# Differences In Spectrum Regulation Between Developing and Developed Markets

**EUROPE (SWEDEN CASE) AND AFRICA (SUDAN CASE)**


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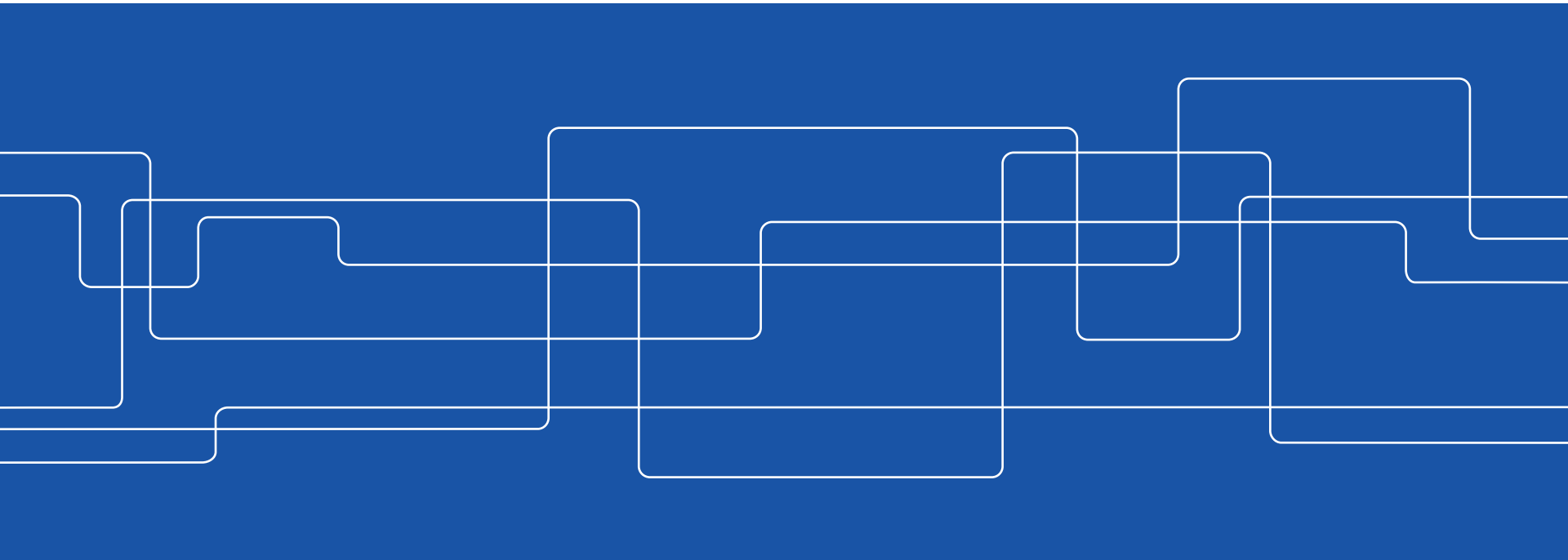


# Outline

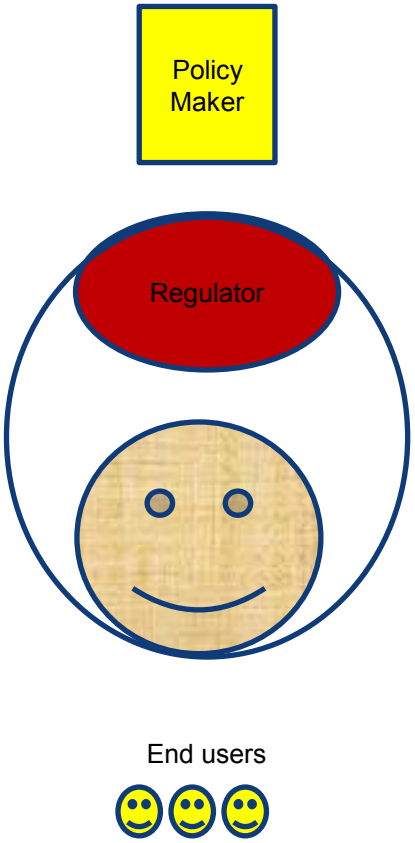
- Background
  - Why to regulate?
  - Common Licensing Approaches
  - How the spectrum is assigned?
- Spectrum Regulation : Similarities and Differences
  - Sudan vs. Sweden

# Why to Regulate (at all)? Historical Background

Historically, in most countries outside of North America, state-owned service providers delivered telecommunications services on a ***monopoly basis***.

Telecommunications services were provided by government departments or agencies, in a similar manner to postal, road transportation, and other government services.

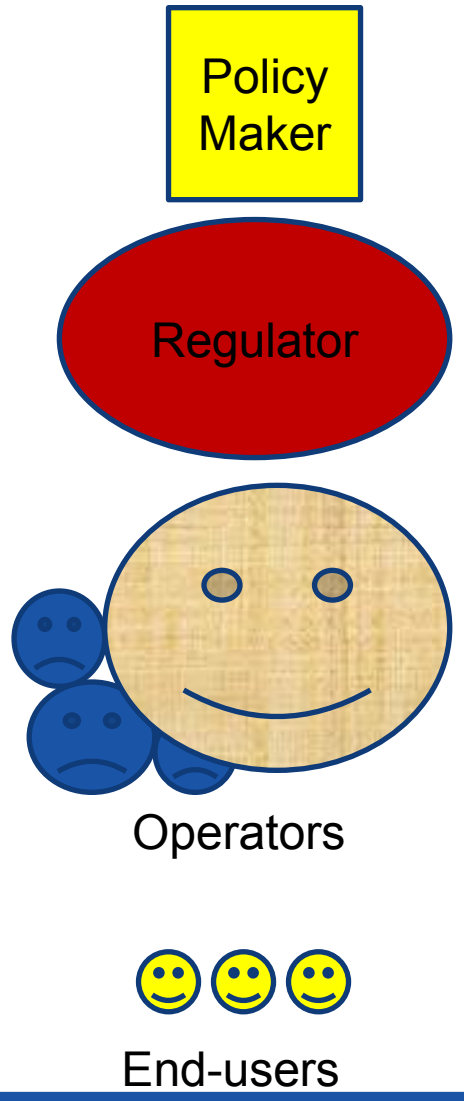
These departments and agencies were often referred to as Post, Telephone and Telegraph Administrations (PTTs).



# Why to Regulate (at all)? liberalization and privatization (1/2)

- Separate authorizations ("individual licenses") were generally issued to ***both*** incumbent service providers, in the process of **liberalization and privatization**, and the new private sector entrants.

- These authorizations set out the terms and conditions governing their provision of telecommunications service, often being very specific on ***what*** service could be offered, and ***how***.



# Why to Regulate (at all)? liberalization and privatization (2/2)

**Some common objectives and challenges of liberalization and privatization process**

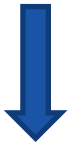
- Privatization or commercialization of agencies, PTTs; to
  - ➢ Facilitate the expansion of networks and services;
  - ➢ Attracting investment in the ICT sector;
- How to assure fair competition in the market
  - ➢ ´There is needs for mechanisms to ensure the availability of scarce resources on fair and equitable terms;
    - The radio spectrum is limited by physical laws, international agreements and the national regulatory system.
    - Another limited resource is the quantity of telephone numbers.
- How to protect End-subscribers;
  - ➢ Need for a framework for quality of service;

# Licensing, Shift in approach

**Today, three ways are used to authorize ICT service providers:**

Individual license: narrow service & platform

Class or general license: all telecommunications-ICT services, regardless of platform



No authorization requirement (i.e., Open Entry, possibly with registration requirement)

# … Why to shift from individual, specific licenses Approach?

- The dynamic nature of the market
  - markets, increasingly opening up
  - Increase competition and the proliferation of service providers;
  - convergence between various communication services

- More consistent with the principle of technological neutrality;
- More consistent with open market entry policies;
- Simplify the regulatory process; and reduce regulatory and administrative costs; (is it really the case?)

# Why is the choice of Licensing model important?

Authorization policies determine the structure and level of competition

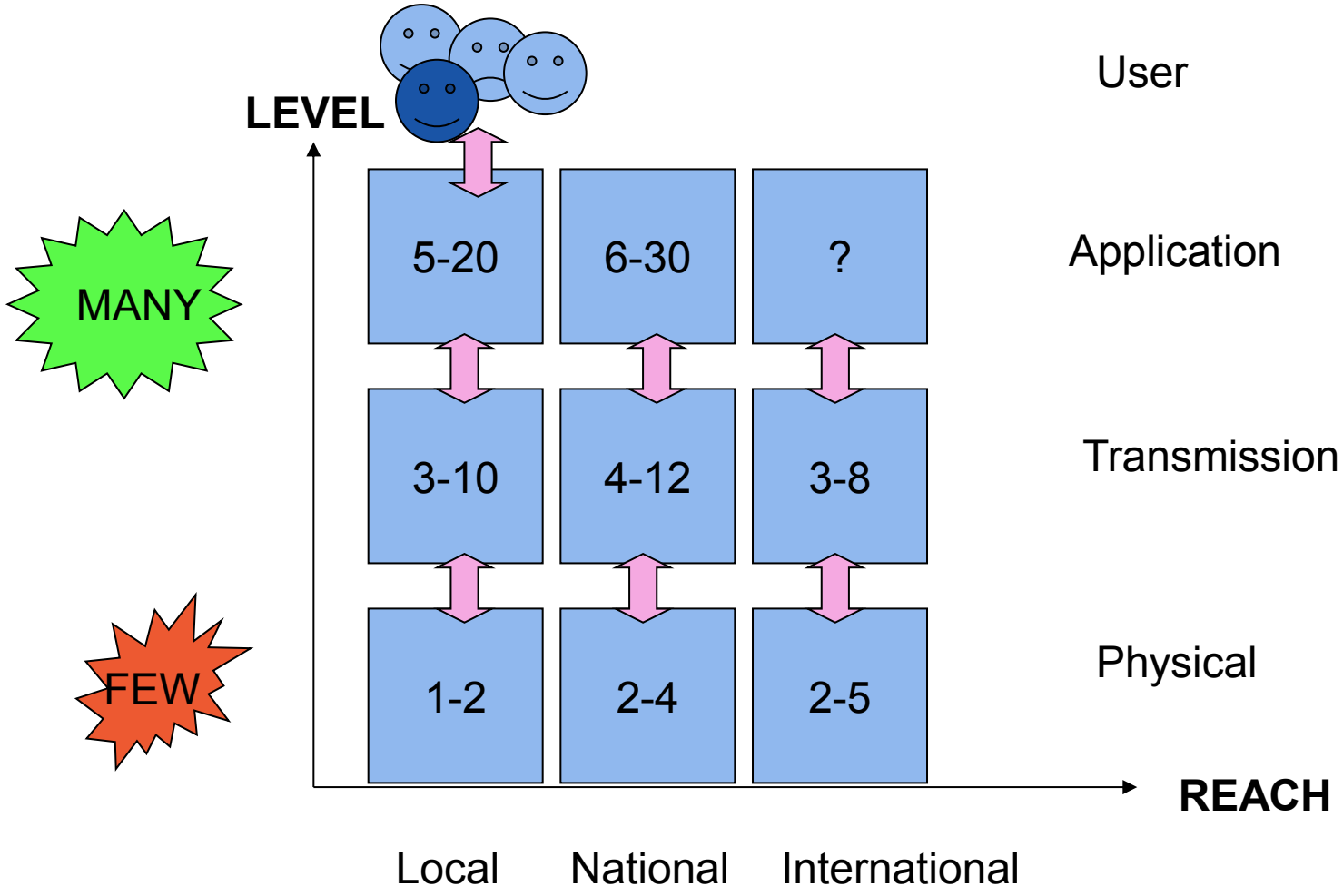
and, ultimately, the efficiency of the services (QoS) delivered to the public.

# The essential facility and resources !

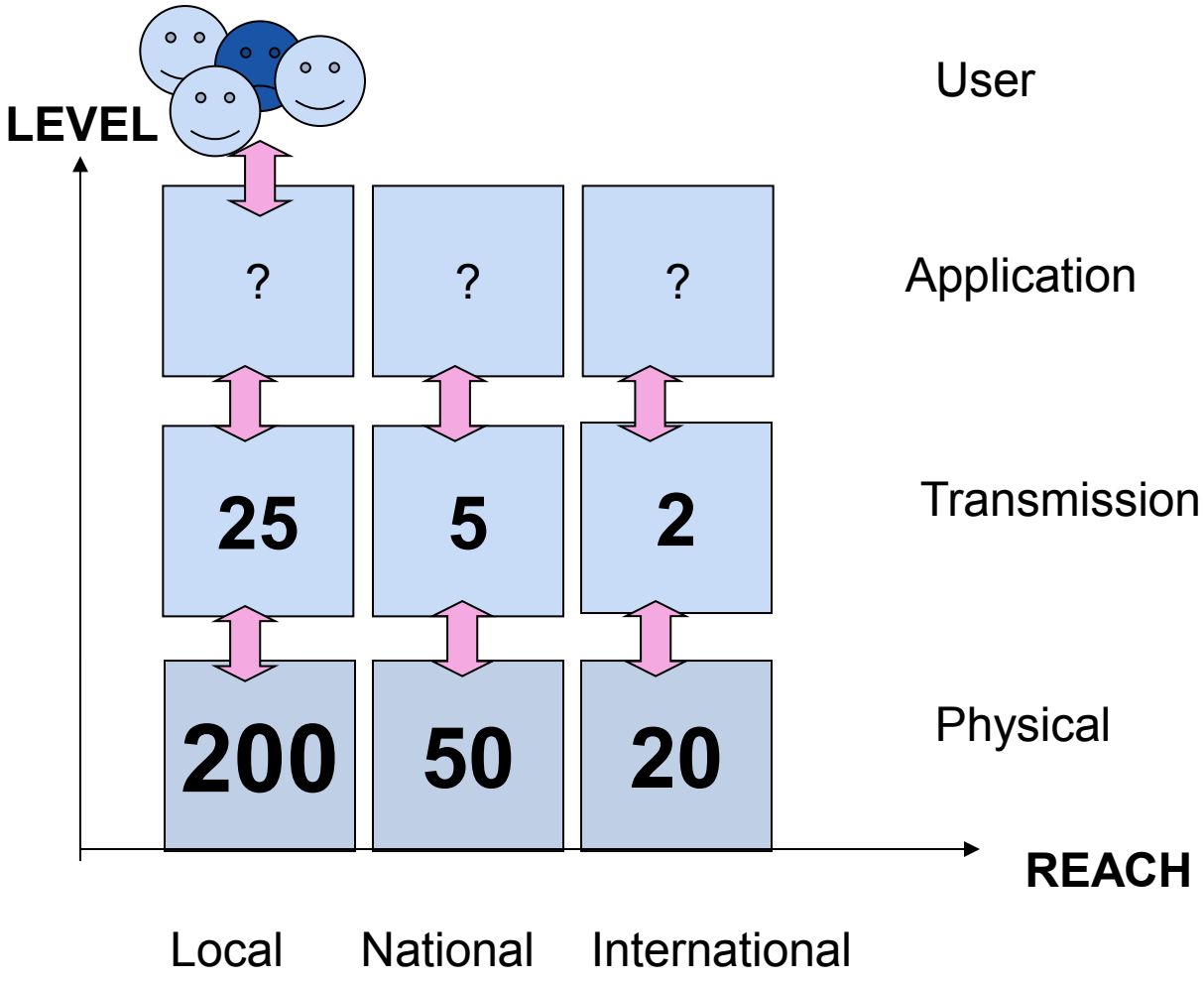
- Big cost in general
- Difficult to duplicate technically, environmentally, socially.
- Low chance to get money back if investing in new, additional one
- Immense first mover advantage
- Big fixed cost, low marginal cost per user or volume unit

## Is the spectrum an essential resources?

# Number of operators on every level



# Relative costs in different parts of the total network



# As essential resource, the spectrum has both technical and economical dimensions

•**Economically**, efficient use of spectrum means the maximization of the value of outputs produced from available spectrum.

• **Technically**, efficient use of spectrum, at a basic level, implies the fullest possible use of all available spectrum. Two measures of technical efficiency are ***occupancy*** and ***data rate.***

**Time**, for example, can be used as a measure of technical efficiency, in the sense of how constant or how heavy the usage of spectrum is over time.

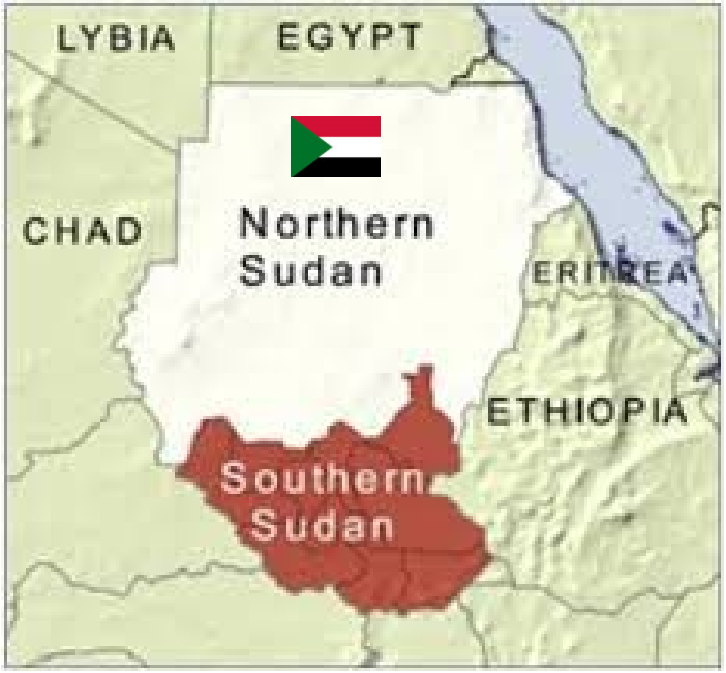
**Data rate /Hz,** how much data and information can be transmitted for a given amount of spectrum capacity.

# How do we assign spectrum?

- The three spectrum management regulatory models deployed most extensively in the past two decades have been command-and-control (administrative), market-based (including spectrum property rights) and spectrum commons;
- Historically three approaches to assign the spectrum resources

  - **First Come First Serve** – not suitable for high demand and limited spectrum
  - **Competitive processes (market based)** –"Beauty contest", Auction,
    - **"**Beauty contest" and Auction can both fulfil developmental goals if designed properly (e.g. Through set asides) – economic equilibrium may be the same.
    - "Beauty contest" more costly and time consuming and prone to human error and subjectivity – more prone to litigation
    - Auction allows the market to determine the value (utility function).
  - **Common use** good for extremely limited spectrum or niche spectrum

# Sudan Country Profile




| Demographic facts | |
|---|---|
| **Population** | 38 m (1.8% p.a. growth) |
| **GNI per capita** | around 1460 PPP dollars in year 2012 |
| **GDP growth** | -6% per annum |
| **Geographic Area** | total area of about 1,864,485 sq. km |
| **Population Density** | **20 per Square Km** |

## Economic facts

- Economy used to grow steadily since 2004 after the peace agreement with South Sudan
- However the country's experience economical crisis (loosing a major share of a Oil production) following the 'Separation of South Sudan 'in 2011

# Key Mobile Operators in Sudanese Market

## How They Entered The Market (1/2)

### MTN

- The brand name Areeba mobile phone company was introduced to the market as the second mobile operator in 2005 with aim of deploying 3G servicesLaunched a mobile service.
- Areeba has been sold to MTN group in 2007.
- Investment in the Market more than $1.3 Billion (estimated)

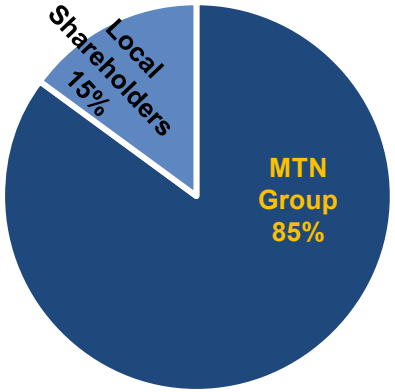
### Sudani

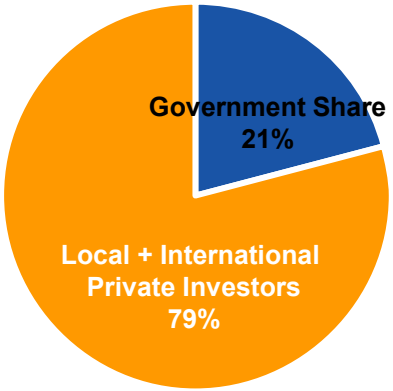
- SUDATL was founded in 1993 as a private company with the government owning 67% and 33%.) for fixed service only
- Launched a mobile service in 2007.
- Investment in the Market more than $900 Million (estimated)

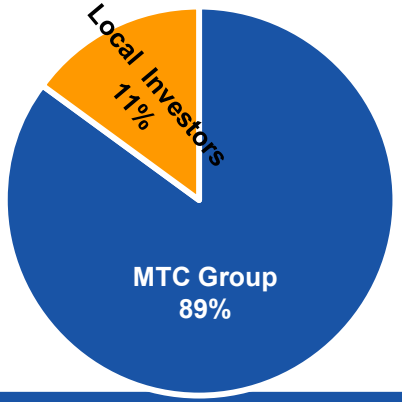
### Zain

- Mobitel Launched a mobile service in1997.
- MobiteL (nowZAIN-SUDAN) was originally operated as a joint venture between Sudatel and Nile Waters Co.Later
- Investment in the Market more than $1.8 Billion (estimated

## Ownership



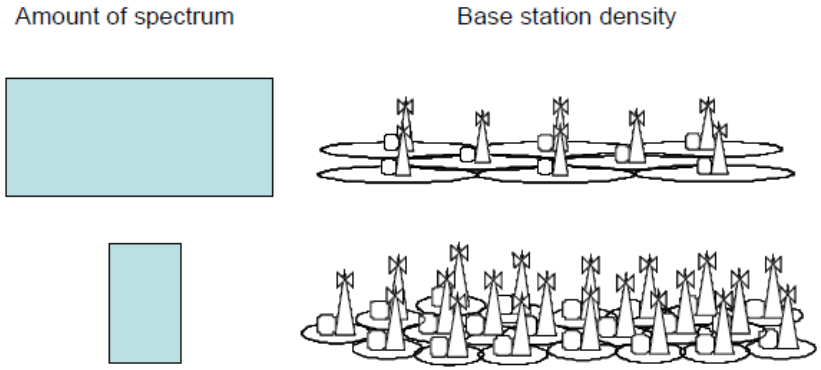
# Access to Essential Resources

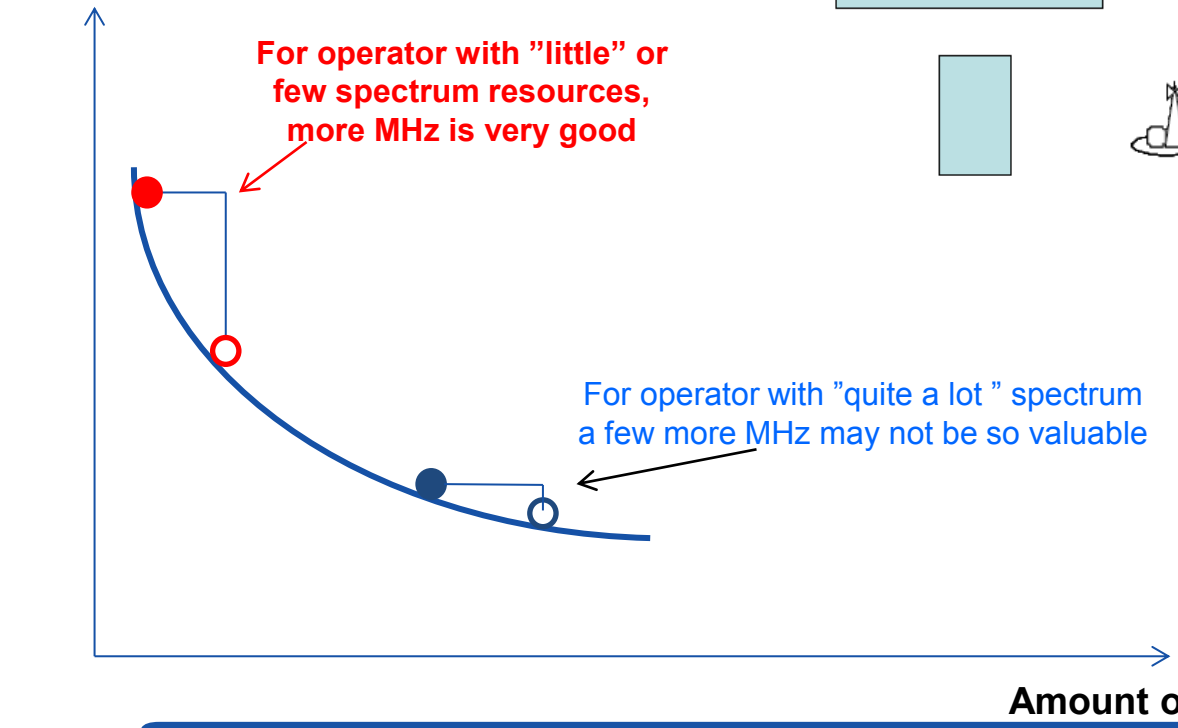
**"Spectrum Allocation in the Market"**

| Operator | 900 MHz (GSM) | 1.8 GHz (GSM) | 2.1 GHz (UMTS) | 800 MHZ (CDMA 200 EVDO) | Total Amount In MHz |
|---|---|---|---|---|---|
| **ZAIN** | 15 MHz (GSM) | 20 | 15 | - | 50 |
| **MTN** | 10 MHz | 15 | 15 | - | 40 |
| **Sudani** | - | 20 | 20 | ~18 MHz (CDMA 2000) | 48 |

- MTN has less spectrum allocation compared to other two Operators!
- At early operation phase only 5 MHz has been assigned to MTN compared to 20 MHz for Mobitel ! How that affect MTN operation?

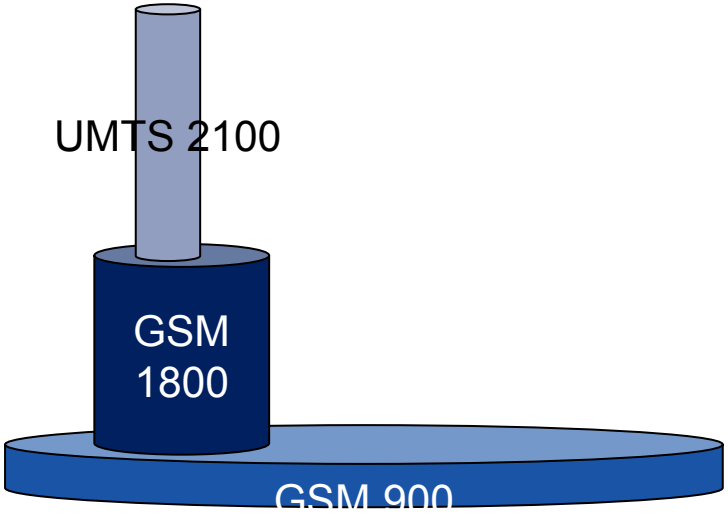
# Spectrum Value (1/2)

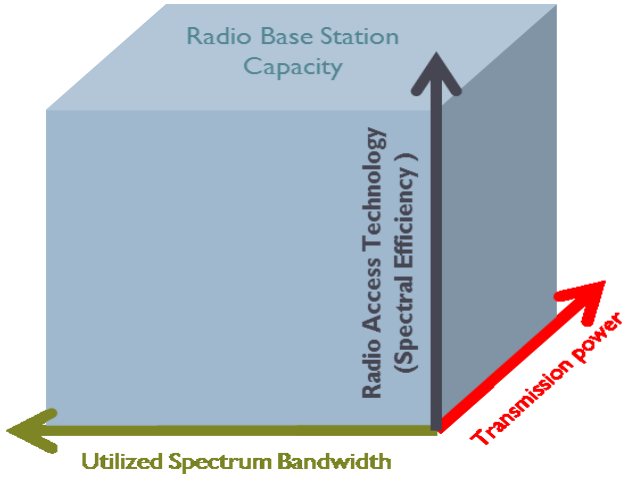


# Spectrum Value (2/2)
# Coverage vs. Capacity Requirement

Operators seek an efficient combination of frequencies both below and above 1 GHz




$$C_{Wireless} = C_{BS} * Max\left[\left(\frac{N_{user} * R_{user} * A_{cell-area}}{\eta * SE * BW_{sys}}\right), \left(\frac{A_{service}}{A_{cell-area}}\right)\right]$$

- $\eta$ is the effective frequency reuse factor,
- SE is the spectral effeicency depend on the adopted technology
- BW is the Available Spectrum
- $R_{user}$ is the average offered data rate per user

# Key Mobile Operators in the market

## Coverage and Market Share

Coverage:
Geographic coverage:35%
Population coverage:88%

Technology: GPSR, HSPA

Subscribers: 12,697,024

Coverage:

Geographic coverage: 31%

Technology: CDMA 1x EV-DO

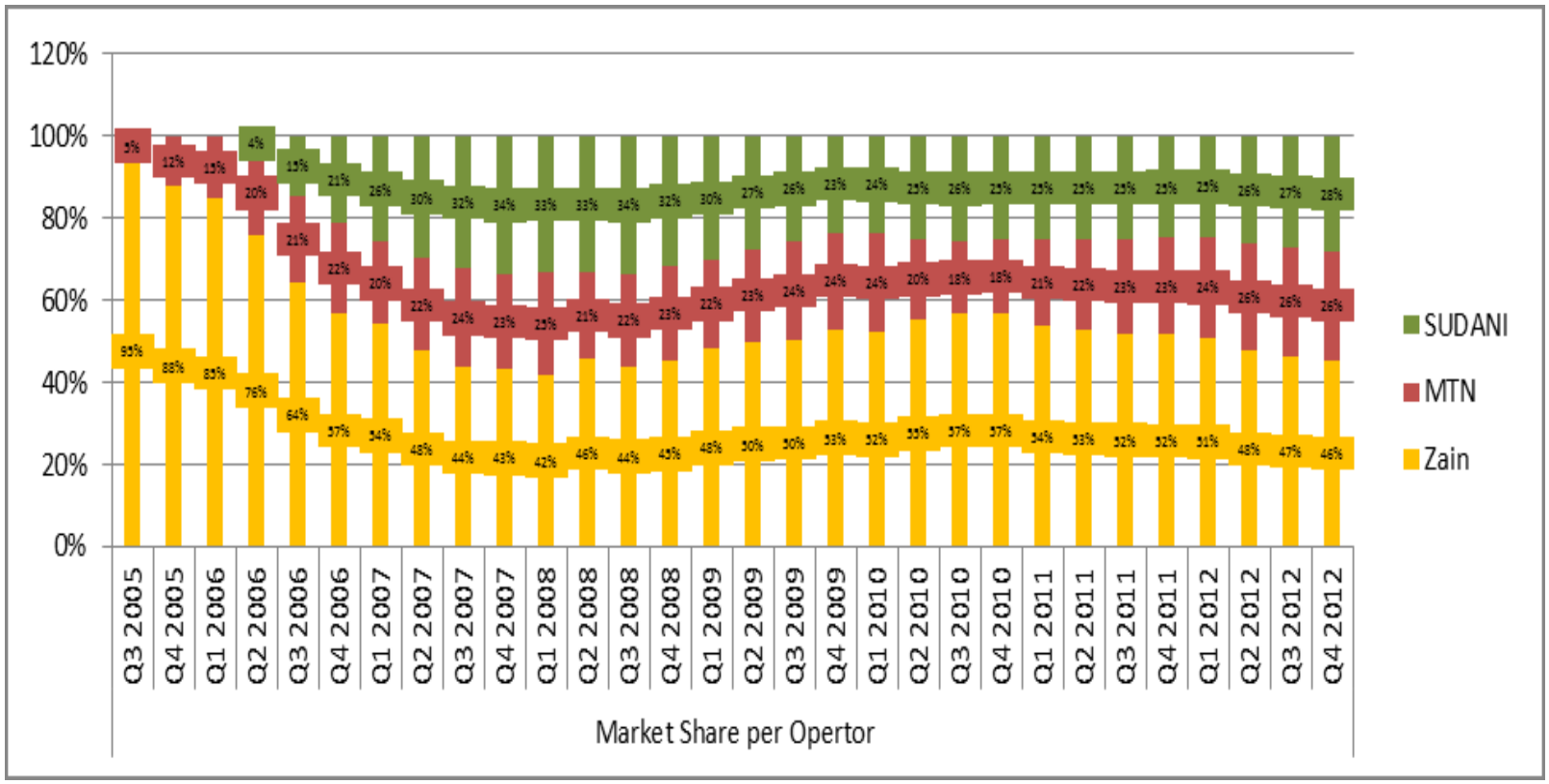
Subscribers: 6,975,145

Coverage:
Geographic coverage:8.5%
Population coverage:55.1%

Technology: GSM / UMTS

Subscribers: 6,969,019

# Market Shares in the Market




What we can be seen from the market share?

# What is HHI? (1/2)

The **Herfindahl index** (also known as **Herfindahl–Hirschman Index**, or **HHI**) is a measure of the size of firms in relation to the industry and an indicator of the amount of competition among them. Named after economists Orris C. Herfindahl and Albert O. Hirschman, it is an economic concept widely applied in competition law, antitrust

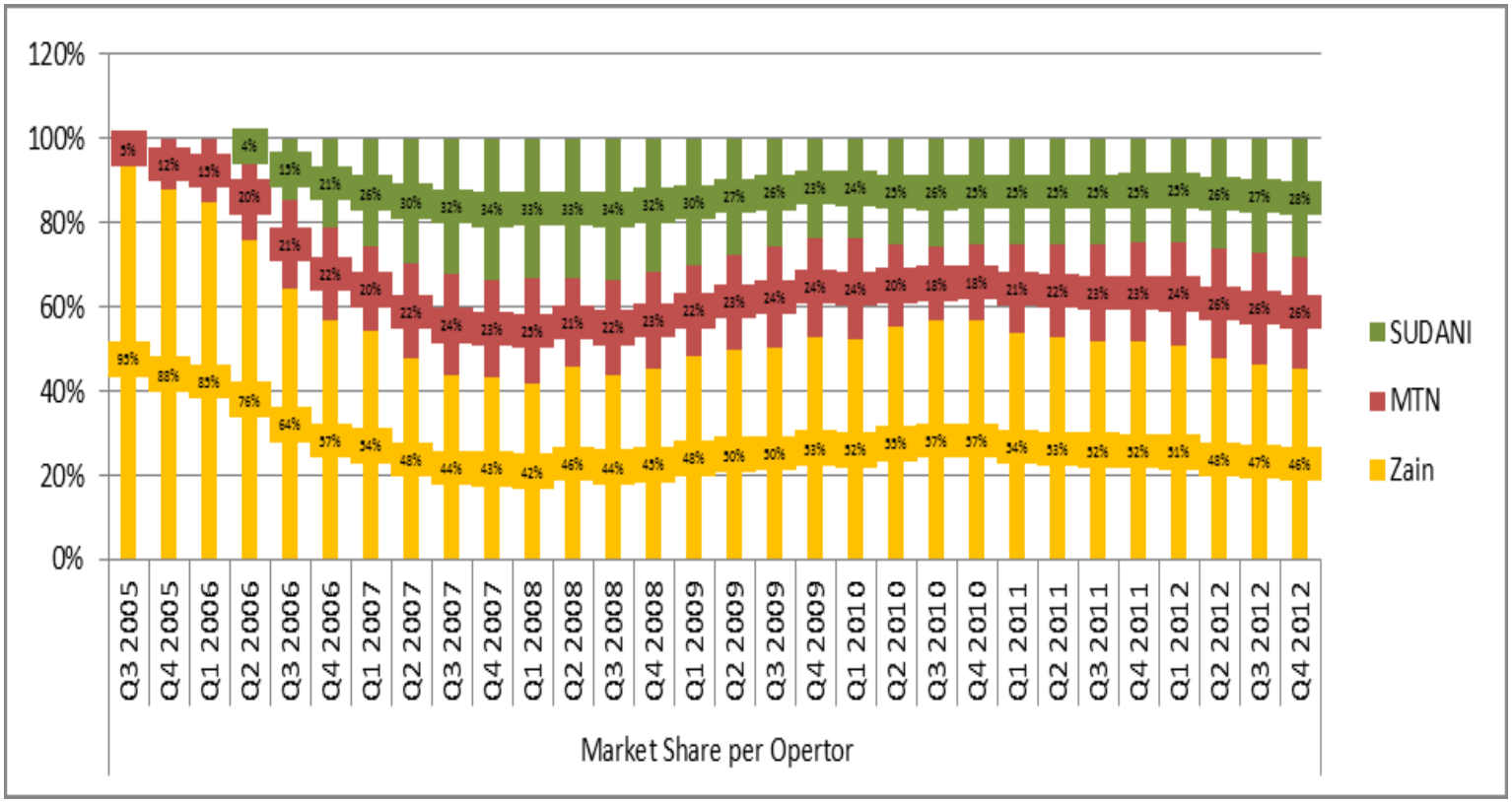
$$H = \sum_{i=1}^{N} s_i^2$$

where $s_i$ is the market share of firm *i* in the market, and *N* is the number of firms.

# What is HHI? (2/2)

- The closer a market is to being a monopoly, the higher the market's concentration (and the lower its competition).
- If, for example, there were only one firm in an industry, that firm would have 100% market share, and the HHI would equal 10,000 (100^2), indicating a monopoly.
- Or, if there were thousands of firms competing, each would have nearly 0% market share, and the HHI would be close to zero, indicating nearly perfect competition.

# Market Shares and Competition Level in the Market



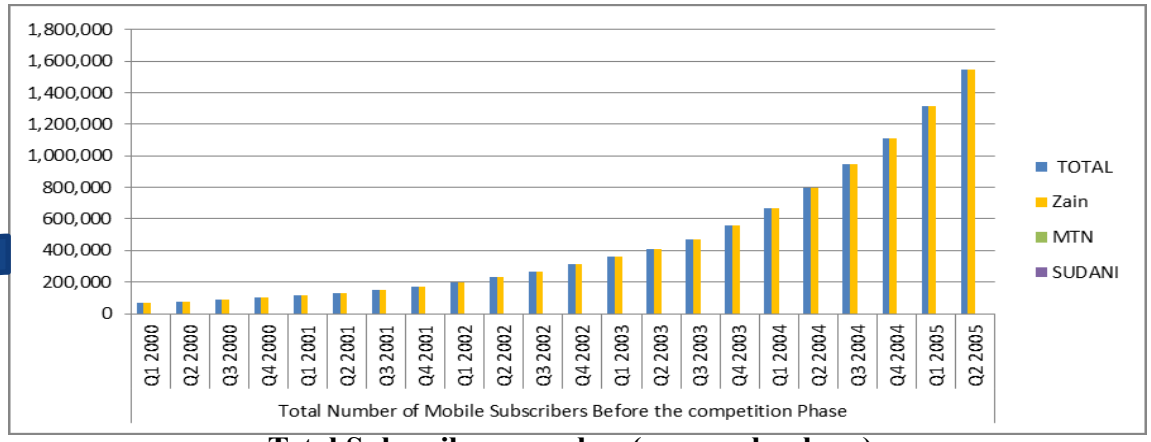

**9050** → **3576**

**HII**

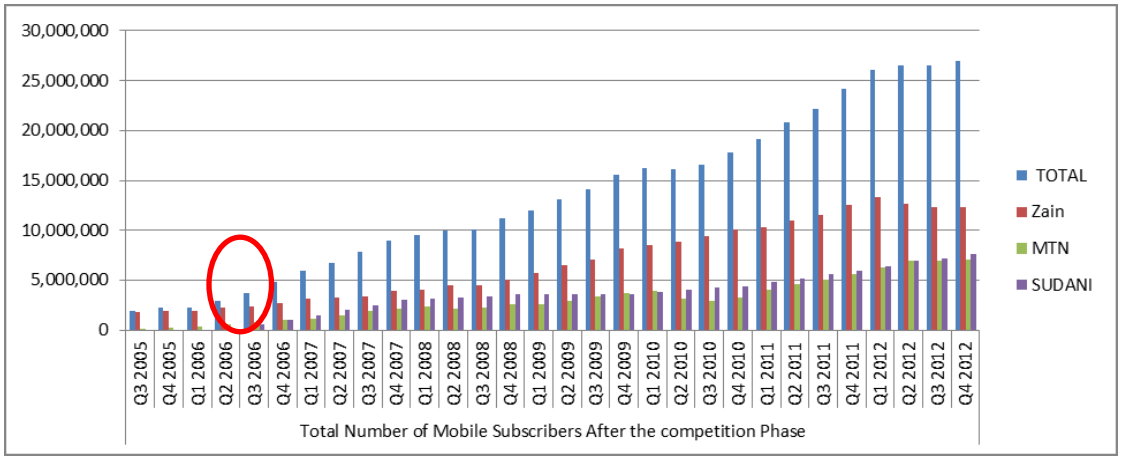
# Mobile Subscribers Number Growth

**The total number of ZAIN mobile subscribers has grown from around 68,000 subscribers in 2000 to 1 million and half in 2005 !**

X 2.5

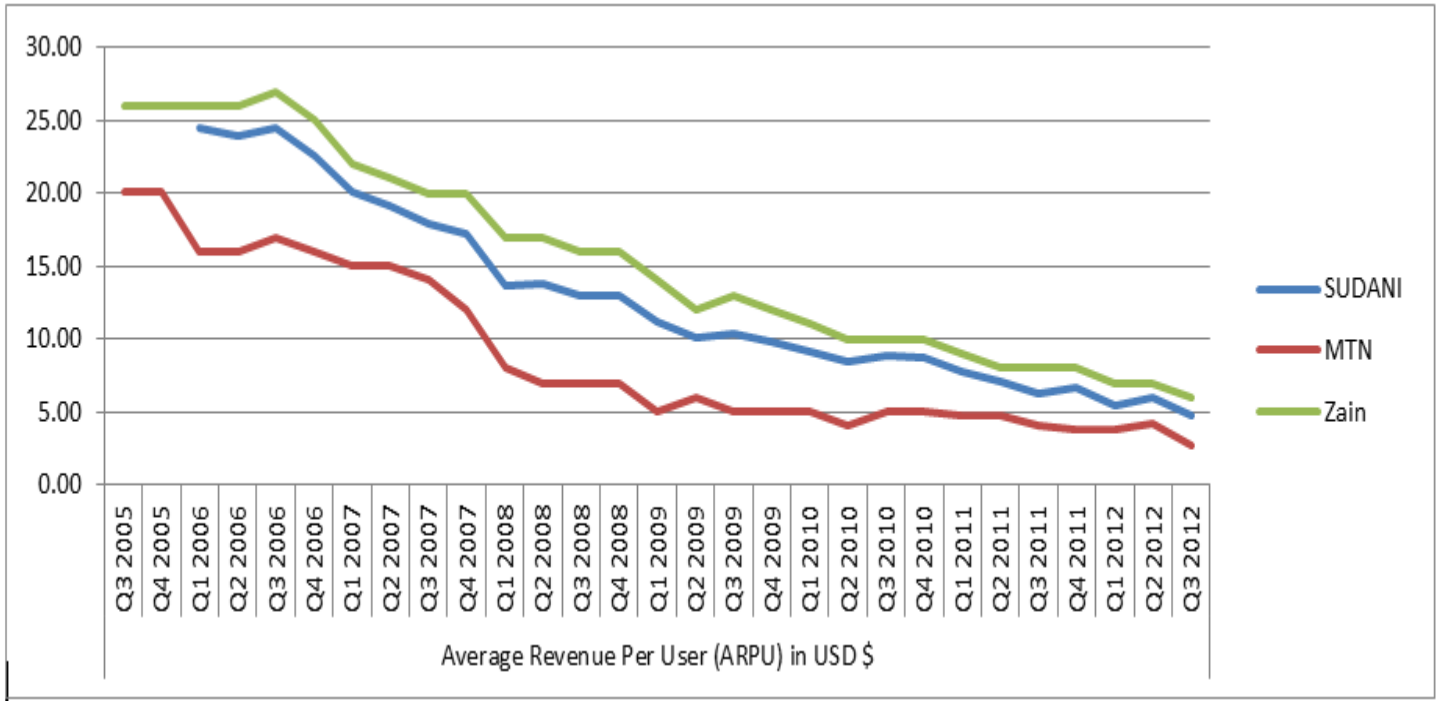



**Total Subscribers number (monopoly phase)**



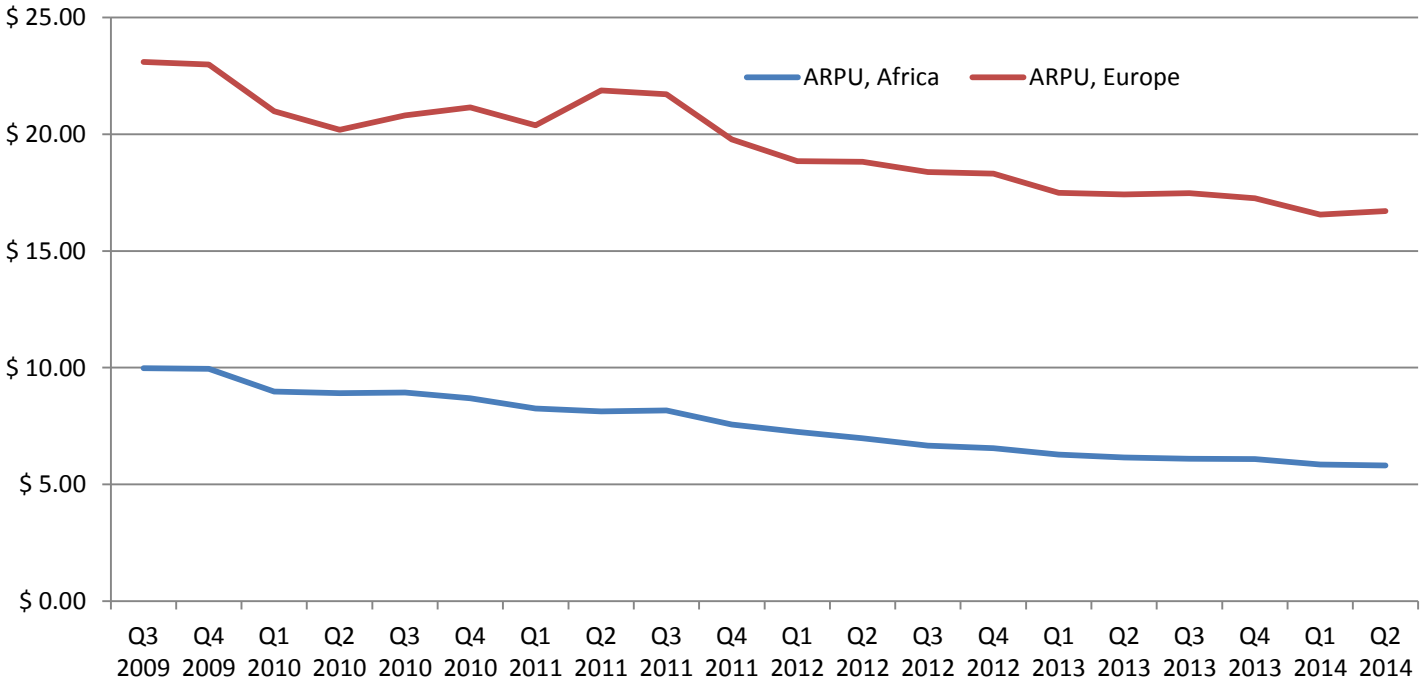

**Total Subscribers number (competition phase)**

# ARPU




- **Although Zain Market Share is increasing, the company sustain a higher revenue compared to other two Operators.**

# ARPU (Eurpe vs. Africa)




- **Zain ARPU high compared to other country in the African Region.**

# Sweden Country Profile


| Demographic facts | |
|---|---|
| **Population** | 9.593 million(0.8% p.a. growth) |
| **GNI per capita** | around 56,12 PPP dollars in year 2012 |
| **GDP growth** | ~1.6% per annum |
| **Geographic Area** | **Land area:** 411,621 sq km; **total area:** 449,964 sq km |
| **Population Density** | **23 per Square Km** |

# Key Mobile Operators in Swedish Market

**Before Year 2000**

- The liberalization process started in 1980 by a parliamentary decision to open the market for terminals attached to the public network. In 1981, a private operator started building its own nationwide cellular network in competition with the NMT system run by Televerket.
    - In the 1980s, NMT 450 was introduced, later followed by NMT900, and the second operator, Comvik, strengthened its position in the market.
    - Sweden was the only European country with three GSM operators (Swedish Telecom, Comvik and NordicTel) in 1992.
- The regulator PTS (The National Post and Telecom Agency), established in 1993, attempts to increase competition through measures to decrease interconnection charges and facilitate the entry of new actors in the telecommunications market

# Key Mobile Operators in Swedish Market

## How They Entered The Market

- Sweden awarded four licenses for third-generation mobile telephony through a "beauty contest" in December 2000.
- Licences were awarded to Orange, Europolitan (which later became Europolitan Vodafone and is now called Vodafone), Tele 2 and HI3G Access (now operating under the name "3").

- The licensees were each awarded 2 × 15 MHz + 5 MHz.
  - Licensees have a possibility to make agreements about, inter alia, site sharing and national roaming in other networks in the relevant frequency bands, in order to achieve the required coverage (99.98%).
  - The licensees must, however, ensure that at least 30% of the required population coverage is covered by their own infrastructure (and consequently the operators may share radio-infrastructure up to 70%).

- The incumbent (Telia) did not receive a license and appealed to the Administrative Court, but the appeal was rejected !

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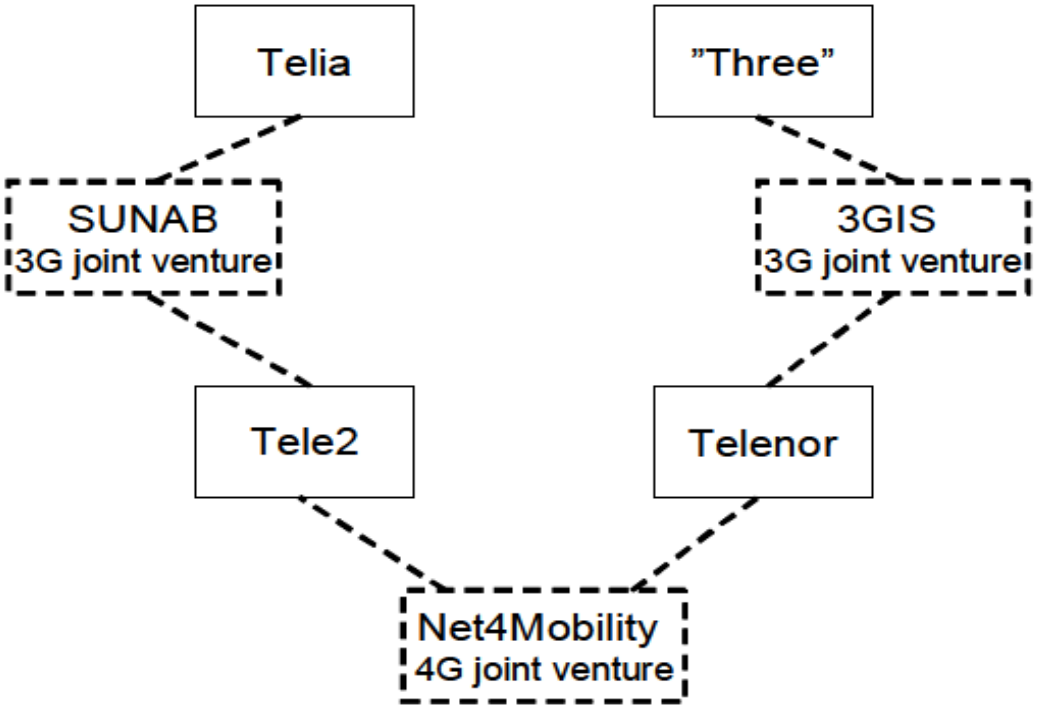
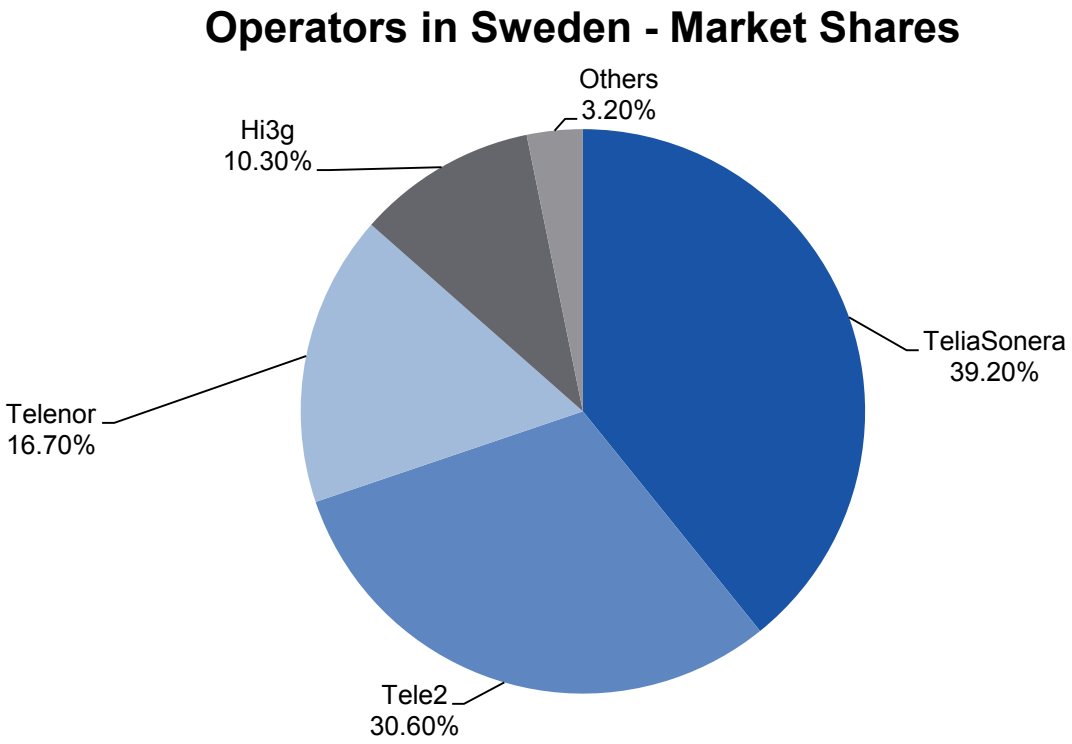
# An Increased Interest in Cooperation and Alliances (1/2)

# An Increased Interest in Cooperation and Alliances (2/2)

Joint Ventures for Shared Network Deployment between Swedish Mobile Operators (Markendahl & Mölleryd, November 2012)

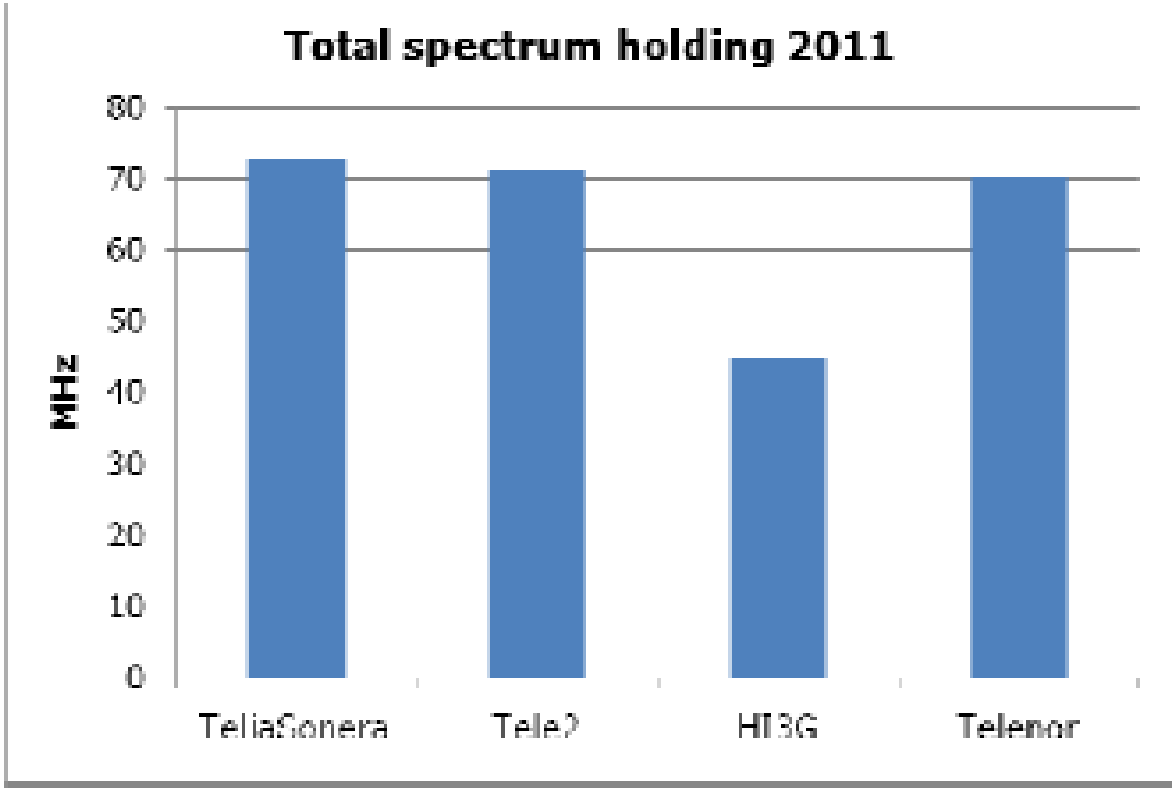


# Mobile Market Share as of Today



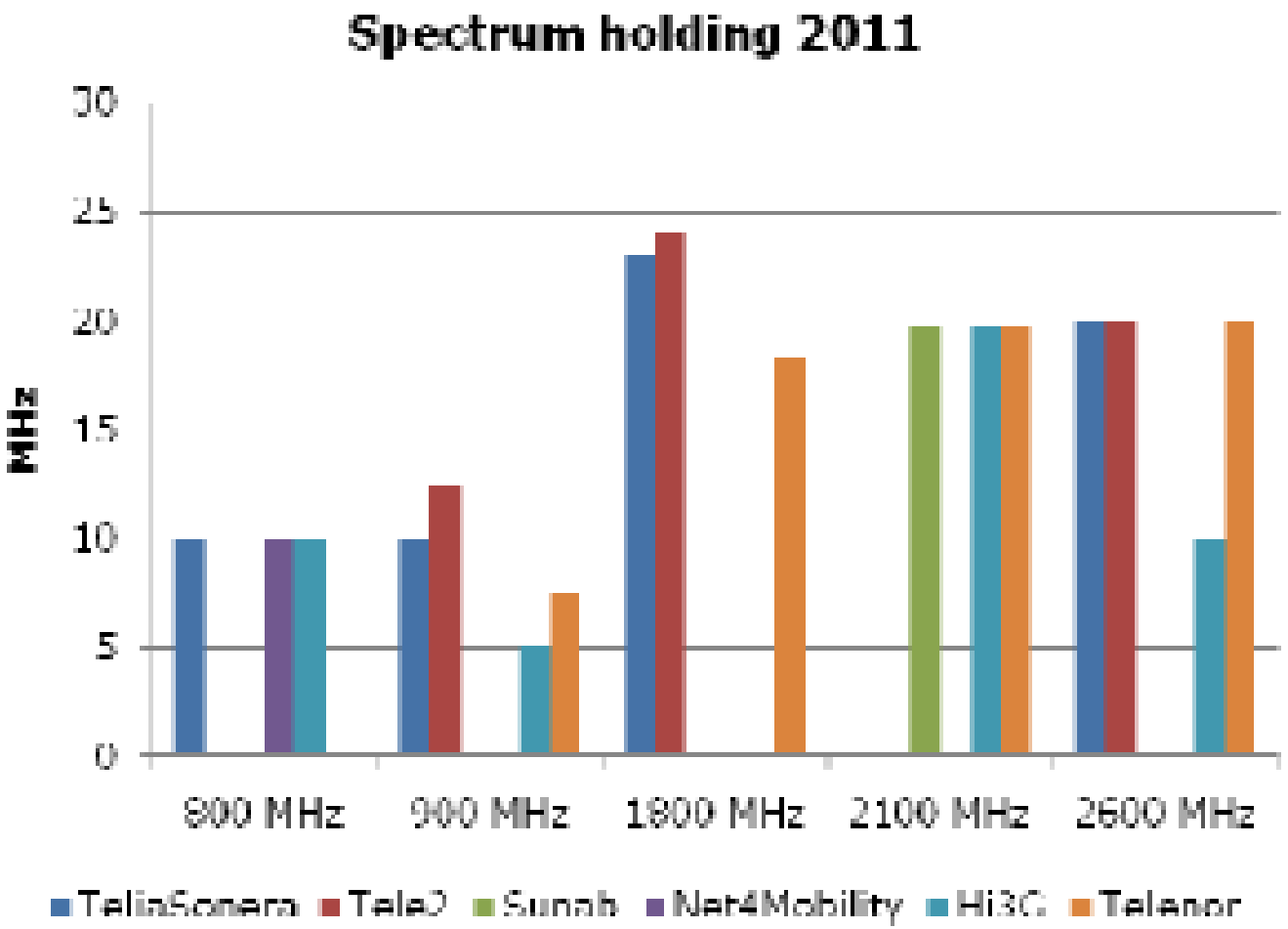

It can be seen that Telia dominates the market, closely followed by Tele2. These operators are considered incumbent actors, as they were among the first three operators to start services in 1992.

# Spectrum Allocation per Operator




Source: (Markendahl & Mölleryd, 2011)

# Spectrum Allocation per Operator and Band



# Reframing, liberalization 900 MHz in Sweden (1)

An operator-initiated process

- The 4 existing operators sent a joint application to PTS in November 2008
- Completed in March 2011

Reframing, liberalization and renewal in one go

- No fees included
- No changes in annual payment practices

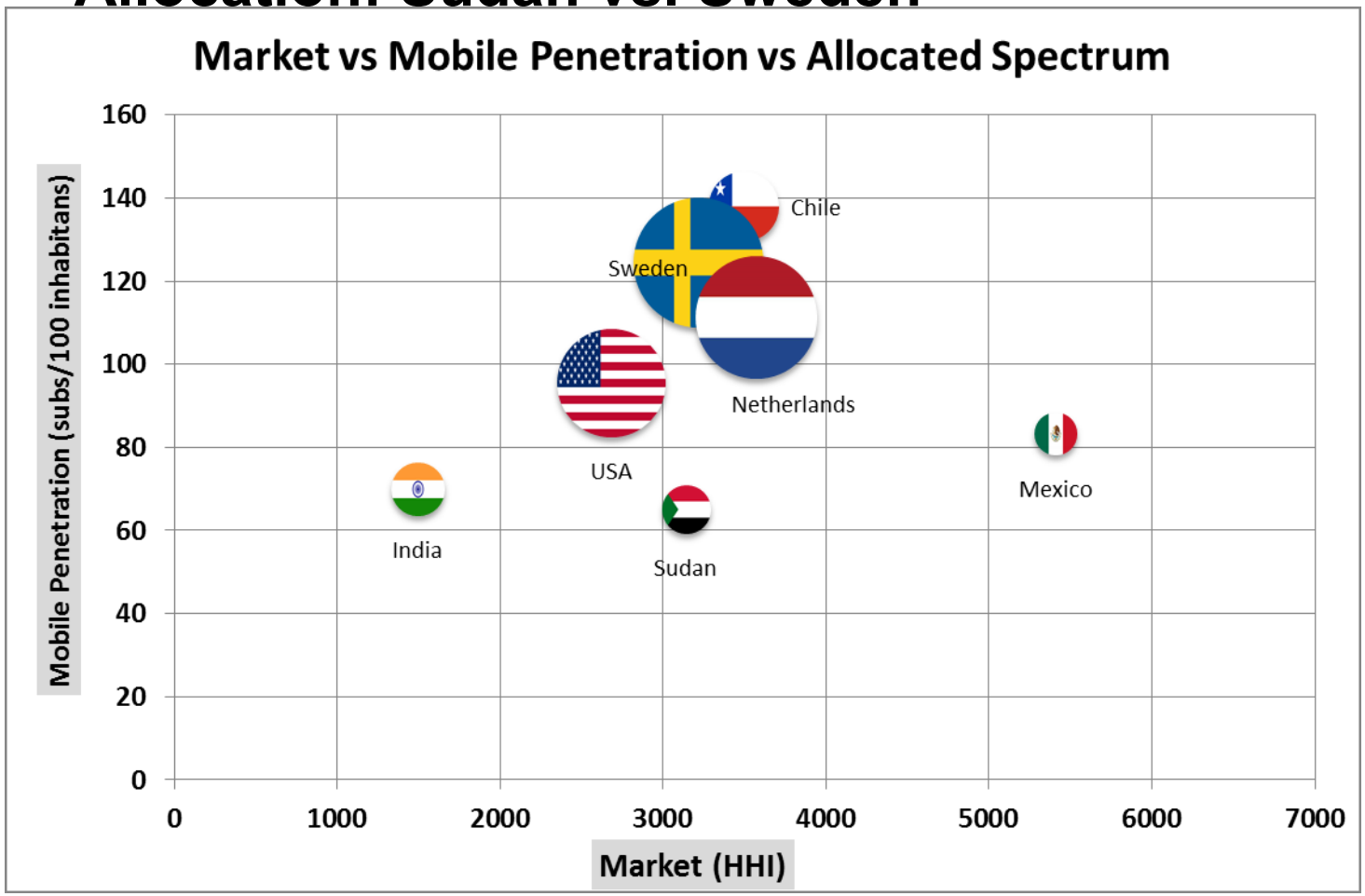
The key objectives

- To put frequencies into efficient use
- To make room for another operator

# Indecency of the regulatory body Sudan vs. Sweden

| | Sudan | Sweden |
|---|---|---|
| Regulatory Body | NTC national Telecommunication (2001) | Swedish national regulatory authority (Post- och telestyrelsen (PTS)) is underpinned by the Swedish Constitution, and the NRA has the requisite powers under EC law (1993). |
| Date of Putting in place the regulation Framework | 2001 | 1993 |
| Independency | NTC is a government agency reporting to the Ministry of Communications and Information Technology | PTS is a government agency reporting to the Ministry of Industry, Employment and Communications |
| Measures/actions taking to assure competition in the market | +Open The mobile market for competition in 2005.<br>+ Number Portability (under discussion)<br>+ network sharing (passive network sharing (tower, site colocation) | +In May 2000 PTS set the fees that would apply for the administration of number portability,<br>+ Open the door for network sharing for rolling the 3G service in the market<br>+ More flexible use of spectrum |

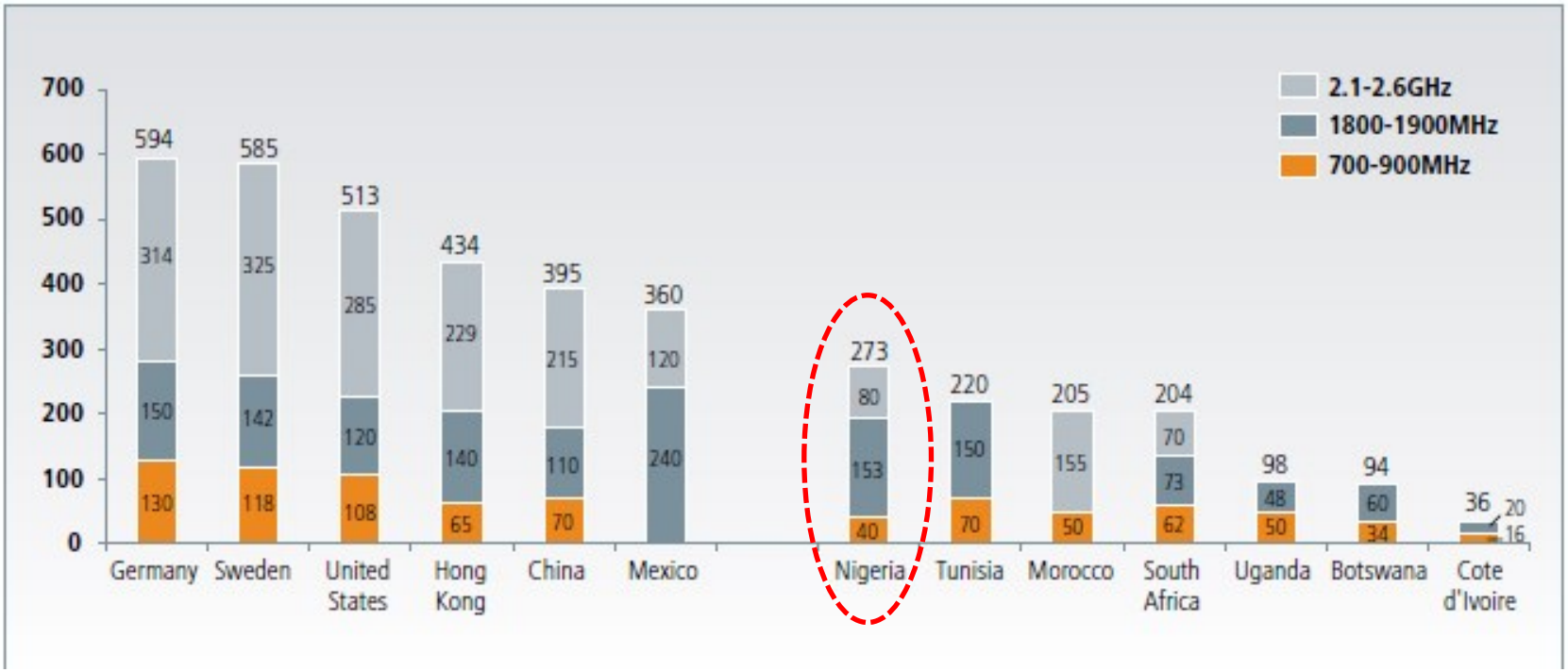
# Mobile penetratin as function of the Spectrum Allocation: Sudan vs. Sweden




* The size of the bubble determines the total spectrum allocated in the country

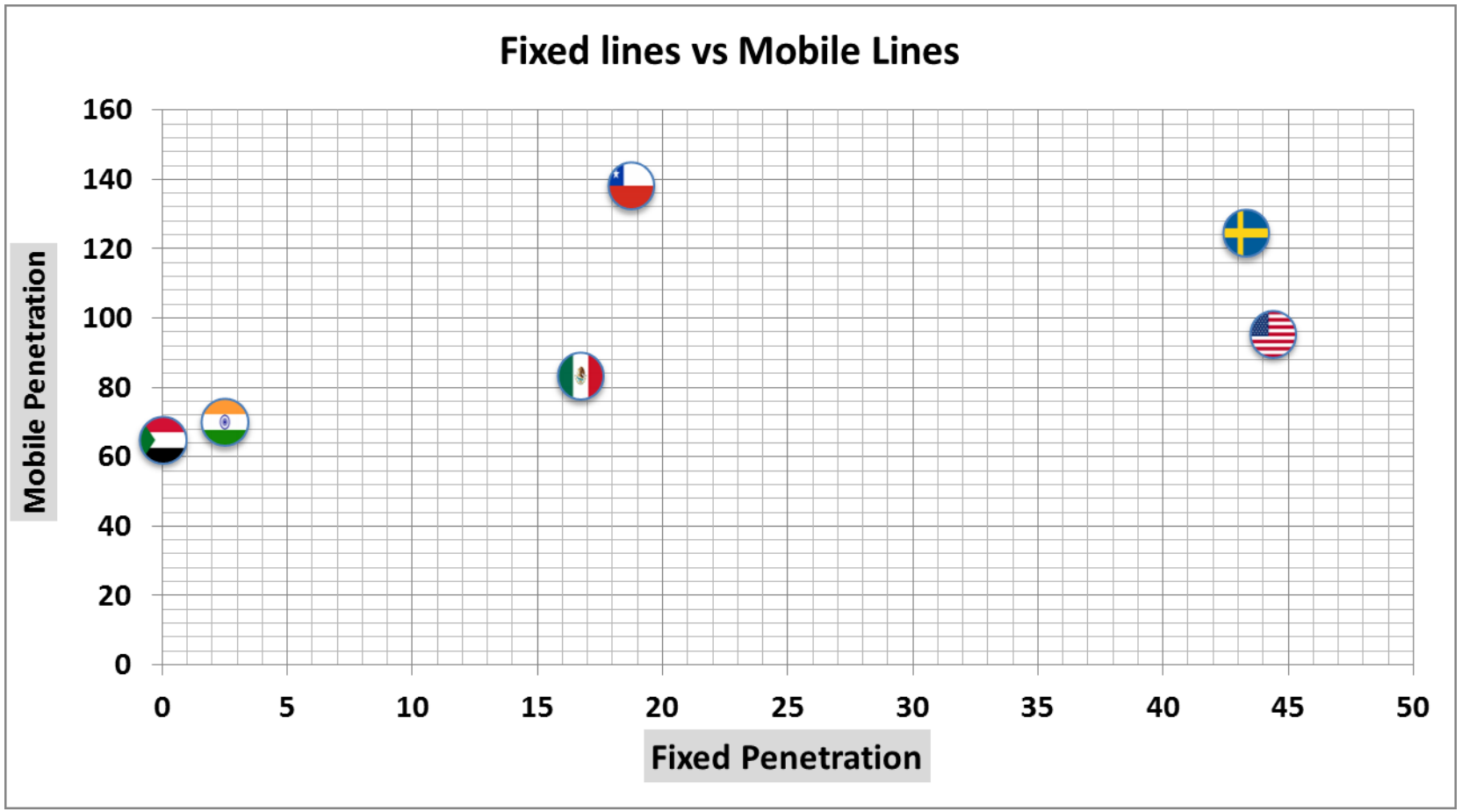
# Spectrum Allocation around the Globe Sudan vs. Sweden

Source: GSMA, 2011

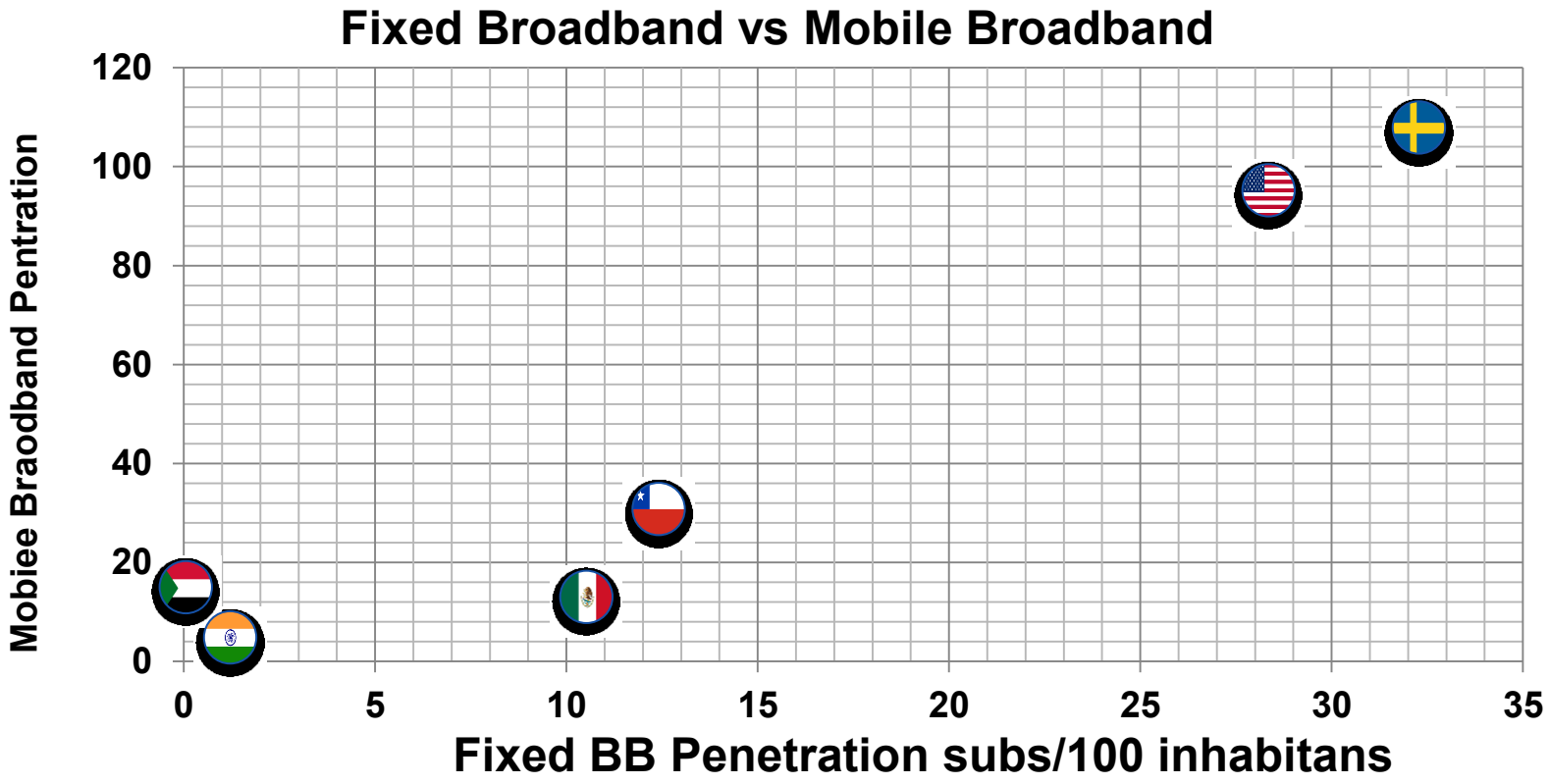



Total allocated Spectrum
For mobile services in
Sudan (~276 MHz)

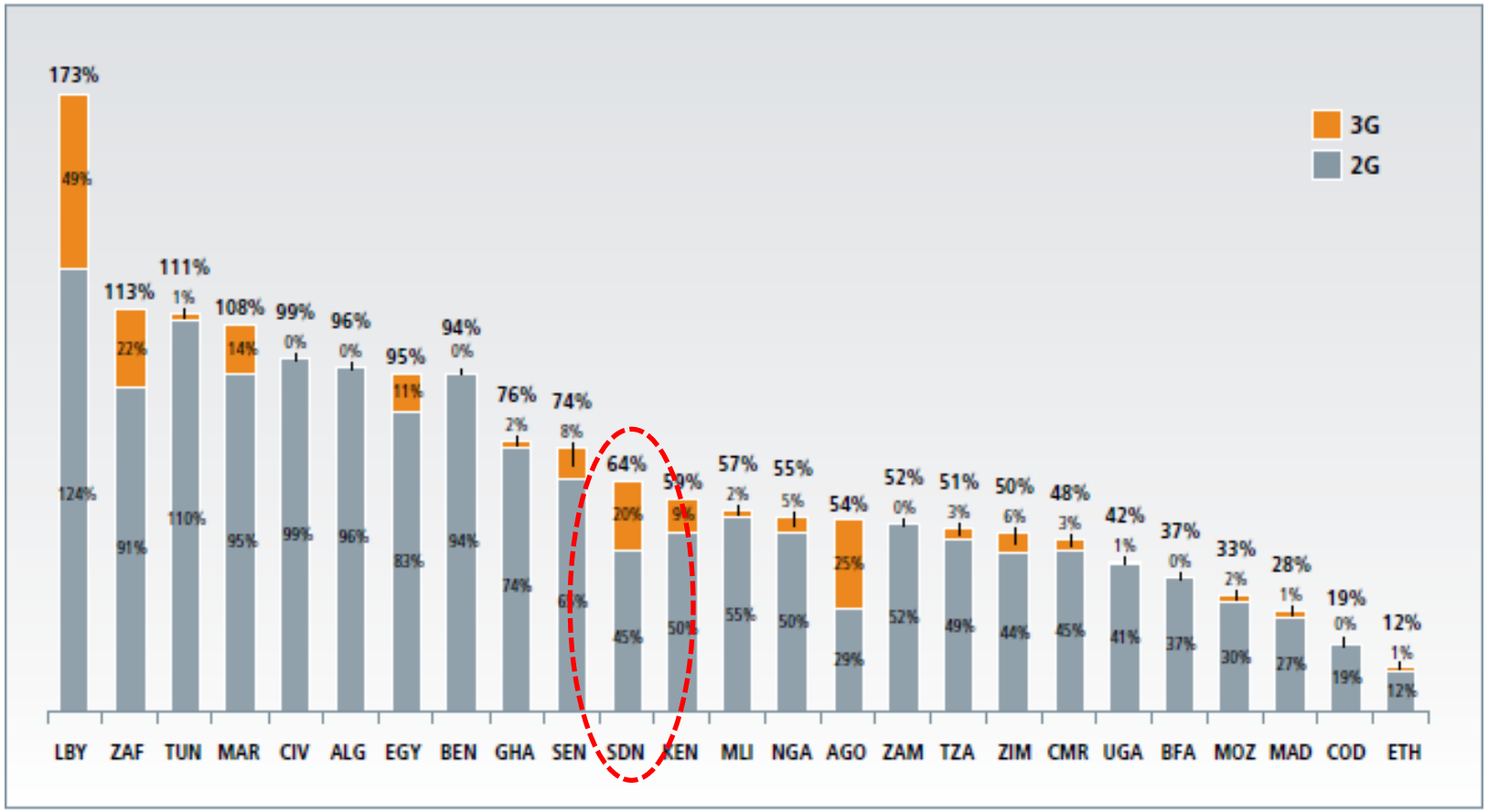
# Fixed vs. Mobile penetration



# Fixed Broadband vs. Mobile Broadband penetration



# 2G vs. 3G penetration in Africa




Source: GSMA, 2011


# Thanks