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Definitive data and analysis for the mobile industry

Economic benefits of using the 3.5 GHz range (3.3-4.2 GHz) for 5G

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Rationale and Methodological note

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Economic benefits model

GSMA Intelligence has developed an economic model that estimates the economic benefits from assigning 3.3-4.2 GHz (the “3.5 GHz range”) to IMT:

- **Conservatively, the model only considers benefits to the urban population**. Due to its technical characteristics, it is expected that this is going to be the primary use of the band. It is nevertheless possible that the 3.5 GHz range can be also used to expand mobile connectivity in some rural spots.
- Given the significant increases in data demand expected in the coming years, our model assesses the benefits of 3.5 GHz spectrum allowing the building of **more efficient networks**.
- While technological innovation and 5G will increase spectrum efficiency, **current spectrum availability may not be enough to fully satisfy growing traffic demand**, requiring densification levels beyond MNOs existing investment cases.
- A “base case” of **200 MHz** of 3.5 GHz spectrum is considered, with benefits calculated for two alternative cases with greater spectrum availability in the 3.5 GHz range for IMT (**500 MHz** and **900 MHz**).
- The study **does not** consider the costs to mobile operators from the use of 3.5 GHz, nor any potential costs to existing or other potential users of 3.5 GHz frequencies.

Economic benefits model

The cost savings from lower BTS costs are assumed to be passed on to consumers: price-sensitive demand is higher in the expanded 3.5 GHz scenario as a result of the lower costs. This has a direct impact on mobile operators and the larger mobile ecosystem.

The increased number of mobile broadband subscribers also has a knock-on impact through the economy, including the larger regional economy and its productivity rate.

Impact on mobile operators

Thanks to lower infrastructure costs, MNOs will be be able to satisfy the increasing traffic demand cost-effectively, without capping traffic capacity, allowing consumers and the mobile ecosystem to benefit from increased connectivity.

Impact on mobile ecosystem

Handset manufacturers, handset retailers and mobile content providers all see an expansion of their businesses as a result of the new subscribers and demand, leading to additional value add for the economy.

Impact on the wider economy

As a result of the expanded mobile ecosystem, other parts of the economy that trade with the mobile ecosystem will expand (through the multiplier effect).

Impact on productivity

The additional proportion of the urban population with access to mobile broadband will improve productivity as mobile broadband will enable them to carry out more tasks more efficiently.

Baseline scenario: No additional 3.5 GHz frequencies assigned to mobile

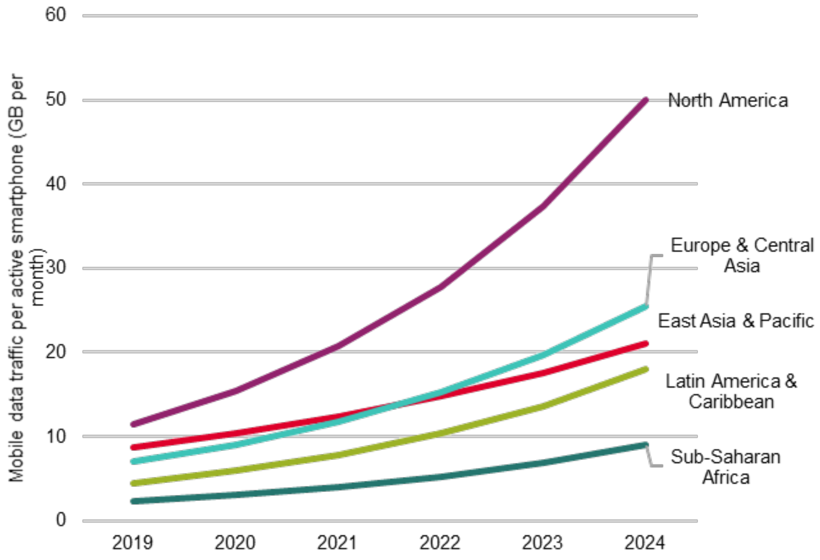
Demand for mobile data is rapidly increasing

Large part of global urban subscribers currently reliant on mobile broadband delivered over a limited amount of spectrum

To meet future demand for data, significant densification of BTS required

Mobile broadband for urban subscribers becomes commercially unviable (or very expensive)

Stagnant take-up of mobile broadband, lower economic productivity.



Source: Ericsson 2019

Main scenario: More 3.5 GHz spectrum allocated to IMT

Demand for mobile data is rapidly increasing

Large part of global urban subscribers currently reliant on mobile broadband delivered over a limited amount of spectrum

~~To meet future demand for data, significant densification of BTS required~~

~~Mobile broadband for urban subscribers becomes commercially unviable (or very expensive)~~

~~Stagnant take-up of mobile broadband, lower speeds, low economic productivity.~~

Allocate 3.5 GHz frequencies to mobile to increase urban capacity

Significantly less densification of BTS required for future demand for mobile data

Cost savings will be passed through to consumers, decreasing price, increasing the number of subscribers and finally allowing greater economic productivity

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Economic impact assessment

Scenario analysis – 200 MHz (base case), 500 MHz and 900 MHz

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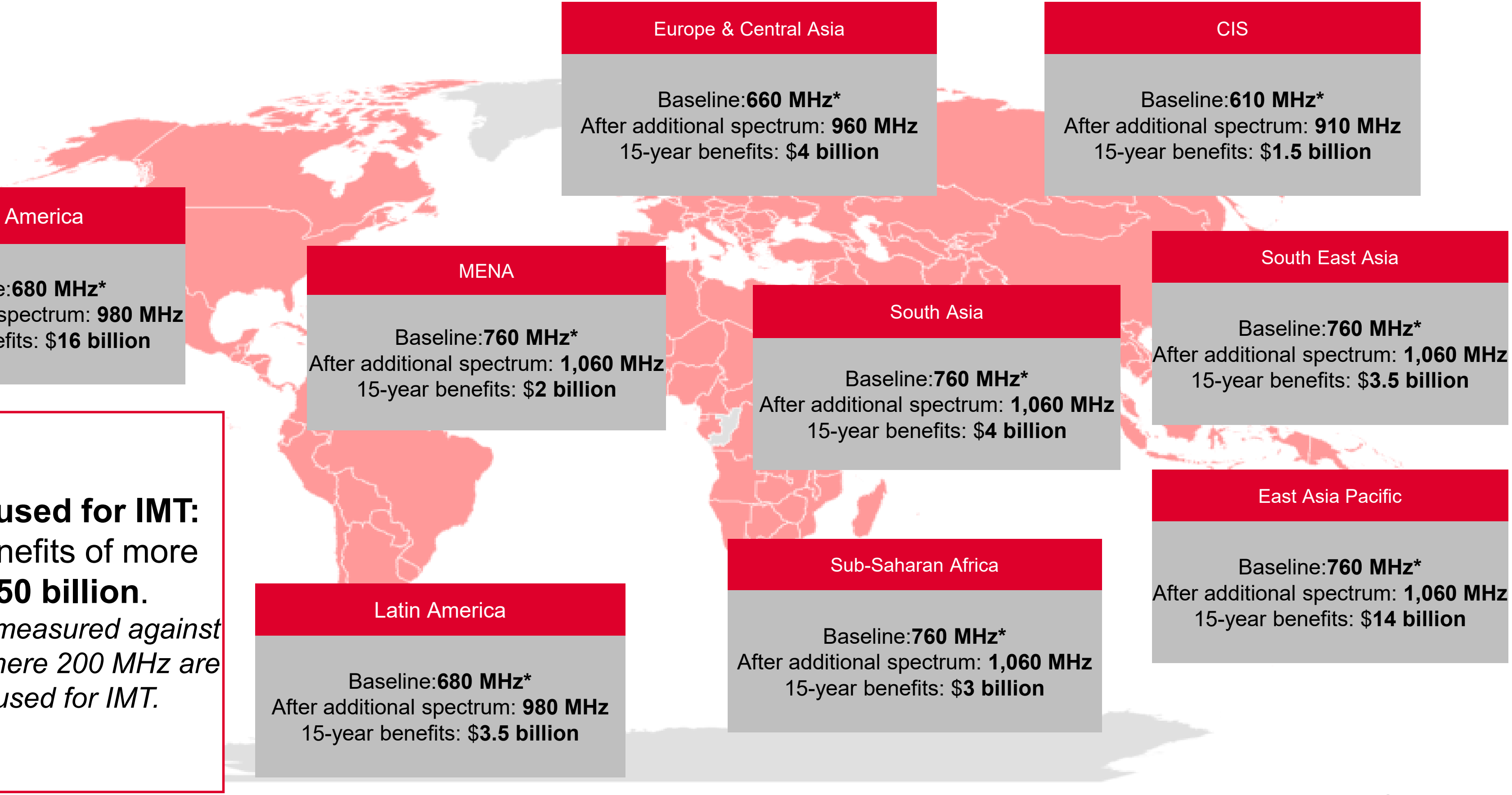
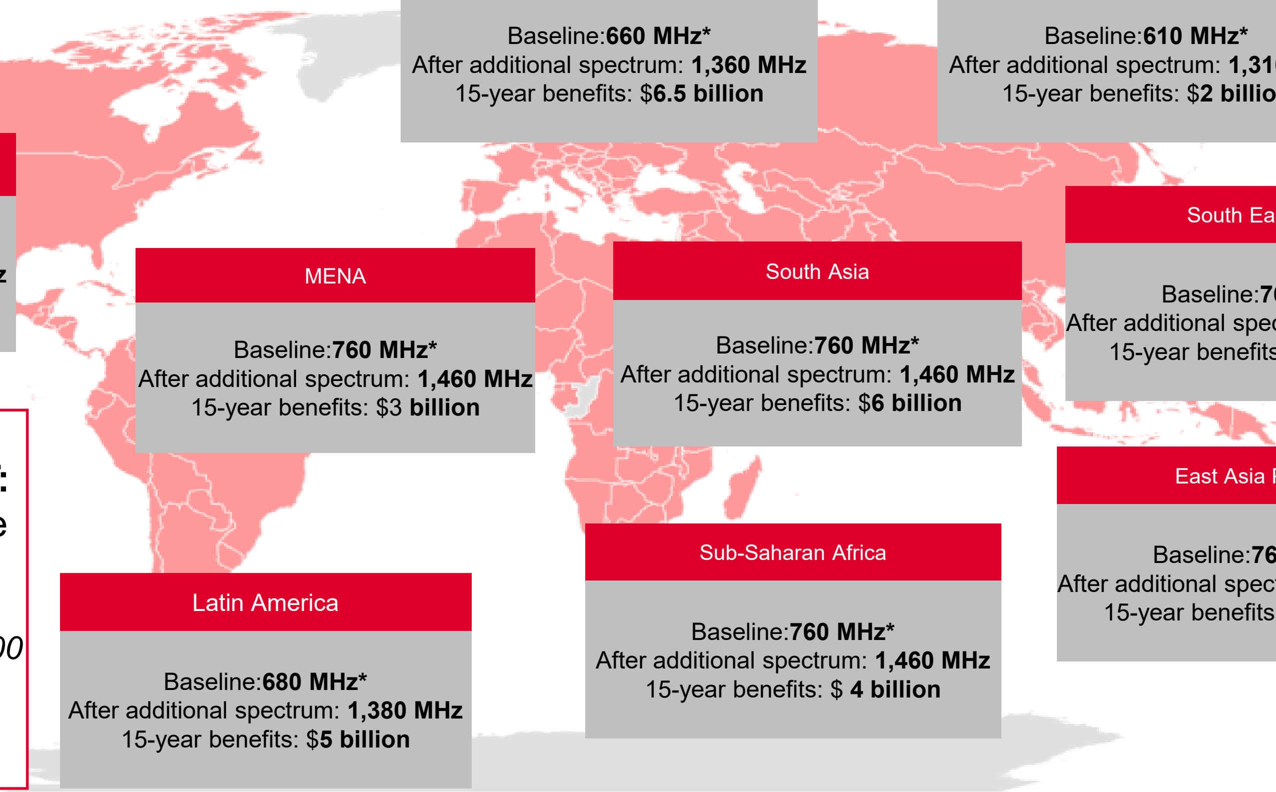


500 MHz used for IMT: Global benefits of more than **$50 billion.**

Benefits are measured against a baseline where 200 MHz are already used for IMT.

*Only above 1 GHz spectrum considered. 2300 MHz band not included. Includes 200 MHz in the C-band. Sum may not add up due to approximation.



Europe & Central Asia

Baseline:**660 MHz***
After additional spectrum: **1,360 MHz**
15-year benefits: $**6.5 billion**

CIS

Baseline:**610 MHz***
After additional spectrum: **1,310 MHz**
15-year benefits: $**2 billion**

North America

Baseline:**680 MHz***
After additional spectrum: **1,380 MHz**
15-year benefits: $**25 billion**

MENA

Baseline:**760 MHz***
After additional spectrum: **1,460 MHz**
15-year benefits: $3 **billion**

South Asia

Baseline:**760 MHz***
After additional spectrum: **1,460 MHz**
15-year benefits: $**6 billion**

South East Asia

Baseline:**760 MHz***
After additional spectrum: **1,460 MHz**
15-year benefits: $5.**5 billion**

East Asia Pacific

Baseline:**760 MHz***
After additional spectrum: **1,460 MHz**
15-year benefits: $**22 billion**

Latin America

Baseline:**680 MHz***
After additional spectrum: **1,380 MHz**
15-year benefits: $**5 billion**

Sub-Saharan Africa

Baseline:**760 MHz***
After additional spectrum: **1,460 MHz**
15-year benefits: $ **4 billion**

700 MHz used for IMT: Global benefits of more than **$80 billion.**
Benefits are measured against a baseline where 200 MHz are already used for IMT.

*Only above 1 GHz spectrum considered. 2300 MHz band not included. Includes 200 MHz in the 3.5 GHz. Regional figures mean that approximation has been used.

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Annexes

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Annex 1: extended description of modelling stages

Data Traffic in urban areas is forecast for the period 2020-2035, based on data consumption, number of subscribers and population forecasts.

Future regional CAPEX/OPEX necessary to satisfy the growing demand is calculated considering aspects such as current spectrum availability, technological changes, % of 3.5 GHz allocation.

Different scenarios where part of the 3.5 GHz range is allocated to MNOs are designed

Based on the different scenarios, the savings in CAPEX/OPEX are assumed to be passed-through to consumers, resulting in an increasing number of subscribers.

Infrastructure benefits are calculated based on cost savings from non having to build base stations. Revenues for handset, content and ecosystem are based on additional number of subscribers.

Indirect impacts are calculated as a percentage of direct value added. Productivity is calculated based on additional subscribers.

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Annex 2: Technical assumptions, global

Variable	Value	Source
Spectral efficiency – 3G	1.50	LTE 5G Innovation - 5G Americas/Rysavy 2017
Spectral efficiency – 4G	2.40	LTE 5G Innovation - 5G Americas/Rysavy 2017
Spectral efficiency – 5G	4.80	Estimate based on ITU IMT2000, Nokia and CTIA sources.
Number of sectors	2.50	Mobile broadband with HSPA and LTE - capacity and cost aspects, Nokia Siemens Networks, 2010
Nationwide data traffic distribution factor - urban	0.25	Mobile broadband with HSPA and LTE - capacity and cost aspects, Nokia Siemens Networks, 2010
Load factor	0.70	Mobile broadband with HSPA and LTE - capacity and cost aspects, Nokia Siemens Networks, 2010
Base station asset life, years	8	Mobile broadband with HSPA and LTE - capacity and cost aspects, Nokia Siemens Networks, 2010
Densification factor - 3G,4G	30%	Assumption. It is considered that operators will be willing to expand their current 3G and 4G base stations networks up to 30% of current footprint. Over this limit, it is assumed that operators will stop densifying their networks.
Densification factor – 5G	100%	Assumption. It is considered that operators will be willing to expand their future 5G base stations networks up to 100% of current footprint. Over this limit, it is assumed that operators will stop densifying their networks.
BTS per site	2	Estimate

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Annex 2: Technical assumptions, regional

Variable	Value	Source
Spectrum holding – 3G, above 1GHZ	0 to 120 MHz depending on the region	ITU Harmonisation database. Transition from different technology (3G to 4G to 5G) is accounted for over time
Spectrum holding – 4G, above 1GHZ	190 to 440 depending on the region	ITU Harmonisation database. Transition from different technology (3G to 4G to 5G) is accounted for over time
Spectrum holding – 5G, above 1GHZ	0	ITU Harmonisation database. Transition from different technology (3G to 4G to 5G) is accounted for over time
Base station upgrade	90.000 $ with 4 % year on year decrease	LATAM L Band model
Number of BTS in urban areas	Varies by region	Calculated with GSMAi data
Percentage of total mobile data traffic carried over mmWave by 2035.	13%	Conservative assumption based on previous GSMA study on Socio-Economic Benefits of 5G Services Provided in mmWave Bands.

Annex 3: Assumed technology transition phases

2019

Based on ITU Harmonisation, available spectrum is shared between 3G and 4G technologies.

2021

5G bands being used to carry mobile data traffic.

2025 – first technological transition (3G to 4G + 5G)

- 3G share of spectrum reduced to 5%.
- 4G share of spectrum equal to 85%.
- 5G share of spectrum equal to 10%.

2030

5G share of spectrum reaches 40%.

2035 – second technological transition (4G to 5G)

- 3G share of spectrum equal to 5%.
- 4G share of spectrum equal to 35%.
- 5G share of spectrum equal to 60%.

Source: GSMA estimation based on current market uptake and planned auctions.