

STRUCTURE OF PRESENTATION

1. Introduction
2. Understanding Spectrum: Technology, History of Regulation, Economics
3. Current Assignment of Radio Spectrum in South Africa
4. DCDT's / ICASA's Understanding of Competition and Open Access
5. Assignment of Emergency Spectrum 2020 and Planned Spectrum Auction
6. An Outlook on Future Requirements of Spectrum Utilization
7. Key Results of SEIA on South Africa's Spectrum Policy

1.

Introduction & Structure: FMF Media Event

1. Introduction: Structure SEIA & FMF Media Event (1/2)

Key Questions guiding the SEIA of South Africa Government's spectrum politics

The following 5 key questions guide the discourse in the 5 key chapters:

1. Do technological facts, historical experience and economic theory back the view of spectrum as a particular (scarce) resource that requires public spectrum ownership and assignment to avoid market failure and justify the current regulatory framework?
(Chapter 2: *Understanding Spectrum: Technology, History of Regulation, Economics*)
2. Have the spectrum policies, for which the DCDT and ICASA are responsible, created the conditions for the mobile industry to achieve the government's socioeconomic goals of rural broadband coverage (to bridge the digital divide) and lower (effective) broadband data prices?
(Chapter 3: *Current Assignment of Radio Spectrum in South Africa*)
3. Does the government's use of the regulatory toolset in relation to competition economics strike a balance between supporting the key players in the mobile industry and keeping the market open for entry guided by evidence-based policymaking for the sake of consumer prosperity?
(Chapter 4: *DCDT's / ICASA's Understanding of Competition and Open Access*)
4. Is the assignment of emergency spectrum in combination with the upcoming auction planned, due to take place by March 2021, likely to put an end to the unfortunate spectrum and competition policies of government? Is the WOAN needed?
(Chapter 5: *Assignment of Emergency Spectrum 2020 and Planned Spectrum Auction*)
5. Is the current regulatory framework of assigning spectrum to MNOs (and other economic entities) on an exclusive basis fit for the future of further massive increases in data demand and new uses cases in the 5G/IoT world?
(Chapter 6: *An Outlook on Future Requirements of Spectrum Utilization*)

1. Introduction: Structure SEIA & FMF Media Event (2/2)

Structure of SEIA

1. Introduction
2. Understanding Spectrum: Technology, Economic Logic & History of Spectrum Regulation
3. Current Assignment of Radio Spectrum in South Africa
4. DCDT's / ICASA's Understanding of Competition and Open Access
5. Assignment of Emergency Spectrum 2020 and Planned Spectrum Auction
6. An Outlook on Future Requirements of Spectrum Utilization



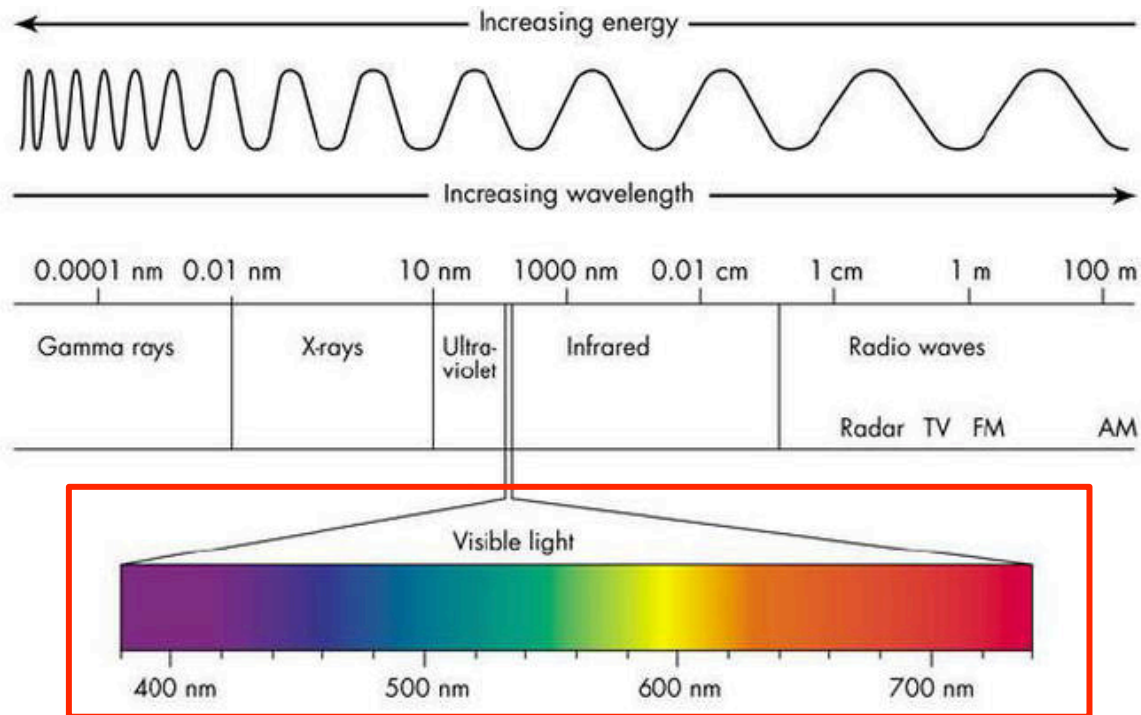
Media Event

1. Introduction
2. Understanding Spectrum: Technology
3. Current Assignment of Radio Spectrum in South Africa
4. DCDT's / ICASA's Understanding of Competition and Open Access
5. Assignment of Emergency Spectrum 2020 and Planned Spectrum Auction
— Economic Logic & History of Spectrum Regulation —
6. An Outlook on Future Requirements of Spectrum Utilization

2. Understanding Spectrum: Technology

2. Understanding Spectrum: Technology

Spectrum Use in Mobile Telecommunication



FREQUENCY RANGE

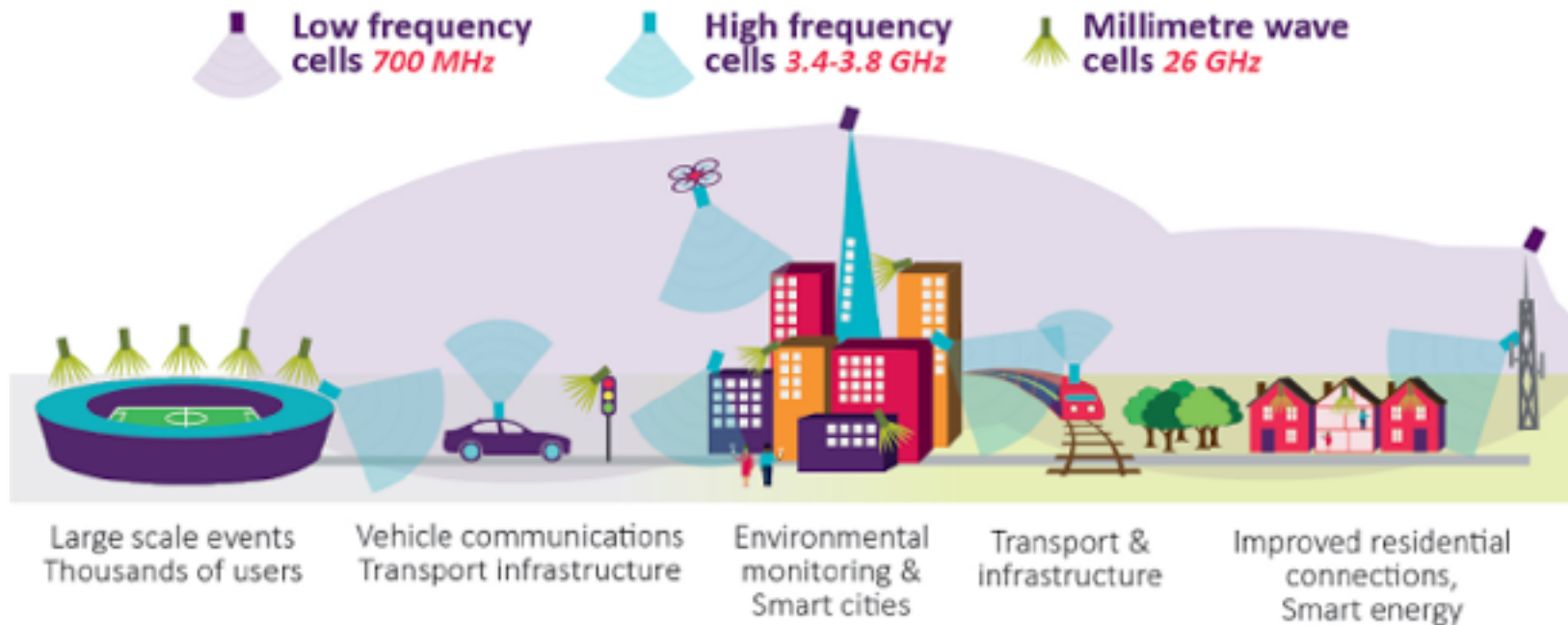
- Spectrum: The fuel of MNOs
- Frequency = electromagnetic wave
- Spectrum band = a specific frequency range of electromagnetic radiation
- Different frequency ranges have different propagation characteristics
- Regulatory model of “licensed carrier” hinges on licensing spectrum on an exclusive-use basis → unusual !

2. Understanding Spectrum: Technology

Spectrum Use in Mobile Telecommunication

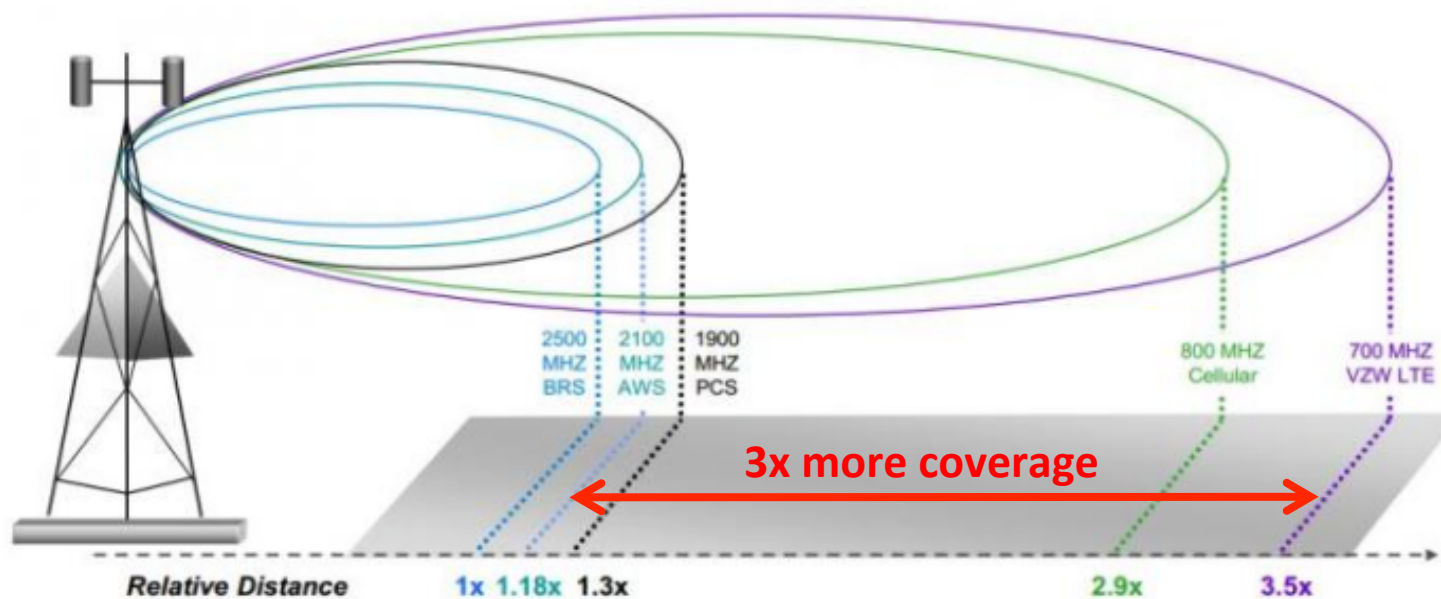
LOW FREQUENCIES → LESS DATA CAPACITY → BETTER COVERAGE → RURAL AREAS

HIGH FREQUENCIES → HIGHER DATA CAPACITY → LOWER COVERAGE → DENSE URBAN AREAS



2. Understanding Spectrum: Technology

The Relationship of Frequency Band and Coverage Range



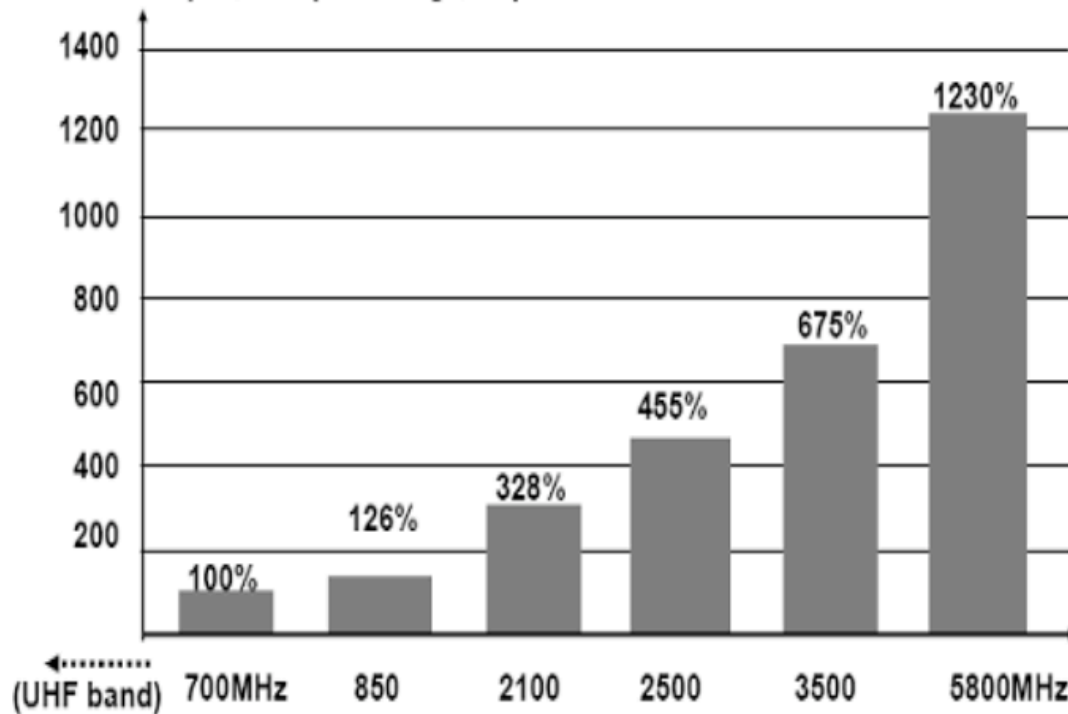
- LTE network rollout 700 MHz-band: **3 times** the coverage compared to 2.1 GHz ($3.5 / 1.18 = 2.97x$; given a similar demand profile)
- LTE network rollout 800MHz-band: **2 times** the coverage compared to 1800 MHz (ITU 2006)

Graph: Verizon (2006)

2. Understanding Spectrum: Technology

The Relationship of Coverage Range and Investment Cost (CAPEX)

Relative CAPEX in % required for network rollout**



- PhD thesis by Wisely (2019): *Capacity and Costs for 5G Networks in Dense Urban Areas*
- **3.28x** the CAPEX in 2.1 GHz band compared to 700 MHz

Graph: Wisely (2019)

2. Understanding Spectrum: Technology

The Advantages of Carrier Aggregation

Carrier Aggregation (CA):

Refers to a technique employed in the radio network that uses spectrum in different frequency bands by combining two or more carriers to increase the performance of the network.

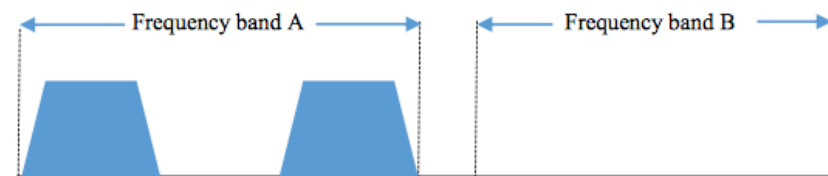
Types of Carrier Aggregation*

Intraband contiguous



Component
Carrier (CC)

Intraband non-contiguous



Interband



*Graph: Ahmed (2018)

2. Understanding Spectrum: Technology

The Advantages of Carrier Aggregation

GOVERNMENT'S FAILED DIGITAL MIGRATION:

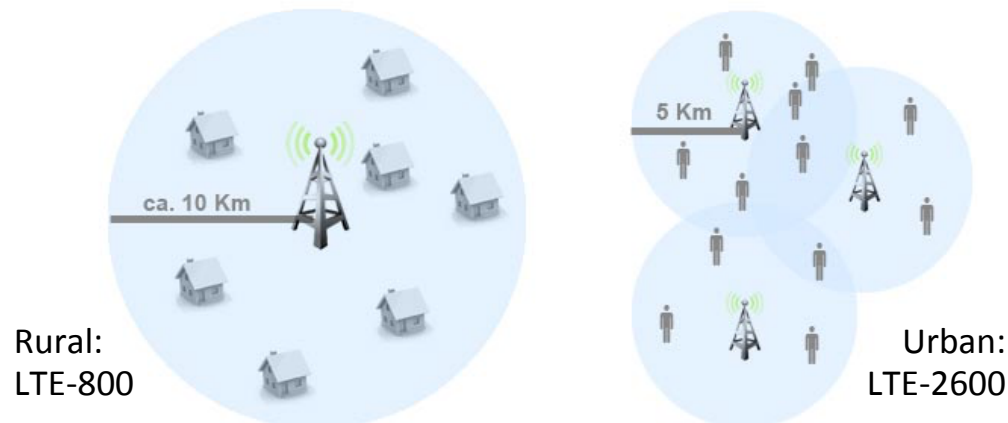
- 700/800MHz-bands not available to be used by MNOs
- Broadcasters still occupying 700/800MHz-bands for analogue TV services
- Spectrum is “dirty” → parallel use by MNOs would lead to interference
- Efficiency benefits of Carrier Aggregation cannot be reaped by MNOs

*Graph: Ahmed (2018)

2. Understanding Spectrum: Technology

The Advantages of Carrier Aggregation

Most common CA combination: LTE-800 and LTE-2600*



Advantages of carrier aggregation:

- More efficient use of spectrum; increased uplink and downlink data rates
- Leveraging of underutilized spectrum
- Sub-1 GHz LTE improves in-building penetration in dense urban areas
- Dynamic switching across carrier components

- ➔ **Higher capacity:** doubles data rates; reduces latency by 50%
- ➔ **Scalability:** Expanded coverage allows to scale networks faster
- ➔ **Power savings:** 31% according to Falkenberg et al. (2017)

*Graph: <https://arxiv.org/pdf/1702.05251.pdf>

2. Understanding Spectrum: Technology

The Technological Impact of Failed Spectrum Regulation

UNAVAILABILITY OF SPECTRUM IN 700/800MHz-bands:

- = Less coverage and worse performance in rural areas**
- = Less capacity and worse performance in urban areas**
- ➔ Adverse socioeconomic impact imposed on consumers due to regulatory constraints inhibiting the use of efficient radio technology**

*Graph: Ahmed (2018)

3.

Current Assignment of Radio Spectrum in South Africa

3. Current Spectrum Assignment in SA

Fixed Spectrum Assignment before Lockdown

Fixed Spectrum Assignment (IMT Bands)*	700/ 800**	900	1800	2100	2300	2600	3500	3700***	Total
VODACOM		22	24	35					81
MTN		22	24	40					86
CELL C		22	24	30					76
TELKOM			24	30	60		28		142
RAIN			34			20		80	134
LIQUID	10		24				56		90
TOTAL	10	66	154	135	60	20	84	80	609

*Icasa_Discussion-document-on-the-market-inquiry-into-mobile-broadband-services.pdf; **10 MHz in 850 MHz; ***80 MHz in 3.7 GHz band no IMT band

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27%

*Icasa_Discussion-document-on-the-market-inquiry-into-mobile-broadband-services.pdf; **10 MHz in 850 MHz; ***80 MHz in 3.7 GHz band no IMT band

Key problem not average assignment to operators but to **which** operator spectrum is assigned in **what** bands:

- Vodacom and MTN only assigned 167 MHz spectrum = 27% of total spectrum
- No spectrum assignment in 700/800 MHz digital dividend bands
- No spectrum assignment in 2.3, 2.6 and 3.5 GHz bands to Vodacom and MTN

3. Current Spectrum Assignment in SA

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Key problem not **how** much assignment to operators but to **which** operator spectrum is assigned in **what** bands:

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- No spectrum assignment in 700/800 MHz digital dividend bands
- No spectrum assignment in 2.3, 2.6 and 3.5 GHZ bands to Vodacom and MTN

3. Current Spectrum Assignment in SA

International Comparison of Spectrum Availability in LTE Bands

Country	GDP / Capita (current US\$)	LTE ¹ 700/800	LTE ¹ 2.6	LTE 1.7/1.8/1.9	LTE 2.1/2.3
South Africa	6.4	--- NONE --- ²		B3	B1, B40 ⁴
Russia	11.6	B20	B7, B41	B3	B38
China	10.3	B20	B41	B3	B1, B40
Brazil	8.7	B28	B7	B3	---
India	2.1	B5, B8	B41	B3	B40
Mexico	9.9	--- ³	B7	B4	---
Peru	7.0	B28	---	B2, B4	B40
Colombia	6.4	B28	B7	B4	---
Philippines	3.5	B28	B41	B3	B40
Morocco	3.2	B20	B7	B3	---
Egypt	3.0	---	---	B3	B1
Nigeria	2.0	B20	B7	B3	---

¹Only retail MNOs considered; ²Rain has spectrum in B39; ³ALTAN Redes in B28 (the Mexican equivalent of a WOAN), ⁴Telkom only

*Wholesale carrier RAIN has 20 MHz in the 2.6 GHz band on which Vodacom roams.

- Total spectrum endowment to retail MNOs* in South Africa very low compared to BRICS member states and countries with similar GDP per capita.
- Socioeconomic opportunity costs in SA, however, not due to total level of spectrum assignment but
 - i. **unavailability of spectrum in 700/800 MHz and 2.6 GHz bands**
 - ii. **no 3.5GHz spectrum assigned yet**

3. Current Spectrum Assignment in SA

High Socioeconomic Cost due to Failed Regulatory Policies

- Gains of **digital-dividend spectrum** cannot be reaped due to failed digital migration
 - ➔ **less coverage and higher (effective) prices in rural areas**
- Benefits of **carrier aggregation** combining LTE-800 and LTE-2600 cannot be reaped
 - ➔ **worse network economics and higher prices in dense urban areas**

4.

DCDT's / ICASA's Understanding of Competition and Open Access

4. DCDT's / ICASA's Take on Competition and Open Access

Defining “Ineffective Competition”

In the opinion of the key various public authorities involved in the regulation of mobile telecommunication market—in the presented study the DCDT, ICASA, and CompCom “effective” competition is given when it meets three simple criteria:

1. there must be many players in the market
→ the more players the better (more players are better than fewer);
2. no player must have a market share of significant scale in any of what authorities define as “relevant” markets
→ the lower the market share the better;
3. players in such markets must not own or dispose of assets of exclusive use that may protect their competitive position
→ the less discretion over one's rightfully acquired assets the better.

4. DCDT's / ICASA's Take on Competition and Open Access

Defining “Ineffective Competition”

- Quote from the *Market Inquiry*:

“The Authority considers a market for roaming services that has a geographic dimension at least as narrow as local and metropolitan municipal areas. This is based on, among other factors, the nature of roaming agreements in South Africa which have geographic limitations. These markets are ineffectively competitive as only MTN and Vodacom have substantial coverage in many municipalities. From a network capacity perspective, measured by number of network sites, MTN is dominant (has a market share of 45% or more) in 34 local and metropolitan municipalities, Vodacom is dominant in 86 and MTN and Vodacom both have a **market share exceeding 45% in 15 municipalities.**” (emphases added)

➔ **pre-emptive of auction design 2021**

4. DCDT's / ICASA's Take on Competition and Open Access

Defining "Ineffective Competition"

The basis of SA regulatory authorities logic of reasoning:

45 it is!

4. DCDT's / ICASA's Take on Competition and Open Access

Defining “Ineffective Competition”

ICASA's logic of reasoning: 45% !

- Verdict “ineffective competition” is derived from section 7 of the Competition Act, which the authors quote;
- 45% is constitutive of dominance
- Dominance means that markets are failing:
 - ➔ Implying consumers are harmed and regulatory intervention is warranted;
 - ➔ Hence, markets are ineffectively competitive because MTN and Vodacom have done their job;

4. DCDT's / ICASA's Take on Competition and Open Access

Defining "Ineffective Competition"

- **Right question: What is effective competition?**
- **But 45% the wrong answer!**
 - ➔ **No scientific basis (arbitrary)**
 - ➔ **Ignores real competitive market forces**
 - ➔ **Competitive pressure from international technology developments**

4. DCDT's / ICASA's Take on Competition and Open Access

The Notions of “Openness” and “Non-Discrimination”

In their *National Integrated ICT Policy White Paper* (dated 28 September 2016), DCDT argues for the need of the WOAN by referring to a list of “open access” principles organized in five bullets:

- Openness;
- Transparency;
- Equal access and non-discrimination;
- Sharing and non-duplication;
- Efficiency, standardisation and reasonableness.

Not definitions
provided by DCDT

→ SEIA Chapter 4: “DCDT / ICASA’s Understanding of Competition and Open Access”

4. DCDT's / ICASA's Take on Competition and Open Access

The Notions of “Openness” and “Non-Discrimination”

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- Openness;
- Transparency;
- **Equal access and non-discrimination;**

Definition of “non-discrimination”: “All access seekers must be granted access to networks in a non-discriminatory manner; a vertically integrated infrastructure provider **cannot favour services** affiliated with its own company.”

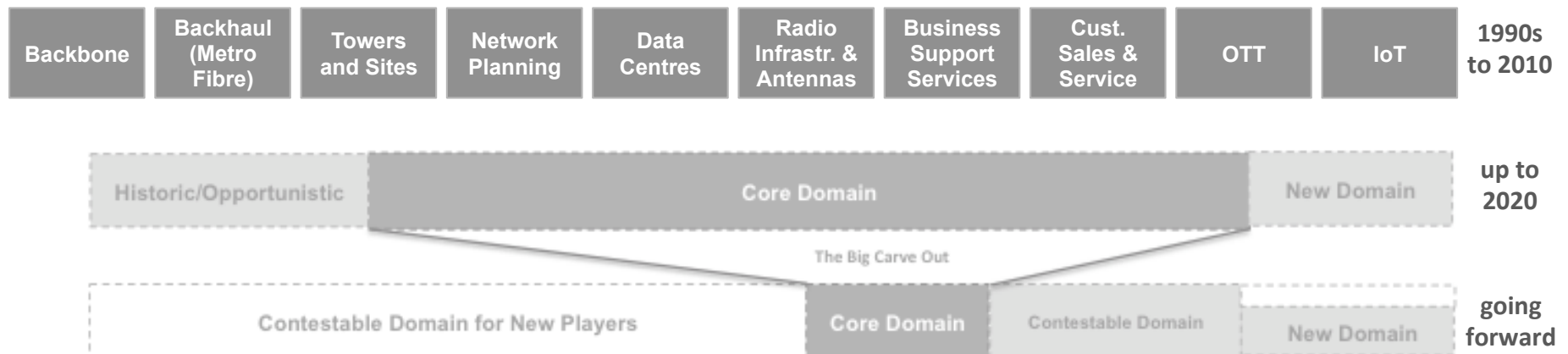
- ➔ Of course they can ... and should.
- ➔ **Discrimination on the basis of price and resource employment is the very basis of competition—that is, economics.**

➔ SEIA Chapter 4: “DCDT / ICASA’s Understanding of Competition and Open Access”

4. DCDT's / ICASA's Take on Competition and Open Access

Key Question: Do Regulatory Actions meet Criterion of Evidence-Based Policy-Making? (1/4)

- Evolution of MNO value chain and functions from 1990s to 2021+:



- 1990s - 2010: GSM voice and SMS provider → vertically integrated
- Up to 2020: Data connectivity provider → outsourcing of infrastructure
- Going forward: Service provider → value chain disintermediation

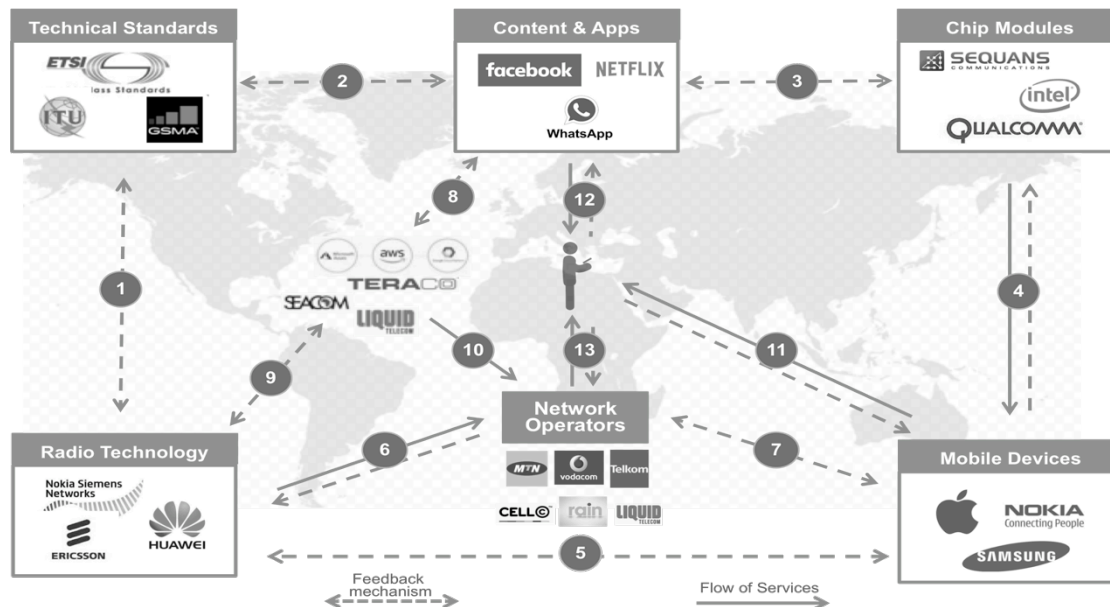
4. DCDT's / ICASA's Take on Competition and Open Access

Key Question: Do Regulatory Actions meet Criterion of Evidence-Based Policy-Making? (2/4)

- ICASA's *Market Inquiry into Mobile Broadband Services* took a narrow view of "relevant markets" which they define for purposes of establishing dominance:
 - consumer retail markets,
 - Infrastructure (and roaming) services between carriers.
- Definition of relevant markets only considers competitive driving forces playing out **in** South Africa and **among** mobile network operators
- But what about the supply-side competitive forces that explain the enormous technology leaps in the past 25 years?
 - ➔ **MNOs have no control over global technological trends**
 - ➔ **Technological innovations a result of consumer demand**

4. DCDT's / ICASA's Take on Competition and Open Access

Key Question: Do Regulatory Actions meet Criterion of Evidence-Based Policy-Making? (2/4)



Aggregators of technologies:

- Technical standards (DWDM, data compression)
- Chip technology & smartphones
- Radio network technology (GSM to 5G, MiMo, Cloud RAN, NFV)
- Architecture (Edge data centre, content localization)
- Content and Apps

MNOs 1990s:

Vertically integrated networks producing and selling GSM voice & SMS

MNOs 2010s:

Technology aggregators intermediating IP data on behalf of content & app providers

MNOs 2030s:

Digital services company? Disintegrating into the cloud?

4. DCDT's / ICASA's Take on Competition and Open Access

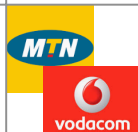
Key Question: Do Regulatory Actions meet Criterion of Evidence-Based Policy-Making? (3/4)

Retail Market Pressure - Agnostic Consumer -

- Unlimited data / high speed
- Coverage everywhere
- Reliability / seamlessness
- Service fragmentation (IoT)

Technological Innovation Pressure - Dispersion of (Value-Chain) Knowledge -

- Radio technology
- Antenna technology
- Edge computing
- IoT eco-system
- Network slicing
- DSS
- DAS



- Rural coverage; cheap data
- Fiscal revenue, taxation target*
- Regulatory activism
- Political-economic ideology (& agendas)

Regulatory-Political Pressure - Still Living in the 20th Century -

- TowerCos and other infra providers
- Fibre networks and DAS
- OTT (and upcoming IoT) providers
- Hyperscalers and small cell operators

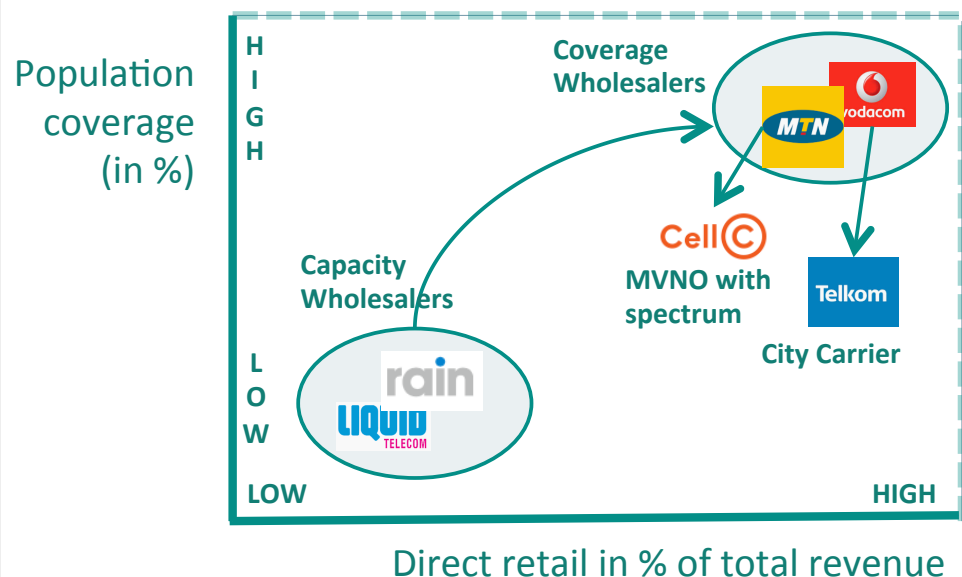
Value Chain Pressure - Farewell to the Orderly Carrier World -

- Answer to the question: No
- The leading carriers are under pressure from three **market** forces:
 - Agnostic consumers
 - Innovation pressure from technology champions
 - Value chain pressures by infrastructure providers and mobile network substitutes, e.g. fibre providers, OTT providers, hyperscalers

*MNOs' formal revenue provide a convenient "tax-handle." See IMF Working Paper (2017): *Taxing telecommunication in developing countries*

4. DCDT's / ICASA's Take on Competition and Open Access

Key Question: Do Regulatory Actions meet Criterion of Evidence-Based Policy-Making? (4/4)

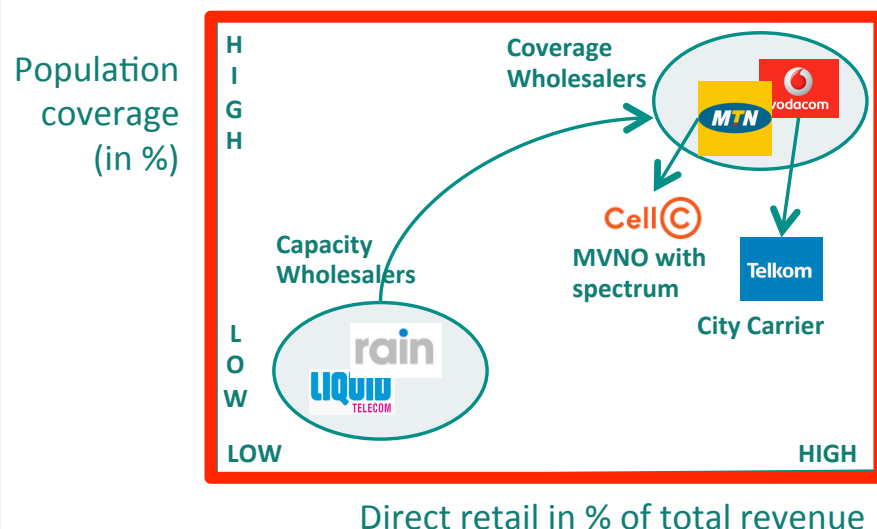


- The two competing country-wide mobile networks: roaming off-takers and roaming providers
- Two wholesale-only MNOs: Liquid Telecom and Rain (does provide retail offering to limited extent)
- **Cell C moving towards MVNO-type network asset structure through roaming agreements with MTN (and Vodacom lately)**
- **Telkom benefits from a roaming agreement with Vodacom relying on their extensive geographical footprint**

4. DCDT's / ICASA's Take on Competition and Open Access

Key Question: Do Regulatory Actions meet Criterion of Evidence-Based Policy-Making? (4/4)

Does South Africa need a Wholesale Open Access Provider (WOAN)?

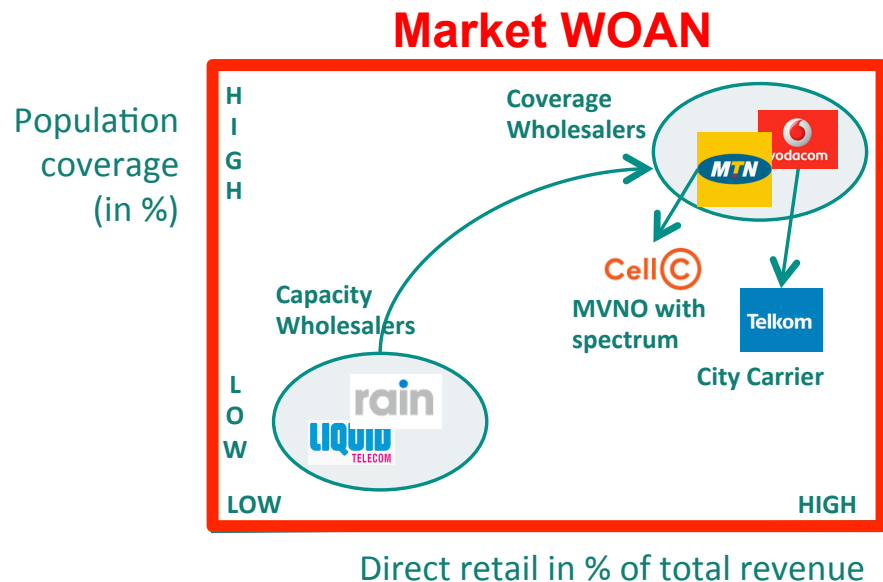


- ➔ Networks established by 6 MNOs have been converging into one telecommunication infrastructure eco-system
- ➔ for the benefit of consumers

4. DCDT's / ICASA's Take on Competition and Open Access

Key Question: Do Regulatory Actions meet Criterion of Evidence-Based Policy-Making? (4/4)

Does South Africa need a Wholesale Open Access Provider (WOAN)?



- No, we do not need another WOAN !
- South Africa does already have a WOAN:
→ a market-based WOAN
- The networks of all MNOs are open to be used by other MNOs subject to voluntary commercial agreement

4. DCDT's / ICASA's Take on Competition and Open Access

Key Question: Do Regulatory Actions meet Criterion of Evidence-Based Policy-Making? (4/4)

On which basis have regulatory authorities planned to establish the WOAN?

- Invitation to apply to the spectrum auction does the trick
- **For MNOs to be able to participate in the spectrum auction, they are compelled to off-take 30% of the capacity of the WOAN**
 - Opposite of voluntary change
 - Coercing MNOs into agreements
 - No international evidence that such artefacts will be to the benefit of consumers

5.

Assignment of Emergency Spectrum 2020 and Planned Spectrum Auction 2021

5. Emergency Spectrum and Planned Spectrum Auction

Assignment of Emergency Spectrum

Table 1: Fixed Spectrum Assignment (IMT Bands)	700/800	1800	2100	2300	2600	3500	Total
VODACOM		24	35	NONE			59
MTN		24	40				64
CELL C		24	30				54
TELKOM		24	30	60		28	142
RAIN		34			20	80	134
LIQUID	10	24				56	90
TOTAL	10	154	135	60	20	164	543

*Icasa_Discussion-document-on-the-market-inquiry-into-mobile-broadband-services.pdf

Table 2: Emergency Spectrum Assignment	700/800	1800	2100	2300	2600	3500	Total
VODACOM	40			20	50	50	160
MTN	40				50	50	140
CELL C							0
TELKOM	40			20	40	12	112
RAIN					30		30
LIQUID						4	4
TOTAL	120	0	0	40	170	116	446

Spectrum could not be employed

Spectrum usable

- Of the 446 MHz spectrum assigned temporarily on an emergency basis, 66 MHz is in frequency bands in which MNOs currently operate radio infrastructure, i.e. $66 / 446 = 15\%$.
- 0 % of 300 MHz of emergency spectrum granted to MTN and Vodacom immediately usable.
- 120 MHz in the digital-dividend band “dirty.”

5. Emergency Spectrum and Planned Spectrum Auction

Assignment of Emergency Spectrum

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Spectrum could not be employed

Spectrum usable

- Vodacom and MTN did not have any spectrum in 2.3, 2.6 and 3.5GHz-bands so far.
- Required for efficient production of broadband data in dense urban areas.
- Vodacom and MTN rolled out hundreds of BTS in the 2600 GHz band ...
- ... despite the considerable uncertainty associated with rolling out infrastructure based on temporary spectrum use licenses.

5. Emergency Spectrum and Planned Spectrum Auction

Spectrum planned to be auctioned by March 2021

Planned Spectrum to be on Auction by 30/03/2021	700	800	800	2600	3500	3500	3500	Total
Lots per Lot Category	4	4	1	14	1	8	1	34
Lot Size in MHz	2 x 5	2 x 5	2 x 10	1 x 10	1 x 2	1 x 10	1 x 4	
Total Spectrum	40	40	20	140	2	80	4	326
Reserve Price per Lot (in bn ZAR)	0.53	0.75	1.16	0.10	0.01	0.08	0.02	
Revenue per Lot Category (in bn ZAR)	2.11	3.01	1.16	1.40	0.01	0.60	0.02	8.3
Price per MHz (in m ZAR)	52.70	75.20	57.75	10.00	5.00	7.56	4.90	25.5

Planned Spectrum Assignment by 30/03/2021 incl. WOAN	700	800	800	2600	3500	3500	3500	Total
Existing MNOs	40	40	20	140	2	80	4	326
WOAN	20				30	30		80
TOTAL	60	40	20	140	32	110		406

*2300 band excluded from spectrum auction (see Icasa announcement 30/09/2020)

→ SEIA Chapter 5: "Assignment of Emergency Spectrum 2020 and Planned Spectrum Auction"

5. Emergency Spectrum and Planned Spectrum Auction

Spectrum planned to be auctioned by March 2021

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Revenue per Lot Category (in bn ZAR)	2.11	3.01	1.16	1.40	0.01	0.60	0.02	8.3
Price per MHz (in m ZAR)	52.70	75.20	57.75	10.00	5.00	7.56	4.90	25.5
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*2300 band excluded from spectrum auction (see Icasa announcement 30/09/2020)

“Dirty”

→ SEIA Chapter 5: “Assignment of Emergency Spectrum 2020 and Planned Spectrum Auction”

5. Emergency Spectrum and Planned Spectrum Auction

Spectrum planned to be auctioned by March 2021 – Opt-in Scheme

Market Inquiry study informed the definition of Tier-1 and Tier-2 MNOs that ICASA applies to the auction:

- Tier-1 MNOs: MTN and Vodacom
“A Wholesale National Operator that has a retail market share in excess of 45% in more than 10 municipalities”*
- Tier-2 MNOs: Cell C, Liquid, Rain and Telkom
“A Wholesale National Operator that has a retail market share **below** (sic!) 45% in less than 10 municipalities.”*

Opt-in Scheme of ITA:

- Gives Tier-2 carriers a pre-emptive right to acquire spectrum prior to the auction process taking place.

*ICASA, Invitation to Apply (ITA), Notice 535 of 2020

5. Emergency Spectrum and Planned Spectrum Auction

Spectrum planned to be auctioned by March 2021 – Opt-in Scheme

The Definition of Tier-1 and Tier-2 MNOs by ICASA:

- Tier-1 MNOs: MTN and Vodacom
“A Wholesale National Operator that has a retail market share in excess of 45% in more than 10 municipalities”*
- Tier-2 MNOs: Cell C, Liquid, Rain and Telkom
“A Wholesale National Operator that has a retail market share below 45% in less than 10 municipalities.”*

	Frequency Bands	Spectrum at Auction in March 2021	Tier-2 Opt-in Spectrum (ITA 2 Oct 2020)	Tier-2 Opt-in Spectrum (revised ITA)	Tier-1 minimum spectrum after Tier-2 opt-in
Sub-1 GHz portfolio	700/800	100	50	50	50
Above-1 GHz portfolio	2600	140	100	100	at least 40
	3500	86	-		none

Original ITA:
3.5 GHZ excluded

*ICASA, Invitation to Apply (ITA), Notice 535 of 2020

5. Emergency Spectrum and Planned Spectrum Auction

Spectrum planned to be auctioned by March 2021 – Opt-in Scheme

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Sub-1 GHz portfolio	700/800	100	50	50
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	3500	86	-	none

Opt-in Scheme as per original ITA (2 October 2020):

- Opt-in portfolios divided into sub-1GHz 700/800 MHz and and >1GHz 2.6/3.5 GHz
- **Original ITA: 100 MHz opt-in reserve applicable to 2.6GHz band only**
- **leaving at least 40 MHz to Tier-1 carriers MTN and Vodacom**

*ICASA, Invitation to Apply (ITA), Notice 535 of 2020

5. Emergency Spectrum and Planned Spectrum Auction

Spectrum planned to be auctioned by March 2021 – Opt-in Scheme

	Frequency Bands	Spectrum at Auction in March 2021		Tier-2 Opt-in Spectrum (revised ITA)	Tier-1 minimum spectrum after Tier-2 opt-in
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	3500	86			none

Retrospective Amendment of Opt-in Scheme :

- 100 MHz opt-in right for the aggregate 226 MHz in the bands of 2.6 & 3.5 GHz
- 140 MHz in 2.6GHz and 86 MHz in 3.5GHz band to be assigned

➔ If Tier-2 carriers opt-in for 86 out of 100 MHz, this would leave no 3.5 GHz spectrum left for Vodacom and MTN to bid for

EXCURSUS: Understanding Spectrum History

The Regulatory System until the 21st Century

- Short excursus into the history of spectrum use and regulation.
- Important to understand the logic of the current regulatory system and the failures of South Africa's regulatory authorities
- **Key question: Is there anything in the nature of the resource “spectrum” that warrants a different treatment compared to other economic resources?**
 - Are there technological characteristics that makes spectrum more prone to market failure than other resources?
 - Does economic logic applicable to the production and consumption of milk, cars and oil not apply to spectrum?

EXCURSUS: Understanding Spectrum History

The Regulatory System until the 21st Century

- Broadcasting markets developed on basis of homesteading from 1920 onwards
- All interference cases settled on a private arbitration basis
- In 1926, *Oak Leaves* legal decision established de facto spectrum property rights → much to the displeasure of government

EXCURSUS: Understanding Spectrum History

The Regulatory System until the 21st Century

- In 1926, *Oak Leaves* legal decision established private spectrum property rights
→ much to the displeasure of government
- Hoover administration passed legislation that guaranteed each spectrum applicant a broadcast license in the spectrum band they chose to operate in at not cost—**regardless of whether or not other broadcasters were already operating in the chosen frequency band:**
 - Deliberate creation of interference by state authorities
 - Violation of property rights
 - No market failure !
- The narrative that regulation was required to avoid interference—parroted by mainstream economic textbooks to this day—is a fairytale invented by legislators.

EXCURSUS: Understanding Spectrum Economics

RECEIVED ECONOMIC WISDOM: Spectrum to be regulated in the public interest to avoid interference

The tautological views of regulators: Spectrum is a scarce and finite resource.

- DCDT (2008) on the benefits of regulation: “Efficient use of the frequency spectrum; a **public** and **scarce** resource.”
- MaCaskill (Ofcom, 2019) “Wireless spectrum is a valuable, **finite** resource, so it’s vital we use it efficiently.”

Three key questions to raise:

- Q1:** What does it mean to say that spectrum a “scarce” resource?
- Q2:** What does it mean to say that spectrum a “finite” resource?
- Q3:** Does the nature of spectrum warrant a different treatment, i.e. public ownership and regulation, compared to other productive resources?

EXCURSUS: Understanding Spectrum Economics

RECEIVED ECONOMIC WISDOM: Spectrum to be regulated in the public interest to avoid interference

The tautological views of regulators: Spectrum is a scarce and finite recourse.

Q1: What does it mean to say that spectrum a “scarce” resource?

- All resources are scarce
- In the free market, it is prices that inform market participants about relative levels of scarcity
- Regulatory provisions dictate exclusive use and prohibit trading
- No trading of spectrum, no market prices for spectrum
- The consequence of the absence of markets is that resources become particularly scarce and the allocation of publically administered goods is particularly dismal

Regulatory spectrum hoarding in South Africa a prime example

EXCURSUS: Understanding Spectrum Economics

RECEIVED ECONOMIC WISDOM: Spectrum to be regulated in the public interest to avoid interference

The tautological views of regulators: Spectrum is a scarce and finite recourse.

Q2: What does it mean to say that spectrum a “finite” resource?

- All resources are finite
- If that were not the case, there would be no reason to economize on resources
- It is the task of entrepreneurs to make resources less finite

Applied to the mobile sector in SA: The release of spectrum in the 700/800MHz-band would allow for cheaper production of rural broadband connectivity:

- ➔ Production of data in 700/800MHz-band **less finite** than in 1.8/2.1GHz-bands, which MTN and Vodacom currently employ to produce 3G/4G data
- ➔ Better coverage, less investments, lower effective prices

EXCURSUS: Understanding Spectrum Economics

RECEIVED ECONOMIC WISDOM: Spectrum to be regulated in the public interest to avoid interference

The tautological views of regulators: Spectrum is a scarce and finite recourse.

Q3: Does the nature of spectrum warrant a different treatment, i.e. public ownership and regulation, compared to other productive resources?

Answer: NO! Spectrum is as special and unique as all other resources

- Same economic principles of entrepreneurial resource allocation apply as to all other resources such as cars, milk or oil
- Why would market participants not find workable exchange mechanisms to allocate the indeed valuable resource “spectrum” when they succeed in the allocation of possibly far more critical resources?
- For example, resources for the production of HIV treatment and solar panels
 - ➔ Assumption of stupidity
 - ➔ History between 1920 and 1926 confirmed that market-based spectrum allocation worked

6.

An Outlook on Future Requirements of Spectrum Utilization

6. An Outlook on Future Requirements of Spectrum Utilization

The Future World of 5G / IoT: Economizing on Spectrum

Net Neutrality: Remember the discussion?

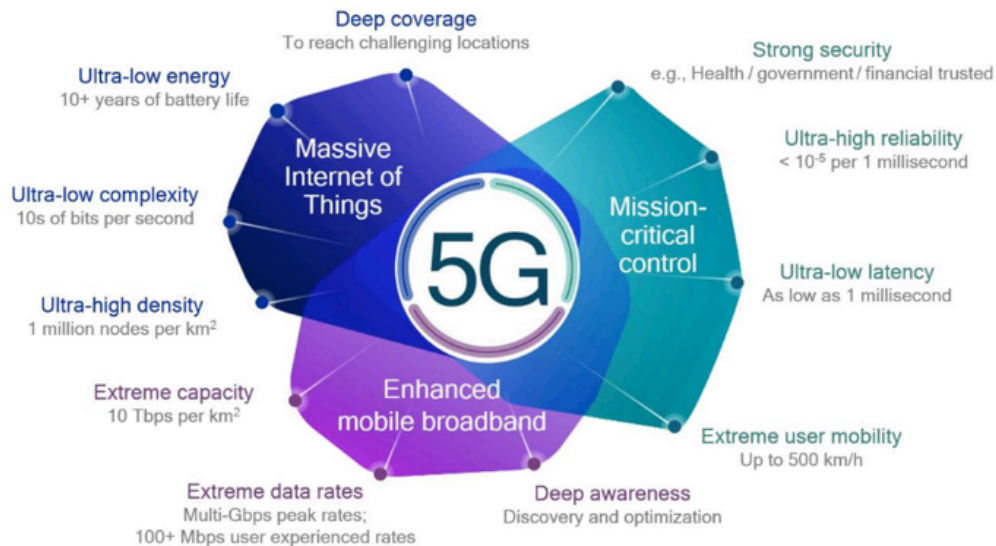
- No discrimination of user groups
- No prioritization of traffic based on price
- No capacity discrimination
- Homogeneous (non-discriminatory) pricing

➔ Romantic ideas about perfect economic equality irrespective of resource constraints and different degrees of economic importance

6. An Outlook on Future Requirements of Spectrum Utilization

The Future World of 5G / IoT: Economizing on Spectrum

Main 5G/IoT Usage Scenarios*



Future 5G/IoT World: Discriminate me, please!

- Mission-critical services to be prioritized
- Spectrum usage and data pricing based on QoS and SLA categories
- Dynamic utilization of spectrum and network elements based on demand patterns

→ SEIA Chapter 6: “The overwhelmed regulator” and “The overwhelmed MNO”

*Graph: Qualcomm (2019)

7.

Key Results of SEIA on South Africa's Spectrum Policy

7. Key Results of SEIA on South Africa's Spectrum Politics

Answers to Key Questions guiding the SEIA of South Africa Government's spectrum politics

Answers to the 5 key questions:

- Do technological facts, historical experience and economic theory back the view of spectrum as a particular (scarce) resource that requires public spectrum ownership and assignment to avoid market failure and justify the current regulatory framework?
No.
- Have the spectrum policies, for which the DCDT and ICASA are responsible, created the conditions for the mobile industry to achieve the government's socioeconomic goals of rural broadband coverage (to bridge the digital divide) and lower (effective) broadband data prices?
No. Public policies imposed high opportunity costs on consumers, in particular on the rural population and the urban poor.
- Does the government's use of the regulatory toolset in relation to competition economics strike a balance between supporting the key players in the mobile industry and keeping the market open for entry guided by evidence-based policymaking for the sake of consumer prosperity?
No. Regulatory policies have been hostile to leading network carriers depriving them of spectrum for 15 years.
- Is the assignment of emergency spectrum in combination with the upcoming auction planned, due to take place by March 2021, likely to put an end to the unfortunate spectrum and competition policies of government?
Hope to support this conjecture is justifiable, provided that digital migration is completed and the market is not burdened by the creation of an extractive WOAN artefact.
- Is the current regulatory framework of assigning spectrum to MNOs (and other economic entities) on an exclusive basis fit for the future of further massive increases in data demand and new uses cases in the 5G/IoT world?
No. Regulatory frameworks and role of regulators will have to dramatically change to allow MNOs to effectively accommodate future consumer needs and reap technological benefits of 5G networks / IoT services.