5G : A Catalyst for Achieving SDGs

5G Huddle 2020

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New Delhi, India

Sameer Sharma
Regional Director a.i

International Telecommunication Union
Regional Office for Asia and the Pacific

ITU at a Glance: About Us

What we do

3 Sectors

ITU Radiocommunication
Coordinating radio-frequency spectrum and **assigning** orbital slots for satellites

ITU Standardization
Establishing global standards

ITU Development
Bridging the digital divide

‘Committed to Connecting the World’

193	+700	+150
MEMBER STATES	INDUSTRY & INTERNATIONAL ORGANIZATIONS	ACADEMIA MEMBERS

MEMBERSHIP

Digital Transformation key to achieving SDGs

Digital transformation is key to accelerate our progress towards SDGs..

17 Sustainable Development Goals

169 Targets

Setting the scene: How we define 5G

Definition

- **Res. ITU-R 56-1: Naming for International Mobile Telecommunications**

  Since ITU is the internationally recognized entity that has sole responsibility to define and to recommend the standards and frequency arrangements for IMT systems, with the collaboration of other organizations such as standard development organizations, universities, industry organizations and with partnership projects, forums, consortia and research collaborations, therefore the RA-15 debated especially on naming of IMT systems.

  - the existing term IMT-2000 continues to be relevant and should continue to be utilized;
  - the existing term IMT-Advanced continues to be relevant and should continue to be utilized;
  - However for systems, system components, and related aspects that include new radio interface(s) which support the new capabilities of systems beyond IMT-2000 and IMT-Advanced, the term “IMT-2020” be applied
  - In addition it was resolved that the term “IMT” would be considered the root name that encompasses all of IMT-2000, IMT-Advanced and IMT-2020 collectively.

Setting the scene: How we define 5G

IMT-2000, IMT-Advanced & IMT-2020

All of today’s 3G and 4G mobile broadband systems are based on the ITU’s IMT standards.	IMT provides the global platform on which to build the next generations of mobile broadband connectivity.	ITU established the detailed specifications for **IMT-2000** and the first 3G deployments commenced around the year 2000.	In January 2012, ITU defined the next big leap forward with 4G wireless cellular technology – **IMT-Advanced** – and this is now being progressively deployed worldwide.	The detailed investigation of the key elements of **IMT-2020** is already well underway, once again using the highly successful partnership ITU-R has with the mobile broadband industry and the wide range of stakeholders in the 5G community.

Setting the scene: Capabilities of the different technologies

Evolution of mobile networks

	1G	2G	3G	4G	5G
Approximate deployment date	1980s	1990s	2000s	2010s	2020s
Theoretical download speed	2kbit/s	384kbit/s	56Mbit/s	1Gbit/s	10Gbit/s
Latency	N/A	629 ms	212 ms	60-98 ms	< 1 ms

Figure 2: Evolution of mobile networks. Source: GSMA, OpenSignal, operator press releases, ITU

Setting the scene: At the WRC-19

Agenda Item 1.13

Background

Enhanced mobile broadband (eMBB),

Massive machine-type communications (mMTC) and

Ultrareliable and low-latency communications (URLLC).

Setting the scene: After the WRC-19

Implications of identifications of IMT spectrum by WRC

Satisfy growing IMT broadband (5G) spectrum requirements

10 times increase in IMT bands compared to WRC-15

IMT spectrum **increases** from 1.886 GHz to **19.136 GHz**

Provide harmonization of IMT bands

91 percent - High global harmonization index WRC-19

Overall global harmonization index* increased to **88.8 % after WRC-19;** 65.9 % after WRC-15

Secures future of other services

Through technical restrictions

Density through coordination procedures, e.g. Article 9

In some cases operation on a non-interference basis

Future Spectrum need estimation for IMT (24.25 GHz - 86 GHz)

Deployment scenarios	Indoor hotspot	Dense urban		Urban macro
		Micro	Macro	
Frequency range	24.25-86 GHz	24.25-43.5 GHz	<6 GHz	<6 GHz

Deployment scenario	Micro	Indoor hotspot
Total spectrum needs for 24.25-86 GHz	14.8-19.7 GHz*	
Spectrum needs for 24.25-43.5 GHz	5.8-7.7 GHz	9-12 GHz
Spectrum needs for 45.5-86 GHz	–**	

* *Considering the coexistence between multiple network operators (e.g. the guard band(s) may be required in the case of multiple network operators scenarios), the total spectrum needs are expected to be increased.*

*** The division in this table regarding frequency ranges and deployment scenarios is just an indicative example on how spectrum needs could be distributed for different spectrum sub-ranges within 24.25-86 GHz and different deployment scenarios. This table should not be understood nor used to exclude any possible IMT-2020 deployment options in the range 45.5-86 GHz.*

Source: WP 5D Liaison statement to Task Group 5/1

WRC-19 IMT identification (24.25 GHz - 86 GHz)

▪ Identified frequency bands for 5G

- 24.25 - 27.5 GHz,
- 37 - 43.5 GHz,
- 45.5 - 47 GHz,
- 47.2 - 48.2
- 66 - 71 GHz

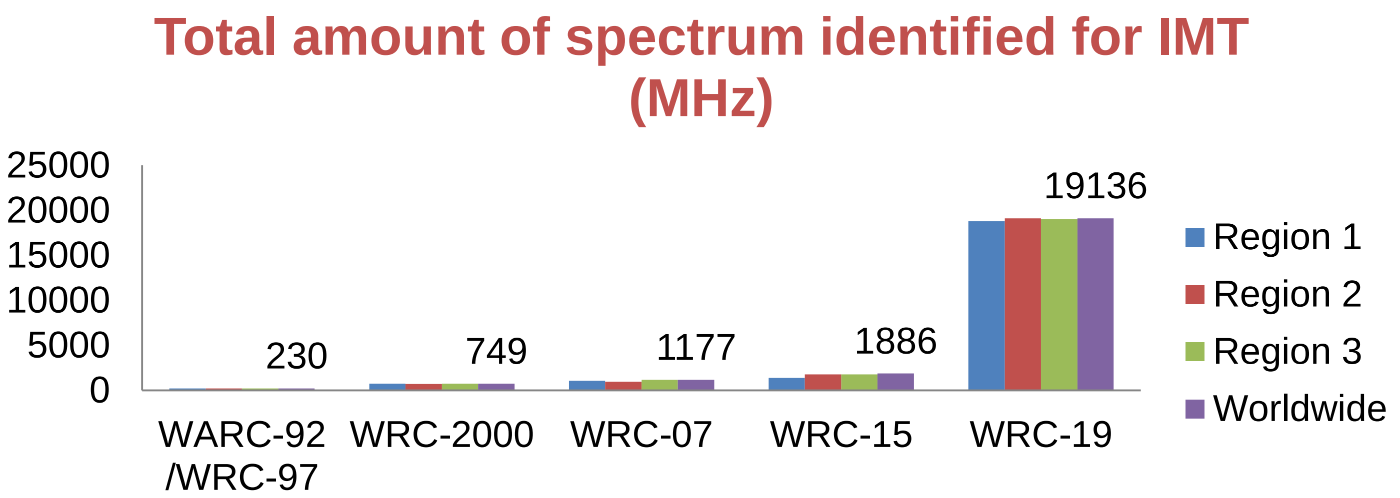
Measures taken to ensure an appropriate protection of the Earth Exploration Satellite Services, including meteorological and other passive services in adjacent bands.

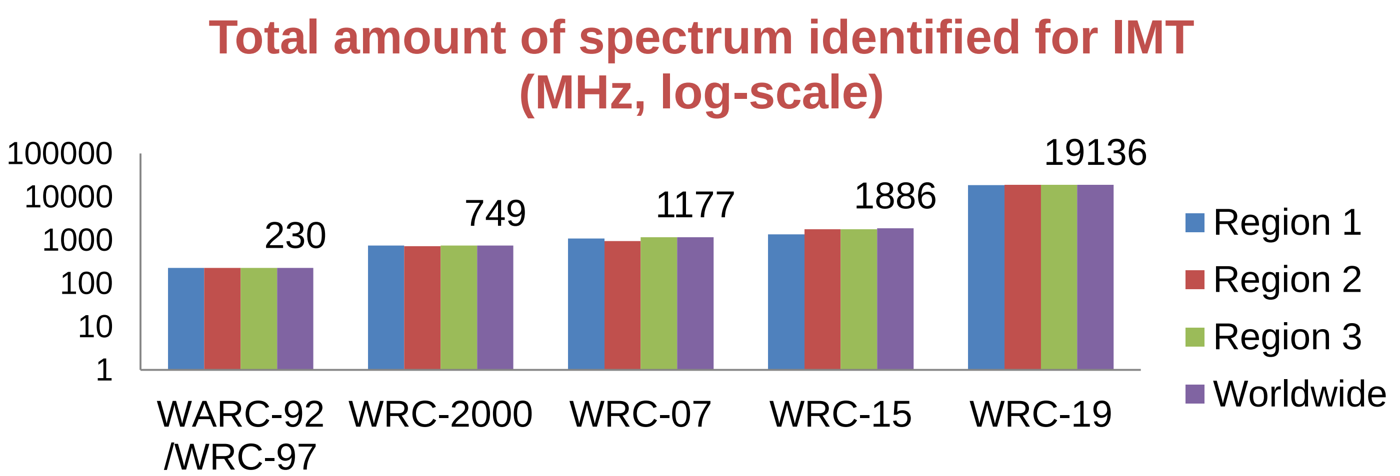
17.25 GHz of spectrum has been identified for IMT

14.75 GHz of spectrum has been harmonized worldwide, reaching 85% of global harmonization.

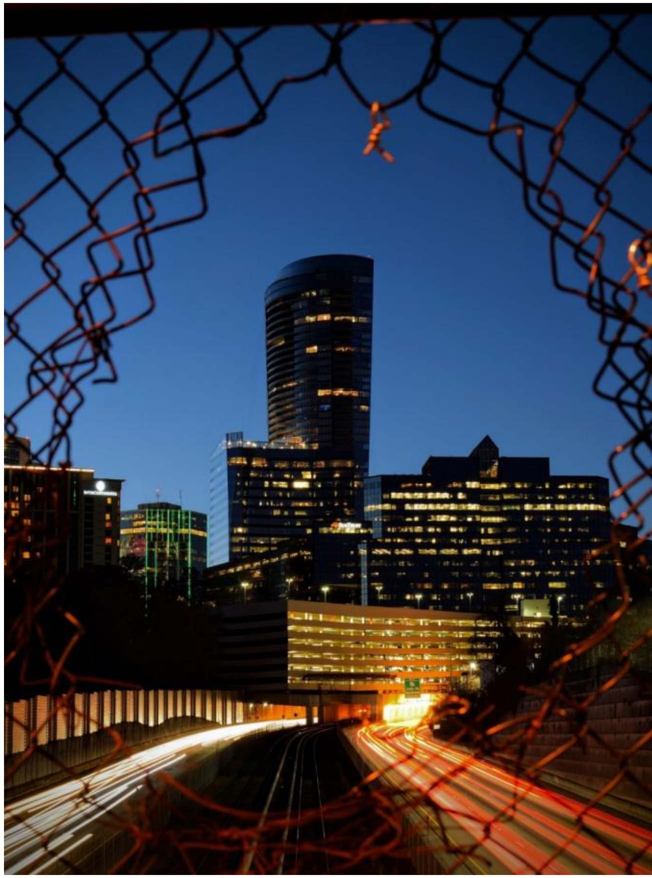
: https://news.itu.int/wrc-19-agrees-to-identify-new-frequency-bands-for-5g/

Identification of spectrum for IMT at WARCs/WRCs



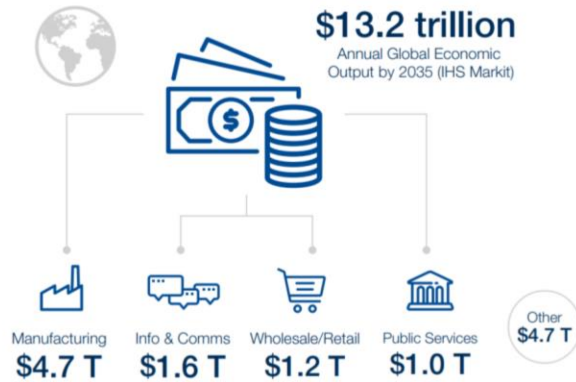


5G: Capabilities and Opportunities

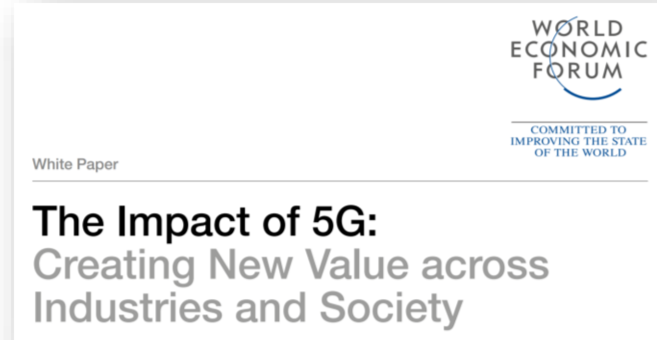


5G as catalyst: Enabling intelligent connectivity

Figure 2: Economic and social value

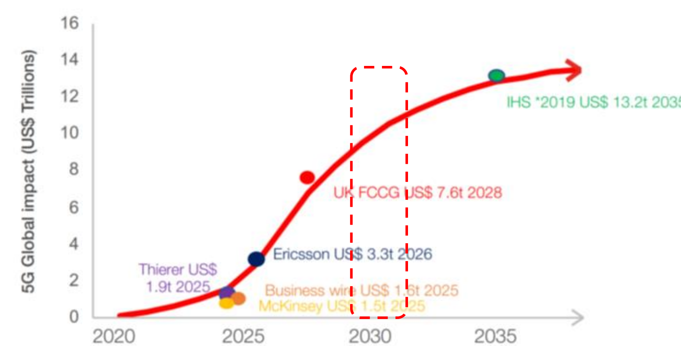


Source: Based on IHS Markit, *The 5G Economy: How 5G will contribute to the global economy*, 2019.



5G will bring us closer towards achieving the SDG by 2030 with more than US$ 7.6t worth of socio-economic impact estimated to come from this technology.

e **3**: Cumulative global 5G impact, 2020-2035



Source: Chart extracted from *5G socio-economic impact in Switzerland* by tech4i2, February 2019, updated with the figure $13.2 trillion by 2035 from *The 5G Economy: How 5G will contribute to the global economy* by IHS Markit, November 2019.

Capabilities and opportunities: The role of 5G

ITU-R Recommendation M.2083-0: IMT should contribute to

Wireless infrastructure to connect the world:

Broadband connectivity will acquire the same level of importance as access to electricity. IMT will continue to play an important role in this context as it will act as one of the key pillars to enable mobile service delivery and information exchanges. In the future, private and professional users will be provided with a wide variety of applications and services, ranging from infotainment services to new industrial and professional applications.

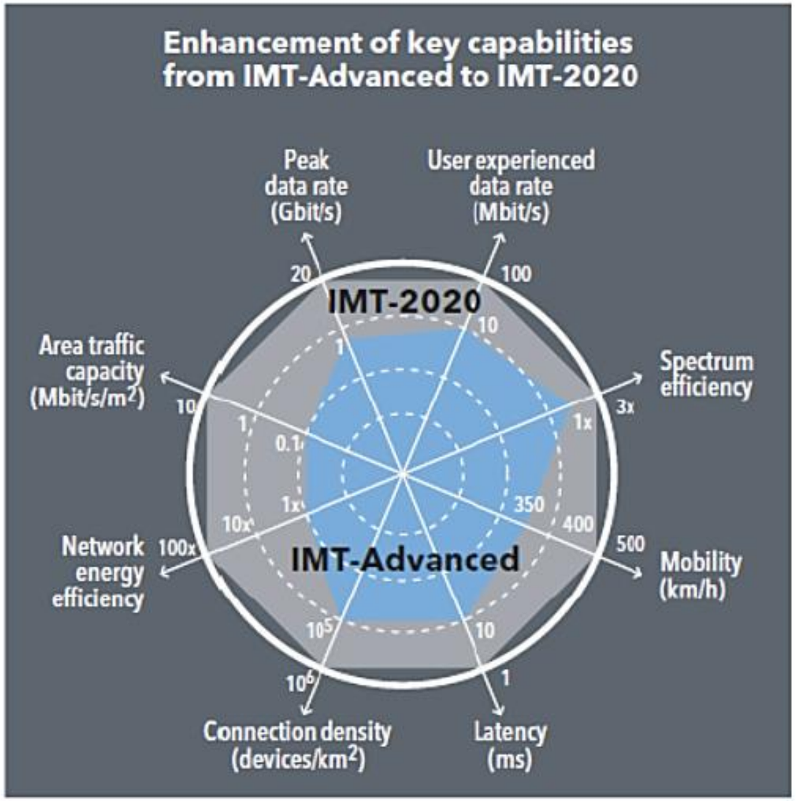
New ICT market:

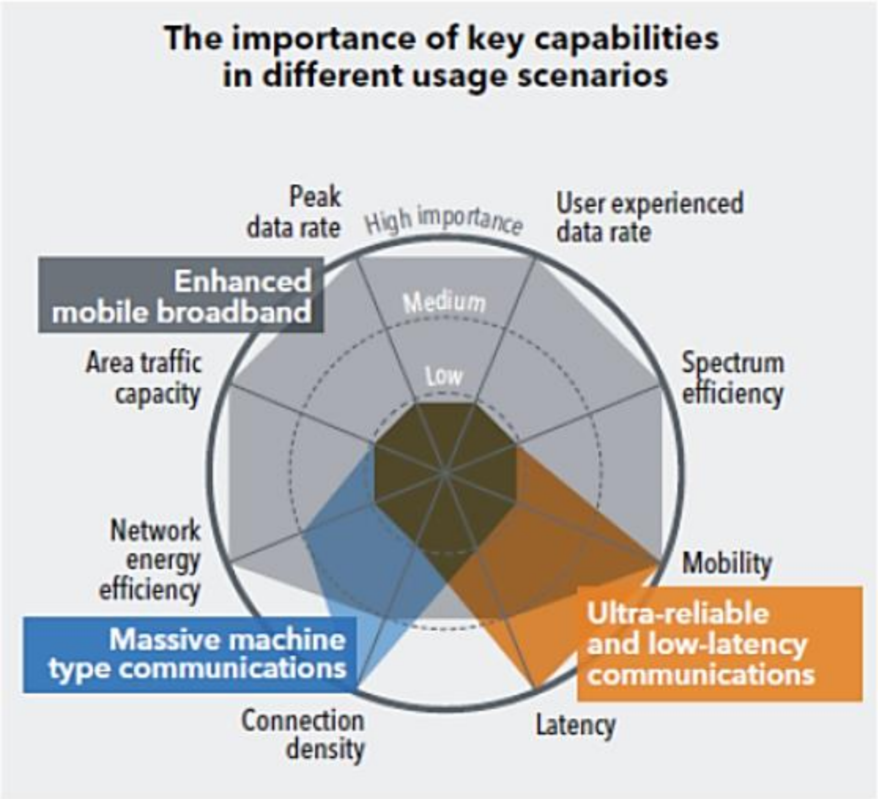
The development of future IMT systems is expected to promote the emergence of an integrated ICT industry which will constitute a driver for economies around the globe. Some possible areas include: the accumulation, aggregation and analysis of big data; delivering customized networking services for enterprise and social network groups on wireless networks.

Capabilities and opportunities: Potential impact for developing countries

What can 5G do for developing countries

IMT-Advanced vs IMT 2020

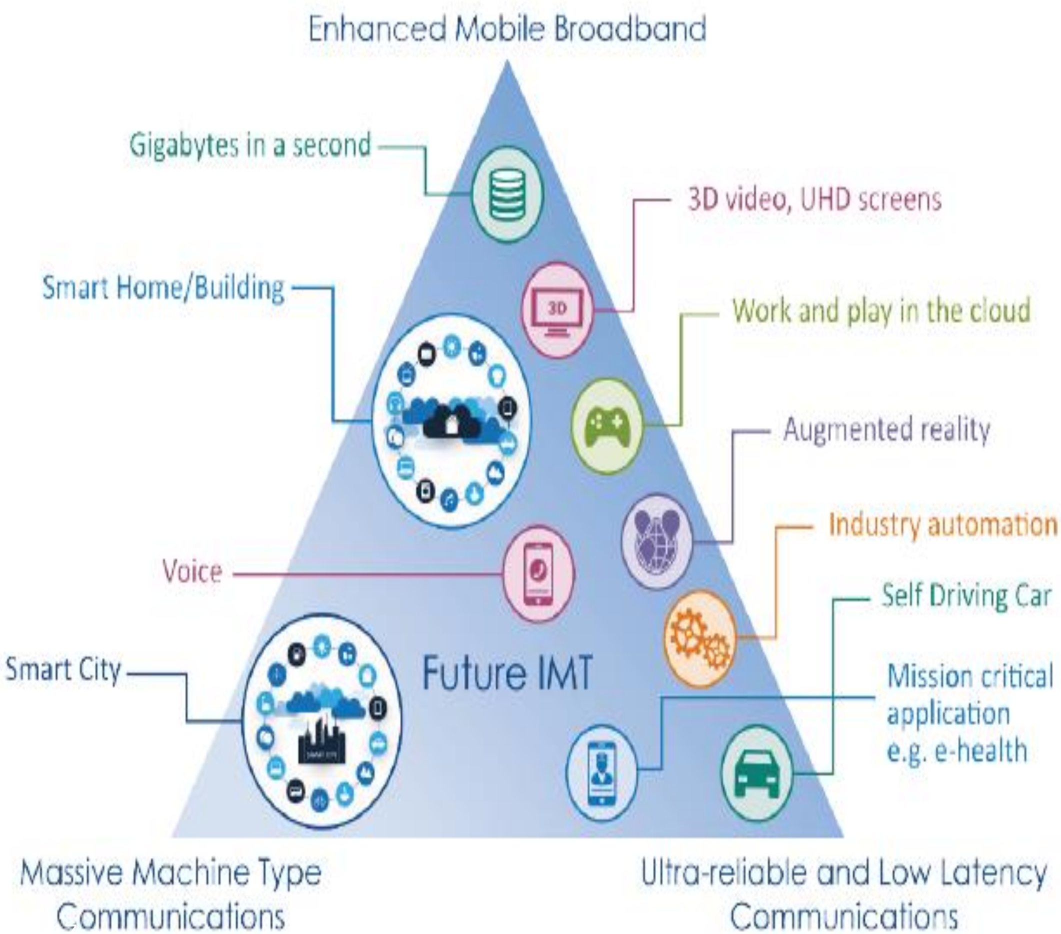




The values in the figures above are targets for research and investigation for IMT-2020 and may be revised in the light of future studies. Further information is available in the IMT-2020 Vision **(Recommendation ITU-R M.2083)**

Capabilities and opportunities: It opens possibilities

5G Use Cases

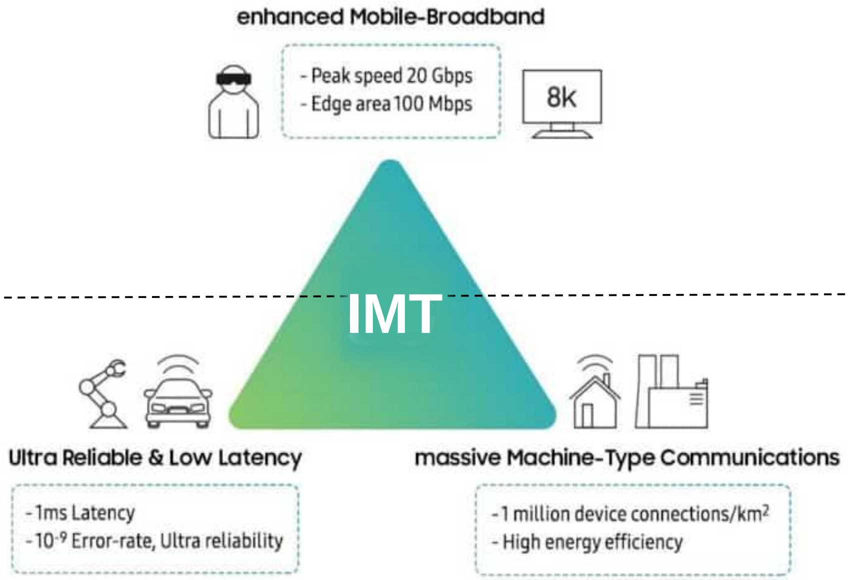


1.Enhanced mobile broadband (eMBB) – enhanced indoor and outdoor broadband, enterprise collaboration, augmented and virtual reality.

2. Massive machine-type communications (mMTC) – IoT, asset tracking, smart agriculture, smart cities, energy monitoring, smart home, remote monitoring.

3. Ultra-reliable and low-latency communications (URLLC) – autonomous vehicles, smart grids, remote patient monitoring and telehealth, industrial automation.

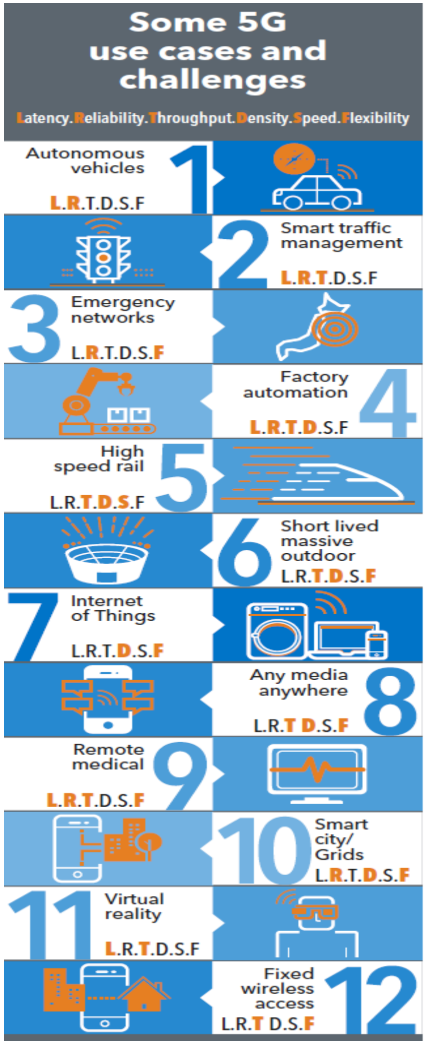
Understanding IMT applications



Consumer – Fixed wireless

Business

Source: Forging paths to IMT-2020 (5G), Stephen M. Blust, Chairman, ITU Radiocommunication Sector (ITU–R) Working Party 5D, Sergio Buonomo, Counsellor, ITU–R Study Group 5, ITU News, 02/2017



5G: Challenges Ahead

5G: Challenges ahead- Economic viability remains the biggest question

Despite the potential economic benefits that can be realised from 5G, the industry is sceptical about the commercial case for investment in 5G.

Given the significant amount of investment that will be required to be made by operators in deploying 5G networks there is scepticism among some European operators over the hype that 5G has caused and over how they are supposed to make money from it.

These concerns have been supported by the 5G Infrastructure Association (5GIA), a European Union (EU)-backed body, and by senior telecoms executives which have cautioned the market against premature 5G launch announcements*.


EU-backed groups warns about 5G claims

By Maxwell Cooter December 01, 2017

5G is a transformative technology - don't let it be overhyped

*https://www.techradar.com/news/eu-backed-groups-warns-about-5g-claims

5G: Challenges ahead- The high cost of deploying 5G infrastructure

Some challenges in rolling out 5G

Small cell deployment

- Local permitting and planning process
- Lengthy engagement and procurement exercises
- High fees and charges to access street furniture (and the access itself)
- EMF

Fiber backhaul

Spectrum

Investment Models

Example of costs and investment implications

Example of a high-level cost model to estimate the potential investment required by a wireless operator to deploy a 5G-ready small cell network

Source: ITU report "Setting the Scene for 5G: Opportunities & Challenges"

Investment Models: Scenarios

➢ Scenario 1 – large densely populated city

Assumptions

- Proposed urban coverage area: 15 sq km
- Population density of coverage area: 12 000 people per sq km
- Inter-site small cell distance: 150 m.

➢ Scenario 2 – small medium density city

Assumptions

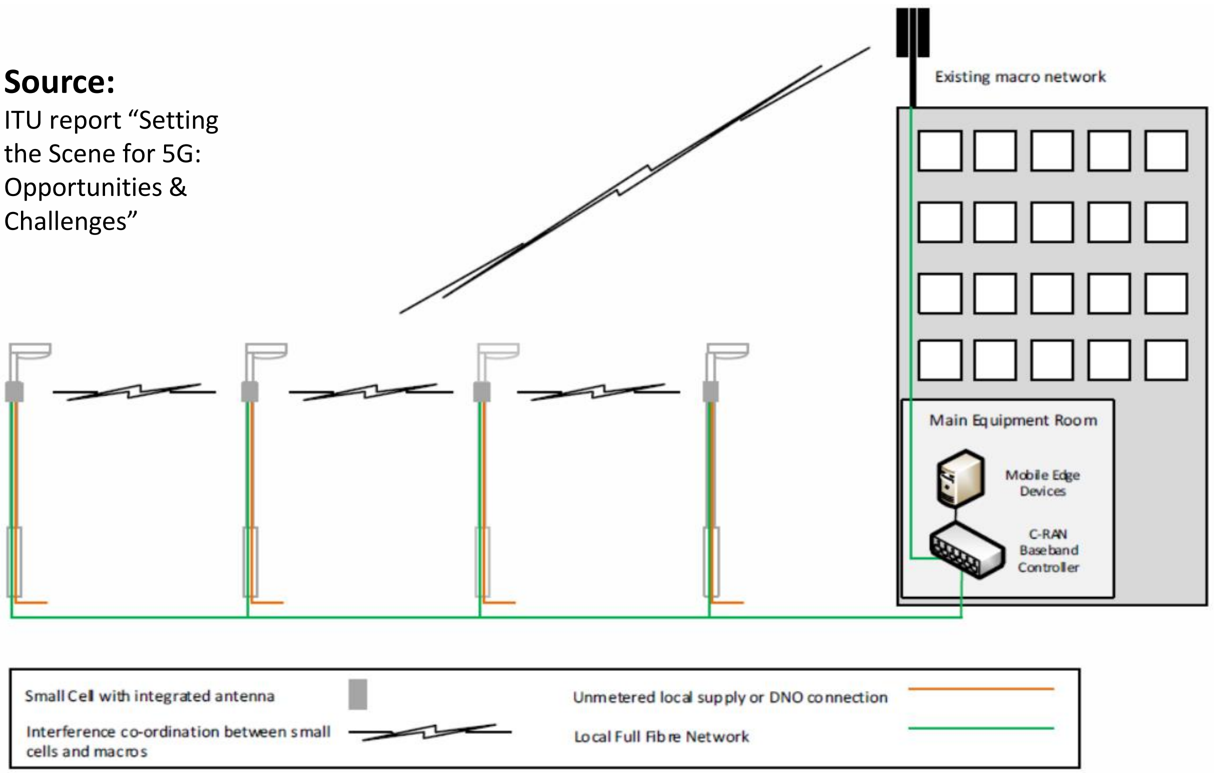
- Proposed urban coverage area: 3 sq km
- Population density of coverage area: 3 298 people per sq km
- Inter-site small cell distance: 200 m.

Source:
ITU report “Setting the Scene for 5G: Opportunities & Challenges”

Investment Models

Typical neutral host wholesale small cell solution

Source:
ITU report "Setting the Scene for 5G: Opportunities & Challenges"



- **Antennae** – discreet high-performance antenna system which shapes the mobile operator's signal to maximize service performance for end users.
- **Street lights** – deployment of antennae on existing street lights to minimize aesthetic disruption.
- **Street cabinets** – shared accommodation hosting mobile operator radio equipment, battery backup and control equipment.
- **Fibre network** – high speed fibre that connects the radio network with the core network. Note that in some cases it may be more cost effective to use wireless backhaul.
- **Main Equipment Rooms (MER)** – A series of localized, shared main equipment

Investment Models: The results

Capex for scenario 1 – large dense city

Item	Value
Total capex (USD millions)	**55.5**
Number of small-cell sites	1,027
Cost per square km (USD millions)	3.7
Capex per site (USD thousands)	54.1

Contributions to capex

Small cell distance	Scenario 1	Scenario 2
RAN equipment (antenna, street cabinet, base station electronics, battery backup and network maintenance modules)	25%	24%
Implementation costs (design and planning costs, site upgrade costs, permit costs and civils costs to lay street cabinets)	50%	46%
Fibre (provision of 144 fibre along the route of activated street assets)	25%	30%
MER (single rack and termination equipment)	<0.1%	<0.1%

Capex for scenario 2 – small less dense city

Item	Value
Total capex (USD millions)	**6.8**
Number of small-cell sites	116
Cost per square km (USD millions)	2.3
Capex per site (USD thousands)	58.6

5G: Role of Regulation

"…regulation has entered a new age and that innovative and collaborative approaches to policy and regulation are more urgently required than ever"

Ms Doreen Bogdan-Martin, Director
Telecommunications Development Bureau (BDT), ITU

Facilitating ICT4SDG

ICTs are specifically mentioned as a means of implementation under SDG17, highlighting the cross-cutting transformative potential of ICTs. Indeed, ICTs are crucial in achieving all of the SDGs, since ICTs are catalysts that accelerate all three pillars of sustainable development – **economic growth, social inclusion and environmental sustainability** – as well as providing an innovative and effective means of implementation in today's inter-connected world.

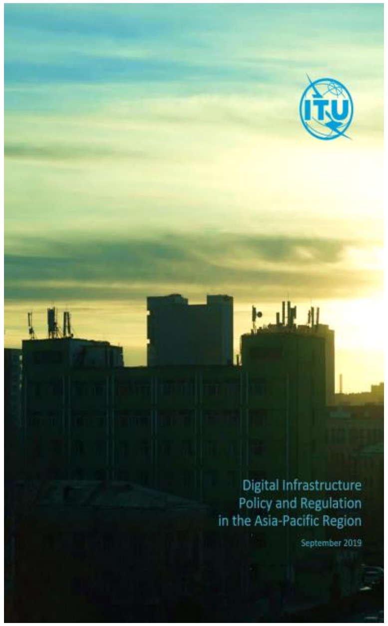
5G Policy and Regulatory Enablers

Issues	Recommendations
Investment case	Policymakers may consider undertaking their own independent economic case assessment of the commercial viability of deploying 5G networks while in the interim facilitating 4G network deployment and where appropriate 2G/3G switchoff
Harmonize spectrum	Regulators should allocate/assign globally harmonized 5G spectrum including 3.5 GHz, mmWave, 2.6 TDD GHz, 2.3 GHz, 700 and 600 MHz
Spectrum roadmap	Regulators should adopt a spectrum roadmap and a predictable roadmap renewal process
Spectrum sharing	Regulators may consider allowing sharing to maximize efficient use of available sharing spectrum, particularly to benefit rural areas
Spectrum pricing	Regulators may consider selecting spectrum award procedures that favour investment (As opposed to auction returns)
Sub-1 GHz spectrum	Policymakers should consider supporting the use of affordable wireless coverage (eg through the 700 & 600 MHz bands) to reduce the digital divide
Fibre investment incentives	Policymakers, where the market has failed, may consider stimulating fibre investment and passive assets through PPPs, investment funds and the offering of grant funding, etc.
Fibre tax	Policymakers may consider removing any tax burdens associated with deploying fibre networks to reduce the associated costs
Copper to fibre	Policymakers may consider adopting policies/financial incentives to to encourage migration from copper to fibre & stimulate deployment of fibre

5G Policy and Regulatory Enablers

Wireless backhaul	**Wireless Operators may consider a portfolio of wireless technologies for 5G backhaul backhaul in addition to fibre, including point-to-multipoint (PMP), microwave and mmWave radio relays, satellites**
Access/sharing of passive infrastructure	Policymakers may consider allowing access to government-owned infrastructure such as utility poles, traffic lights and lampposts to give wireless operators the appropriate rights to deploy electronic small cell apparatus to street furniture. And Regulators may consider continuing to elaborate existing duct access regimes to encompass 5G networks allowing affordable fibre deployments
Access costs	Policymakers/Regulators may consider ensuring reasonable fees are charged to operators to deploy small-cell radio equipment
Asset database	Policymakers may consider holding a central database identifying key contacts, showing assets such as utility ducts, fibre networks, CCTV posts, lampposts, etc. This will help operators cost and plan their infrastructure deployment more accurately
Wayleaves (ROW)	Policymakers may agree upon standardized wayleave agreements to (rights of way) reduce cost and time to deploy fibre & wireless
5G test beds	Policymakers to encourage 5G pilots and test beds to test 5G technologies, & use cases, and to stimulate market engagement

ITU Digital Infrastructure White Paper : Key Recommendations



1 Set broadband targets for digital infrastructure

Develop national plans for affordable broadband targeting 65% in developing and 35% in least developed nations

2 Ensure legislation is updated and fit for purpose

Promote independent regulatory bodies, fair non-discriminatory rules, open access and rights of way

3 Incentives for the deployment of digital infrastructure

Balance regulatory and tax imposts of operators to encourage infrastructure deployment

4 Issue new rules addressing rights of way

Overcome barriers to rights of way processes to facilitate more rapid infrastructure deployment

5 Facilitate fixed broadband and 5G infrastructure deployment

Encourage sharing infrastructure for 5G, build check-before-you-dig national database, one-stop approvals

6 Releasing more IMT spectrum for wireless broadband and 5G

Expand allocations to at least 840 MHz in contagious blocks to encourage investments by operators

7 Facilitate switch-off of legacy 2G/3G services

Promote orderly migration to newer technologies for benefits such as spectral efficiency and lower capex and opex

8 Improve quality of broadband services

Require accurate advertising and assessment of actual broadband speeds, encourage higher speed targets

9 Improve regulatory skillsets

Build skillsets in economics, finance, content regulation, cybersecurity, law, competition analysis, tax and cross-government experience.

Summary

The scope of IMT-2020 is much broader than previous generations of mobile broadband communication systems.

Use cases foreseen include enhancement of the traditional mobile broadband scenarios as well as ultra-reliable and low latency communications and massive machine-type communications.

The ITU's work in developing the specifications for IMT-2020, in close collaboration with the whole gamut of 5G stakeholders, is now well underway, along with the associated spectrum management and spectrum identification aspects.

IMT-2020 will be a cornerstone for all of the activities related to attaining the goals in the **2030 Agenda for Sustainable Development.**

Thank you