GSMA

VISION 2040



The economic benefits of 6G

Copyright © 2026 GSMA

GSMA

The GSMA is a global organisation unifying the mobile ecosystem to discover, develop and deliver innovation foundational to positive business environments and societal change. Our vision is to unlock the full power of connectivity so that people, industry and society thrive. Representing mobile operators and organisations across the mobile ecosystem and adjacent industries, the GSMA delivers for its members across three broad pillars: Connectivity for Good, Industry Services and Solutions, and Outreach. This activity includes advancing policy, tackling today's biggest societal challenges, underpinning the technology and interoperability that make mobile work, and providing the world's largest platform to convene the mobile ecosystem at the MWC and M360 series of events.

We invite you to find out more at gsma.com

GSMA Intelligence

GSMA Intelligence is the definitive source of global mobile operator data, analysis and forecasts, and publisher of authoritative industry reports and research. Our data covers every operator group, network and MVNO in every country worldwide — from Afghanistan to Zimbabwe. It is the most accurate and complete set of industry metrics available, comprising tens of millions of individual data points, updated daily.

GSMA Intelligence is relied on by leading operators, vendors, regulators, financial institutions and third-party industry players, to support strategic decision-making and long-term investment planning. The data is used as an industry reference point and is frequently cited by the media and by the industry itself.

Our team of analysts and experts produce regular thought-leading research reports across a range of industry topics.

www.gsmaintelligence.com

info@gsmaintelligence.com

Authors:
Harry Aquije Ballon, Economist, GSMA Intelligence
Kalvin Bahia, Senior Director of Economics, GSMA Intelligence
Pau Castells, Head of Economic Analysis, GSMA Intelligence

Published: November 2026

CONTENTS

Executive summary 5

1. The macroeconomics of 6G 13
What makes 6G different? 15
The economic drivers of 6G 19

2. The additional economic contribution of 6G 22
Global results 23
Results by sector 25

3. Spectrum is required to enable the 6G economy 27
6G spectrum constraints 28
Implications for spectrum policy 29
Why spectrum impacts 6G's economic benefit 30
Candidate 6G bands 31

4. Results by region 32

Appendix A: modelling the economic impacts of 6G 39
The impact of mobile technologies 40
The impact of AI 41

Appendix B: the role of each band 43

VISION 2040: THE ECONOMIC BENEFITS OF 6G

6G's additional contribution to the global economy in **2040** is

$1.24 TRILLION

or **0.7%** of global GDP

Dependent on timely access to spectrum capacity

Spectrum is required to enable the 6G economy

The global economy could lose up to **$520 billion** by **2040** if **6G spectrum is constrained**

$1.24 TRILLION	This is **42%** of the benefit in **2040**
	$720 BILLION
Optimal scenario	Constrained scenario

6G use cases

AI connectivity
Integrating and optimising future AI capabilities

MIoT and URLLC
Industrial automation and robotics

eMBB and FWA
Immersive experiences (extended reality)

ISAC
Joint sensing and communication, and detection

NTNs
Ubiquitous coverage, service continuity

Factors impacting 6G benefits

1 The pace of 6G adoption
Network rollout, affordability of devices and services, applications ecosystem

2 Regulatory frameworks
Cost of spectrum, amount of spectrum, licence duration, data governance, cybersecurity

3 Macroeconomic conditions
Physical and digital infrastructure, human capital and skilled workforce

Policy recommendations

LOW BANDS

Make the 600 MHz band available for 6G – and consider 500 MHz – to improve low-band coverage and capacity

MID-BANDS

Release at least 2 GHz of mid-band spectrum by around 2030. By 2035–2040 a global average of 2–2.5 GHz is needed, or 2.4–3.3 GHz in higher-demand countries. The upper 3.5 GHz, 4.5 GHz and 6–8 GHz bands should be considered.

EXECUTIVE SUMMARY

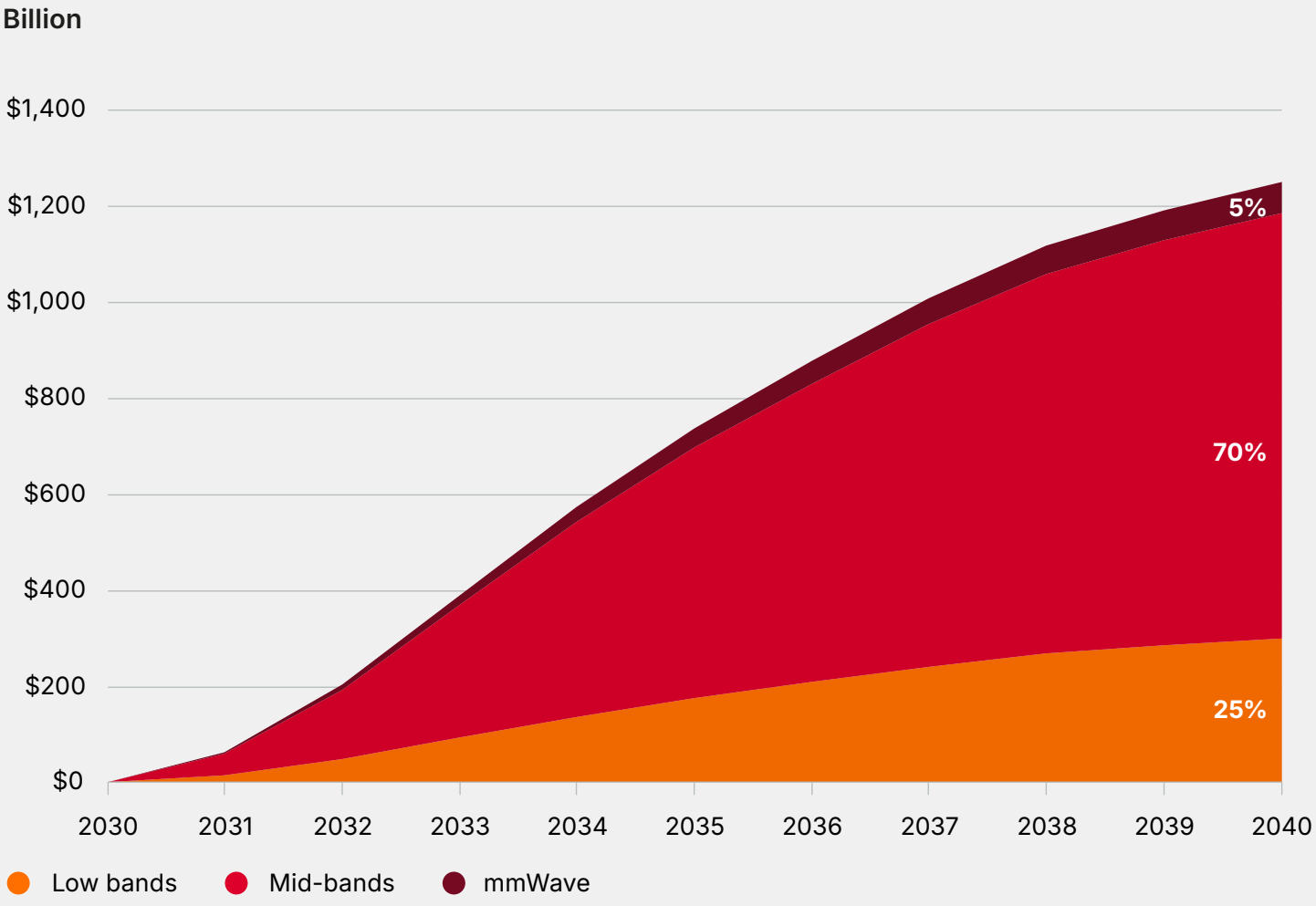


6G can add $1.24 trillion to the global economy in 2040 if the right amount of spectrum is made available

Four decades of digital technology have raised productivity and improved market efficiency by transforming how information is generated, shared and used. Each generation of mobile technology has increased the socioeconomic impact of mobile by reaching new sectors and enabling new use cases. 6G is expected to continue this evolution as an AI-native network that not only carries data but senses, reasons and acts. This shift will enhance what mobile connectivity contributes to the economy – but realising these benefits starts with ensuring there is enough spectrum to power the world's mobile networks.

6G is set to contribute $1.24 trillion to the global economy in 2040, equal to 0.7% of GDP. Importantly, this represents the additional contribution of 6G – beyond what mobile networks would deliver if 5G remained the most advanced technology in use. It therefore comes on top of the existing contribution of mobile, which includes all generations of mobile technology and the services built on them.[1]

Figure i
Annual impact of 6G on GDP by band, 2030–2040



Source: GSMA Intelligence

1 For further details see The Mobile Economy 2026, GSMA, 2026



Mid-bands will drive most of the 6G benefits, at 70% of the total in 2040, while low bands will contribute to a quarter of the total. Low bands will provide the coverage layer of this opportunity, carrying connectivity across wide areas and deep indoors at the lowest cost per square kilometre. In dense urban areas it is what carries service furthest inside large buildings, where higher frequencies struggle to penetrate concrete and the alternative is indoor infrastructure. Low bands are therefore the most important for enabling the inclusion benefits of 6G, from closing coverage gaps to increasing rural capacity, improving network quality and enabling MIoT.

Socioeconomic gains will arrive through two channels. The first is higher productivity within existing activities as organisations apply digital tools more intensively in production, logistics and services. The second is the creation of new products, services and markets that need more throughput, lower latency or greater reliability than what today's networks provide.

6G will build on the capabilities of today's networks and further enhance current use cases, such as enhanced mobile broadband (eMBB), machine-type communications (MTC) and ultra-reliable low-latency communications (URLLC).

The greater economic impact will also be supported by three new elements of 6G:

- It is AI-native.
- It can sense its environment as well as communicate.
- It integrates terrestrial networks and non-terrestrial networks (NTNs).

6G will enhance existing use cases around eMBB by enabling immersive experiences (extended reality) and richer digital services for consumers. For fixed wireless access (FWA), 6G will provide greater capacity, more consistent performance and more efficient network management. 6G will also support industrial automation and robotics by improving massive IoT (MIoT) and URLLC. Together, these capabilities will increasingly create economic value through new activities, including intelligent automation, real-time services and ubiquitous coverage, rather than incremental improvements to existing activities.

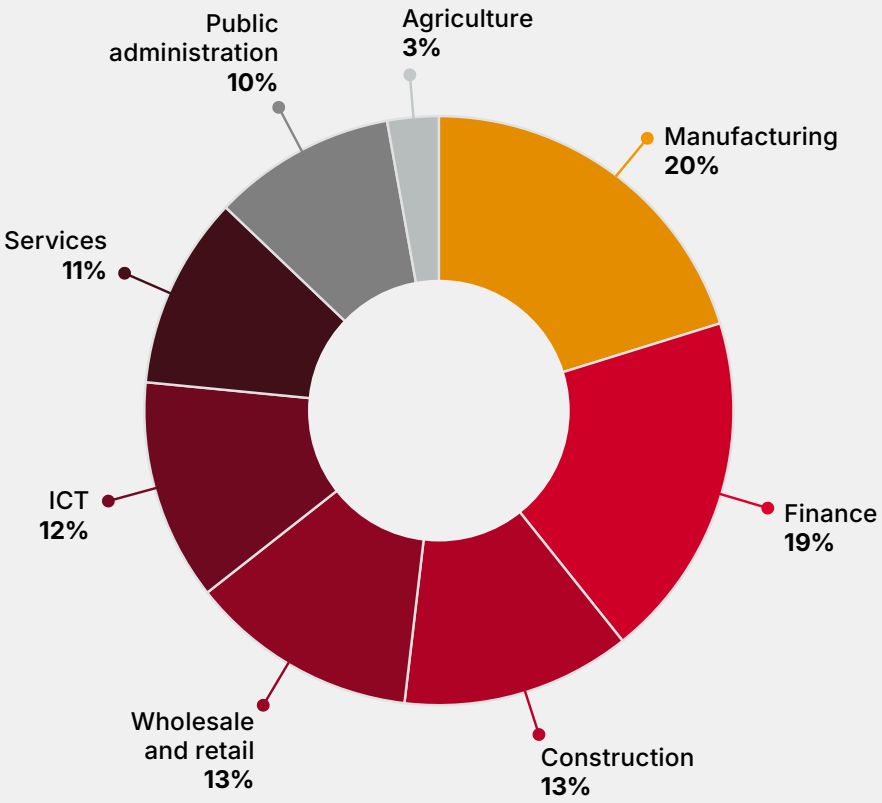
6G can uplift the economy through new and enhanced use cases

The additional benefits that 6G brings on top of existing technologies will come from its ability to maximise productivity across five use cases:

- **Connectivity for AI systems** carries AI services across sectors – 6G is not a requirement for supporting today's AI but it will integrate and optimise future AI capabilities.
- **MIoT and URLLC** instrument and automate physical processes in manufacturing, transport and utilities.
- **eMBB and FWA** extend today's services with immersive communication as well as improved performance and capacity.
- **Integrated sensing and communication (ISAC)** turns the network into a source of data on the physical environment.
- **NTNs** extend coverage to areas that terrestrial networks do not reach.

The benefit will spread across all economic sectors, but the level of benefit will depend on their ability to incorporate 6G use cases. By 2040, the leading sectors are expected to be the manufacturing and finance sectors, which together will account for almost 40% of the total benefit of 6G. Much of the value in certain sectors will depend on wide-area connectivity rather than on networks confined to a single site. For example, logistics fleets are tracked across a country, construction sites move from place to place and public-safety services need to reach people wherever they live. These applications draw on the coverage layer as well as on mid-band capacity.

Figure ii:
Distribution of 6G benefits by sector, 2040



Source: GSMA Intelligence

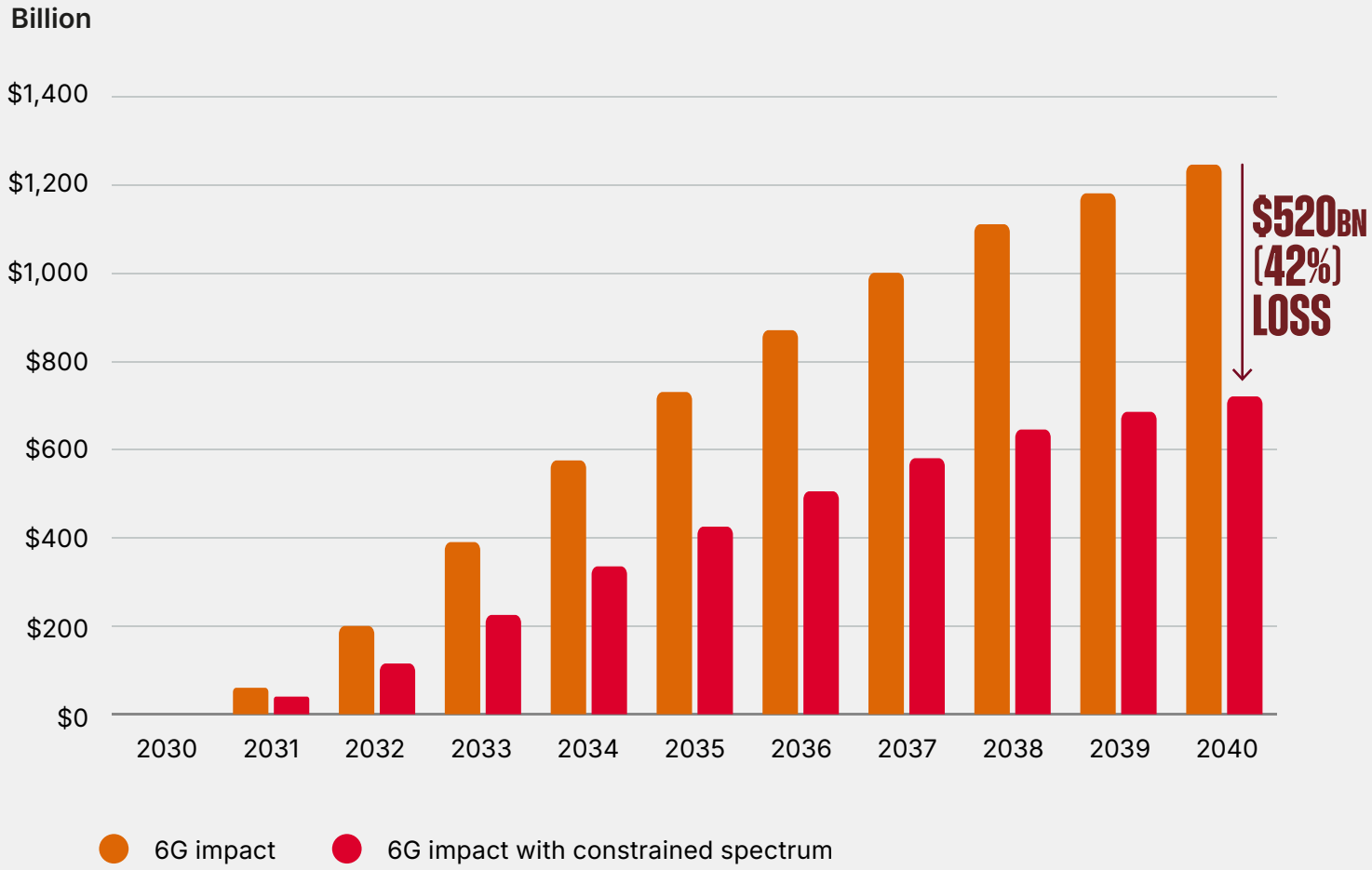
Constrained spectrum could cause 42% of the benefits to be lost

The $1.24 trillion in economic benefits is dependent on timely access to spectrum capacity. Spectrum is the fundamental input to mobile networks and determines traffic capacity, coverage and service quality. Many 6G applications need high throughput, low latency and reliable performance at the same time, and that combination cannot be delivered without enough spectrum in the right bands.

The timing of these decisions matters. The World Radiocommunication Conference in 2027 (WRC-27) will shape the harmonised spectrum foundation for the 6G era just as the first networks are being designed. But without sufficient low- and mid-band spectrum for 6G, the global economy could lose up to $520 billion or 42% of the benefit in 2040.

A shortage of low bands and mid-bands would also affect other mobile generations. These networks use the same spectrum, so their capacity and quality would fall, at a separate cost to the economy. This report measures only the loss to the additional 6G contribution.

Figure iii:
Impact of constrained spectrum allocation on total 6G economic benefits, 2030–2040[2]



Source: GSMA Intelligence

2 Constrained spectrum allocation refers to a scenario in which only part of the spectrum that 6G needs is made available, with low-band availability at 72% of the requirement and mid-band at 50%. The loss shown is the difference between this scenario and one with sufficient spectrum in every band. The assumptions are explained in Chapter 3.

To ensure that the full socioeconomic benefits of 6G are realised, policymakers should take the following actions:

- Make 600 MHz available as a band suitable for 6G to enhance low-band coverage and capacity, particularly for deep indoor coverage (including in urban areas), rural reach and the NTN and MIoT use cases that depend on it. Further low bands such as 500 MHz may be considered in the future, especially in countries with lower access to other low bands.

- Make at least 2 GHz of mid-band spectrum available by 2030, and increase mid-band capacity subsequently, in line with identified 6G needs, because mid-bands drive most of the benefit and are the most at risk of under-provision. Upper 6 GHz assignments can form part of the necessary capacity and can be built upon with additional capacity in upper 3.5 GHz (3.8–4.2 GHz), 4.5 GHz and 7 GHz.

- Set out a clear, timely spectrum roadmap so that operators can plan investment and scale up networks ahead of demand. Global demand projections may not fully capture the diversity of national or regional priorities. For example, a country with high demand for mobile services and limited fixed broadband access will have needs that are not adequately addressed by global averages. Spectrum needs will therefore vary across markets, which should be reflected in their roadmaps.

The contribution varies by region

The regional contribution of 6G will depend on the size of each region's economy and the extent to which firms and consumers adopt 6G. These differences are shaped by population size, industry structure, physical and digital capital, workforce skills and the ability of firms to integrate new technologies. Macroeconomic conditions and institutional quality will also affect how quickly regions translate 6G capabilities into productivity gains and wider economic benefits.

Asia Pacific, North America and Europe will account for the largest shares of the global total in 2040. For most regions, the additional contribution of 6G is worth around 0.7% of GDP. The contribution is smaller where forecast adoption and income are lower.



REGIONAL CONTRIBUTION OF 6G TO GDP, 2040

DEVELOPED ASIA PACIFIC



6G impact
$75BN

Percentage of GDP
0.7%

SOUTHEAST ASIA



6G impact
$45BN

Percentage of GDP
0.7%

SOUTH ASIA



6G impact
$55BN

Percentage of GDP
0.5%

OTHER ASIA PACIFIC



6G impact
$1BN

Percentage of GDP
0.3%

GREATER CHINA



6G impact
$390BN

Percentage of GDP
1.2%

NORTH AMERICA



6G impact
$290BN

Percentage of GDP
0.7%

LATIN AMERICA AND THE CARIBBEAN



6G impact
$70BN

Percentage of GDP
0.7%

GCC STATES



6G impact
$25BN

Percentage of GDP
0.7%

MIDDLE EAST AND NORTH AFRICA*



6G impact
$35BN

Percentage of GDP
0.5%

SUB-SAHARAN AFRICA



6G impact
$15BN

Percentage of GDP
0.3%

EUROPE



6G impact
$225BN

Percentage of GDP
0.7%

EURASIA



6G impact
$20BN

Percentage of GDP
0.4%

* Excluding the GCC states



Shaping the future of mobile technology

6G offers the same set of benefits to every economy, with extended coverage through low-band spectrum and NTNs, and productivity gains from bringing AI-enabled optimisation, automation and sensing into the physical and service economy. How much each benefit will materialise depends on the structure of the economy in question. Where coverage gaps remain, the most immediate gain will be from closing the digital divide and bringing more people and businesses into the digital economy. Where connectivity is already near universal, larger gains can be made from improving productivity, a critical issue for many high-income countries that have suffered weak productivity for nearly two decades. In most countries, growth will come from both better inclusivity and higher productivity. These will be impacted by the starting point set by today's level of connectivity and technology adoption, as well as broader economic growth policies.

Each market will therefore need its own strategy, matched to its own dynamics. In every case, the timely release of spectrum is the common starting point: without the right capacity, these benefits cannot be realised.

1. THE MACROECONOMICS OF 6G



Digital technologies have raised productivity across the global economy for decades. They have lowered the cost of doing business and widened access to services such as financial markets, healthcare and education. This has broadened the economic opportunity, reduced transaction costs and promoted innovation that translates into improvements in living standards.

A central driver of this transformation has been the rapid flow of information. Digital technologies have made processes more interconnected, helping firms and consumers find, share and act on information faster. In turn, improved access to information makes markets work more efficiently.

Mobile connectivity has been central to this transformation. Successive generations of mobile technology have enhanced network capabilities and enabled new digital services across consumer and enterprise markets. Each generation has supported faster speeds, lower latency and higher capacity, allowing digital technologies to reach new sectors and use cases.

Table 1:
The evolution of mobile technology and the applications enabled

Generation	Launch year	Network capability	New applications enabled
1G	1980	Analogue voice	Voice calls
2G	1990	Digital voice and messaging	Text and picture messaging (SMS, MMS), limited browsing
3G	2001	Mobile data	High-speed browsing, first mobile applications
4G	2009	Mobile broadband	Video streaming, mobile internet on smartphones, the app economy
5G	2018	High speeds, low latency and massive connectivity	eMBB, FWA, MIoT, URLLC
6G	2030 (expected)	AI-native, integrated sensing and ubiquitous coverage	Real-time AI services, ISAC, NTNs

Source: GSMA Intelligence

The pattern has been consistent. A new technology generation first raises the performance of the network. Higher performance then allows existing digital activities to be carried out more efficiently, and it allows new activities that were previously impractical or not possible. Over time, these changes accumulate into measurable effects on output and productivity. 6G will follow the same pattern as it enables new use cases and enhances existing ones.

WHAT MAKES 6G DIFFERENT?

6G is expected to continue the evolution of network generations as an AI-native network that not only carries data but senses, reasons and acts.

Previous network generations improved familiar dimensions, including faster speeds, better capacity and lower latency. 6G continues these improvements, but it also adds capabilities that change what mobile networks can do.

There are three elements that make 6G different:

6G

1. 6G is AI-native



2. 6G can sense its environment as well as communicate



3. 6G integrates terrestrial networks and NTNs



1 | 6G WILL BE AI-NATIVE

The first difference is that 6G will be AI-native. Intelligence is designed into the network from the start and works in two directions.

'AI for the network' describes mobile networks using AI to deliver connectivity more efficiently. While 5G standalone (SA) enables networks to automate their operations, predicting congestion or rerouting traffic, 6G puts the intelligence inside the radio interface. It is the first generation designed with machine learning in channel estimation and prediction, beam management and the scheduling of transmissions. The result is more capacity, lower energy use per unit of traffic and the guaranteed quality of service on which AI applications rely on.

'Network for AI' describes how 6G networks will become the communications and distribution platform for AI. This builds on 5G, which already carries AI traffic and brings computing to the network edge, with 5G-Advanced further expanding both capabilities. Continuing on this path, 6G will enable AI workloads to travel seamlessly across devices, edge infrastructure and cloud resources, carrying and running them close to where data is produced, rather than sending everything to a distant data centre. 6G will also enable physical AI, where intelligence is built into machines, such as robots, humanoids and vehicles that sense their surroundings and decide and act in real time. The latency, reliability and capacity of the connection set the limits on what the machines can do, and it is in these industrial settings that some of the largest productivity gains lie. Beyond enabling these new industrial use cases, mobile networks will also be the primary means through which billions of people and businesses access AI-powered services.

The same capabilities also benefit consumers through more personalised and efficient everyday services, including retail and entertainment services. Just as mobile telephony improved market efficiency by moving information faster,[3] immersive communication adds something voice and data cannot carry, the sense of being present with the person or object at the other end.

Together, these will make the network a platform for distributed intelligence, not just a means of transport. 6G will influence both where AI can be deployed and the pace at which AI diffuses through the wider economy.



3 The Digital Provide: Information (Technology), Market Performance, and Welfare in the South Indian Fisheries Sector, Quarterly Journal of Economics 122(3), Jensen, 2007

2 | 6G CAN SENSE AS WELL AS COMMUNICATE

The second difference is that 6G will sense as well as communicate, a capability known as ISAC.

By reusing radio signals it already transmits, the same infrastructure that carries data can also detect the location, movement and shape of objects around it. In effect, this turns the network into a distributed radar. The objects need no device, tag or sensor of their own, which is what separates sensing from the positioning of connected devices that 5G already offers.

Two features of 6G make this possible. First, its wider channels sharpen the measurement, since resolution rises with bandwidth, from around a metre and a half on a typical 5G carrier to tens of centimetres in the upper mid-band and mmWave ranges. Second, its radio is designed for sensing from the outset, so sensing can be offered as a service alongside connectivity rather than added to a waveform built for communication alone. A network could, for example, detect a pedestrian stepping into the road and warn an approaching vehicle or track drones in controlled airspace. Indoors, it could monitor a patient's movement and breathing without a camera or a wearable device. Because the sensing reuses existing infrastructure, these services come without the cost of deploying a separate sensor network. This matters economically because what can be measured can be managed, so industries gain safer transport, better use of assets and infrastructure at negligible additional capital cost.



3 | 6G WILL INTEGRATE TERRESTRIAL NETWORKS AND NTNS

The third difference is reach.

6G is expected to fully integrate terrestrial networks and NTNs into a single architecture, so that coverage extends to areas that fixed and terrestrial mobile infrastructure have never been able to serve economically. Satellite connectivity is not new to mobile: 5G added support for NTNs and satellite-to-phone services are available today. 6G will continue this evolution with a design that incorporates the satellite layer inside the same network from the start, allowing integrated connectivity and dynamic spectrum use. Turning always-on connectivity from a specialist application into a standard feature makes it economical for sectors such as logistics, shipping, agriculture and aviation to build operations on it.



These differences explain why the economic contribution of 6G is not simply a continuation of 5G, but is concentrated in new capabilities around AI, sensing, and ubiquitous reach, alongside the continued growth in mobile broadband.

The economic consequence is that 6G's value come less from spending on connectivity itself and more from raising productivity in the industries that use these capabilities, which is the effect quantified in the rest of this report.

THE ECONOMIC DRIVERS OF 6G

Five groups of use cases drive the economic contribution of 6G (see Table 2). Each draws on a particular set of network capabilities and applies to a distinct set of verticals. Some extend capabilities that already exist in 5G, such as mobile broadband and MIoT. Others, such as integrated sensing and AI-native operation, are new to 6G. Each use case also relies on a different mix of spectrum bands, which is the link between the use-case results and the spectrum results presented later.

Table 2:
6G economic drivers, business needs and verticals

Use case	Description	Business need	Sectors
eMBB and FWA	6G will raise capacity and reliability to support increasingly immersive experiences for consumers and enterprises. FWA extends high-speed broadband to homes and businesses where fibre is limited.	Immersive experience (extended reality), consistent high capacity, fibre-like fixed broadband	Media and entertainment, retail, real estate, public administration, education
MIoT and URLLC	6G will connect very large numbers of sensors and devices and provide the deterministic, ultra-reliable low-latency links that time-critical control needs.	Massive device density, deterministic low latency, high reliability	Manufacturing, transport and logistics, utilities, agriculture, healthcare, construction
AI systems	AI is a primary driver of demand for next-generation connectivity. AI systems rely on continuous data flows between devices, sensors, edge computing and cloud platforms, raising uplink demand and the need for low, predictable latency for real-time inference.	High-uplink and low-latency inference, edge–cloud continuum, autonomous network operations	ICT, finance, healthcare, mobility, services, smart infrastructure
ISAC and sensing	6G networks will reuse radio signals to sense the environment. By analysing reflected signals, mobile infrastructure can detect and monitor objects, movement and conditions within the coverage area.	Joint sensing and communication, detection, location and environmental data	Transport, manufacturing, public infrastructure, smart cities, logistics, construction, public administration and defence
NTNs	6G will integrate terrestrial networks and NTNs, including satellite, into a single architecture. Connectivity will extend beyond traditional coverage to remote regions, maritime and aviation routes.	Ubiquitous coverage, resilience and redundancy, service continuity	Transport, agriculture, energy, environmental monitoring, maritime and aviation

Source: GSMA Intelligence

FACTORS IMPACTING 6G ECONOMIC BENEFITS

There are a number of factors that impact the extent to which countries will realise the full economic benefits of 6G.

1

The pace of 6G adoption will determine how widely the technology is used across the economy. Adoption depends on network rollout, device availability, affordability of devices and services, the maturity of applications and the willingness of enterprises to change their processes. The GSMA's State of Mobile Internet Connectivity report shows that most people who remain offline already live within mobile broadband coverage, and that the cost of handsets and data is among the main reasons they do not connect.[4] A capability that exists in the network but is not adopted produces no economic benefit.
6G adoption will also be determined by the extent and depth of 6G network deployment, which will in turn be impacted by the costs of building and running 6G networks. This includes passive and active equipment costs, planning rules for sites, small cells, rights of way for fibre, rules on infrastructure sharing, electricity tariffs and grid reliability. Moreover, taxes and duties on devices, equipment and services all affect the costs that operators must recover before a deployment generates a return on investment.

2

Regulatory frameworks shape how efficiently networks and services can scale up. Spectrum policy is one of the main levers because it determines the capacity and coverage available to operators. This includes the cost of spectrum, the amount assigned, technology and service neutrality, licence duration and associated obligations. Spectrum harmonisation adds to this, since aligned band plans deliver equipment scale economies and investment confidence, helping to realise benefits sooner. Other digital policies – such as data governance and data-sharing rules, cybersecurity frameworks, digital identity and authentication – also shape how easily new services can be developed and how confidently enterprises adopt them.

3

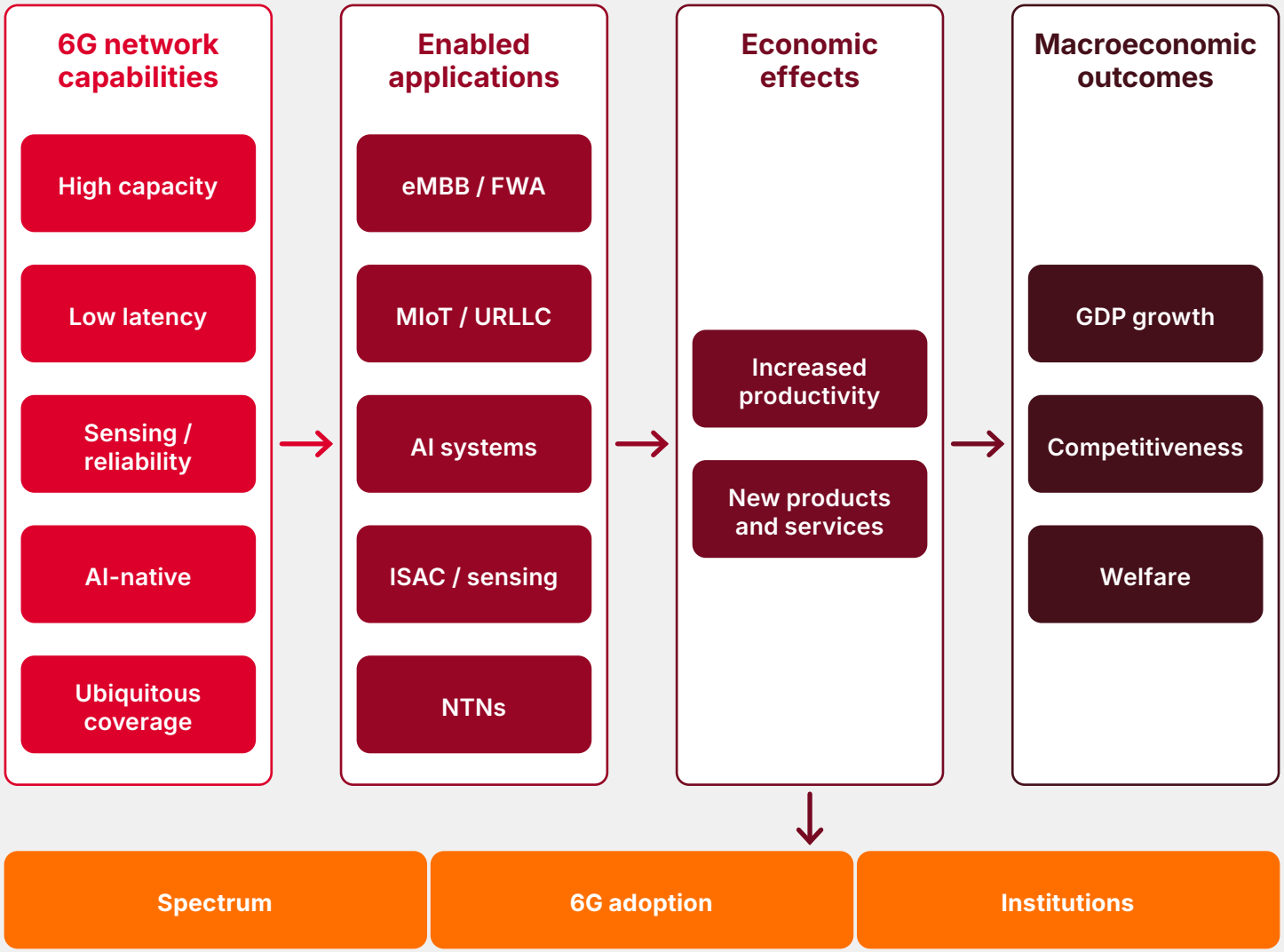
Institutional and economic conditions affect how far productivity gains translate into sustained growth. These include business dynamism and competition, investment climate and integration into global value chains.
The same technology produces a larger benefit in an economy with a skilled workforce, deep capital markets and a competitive business environment.

4 The State of Mobile Internet Connectivity 2026, GSMA, 2026

Figure 1 sets out the mechanisms through which 6G will contribute to growth: the technological capabilities of 6G networks will translate into improvements in network performance and new functions; improved performance will enable a range of applications across different sectors; and these applications generate economic benefits that will translate to macroeconomic outcomes and welfare improvements. Regulation impacts the extent to which these effects will materialise.



Figure 1:
Conceptual framework for the contribution of 6G to economic growth



Source: GSMA Intelligence

2. THE ADDITIONAL ECONOMIC CONTRIBUTION OF 6G

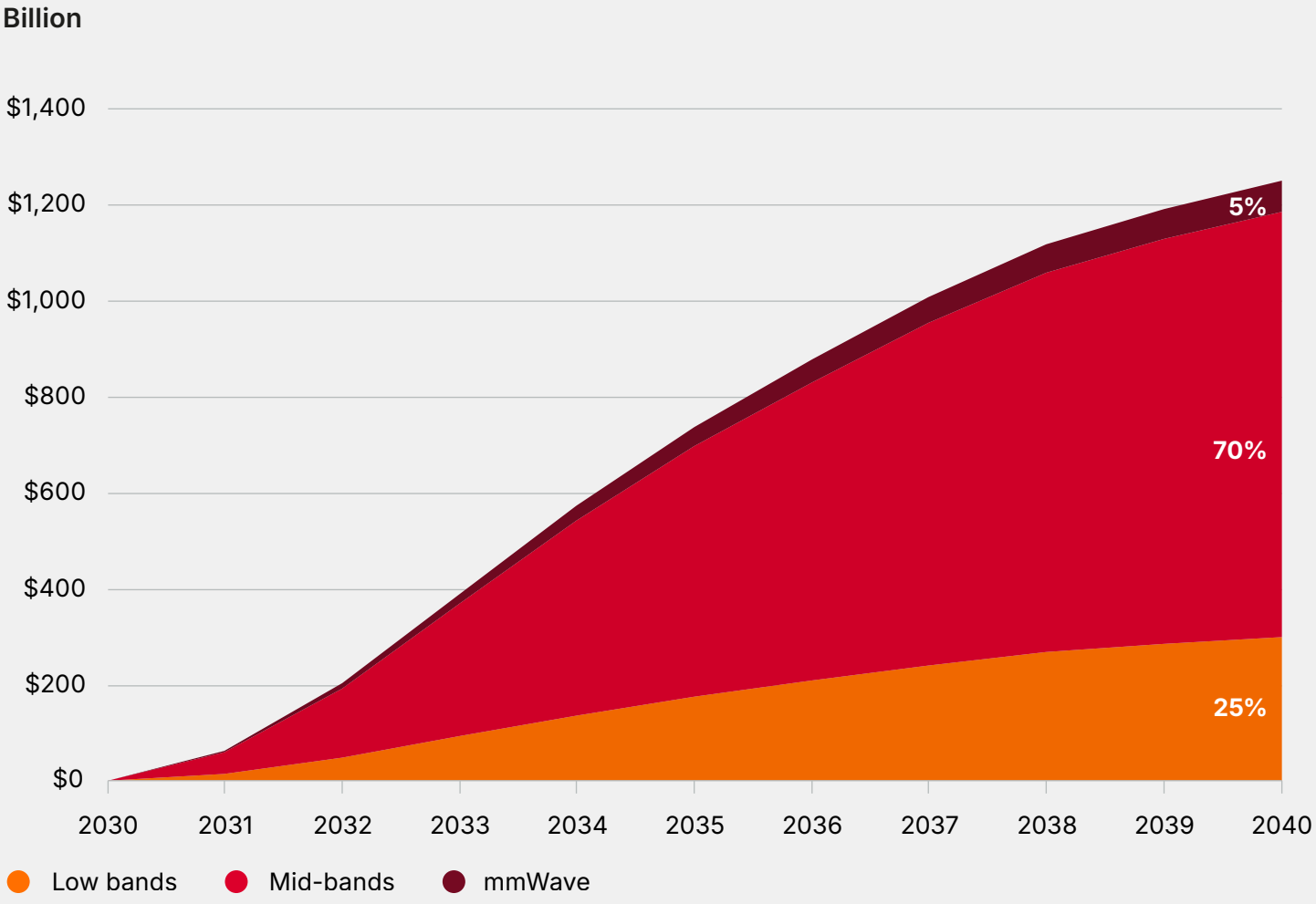


GLOBAL RESULTS

6G is expected to contribute $1.24 trillion to the global economy in 2040, or 0.7% of GDP. The S-shaped path is characteristic of a new technology's impact being slow at first while networks and ecosystems develop, then growing rapidly as adoption broadens and slower again as the technology approaches maturity (see Figure 2).

This analysis specifically captures the economic value that the capabilities of 6G will add beyond what existing mobile technology can deliver. In other words, it compares a world with 6G against one in which mobile networks continue to operate on the generations available today.

Figure 2:
Annual impact of 6G on GDP by band, 2030–2040



Source: GSMA Intelligence

Mid-bands deliver most of this incremental value, $880 billion, or approximately 70% of the total in 2040. Low bands – which the inclusion benefits of 6G depend on the most – contribute $300 billion (25%) and mmWave contributes $70 billion (5%). This distribution follows from how each use case maps into the spectrum bands. Mid-band spectrum combines capacity and city-wide coverage, so it carries most of the benefits for every use case. Low bands provide the wide-area reach that rural users and MIoT applications rely on. mmWave adds targeted capacity in dense environments and for sensing, but its limited propagation restricts it to a smaller share of the total.

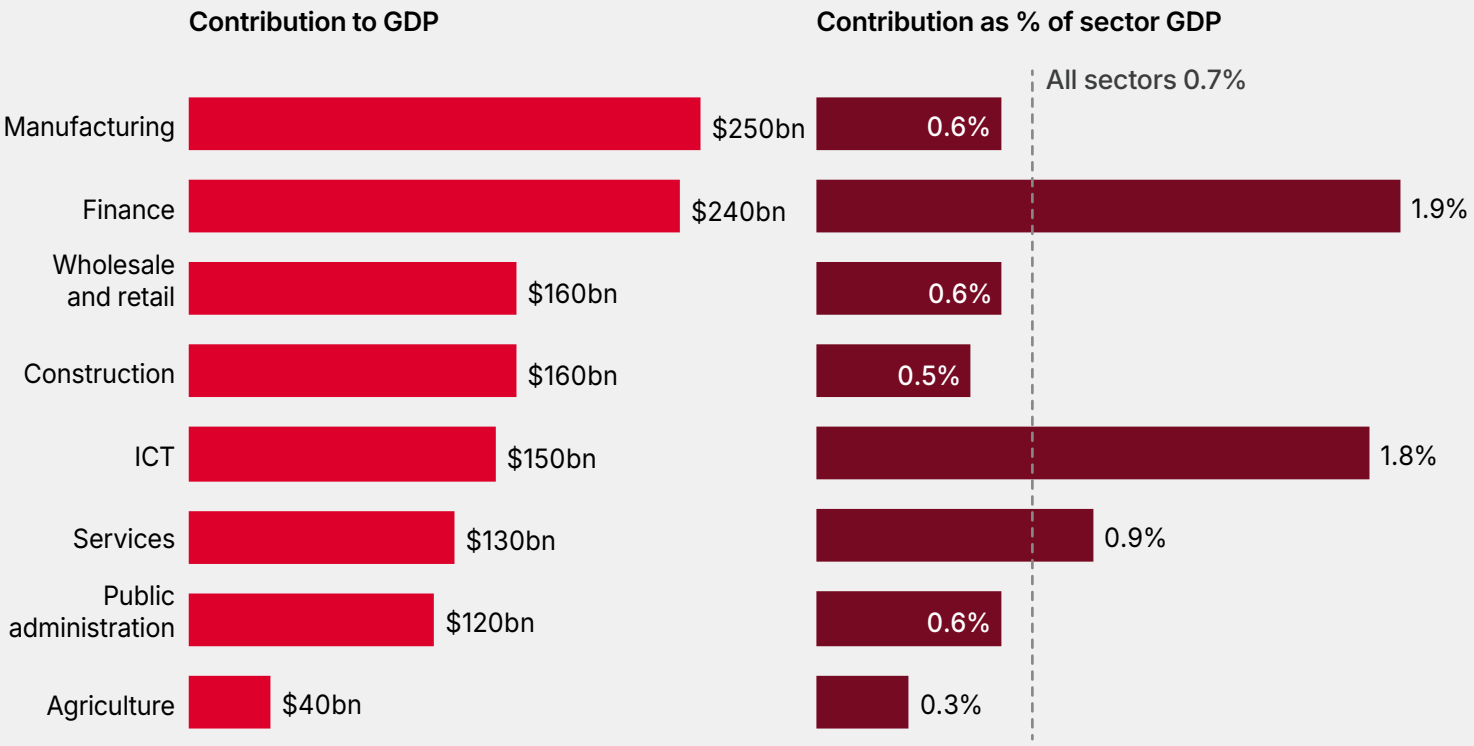
The 6G contribution is not evenly spread across the five use cases outlined earlier in Table 2. Connectivity for AI is likely to be the largest contributor because it raises productivity in almost every sector rather than in a specific set of applications. MIoT and URLLC deliver their gains through automation of physical processes, mainly in manufacturing, transport and utilities. eMBB and FWA bring richer consumer and enterprise services while extending high-speed broadband to premises without fibre. ISAC turns what the network observes about its surroundings into efficiency gains and new data services. NTNs extend coverage and resilience to areas that terrestrial networks do not reach.



RESULTS BY SECTOR

The contribution by sector depends on each sector's readiness to adopt new technologies and the availability of related skills.

Figure 3:
Estimated global contribution of 6G to GDP by sector, 2040



Source: GSMA Intelligence
Note: Sectors are ordered by total contribution to GDP.

6G will have the biggest impact on manufacturing, at $250 billion or 20% of the total additional value of 6G in 2040. The sector has historically been quick to adopt new production technologies and there is expected to be a link between industrial automation, MIoT and 6G capabilities. This is followed by the finance sector at $240 billion, or 19% of the total, driven largely by AI-enabled services, where the value of faster and more reliable data processing is high relative to the cost. Together, these two sectors will account for almost 40% of the global benefits of 6G in 2040.

A middle group of sectors each contribute around 13% of the total, including construction ($160 billion), wholesale and retail ($160 billion) and ICT ($150 billion). For these sectors, the benefit comes from a mix of automation, improved coordination and new digital services. Services and public administration each contribute around 10%, reflecting steady but less technology-intensive adoption. In agriculture, which will contribute the least at 3%, technology adoption has historically been slower and the benefit will take longer to materialise.

Measured against the size of each sector, 6G will drive the highest growth in the finance and ICT sectors, at 1.9% and 1.8% of the sectoral GDP, respectively. This is mainly from AI, the largest of the 6G use cases. 6G carries AI into every sector, with the level of gain following adoption. The difference in AI adoption between sectors reflects the volume of tasks that AI can perform or assist with in each sector. In finance and ICT, much of the work consists of tasks that AI can perform at low cost, such as processing transactions or assessing risk. These tasks are well defined, repeated over time and leave a record, making it possible for AI to learn them. The saving per task is significant and it multiplies across the sector. Manufacturing, the largest contributor in absolute terms, sits at 0.6% of sectoral GDP. This figure is 0.9% for services, 0.5–0.6% for construction, public administration and wholesale and retail, and 0.3% for agriculture.

HOW DOES 6G DELIVER VALUE?

The impact of mobile technology and mobile broadband on GDP is well established in economic literature. A 10% increase in mobile adoption is associated with an increase in GDP of between 0.5% and 3%, depending on the methodology, time period and geographic scope of the study.[5] As connections upgrade from basic mobile to 3G and 4G, mobile's baseline economic impact increases by around 15%, reflecting the additional value of mobile broadband over voice and basic data.[6]

5G adds further value by improving speed and functionality. Improvements in network quality drive positive effects on GDP, and 5G improves network quality materially. By combining the two effects together, a 10% increase in 5G adoption is associated with an estimated 0.15% increase in GDP. This is comparable to the effects of previous technology upgrades (from 2G to 3G and from 3G to 4G).

Given that 6G does not yet exist commercially, it is not possible to directly measure its economic impact. Instead, this study uses evidence from previous mobile generations (particularly 5G) to estimate its potential benefits. This grounds the analysis in real-world experience, with the results showing the additional economic value that 6G could create under the model's assumptions on adoption and spectrum availability. The modelling approach is explained further in Appendix A.

Two points are worth noting. First, the estimate is deliberately conservative, based on observed links between connectivity and output and modelled on 5G impacts. As 6G enables new capabilities, the actual economic impact could be higher. Second, the estimate depends on adoption, as the benefit reflects how widely 6G has been taken up each year.

The analysis is also conducted based on a 15-year forecast, which causes uncertainty in the projections. External factors include long-run forecasts of economic output that could be altered by the speed of technological progress, political and regulatory shifts or climate change. 6G is still being defined and its precise capabilities are not yet fixed. We therefore present these figures as an indication of the scale of the opportunity, rather than as a point forecast.

5 See for example Czernich et al. (2011), Gruber et al. (2014), Koutroumpis (2019), ITU (2020, 2025) and Briglauer et al. (2024).
6 Mobile technology: two decades driving economic growth, GSMA, 2020; The impact of digital transformation on the economy: Econometric modelling, ITU, 2025; Socioeconomic benefits of high-speed broadband availability and service adoption: A survey, Telecommunications Policy, 48(7), p.102808, Briglauer, W., Krämer, J. and Palan, N., 2024

3. SPECTRUM IS REQUIRED TO ENABLE THE 6G ECONOMY



6G SPECTRUM CONSTRAINTS

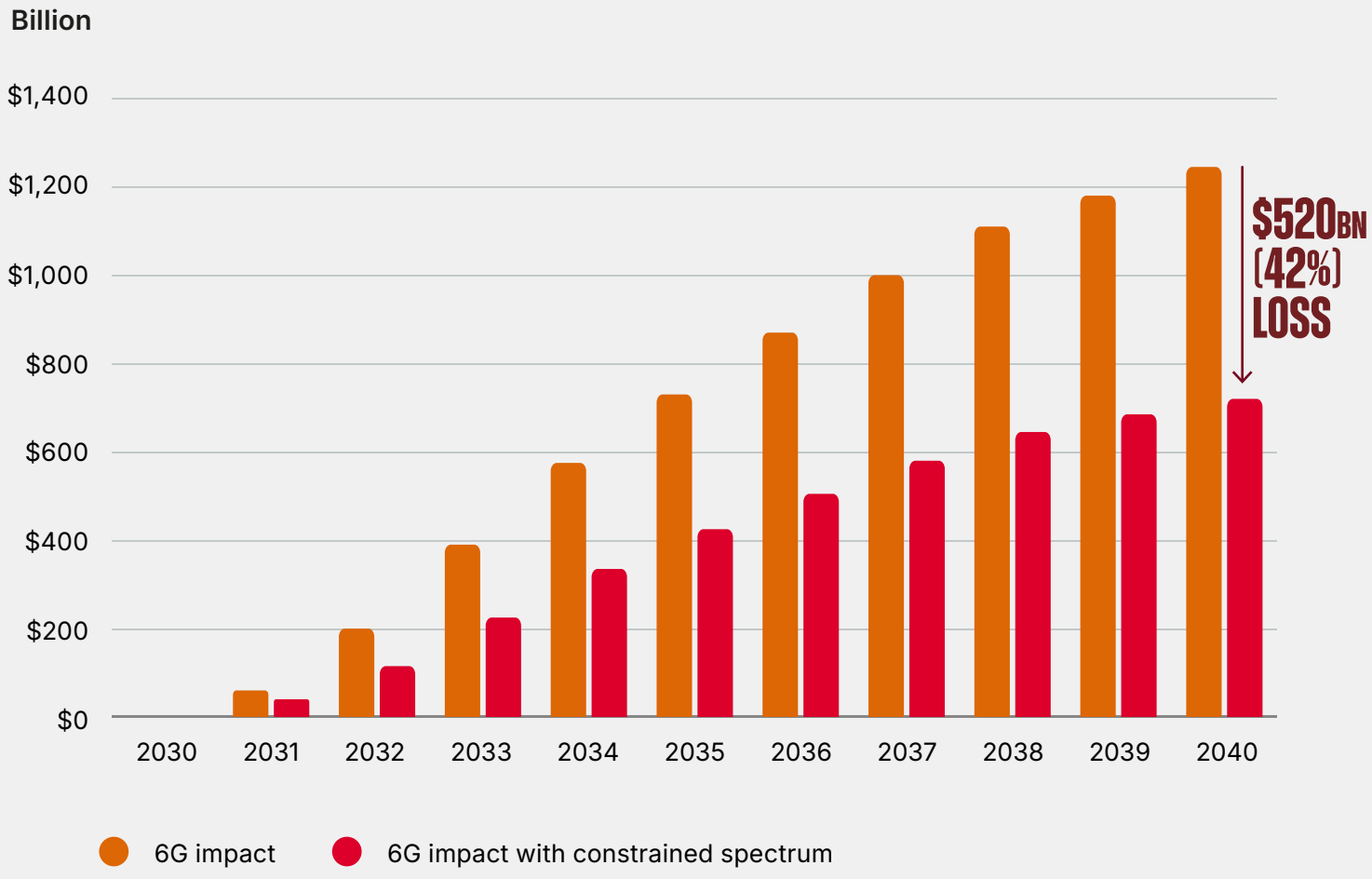
The full incremental benefits of 6G will not be realised if spectrum is constrained:

- If the 600 MHz band is not allocated for 6G, 80 MHz of 290 MHz would be lost.[7] This would mean only 72% of the required low-band spectrum is available.
- A global average of 2-2.5 GHz of total mid-band spectrum is required by 2035-2040, while higher demand countries will require 2.4–3.3 GHz in this period. This compares to current average assignments of around 1 GHz.[8]

This compares to current average assignments of around 1 GHz. Therefore, if spectrum is kept at today's level, at least 50% of the required mid-band spectrum will not be available.

Under the spectrum constraints above, the global economy could lose up to 42% of the additional GDP benefit from 6G. This would mean that in 2040, the contribution of 6G would fall from $1.24 trillion to $720 billion.

Figure 4:
Impact of constrained spectrum allocation on the additional economic benefits of 6G, 2030–2040



Source: GSMA Intelligence

7 We assume 210 MHz would be available from spectrum in the following bands: 80 MHz in the 700 MHz band; 60 MHz in the 800 MHz band; and 70 MHz in the 900 MHz band.
8 Vision 2040: Spectrum for the future of mobile connectivity, GSMA Intelligence, 2026

The loss of GDP from constrained spectrum is cumulative. Insufficient spectrum lowers performance throughout the period – so the economic loss grows as the decade progresses. Most of the projected loss is linked to mid-band spectrum, reflecting both its important role for 6G performance and expected scarcity.

These constraints would not affect 6G alone. The same spectrum carries 4G and 5G traffic, and a shortfall in low bands and mid-bands would also reduce the capacity and quality of the networks already in service, with a cost to the economy of its own. However, this report measures only the effect on the additional 6G contribution.

IMPLICATIONS FOR SPECTRUM POLICY

Spectrum policy shapes the long-term economic benefit of mobile technology. Timely assignment of additional spectrum lets operators plan investment, expand capacity and deploy new technologies efficiently. The terms of assignment also matter as much as its timing. Operators have the certainty to invest when spectrum is priced to reflect its value (rather than to maximise short-term revenue), when licences are technology- and service-neutral and when licence terms run for at least 20 years with a clear expectation of renewal. Prices per megahertz differ widely between bands, meaning that prices for new bands should be set on their own value rather than on benchmarks carried over from other bands.

By ensuring that enough spectrum is available to support future connectivity needs, policymakers can help realise the full economic contribution of 6G. Constraining spectrum could cause 42% of the economic benefits of 6G to be lost. The cost of acting late is large and grows over time.

The evidence points to three priorities for policymakers:

- Make 600 MHz available as a band suitable for 6G to enhance low-band coverage and capacity, particularly for deep indoor coverage (including in urban areas), rural reach and the NTN and MIoT use cases that depend on it. Further low bands such as 500 MHz may be considered in the future, especially in countries with lower access to other low bands.
- Make at least 2 GHz of mid-band spectrum available by 2030, and increase mid-band capacity subsequently, in line with identified 6G needs, because mid-bands drive most of the benefit and are the most at risk of under-provision. Upper 6 GHz assignments can form part of the necessary capacity and can be built upon with additional capacity in upper 3.5 GHz (3.8–4.2 GHz), 4.5 GHz and 7 GHz.
- Set out a clear, timely spectrum roadmap so that operators can plan investment and scale up networks ahead of demand. Global demand projections may not fully capture the diversity of national or regional priorities. For example, a country with high demand for mobile services and limited fixed broadband access will have needs that are not adequately addressed by global averages. Spectrum needs will therefore vary across markets, which should be reflected in their roadmaps.

Mobile networks rely on radio spectrum as a fundamental resource for delivering connectivity. The quantity and characteristics of spectrum influence network capacity, coverage and service quality. As demand for mobile data and advanced digital services rises, sufficient spectrum becomes essential to maintain reliable performance and to enable new applications. Each band has different physical properties, and these properties determine the role they play.

WHY SPECTRUM IMPACTS 6G'S ECONOMIC BENEFIT

Spectrum availability affects economic outcomes through its impact on network performance. Additional spectrum allows operators to increase capacity, reduce congestion and support the wider channels that enable higher throughput and lower latency. Adequate spectrum also reduces the need for network densification. When operators can deliver a given capacity with fewer sites, deployment and operating costs fall and so do the energy consumption and carbon emissions of the network. These improvements let networks serve more users and devices while maintaining consistent service quality. Improved performance, in turn, widens the range of digital applications that can be deployed across the economy, which supports growth through the five use cases described earlier.

Conversely, limited spectrum constrains performance and slows the adoption of advanced applications. When networks operate close to capacity, service quality deteriorates in high-demand areas and the applications that require reliable low-latency connectivity become harder to deploy. Because the most valuable 6G use cases are also the most demanding, spectrum scarcity affects the highest-value activities the most.



CANDIDATE 6G BANDS

6G will use a mix of spectrum across three broad ranges, as outlined in Table 3.

Table 3:
Spectrum bands for 6G: characteristics, use cases and economic contribution

Bands	Frequency range	What it enables	Principal use cases	Share of 6G benefit
Low bands	Frequencies below 1 GHz. 600 MHz is expected to be a critical band for 6G because it will provide the coverage layer.	Signal travels far and passes through buildings. Wide-area coverage and indoor reach.	**NTNs and MIoT:** These need to reach remote areas and connect vast numbers of low-data devices over long distances, where coverage matters more than speed.	25%
Mid-bands	Frequencies between 1 and 8 GHz. Key bands for 6G are expected to include 4.4–4.99 GHz, upper 6 GHz and 7–8 GHz.	City-wide coverage and capacity	**Almost every use case, including eMBB, time-critical control and AI services:** For example, a factory running real-time AI control needs wide coverage across the site and high capacity at once.	70%
mmWave	Frequencies above 24 GHz	Very high capacity over short distances. Supports precise sensing.	**ISAC and ultra-dense capacity:** High-resolution sensing and immersive applications need very high bandwidth over short range. For example, detecting a pedestrian's movement or serving thousands of users in a packed stadium.	5%

Source: GSMA Intelligence

Low-band spectrum below 1 GHz provides the coverage layer and penetrates deep indoors. The 600 MHz range is the initial focus for 6G and if it is not made available, low-band capacity for 6G will be restricted. 500 MHz may be deployed later to expand low-band supply.

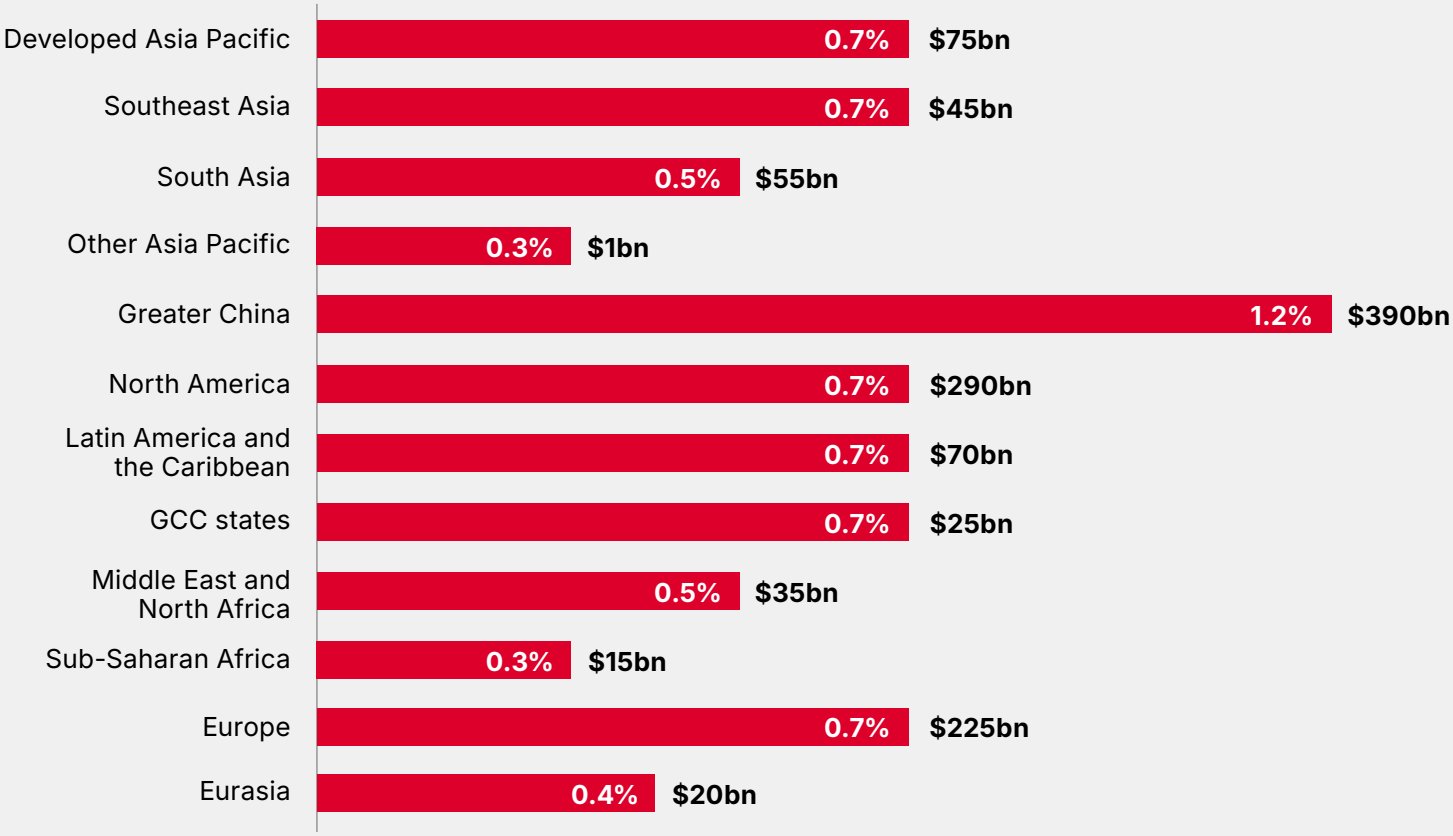
Mid-band spectrum carries most of the benefits. Existing IMT mid-bands provide around 1 GHz of usable spectrum today, whereas 6G is expected to need at least 2 GHz. Part of the gap is expected to be met by additional spectrum in the 3.5 GHz, 4.5 GHz (4.4–4.99 GHz), upper 6 GHz and 7–8 GHz bands. mmWave spectrum above 24 GHz provides very high capacity over short distances. Existing assignments are expected to be largely sufficient for 6G, which is why the modelling assumes full availability in this range.

4. RESULTS BY REGION



The incremental economic benefits of 6G reach every region, but its scale varies with the size of each economy and the pace of adoption. In absolute terms, Greater China, North America and Europe will account for the largest shares of economic benefit in 2040. Measured as a share of GDP, the contribution is around 0.7% for most regions that are expected to have reached 6G maturity by 2040. Greater China is the clear outlier to this on the high side, while lower-income regions, which will not yet have fully developed 6G, are on the low side. The relatively even share of economic uplift reflects the global nature of the technology; the variation in absolute terms reflects differences in economic size.

Figure 5:
6G's regional contribution - percentage of GDP, 2040



Source: GSMA Intelligence

REGIONAL CONTRIBUTION OF 6G TO GDP, 2040

ASIA PACIFIC (EXCLUDING GREATER CHINA)

In developed Asia Pacific, 6G is expected to add an incremental $75 billion, equivalent to 0.7% of GDP in 2040, supported by advanced networks and high adoption. The emerging Asian economies contribute more modestly as a share of GDP but represent a large and growing pool of economic benefit. South Asia adds a further $55 billion (0.5% of GDP) and Southeast Asia an additional $45 billion (0.7%). The remaining smaller markets, grouped as other Asia Pacific, add around $1 billion at 0.3% of GDP, reflecting their earlier-stage adoption.

DEVELOPED ASIA PACIFIC



6G impact
$75BN

Percentage of GDP
0.7%

SOUTHEAST ASIA



6G impact
$45BN

Percentage of GDP
0.7%

SOUTH ASIA



6G impact
$55BN

Percentage of GDP
0.5%

OTHER ASIA PACIFIC



6G impact
$1BN

Percentage of GDP
0.3%

EURASIA

In Eurasia, 6G is expected to contribute 0.4% of GDP, equivalent to an additional $20 billion in 2040. The lower share reflects a slower expected pace of adoption and a different economic structure, with the benefit weighted towards resource and industrial sectors rather than the service and AI-intensive activities that drive the largest gains in other regions.

EURASIA



6G impact
$20BN

Percentage of GDP
0.4%

REGIONAL CONTRIBUTION OF 6G TO GDP, 2040

EUROPE

In Europe, 6G is expected to contribute an incremental $225 billion, equivalent to 0.7% of GDP in 2040. The benefit is broad-based, drawing on a diverse industrial and services economy. Realising this will depend on the timely and harmonised availability of spectrum across the region, given the value of cross-border consistency for both networks and applications. As elsewhere, mid-band availability is the key variable.



GREATER CHINA

In Greater China, 6G is expected to generate a further $390 billion, equivalent to 1.2% of GDP in 2040, the highest share across all regions. This reflects the scale of the economy, the depth of the manufacturing base and an expected early and broad rollout of 6G.



LATIN AMERICA AND THE CARIBBEAN

In Latin America and the Caribbean, 6G is expected to add $70 billion to the economy in 2040, representing an additional 0.7% of GDP – a share in line with the developed regions, despite lower income levels. The result reflects the importance of mobile connectivity in economies where fixed infrastructure is less developed, in addition to the role that FWA and broad mobile coverage play in extending digital services.



REGIONAL CONTRIBUTION OF 6G TO GDP, 2040

MENA AND THE GCC STATES

In the Middle East and North Africa (MENA), which excludes the Gulf Cooperation Council (GCC) states, 6G is expected to generate a further $35 billion or 0.5% of GDP in 2040, while in the GCC states, 6G is expected to contribute an additional $25 billion or 0.7% of GDP. The GCC states' higher share reflects their high income levels, strong digital investment and ambitious national programmes for advanced connectivity. The pace of adoption in the other countries in MENA is more varied, which is reflected in MENA's lower share of GDP.

MIDDLE EAST AND NORTH AFRICA*



6G impact
$35BN

Percentage of GDP
0.5%

GCC STATES



6G impact
$25BN

Percentage of GDP
0.7%

NORTH AMERICA

In North America, 6G is expected to add $290 billion to the economy in 2040, equivalent to an incremental 0.7% of GDP, which is the second-largest total in absolute terms. The economic benefit is supported by a large, technology-intensive economy, strong demand for AI-enabled services and a history of early adoption of new mobile generations. The weighting of the benefit towards AI systems and enhanced mobile broadband is consistent with the region's service-heavy economic structure.

NORTH AMERICA



6G impact
$290BN

Percentage of GDP
0.7%

REGIONAL CONTRIBUTION OF 6G TO GDP, 2040

SUB-SAHARAN AFRICA

In Sub-Saharan Africa, 6G is expected to generate an additional $15 billion in economic value in 2040, equivalent to 0.3% of GDP. The result reflects later-stage network development, lower income levels and slower expected adoption. It also points to the importance of coverage-oriented capabilities for the region. Low-band spectrum and NTNs, which extend reach to rural and remote areas, are particularly relevant to closing the coverage gap over time. As adoption deepens, the region's share of the benefit is expected to rise beyond 2040.

SUB-SAHARAN AFRICA



6G impact

$15BN

Percentage of GDP

0.3%



COMMON THEMES ACROSS REGIONS

Three common themes run through the regional results:

1

The additional contribution as a share of GDP is generally consistent, at around 0.7% for most regions, showing a similar sector composition and pace of 6G adoption. The main exceptions are the bigger share of Greater China, reflecting scale and early adoption, and the smaller shares of the lowest-income regions, reflecting slower uptake to 2040.

2

The composition of the incremental benefit differs by region, even where sizes are similar. Service- and AI-intensive economies draw more of their benefit from AI systems and mobile broadband; industrial economies draw more from MIoT and automation; and less-connected regions depend more on the coverage extension that low-band spectrum and NTNs provide.

3

In every region, the additional benefit depends on timely access to required spectrum, particularly mid-band spectrum. The spectrum constraint modelled at the global level applies in each region, so the regional figures in this section represent the incremental benefit available if access to sufficient and suitable spectrum is provided in time. Where it is not, each region faces a proportionate reduction in the contribution shown above.



APPENDIX A: MODELLING THE ECONOMIC IMPACTS OF 6G



THE IMPACT OF MOBILE TECHNOLOGIES

The economic impact of mobile technologies is modelled based on the production function theory. This approach depicts a process of physical transformation of inputs into outputs.

To estimate the economic contribution of 6G, data is combined on the adoption forecast with the parameters obtained in the empirical analysis for the impact of 5G. Formally, the total benefit for a country i in year t is the output in the previous year ($\mathrm{GDP}_{i,t-1}$) multiplied by the expected change in the 6G adoption rate ($\propto_{i,t} - \alpha_{i,t-1}$) and the productivity parameter impact for 6G ($\beta_{i,t}^{6G}$).

The economic impact of 5G

5G's economic contribution comes from improved speeds (better network quality) and functionality, linked to 5G SA and the ability to support advanced use cases. There is important literature on the effects of mobile broadband speed on GDP (Bohlin and Rohman (2012), Edquist (2022)). On a panel of 163 countries from 2014 to 2025, the results show that a 10% increase in download speeds is associated with an approximately 0.20–0.24% increase in GDP.

In parallel, a reduced form model is estimated to find the relationship between 5G adoption and download speeds, controlling by country and year fixed effects in the same panel of countries from 2018 to 2025. The evidence shows that a 10% increase in 5G adoption is associated with approximately a 10.3% increase in mobile download speeds. Combining both estimates, the empirical analysis indicates that a 10% increase in 5G adoption is associated with an estimated 0.14–0.17% increase in GDP, similar to the effects of previous technology upgrades at 15% (from 2G to 3G and from 3G to 4G). Adoption is the variable in the equation because the benefit arises when connections are used, but adoption follows rollout. The 6G adoption path in the model is therefore anchored to the pace of network deployment as the main determinant of that pace.

The coefficient for 6G comes from the econometric estimates of 5G impacts and is then adjusted according to the country's level of development $\rho_{i,t}$ based on the World Bank's historical income classification. Low-income countries are expected to see higher additional benefits, as there is more room for improvement and efficiency gains, in line with the convergence hypothesis (Mankiw, Romer and Weil (1992), Johnson and Papageorgiou (2020)) as well as empirical evidence on the impact of mobile technologies (for example, ITU (2020)) and our econometric results. Informed by these studies, an uplift of 1.3 for the low-income economies and a downgrade of 0.5 for the high-income economies are applied.

Equation 1:

$$\mathrm{Economic_Benefit}_{i,t} = \mathrm{GDP}_{i,t-1} * \rho_{i,t} * \left[(\alpha_{i,t} - \alpha_{i,t-1}) * \beta_{i,t}^{6G} + (\delta_{i,t} - \delta_{i,t-1}) * \gamma_{i,t}\right]$$

Finally, to obtain the total benefits for a country on a given year, the results are aggregated since the expected introduction of 6G in 2030 until 2040.

Equation 2:

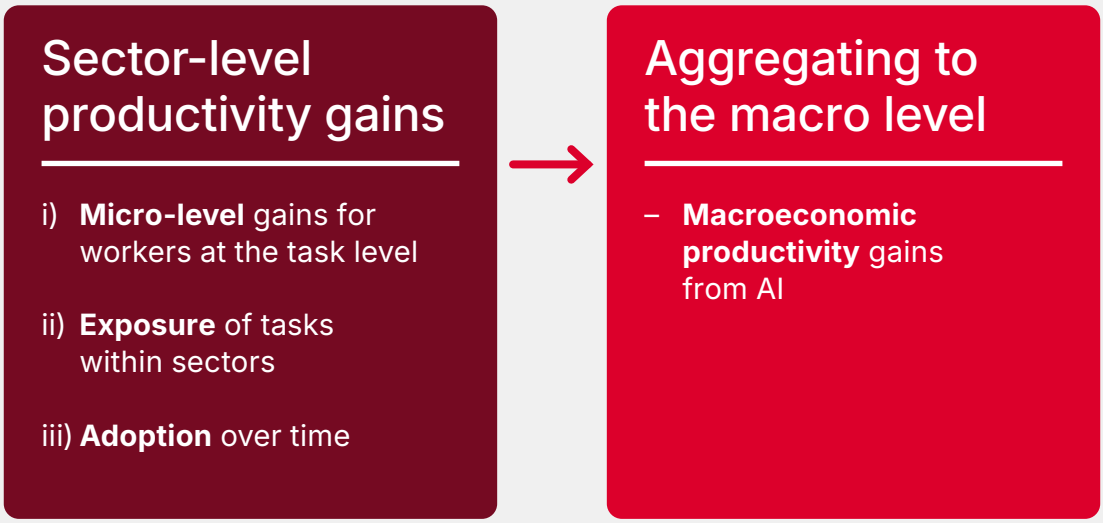
$$\mathrm{Total_Benefit}_{i,t} = \sum_{t=2030}^{2040} \mathrm{Economic_Benefit}_{i,t}$$

THE IMPACT OF AI

The model for the economic impact of AI follows the framework proposed by Acemoglu (2025) and extended by Filippucci et al. (2025) calculating macroeconomic impacts from micro-level effects on productivity, exposure of activities to AI by sector and country-level AI adoption.[9]

The micro-level studies show an average baseline effect of 30% on total factor productivity, with a lower and upper bound of 14% and 56%, respectively.[10] The exposure of tasks within each sector is calculated from the Anthropic (2026) data published on the 'Labor market impacts of AI', following the same methodology as Acemoglu (2025).[11] Finally, the latest AI adoption is obtained from Eurostat and other country surveys where available. Otherwise, it is estimated with regression techniques using digital infrastructure and skills as predictors (Lasso methodology). The forecast up to 2040 assumes a similar path to previous digital technologies such as the internet and 5G adoption.

Figure A1:
Framework for estimating the impacts of AI



Source: GSMA Intelligence based on Acemoglu (2025) and Filippucci et al. (2025)

9 The simple macroeconomics of AI, Economic Policy, 40(121), pp.13-58, Acemoglu, D., 2025
10 Macroeconomic productivity gains from Artificial Intelligence in G7 economies, OECD Artificial Intelligence Papers, Filippucci, F., Gal, P., Laengle, K. and Schief, M., 2025
11 Labor market impacts of AI: A new measure and early evidence, Anthropic Research, 5, Massenkoff, M. and McCrory, P., 2026

The effects at the macro level are aggregated as described in Equation 3.

Equation 3:

$$\mathrm{AI_TFP_{i,t}} = \mathrm{Micro_gains} * \mathrm{AI_Exposure_{i,j,t}} * \mathrm{AI_adoption_{i,t}}$$

For country i at year t the micro gains are multiplied by the AI exposure and AI adoption by country. $\mathrm{AI_Exposure_{ijt}}$ is the weighted average at the country level of the AI exposure by tasks across different sectors.

Based on the Hulten's theorem, the micro-level productivity gains are translated into macroeconomic impacts of AI.[12] Equation 4 presents this approach using GDP, productivity gains and mobile data traffic to obtain the impacts of AI originated from mobile technology, which are assumed will come from 6G.

Equation 4:

$$\sum_{t=2030}^{2040} \mathrm{AI_Benefit_{i,t}} = \sum_{t=2030}^{2040} \mathrm{GDP_{i,t-1}} * \mathrm{AI_TFP_{i,t}} * \mathrm{Mobile_traffic_{i,t}}$$

Where $\mathrm{GDP_{i,t-1}}$ is the output of a country in the previous year. $\mathrm{AI_TFP_{i,t}}$ are micro level productivity gains from AI and $\mathrm{Mobile_traffic_{i,t}}$ is the percentage of mobile traffic of total data traffic.



12 The Hulten's theorem is a foundational principle in macroeconomics providing a simple formula for competitive economies with constant returns to scale, to translate micro-level productivity improvements into macro changes.

APPENDIX B: THE ROLE OF EACH BAND



The contribution of 6G by spectrum band is estimated in two steps. The first step allocates the total 6G contribution across the five use cases described in Chapter 1. The allocation draws on the value of each use case from the economic literature and on consultation with industry experts. It is then checked against the inventory of use cases under study for 6G in the 3GPP's Release 20 work, which indicates where the industry expects the technology to be applied, although the number of use cases in a category is not a measure of its economic value.

Connectivity for AI systems receives the largest weight because it can be applied to a large set of tasks across all sectors according to its ability to adopt the technology. The weight comes from the estimates of AI delivered over mobile networks presented in Appendix A. MIoT and URLLC take the next largest weight, followed by eMBB and FWA. ISAC is weighted for the efficiency gains and new data services that sensing enables, including the use of network data in digital twins. NTNs take the smallest weight, reflecting the value of coverage and resilience in areas that terrestrial networks do not reach.

The second step maps each use case onto the three spectrum bands. Table B1 presents the impacts of 6G by use case and band. The impact parameters come from the analysis of the technical requirements of each use case, complemented by consultation with industry experts and analysis of the traffic currently delivered by each band.

Table B1:
6G use cases and relevance of spectrum band

Band	eMBB/FWA	MIoT/URLLC	AI systems	ISAC/sensing	NTNs
Low band	20%	30%	20%	20%	40%
Mid-band	75%	65%	75%	70%	60%
mmWave	5%	5%	5%	10%	0%

Source: GSMA Intelligence
Note: The numbers refer to the percentage of benefits of each use case that are driven by a particular band.

GSMA Head Office
1 Angel Lane
London
EC4R 3AB
United Kingdom
gsma.com

