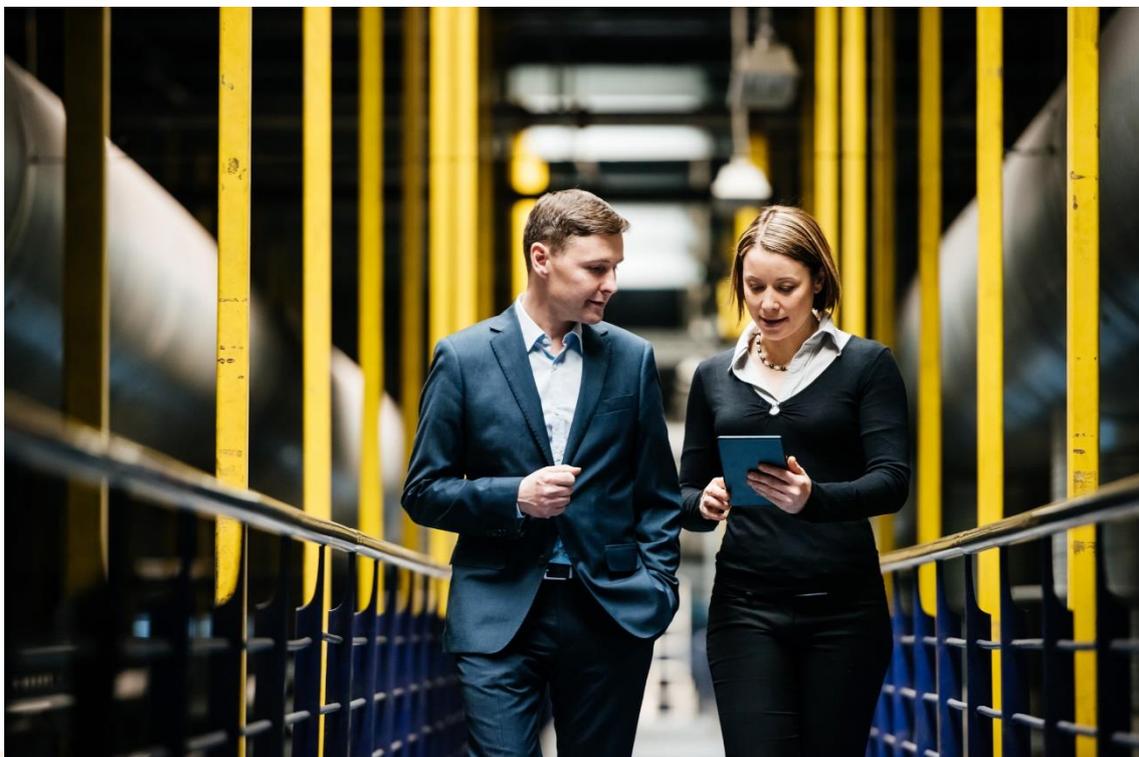




## Executive Briefing

# \$1.4TN OF BENEFITS IN 2030: 5G'S IMPACT ON INDUSTRY VERTICALS

The unique benefits of 5G could unlock \$1.4tn of value in eight key industries in 2030. What steps should operators take to deliver these benefits? What business and organisational transformation must occur to unlock this opportunity?



# Preface

The document has been prepared by independent consulting and research firm STL Partners. It is based on extensive research into the impact of 5G on industries and leveraged the output of an interview programme with telecoms, digital solution providers and industry representatives and a survey of over 200 participants from the manufacturing and healthcare industries across developing and developed countries. The research programme has kindly been supported by Huawei.

This report should be read by telecoms operators, particularly CSOs, strategists, CMOs, enterprise executives, and other ecosystem stakeholders: software/application vendors, cloud and edge computing companies, ISPs, systems integrators, developers and similar organisations. The content is also relevant to industry players who are interested in using technology to enhance operations, particularly those responsible for operations and digitalisation: COOs, CEOs and CSOs.

Mentions of companies in this document are intended as illustrations of market evolution and are not intended as endorsements or product/service recommendations.

If you find this report of interest and would like to discuss any aspects of the content further, please contact any of the following:

## STL Partners:

- Tilly Gilbert: Consultant and Lead Author, [tilly.gilbert@stlpartners.com](mailto:tilly.gilbert@stlpartners.com)
- Chris Barraclough: Partner, [chris.barraclough@stlpartners.com](mailto:chris.barraclough@stlpartners.com)

## Key contributors:

- Ian Mash: Director - CTO Carrier Business Group, [ian.mash@huawei.com](mailto:ian.mash@huawei.com)
- Mark Easton: Principal Consultant - CTO Carrier Business Group, [mark.easton@huawei.com](mailto:mark.easton@huawei.com)

STL Partners is continuously working to understand how 5G can benefit other industries and develop strategies for telecoms operators and other industries to accelerate the delivery of benefits. Should you like to learn more about this research and future projects or find out how we can help operators and industry experts to work more effectively together and take advantage of 5G please contact us.

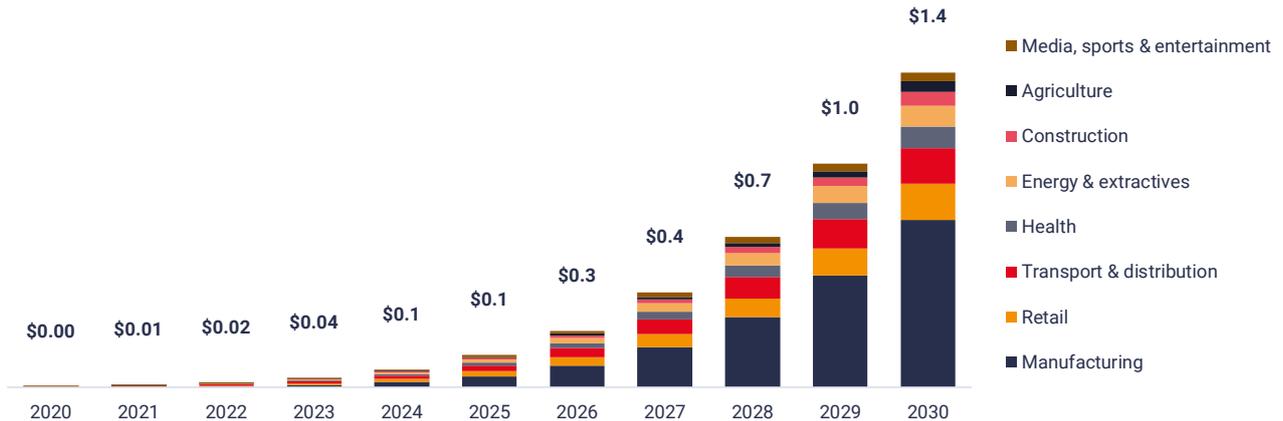
## Other reports in this 5G series include:

- Curtailing Carbon Emissions: Can 5G Help?
- 5G's Healthcare Impact: 1 Billion Patients With Improved Access In 2030
- 5G's Impact On Manufacturing: \$740bn Of Benefits In 2030
- 5G Regulation: Ensuring Successful Industrial Transformation

# Executive Summary

5G enabled solutions are estimated to add c.\$1.4 trillion to global GDP in 2030

Benefits to industry attributable to 5G (USD trillions)



Source: STL Partners

5G-enabled use cases will enable eight industries to add an extra \$1.4 trillion to global GDP in 2030. To reach these predictions, STL Partners has interviewed more than 20 enterprises, software developers and operators and conducted more than 200 surveys with industry experts. We have explored 5G use cases across the verticals with a particular focus on healthcare and manufacturing. These use cases are each enabled by the unique properties of 5G, explored in more detail in the section **It's not all about LTE: 5G must be compared to all available technology.**

The manufacturing industry benefits most, both because of the large impact we predict 5G will have on it (increasing its GDP contribution by more than 4%) and because of the absolute size of the industry. Industries like retail – where key use cases include AR/VR experiences for customers and massive IoT for asset tracking and management – and transport and distribution – where key uses include the connected car and drones for parcel delivery – also benefit heavily from 5G.

We have deep-dived on two industries in particular: healthcare and manufacturing. Here we have modelled the bottom-up benefits of three key uses cases: remote patient monitoring, HD video consultations and connected ambulance in healthcare and advanced predictive maintenance, precision monitoring and augmented reality and remote expert in manufacturing.

In healthcare, we predict 5G enabled use cases globally could enable healthcare professionals to treat more than 850 million extra outpatients per year in 2030, while also making available more than 4 million extra bed days for use in hospitals. For the most severe of health incidents, ambulance services should be able to handle 40 million more emergency responses per year by 2030. For manufacturing, 5G has the potential to grow global manufacturing GDP by 4%, or just under \$740 billion, by 2030.

## Operators must embrace new business models to unlock significant revenues with 5G

4G rollout did not unlock long term ARPU increases for operators. Unless they do something different (i.e. develop successful new businesses that go above and beyond delivering the benefits of connectivity), 5G will likely do the same. In this report we have outlined three roles we see telcos should consider in order to move up the value chain and unlock new revenues with 5G.

	Network-as-a-Service	Application enablement	Solutions and applications
Value proposition	Providing and managing custom networks in a cloud-like way: ability for customer to scale up and down, define parameters (e.g. latency), add additional functionality (e.g. security).	Aggregating applications and data from multiple partners to multiple users, could include providing data sharing and management capabilities, billing/transactions and revenue management, marketplace.	Specific solutions (could be end-to-end) and applications for customers, including consulting and advisory services, systems integration and solution sales.
Customers	Enterprise (site) IT teams	Application providers, consumers & enterprises	Enterprise IT teams
Revenue models	Access fee/subscription (usage), licensing	Revenue share (from subscriptions, access fees), brokerage commission, access fee	Professional services, one-off sales (for hardware)
Capabilities required	Software skills, remote operations and management	Software skills to operate platform, billing, data management, cloud infrastructure seamless partner onboarding	Sourcing and coordinating partners, strong sector knowledge, systems design & build, software capabilities
Real-life examples	<ul style="list-style-type: none"> <li>AWS/Azure for cloud services</li> <li>Colt On Demand</li> </ul>	<ul style="list-style-type: none"> <li>Amazon/eBay</li> <li>App Store/Play Store</li> </ul>	<ul style="list-style-type: none"> <li>Accenture/IBM</li> <li>Telco SIs (e.g. T-Systems)</li> </ul>

Source: STL Partners

The opportunities for telcos in each of these roles, as well as the investment and capabilities required to do it successfully, is illustrated in more detail with reference to our two focus industries, manufacturing and healthcare.

## Recommendations for operators: how to capitalise on the 5G opportunity<sup>1</sup>

In order to maximise their share of this \$1.4 trillion opportunity, telcos need to think differently. In particular, these recommendations link to STL Partner's vision for telcos to play a coordinating role in society, helping to solve the next wave of problems facing the world including resource shortages, climate change, wealth distribution and unemployment.<sup>2</sup> The recommendations here to move beyond connectivity, move into verticals and engage and work with wider communities chime with those explored in more detail in [The Coordination Age: A third age of telecoms](#).

To maximise the 5G opportunity, telcos should:

1. **Focus their efforts on becoming vertical specialists.** In order to successfully deliver innovative 5G-enabled use cases to industry verticals, telcos must invest significant time and money in understanding the pain points, challenges and opportunities within specific markets. Those that have done this successfully, such as TELUS in healthcare, have been building their proposition and expertise through M&A and internal product development for more than 10 years. Telcos must look learn from and emulate this success when offering anything more than compute and connectivity to an industry.
2. **Engage closely with industry leaders.** In order to grow into verticals, telcos must engage with industry leaders to understand their requirements and expectations, and educate them on the potential of 5G.
3. **Embrace new business models.** 4G rollout did not unlock long term ARPU increases for operators. Unless they do something different, 5G will likely deliver the same result. In this report we have outlined three non-mutually exclusive roles that telcos should consider in order to play further up the value chain, adding additional value to governments, enterprises, and consumers and so unlocking new revenues with 5G:
  - **Network-as-a-Service.** Providing and managing custom networks in a cloud-like way, enabling customers to scale up and down, define specific parameters (such as latency) and add additional functionality they might require (such as specific security features).
  - **Application enablement.** Aggregating applications and data from multiple partners in a marketplace environment, including providing data sharing and management capabilities and billing/transaction and revenue management.
  - **Solutions and applications.** Bringing specific (could be end-to-end including compute and connectivity) solutions and large-scale applications to customers, including consulting and advisory services, system integration and solution sales.

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<sup>1</sup> For implications for enterprises within manufacturing and healthcare, see STL Partners reports: 5G's healthcare impact: 1 billion patients with improved access in 2030 and 5G's impact on manufacturing: 740bn of benefits in 2030. For implications for regulators, local governments and the wider community, see STL Partner's report 5G regulation: Ensuring successful industrial transformation.

<sup>2</sup> See [The Coordination Age: A third age of telecoms](#)

- 4. Manage partnership ecosystems.** In order to successfully play higher up the value chain and diversify beyond traditional connectivity offerings, telcos will need to work with partners. This is particularly true if they look to offer end-to-end solutions and applications. Sourcing and coordinating multiple partners is already something telcos are strong at –they must capitalise on this if they are to challenge more established vertical-specific digital solution providers. This idea has been explored further in STL Partner’s research into a new age for telecoms, *The Coordination Age*.<sup>3</sup>
- 5. Work with national governments and regulators to accelerate 5G rollout.** 5G offers significant potential benefits to governments, enterprises and consumers. These benefits are contingent upon the swift and effective roll-out of 5G networks. For some industries, such as manufacturing, a deep local network with strong in-building coverage will be required. For others, such as healthcare, a national network will be required to deliver benefits to all citizens regardless of their location. As such, regulators and governments need to balance the short-term incentive of high spectrum auction fees against the need to encourage mobile network operators and other enterprises to build networks quickly. Overall, we believe that governments should consider lowering spectrum prices and setting more stringent requirements for national network deployment. At the same time, some high- and medium-band spectrum should be opened to new competitors wishing to develop deep local 5G (private) networks. For more information, see STL Partner’s report *5G regulation: Ensuring successful industrial transformation*.

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<sup>3</sup> See [The Coordination Age: A third age of telecoms](#)

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# Introduction

## Background

The aim of this report is to highlight the impact that 5G will have on global GDP between 2020 and 2030. To do this, we have focused on eight industries where we feel 5G will have the largest impact. Often when 5G is discussed, the focus is on the impact it will have on the consumer market. Here, we argue that 5G will unlock significant new revenue opportunities in the enterprise space, enabling innovative use cases that are currently impossible to scale commercially (with existing technologies).

This report is part of a series of 5G reports STL Partners has produced. It draws upon insight which is explored further in the following publications:

1. Two industry deep-dive reports on the impact 5G will have, including in-depth economic modelling of the most promising use cases
  - 1.1. The first focuses on the **manufacturing industry** and covers use cases including advanced predictive maintenance, precision monitoring and augmented reality (AR) remote expert.
  - 1.2. The second focuses on the **healthcare industry** and covers use cases including remote patient monitoring, high-definition (HD) video consultations and the connected ambulance.
2. A report focused on the role of regulation in the rollout of 5G and how governments and regulatory bodies can best enable the economic benefits associated with 5G's use within enterprises to be realised.
3. A report predicting the impact 5G will have on the energy efficiency of telcos' networks. Here, we move beyond the economic impact of 5G and emphasise how it will enable telcos to simultaneously improve their services while reducing their impact on the environment.

The document was researched and written independently by STL Partners, supported by Huawei. STL's conclusions are entirely independent and built on ongoing research into the future of telecoms. STL Partners has written widely on the topic of 5G, including a recent two-part series into the short- and long-term opportunities unlocked by 5G,<sup>4</sup> and lessons that can be learnt from early movers.

## Comparing apples with apples: how to compare nascent 5G with established 4G

If you compare the technological specifications for 3GPP release 14 and 3GPP release 15 (the first 5G release), you might be underwhelmed. Despite the hype that 5G will be transformative, it does not appear to be delivering much more than incremental increases in speed and reliability. But, of course, 4G is now a mature form of connectivity (having been in-life for 6+ years) whereas 5G is still nascent.

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<sup>4</sup> See [5G strategies: Lessons from the early movers](#)

To compare apples with apples, it makes sense to compare 5G release 16, where capabilities such as ultra-reliable low-latency and network slicing are being added, with LTE today (See Figure 1).

**Figure 1: Mature 5G benchmarked against the capabilities of mature 4G**

Specification		LTE (Rel. 12-13)	→	5G (Rel. 16/IMT-2020)
<b>Average data rate per user</b>	Downlink	10Mb/s	<b>10x</b>	100Mb/s
	Uplink	0.5Mb/s	<b>100x</b>	50Mb/s
<b>Peak data rate</b>	Downlink	1Gb/s	<b>20x</b>	20Gb/s
	Uplink	150Mb/s	<b>100x</b>	10Gb/s
<b>Latency</b>	End-to-end	<100ms	<b>10%</b>	<10ms
	Airlink	<10ms	<b>10%</b>	<1ms
<b>Density / capacity</b>	Traffic capacity	100Kb/s/m <sup>2</sup>	<b>100-1000x</b>	10-100Mb/s/m <sup>2</sup>
	Device density	100K	<b>10x</b>	1M
<b>Reliability</b>				99.999%
<b>Mobility</b>		350km/h	<b>1.5x</b>	500km/h
<b>Spectral efficiency</b>			<b>3-4X</b>	
<b>Energy efficiency</b>			<b>10%</b>	
<b>Device battery life</b>			<b>10x(?)</b>	
<b>Network slicing</b>		Limited		End-to-end
<b>Location accuracy</b>		10-50m		<1m

Source: ITU, 5G lecture, ublox, gps world

Of course, these figures represent a best-case scenario occurring in a laboratory environment. This is true for both the 4G and 5G numbers. It's also true that, in reality, it will take time before we see commercialised rollout of enhanced mobile broadband ("pure 5G") rather than enhanced mobile broadband with 4G fall-back alongside fixed wireless access. Despite this, these figures make clear that when 5G reaches maturity, it will far outstrip the capabilities of 4G, and unlock new use cases.

Our assumption is that by 2025 5G technology will be mature, enabling massive M2M / IoT use cases as well as those that require ultra-reliable low-latency communications. Several of the 5G use cases we'll go on to explore in more detail are reliant on this technology, so it is important to acknowledge that their commercialisation is only likely to start from around 2023 and in many markets they still won't be fully deployed in 2030.

## It's not all about LTE: 5G must be compared to all available technology

Mobile is not the only form of connectivity used by enterprises. Plenty of industries are also making use of Wi-Fi, LPWAN, Zigbee, Bluetooth and fixed connectivity as part of their overall connectivity solution. When 5G is rolled out, in some cases, it will need to integrate with these existing technologies rather than replace them. Figure 2 summarises some of the key benefits and shortcomings of current technologies, including highlighting the sorts of situations in which industries are making use of them.

**Figure 2: Current technologies will not be entirely replaced by 5G, but it can address some of their key shortcomings**

Type of connectivity	Current industry example	Key benefits	Key shortcomings
LTE	<ul style="list-style-type: none"> <li>Used widely across industries</li> </ul>	<ul style="list-style-type: none"> <li><b>Flexible</b> and <b>mobile</b></li> <li><b>No installation fees</b></li> </ul>	<ul style="list-style-type: none"> <li><b>Performance</b> and <b>reliability</b> not in the lab not good enough for mission critical communications</li> <li>Cannot enable <b>network slicing</b></li> <li>Cannot handle <b>cell density</b> that comes with massive IoT</li> </ul>
Wi-Fi	<ul style="list-style-type: none"> <li>Used for general site connectivity in industries with long term indoor sites e.g. manufacturing</li> </ul>	<ul style="list-style-type: none"> <li><b>Cheaper</b> than a fixed line solution</li> <li>Unlimited data allowances possible</li> </ul>	<ul style="list-style-type: none"> <li>Deemed by many in industry as not <b>secure</b> enough</li> <li>Takes relatively long time (often weeks) to set up</li> <li>Cannot handle <b>cell density</b> that comes with massive IoT</li> <li><b>Indoor coverage</b> can be patchy</li> </ul>
Fixed / Ethernet	<ul style="list-style-type: none"> <li>Used in industries where fixed sites are common and speed and latency are top priorities e.g. media, sports and entertainment</li> </ul>	<ul style="list-style-type: none"> <li>Often the <b>fastest</b> and most <b>reliable</b> of the current solutions, particularly when high bandwidth required</li> </ul>	<ul style="list-style-type: none"> <li>Takes a long time to set up (often months)</li> <li>Lack of <b>mobility</b> and <b>flexibility</b></li> </ul>
LPWAN (e.g. LoRA and Sigfox)	<ul style="list-style-type: none"> <li>Used for low data rate applications such as alarm systems and asset tracking</li> </ul>	<ul style="list-style-type: none"> <li>Cheaper than licensed technology</li> <li>Connectivity can penetrate to underground equipment and supports <b>wide area coverage</b></li> </ul>	<ul style="list-style-type: none"> <li>Will not be able to support number of devices and <b>cell density</b> of massive IoT</li> <li><b>Unlicensed technology</b> means no control of number of devices on the network</li> <li><b>Infrastructure</b> currently thinly spread</li> </ul>

Type of connectivity	Current industry example	Key benefits	Key shortcomings
NB-IoT	<ul style="list-style-type: none"> <li>Used for low data rate applications such as wearables, asset tracking and some smart infrastructure</li> </ul>	<ul style="list-style-type: none"> <li>Some degree of <b>network quality</b> can be guaranteed as <b>congestion</b> can be managed</li> <li>Better <b>scalability</b> and <b>quality of service</b> than unlicensed alternatives</li> </ul>	<ul style="list-style-type: none"> <li>Less suitable for <b>high data rate</b> applications</li> <li>Roaming and voice transmission not supported</li> <li>Scarce <b>coverage</b> (currently)</li> </ul>
Zigbee	<ul style="list-style-type: none"> <li>Used for machine-to-machine communication in low data rate applications like sensors and actuators</li> </ul>	<ul style="list-style-type: none"> <li>Device-to-device <b>interoperability</b> possible</li> <li>Less <b>complex</b> than Bluetooth with fewer points of failure</li> </ul>	<ul style="list-style-type: none"> <li>Will not be able to support number of devices <b>and cell density</b> of massive IoT</li> <li>Cannot support <b>wide area</b> use cases</li> </ul>
Bluetooth	<ul style="list-style-type: none"> <li>Used for low data rate applications such as indoor asset tracking</li> </ul>	<ul style="list-style-type: none"> <li>Long <b>battery life</b></li> <li>Easy to deploy</li> <li><b>Cost-effective</b></li> </ul>	<ul style="list-style-type: none"> <li>Will not be able to support number of devices and <b>cell density</b> of massive IoT</li> <li>Lack of <b>security</b></li> </ul>

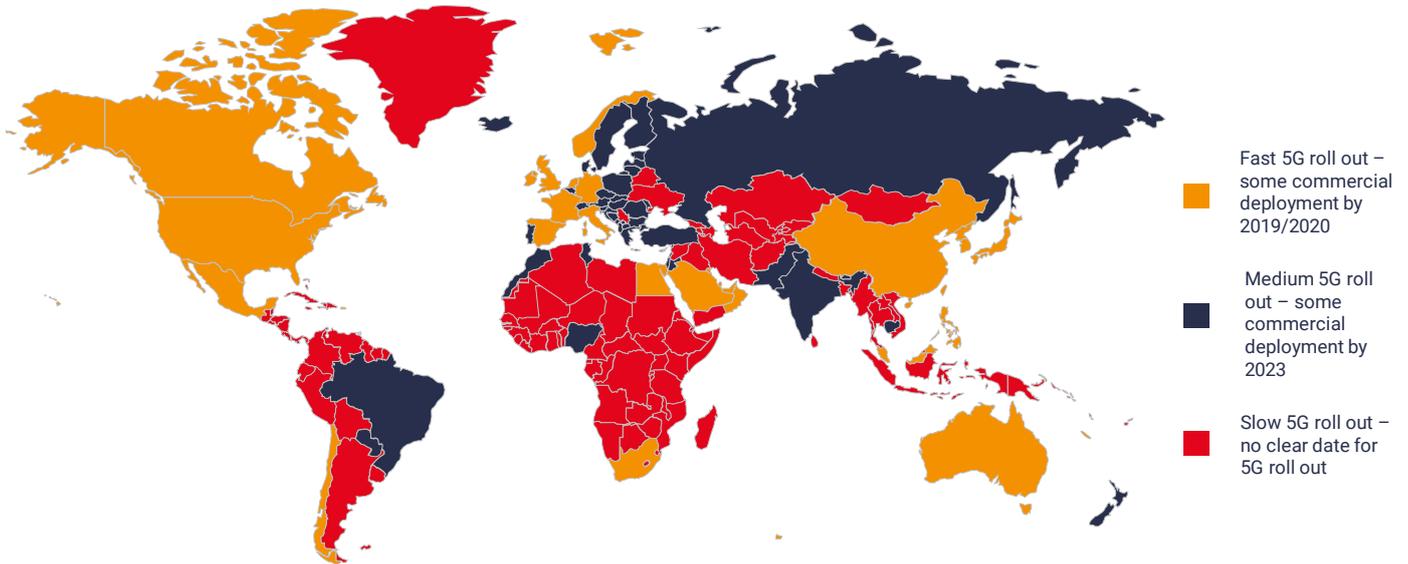
Source: STL Partners

There are clear scenarios where 5G will be superior to existing technologies and bring significant benefits to industrial users. Ultimately, in particular, 5G will enable:

1. Low latency and high bandwidth requirements for wireless connectivity
4. Massive IoT through ability to handle high cell density
5. Ultra-reliable and secure connectivity.

## 5G deployment: 5G will mature over the next ten years

**Figure 3: Forecast of 5G deployment in major regions**



Source: STL Partners

It will take time for the benefits of 5G to be fully realised, both in terms of performance by the network and in terms of financial benefits for operators rolling it out. Figure 3 indicates a high-level overview of when countries are expected to gain 5G.<sup>5</sup> Figure 3 rollouts are based on 5G for enhanced mobile broadband. Most operators have indicated that the types of 5G use case that require network slicing or ultra-reliable low latency will be further out, with fast adopters expecting this by 2023 while those with no clear date for 5G rollout probably only having sufficient coverage for these use cases from 2028 onwards. Each economic forecast takes these 5G rollout timelines into account in addition to the speed at which we predict industries will adopt each solution.

Deployment speeds will also be influenced by the ability and willingness for regulators and local governments to make decisions which will facilitate 5G adoption. Telcos will want to work with regulators to ensure this happens. The nuances of 5G regulation have been explored in more detail in the following report 5G regulation: Ensuring successful industrial transformation.

<sup>5</sup> The chart reflects population coverage rather than geographic coverage, hence countries like Australia fall into the fast 5G roll out category (as the majority of their population will receive 5G relatively quickly despite the roll out being concentrated on the top five most populous cities).

# 5G will add more than \$1.4 trillion to the global economy by 2030

Our research focused on two industry sectors – healthcare and manufacturing – that will benefit in exciting ways from 5G and the new use cases it can unlock. For these industries we have modelled the impact of 5G bottom-up based on specific use cases over the next 10 years. This is explored in more detail in the following sections of the report (**5G-enabled digital transformation in healthcare** and **5G-enabled digital transformation in manufacturing**).

To do this we interviewed 10 industry experts and surveyed industry professionals in both developed and developing markets (see Figure 4). From these forecasts, we extrapolated the 5G benefits for six other industries through mapping where manufacturing and healthcare use cases will bring similar benefits to those industries. For example, a use case explored in manufacturing focused on the use of augmented reality headsets to collaborate with remote experts. The experts can then provide second or third line support, guiding on-site workers through the maintenance of machinery.

This same use case can also deliver benefits in other industries, such as energy & extractives, which rely on sophisticated machinery that is often situated in relatively remote sites. When this is the case, it is time-consuming and expensive to physically bring in an expert.

We have also reflected where use cases map but the benefits to specific industries will be lower. For new use cases for a particular industry, such as connected traffic infrastructure and autonomous cars in transport and distribution, we have used the use cases modelled in healthcare and manufacturing as a benchmark to predict the impact these additional use cases will have.

**Figure 4: Responses from industry surveys**

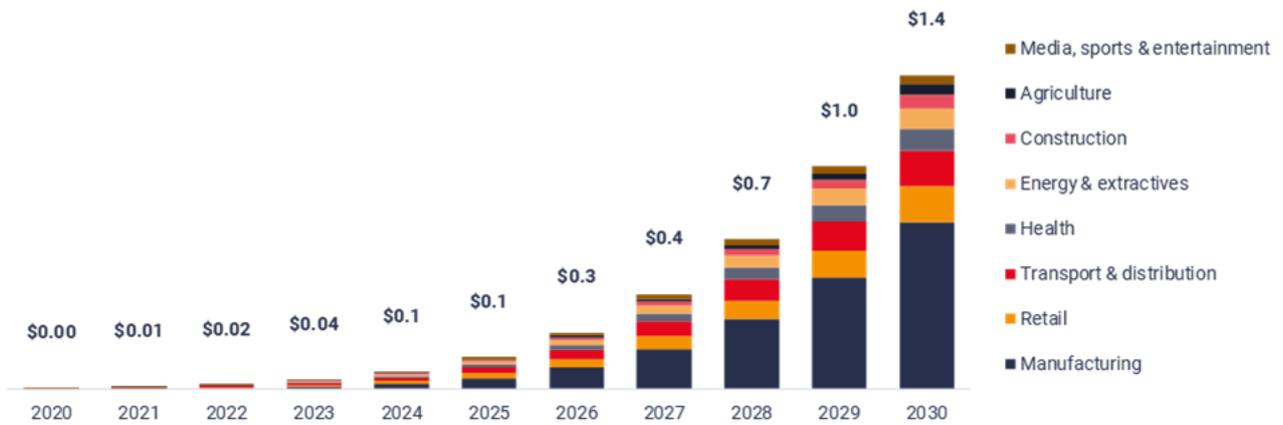
Development level	No. of responses	
	Manufacturing	Healthcare
Developed (UK, USA)	54 (25, 29)	69 (36,33)
Developing (Indonesia, Brazil)	50 (21, 29)	40 (8,32)

Source: STL Partners

Following this methodology, Figure 5 indicates the predicted benefit 5G can bring to these eight key industries.

**Figure 5: 5G will contribute ~\$1.4 trillion to global GDP by 2030<sup>6</sup>**

**Benefits to industry attributable to 5G (USD trillions)**



Source: STL Partners

The manufacturing industry accounts for more than half of the overall benefit 5G will bring in 2030, accounting for approximately \$740 billion. The reason for this is twofold:

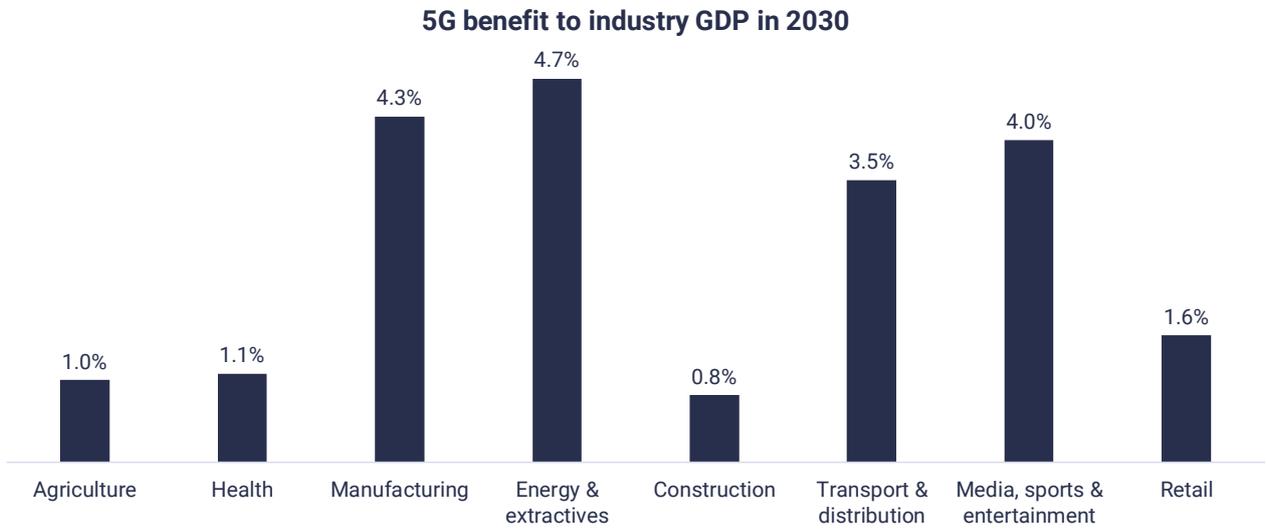
1. The manufacturing industry makes up on average 12% of GDP of each country but is much larger in some big economies such as Germany (21.1%), China (29.3%) and Japan (20.7%).<sup>7</sup> The size of this industry means any increase in revenue from 5G creates a big GDP benefit.
2. As Figure 6 shows, we predict 5G will have a large impact on manufacturing, allowing it to produce 4.3% extra in terms of GDP by 2030.

Figure 5 shows that retail and transport & distribution are expected to see a significant increase in revenue thanks to 5G. In retail, the primary 5G use cases are around asset tracking and warehouse optimisation in the backend, and immersive AR experiences for shoppers in the frontend. For retail and transport & distribution, connected traffic infrastructure and vehicles is clearly a key use case, as well as temporary networks for pop-up distribution centres and drones for package delivery and location.

<sup>6</sup> Healthcare GDP is calculated by the total global cost of healthcare – the figure shown is savings thanks to 5G-enabled use cases.

<sup>7</sup> World Bank development indicators

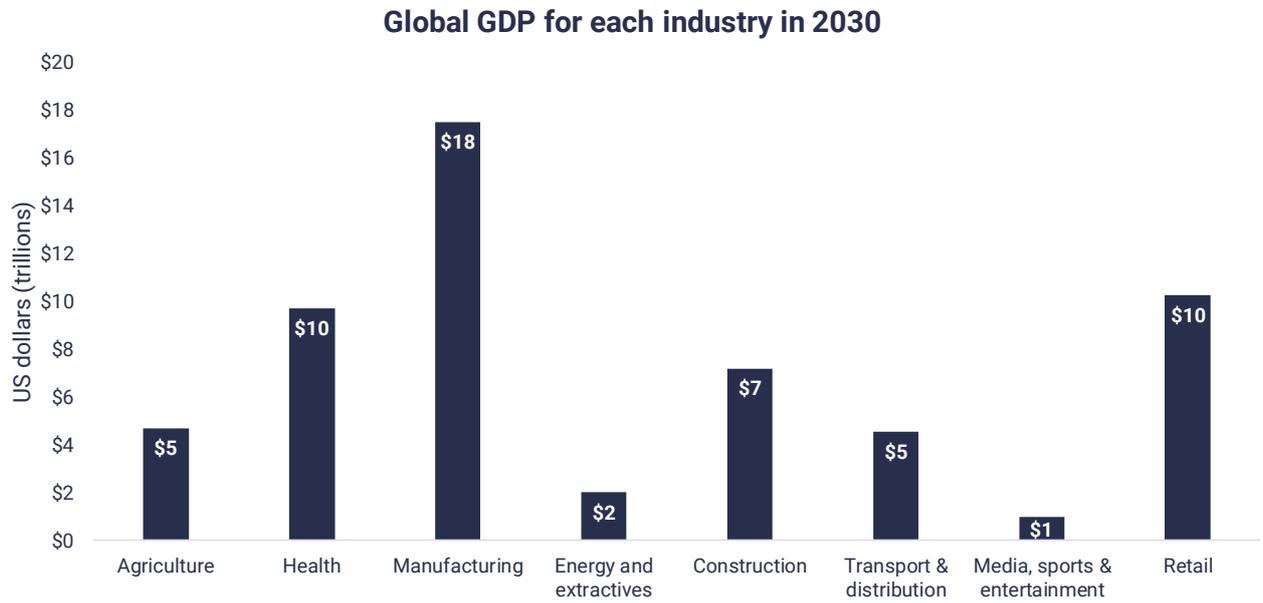
**Figure 6: Manufacturing, energy & extractives and media, sports & entertainment industries will see the largest upticks to their industry thanks to 5G use cases**



Source: STL Partners

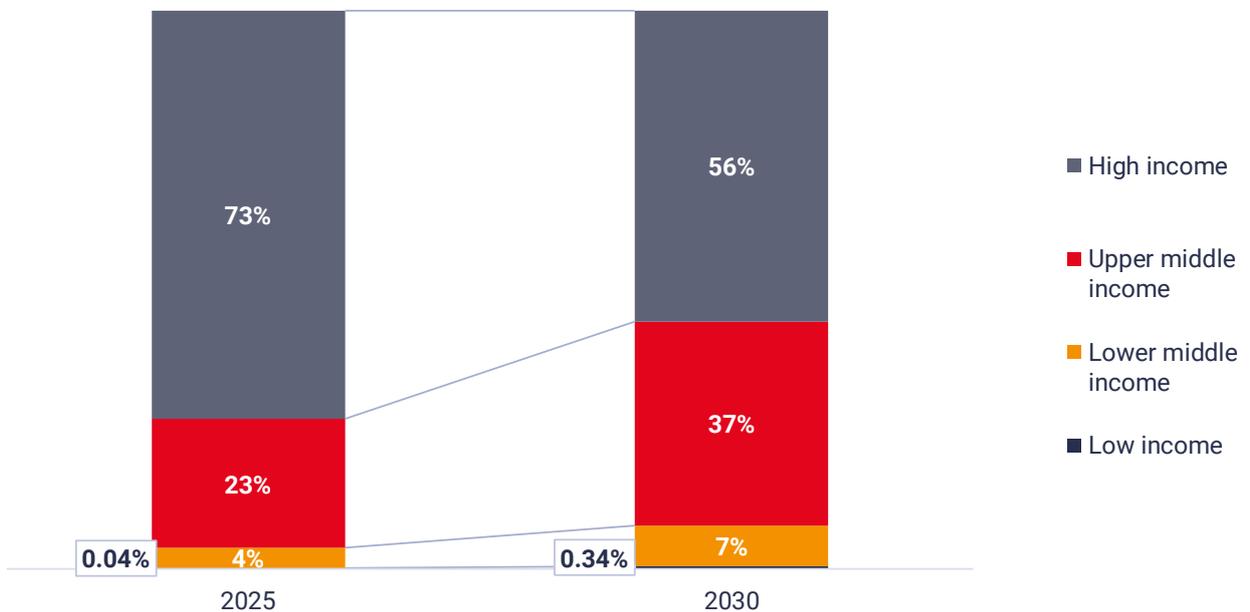
Figure 6 tells a slightly different story. Here, we show the 5G benefit as a percentage of total GDP for each industry. While Figure 5 highlights that 5G in media, sports and entertainment (thanks to the relatively small size of the industry – see Figure 7) brings the smallest overall benefit to global GDP, Figure 6 shows that 5G has the third largest impact on it as an industry. This is clearly enough for leaders within the industry to sit and take notice and may be where more traction is to be found early on, than larger industries like construction which are both less digitised and slower to adopt new technologies. The benefits relating to health are more complex and yet we believe significant and will be explored **later in this paper**.

**Figure 7: In 2030, manufacturing and construction will be the largest industry sectors (in 2030)**



Source: STL Partners

**Figure 8: High income countries will see almost 75% of the benefit of 5G in 2025, but the share is more even across all geographies by 2030**



Source: STL Partners

5G's impact on the global economy in the next ten years is, clearly, skewed towards those countries who will roll 5G out the fastest. It is also skewed towards countries that contribute the most to global GDP. This means that high income countries (as classified by the World Bank) will receive almost 75%

of the benefit from 5G to their economies in 2025 (see Figure 8). By 2030, 5G's benefits to the economy will be more equally shared – in particular with upper middle income countries gaining more than one third of the share. Low income countries, due to the size of their economies and their slower adoption of 5G will gain very little of the benefits, though as we reach 2030 onwards this balance will continue to be redressed.

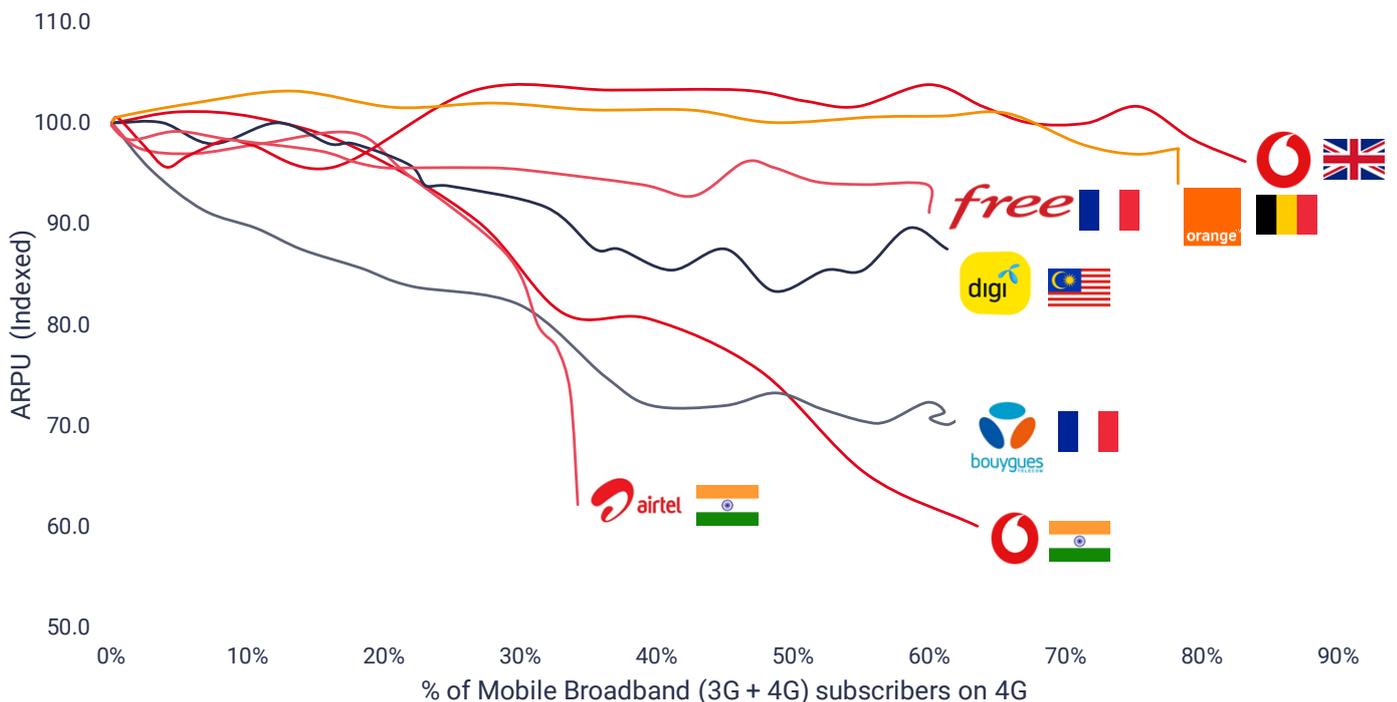
# Mobile network operator strategic options with 5G

## 5G alone will not change the game for operators

We know that consumers, particularly in the long term, are unlikely to pay a premium for 5G connectivity. The same was true with 4G. As it rolled out, ARPUs did not increase for most operators. Connectivity, even with the unique benefits 5G brings (such as network slicing), is a commodity. This is because almost all operators have the same network characteristics at their disposal and even if a player can gain first-mover advantage from launching a new generation of network, their competitors rapidly follow.

Most telcos have been forced, therefore, to compete primarily on price. Figure 9 shows that established operators in mature, consolidated markets who rolled out 4G, such as Vodafone in the UK and Orange in France, were able to only maintain their previous ARPU. Those in markets which were disrupted by new entrants, like Airtel in India, saw their ARPU plummet despite 4G rollout.

**Figure 9: 4G rollout did not produce sustainable revenue increase**



Source: STL Partners

It is unlikely to be a different story with 5G – unless telcos do something different. For new value to be squeezed out of 5G operators are likely to need to do more than connectivity, through embracing new business models (see Figure 10) and entering into new markets (see Figure 12).

## Strategic options for operators to add more value with 5G

5G can be a strategic opportunity for telcos looking to play further up the value chain and bring more value to their customers.

Figure 10 highlights three generic roles that operators can take beyond connectivity. Each requires different skills and capabilities and have different potential revenue models. The strategies for how to build these capabilities (organic, internal development versus aggressive M&A, for example) will differ.

**Figure 10: What should telcos' role be in 5G B2B?**

	Network-as-a-Service	Application enablement	Solutions and applications
Value proposition	Providing and managing custom networks in a cloud-like way: ability for customer to scale up and down, define parameters (e.g. latency), add additional functionality (e.g. security).	Aggregating applications and data from multiple partners to multiple users, could include providing data sharing and management capabilities, billing/transactions and revenue management, marketplace.	Specific solutions (could be end-to-end) and applications for customers, including consulting and advisory services, systems integration and solution sales.
Customers	Enterprise (site) IT teams	Application providers, consumers & enterprises	Enterprise IT teams
Revenue models	Access fee/subscription (usage), licensing	Revenue share (from subscriptions, access fees), brokerage commission, access fee	Professional services, one-off sales (for hardware)
Capabilities required	Software skills, remote operations and management	Software skills to operate platform, billing, data management, cloud infrastructure seamless partner onboarding	Sourcing and coordinating partners, strong sector knowledge, systems design & build, software capabilities
Real-life examples	<ul style="list-style-type: none"> <li>AWS/Azure for cloud services</li> <li>Colt On Demand</li> </ul>	<ul style="list-style-type: none"> <li>Amazon/eBay</li> <li>App Store/Play Store</li> </ul>	<ul style="list-style-type: none"> <li>Accenture/IBM</li> <li>Telco SIs (e.g. T-Systems)</li> </ul>
Manufacturing examples	<ul style="list-style-type: none"> <li>Flexible connectivity based on factory uptime (e.g. URLL when robotic sensors are in use)</li> <li>Private networks</li> </ul>	<ul style="list-style-type: none"> <li>Data management platform across the supply chain</li> <li>Elisa smart factory</li> </ul>	<ul style="list-style-type: none"> <li>T-Systems Smart Factory in manufacturing</li> </ul>
Healthcare examples	<ul style="list-style-type: none"> <li>Remote healthcare models</li> <li>BT's proposed NHS national network</li> </ul>	<ul style="list-style-type: none"> <li>TELUS health exchange (national health data platform)</li> <li>Swisscom Health Data Hub (Evita)</li> </ul>	<ul style="list-style-type: none"> <li>Babylon Health – remote GP consultations and health-checking service</li> </ul>

Source: STL Partners

For the Finnish operator Elisa, its smart factory solution was launched off the back of the internal skills built up from its automation and optimisation efforts within its own network operations centre. The ability to manage highly automated infrastructure and anticipate disruptive incidents were skills that transferred to the factory. The General Manager, Kari Tarho, leveraged personal experience of previously leading Elisa's Industrial IoT team, also hiring experts from industry technology providers such as ABB and Fujitsu, in order to move into providing an application platform in the manufacturing industry.<sup>8</sup>

By contrast, for TELUS the key turning point to build its health exchange platform was the relatively opportunistic acquisition of Emergis, a health insurance company. Darren Entwistle, TELUS's CEO, was convinced that communications revenues would not sustain long term revenue growth and saw opportunity in health thanks to the overlap in technological requirements between health insurance and telecoms billing processes. Through Emergis, which operated independently from the core telecoms business, TELUS forged relationships with hospitals, health regions (how hospitals and other healthcare services are organised within each Canadian province or territory), government health technology agencies building the Canadian eHealth infrastructure and insurance providers. From this launching pad, TELUS has been able to make plays into electronic medical records (EMRs), digital prescriptions, secure messaging and home health monitoring – all of which now make up its application enablement platform, the TELUS health exchange.<sup>9</sup>

To move beyond connectivity, telcos must make investments, both in M&A and the development of internal capabilities – building systems, processes, relationships, and people. But there is real opportunity to increase revenues if these investments are made effectively.

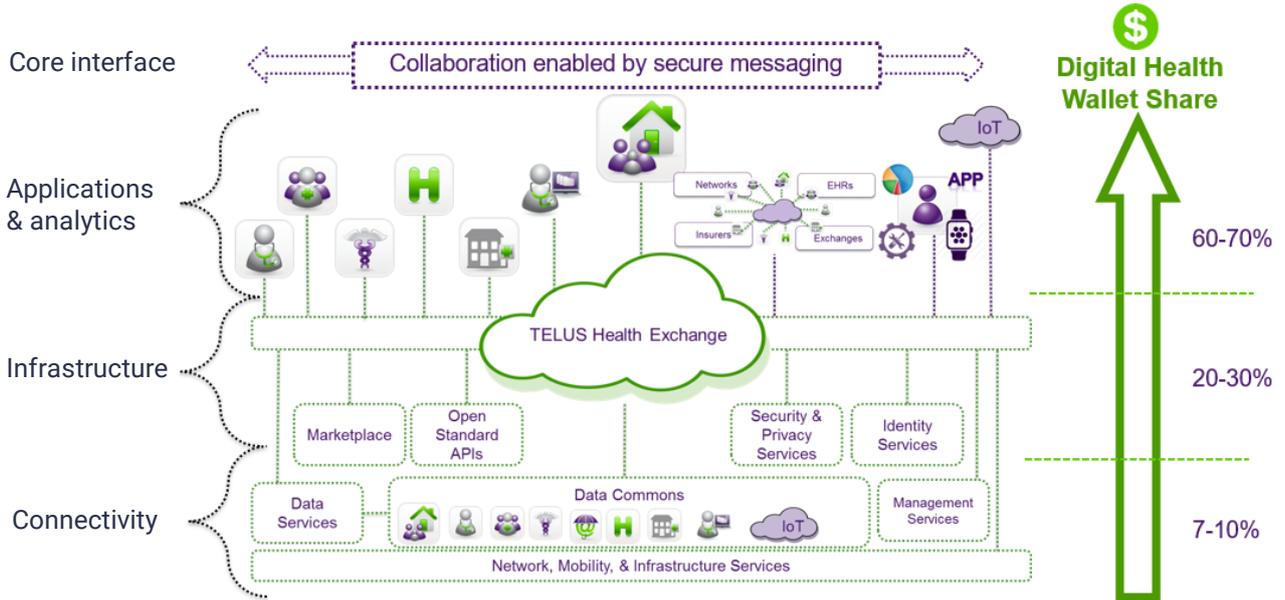
Figure 11 highlights the increased share of the wallet that can be experienced by moving beyond connectivity (the terminology TELUS uses is slightly different but the three roles they highlight are similar to those in Figure 10). Essentially, TELUS states that NaaS makes up only 7-10% of the revenue opportunity, with 20-30% residing in application enablement and 60-70% of the value in the applications that work on top of this.

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<sup>8</sup> For more information, see [Elisa's Smart Factory: How to win over industry leaders in two years](#)

<sup>9</sup> For more information, see [TELUS Health: Innovation leader case study](#)

**Figure 11: As telcos move beyond just connectivity, they can increase their share of the wallet**



Source: TELUS Health

Of course, telcos must focus their efforts. They will not be able to be competitive in the ‘higher value’ roles in multiple different industries and regions. Figure 12 highlights where some operators have already made moves into specific industries. The key takeaway is that there are industries that are underserved (note the white space in some industries’ boxes) – and that 5G should be a strategic opportunity not just to improve network performance but also take on a bigger, and more valuable, role within chosen verticals.

**Figure 12: Telcos must focus efforts in specific verticals – some are already doing this**

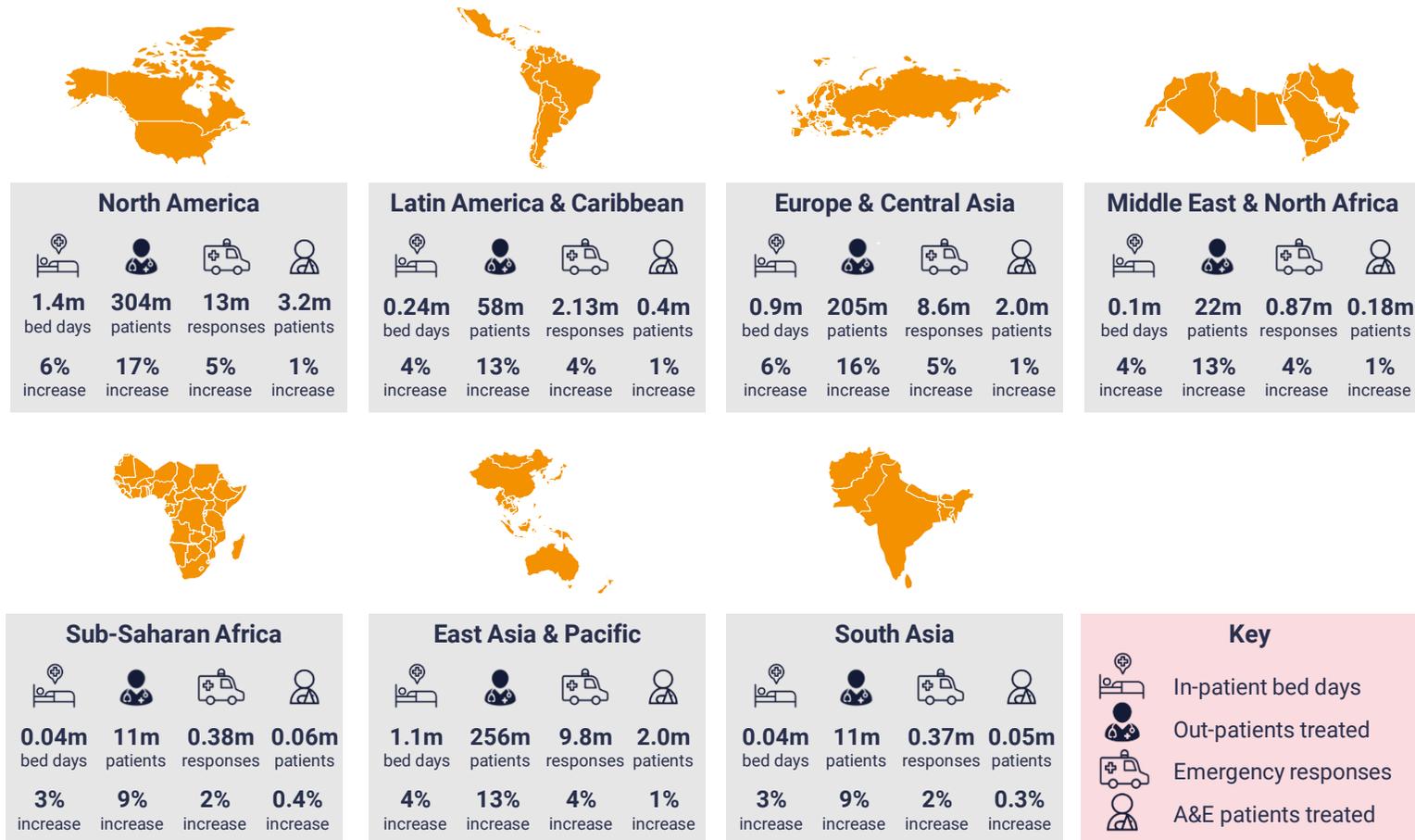


Source: STL Partners

# 5G-enabled digital transformation in healthcare

For more information, see 5G's healthcare impact: 1 billion patients with improved access in 2030

Figure 13: Global impact of 5G on healthcare across four key contact points



Source: STL Partners

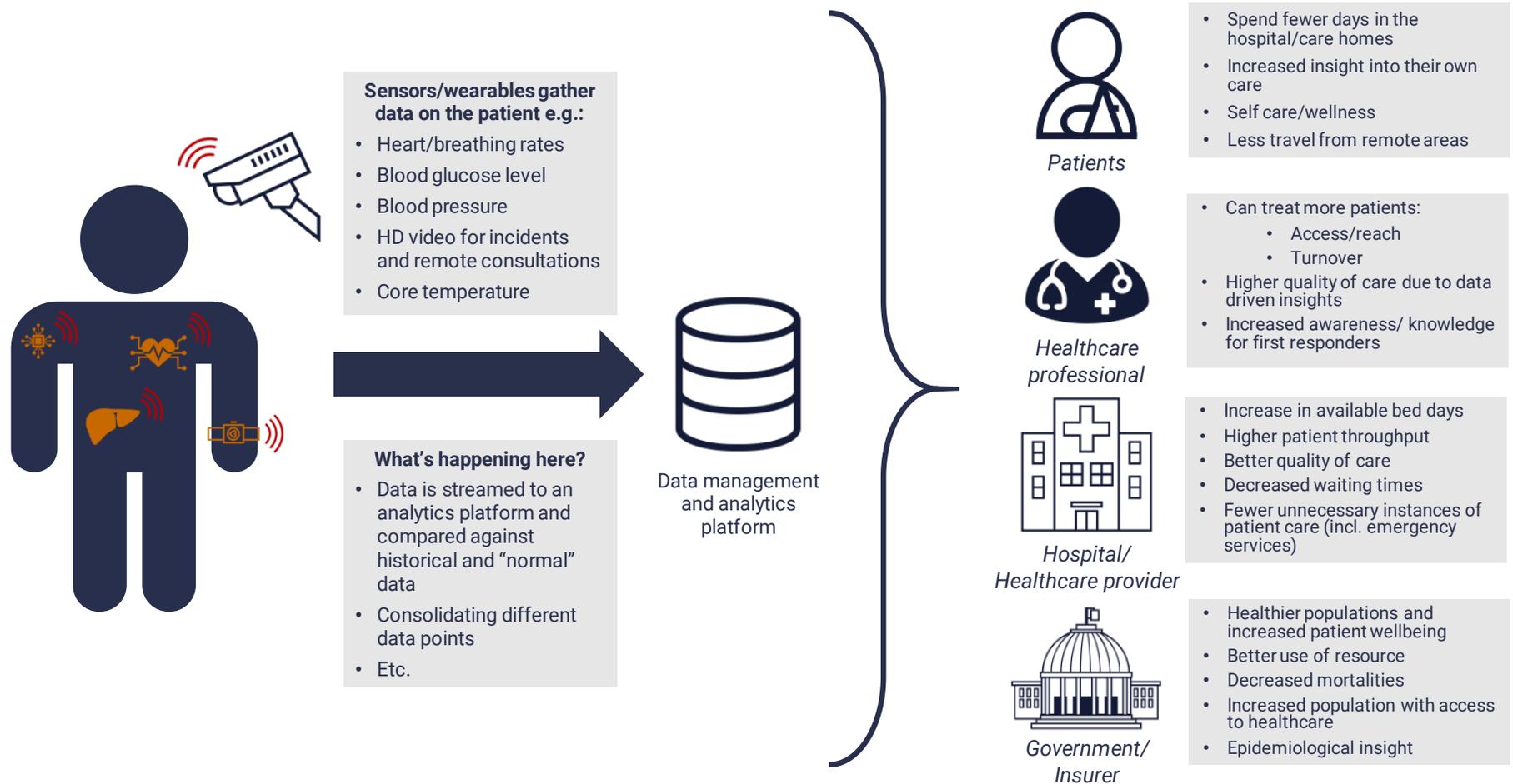
As healthcare services throughout the world continue to be stretched, digital solutions can offer major opportunities to treat the increased number of patients more effectively – through improved access to and more efficient use of health expertise and resources. Globally, we predict 5G enabled use cases will enable healthcare professionals to treat more than 850 million extra outpatients, while also making available more than 4 million extra bed days for use in hospitals. For the most severe of health incidents, ambulance services should be able to handle 40 million more emergency responses.

In high and medium income markets, 5G-enabled solutions will help healthcare professionals deal with aging populations, increased occurrences of chronic diseases and the resulting skills gap that come with them. In low income markets, 5G solutions can help improve access to healthcare through better connecting local, national and international healthcare resources, even when there is limited existing infrastructure. In this report we will highlight the outcomes from one promising 5G use case, remote patient monitoring. To read more on other solutions and the impact they will have on healthcare industry, read our healthcare industry deep-dive report 5G's healthcare impact: 1 billion patients with improved access in 2030.

## Example 5G use case: Remote patient monitoring

Remote patient monitoring works by using sensors, wearables and e-health devices to collect and analyse patient attributes without the need for patients to travel to primary care facilities and have an appointment with a medical professional. This creates better patient insight, reduces the burden on medical professionals, and means patients with limited access to infrastructure can still access the healthcare and disease management they need. 5G is crucial to enabling this massive IoT use case at scale thanks to its ability to handle very large cell density in a given area. It will also accelerate adoption through its usability and security, as well offering a ubiquitous solution which removes the need for individual managed networks.

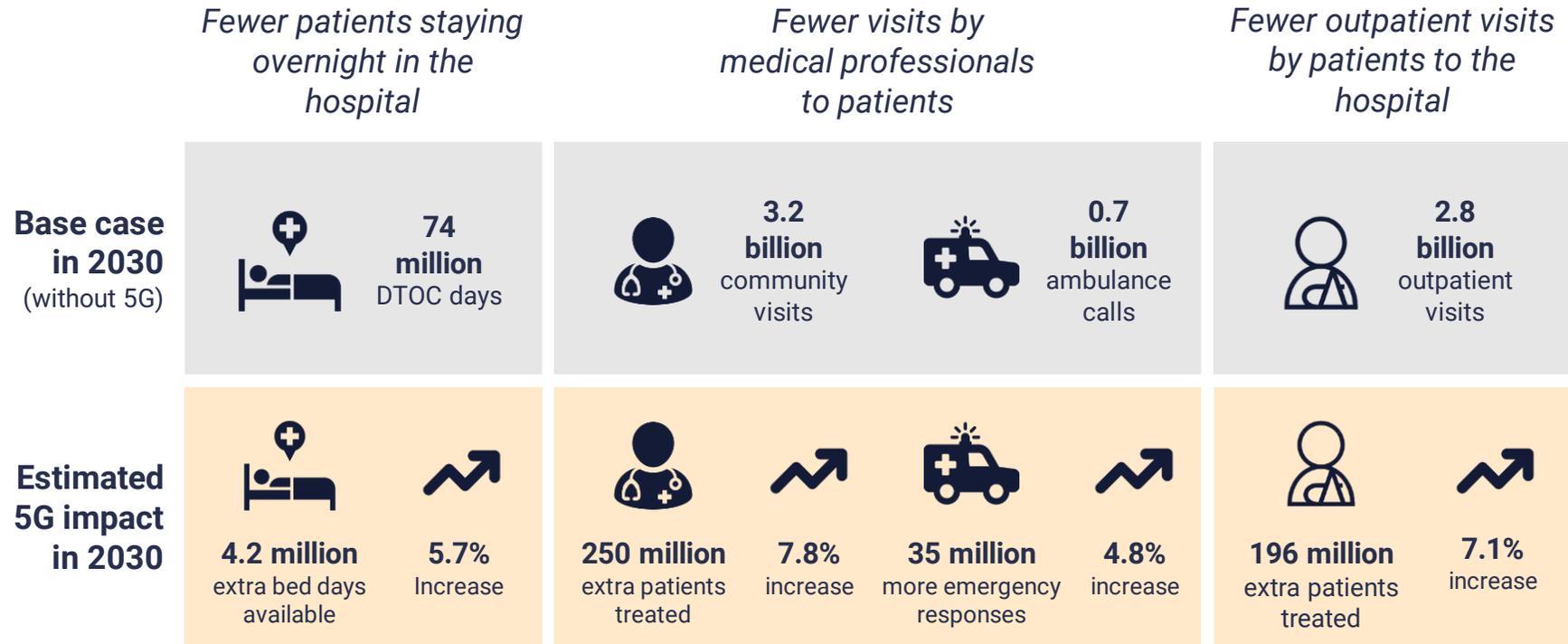
**Figure 14: Remote patient monitoring enables wearables to send data about the patient to the hospital for monitoring**



Source: STL Partners

The benefits remote patient monitoring will bring to the healthcare industry globally in 2030 is highlighted in Figure 15. These benefits have been scaled up from the UK based on population size, healthcare spend per capita and 5G adoption curves.

**Figure 15: Estimated impact of 5G-enabled remote patient monitoring**

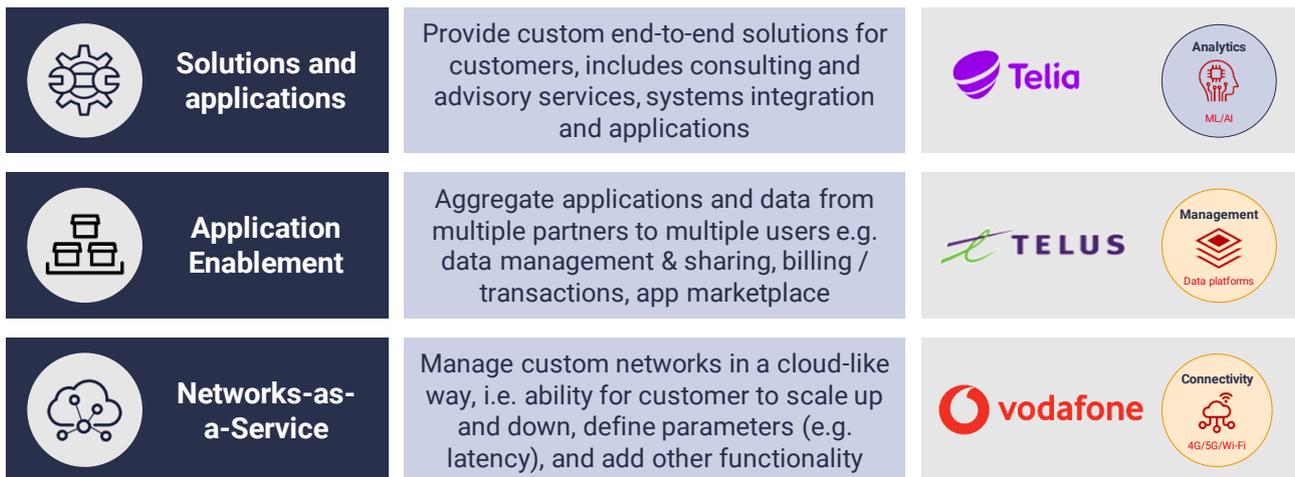


Source: STL Partners analysis, [NHS data](#), [NHS England data](#), STL Partners survey August 2019, World Bank Data

## Implications for telcos

There are already examples of telcos performing all three key roles in the healthcare industry. TELUS and Telstra, for example, have made significant movements into healthcare, via M&A as well as in internal development of the capabilities needed to succeed.

**Figure 16: The potential roles for telcos can within healthcare**



Source: STL Partners

However, no two telcos are alike and the role each adopts in the ecosystem will depend heavily on the telco's ambition and current expertise within healthcare. Most telcos understand that healthcare is and will continue to be an important enterprise market. However, due to difficulties with competition, level of investment required and the stringent regulation requirements, some telcos may shy away from application enablement or healthcare solutions or applications and stick to NaaS offerings.

### Telcos will provide Network-as-a-Service offerings

There is value for telcos in providing NaaS in the healthcare industry. There are two key areas that telcos may focus on:

1. **5G IoT connectivity.** Telcos such as Vodafone are already providing LTE connectivity for connected devices in healthcare.<sup>10</sup> As the number of devices increases, network-as-a-Service offerings will need to be able to guarantee reliable and secure connectivity, as well as handle the drastic increase in cell density demands.
2. **Mission critical communications connectivity (potentially using network slicing).** Ultra-reliable connectivity will need to be available for a use case such as the connected ambulance to scale.

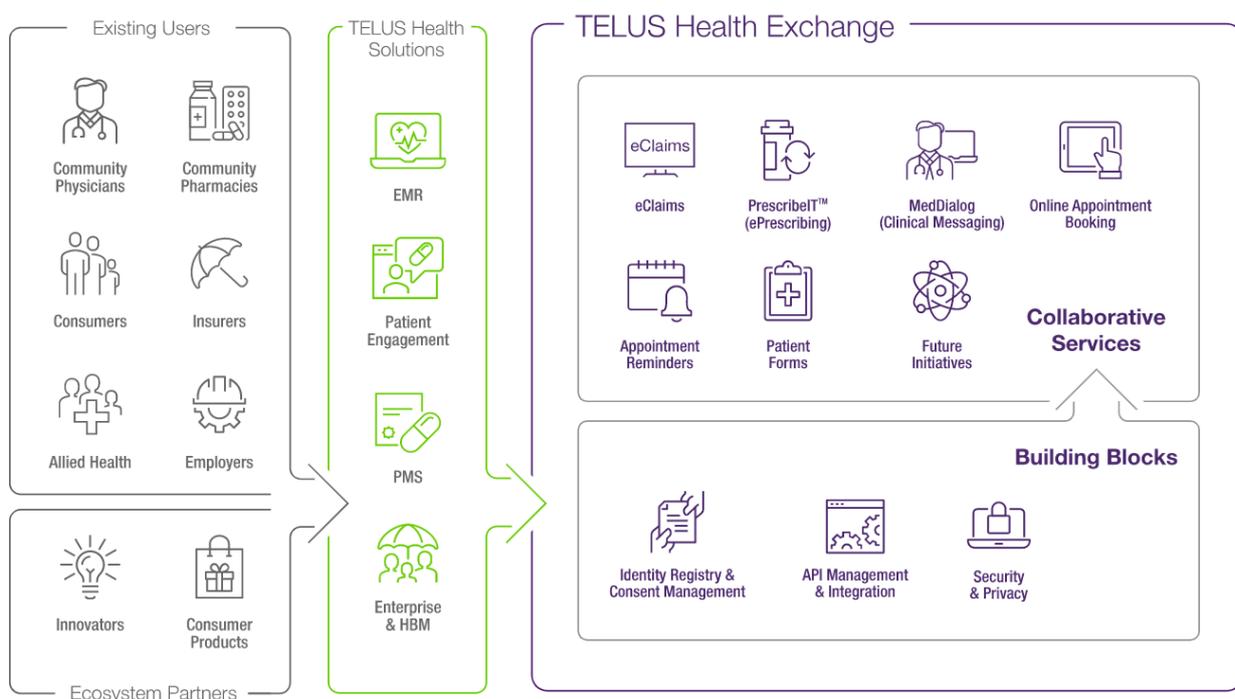
<sup>10</sup>See: <https://www.vodafone.com/business/industry/health>

Here network slicing will be able to ensure that there is always high bandwidth availability for HD video streaming between paramedics and healthcare professionals at the hospital.

## Telcos as an application enablement provider

Within our example 5G use case (remote patient monitoring), many streams of patient data from different wearables (and even different patients) must connect to and integrate with the same system to provide useable records for the healthcare provider. These streams of data, likely from different types of end devices and from different manufacturers, will all produce data at different rates and in different formats. This creates issues in collating and analysing the data in a unified system/EMR, and creating visibility across the healthcare ecosystem.

**Figure 17: The TELUS Health Exchange as a point of coordination**



Source: TELUS Health Innovation

It is unlikely that different device manufacturers will all adopt the same standards of data management as dictated by the healthcare providers' systems, especially as applications may be developed by global players whereas healthcare systems may differ on a regional level. Therefore, there is a pivotal role in the value chain for an entity which can "translate" and collate all the data sources into useable streams. This is often known as extract, transform, load (ETL).

KPN, the Dutch incumbent telco, has done just this with their data services hub (DSH) – taking many streams of disparate data and integrating them into one platform for analysis and delivery of next generation services. Another example would be the TELUS health exchange, a platform that enables clinicians and digital health applications across many different primary care settings to communicate and share information effectively (see Figure 17). TELUS takes a small percentage of the available revenues/charges for every new user of the platform.

## Telcos can provide healthcare solutions

There is an opportunity for telcos to play in the solutions and applications space because of two interconnected reasons:

- **Healthcare providers globally are not highly digitised.** They are unlikely to have the technical knowledge and skills to manage the implementation, configuration, and orchestration of a digital solution and will outsource this to a partner.
- **They need end-to-end solutions.** The industry desperately needs end-to-end solutions due to the lack of consistency between healthcare providers and systems, which often vary nationally and regionally. The difference in digitalisation levels between healthcare systems also makes the need for a unified platform crucial. A telco with a managed end-to-end service (including the connectivity piece) could provide healthcare enterprises with a simple and more out-of-the-box proposition.

As we've demonstrated, telcos are well positioned to play a role in solutions and application delivery because some are already playing successfully in the first two layers of the value chain (NaaS and application enablement platforms). Their regional, local presence and experience in highly regulated industries lends them credence with healthcare providers.

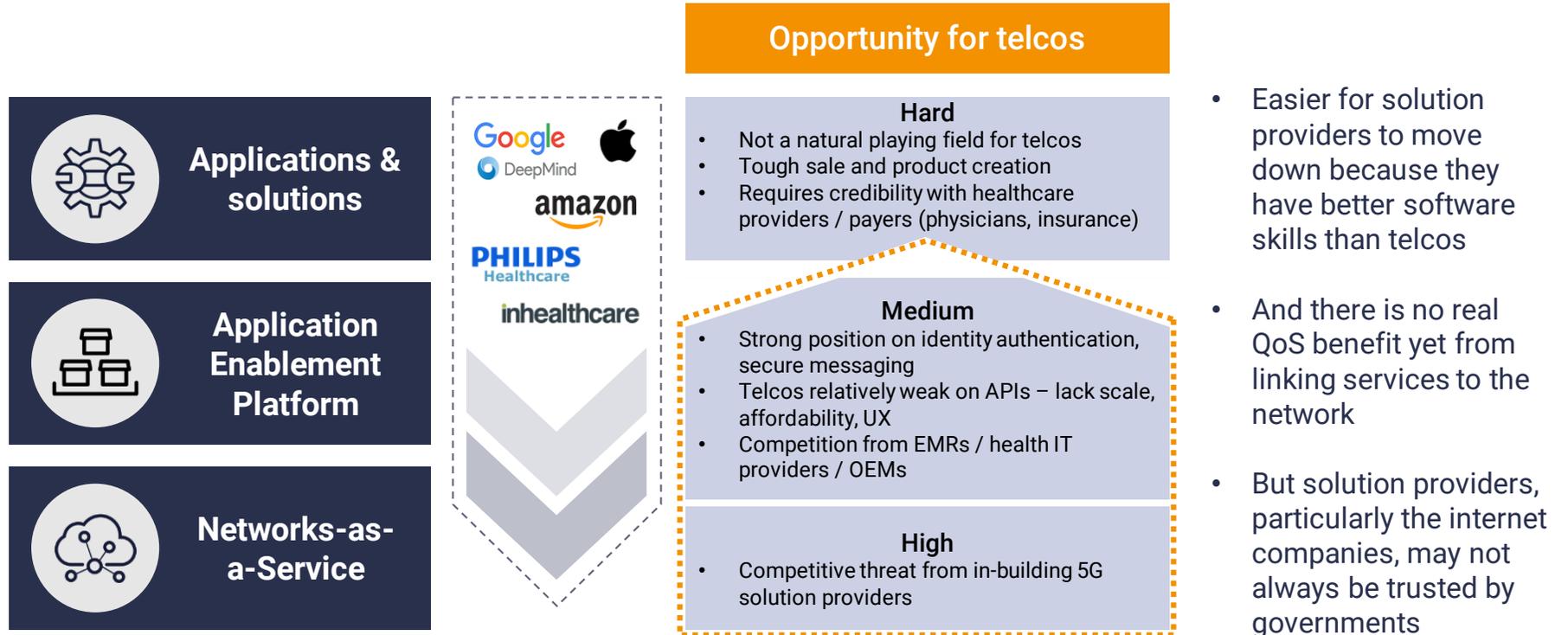
However, providing applications and solutions cannot be done alone. Telcos will need to partner with application developers and solution providers to align and co-deliver applications, services, and solutions. This should be mutually beneficial. Telcos do not have the time, skills and resource to develop applications themselves. In addition, they'd face strong competition from the global players, internet giants, and smaller, more agile, and more niche tech companies who have already established themselves in this market. This is not a natural space for them to play – they will instead need application developers to do this.

But, telcos can leverage their existing capabilities to be a useful partner for application developers by providing a key channel for sales and means of integration. The opportunity for telcos may be particularly strong in developing markets where operator brands are strong. In many developing markets, operators are already providing mobile financial services and so they are credible as trusted providers of additional specialist services to consumers.

We saw this trend of market development through partnerships with the telcos during our interview programme. Healthcare application providers looking to expand into new markets sought the help of telcos as a local and trusted presence. Tactio is a good example – a healthcare solution provider which white-labels its solutions for telcos (in this case, Telia) due to Telia's strong position to offer health solutions in Nordic and Baltic market. This has allowed Tactio to access an otherwise closed off market with high barriers to entry.

The opportunity exists for operators but success takes time and investment – TELUS has spent more than 10 years building up its proposition. And competition is tough. The internet players and more niche digital health solution players are already established in the solution and applications space and are looking to move down the stack too. So telcos should ready themselves to face new competition in application enablement and NaaS as well. Figure 18 summarises this.

**Figure 18: There is opportunity for telcos' to play multiple roles higher up the value chain in healthcare**



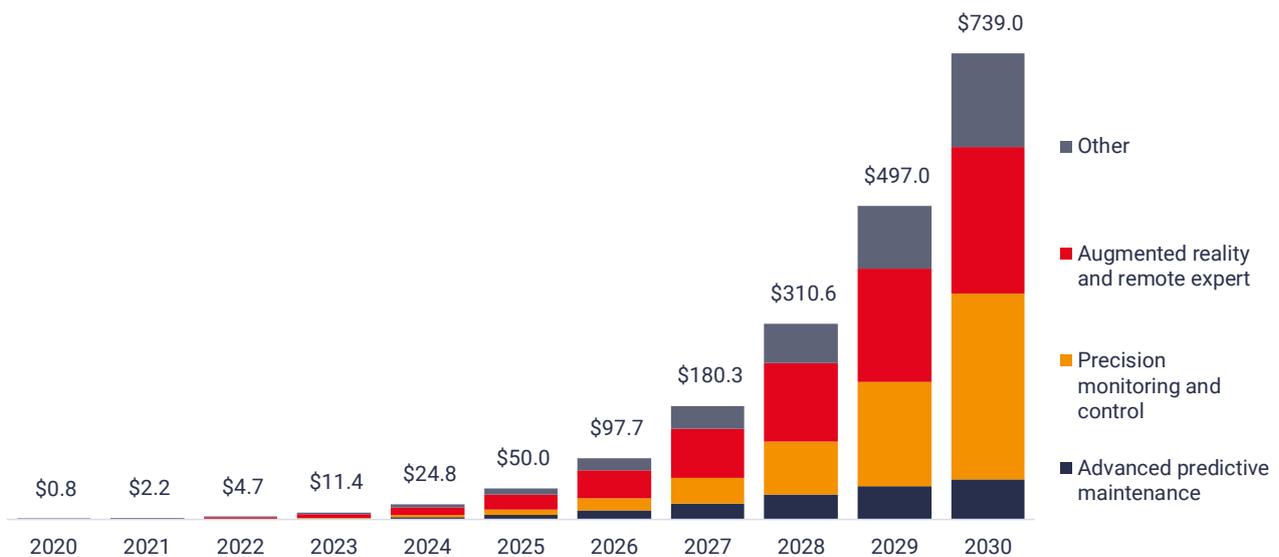
Source: STL Partners

# 5G-enabled digital transformation in manufacturing

For more information, see 5G's impact on manufacturing: \$740bn of benefits in 2030.

5G can create \$740bn in additional GDP by 2030

Figure 19: Estimated impact of 5G on manufacturing GDP (USD Billions) by use case



Source: STL Partners

We estimate that 5G can increase manufacturing GDP significantly and this the largest impact on global GDP of any industry. For the manufacturing industry, 5G can enable solutions that both reduce costs and unlock new revenues. The bandwidth and cell density capacity of 5G networks enables manufacturers to monitor and analyse in real-time far more data than they ever have before. The insights generated can reduce the impact of major pain points of the industry, including machine downtime, maintenance costs and wasted resources. Today manufacturers are only able to monitor a limited number of variables, in the future with 5G they will be able to monitor, and manage in near real-time, hundreds. Not only this, but today the connectivity options either lack security and reliability (Wi-Fi) or require cabling (Ethernet) which reduces the manufacturer’s ability to flexibly optimise their factories based on demand. On the new revenue side, 5G may enable manufacturers to change their business model, offering as-a-service solutions themselves for connected products. This would create the opportunity for recurring revenue models, rather than one off sales.

In this report we will highlight the outcomes from one promising 5G use case, advanced predictive maintenance. To read more on other solutions and the impact they will have on manufacturing industry, read our manufacturing industry deep-dive report 5G’s impact on manufacturing: 740bn of benefits in 2030.

## Example 5G use case: Advanced predictive maintenance

**Figure 20: Advanced predictive maintenance enables many sensors to send data about machinery for monitoring and optimisation**



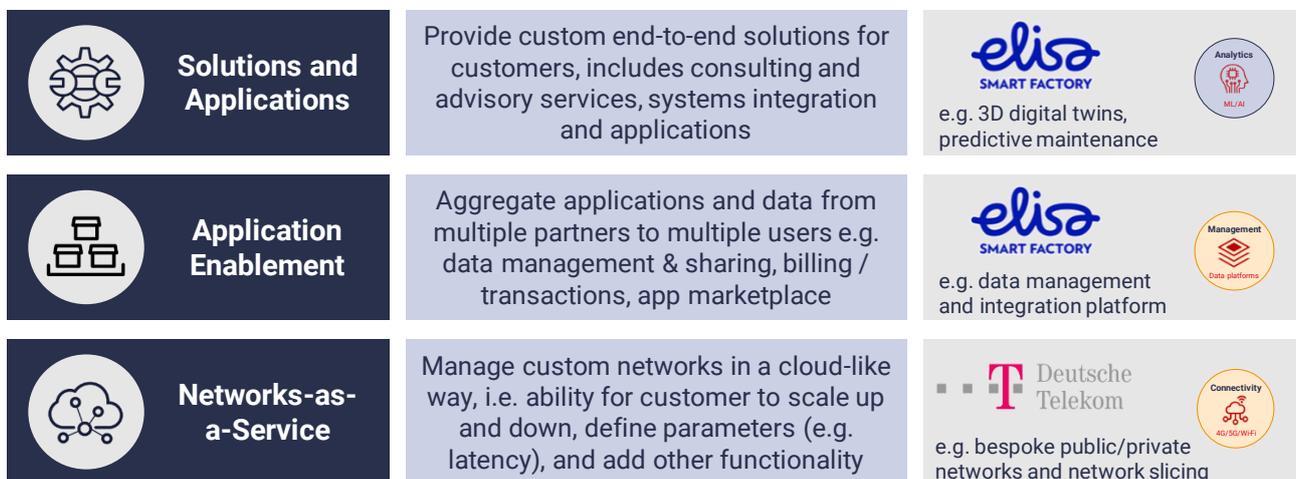
Source: STL Partners

While predictive maintenance is already in use in the manufacturing sector, 5G will enable **advanced** predictive maintenance as described in Figure 20. It maximises the possible benefits of predictive maintenance through the sheer number of connected devices, and therefore the sheer amount of data produced, in a limited area. The lack of need for cabling means that sensors can even be placed on mobile or inaccessible parts of the machines. Plant owners who implement advanced predictive maintenance will see improvements in machine availability and process continuity - it is estimated that the use case will reduce machine downtime by 6%<sup>11</sup>, a huge impact even if machine downtime constitutes a small portion of planned production. It can also benefit other stakeholders, such as:

1. **Maintenance services provider:** costs can be reduced for repair services as staff no longer need to physically go and check equipment when it breaks down. Instead, the root cause can be identified remotely via insights from the data platform.
2. **Equipment manufacturers:** create new revenue streams through new services, either providing dashboards on machine conditions or by completely altering the business model and selling equipment by time rather than as a one-off sale.
3. **Machine parts suppliers:** leverage the insight to improve their products and, by knowing when break downs occur in advance, ensure parts are sent on time and reduce delays for their customers.

## Implications for telcos

**Figure 21: Telco 5G business models**



Source: STL Partners

## Network-as-a-Service

One of the biggest challenges for manufacturers today is that they have multiple networks running in a single factory; Wi-Fi for broad IT applications, short-range technologies like Zigbee to connect

<sup>11</sup> Based on results from STL Partners survey with manufacturers, August 2019

sensors, ethernet for fixed machines and mobile networks for moving objects like a robotic arm. This is because no one connectivity solution today can handle effectively the multiple requirements. One of the promises of 5G is that it is flexible enough to meet these different needs. It can, therefore, be a mechanism for consolidating the number of networks within a single enterprise.

Telcos providing Network-as-a-Service to manufacturers can enable new business opportunities such as by connecting “pop up” factories in a new location without having to go through a long cycle waiting for the network to be deployed. This is relevant for factories producing goods with a seasonal cycle, for example rather than investing in another full production facility that is only needed ahead of the Christmas period to produce Christmas puddings and crackers, the manufacturer can use a temporary site with 5G IoT-enabled processes and machines to produce goods. Ultimately, this will enable manufacturing-as-a-service models.

Telcos may also provide custom networks for manufacturers, where different applications run on different “slices” of the 5G network. We are seeing some manufacturers exploring the idea of using a combination of a public and private cellular network for different applications. Deutsche Telekom terms this “dual-slice campus networks,” although they are starting with LTE networks and will move to 5G once the technology is ready. They are currently running tests with Osram to trial using private LTE connectivity that can meet low latency targets for a flexible automated guided vehicle solution. An alternative with 5G would be to use a “low latency” slice for mission critical applications. This can be linked with an emerging need for manufacturers to want “private networks”, as explored in the report *Private and vertical cellular networks: Threats and opportunities*.

## Application enablement

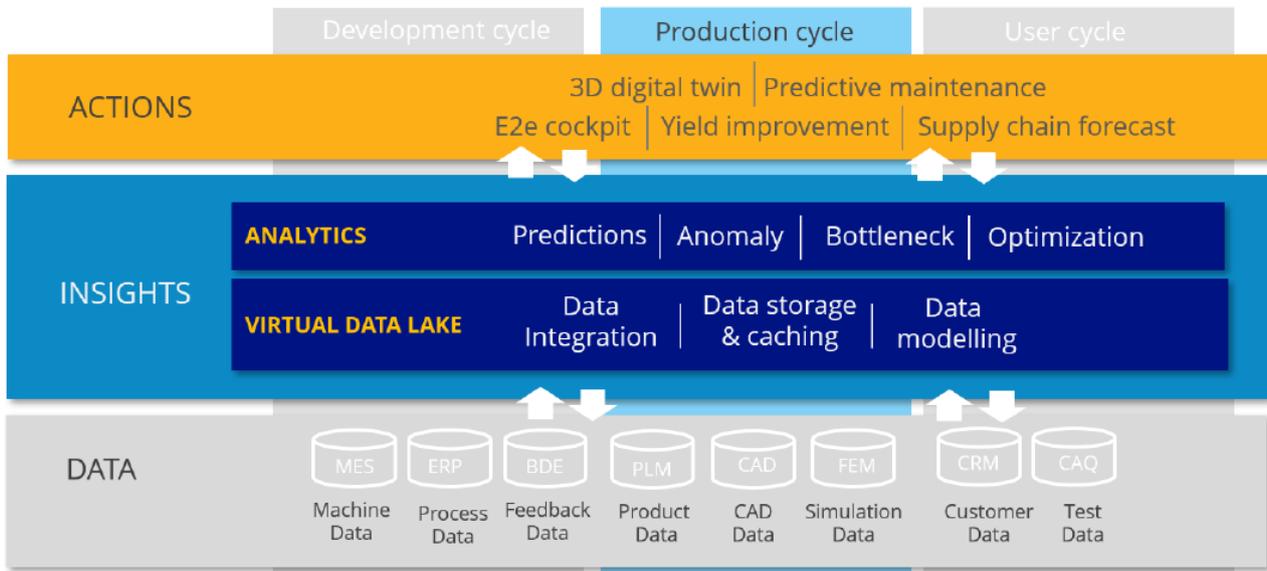
Data aggregation and management is a key capability required for an application enablement platform for the manufacturing industry. In order to enable a smart factory which automatically adapts the processes within a factory based on environmental conditions, customer demands or machine tool status, it is critical to collect the right data and be able to analyse it quickly.

In manufacturing, the challenge stems from collecting and aggregating data that may use different protocols, may be structured or unstructured and is from many different devices. For the smart factory to be fully realised, data must be translated and collated into useable streams. Figure 22 highlights how Elisa is developing these data management processes for their smart factory offering.

In addition, who accesses the data will change as processes become more intertwined across the supply chain. As seen in the advanced predictive maintenance use case, the outcome from analysis on how a machine is performing needs to be shared with multiple stakeholders:

1. The plant owner so they know how the status of their machines
2. The original manufacturer of the machine so they can optimise the product in the future
3. Supply chain partners who provided the specific component within the machine and, potentially...
4. ... A separate third party maintenance service provider who knows how to fix the machine

**Figure 22: Elisa Smart Factory Schematic**



Source: Elisa Smart Factory

## Solutions and applications

All factories are different so it is difficult for a solutions provider to have a standardised platform for all customers. Each manufacturing plant will have its own production process, line layout, equipment, products and other factors. Plus, a solution is only valuable if it integrates with other processes. For example, there is limited benefit in having a standalone predictive maintenance solution that does not connect to the enterprise’s ERP system to trigger workflows to address maintenance issues and replacement part ordering processes.

Elisa recognised this early on and, in addition to the application enablement platform (virtual data lake), Elisa Smart Factory also offers bespoke solutions for customers. As seen in Figure 22, Elisa’s applications include 3D digital twin (providing a virtual factory view using real-time data) and predictive maintenance, which it combines with systems integration to form a compelling proposition. However, its platform is a solid foundation to make the solution relatively scalable – claiming to take only 12 weeks in delivering “concrete results.” More on Elisa Smart Factory can be found in the STL Partners report *Elisa’s Smart Factory: How to win over industry leaders in two years*.

Although many large manufacturing companies are global by nature and may be served by global solutions providers such as General Electric, Siemens, Bosch, etc. a national telco has a strong local position. It can therefore act as a coordinator to bring in different partners, particularly for small and medium sized enterprises who may require support in identifying the right technology partners as they seek to digitalise. A telco with a managed end-to-end solution (including the connectivity piece) could provide manufacturing companies with a simple and more out-of-the-box proposition. This will be extremely useful in driving adoption of use cases where a key barrier is usability. It is unlikely a telco will create its own industrial applications as Elisa has done, but it can work with multiple partners to bring their solutions to market and create a stronger ecosystem.

# Conclusions for operators: how to capitalise on the 5G opportunity

In this report we have demonstrated the potential value 5G can bring to industries in 2030. In order to capitalise on this opportunity, telcos should:

1. **Focus their efforts on becoming vertical specialists.** In order to successfully deliver innovative 5G-enabled use cases to industry verticals, telcos must invest significant time and money in understanding the pain points, challenges and opportunities within specific markets. Those that have done this successfully, such as TELUS in healthcare, have been building their proposition and expertise through M&A and internal product development for more than 10 years. Telcos must look to emulate this success when offering anything more than compute and connectivity to an industry.
2. **Engage with industry leaders.** In order to grow into verticals, telcos must engage with industry leaders to understand their requirements and expectations, and educate them on the potential of 5G.
3. **Embrace new business models.** 4G rollout did not unlock long term ARPU increases for operators. Unless they do something different, 5G will likely deliver the same result. In this report we have outlined three non-mutually exclusive roles that telcos should consider in order to play further up the value chain, adding additional value to governments, enterprises, and consumers and so unlocking new revenues with 5G:
  - **Network-as-a-Service.** Providing and managing custom networks in a cloud-like way, enabling customers to scale up and down, define specific parameters (such as latency) and add additional functionality they might require (such as specific security features).
  - **Application enablement.** Aggregating applications and data from multiple partners in a marketplace environment, including providing data sharing and management capabilities and billing/transaction and revenue management.
  - **Solutions and applications.** Bringing specific (could be end-to-end including compute and connectivity) solutions and large-scale applications to customers, including consulting and advisory services, system integration and solution sales.
4. **Manage partnership ecosystems.** In order to successfully play higher up the value chain and diversify beyond traditional connectivity offerings, telcos will need to work with partners. This is particularly true if they look to offer end-to-end solutions and applications. Sourcing and coordinating multiple partners is already something telcos are strong at –they must capitalise on this if they are to challenge more established vertical-specific digital solution providers.

**Work with national governments and regulators to accelerate 5G rollout.** 5G offers significant potential benefits to governments, enterprises and consumers. These benefits are contingent upon the swift and effective roll-out of 5G networks. For some industries, such as manufacturing, a deep

local network with strong in-building coverage will be required. For others, such as healthcare, a national network will be required to deliver benefits to all citizens regardless of their location. As such, regulators and governments need to balance the short-term incentive of high spectrum auction fees against the need to encourage mobile network operators and other enterprises to build networks quickly. Overall, we believe that governments should consider lowering spectrum prices and setting more stringent requirements for national network deployment. At the same time, some high- and medium-band spectrum should be opened to new competitors wishing to develop deep local 5G (private) networks.

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