



# ZICTA

ZAMBIA INFORMATION AND COMMUNICATIONS TECHNOLOGY AUTHORITY

## Training Workshop on Spectrum Auction

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## 1. Workshop Highlights

### 1.1 General

The Author provided to ZICTA the full presentation (238 slides) including operational Recommendations, and a reduced file (226 slides) that may be published by ZICTA. Significant ITU-D Deliverables were referenced. ITU-D Indicators served to benchmark Zambia versus SADC and other relevant African countries. Actually, ZICTA started the Auction's process on 2017, advancing the Broadband Spectrum Audit and the Broadband Pricing Model (provided by the Author).

The ITU-D ICT Indicators should be used carefully; for example, the 2017 Mozambique Revenue from Mobile Networks 6,412,559.753 (US\$) contradicts the value published in the official Mozambique [site](#): 458 M.US\$ (14 times smaller).

### 1.2 Opportunity Cost & Administrative Incentive Pricing

Based also on Zambian experience, the Author developed the Opportunity Cost & Administrative Incentive Pricing (AIP): revised section 4.8 at ITU-R Report [SM.2012](#). The equations are proposed again for Zambian annual fees. Following the broadband RF [Spectrum Audit](#), Lusaka; 19 April 2017, where the method was already offered (and now being implemented in Zambia), the Author proposes to use it with some changes: all cellular annual fees below 6 GHz are similar.

### 1.3 Frequency arrangements and re-farming

Based on the Author's presentation in Yaoundé '[Common Wealth Workshop Re-Farming and methodologies](#)', the Author proposes to re-farm the existent operator in the 800 MHz. More details appear at section 5, the part of the Report published only for ZICTA.

### 1.4 Tanzania successful auction

Tanzania successful auction was well analyzed. The 10 (Million USD) for 2 x 10 MHz in Tanzania were normalized to Zambian economy, using initially ITU-D Indicators GDP, GDP per capita and ARPU and then also the Revenues from Mobile Networks (RMN).

### 1.5 RF Cost accounting

The Tanzanian RF spectrum is a **Tangible Asset**. The Annual fees and Auctions enable to know more about costs, and is a useful and durable tool for enhancing performance and decision making and thus optimizing implementation of public or business policy. Information Technology tools and financial management software can be used to establish a direct link with budget accounts.

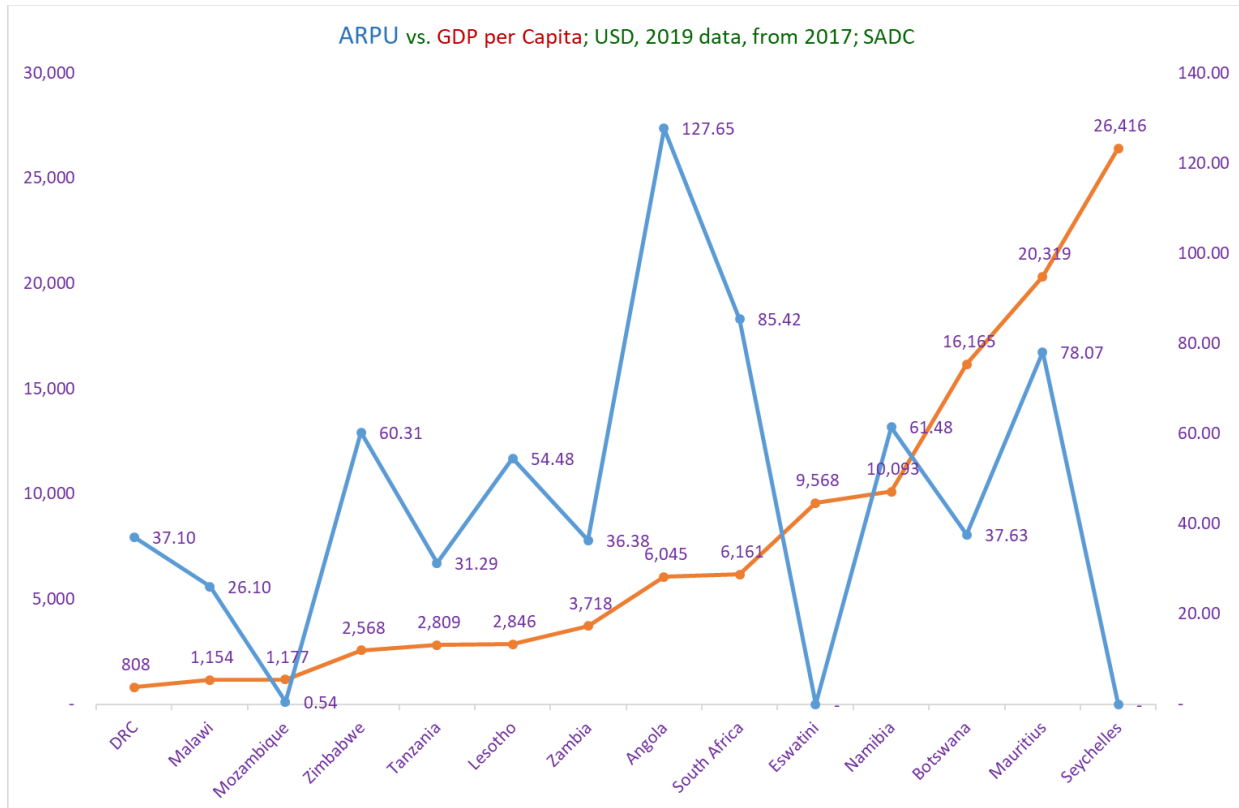
## 2. Workshop Particulars

### 2.1 Table of sessions

- 1) Preamble
- 2) Abbreviations & Glossary
- 3) Spectrum Demand
- 4) Assignments Methods: Lotteries, Secondary Trading & Auctions
- 5) Economic Theories of Auctions: Econometrics & Benchmarks
- 6) Types of Auctions
- 7) Auctions Principles: Legal, Economic & Engineering
- 8) Advancing Auctions
- 9) Economic Impact & Spectrum Price
- 10) Opportunity Cost & Administrative Incentive Pricing (AIP)
- 11) Re-Deployment/ Re-Farming
- 12) Sub-Sahara 800/700 MHz Case Study
- 13) Tanzania 700 MHz Auction
- 14) ITU ICT Indicators
- 15) GSMA Views
- 16) RF as a Tangible Asset
- 17) Broadband Spectrum Audit; Lusaka, 19 April 2017
- 18) Broadband Pricing Model; Lusaka, 19 April 2017
- 19) ZICTA Preliminary Expectations
- 20) Summary & recommendations

## 2.2 Indicators ITU-D Statistics and benchmarking

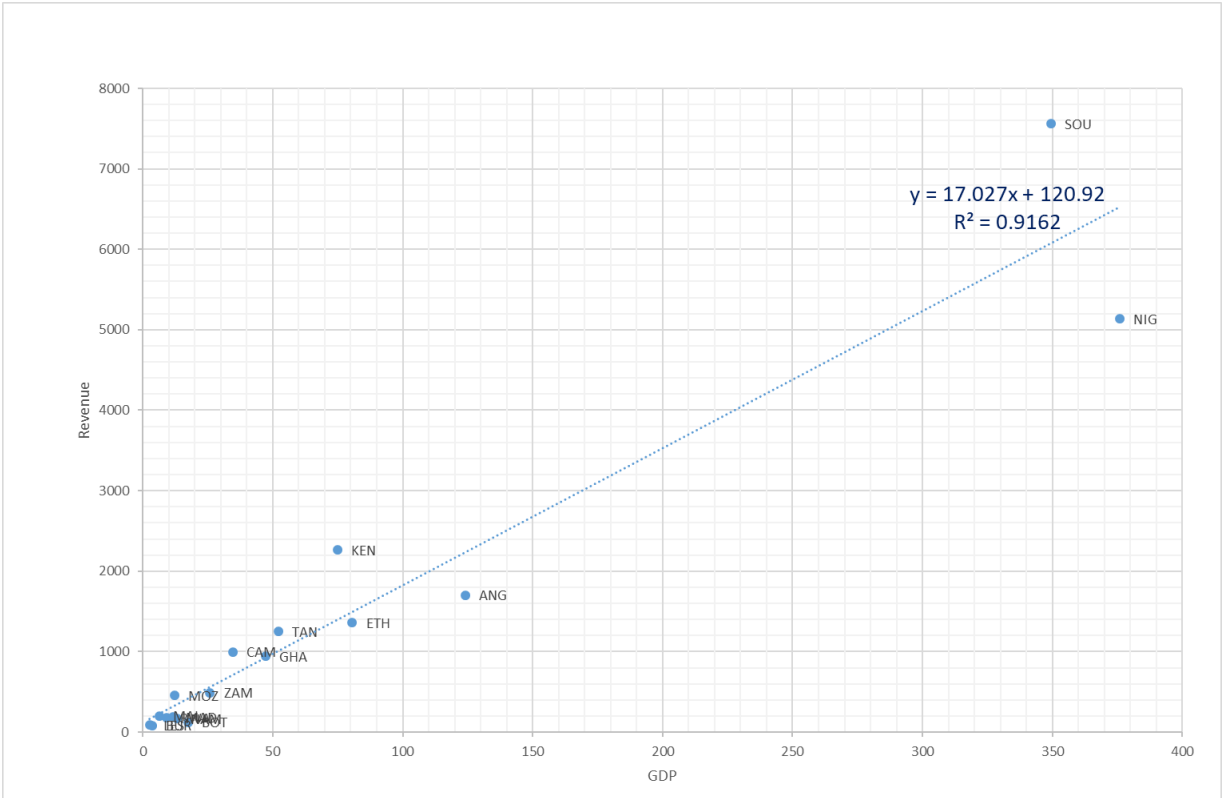
1 The last [ITU-D Indicators](#) are ideal for benchmarking. The Gross Domestic Product (GDP), GDP per capita, Average Revenue Per User (ARPU) and Revenues from Mobile Networks (RMN) provide the comparable points of reference. The following Figure depicts the relation between ARPU and GDP per Capita, for the South African Development Community (SADC) countries.



2 RMN estimates well the reserve-price for the 800/700 MHz Auctions. As RMN<sup>1</sup> and GDP are strongly correlated,  $R^2=0.9162$ , GDP (GDP is easily found at web) alone may well estimate the auction reserve-price and the assignment administrative- price. The following figure depicts Revenues from mobile networks (RMN) vs GDP in 17<sup>2</sup> African countries.

<sup>1</sup> The Tanzania RMN retrieved from GSMA data and Mozambique RMN from Mozambique [website](#).

<sup>2</sup> Angola, Botswana, Burundi, Cameroon, Ethiopia, Ghana, Kenya, Lesotho, Madagascar, Malawi, Mozambique, Namibia, Nigeria, Rwanda, South Africa, Tanzania and Zambia.



## 2.3 Main (hyperlinked) references of the auctioning training

- [1] ITU-D Resolution 9 [Final Report](#); 2014
- [2 & 6] ITU-D Guidelines for the [review of spectrum pricing](#) methodologies and the preparation of spectrum fees schedules; 2016
- [3] [ITU-D ITU Statistics](#); June 2019
- [4] ITU-R Report [SM.2012-6](#) (06/2018) Economic aspects of spectrum management
- [5] ITU-D [Economic contribution of broadband](#), digitization and ICT regulation, econometric modelling for Africa; 2019
- [7] ITU-D [exploring the value and economic valuation](#) of Spectrum; April 2012
- [8] Ofcom, [Annual licence Fees for 900 MHz and 1800 MHz](#) frequency bands; 2018
- [9] Ofcom Statement on the making of certain regulations in connection with [the award of 700 MHz and 3.6–3.8 GHz spectrum](#); 21 May 2019
- [10] Mazar H., Wiley book [Radio Spectrum Management: Policies, Regulations and Techniques](#); sub-chapter 4.3 Economic Environment; 2016
- [11] GSMA [Effective Spectrum Pricing](#): Supporting better quality and more affordable mobile services February 2017
- [12] GSMA [Spectrum pricing in developing countries](#), Evidence to support better and more affordable mobile services; July 2018
- [13] GSMA [Auction Best Practice](#) GSMA Public Policy Position May 2019
- [14] Plum Insight, [Vorsprung durch Econometrics: what drives spectrum value?](#) April 2016
- [15] Mazar H., Common Wealth Workshop, [Spectrum Re-Farming](#): Framework and Methodology; Yaoundé; 2 Nov. 2016
- [16] Mazar H. [Broadband RF Spectrum Audit](#), Lusaka; 19 April 2017
- [17] Mazar H. [Broadband Pricing Model](#), Lusaka; 19 April 2017
- [18] Coleago Consulting Ltd Increasing mobile broadband coverage through spectrum awards; Sept. 2019.

## 2.4 Lessons to learn from last spectrum auctions in Africa

ZICTA should be prudent before entering to a thorough Auction process, as:

- 1) Mozambique attempted to auction the 800MHz, 1,800MHz & 2,600MHz 2018. All 800MHz lots were sold only to Vodacom;
- 2) Ghana, between Nov & Jan 2018, also auctioned 800 MHz;
- 3) Ghana & Mozambique set reserve-price too high and actually failed;
- 4) In 2016 Nigeria attempted to auction the 2.6 GHz band. Only one operator acquired spectrum at the reserve price. For the others, reserve price was deemed too high;
- 5) Tanzania **successfully auctioned** the 700 MHz band;
- 6) South Africa prepares a spectrum auction. Regulator has committed to publishing an Information Memorandum with details of the auction before the end of year 2019.

## 2.5 Channel Arrangements at the 800 and 700 MHz bands

The Author recommends to use the FDD frequency arrangements at Recommendation ITU-R [M.1036](#) band-plan A3 (3GPP band-plan 20) at 800 MHz and [M.1036](#) band-plan A7 (3GPP band-plan 28) at 700 MHz, as shown:

*Table 1 Recommended Channel Arrangements at 700/800 MHz bands*

ITU/GPP band-plan	UL, Base station BS receive	DL, BS transmit UE receive
A3/20	832 MHz – 862 MHz	791 MHz – 821 MHz
A7/28	703 MHz – 748 MHz	758 MHz – 803 MHz

## 3. Best-Practices for 800 and 700 MHz bands

### 3.1 RF Assignments:

- 1) Assign RF only at the allocations of the ITU Radio Regulations to the MOBILE except aeronautical, at 700/800 MHz bands;
- 2) The channel-arrangements should follow Recommendation ITU-R. [M.1036](#);
- 3) Take into account RF spectrum restraints;
- 4) Disregard technology, assign technology-neutrality;
- 5) Assure coverage (including in rural and remote areas) and capacity obligations, to attain policy objectives;
- 1) Consider to re-farm the existent operators in the 800/700 MHz;
- 6) Consider active RF sharing;
- 7) Rollout time, about 12 months.

### 3.2 Process:

- 1) Fairness, transparency and efficiency should guide Administrations;
- 2) Keep the process as simple as possible;
- 3) Avoid unnecessary activities, that will delay the assignment;
- 4) Check if there is enough RF to all RF users;
- 5) When supply of RF is bigger than demand (more RF lots than competitors), check the Operators (beauty-contest) and prefer the administrative-auction: only initial price without Auction;
- 6) Learn lessons from the 800/700 MHz auctions in similar countries, that have (successfully or not) conducted a bidding process;
- 7) Use the last [ITU-D Statistics](#) for benchmarking;
- 8) Benchmarks do not capture the differences in value between operators;



- 9) Try to avoid complicated multiple-round / combinatorial-clock auctions, to save time (economic/legal/engineering processes) and money (external-consultants, bidder training, mock auctions and auction software tools);
- 10) Draft an information-memorandum and start Industry stakeholder- consultation;
- 8) Revenues from reserve-price or auctions may finance the transition to digital broadcasting and the re-farming;
- 9) High reserve and auction prices increase national revenues, but may raise the services costs and hurt competition, as Operators may refrain to buy RF or invest in infrastructure.

### 3.3 Reserve price:

- 1) Set appropriate initial reserve-prices: not too low (to avoid spectrum-caps, set-asides and spectrum-hoarding) and not too high (to promote competition);
- 2) A high reserve-price would result in complete auction failure, but this is a “good” failure, as the regulator can always start the process again;
- 3) “bad” failure: only one operator would acquire the spectrum which would be damaging to competitive dynamics and regulator would find it difficult to assign the unsold spectrum;
- 4) Set low but material reserve-price, to maximise auction participation and to recognise the burden that the coverage/capacity obligations would place on the operators.

### 3.4 RF Auctions:

- 1) The economic way to reveal the real value of the RDF spectrum;
- 2) Efficient use of spectrum: assign spectrum to those that will generate the greatest socio-economic benefit from its use;
- 3) Strive for maximum clarity and minimise confusion and ambiguity;
- 4) Include a clause *caveat-emptor*: monitor the RF before buying RF in a bid.

### 3.5 Annual Fees:

- 1) Set suitable annual-fees, also to prevent spectrum-hoarding;
- 2) Use Report ITU-R [SM.2012](#) 2018 ‘Economic aspects of spectrum management’. It details annual-fees in section 4.8 ‘Opportunity cost and administrative incentive pricing: simple, functional and linear equations’; contributed by Author.

## 4. Workshop Summary

The Revenue from Mobile Networks (RMN) is the best indicator to estimate the reserve-price for the 800/700 MHz Auctions. As RMN and GDP are strongly correlated,  $R^2=0.9162$ , GDP (easily found at web) may well estimate the auction reserve-price and the assignment administrative price.

## 5. Proposals

Detailed text and table at this subsection are published only to ZICTA

- 1 Main Operational Recommendations
- 2 Decisions are needed: mainly administrative uncertainties
- 3 Decisions are needed: mainly technical uncertainties
- 4 Normalizing the results in Ghana, Mozambique Tanzania to Zambian economy
- 5 Re-farming.

## Annex- Some Pictures



