Caveat

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1. State of the Nigerian Economy
2. Health Landscape in Nigeria
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State of the Nigerian Economy
2016: Average total population growth vs. average working age population growth (2016 - 2050)

Nigeria, Egypt, Pakistan and the Philippines are projected to have the highest average annual population and working age population growth rates.
However, real GDP growth has fallen below population growth in the past two years, worsening the standard of living.

Source: CBN, PwC Analysis
The Nigerian economy has turned a corner; recent macroeconomic trends strongly suggest a return to positive growth by YE2017

Q2’2017 Real GDP growth 0.55% y/y – best in six quarters

Inflation moderates to 15.9% y/y as at September from a peak of 18.7% y/y in January 2017

Reserves up by 40.6% in the past 12 months to USD33.3 billion

Q3’2017 Purchasing Managers Index average at 54.3 points – best since Q3’2014

NSEASI YtD 35.3%* vs -6.2% in 2016

Source: CBN, NBS, NSE, PwC Analysis

*NSEASI YtD is as at 23 October 2017
*Reserves is as at 18 October 2017
*YE – Year End
With Gross Fixed Capital Formation at only 13% of GDP, Nigeria needs significant FDI to bridge the infrastructure deficit which is key to diversification.

Source: World Bank, PwC Analysis


Gross Fixed Capital Formation to GDP

PwC estimates that Nigeria would need an investment rate of at least 26% of GDP to achieve a growth of 7%
Though recovery is still fragile relative to pre-recession era, high yields continue to attract foreign investment in Q2’2017

The spike recorded in FPI in Q3’2016 was due to:
1. hike in MPR to 14% in July 2016
2. the proposed move to a flexible exchange rate regime in June 2016
3. Brexit

Source: National Bureau of statistics
The Federal Budget is limited in its impact to deliver significant social and economic outcomes

Source: Budget office, PwC Analysis
Yields and interest rates have remained elevated as monetary policy remains tight

Source: Central Bank of Nigeria, FMDQ and PwC estimates
Nigeria’s public debt portfolio is heavily exposed to domestic debt which has become more expensive to service

**Nigeria’s Public Debt Stock as at 30th June 2017**

<table>
<thead>
<tr>
<th></th>
<th>Domestic Debt (NGN’ billion)</th>
<th>External Debt (NGN’ billion)</th>
<th>Total (NGN’ billion)</th>
</tr>
</thead>
<tbody>
<tr>
<td>FGN</td>
<td>12,033.5</td>
<td>3,388.6 (USD11.11 billion)</td>
<td>15,422.1</td>
</tr>
<tr>
<td>36 States and the FCT***</td>
<td>2,958.5</td>
<td>1,189.5 (USD3.9 billion)</td>
<td>4,148.0</td>
</tr>
<tr>
<td>Total</td>
<td>14,992.0</td>
<td>4,578.1</td>
<td>19,570.1</td>
</tr>
<tr>
<td>Contribution (%)</td>
<td>77%</td>
<td>23%</td>
<td></td>
</tr>
<tr>
<td>Cost of Debt estimate**</td>
<td>14.1%</td>
<td>1.9%</td>
<td></td>
</tr>
</tbody>
</table>

Source: Debt Management Office (DMO), PwC Analysis

* Computed at an exchange rate of NGN305/USD
** Estimated Cost of debt for year-end 2017
***Domestic debt for sub-nationals is as at 30 December 2016
Debt to GDP remains comparatively low which gives Nigeria room to borrow to fund developmental activities.

Source: IMF World Economic Outlook October 2016
Historically low tax collection provides headroom to improve revenue collection, close fiscal deficit and reduce borrowing

*Oil Tax/ GDP vs Non-Oil Tax/GDP*

Source: FIRS, CBN, PwC Analysis

PwC
Diversification through development of value addition across the Agriculture and Downstream Petroleum would reduce demand pressure on Forex

- Petroleum and food products account for a significant portion of Nigeria’s importation bill
- Through import substitution of agricultural products and improving value added in the petroleum industry, Nigeria’s FX demand could reduce by c.30-40%

Source: National Bureau of Statistics
**Nigeria ranks low in the Ease of Doing Business (EoDB) index compared to other large/populous countries globally and across Africa**

- Nigeria currently ranks **169** (out of 190 countries) in the EoDB index. This ranking is significantly below the regional average rank of **143** for all 48 countries in Sub-Saharan Africa (SSA).
- In addition, this ranking places Nigeria in the 9th position (out of 10), when compared to similar countries with large population sizes.

<table>
<thead>
<tr>
<th>Countries (Global Top 10)</th>
<th>Population (in Billions)</th>
<th>EoDB Ranking</th>
<th>EoDB Position</th>
</tr>
</thead>
<tbody>
<tr>
<td>United States</td>
<td>0.33</td>
<td>8</td>
<td>1</td>
</tr>
<tr>
<td>Russia</td>
<td>0.14</td>
<td>40</td>
<td>2</td>
</tr>
<tr>
<td>Mexico</td>
<td>0.13</td>
<td>47</td>
<td>3</td>
</tr>
<tr>
<td>China</td>
<td>1.39</td>
<td>78</td>
<td>4</td>
</tr>
<tr>
<td>Indonesia</td>
<td>0.26</td>
<td>91</td>
<td>5</td>
</tr>
<tr>
<td>Brazil</td>
<td>0.21</td>
<td>123</td>
<td>6</td>
</tr>
<tr>
<td>India</td>
<td>1.34</td>
<td>130</td>
<td>7</td>
</tr>
<tr>
<td>Pakistan</td>
<td>0.20</td>
<td>144</td>
<td>8</td>
</tr>
<tr>
<td>Nigeria</td>
<td>0.19</td>
<td>169</td>
<td>9</td>
</tr>
<tr>
<td>Bangladesh</td>
<td>0.16</td>
<td>176</td>
<td>10</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Countries (Africa Top 10)</th>
<th>Population (in Billions)</th>
<th>EoDB Ranking</th>
<th>EoDB Position</th>
</tr>
</thead>
<tbody>
<tr>
<td>South Africa</td>
<td>0.06</td>
<td>74</td>
<td>1</td>
</tr>
<tr>
<td>Kenya</td>
<td>0.05</td>
<td>92</td>
<td>2</td>
</tr>
<tr>
<td>Uganda</td>
<td>0.04</td>
<td>115†</td>
<td>3</td>
</tr>
<tr>
<td>Egypt</td>
<td>0.10</td>
<td>122</td>
<td>4</td>
</tr>
<tr>
<td>Tanzania</td>
<td>0.06</td>
<td>132</td>
<td>5</td>
</tr>
<tr>
<td>Algeria</td>
<td>0.04</td>
<td>156</td>
<td>6</td>
</tr>
<tr>
<td>Ethiopia</td>
<td>0.10</td>
<td>159</td>
<td>7</td>
</tr>
<tr>
<td>Sudan</td>
<td>0.04</td>
<td>168</td>
<td>8</td>
</tr>
<tr>
<td>Nigeria</td>
<td>0.19</td>
<td>169</td>
<td>9</td>
</tr>
<tr>
<td>DR Congo</td>
<td>0.08</td>
<td>184</td>
<td>10</td>
</tr>
</tbody>
</table>

Sources: [www.worldbank.org](http://www.worldbank.org), [www.doingbusiness.org](http://www.doingbusiness.org)
Health Landscape in Nigeria
Since 1990, impressive advancements have been made on many health fronts globally

SDG Goal 3
Ensure healthy lives and promote well-being for all at all ages

**Under-five Mortality Rate**

<table>
<thead>
<tr>
<th>Region</th>
<th>1990</th>
<th>2015 projection</th>
<th>2015 target</th>
</tr>
</thead>
<tbody>
<tr>
<td>Developed regions</td>
<td>15</td>
<td>61%</td>
<td>100</td>
</tr>
<tr>
<td>Developing regions</td>
<td>47</td>
<td>53%</td>
<td>90</td>
</tr>
<tr>
<td>World</td>
<td>43</td>
<td>53%</td>
<td></td>
</tr>
</tbody>
</table>

**Estimated number of new HIV infections**

<table>
<thead>
<tr>
<th>Region</th>
<th>2000</th>
<th>2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>Developed regions</td>
<td>1,940</td>
<td>3,340</td>
</tr>
<tr>
<td>Developing regions</td>
<td>2,100</td>
<td>3,350</td>
</tr>
<tr>
<td>World</td>
<td>2,100</td>
<td>3,350</td>
</tr>
</tbody>
</table>

**Probability of premature deaths from NCDs**

<table>
<thead>
<tr>
<th>Region</th>
<th>2000</th>
<th>2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>Developed regions</td>
<td>16.5</td>
<td>21.2</td>
</tr>
<tr>
<td>Developing regions</td>
<td>18.6</td>
<td>22</td>
</tr>
<tr>
<td>World</td>
<td>18.6</td>
<td>22.2</td>
</tr>
</tbody>
</table>

Source: United Nations SDG Indicators Global Database, Millennium Development Goals Report 2015, PwC Analysis

Supply Chain improvements have directly contributed to these enhanced outcomes

1Deaths per 1,000 live births
2Thousands
3Probability of death between 30 and exact age of 70 from CVD, Diabetes, Cancer, CRD
Nigeria has fared marginally well in achieving desired global health outcomes...

**Under-five Mortality Rate**
- 2000: 186.8
- 2015: 108.8 (42% decrease)

**Sub-Saharan Africa Average 2015**: 83.6

**Estimated number of new HIV infections**
- 2000: 2.74
- 2015: 1.36 (50% decrease)

**Sub-Saharan Africa Average 2015**: 1.54

**Probability of premature from NCDs**
- 2000: 23.7
- 2015: 20.8 (3% decrease)

**Africa Average 2015**: 20.9

Source: WHO Global Health Observatory, United Nations SDG Indicators Global Database, PwC Analysis

Planning and donor interventions in drug supply ensure medicines reflect local disease profile

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1. Deaths per 1,000 live births
2. Per thousands
3. Probability of death between 30 and exact age of 70 from CVD, Diabetes, Cancer, CRD
However there remains a huge supply and financing gap across the health system

Number of Pharmacists to 1000 People

There are about 22,300 pharmacists in Nigeria, lowest amongst similar economies

Health Spending per Capita $US

Spending on health in Nigeria estimated to be one of lowest in the world

Health Spending to Total Government Spending(%)

Globally, governments spend nearly 50% more on healthcare than the private sector, the reverse is the case in Nigeria with very low budgetary allocation to health

Source: BMI, WHO Global Health Observatory Database, PwC Analysis

*WHO Africa average 2004
**WHO 2014 average was $1058 per capita
...evident in relatively small pharma market in Nigeria

Access to high cost therapies drive pharmaceutical market in more developed markets

Pharmaceutical Sales in $bn 2016

Pharma market is relatively small, occasioned by low purchasing power and limited financing

Pharmaceutical Sales as % of GDP

Total health spending is about 10% of global GDP with pharmaceutical sales being about 1.5%

Source: BMI, PwC Analysis

1Revenues generated by generic, patented, and over-the-counter (OTC) drugs through hospitals, retail pharmacies and other channels
Nigeria disease map shows a double burden of increasing incidence of non-communicable diseases and still high incidence of communicable diseases

Projected Burden of Diseases in Nigeria

Non-communicable diseases DALYS 2016 = 29.8m

Communicable diseases DALYS 2016 = 69.3m

About 3.5m people suffer from HIV/AIDS, only 800k access subsidised ARV

Number of new cases of cancer in Nigeria will increase by nearly 62% by 2030
**Access to essential medicines is yet threatened by high poverty rate**

### Population by Household Annual Income in Nigeria

<table>
<thead>
<tr>
<th>Income Level</th>
<th>Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>Middle – High Income level</td>
<td>10,831,672</td>
</tr>
<tr>
<td>Low- Middle Income level ($1100 - $4,500)</td>
<td>64,980,020</td>
</tr>
<tr>
<td>Poverty Line</td>
<td>112,950,311</td>
</tr>
<tr>
<td>Low-income level Below $1100 or N360,000</td>
<td>250,460,000</td>
</tr>
</tbody>
</table>

Please note that costs here are basic drugs and are based on pricing for most affordable generic products at private pharmacies; in reality a person may pay up to 10-15 times this cost at a private clinic. Thus, affordability was largely dependent on choice of therapeutic class, product or sector from which the medicine was purchased.

**Cancer care costs about 5 times the monthly minimum wage for a government employee**

**Anti-diabetics costs N1500 for a 30-day supply of drugs, thus costs a minimum wage worker 2 days worth of work**

**Anti-hypertensives costs about half a day’s work for a month course of treatment**
Technology for Drug Security
Nigeria’s medicine supply chain....

Threat of counterfeits and substandard low-price medicine is particularly predominant in the private sector.

Source: Onyebuchi, National Drug Distribution In Nigeria, European Journal of Pharmaceutical and Medical Research; Frost & Sullivan, PwC Analysis
Key Players in the pharmaceutical segment....

Branded Companies
- GSK
- Pfizer
- AstraZeneca
- Roche
- Sanofi
- Merck

Local manufacturers
- M&B
- Evans The Hope
- May & Baker Nigeria PLC.

Generic Companies
- Emzor
- Fidson
- Ranbaxy
- Cadila
- NGC
- Neimeth

The industry operates at below full capacity, despite the obvious demand for effective medicines due to widespread counterfeit trade in medicines.

Source: Frost and Sullivan, BMI
**Counterfeits account for 17% of drugs in supply**

17% of essential generic drugs and 30% of anti-malarials are routinely faked

A 2012 report found 64% of antimalarial drugs to be counterfeit

Over 10,000 unregistered patent and proprietary drug stores

Private sector remains the main hub for counterfeit product AND main source of medicine for many Nigerians

34 Nigerian children died of kidney failure when a teething mixture found to be contaminated with diethylene glycol in 2008

NAFDAC seized NGN12 billion worth of counterfeit drugs in 2016

NAFDAC has seized NGN29 billion worth of counterfeit drugs in 3 years


2015 figures quoted by NAFDAC DG. Actual counterfeit drug prevalence is unclear with various sources quoting between 15% - 70%
NAFDAC has pioneered several authentication technologies targeted at fighting counterfeit drugs

On the back of technology adoption, circulation of counterfeit medicines dropped from 40% in 2001 to 16.7% in 2015\(^1\)

NAFDAC is the first regulatory agency in the world to use the Truscan

Mobile Authentication service

Radio Frequency Identification System to authenticate high-value brands

Black eye Infra-red scanners to enhance packaging security

More needs to be done in securing the supply chain end-to-end

\(^1\)2015 figures quoted by NAFDAC DG. Actual counterfeit drug prevalence is unclear with various sources quoting between 15% - 70%
A new mandatory method called “mass serialization,” often combined with “track-and-trace” requirements, is becoming the worldwide standard for regulators in securing the supply chain.

Experts say the backing technologies may still be inadequate.
The use case for blockchain technology

https://youtu.be/9_Dvnz7aBRe
Supply chain integrity can be maintained by preventing counterfeit drugs based on the asset transfer concept on the blockchain

Supply chain integrity for medicines on the Blockchain

Behind the scenes on the Blockchain

Movement of drugs through the supply chain is analogous to transferring assets on the blockchain

Advantages

01. Impossible to counterfeit and immutable
02. Disintermediation and ease of transfer
03. Transparency and ease of auditing
04. No overhead related to transaction processing

Batch of medicines are manufactured by the manufacturer (Point of origin)

Every batch of medicines is assigned a unique ID and added to the blockchain

Every ID is treated as an asset on the blockchain

Medicines are transferred to warehouses digitally on the blockchain

Medicines are transferred to pharmacists from warehouses digitally

Customer can then audit the authenticity of the medicine from Point of Origin to Point of Sale

Source: http://bitfury.com/content/5-white-papers-research/bitfury-digital_assets_on_public_blockchains-1.pdf
Source: https://exponential.singularityu.org/medicine/patient-centered-health-on-the-blockchain-with-chelsea-barabas/
Many pharma/biopharma companies and governments are exploring blockchain technology, why can’t we?

According to a Pistoia Alliance survey, 83% of Senior Pharmaceutical and Life Science leaders are interested in blockchain and expect blockchain to be adopted in under 5 years.

Pharma Giants such as Pfizer and Genentech recently announced they completed a medicine tracking pilot program, MediLedger Project, a blockchain tool used to manage pharmaceutical supply chains.

The State of Delaware, in the USA, is implementing a blockchain initiative including a law that allows companies manage shares via distributed ledgers backed by blockchain; the state is also adopting blockchain in state governance and has streamlined record-keeping for corporates (filings) using the technology.
What else can be done?
Industry including pharma companies and the government, consider the following...

1. Mandatory licensing of patented drugs to improve access to essential treatments for NCDs and infectious diseases

2. Advocacy for increased funding for health

3. Get behind a system
Every pharmacist must also remember their duty

Do NOT turn a blind eye to malpractices and counterfeits in the system. Remember about 100,000 people die annually in Africa from fake drugs.

Provide pharmaceuticals in the best interest of patients.
Thank You