



The Impact of 5G on the U.S. & European Economies

By Accenture Strategy

February 2021

Comprehensive economic analysis of 5G's economic impacts in the United States and Europe examined:

1

Will 5G be a force for growth and resiliency in the post-COVID economy?

Approach:

Rigorous economic modeling to measure immediate impact on sales, GDP, jobs

2

What are consumer expectations of the role and value of 5G in their lives?

Approach:

Consumer Survey Results (3,000+ respondents) in U.S. and Europe

3

How will 5G transform industries?

Approach:

Industry deep-dives with specific 5G use cases and enablers detailed

4

How can 5G be accelerated to assure full impact?

Approach:

Policy suggestions, highlighting individual state and country impact

Key Questions and Outcomes

1



Immediate impacts of 5G over five years, between 2021 and 2025.

2



Focused on GDP and job growth.

3



Detailed impact on key industries for each report.

4



Granular geographical impact for the US (By State) and Europe (By Country).

Accenture's 5G Economic Model complements existing studies

United States Economic Results Overview



\$2.7
Trillion sales*



\$1.5
Trillion new GDP



Potential to create or transform up to

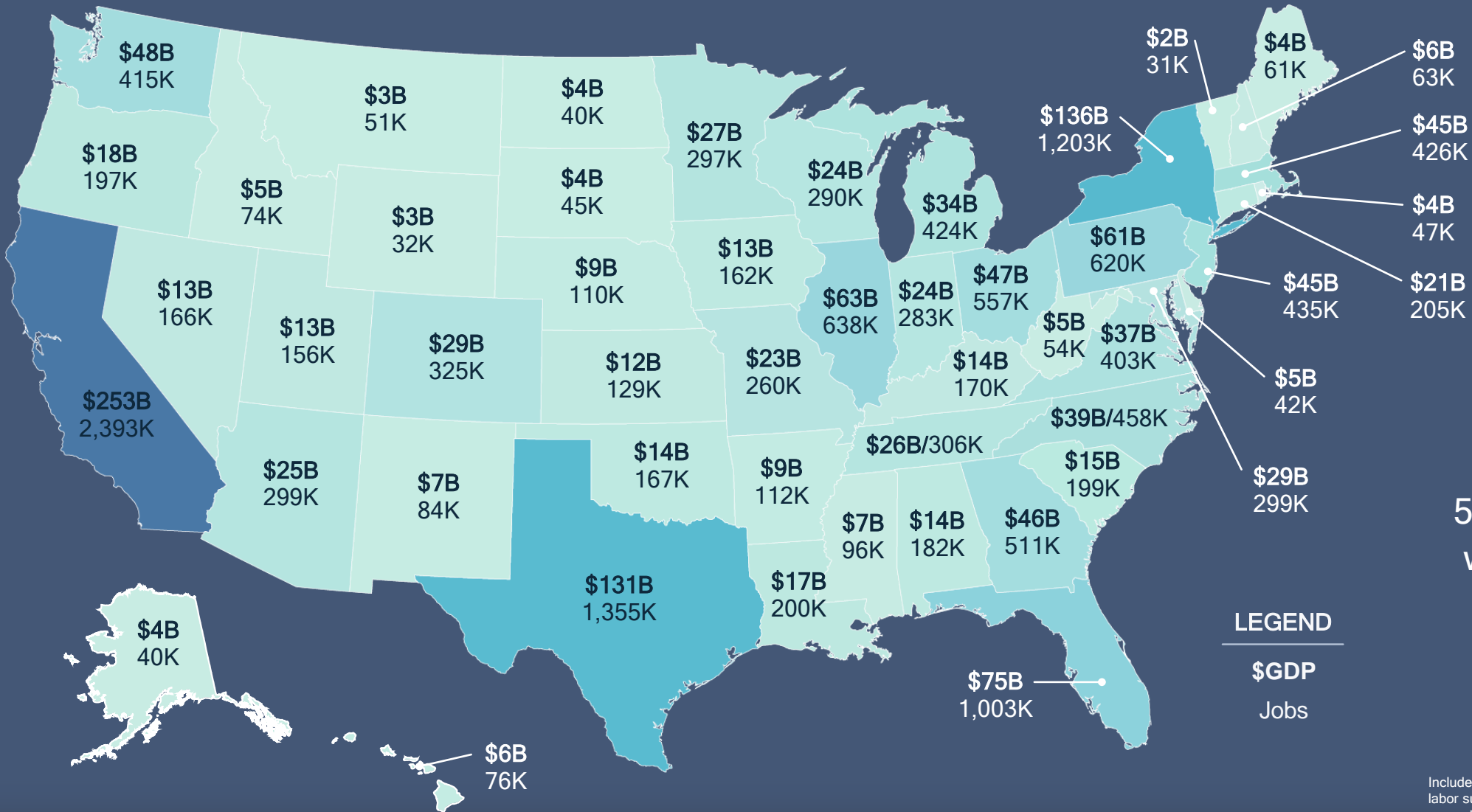
16
Million jobs**
(includes full-time, part-time and temporary jobs)



5G will be an immediate economic force for growth from 2021-2025, driven by new 5G connections.

* 5G sales value indicates additional sales increase based on new 5G connections

**Includes full-time, part-time and temporary jobs; Assumes no labor supply constraints, some of these jobs will be replaced by upward pressure on prevailing wages instead.



5G's economic impact will be felt across the United States, cascading through every state

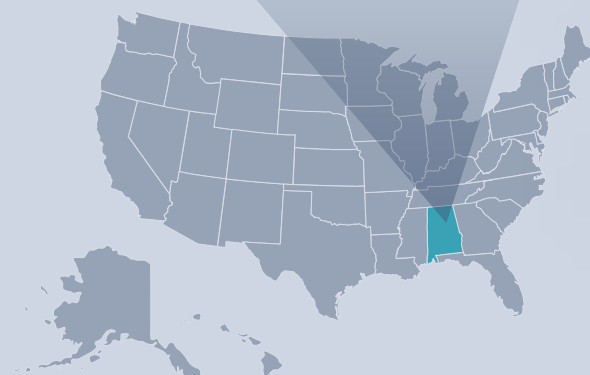
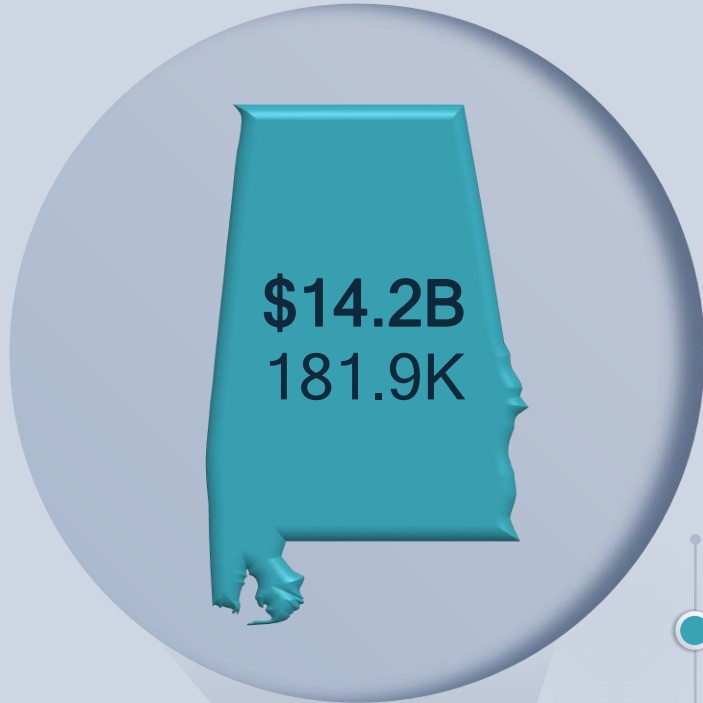
LEGEND

\$GDP
Jobs

Includes full-time, part-time and temporary jobs; Assumes no labor supply constraints, some of these jobs will be replaced by upward pressure on prevailing wages instead.

U.S. GDP and Jobs by State




Alabama: 5G driven economic impact between 2021 and 2025



- Highlighted Industries
- Manufacturing ▶
 - Healthcare ▶
 - Agriculture ▶

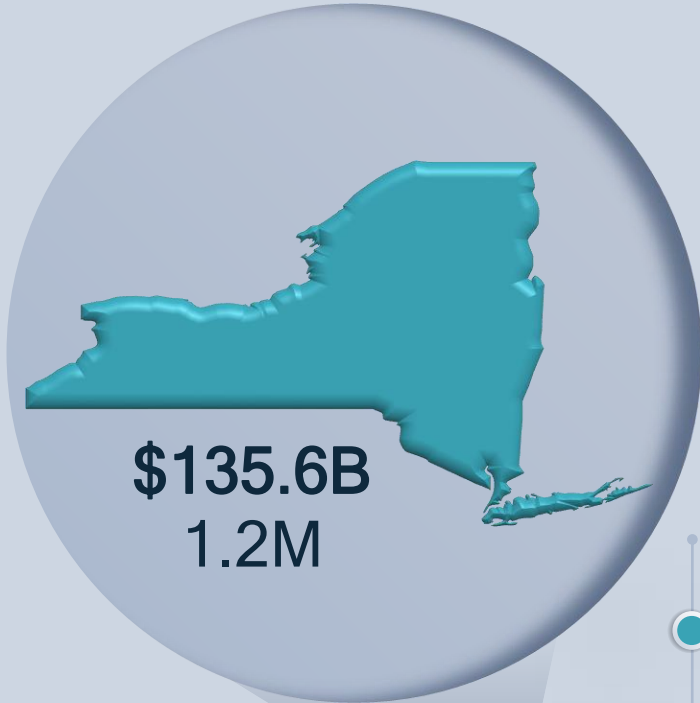
LEGEND

\$ GDP
Jobs

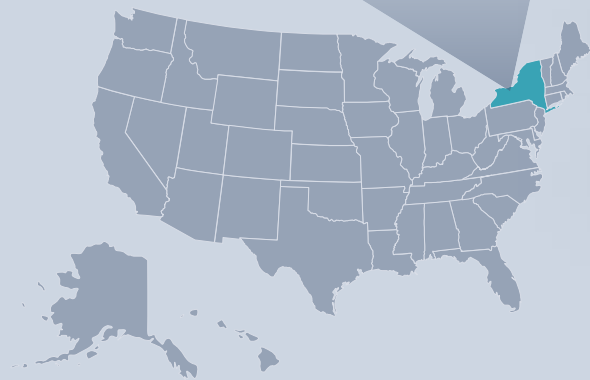
	 \$26.8 Billion additional sales	 \$14.2 Billion new GDP	 Potential to create or transform up to 181.9k jobs
Manufacturing	\$5.6B	\$2.4B	22.1k
Healthcare	\$2.1B	\$1.3B	18.6k
Agriculture	\$0.4B	\$0.2B	4.3k

Includes full-time, part-time and temporary jobs; Assumes no labor supply constraints, some of these jobs will be replaced by upward pressure on prevailing wages instead.

New York: 5G driven economic impact between 2021 and 2025



- Highlighted Industries
- Manufacturing ▶
 - Healthcare ▶
 - Agriculture ▶



LEGEND

\$ GDP
Jobs



\$26.8 Billion
additional
sales



\$14.2 Billion
new GDP



Potential to
create or transform
up to 181.9k jobs

\$10.4B

\$4.7B

34.2k

\$15.4B

\$9.5B

132.2k

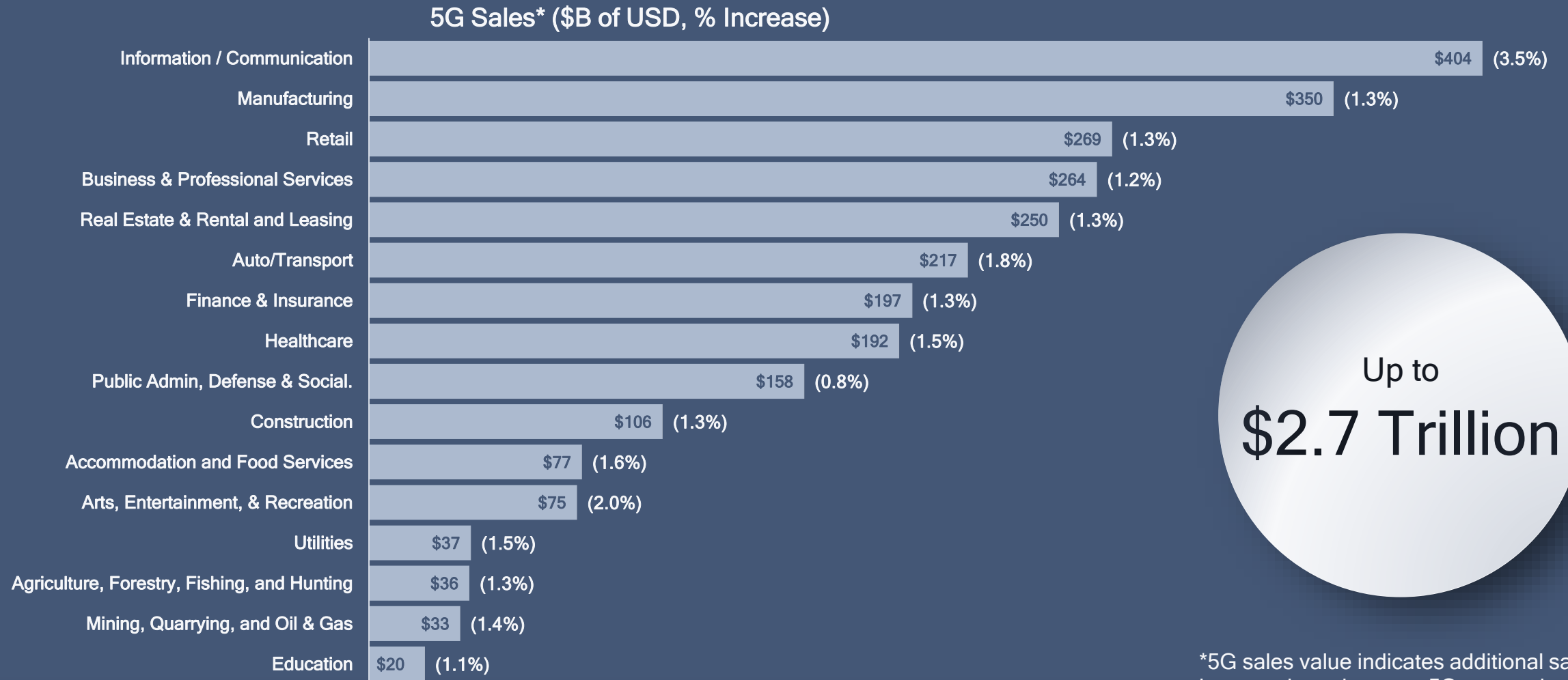
\$0.6B

\$0.2B

9.1k

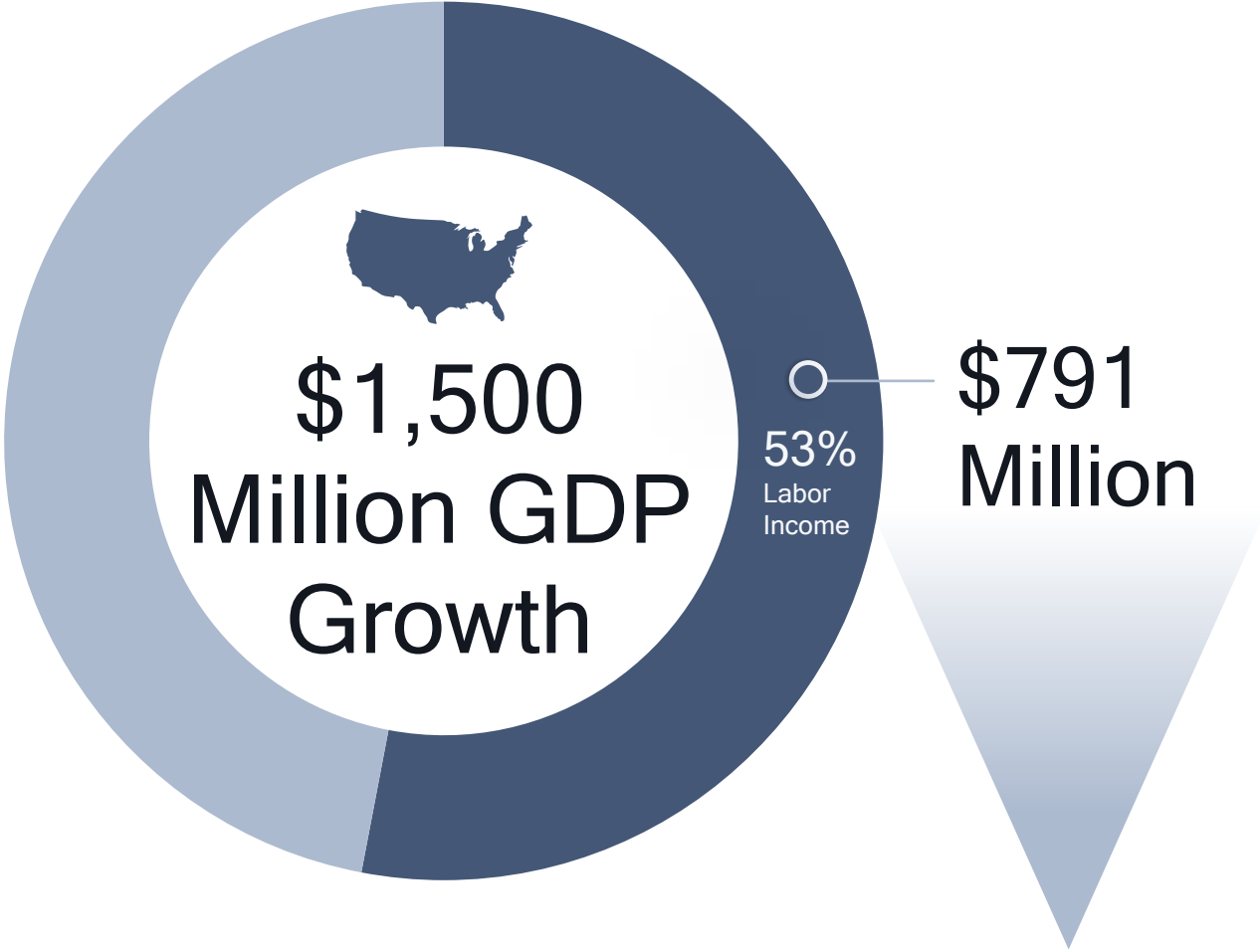
Includes full-time, part-time and temporary jobs; Assumes no labor supply constraints, some of these jobs will be replaced by upward pressure on prevailing wages instead.

This benefit spans all major industries in the U.S., as 5G unlocks new demand and productivity improvements.



5G U.S. Sales Impact by Industry

Majority of new GDP is captured by labor, creating and transforming jobs



Create or transform up to **16 Million jobs**

Includes full-time, part-time and temporary jobs; Assumes no labor supply constraints, some of these jobs will be replaced by upward pressure on prevailing wages instead.

Europe Economic Results Overview



€2.0

Trillion
additional sales*



~€1

Trillion new GDP



Potential to create or transform

20

Million jobs**

(includes full-time, part-time and temporary jobs)



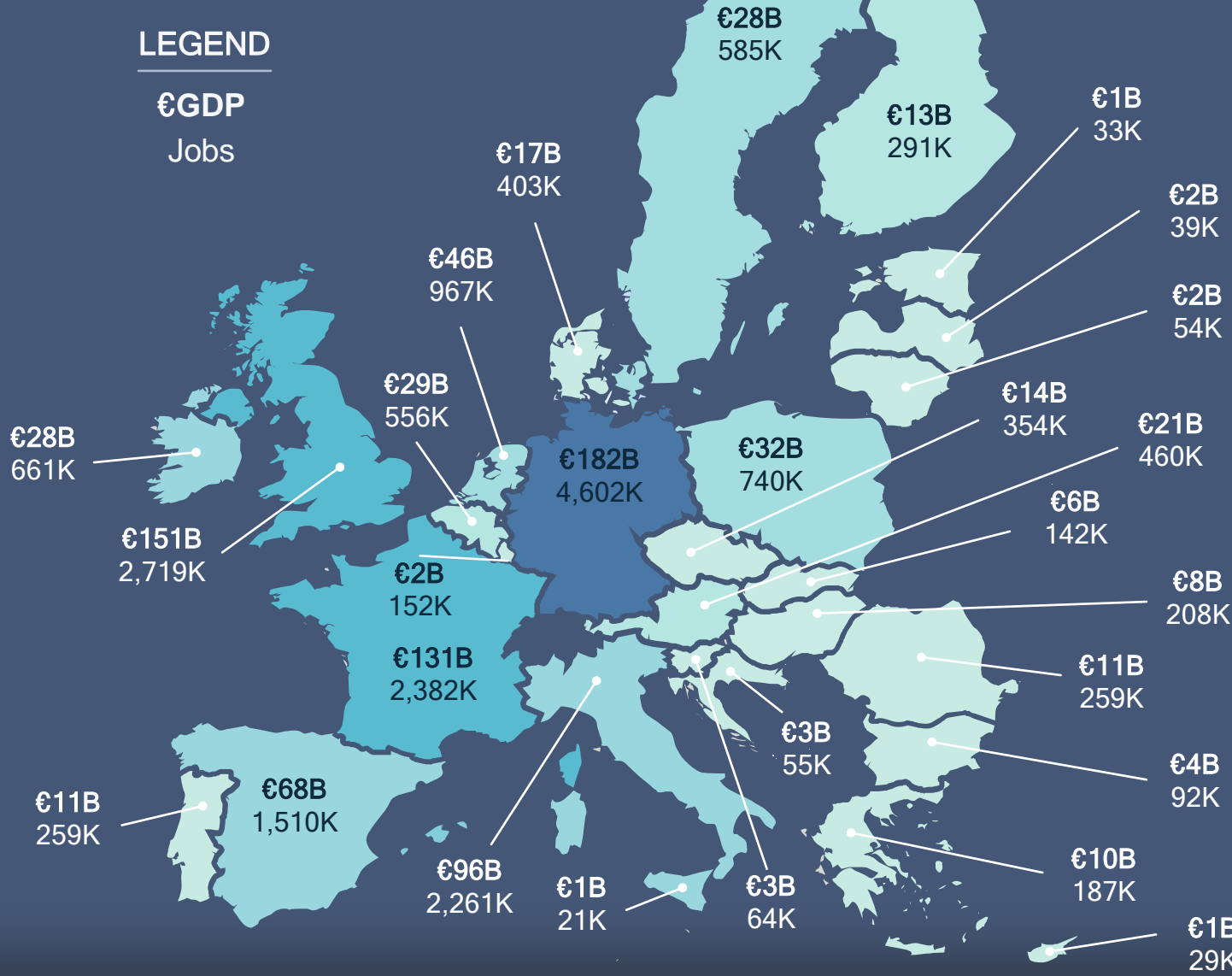
5G will be an immediate economic force for growth from 2021-2025, driven by new 5G connections.

* 5G sales value indicates additional sales increase based on new 5G connections

**Includes full-time, part-time and temporary jobs; Assumes no labor supply constraints, some of these jobs will be replaced by upward pressure on prevailing wages instead.

LEGEND

€GDP
Jobs



5G's economic impact will be felt across the continent, cascading through every country

Includes full-time, part-time and temporary jobs; Assumes no labor supply constraints, some of these jobs will be replaced by upward pressure on prevailing wages instead.

European GDP and Jobs by Country




United Kingdom: 5G driven economic impacts between 2021 and 2025



- Highlighted Industries
- Business Services ▶
 - Healthcare ▶
 - Manufacturing ▶

LEGEND

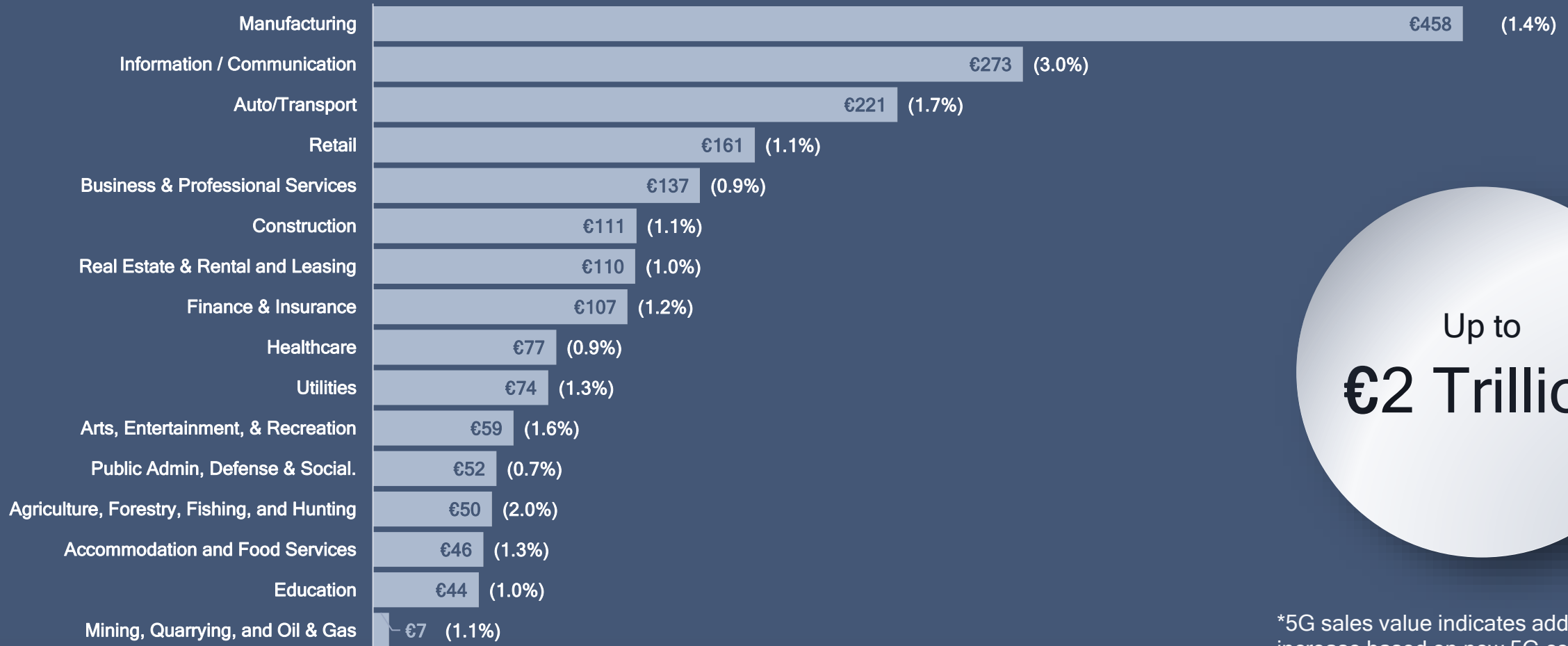
€GDP
Jobs

	 €307 Billion additional sales	 €150.9 Billion new GDP	 Potential to create or transform up to 2.7M jobs
Business Services	€23.8B	€14.7B	186.8k
Healthcare	€15.2B	€10.1B	81.1k
Manufacturing	€40.6B	€11.7B	408.7k

Includes full-time, part-time and temporary jobs; Assumes no labor supply constraints, some of these jobs will be replaced by upward pressure on prevailing wages instead.

This benefit spans all major industries in the EU and UK, as 5G unlocks new demand and productivity improvements.

5G Sales* (€B of Euro, % Increase)

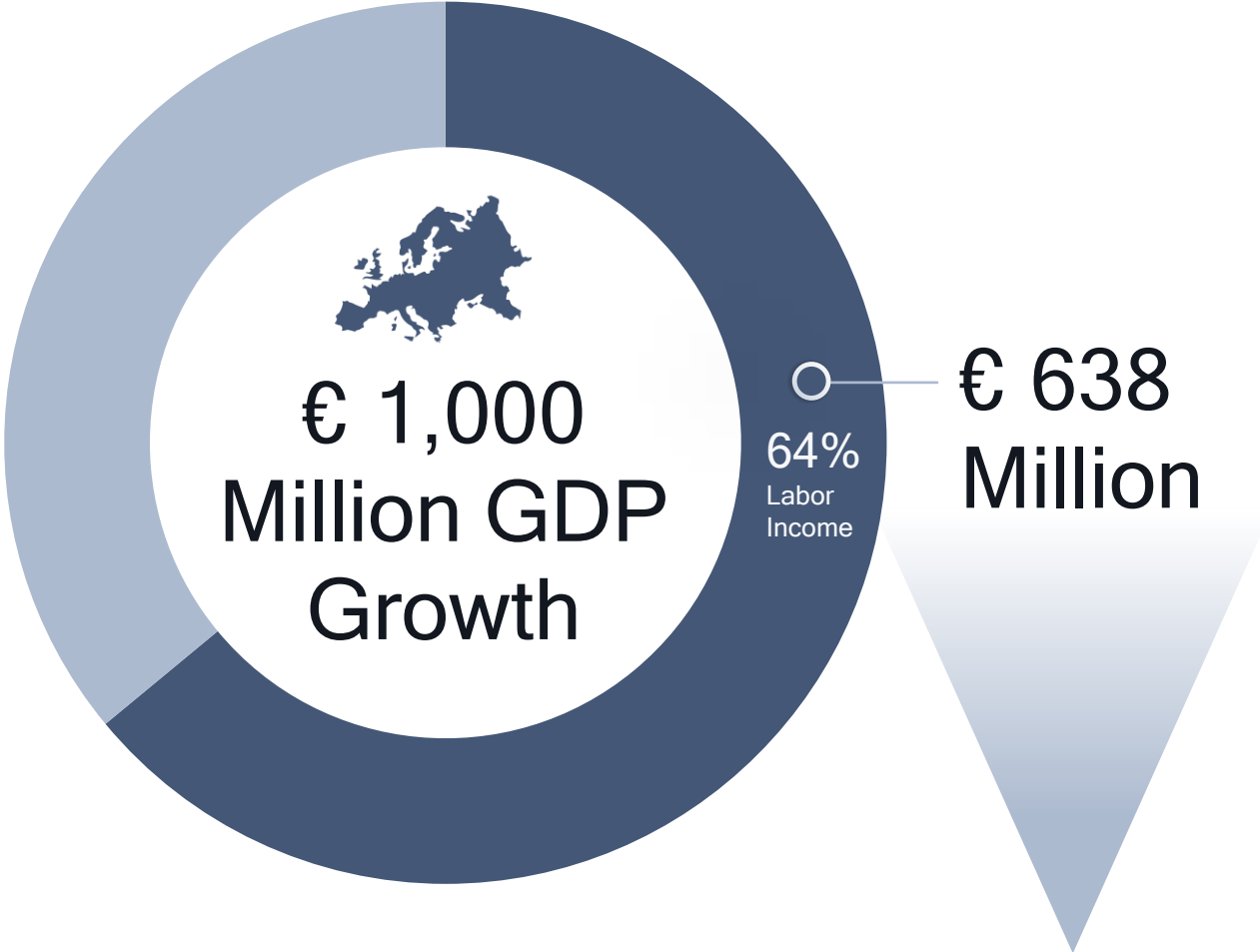


Up to
€2 Trillion

*5G sales value indicates additional sales increase based on new 5G connections

5G EU Sales Impact by Industry

Majority of new GDP is captured by labor, creating and transforming jobs



Create or transform up to **20 Million jobs**

Includes full-time, part-time and temporary jobs; Assumes no labor supply constraints, some of these jobs will be replaced by upward pressure on prevailing wages instead.

New devices and services required for enablement, along with new jobs



Manufacturing



5G USE CASE:
HD video based real-time quality control

New Services/Products

- Train ML/AI to detect quality issues
- HD Video and manufacturing line control equipped with feedback

New Jobs

- Data Scientist specializing in manufacturing
- Industrial design engineer and factory worker to design and produce entire solution



Agriculture



5G USE CASE:
Pest and weed eradication using UAV and AI/ML

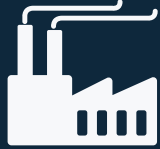
New Services/Products

- Subscription based Weed/Pest eradication services
- 5G Connected UAV that feeds Video to Edge Computing

New Jobs

- Drone Engineer maintaining and improving effectiveness of the solution
- Drone Engineer maintaining and improving effectiveness

5G Sustainable Benefits



Eliminates Emissions

- Efficiencies in 5G network equipment can help reduce carbon emissions from mobile networks by **50% over the next 10 years**.¹

- One UK wireless operator estimated that **40 megatons of carbon consumption can be saved** by using 5G networks.²



Reduces Pollution

- 5G drone using AI/ML to perform **targeted weed eradication** can **reduce pesticide and herbicide usage by 50%**.³

- 5G enabled Intelligent Transportation System can lead to **15% less traffic** and as a result **pollution emitted by vehicles**.⁴



Increases Energy Efficiency

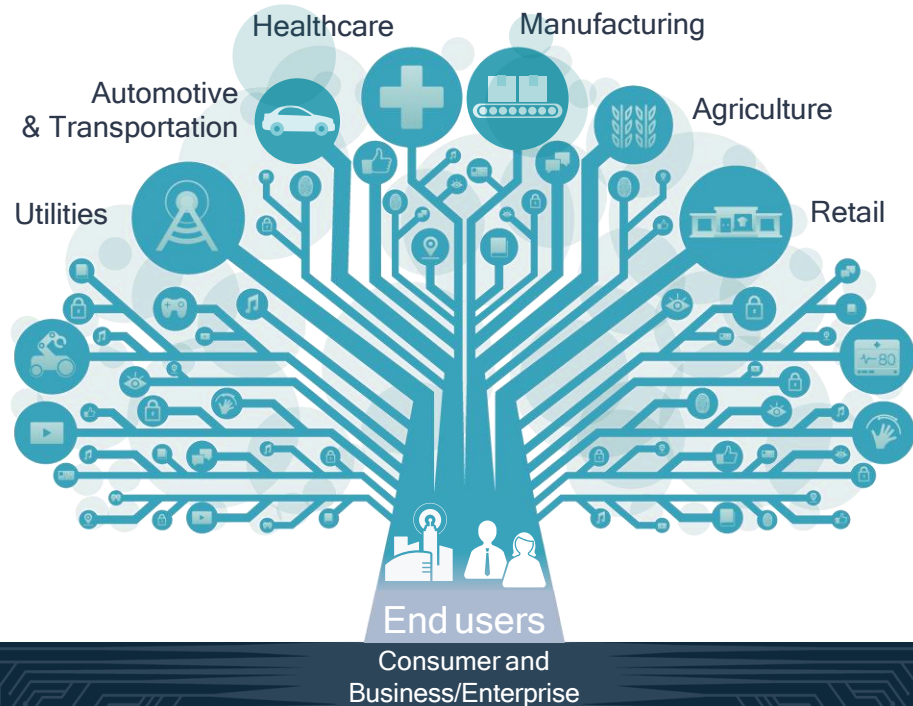
- 5G can lead to more **consistent driving patterns of automated trains**, which could reduce energy consumptions by **20%**.⁵

- 5G enabled **mIOT devices** are developed to have a **longer battery and device lifetime** compared to previous technology.⁶

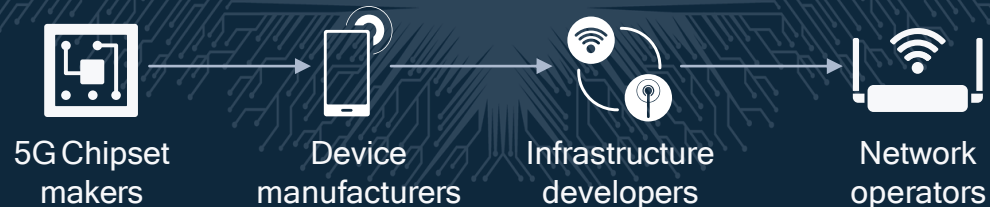
Sources:
¹<https://www.powerengineeringint.com/digitalization/fast-5g-roll-out-will-radically-impact-global-emissions/>
²<https://news.o2.co.uk/press-release/o2-reveals-vision-for-a-greener-connected-future-5g-to-play-key-role-in-building-a-greener-economy/>
³https://croplife.org/wp-content/uploads/2020/03/Drones_Manual.pdf
⁴<https://equalocean.com/news/2020082614640>
⁵https://www.railjournal.com/in_depth/automatic-for-the-people-unlocking-the-benefits-of-automated-operation-on-the-main-line
⁶Accenture research

5G Enablement Delivers Sustainability Benefits

Built on 5G Foundational Technology



- 5G enables use case applications across different industries that will unlock entirely new ways of engaging with people and information
- The value chain encompasses many players, including chipset makers, device manufacturers, infrastructure developers and network operators
- 5G will unlock the next wave of rapid data- and insight-driven decision making
- Ecosystem allows for the optimization of business functions and creation of new value for customers



Foundational technology

5G standards development: design, analysis, implementation, and testing

United States Survey Findings Snapshot

Americans recognize 5G's benefits: enabling work from home, reducing the digital divide and better service.



Connectivity is a fundamental expectation and is seen as essential



Consumers are not quite getting what they need in terms of quality



U.S. consumers recognize the digital divide



People really like working from home – and want to if they don't already



Consumers are surprisingly willing to pay for potential added benefits or new services

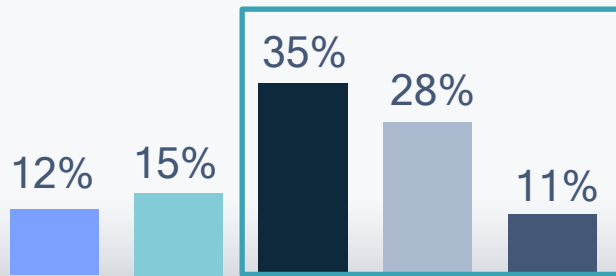


5G has an image problem

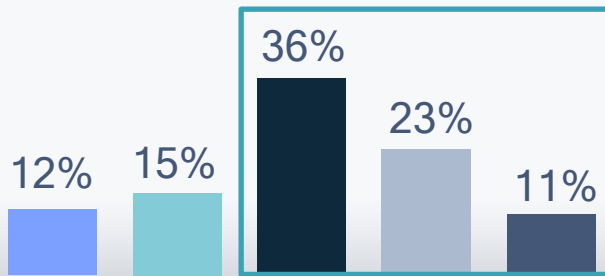
+ The Desire of Virtual and Digital Healthcare

Q How interested are you in the following experiences in the future?

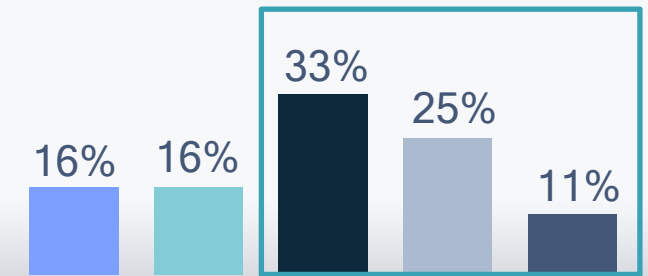
The ability to have faster care at a hospital because your visit is coordinated through digital communication



Having hospital-level care in your home, including virtual doctor consultations and real-time feedback



Real-time health monitoring devices that help me avoid unnecessary trips



■ Not at all interested ■ Not very interested ■ Somewhat interested ■ Very interested ■ This is a top priority for me

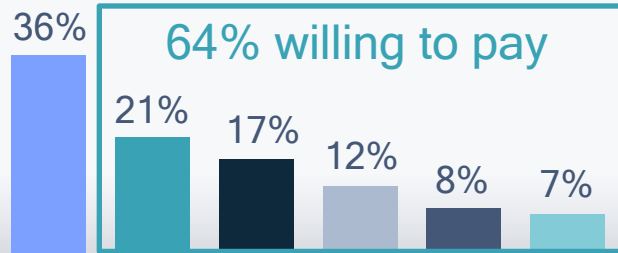
Takeaway: Over two-thirds of American consumers are highly interested in a variety of digital healthcare experiences that can be enabled by 5G connectivity



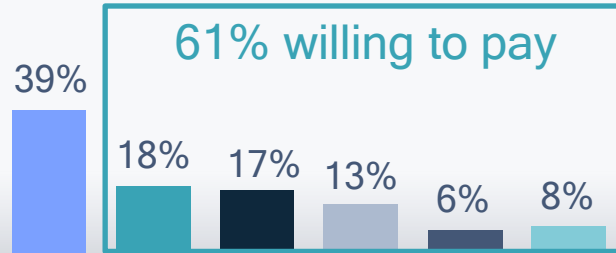
Willingness to pay for new experiences were mixed

Q How much of a premium would you pay to receive the following services?

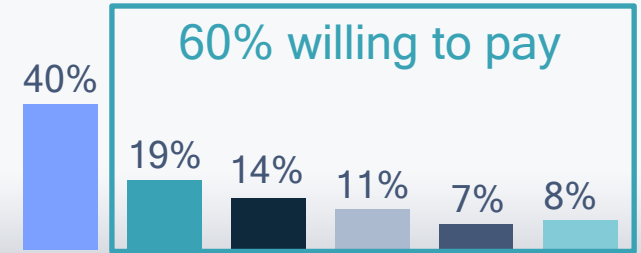
Faster travel because vehicles can communicate and coordinate with each other to reduce congestion



In-store virtual assistants at any time to give guidance and help me choose the products



Virtual exploration and design sessions on new products with augmented or virtual reality



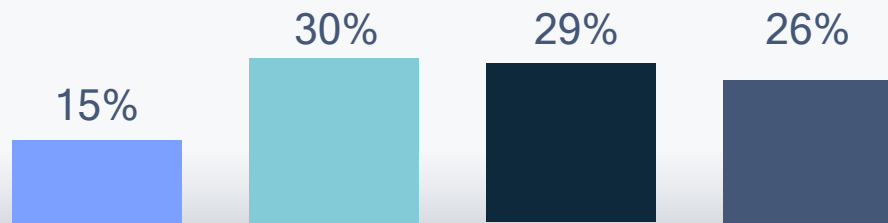
I would not pay extra to receive this Would pay 1-5% more Would pay 6-10% more Would pay 11-15% more Would pay 16-20% more Would pay more than 20%

Takeaway: Consumers are optimistic, but cautious to pay for new experiences

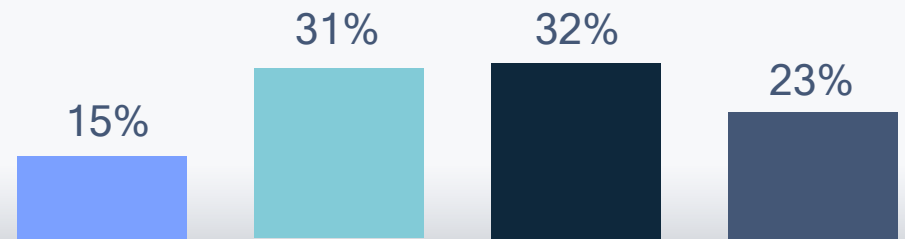
5G Half get 5G, half don't

Q How well do you understand what 5G technology is?
How well do you understand the potential impacts of 5G on your life?

What 5G technology is?



Expected impacts of 5G?



■ No understanding at all ■ Minimal understanding ■ Moderate understanding ■ Strong understanding

Takeaway: Education of 5G fundamental technology is needed.



Connected Dwellings are a Necessity



How important to you is internet connectivity inside of your home?
Outside your home?

97%

Inside the
home



79%

Outside
the home



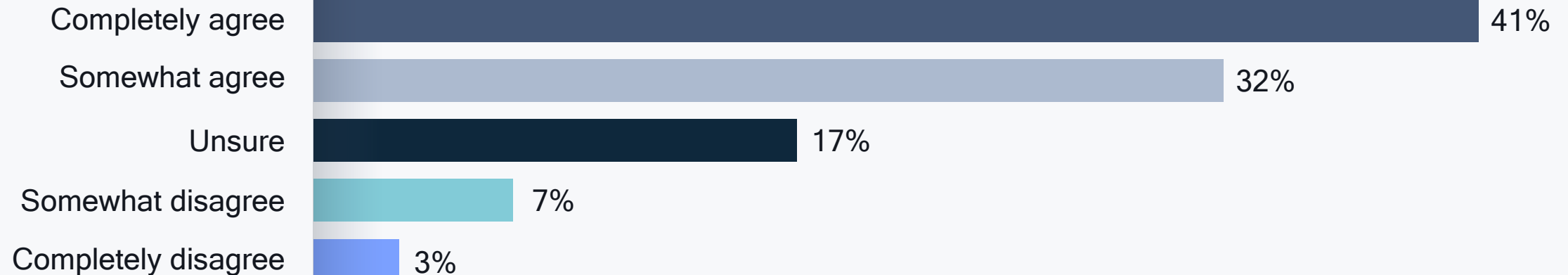
Takeaway: Internet connectivity is a critical need.



Reliable, high-quality internet is a new necessity

AGREE / DISAGREE:

The pandemic has made high-quality internet a necessity



Takeaway: More than 70% of U.S. consumers have seen a shift in habits and thereby, connectivity needs due to access to education, healthcare, work, etc. during the pandemic



Acknowledging the connectivity gap

To what extent do you agree with the following statements about access to the internet?
“COMPLETELY AGREE” AND “SOMEWHAT AGREE” RESPONSES

67%

Access to the internet is affected by income and ability to pay

64%

Ensuring access to the internet for everyone regardless of location or income should be a priority for my country

58%

The ability to access the internet in my country is constrained by the high cost of connectivity

32%

Everyone in my country has equal access to the tools needed to access the internet, in terms of speed and consistency of internet access

32%

Everyone in my country has equal access to the internet in terms of speed, consistency and coverage

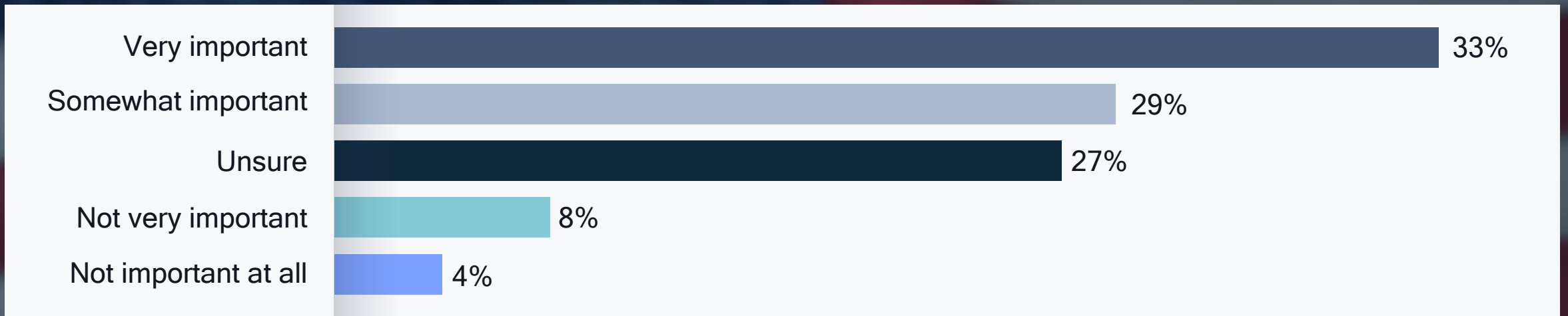
Takeaway: The digital divide needs to be addressed by policy makers



Next-gen connectivity is a patriotic issue



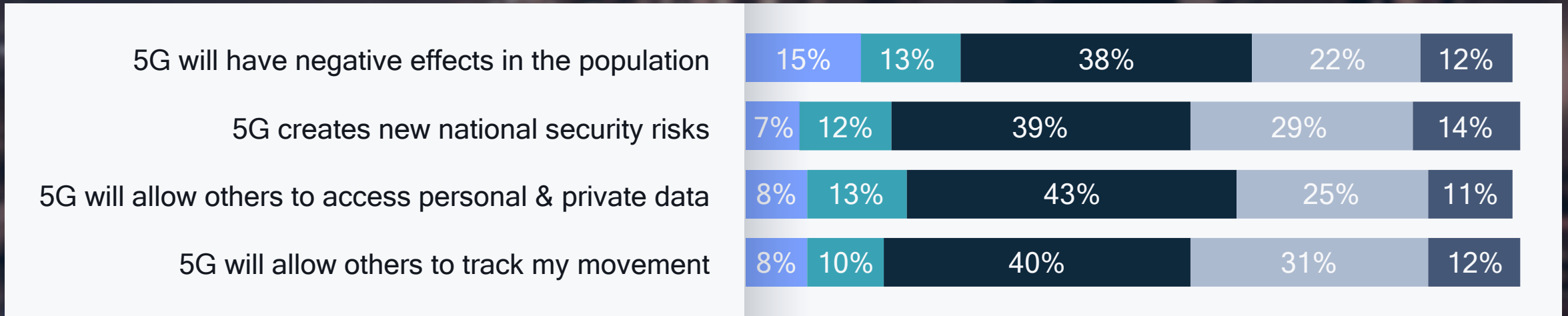
How important is it to you that your country has influence or control over the next generation of internet and internet connectivity (for example the underlying technology and the app economy enabled by that technology)?



Takeaway: Education is needed to understand the connection between R&D and economic growth

5G EU + UK consumers are concerned about 5G costs and risks

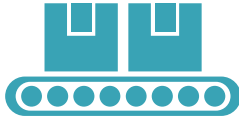
Q To what extent do you agree with the following statements, based on your knowledge of 5G technology?



Not at all interested Not very interested Somewhat interested Very interested This is a top priority for me

Takeaway: Education of 5G fundamental technology & use cases is needed.

Highlights: Key use cases, by industry



Utilities

Healthcare

Manufacturing

Auto/transport

Retail

Agriculture

Intelligent grid

Remote medicine/
virtual consultations

Factory floor automation/
robotic process control

Connected and
automated vehicles

Digital consultations

Pest and weed
eradication using
drones (UAVS)

Smart power plant

Remote patient
monitoring

Intelligent asset
management

Intelligent
transportation
infrastructure

Frictionless checkout

Connected tractor

Connected worker

Connected hospital

Quality assurance
(product and process)

Vehicle telematics,
crash detection and
PHYD insurance

In-store monitoring

Livestock safety
monitoring

Connected worker/
workforce
effectiveness

Connected and
automated train
operations (ATO)

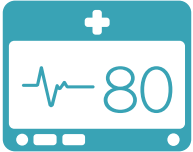
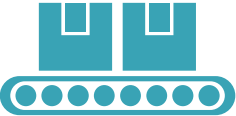
(U.S. & Europe Report)

(U.S. Report)

(Europe Report)

United States Survey Findings Snapshot

Key findings: From research, interviews and surveys



Manufacturing	Healthcare	Automotive	Utilities	Retail	Agriculture
---------------	------------	------------	-----------	--------	-------------

- 20%-30% potential overall productivity gains
- 50% improvement in assembly efficiency
- 20% increase asset life
- 90% defect detection

- 30% cost savings in transition to remote home-based models
- Improved patient outcomes and access to care

- 80% reduction of vehicle collisions
- \$3.6 billion savings in repair costs
- 25% reduction in traffic

- ~Billions in savings resulting from 5G transition and distribution line monitoring
- Drive down 12% of energy use
- Reduce risk of wildfires

- 50% sales growth when combined streaming and XR

- 25% potential increased productivity
- 30% decrease inputs
- 20% decreased costs
- 15% increased crop yields

Key U.S. and Europe industry highlights and summary of findings

Industry and Technology Context



Rising Healthcare Costs

>\$3.5T total (2017) rising to an expected \$6 trillion by 2025; including substantial waste within system.



Aging Population & Increase in Chronic Conditions

90% of system costs driven by chronic conditions; increase in comorbidities & complexity.



Challenges To Health Access

Socioeconomic status, rural vs urban divide, and lack of insurance coverage/affordability.



Consumerization of Healthcare

Patients increasingly playing more active role in health decisions.

Adoption Challenges



FDA Approval & Regulatory Barriers

Hinder rapid innovation; opportunities to develop “white label” 5G kits, streamline/improve approval processes for cloud, edge, AI applications.



Interoperability (US)

Highly fragmented healthcare system creates challenges for new applications; opportunity for better standards-setting and simplification.



Reimbursement Models

Many services tied to physical location; structures aren't in place to transition to virtual or have substantially reduced fees.



Awareness

Both patients and medical professional awareness lags reimbursement models; 2018 showed 0.25% of patients use available virtual options.

5G technology will allow more mobile/home care, better patient outcomes and more capacity and flexibility within healthcare.

Healthcare: Key Highlights

5G Themes and Benefits for the Industry



Rapid transmission & processing of high quality and quantity of medical data (from wearables, multi-modal sensors, etc.)



Richness of in-person physician interactions to remote/home settings (rich bi-directional communication, HD video and a wide array of biometric and other sensors).



Reliability and extreme low latency in critical patient applications.

Priority Use Cases



Remote Patient Monitoring



Virtual Consultations & Care



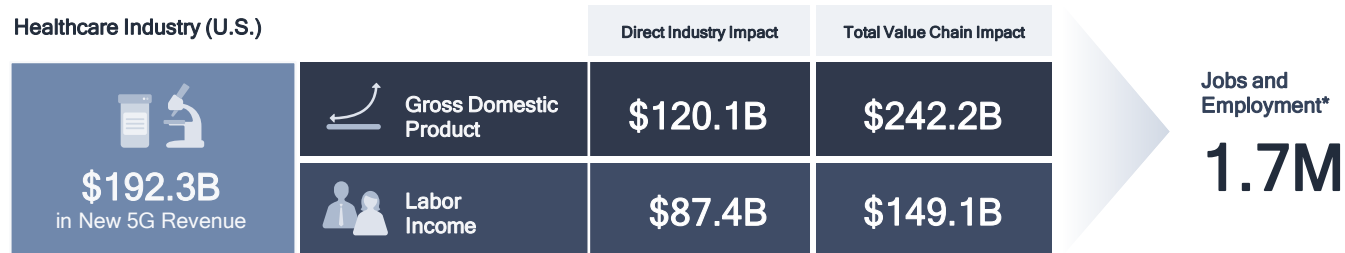
Connected Hospital [& Ambulance]

5G technology will allow more mobile/home care, better patient outcomes and more capacity and flexibility within healthcare.

Healthcare: Key Highlights

Healthcare: Overview

5G technology will allow more mobile/home care, better patient outcomes and more capacity and flexibility within the healthcare system



Note: Multiplier is calculated as the ratio of Total Value Chain Impact to Direct Industry Impact.

5G Use Cases

- Remote Patient Monitoring
- Virtual Consultation and Care
- Connected Hospital
(and Ambulance - EU)

Highlights

5G will allow more post-acute care to transition to remote, home-based models, where cost savings are greater than 30% and drive better patient outcomes

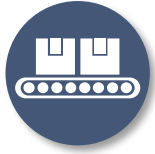
Note (*) Includes full-time, part-time and temporary jobs; Assumes no labor supply constraints, some of these jobs will be replaced by upward pressure on prevailing wages instead.

Industry and Technology Context



Rising Demand of Customization

Manufacturers must shift production to accommodate higher demand for personalized products.



Competitive Production

Manufacturers face increasing pressure to produce against lower prices to stay competitive.



Worker Safety and Health

Compliance with health and safety standards is top of mind, but manufacturing still reports the highest non-fatal injury rate.



Connectivity and the Need for Data

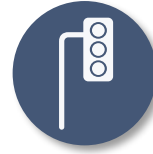
Current data collection is patchy due to connectivity interference, thus unable to yield insights or actions.

Adoption Challenges



Legacy Infrastructure and Standardized Protocols

Manufacturers have heavily invested into legacy infrastructure that is built to last 10-20 years.



Investments and Proof of Concept

Companies are hesitant to invest before they have a clear idea of benefits due to the high impact on business output.



Device and Ecosystem Readiness

There are few commercially ready 5G-ready devices available in the ecosystem.

5G technology unlocks the ability to sense and respond for manufacturers in the United States, facilitating efficient communications between people and machinery.

Manufacturing: Key Highlights

5G Themes and Benefits for the Industry



5G enables manufacturers to **sense and respond** to their environment, collecting more data to **increase precision and control**.



Using wireless 5G will allow factories to become **more flexible**, easing reconfigurations.



5G brings a **more secure network** and ensures and ensures **limited network downtime**, increasing productivity.

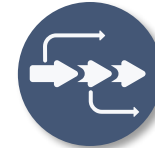


Manufacturers must find **creative ways to retrofit** their existing equipment to deliver the data and insights needed.

Priority Use Cases



Factory Floor Automation and Robotic Process Control



Intelligent Asset Management



Quality Assurance



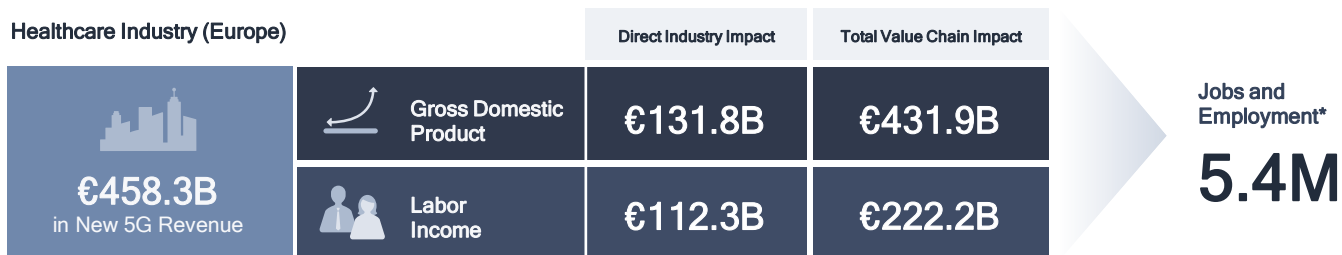
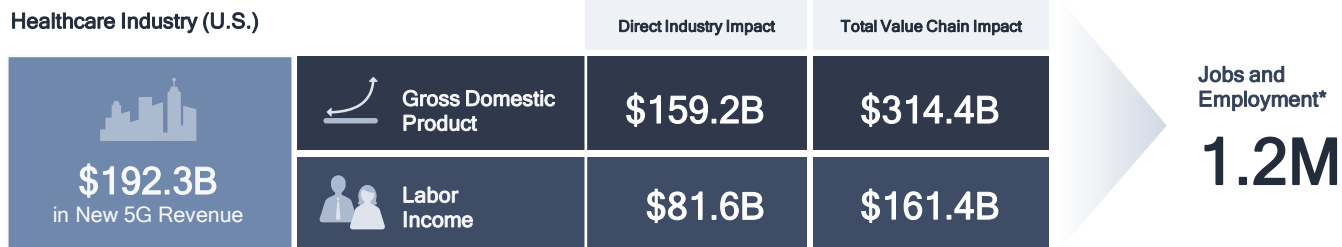
Connected Worker

5G technology unlocks the ability to sense and respond for manufacturers in the United States, facilitating efficient communications between people and machinery.

Manufacturing: Key Highlights

Manufacturing: Overview

5G technology will unlock the ability to sense and respond for manufacturers in the United States, facilitating efficient communications between people and machinery



Note: Multiplier is calculated as the ratio of Total Value Chain Impact to Direct Industry Impact.

Key 5G Use Cases




- Factory Floor Automation
 - Intelligent Asset Management
- Connected Worker
- Quality Assurance

Key Highlights




5G-enabled factories can see up to 20-30% in overall productivity gains, including improvements of 50% in assembly time, 20% in asset life, and 90% in defect detection

Note (*) Includes full-time, part-time and temporary jobs; Assumes no labor supply constraints, some of these jobs will be replaced by upward pressure on prevailing wages instead.

Policy Recommendations

CHALLENGES	DESCRIPTION	POLICY RECOMMENDATION
 <p>IP, Technology, and Ecosystem</p>	<ul style="list-style-type: none"> • Wireless technology R&D requires a high up-front investment, and it may not come to fruition for several years • Innovation must be properly compensated and protected with strong IP protections 	<ul style="list-style-type: none"> • Balance innovation stimulation with IP protections to ensure continuous investment • Encourage innovation via subsidies and government-funded R&D incentives and/or grants
 <p>Resilient Wireless Technology Supply Chain</p>	<ul style="list-style-type: none"> • Ensuring semiconductor supply chain resiliency to de-risk development and delivery of 5G technology 	<ul style="list-style-type: none"> • Policies designed to support a reliable and trusted wireless technology value chain (e.g., Chips and network equipment)
 <p>Network Deployment and Build-Out</p>	<ul style="list-style-type: none"> • Permitting process for RAN buildout can be complex, with long lead time • The cost of network deployment threatens to limit timely buildout in rural areas 	<ul style="list-style-type: none"> • Streamline local and municipal site approvals and processes • Increase incentives to carriers to provide coverage in underserved areas • Support and fund the development of Open RAN, which will allow interoperability and drive down total cost of up to 49%

Policy Recommendations (cont'd)

CHALLENGES	DESCRIPTION	POLICY RECOMMENDATION
 <p>Return of Investment</p>	<ul style="list-style-type: none"> • High capital investment may appear prohibitive to industry players • Complexity and legacy infrastructure can lead to a slower ROI 	<ul style="list-style-type: none"> • Establish subsidies and tax incentives to encourage pilot projects or even full-scale testbeds • Provide investment support for use cases that have broader benefits throughout the economy and consider comprehensive
 <p>Spectrum Availability</p>	<ul style="list-style-type: none"> • Mid and High band spectrum availability 	<ul style="list-style-type: none"> • Prioritize and accelerate the release and allocation of critical mid and high band spectrum • Encourage spectrum usage in strategic industries (e.g., utilities) • Develop remedies (e.g., subsidies, sharing frameworks) that will support region-wide coverage and interoperability, where required
 <p>Balancing Regulations</p>	<ul style="list-style-type: none"> • Certain industries with strict regulations (e.g., healthcare, automotive) may have lengthy approval timelines for devices • This may cause a delay in commercially available devices or discourage investment in device development 	<ul style="list-style-type: none"> • Streamline industry-specific processes and policymaking, such as the EMA approval process for medical devices and healthcare use cases • Foster collaboration between the private sector and government, to balance public and economic benefit and accelerate timelines