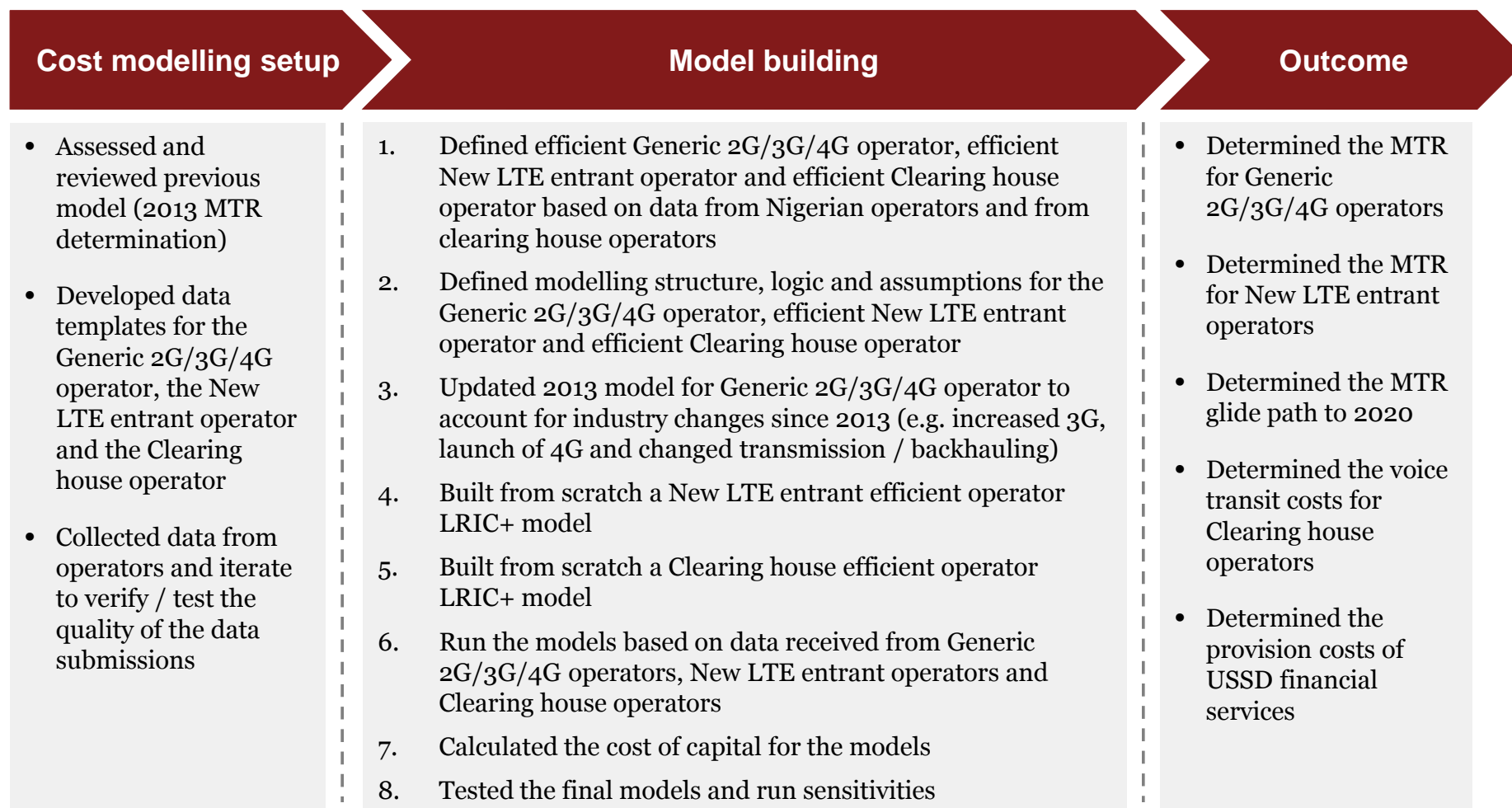
PwC has conducted a cost modelling exercise to inform the MTR, MTR glide path and the cost of a USSD session

Objectives of the cost modelling exercise:

- Estimate the cost-based MTR for voice services using industry best practice cost modelling techniques for:
 - Generic 2G/3G/4G operators
 - New LTE entrant operators
 - Clearing houses
- Estimate a possible MTR glide path
- Estimate the cost per minute session for the use of USSD financial services

Methodology and assumptions

We updated the 2013 model to accommodate industry developments and built two other models from scratch



The telecoms industry has significantly changed since 2013 and we have adapted our methodology accordingly

Rise of 3G and 4G technologies

- Most large operators now have 3G and 4G networks
- Built one Generic 2G/3G/4G model based on large mobile players (MTN, Glo, Airtel and 9Mobile)

New LTE entrants

- New LTE only operators have entered the Nigerian telecoms market since 2016
- Built one New LTE entrant operator model, which included new services such as VoLTE and SMS over LTE, based on Smile, ntel and InterC

Radio access site leasing

- Most large operators have signed lease back agreements with tower companies and this has been taken into account in the model
- Improved the transmission module which now takes into account both access, aggregation rings and core rings transmission links

Relevance of clearing houses

- As the market expands, operators are increasing their connections to one another, which raises questions on the relevance of clearing houses
- Built one Clearing house model to understand the cost of call clearing services

Growth in USSD services

- USSD services are playing an increasingly important role in the mobile financial services industry in Nigeria
- Analysed the cost of providing USSD services for Generic 2G/3G/4G

The 3 models account for different types of operators with varying network services and infrastructure layers

Network services per model type

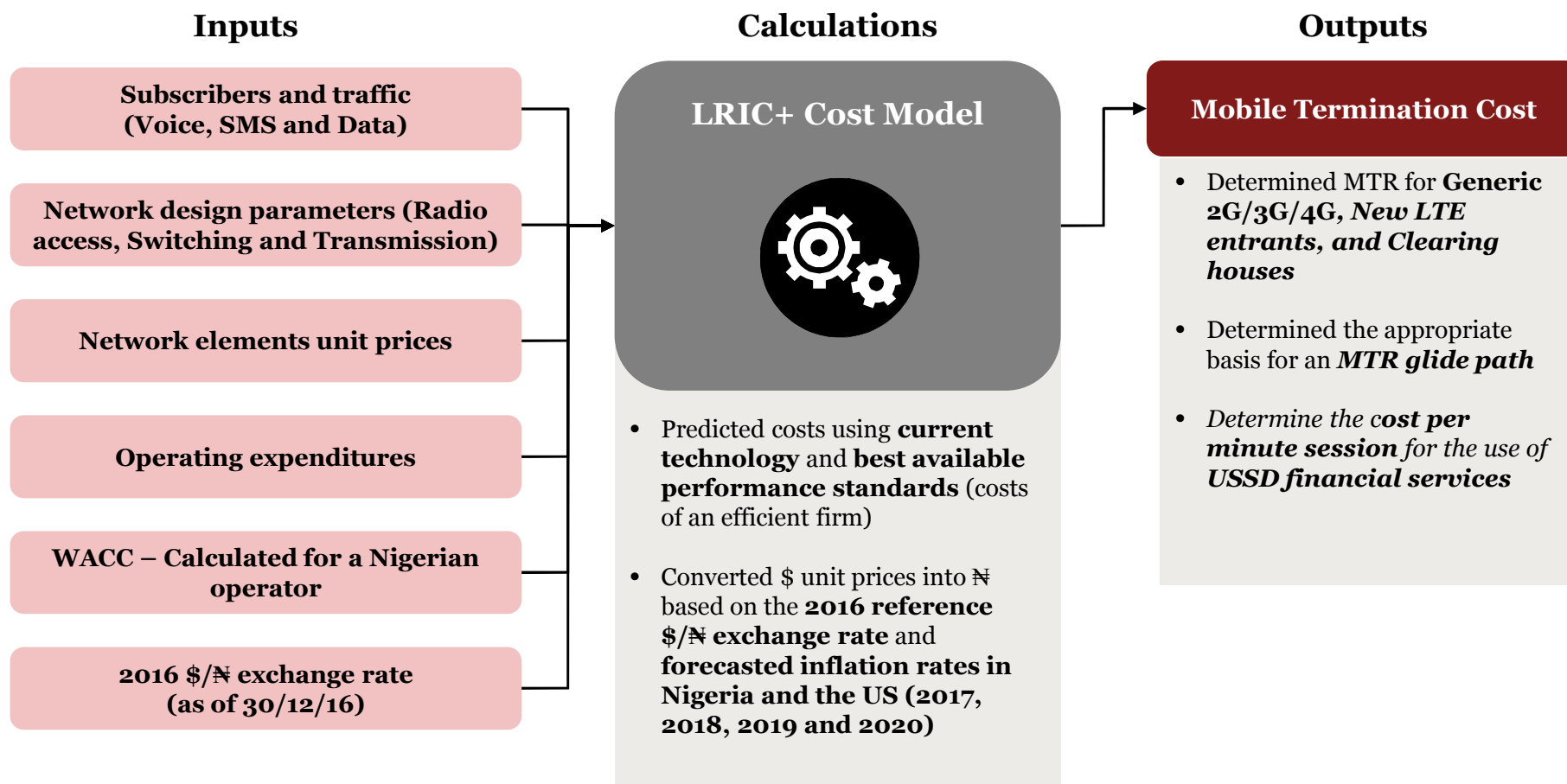
Model type	Operators	2G voice	2G SMS	2G data	3G voice	3G SMS	3G data	VoLTE	SMS over LTE	4G data
Generic 2G/3G/4G	MTN, Glo, Airtel and 9Mobile	✓	✓	✓	✓	✓	✓	✗	✗	✓
New LTE entrant	Smile, ntel and InterC	✗	✗	✗	✗	✗	✗	✓	✓	✓
Clearing house	Medallion, Solid, Interconnect and Exchange	✓	✓	✗	✓	✓	✗	✗	✗	✗

Network infrastructure layers per model type

Model type	Operators	2G access	3G access	4G access	Transmission	Core
Generic 2G/3G/4G	MTN, Glo, Airtel and 9Mobile	✓	✓	✓ <i>(not for Airtel)</i>	✓	✓
New LTE entrant	Smile, ntel and InterC	✗	✗	✓	✓	✓
Clearing house	Medallion, Solid, Interconnect and Exchange	✗	✗	✗	✓	✓

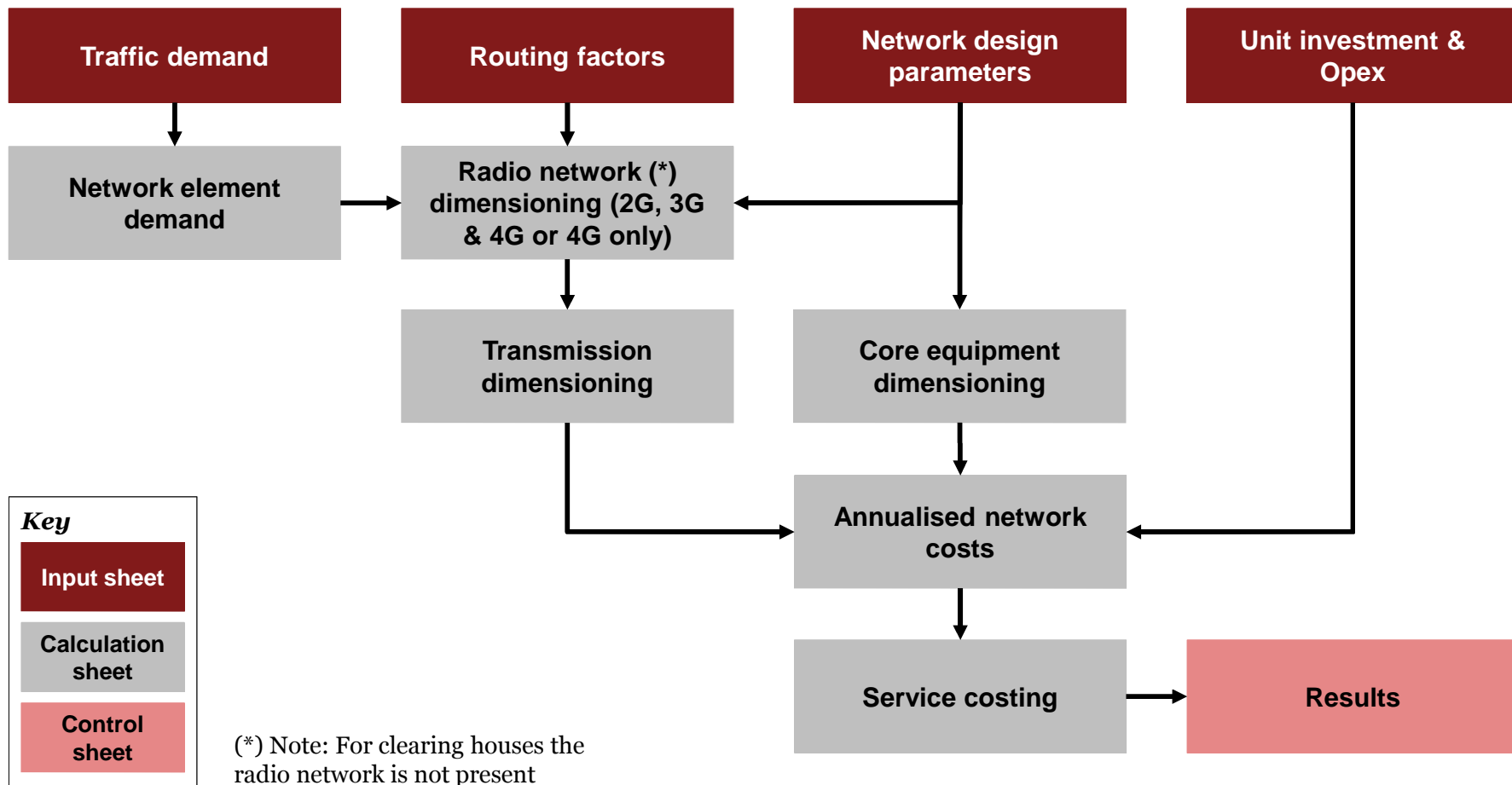
The LRIC+ model uses volume inputs, financial inputs, WACC and engineering rules to estimate the MTRs

LRIC+ Modelling Method

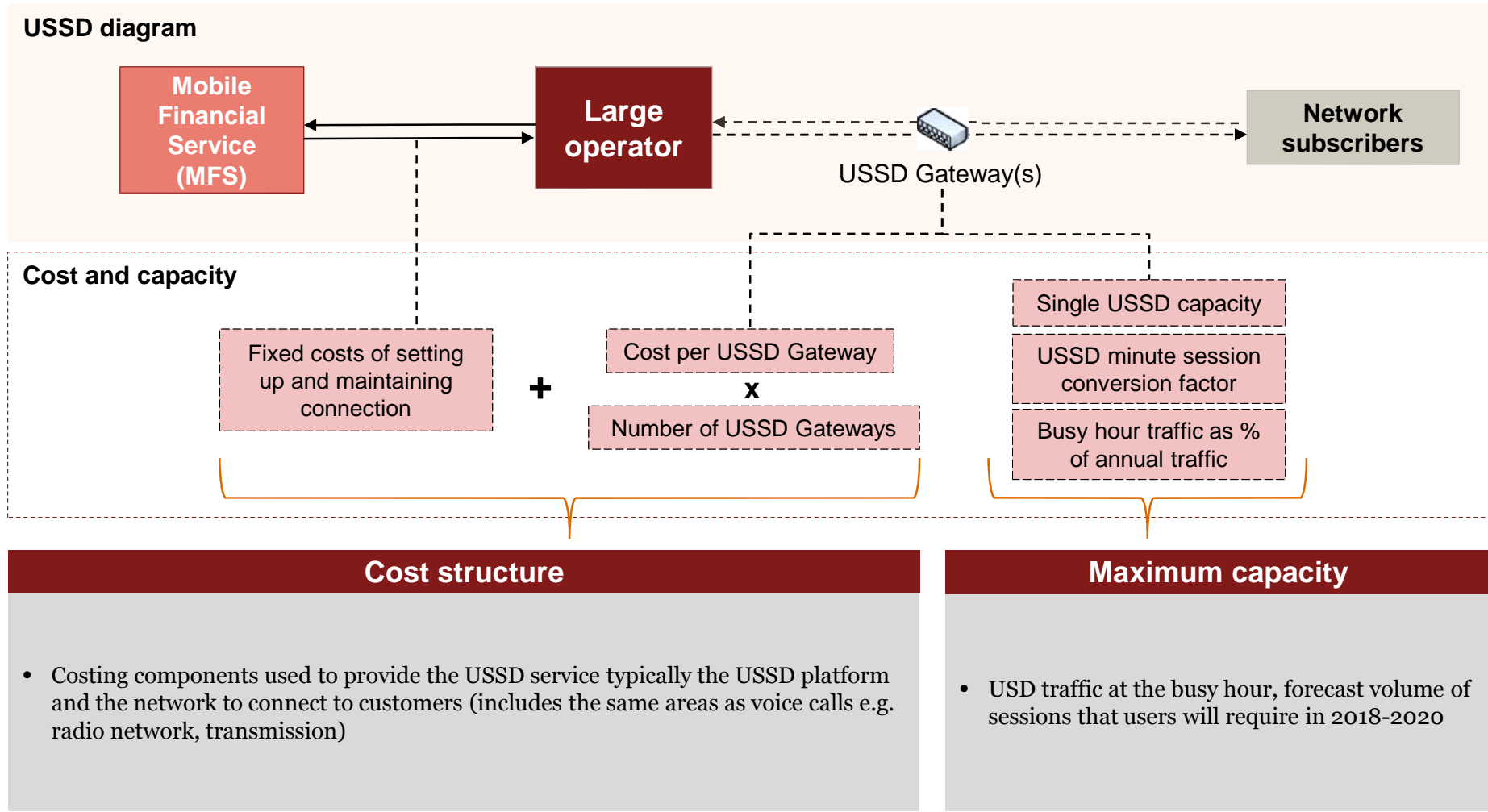


The model diagrams for Generic 2G/3G/4G, New LTE entrants, and Clearing houses are similar

ILLUSTRATIVE



For USSD, the methodology calculated the cost of the network components used to provide the services



We received the requested information in order to define an efficient operator profile and calibrate the models

Data tracker:

Operator	Contact name	Not received	Some information	Partially complete	Mostly complete	Fully complete
MTN	Quasim Odunmbaku					
Airtel	Lucky Ubani					
Glo	Aremu Olajide					
9Mobile	Tolulope Alaja-Browne					
ntel	Damian Udeh					
Smile	Gbolahan Thomas					
InterC	Mohammed Abdu Waya					
Interconnect	Uche Agbamuche					
Medallion	Ikechukwu Nnamani					
Exchange	Eboojor Ogoh					
Solid	Chinwe Obiabaka					

We converted \$ unit prices into ₦ based on the forecast exchange rate based on inflation in Nigeria vs US

2016 exchange rate and forecasted inflation rates

Exchange rate	2016
\$/₦ (as of 30/12/16)	304.5

Inflation	2017	2018
Nigeria	17.35%	17.46%
USA	2.65%	2.38%

Inputs:

- 2016 exchange rate based on data from the **Central Bank of Nigeria** (as of 30/12/2016): 304.5
- Forecasted inflation rates for Nigeria and the USA based on data from the **IMF World Economic Outlook** (Spring 2017)

Conversion of \$ unit prices into ₦ for a given year

2016 reference unit price

Equipment	Unit price in \$	Unit price in ₦	
		2016	2017
Radio Access Site	\$195,000	₦59.4mn	₦67.9mn

$$\$195,000 \times 304.5 \rightarrow \text{₦59.4mn}$$

$$\$195,000 \times 304.5 \times (1+17.35\%)/(1+2.65\%) \rightarrow \text{₦67.9mn}$$

Conversion:

- **2016** is set as a **reference year** for all equipment unit prices
- For 2016, \$ unit prices are converted into ₦ based on **the 2016 exchange rate** (304.5)
- For 2017, \$ unit prices are converted into ₦ based on the 2016 exchange rate (304.5) and the **forecasted inflation rates** for Nigeria (17.35%) and the USA (2.65%)
- Similar process for 2018 and 2020

Model results

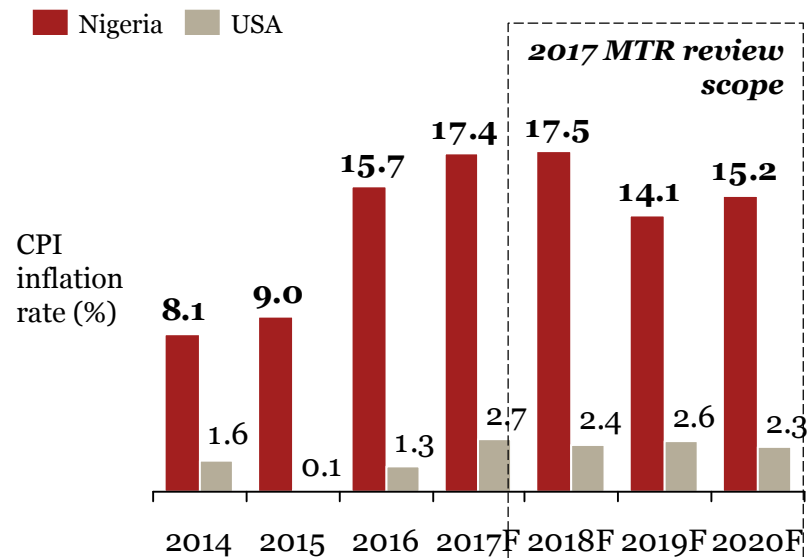
PwC's cost model suggests an MTR of ₦5.02 per minute for 2018 for the Generic 2G/3G/4G operators

- PwC's cost model suggests a cost-based MTR of \$1.26¢/₦5.02 for 2018
 - In April 2013, the cost-based MTR was set by the NCC at \$3.09¢/₦3.90
 - From 2013 to 2018, the MTR decrease in dollar terms has been driven by the increase in voice traffic, the reduction in voice network equipment unit prices and network economies of scale
 - Going forward, the MTR value in ₦ could be revised annually to reflect \$/₦ exchange rate fluctuations
- PwC's cost model estimates New LTE entrants' mobile termination cost to be \$1.93¢/₦7.70 per minute in 2018
 - The forecasted growth of new LTE entrants' traffic will enable them to rapidly decrease their mobile termination costs to current MTR levels for Large operators
 - In 2020, PwC's cost model suggests a cost of \$1.15¢/₦5.72 per minute
- PwC's cost model estimates clearing houses' call clearing cost to be \$0.15¢/₦0.60 per minute in 2018
 - Clearing houses could offer a cost efficient interconnection short term solution to new LTE entrants
- PwC's cost model suggests the provision of USSD services costs large operators \$1.16¢/₦4.64 per minute session in 2018
 - When subscribers are charged directly for the use of USSD services, large operators charge on average ₦5.82 per minute session in 2017
 - When third parties (financial services companies) are charged on a wholesale basis for the use of USSD services, large operators charge on average ₦3.77 per minute session in 2017

Note: The notation \$1.26¢ means \$0.0126 or 0.0126 USD. This is 1.26 dollar cent

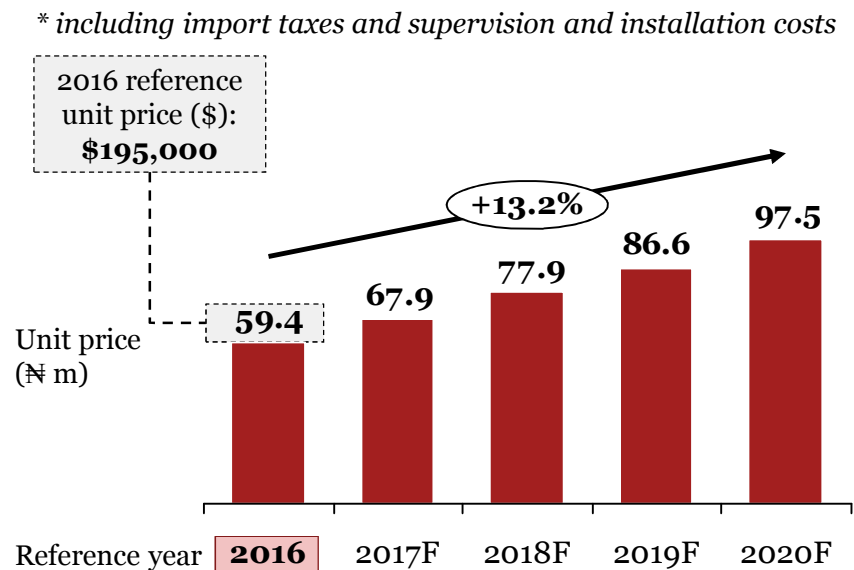
Nigeria's high forecasted inflation rates compared to the USA have a significant impact on network Naira prices

Historic and forecasted inflation rates for Nigeria and the USA (% , 2016 – 2020)



- Nigeria experienced an increase in inflation rate from 9.01% in 2015 to **15.70% in 2016**
- The IMF forecasts Nigerian inflation rates of **17.35%** and **17.46%** for 2017 and 2018 respectively slowing down to **15.21%** in 2020

Radio access site unit price* (₦ million, 2016 – 2020)



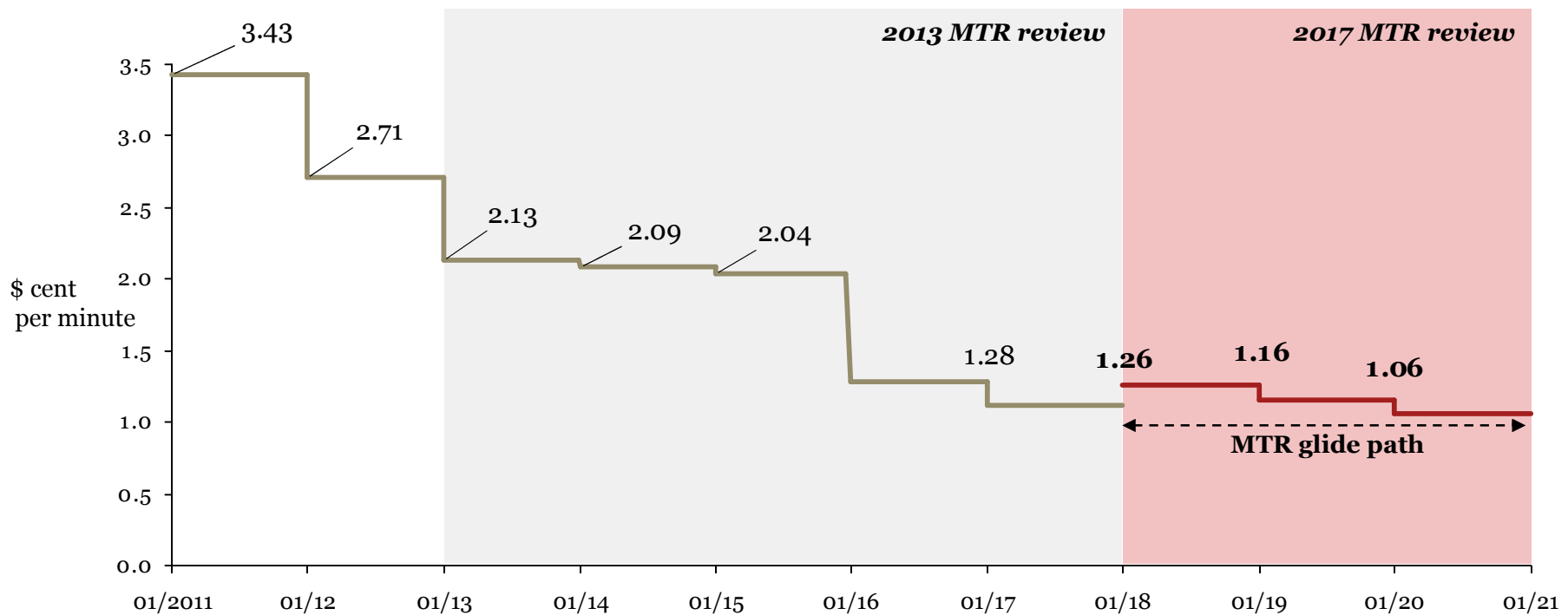
- As network equipment is **mostly purchased in US\$ by Nigerian operators**, Nigeria's high forecasted inflation rates compared to the USA has a **significant impact on network unit prices when expressed in Naira terms**
- As an example, the unit price in ₦ terms of a radio access site is forecasted to **increase by c. 13% CAGR** from 2016 to 2020

Sources: Central Bank of Nigeria for 2016 USD/NGN exchange rate (as of 30/12/2016)

IMF World Economic Outlook (Spring 2017) for USA and Nigeria forecasted (2017, 2018, 2019 and 2020) CPI inflation rates

The reduction in MTR, in \$ terms, is driven by voice traffic increase and network unit price decreases

Mobile Termination Rate of Generic 2G/3G/4G for 2013 and 2017 review (\$¢ per minute, 2011 – 2020)

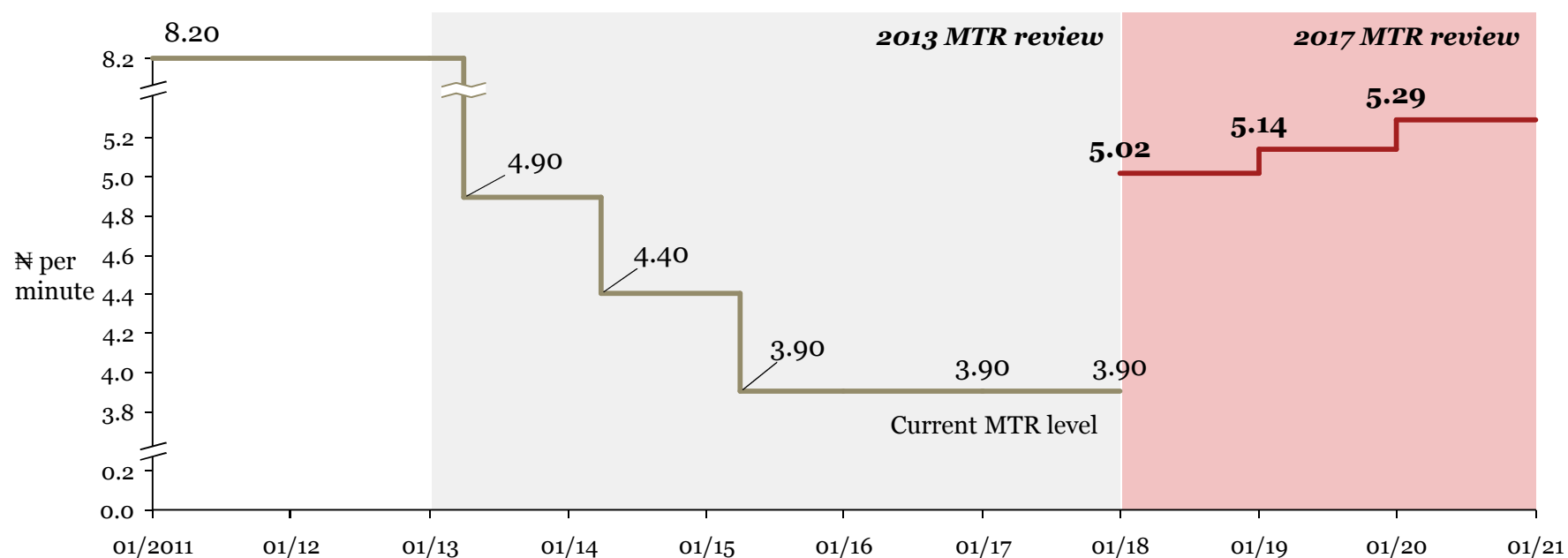


- Since the 2013 MTR review, the calculated MTR has continuously decreased from \$3.43¢ in dollar terms
- The observed MTR decrease has been driven by the a decrease in voice network unit costs in dollar terms and an increase in traffic volume
- In addition reduction in coverage needs and more efficient use of the network (higher volume per equipment) also contributes to declines

Note: The notation \$1.26¢ means \$0.0126 or 0.0126 USD. This is 1.26 dollar cent

For 2018, PwC’s cost model projects a MTR value of ₦5.02 per minute, higher than its current level at ₦3.90

Mobile Termination Rate of Generic 2G/3G/4G for 2013 and 2017 review (₦ per minute, 2011 – 2020)

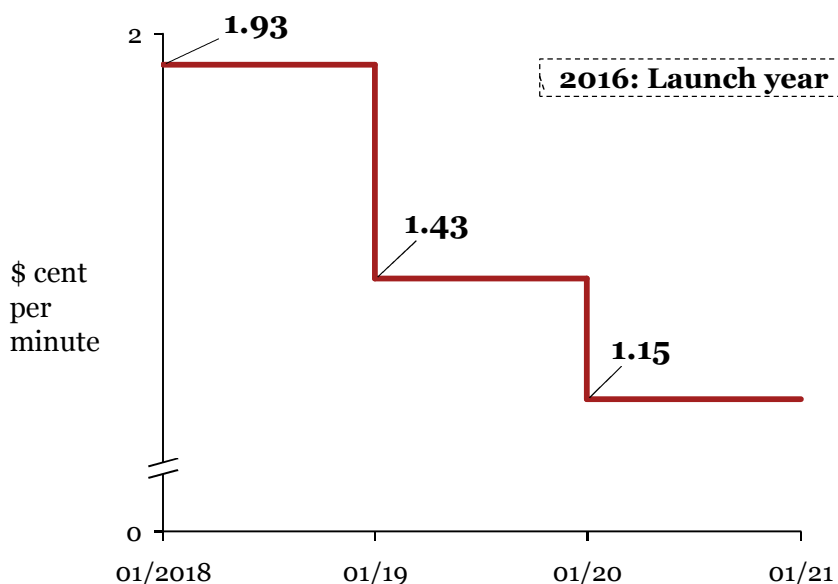


- Nigeria’s high forecasted inflation rates compared to the USA has a significant impact on network equipment unit prices for 2019 and 2020
- This increase in network equipment unit prices translates into an increase in network costs and therefore an increase in MTR
- For 2018, 2019 and 2020 the exchange rate used is 399 ₦/\$, ₦/\$ 444 and ₦/\$ 500 respectively – In the model the exchange rate is forecasted using the difference in inflation rates between Nigeria and the USA

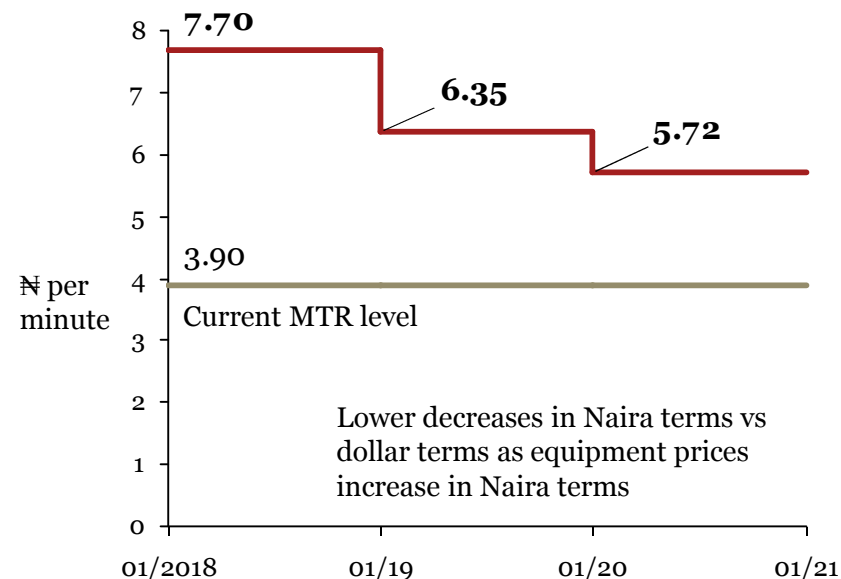
Sources: Central Bank of Nigeria for 2016 USD/NGN exchange rate of 304.05 ₦/\$, (as of 30/12/2016)
 IMF World Economic Outlook (Spring 2017) for USA and Nigeria forecasted (2017, 2018, 2019 and 2020) CPI inflation rates

The significant voice traffic growth experienced by New LTE entrants resulted in a decrease in termination costs

Mobile Termination Costs of New LTE entrant (\$ cent per minute, 2018 – 2020)



Mobile Termination Costs of New LTE entrant (₦ per minute, 2018 – 2020)



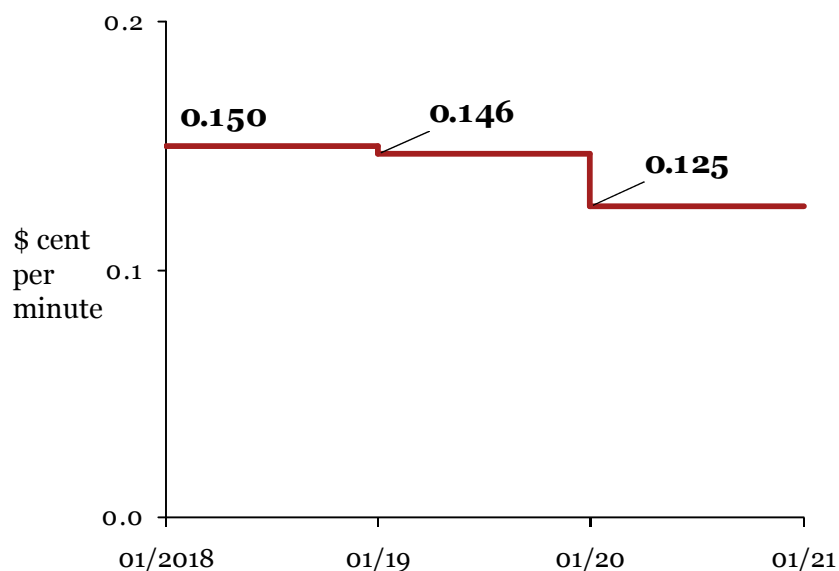
- Total voice network costs are expected to grow at a lower rate than traffic, as inflation is expected to moderate in the future
- As a result, the mobile termination cost per incoming minute for new LTE entrants is forecasted to decrease going forward

- The PwC cost model suggest that the mobile termination costs will further decrease from 2018 to 2020 due to traffic increase
- The mobile termination costs will still remain higher than the current MTR of ₦3.90 for Large operators

Sources: Central Bank of Nigeria for 2016 USD/NGN exchange rate of 304.05 ₦/\$, (as of 30/12/2016)
IMF World Economic Outlook (Spring 2017) for USA and Nigeria forecasted (2017, 2018, 2019 and 2020) CPI inflation rates

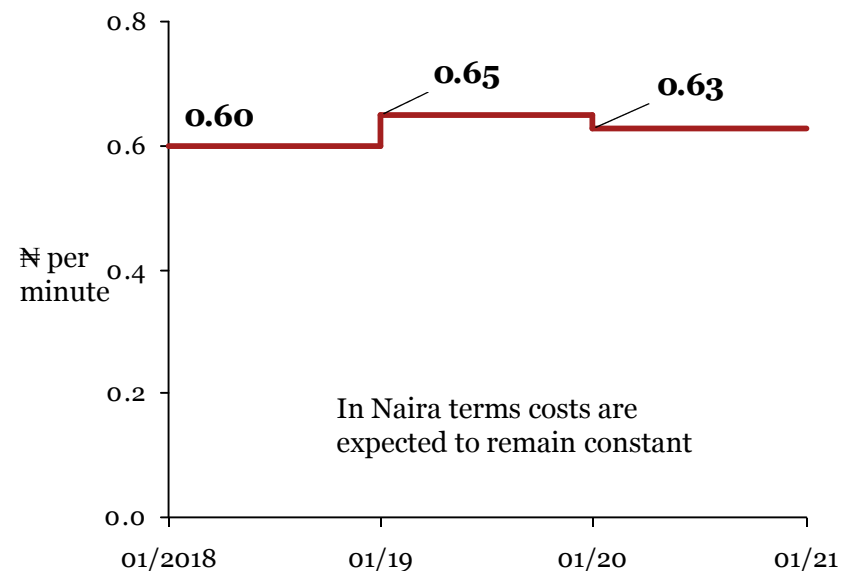
Due to voice traffic growth, clearing houses' costs (in \$ terms) are expected to decrease going forward

Mobile Call Clearing Costs of Clearing House (\$ cent per minute, 2018 – 2020)



- Clearing costs (equipment) in dollar terms are expected to grow at a lower rate than cleared call traffic
- As a result, the clearing cost (in \$ terms) per minute for clearing houses is forecasted to decrease going forward

Mobile Call Clearing Costs of Clearing House (₦ per minute, 2018 – 2020)

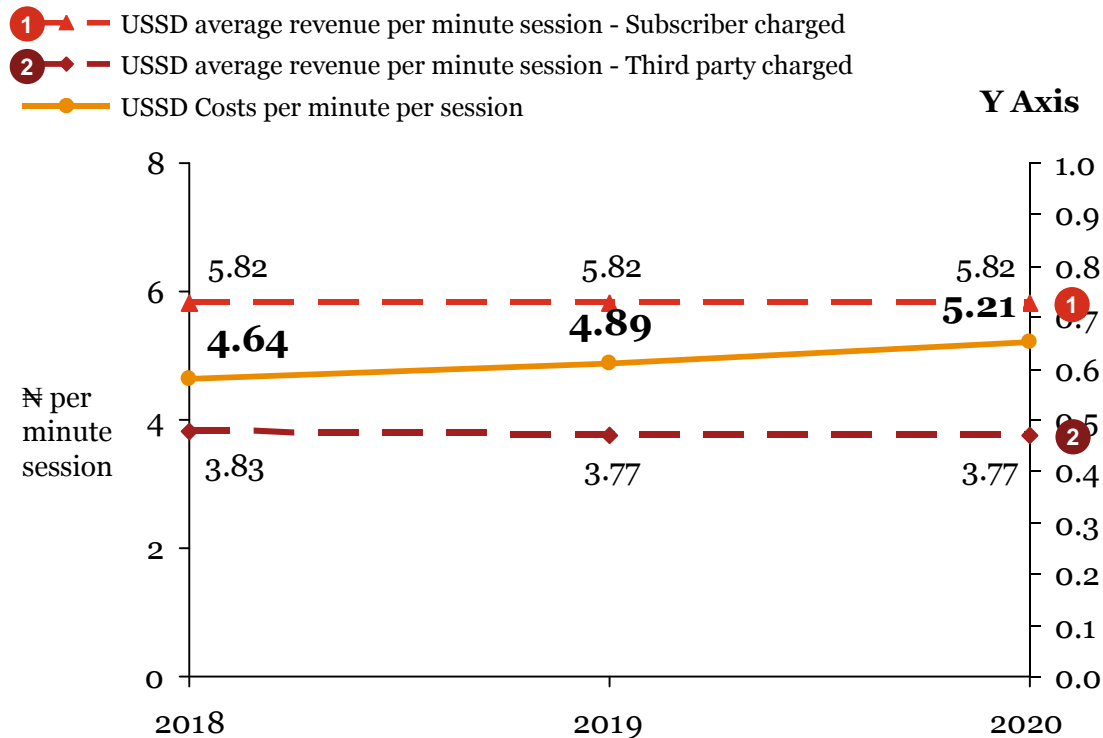


- Clearing costs (equipment) in Naira terms are expected to increase at roughly the same rate as cleared traffic
- This increase is due to the high forecasted inflation rates in Nigeria relative to USA

Sources: Central Bank of Nigeria for 2016 USD/NGN exchange rate of 304.05 ₦/\$, (as of 30/12/2016)
IMF World Economic Outlook (Spring 2017) for USA and Nigeria forecasted (2017, 2018, 2019 and 2020) CPI inflation rates

PwC's cost model suggests the provision of USSD services costs operators \$1.16¢/₦4.64 per minute in 2018

Revenue and costs of USSD services of Generic 2G/3G/4G operators (₦ per minute session, 2018 – 2020)



USSD business model	Operator
1 Operator charges the subscriber directly for the use of USSD services	Glo, 9Mobile & Airtel
2 Operator charges the third party on a wholesale basis for the use of USSD services by subscribers	MTN & Airtel

- The model suggests that USSD provision costs will **increase** in 2020 due to **forecasted high inflation rate in Nigeria compared to the USA**
- The notation \$1.16¢ means \$0.0116 or 0.0116 USD. This is 1.16 dollar cent

Operators are charging either the subscriber or the third party based on regulatory guidance

Sources: Central Bank of Nigeria for 2016 USD/NGN exchange rate of 304.05 ₦/\$, (as of 30/12/2016)

IMF World Economic Outlook (Spring 2017) for USA and Nigeria forecasted (2017, 2018, 2019 and 2020) CPI inflation rates



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