Industry Survey 2024

Introduction

What are mobile professionals most excited for in 2024? Where are the biggest threats coming from? What do enterprises want from mobile network operators (MNOs)? How is the market progressing for standalone (SA) 5G, open RAN, eSIM, IoT and more?

Mobile World Live set out to answer these fundamental questions in a landmark survey of our global audience.

Our database numbers more than 150,000 mobile industry insiders comprising C-level executives from carriers, device manufacturers, systems integrators and a range of service providers. It is the perfect cohort to provide a bellwether of industry sentiment as we move into 2024.

Here are the results. We hope you find them enlightening.

Contents

The state of the industry

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KEYSIGHT

Every year, the mobile channel consolidates its place as a driver of trade and commerce, and as a central force in the lives of billions of people.

The GSMA estimates that mobile technologies and services generated **5 per cent of global GDP in 2022**. This equates to $5.2 trillion of economic value. At the same time, more than 5.4 billion people were subscribed to a mobile service, with 4.4 billion connected to the mobile internet.

So mobile has achieved a great deal. But there is so much more to come. New 5G networks promise
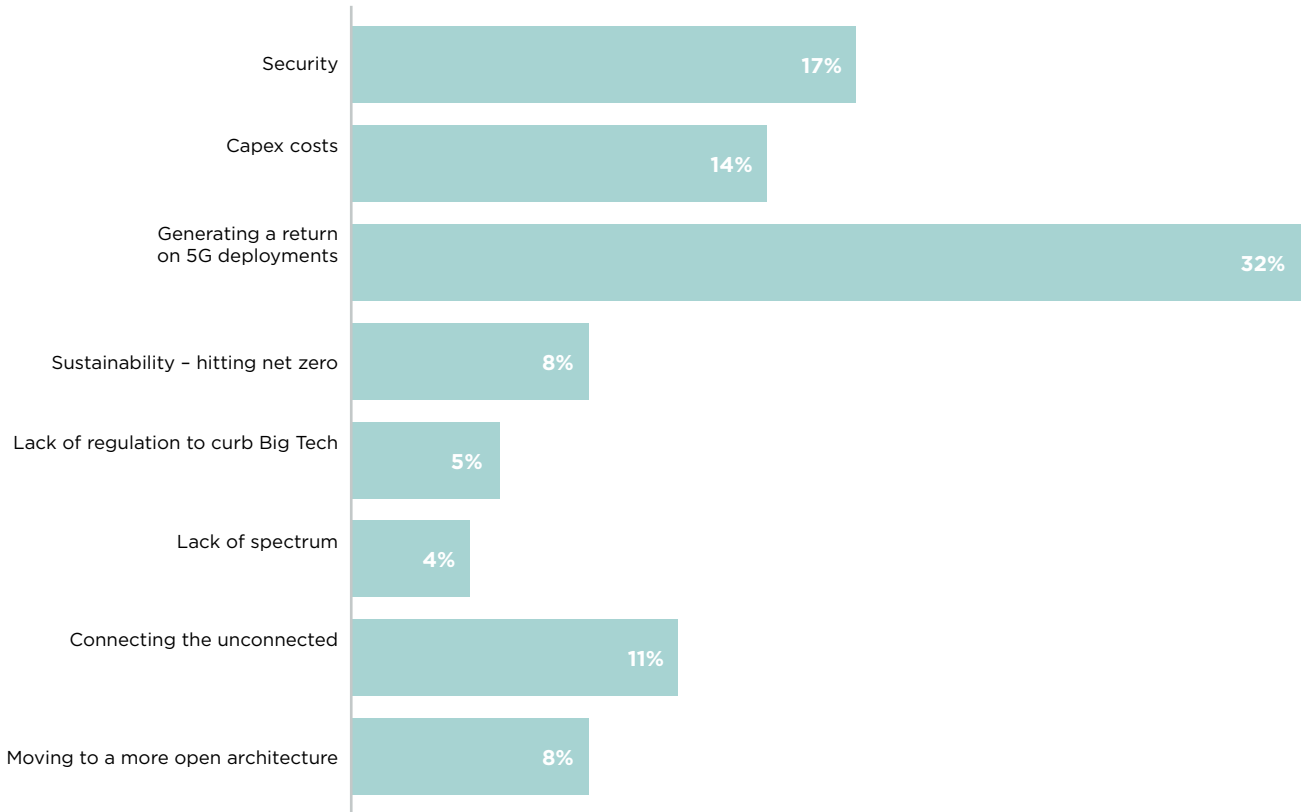
exponential improvements in speed, reach and capacity. Now, they are rolling out fast. The GSMA expects 5G adoption to have reached 17 per cent in 2023, rising to 54 per cent (equivalent to 5.3 billion connections) by 2030. The technology will add almost $1 trillion to the global economy in 2030, with benefits spread across all industries.

While the long-term future of mobile connectivity is bright, there are still short-term challenges to face. MNOs must grapple with how best to monetise 5G now, and also consider the pros and cons of private network deployments, generative AI, non-terrestrial connectivity, sustainability, open RAN and more.

How do mobile insiders feel about these questions? Find out in the first part of our industry survey: The state of the industry.

What's the biggest issue facing the mobile industry today? There is no shortage of candidates in this fast-moving, ever-evolving business. In our survey, however, the answer was clear: monetising 5G deployments. 32 per cent of respondents made monetisation the biggest issue, double the next two choices of security (17 per cent) and capex (14 per cent). Perhaps this is unsurprising. It is estimated that <u>**MNOs will spend $800 billion in capex on**</u> 5G between 2020 and 2025.

What's the biggest issue facing the mobile industry today?

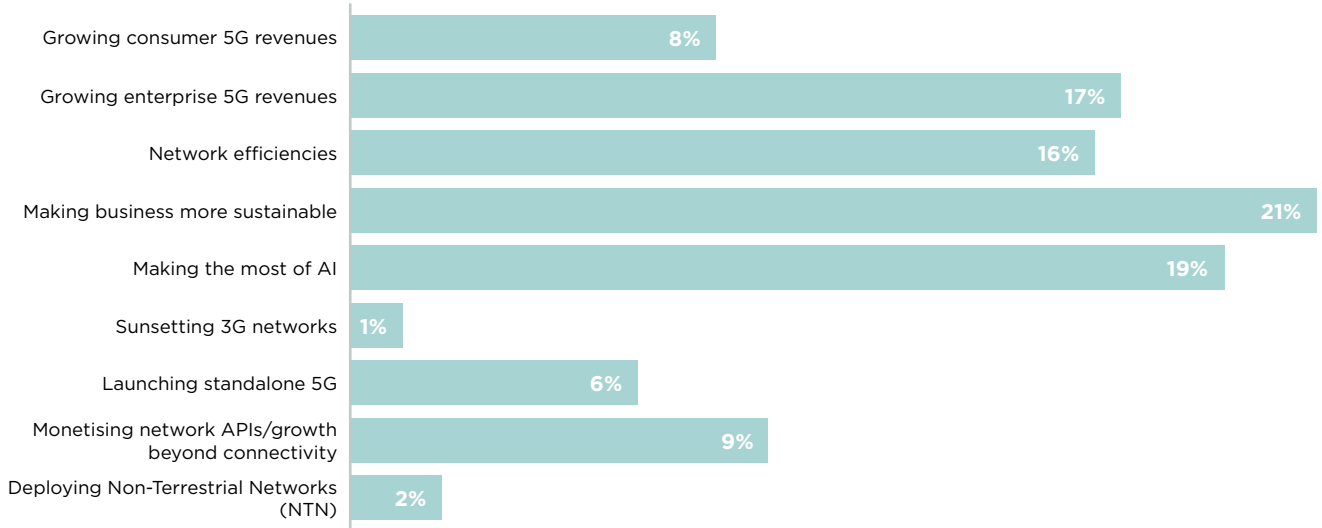| Issue	Percentage
Security	17%
Capex costs	14%
Generating a return on 5G deployments	32%
Sustainability – hitting net zero	8%
Lack of regulation to curb Big Tech	5%
Lack of spectrum	4%
Connecting the unconnected	11%
Moving to a more open architecture	8%

Given the importance of monetising 5G for MNOs, it makes sense to know how they intend to do it. When asked **where do you expect to increase monetisation for 5G**, the responses showed emphatically that they will start with the enterprise. 58 per cent chose enterprise/commercial deployments, while 25 per cent selected vertical markets. Just 17 per cent plan to focus on consumer markets features (AR/VR (augmented reality/virtual reality) et cetera).

Where do you expect to increase monetisation for 5G?

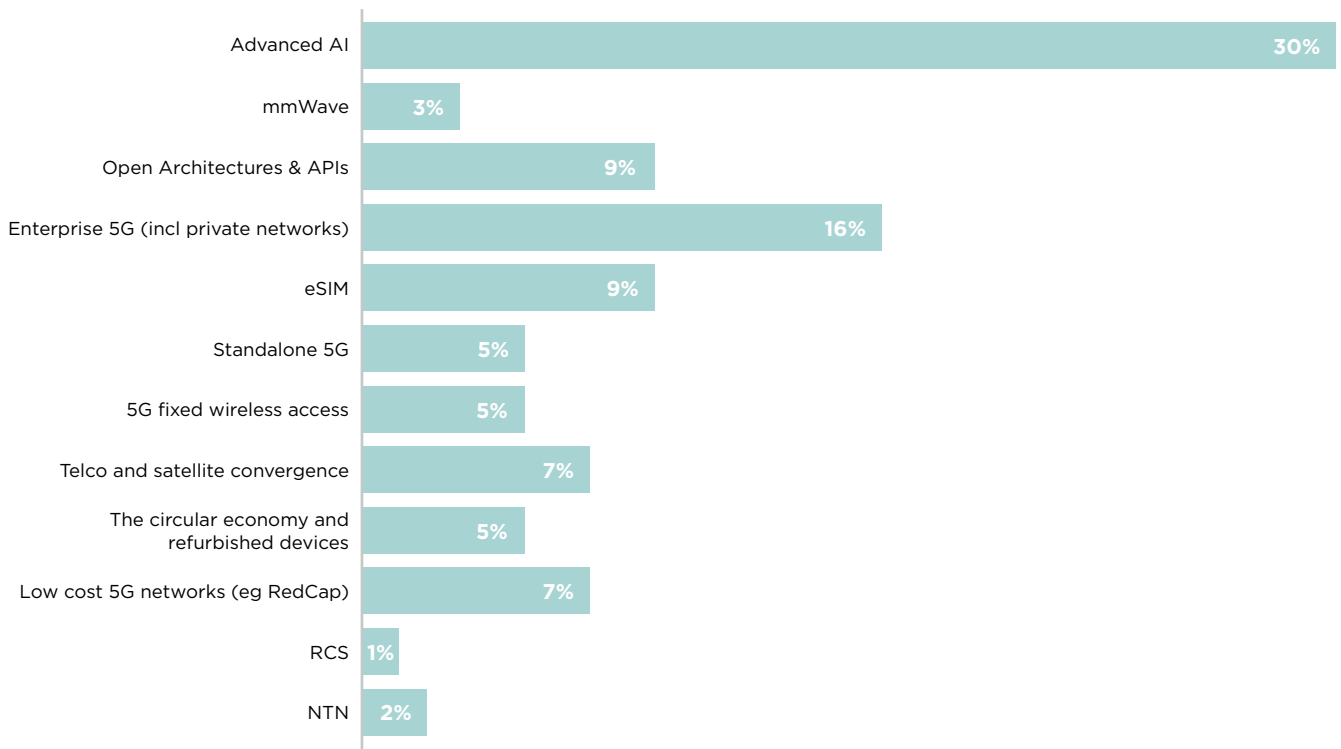| Category	Percentage
Enterprise/commercial deployments	58%
Vertical markets	25%
Consumer-focused features (AR/VR, etc.)	17%
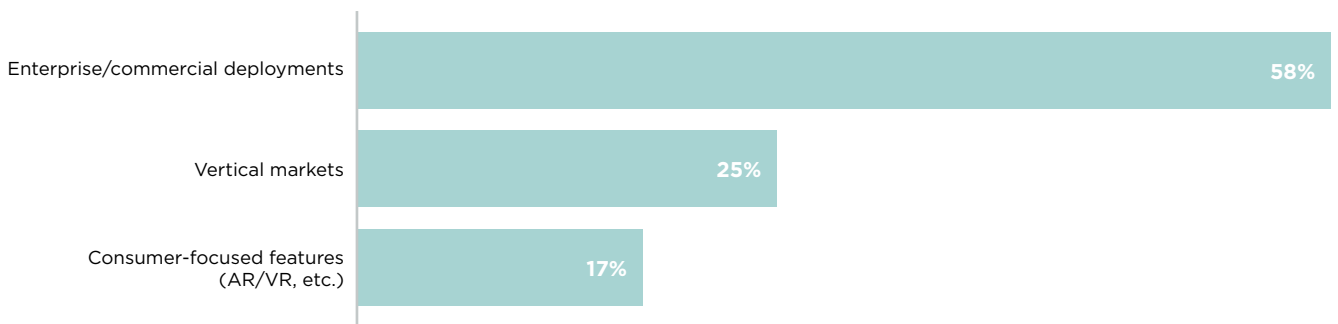
When asked **what is your number one priority in 2024**, the answers were nuanced. A combined 25 per cent chose 'generating enterprise or consumer 5G revenues'. But not far behind was 'making business more sustainable' at 21 per cent. In third place was 'making the most of AI' (19 per cent), which is obviously a preoccupation for most industries in the ChatGPT era. At the bottom of the poll was 'sunsetting 3G networks', a priority for just 1 per cent.

What is your number one priority in 2024?
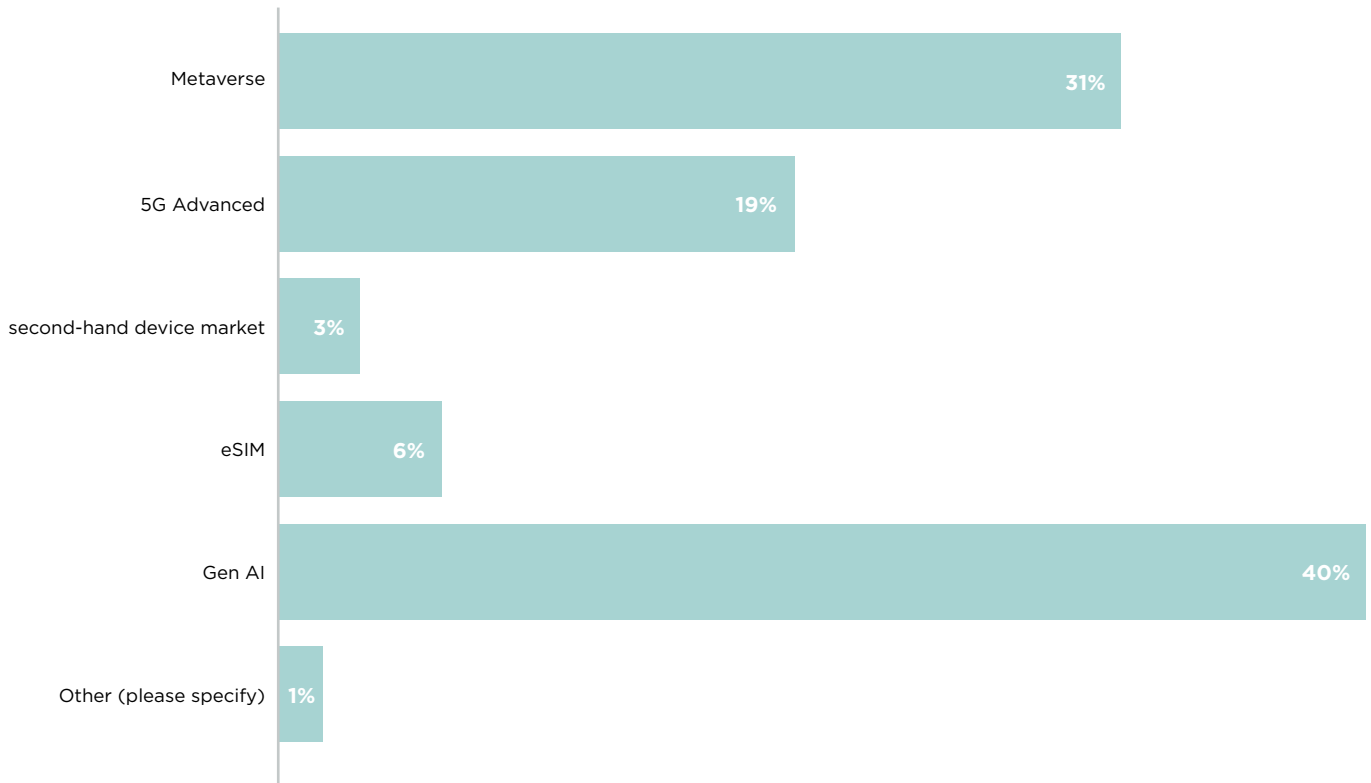
Category	%
Growing consumer 5G revenues	8%
Growing enterprise 5G revenues	17%
Network efficiencies	16%
Making business more sustainable	21%
Making the most of AI	19%
Sunsetting 3G networks	1%
Launching standalone 5G	6%
Monetising network APIs/growth beyond connectivity	9%
Deploying Non-Terrestrial Networks (NTN)	2%

AI featured strongly when respondents were asked **which new business area will be the most attractive in 2024.** In fact, 'advanced AI' came out top with a 30 per cent share. Of the other options, only enterprise 5G achieved double figures (16 per cent). There was notably low support for the next-generation messaging channel Rich Communication Services (RCS) (1 per cent) and non-terrestrial networks (2 per cent).

Which new business area will be the most attractive in 2024?

| Category	%
Advanced AI	30%
mmWave	3%
Open Architectures & APIs	9%
Enterprise 5G (incl private networks)	16%
eSIM	9%
Standalone 5G	5%
5G fixed wireless access	5%
Telco and satellite convergence	7%
The circular economy and refurbished devices	5%
Low cost 5G networks (eg RedCap)	7%
RCS	1%
NTN	2%

Because it is so hyped, AI arouses as much doubt as it does excitement. This came through clearly in the question **what will be the most overhyped market in 2024**. Some 40 per cent think it will be Advanced AI, easily the top answer. This was followed by Metaverse, with 31 per cent of the vote. Interestingly 19 per cent chose SA 5G, a little alarming given the capex numbers quoted above.

What will be the most overhyped market in 2024?

| Category	Percentage
Metaverse	31%
5G Advanced	19%
second-hand device market	3%
eSIM	6%
Gen AI	40%
Other (please specify)	1%

But perhaps this is more of a timing issue than a fundamental question mark over the promise of the 5G network. Asked **when do you plan to start making use of 5G Advanced technology**, just 32 per cent replied 2024. The remaining 68 per cent expect to deploy in 2025 and 2026.

When do you plan to start making use of 5G Advanced technology (e.g. eMBB, mMTC, URLLC)?

Year	Percentage
2024	32%
2025	42%
2026	26%
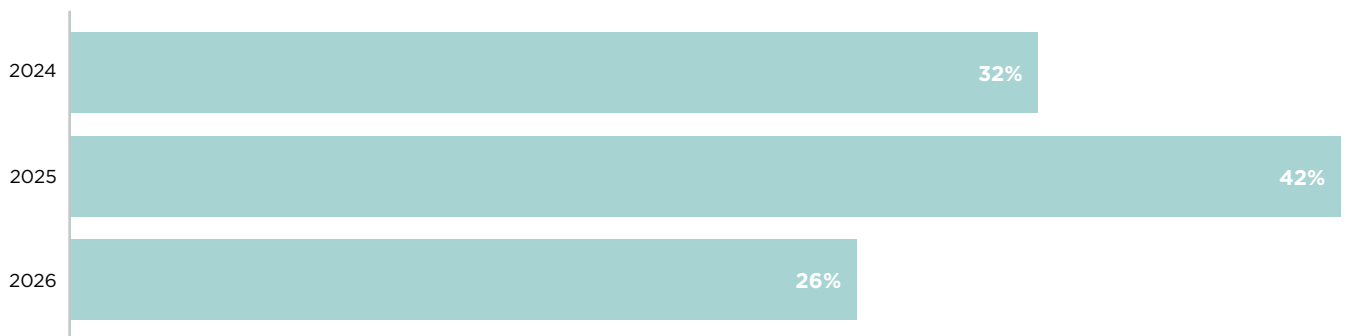
And what of 6G? It is a long way off, but are MNOs exploring it yet? The answer: not really. The survey put the question **have you already started to invest in 6G** and 87 per cent replied that they are not. 50 per cent are monitoring the market closely, while 37 per cent have deferred investment as '6G will not be a commercial reality until at least 2030.' Meanwhile 14 per cent of respondents have started to invest.

Have you already started to invest in 6G?

Category	Percentage
Yes	14%
No, but I'm monitoring the market closely	50%
No, this will not be a commercial reality until at least 2030	37%

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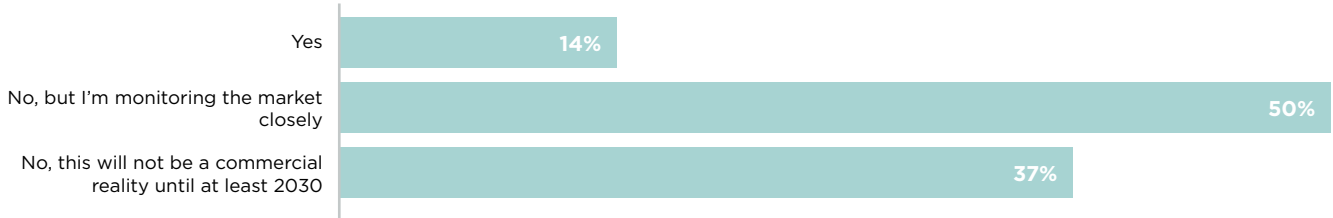
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The original vision of 5G included improved scale, reliability and network performance, all of which gives MNOs the ability to offer new services and enhance existing ones. Among the possibilities are enhanced mobile broadband (eMBB), IoT services, fixed wireless access (FWA), enterprise solutions, and applications such as AR and VR across multiple verticals.

Keysight helps the global mobile ecosystem to capture these revenue opportunities. We provide future-proof test solutions for chipset makers, device manufacturers, MNOs, test labs, system integration, and operational technology vendors. Our products develop and verify 5G devices and networks according to the latest 3GPP standards. We can also validate network equipment and optimise live network deployment and testing with tools that scale across network lifecycles.

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eSIM

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Who are you? This is the question every MNO must ask every time a device connects to the network. It gets the answer thanks to the subscriber identity module (SIM). In short, the SIM card identifies and authenticates the subscriber to the network.

Since being introduced in 1991, the **plastic SIM card has evolved**. The first product was almost as big as a credit card. The nano SIM, introduced in 2012, is just 8.8 mm wide. But now the biggest change of all is underway. The physical SIM card is turning into software.

This is the embedded SIM (eSIM) and it has many form-factors. Currently the eSIM (as used in smartphones since 2019) is a physical but programmable product. It is embedded (rather than manually inserted) directly inside a device. However, work is also now underway to create SIM formats that have no physical component at all. These include the **iSIM and the Cloud SIM**. The iSIM puts all the SIM functionality directly into the chipset in a process called **system-on-chip (SoC)**. Meanwhile Cloud SIM moves telco profiles from the physical card into the cloud.

Clearly, eSIM represents an historic shift for the mobile industry. This raises the question: why do it?
Well, the eSIM promises a number of powerful benefits:

• It is interoperable and reprogrammable. Customers can start a carrier subscription or switch providers with a few taps on a menu

• It is better suited to connecting machines and sensors than the physical SIM, bringing in customers from new verticals

• It removes the cost of making and distributing physical SIM cards

• It takes up less device space

• It is secure. Criminals cannot physically remove the SIM card

Of course, there are also challenges. Most obviously, eSIMs change the dynamics of loyalty and churn, since customers can more easily switch providers. The eSIM also forces MNOs to abandon decades-old cost and distribution structures. For example, they have to migrate from distributing millions of physical SIM cards to managing connections over the air (remote SIM provisioning).

It has taken a while for the eSIM to break through. The first device to support it was the **Samsung Gear S2 smartwatch** in 2016. In the phone arena, Lenovo-owned Motorola debuted the first eSIM-only phone (the Razr 4G model) in 2019. But it was Apple's launch of eSIM-only iPhones in the US in September 2022 that really moved the needle.

So where do we stand now?

According to GSMA Intelligence, at the end of June 2023, **nearly 400 mobile service providers** (id est MNOs, MVNOs and providers of international roaming services) had launched commercial eSIM services for smartphones across 116 countries.

In terms of devices, the cumulative number of eSIM smartphone models launched reached 109 in June 2023. Most smartphone manufacturers have launched eSIM smartphones. Xiaomi, Vivo and Nokia (HMD Global) were new entrants in 2022, while Honor and TCL Communication launched their first eSIM smartphone models in H1 2023. The rate is accelerating too: 20 new eSIM models were launched in H1 2023, compared with 28 in all of 2022.

For all this progress, consumer awareness and adoption is relatively low. Nevertheless, GSMA Intelligence expects eSIM adoption to gain momentum in the next two years, followed by a more substantial acceleration from 2026.

It predicts around 1 billion eSIM smartphone connections by the end of 2025, growing to **6.7 billion by 2030**. The latter number will account for 76 per cent of all smartphone connections.

As the introduction suggests, eSIM is still a relatively nascent telecoms innovation. It has yet to break through to the mainstream. Our survey confirmed this. It asked respondents **what percentage of their customer base is currently using eSIM.** It revealed that around half of all carriers have an eSIM user base of less than 10 per cent.

What percentage of your customer base is currently using eSIM?

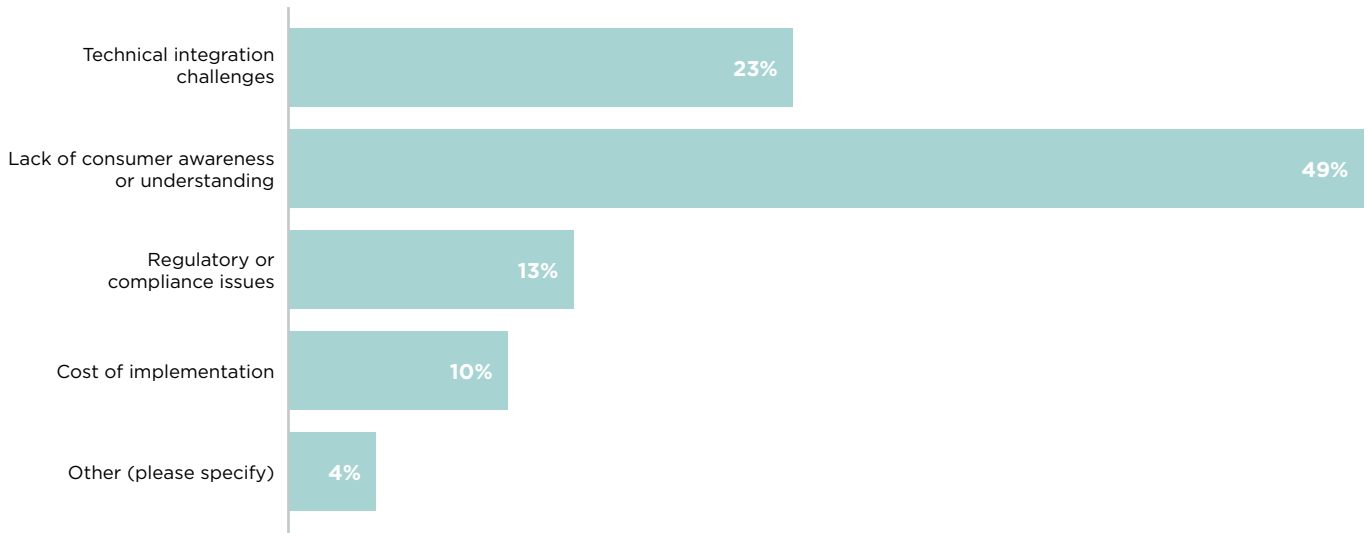|	
Less than 10%	48%
10% - 25%	33%
26% - 50%	15%
51% - 75%	3%
More than 75%	1%
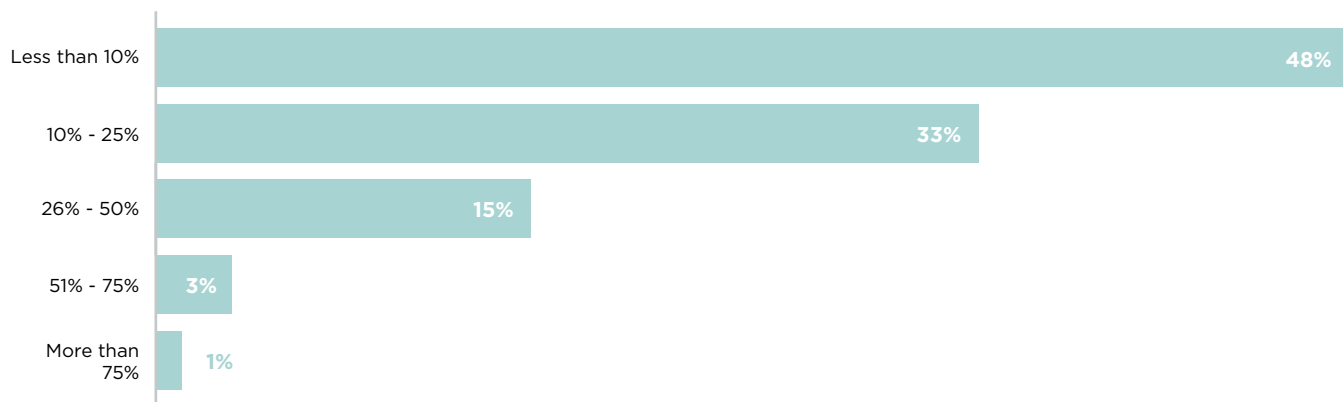
When asked to **rate current consumer demand for eSIM in your market**, the most popular answer was 'neutral' at 45 per cent. That said, it does seem that interest is rising: 37 per cent answered that demand is 'moderately or very high', double the number that replied 'low or very low' (18 per cent).

eSIM How would you rate current consumer demand for eSIM in your market?

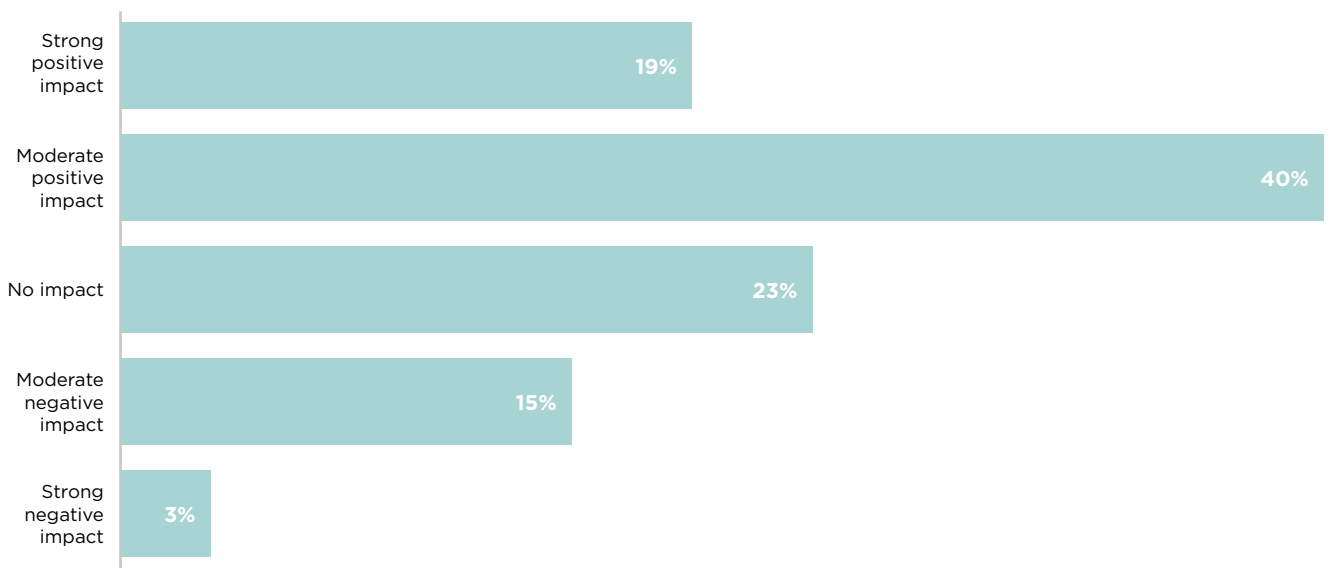|	
Very high	11%
Moderately high	26%
Neutral	45%
Low	15%
Very low	3%
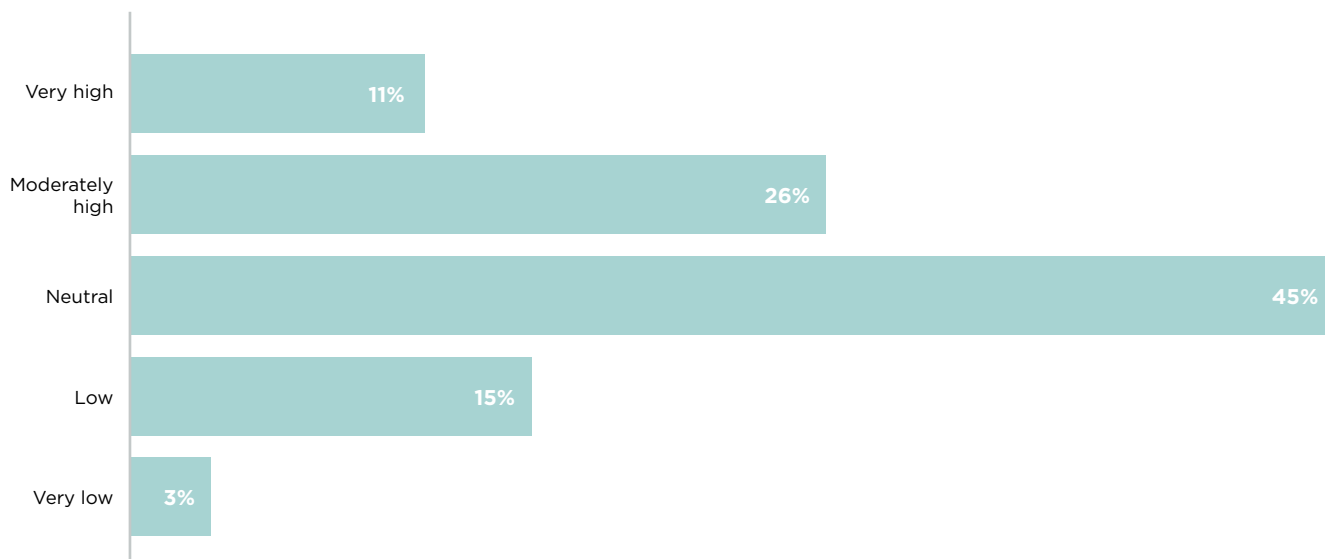
It does appear that consumer resistance, rather than any technical complexity, is the key barrier to more eSIM adoption. 49 per cent of respondents cited 'lack of consumer awareness or understanding' as **the biggest challenge to your organisation faces in adopting eSIM technology**. By contrast 23 per cent cited integration and 13 per cent regulation.

What is the biggest challenge your organisation faces in adopting eSIM technology?

Challenge	Percentage
Technical integration challenges	23%
Lack of consumer awareness or understanding	49%
Regulatory or compliance issues	13%
Cost of implementation	10%
Other (please specify)	4%

When it was first introduced, there was some negativity around eSIM. The argument was that eSIM could make it easier for subscribers to switch between carriers and that power could migrate from MNOs to device makers. However, our survey reflects a mostly positive sentiment towards the form-factor. When asked **what impact will eSIM technology have on customer retention**, 60 per cent said it would be moderate or very strong.

What impact will eSIM technology have on customer retention?

| Impact	Percentage
Strong positive impact	19%
Moderate positive impact	40%
No impact	23%
Moderate negative impact	15%
Strong negative impact	3%

Respondents were a little more circumspect about roaming. When asked **what impact will eSIMs have on roaming revenues**, 52 per cent were positive, 28 per cent were neutral and 20 per cent believe eSIM will have a negative impact.

What impact will eSIMs have on roaming revenues?

Strong positive impact	18%
Moderate positive impact	34%
No impact	28%
Moderate negative impact	14%
Strong negative impact	6%
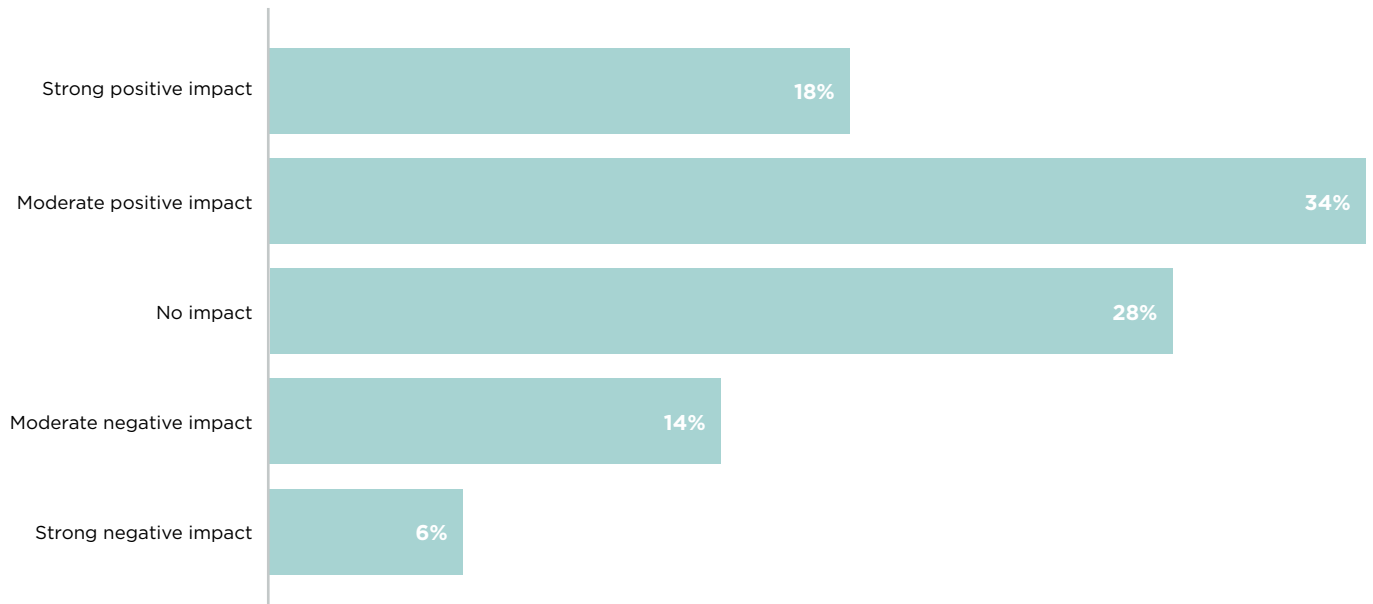
So if we assume that eSIM is the future, how long will the replacement rate take? Once again, the survey results reflect a cautious perception. When asked **how long it will take eSIMs to overtake physical SIMs in mobile devices**, 70 per cent chose three years and more and 50 per cent believe it will take more than five years.

When will eSIMs overtake physical SIMs in mobile devices?

Less than 3 years	29%
3 - 5 years	50%
More than 5 years	20%

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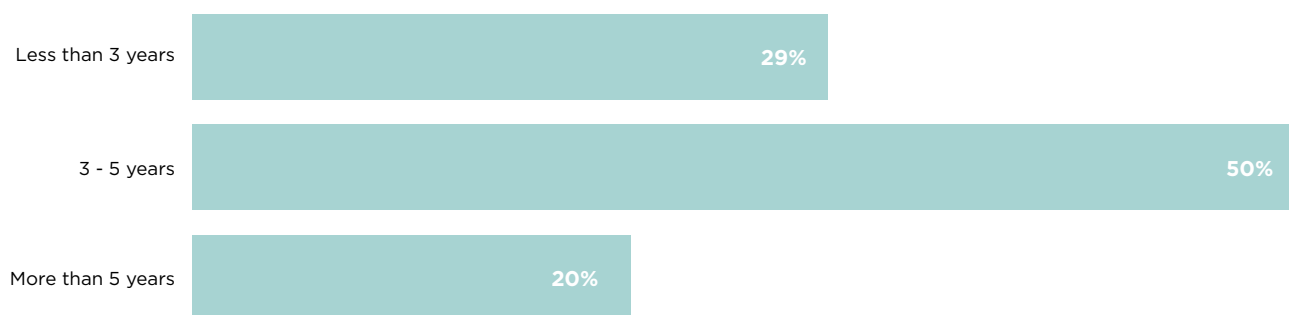
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The emergence of eSIM technology is driving a significant shift in telecommunications, driven by growing consumer demand. It has the potential to revolutionise connectivity and create exciting new opportunities, especially in the roaming and IoT spaces. eSIM technology simplifies connectivity for travellers, promising more flexible roaming options. In the IoT sector, it enables seamless integration of various devices, fostering the growth of smart ecosystems. This survey reveals a promising future for eSIM tech and underlines its central importance in a digitally connected world.

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Between 2023 and 2030, global mobile operator **capex will reach $1.5 trillion.** It is a huge sum and the vast majority (perhaps 80 per cent) of the outlay will be on equipment related to the rollout and expansion of SA 5G, and initial investment on prototype 6G.

While every cellular network upgrade requires investment, SA 5G infrastructure is different. It is a step change on what came before. Why? Because SA 5G is cloud-native. In other words, most of the network functions that would traditionally be delivered by hardware are run as software applications on remote servers.

This represents nothing less than the digitisation of mobile networks. And it unlocks two game-changing benefits. The first is super-high-density of connected devices (up to 1 million devices per square km). The second is ultra-reliable, low-latency communication (URLLC), which stretches to 1 millisecond or less.

So the question is how can MNOs recoup their 5G investment? Needless to say, high capacity and low-latency will create many consumer-led market opportunities: cloud gaming; virtual and augmented reality applications; HD video streaming; and more. However, the more immediate, and ultimately more lucrative, opportunity **lies with the enterprise sector.** To be clear, industry revenue from B2B services has been on the rise for many years. According to GSMA Intelligence the **contribution of enterprise revenue** rose from 26 per cent in 2017 to 30 per cent in 2022.

The bulk of this income has come from connecting machines: the so-called Internet of Things (IoT). When the growth in consumer connections began to slow,

MNOs looked to IoT connections as a potentially limitless source of new business. To pursue this opportunity, the industry developed specialist technologies NB-IoT and LTE-M to support devices that need long battery life or are used at difficult-to-reach remote locations.

Now, the speed and capacity of 5G promises to supercharge IoT revenue. There will be challenges. MNOs and enterprises must work out how to remotely manage and maintain many millions of connected machines. There is also the question of 3G sunsets: what happens to remote devices that are connected to 3G when those networks are switched off? And then there are the commercial models, especially for IoT devices (in automotive contexts for example) that roam across multiple regions.

Nevertheless, GSMA Intelligence expects IoT connections to soar. It forecasts that they will reach **39 billion by 2030**, up from 6.3 billion in 2017 and 25.2 billion in 2025.

Alongside IoT, the other key revenue opportunity unleashed by 5G is the private network. Private wireless networks have been deployed on LTE spectrum for several years. However, the installations have mostly been low-profile niche offerings. SA 5G changes this. The move from hardware-based to software-based infrastructure brings with it the ability to **slice the network.** Network slicing lets an MNO offer parts of its core network to private enterprises. In effect, this means organisations can run their own MVNOs walled off from the public network. This offers more functionality, data security and privacy.

This switch is already underway. According to the **Global mobile Suppliers Association (GSA),** 1,148 organisations were known to be deploying or had been granted a licence for private LTE or 5G networks as of August 2023.

These early adopters comprise some of the biggest companies in the world. They are usually in verticals that deal in sensitive information and have strict regulatory protocols: power generation, mining, aviation et cetera.

However, the GSMA expects the market to quickly expand beyond this group. Companies across all sectors are embracing digital transformation. They all want to explore use cases based on the capacity, latency and reliability of 5G in a private wireless setting.

And MNOs are trying to make it easy for them. For example, AT&T created its **Private Cellular Networks** offering to be "simpler and faster for organisations of all shapes and sizes to get their private edge networks up and running".

As with IoT, the private wireless opportunity is not a certainty. MNOs will have to deal with competition from big tech hyperscalers that are also eyeing the market. There will be the inevitable security risk, especially in hybrid networks that combine elements of a private network with public resources. And finally, there is the cultural challenge which comes with sharing network infrastructure (as opposed to merely selling connectivity).

Still, GSMA Intelligence found around half of operators expect private wireless to account for more than 10 per cent of their total enterprise revenue by 2025. According to ABI Research, demand for private network capability from multiple industry verticals could **generate revenue of $64 billion** by 2030.
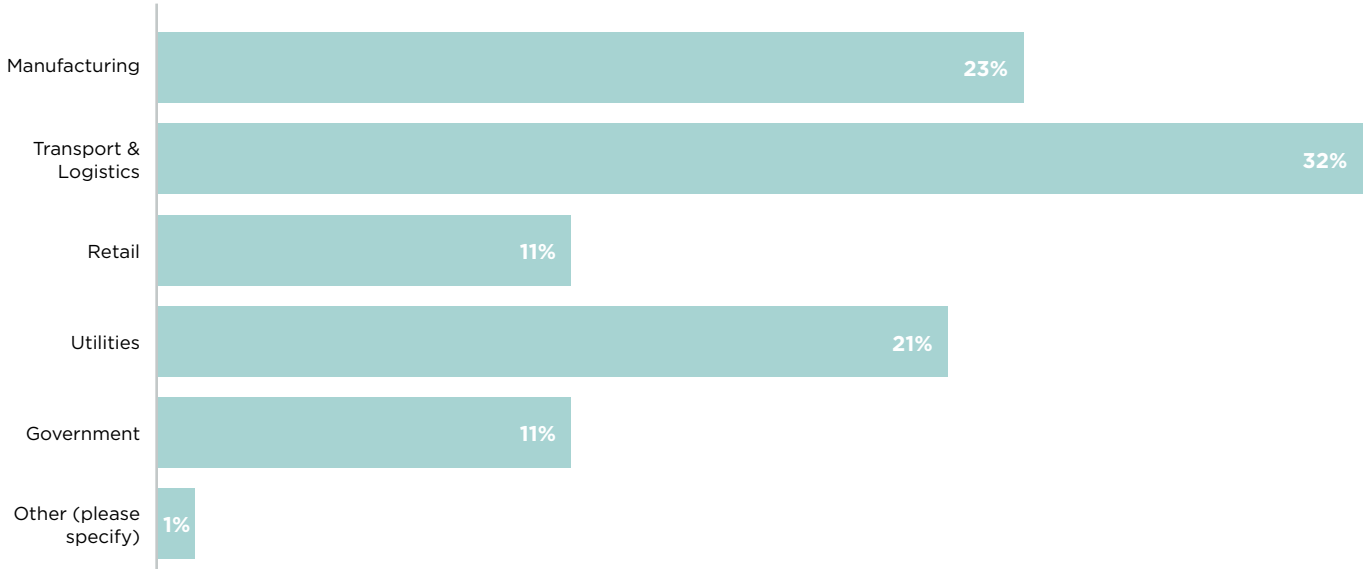

As our introduction outlines, the enterprise sector is increasingly important for telcos. It accounted for 30 per cent of revenue in 2022. Given this, we wanted to know **which is the MNOs' biggest new business opportunity in the enterprise space.** IoT gathered the most support (46 per cent) followed by security (29 per cent) and cloud (25 per cent).

Which is the MNOs' biggest new business opportunity in the enterprise space?

|	
Security	29%
IoT	46%
Cloud	25%
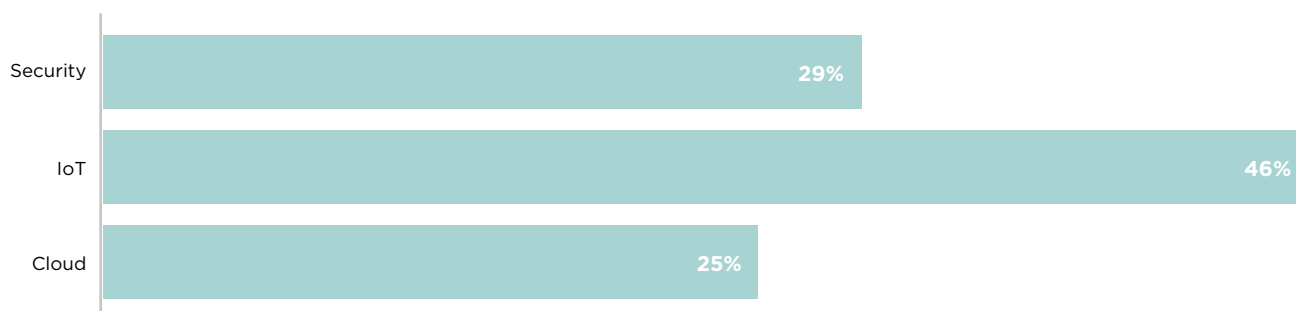
If IoT is the dominant driver of enterprise business, which verticals are most active? To find out, we asked **which sectors represent the biggest opportunity for IoT.** Transport and logistics was the top answer with 32 per cent, with manufacturing and utilities scoring 23 per cent and 21 per cent, respectively.

## Which sectors represent the biggest opportunity for IoT?

Sector	
Manufacturing	23%
Transport & Logistics	32%
Retail	11%
Utilities	21%
Government	11%
Other (please specify)	1%

To get some insight into what might be holding back enterprise customers from doing more in IoT, we asked respondents to consider what are the biggest barriers to more IoT deployments. The prosaic answer? Cost. Some 33 per cent of telcos said the price of connectivity is still the primary concern. Meanwhile security and ease of deployment emerged as more important barriers than network coverage.

What are the biggest barriers to more IoT deployments?

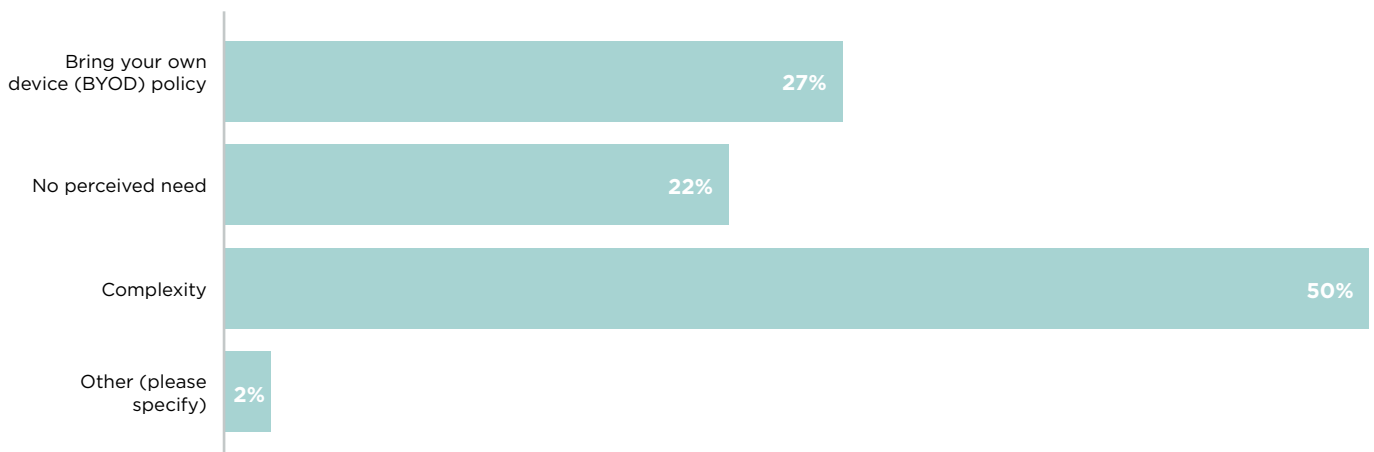| Barrier	
Connectivity costs	34%
Security	23%
Coverage	16%
Ease of deployment	26%
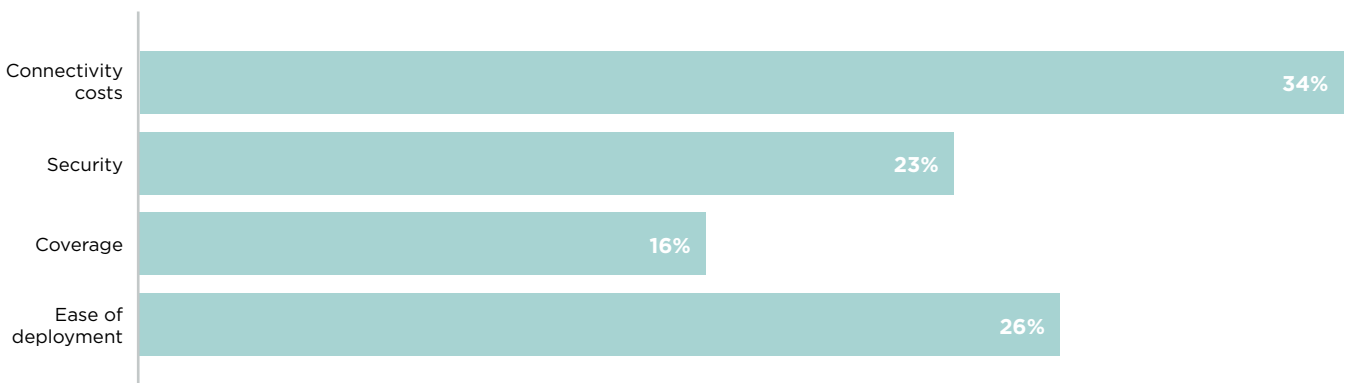
Pursuing the theme of network security in the enterprise space, we also posed the question **what's the key factor for enterprises when choosing a mobile security solution.** Unsurprisingly threat detection came top (31 per cent), while ease of deployment and detection/response came equal second (23 per cent). Respondents were less focused on scalability (17 per cent) and vendor reputation (8 per cent).

What's the key factor for enterprises when choosing a mobile security solution?

Ease of deployment	23%
Threat prevention	31%
Detection and response	23%
Scalability	17%
Vendor reputation	8%
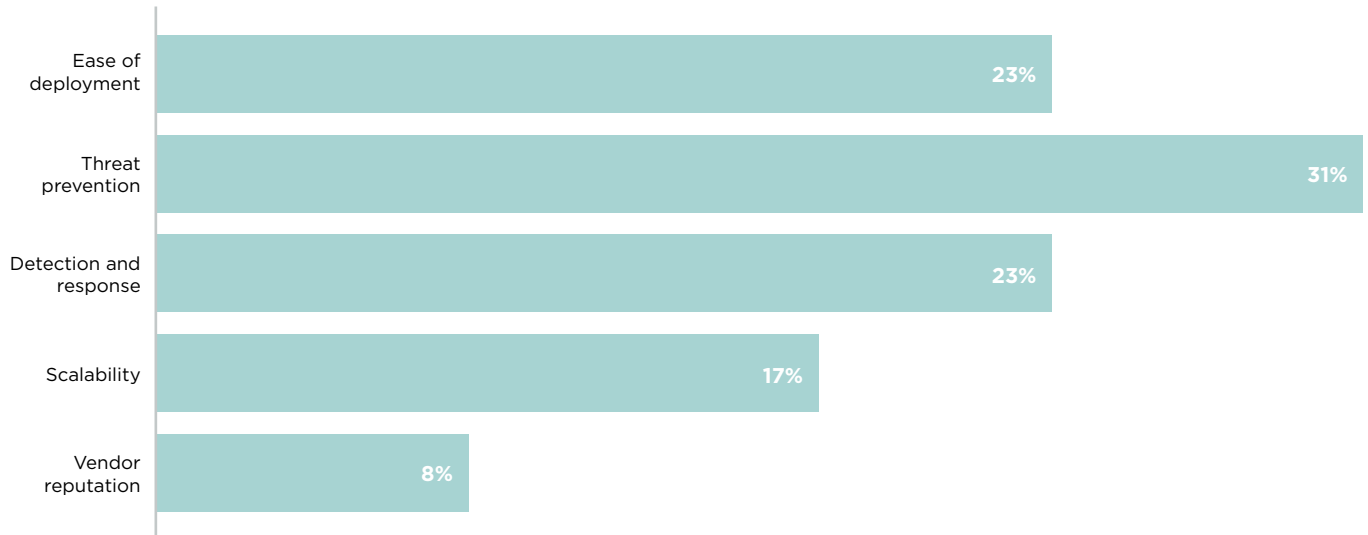
And the hurdles? The survey asked **what are the main barriers to adoption of mobile security solutions** and the response was emphatic. Half of respondents believe complexity is holding back the market, while for 26 per cent it is problematic bring your own device policies and 22 per cent stated lack of demand.

What are the main barriers to adoption of mobile security solutions?

Bring your own device (BYOD) policy	27%
No perceived need	22%
Complexity	50%
Other (please specify)	2%

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Enterprises are now developing a range of use cases that build on the speed, reach and capacity of 5G. But they need help to secure these new services. These survey results support our proposition that MNOs are best positioned to provide this. Only MNOs can offer the foundational security services that let businesses protect all their cellular connected devices. With technology that's tightly integrated into their networks, MNOs can secure phones and IoT deployments at any scale, and also target private network opportunities. By offering features that enable automation and self-service, they can enhance new 5G applications and help businesses to move quickly while reducing costs.

Open RAN

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KEYSIGHT

Everyone loves competition. It promotes innovation and efficiency, and usually brings down prices. But, until recently, competition has not exactly been overflowing in the domain of mobile radio access networks (RAN).

The RAN describes the final link between the network and the phone. It comprises towers, antennae and base stations. When a subscriber makes a call or connects to the internet, it is the RAN that receives, digitises and transmits the signals.

But here is the problem. Over the years, the industry has consolidated around a small number of RAN suppliers. RAN architecture has evolved into a closed system characterised by vendor-specific hardware and software. Though these proprietary systems can be efficient and reliable, they limit an MNO's options. Ultimately, no company wants to be overly dependent on a small group of specific partners.

Put simply, operators need a more diverse ecosystem of vendors. They want a more interoperable approach.

This is open RAN. It disaggregates the RAN into three main building blocks. The first is the Radio Unit (RU), where the radio frequency signals are transmitted, received, amplified and digitised. The remaining two are the Distributed Unit (DU) and the Centralised Unit (CU), which send the digitised signal into the network.

Open RAN solves the problem of incompatibility between these elements by introducing open-source software and cross-industry standards. The concept was established by the **O-RAN Alliance**, which **defined specifications** for the RAN components, allowing baseband and radio unit components from different suppliers to operate together seamlessly.

It is important to note **open RAN is not the same as virtualised RAN, which refers to the process of turning** RAN elements into software rather than hardware. It is also distinct from cloud RAN, which moves baseband processing to a cloud environment. Indeed, open interfaces can be implemented even when there is purpose-built hardware.

We can summarise the benefits of open RAN as follows:

- **Lower capex and opex.** Increased competition among vendors should push costs down. Meanwhile simplified standardised equipment rather than high-spec hardware should reduce operating expenses

- **Less risky supply chain.** Having multiple alternative suppliers should mitigate against product shortages, vendors going out of business et cetera

- **Fewer operational risks.** In a multi-vendor environment, components are, in theory, interchangeable. This makes service interruptions less likely

Needless to say, there are risks too. The most obvious is reliability. Even when one company takes ownership of building the open RAN solution, there is still a risk insufficiently tested configurations could degrade the network.

Then there is security. In open RAN, there are more interfaces and suppliers, and all increase the attack surface available to criminals. There is also more network management and testing complexity to contend with. A multi-vendor environment brings with it more manuals, specifications and procedures even if, in theory, the architecture is standardised. Automation can help.

Open RAN represents an important new methodology for MNOs. However, migration to this new paradigm is highly complex, so adoption has been modest. GSMA Intelligence data showed that although only **18 operators had commercially deployed open RAN** in 2023, more than 80 had exhibited interest or announced plans to deploy. ABI Research placed open RAN installations in 2021 at 1.4 million and forecasts **22.5 million by 2026.**

It is a huge industry topic, but is the drive towards open RAN succeeding? We asked **has open RAN and the O-RAN Alliance architecture lived up to expectations** and the answer was kind of. While half (53 per cent) say open RAN has performed as expected, 35 per cent said it was worse while just 12 per cent think it is better.

## Open Architecture In your opinion, has Open RAN and the O-RAN architecture lived up to expectations?

Better than expected	12%
Worse than expected	35%
About as expected	53%

Obviously, open RAN is a relatively new approach and there is plenty of time for it to succeed. So why pursue it now? We asked **what is the primary driver for considering open RAN technology in your organisation** and there was a clear reason. Telcos want more power over their choice of partners, with 56 per cent citing technology flexibility, compared with 35 per cent which chose cost and energy savings.

What is the primary driver for considering open RAN technology in your organisation?

Cost and energy savings	35%
Technology flexibility	56%
Speed of deployment	8%

In any discussion of open RAN, the topic of network security always arises. We asked respondents for their thoughts on **how secure will open RAN networks be compared to traditional single vendor networks.** The collective answer was neutral, with 53 per cent selecting about the same and 25 per cent apiece for more and less secure.

How secure will open RAN networks be compared to traditional single vendor networks?

|	
More Secure	22%
About the same	53%
Less Secure	25%
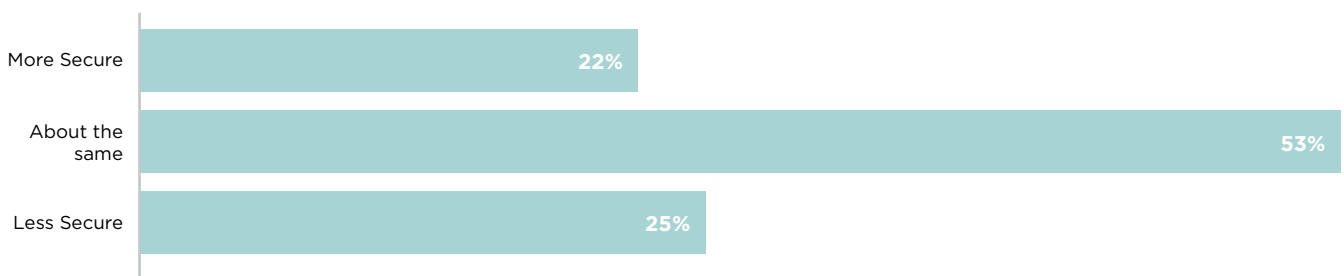
There was a similarly balanced response to questions about technical considerations for deploying open RAN. When asked **what portion of your open RAN network deployment is the most challenging**, there was almost no difference between the percentage choosing fronthaul, backhaul and mid-haul.

What portion of your open RAN network deployment is the most challenging?

Fronthaul	35%
Midhaul	32%
Backhaul	33%

Similarly, when questioned about whether companies would choose **a software-based service mesh architecture in your ORAN operation**, 20 per cent said yes, 25 per cent no and 55 per cent were still deciding.

Do you intend to implement a software-based service mesh architecture in your ORAN operation?

Yes	20%
No	25%
Still deciding	55%

KEYSIGHT
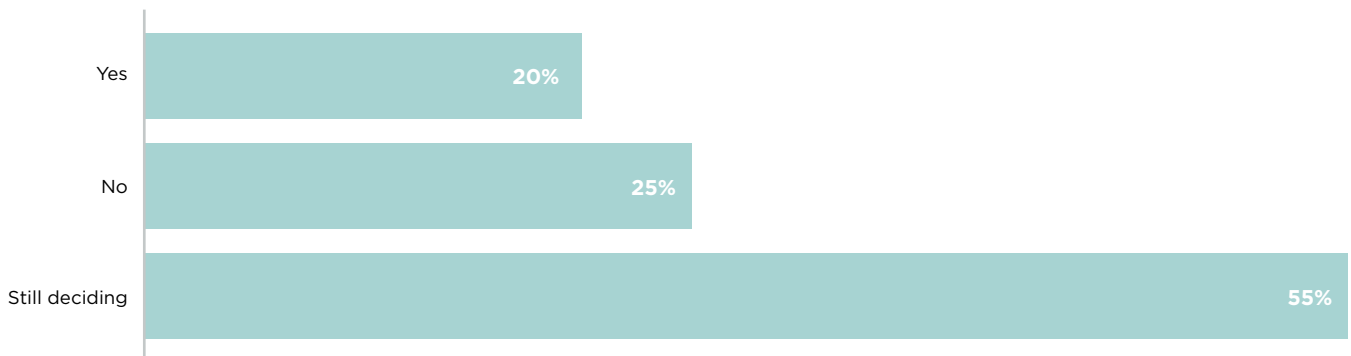
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The virtualisation of the radio access network (RAN) is now in full force. In a 5G world, wireless networks are moving to virtualised, disaggregated open RAN architectures. This is a demanding process. Thanks to its close association with O-RAN standards, open RAN constantly demands new test requirements. Equipment vendors need innovative solutions to deploy and operate open RAN networks efficiently, reliably and securely. Interoperability is key in both the technical and the business domain.

Future Networks (NTN and 6G)

In partnership with

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SUPERCHARGED WIRELESS

The mobile industry has made extraordinary progress in connecting the world's population. Still, stubborn gaps remain. It is estimated 1.2 billion people do not have a mobile phone and **600 million live outside the range of a mobile network.** And while mobile internet take-up has raced to around 55 per cent, the rate of growth is now slowing considerably.

Why is this? The key reason is the sheer cost of extending the terrestrial network into hard-to-reach regions. It is hard to justify the economics of building the infrastructure: backhaul costs can be up to ten-times more than those of suburban or rural areas. There are also increased costs associated with new base station construction, energy and ongoing maintenance. GSMA Intelligence estimates extending terrestrial networks would increase subscriber penetration by **only 5 percentage points by 2030.**

So what is the alternative? For most industry stakeholders, there is one preferred candidate: satellite-enabled non-terrestrial networks. NTNs promise to provide coverage to elusive targets including:

• Existing subscribers in hard-to-reach locations

• IoT devices in outdoor conditions

• Unconnected populations in remote locations or islands

• Connections on moving platforms in areas with discontinuous service coverage (vessels, aircraft, trains)

• Connecting billions of homes still excluded from wired broadband. This is Fixed Wireless Access. It is already a growing market, but NTN could accelerate it

Satellite communication for telecoms is not new. Providers already work with the mobile industry, providing backhaul for existing networks. But, for all the progress made in NTNs, the real prize is to move beyond backhaul and provide a direct connection between the satellite and the phone/IoT sensor. This is called **direct to device (D2D).**

D2D is possible now. But it is very expensive and, therefore only available to companies in heavy industry,

maritime and energy. However, this is changing thanks to the **inclusion of NTN standards by the 3GPP.** It has issued a series of releases so that, eventually, device makers will be able to support direct satellite access without having to develop new chipsets. Instead, they will just make a software upgrade. The 3GPP's Release-17 has already been published, with Release-18 set to follow in 2024.

Underpinning this advancement has been the development of **low-earth orbit (LEO) satellite technology.** LEO form-factors are small and relatively cheap to build and run. LEO satellites circumnavigate the globe around 16 times per day, so they also support low-latency, typically 30 milliseconds to 40 milliseconds.

The downside? Coverage is less dependable than for geostationary earth orbit (GEO) satellites, which fly higher and follow the rotation of the earth. For users, the position of a GEO satellite remains the same throughout the day, preserving line of sight and reducing the risk that coverage is lost.

For MNOs, D2D is an exciting prospect. There is now a growing list of partnerships between satellite groups and operators including Bharti Airtel, Telefonica, Vodafone Group, Veon and many more. Equipment suppliers are also making progress. Qualcomm, for example, has launched two modems specifically designed for NTN access. Meanwhile the development of eSIM for IoT devices makes it much easier to update IoT devices for satellite connectivity than would be possible using physical SIMs.

In 2023, the **first Release-17 LEO constellation** with 5G IoT standard coverage was launched. For the first time, any operator could affordably connect with the satellite network whenever it needed coverage. This raised the prospect of a massive boost in IoT adoption, even in the most remote areas.

GSMA Intelligence believes NTNs could **generate more than $30 billion** in new revenue for operators by 2035, with the consumer segment accounting for nearly 66 per cent ($20 billion), enterprise IoT 33 per cent ($10 billion) and government applications the remaining portion ($2 billion). This represents 3 per cent of total telecoms industry revenue.

Of course, NTN is not the only next-generation network upgrade under discussion by telcos. There is also the matter of 6G to consider.

At time of writing, 6G standards and specifications have not been defined. However, industry stakeholders have discussed many technical options and their broad objectives for the network. Two stand out. The first is its ability to support what is described as an **Internet of Senses.**

According to Cap Gemini, 6G networks will make it possible for applications to sense their surroundings and thereby turn the network into our sixth sense. This could accelerate the development of immersive mixed reality, holographic and multi-sensory communication.

The second objective is **low-energy consumption.** Some observers believe 6G will enable devices with the potential to harvest ambient energy from vibrations, light, temperature gradients, or even radio-frequency waves themselves.

This could have a profound impact on IoT deployments.

While 6G standards are still under discussion, various industry bodies are experimenting. They include the European **Hexa-X project**, **North American Next G Alliance** (NGA), Chinese **IMT-2030 (6G)** Promotion Group and the **6G Industry Association (6GIA).**

And in November 2023, there was a significant announcement when the **ITU confirmed** it had "agreed on IMT-2030 as the technical reference for the sixth generation of mobile systems".


> NTN innovation is advancing fast. So, on this assumption, where does the industry see the most promising application of the technology? When asked **what will be the dominant use case for NTN**, the top answer was fixed wireless access (45 per cent). D2D was next at 34 per cent. Interestingly, backhaul services scored just 21 per cent despite this being the main application of current NTN connectivity.

What will be the dominant use case for NTN?

| Use case	Percentage
Direct to handset	34%
Fixed Wireless Access	45%
Backhaul services	21%
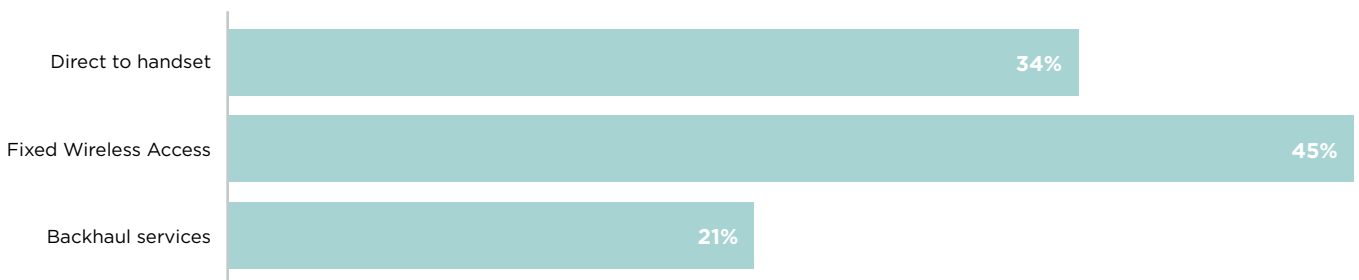
Of course, every new network upgrade presents deployment challenges. What about NTN? We asked respondents to consider **what is the most significant hurdle to successful commercial deployment of NTN services**. The top answer was the most basic of all: monetisation. Some 49 per cent of telcos said making money will be the biggest challenge, compared with 31 per cent for security and 21 per cent for signal penetration.

What is the most significant hurdle to successful commercial deployment of NTN services?

Monetisation	49%
Security	31%
Signal Penetration	20%
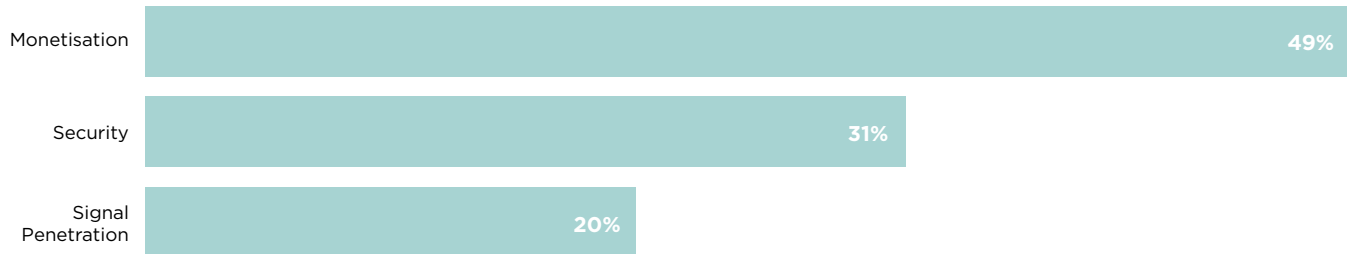
Diving into the issue of security, we quizzed respondents on **the biggest challenge in securing NTN**. The answer revealed that cooperation between stakeholders is a bigger issue than technical considerations, with 56 per cent citing global collaboration as the top challenge. Infrastructure security was next at 34 per cent.

What is the biggest challenge in securing NTN?

|	
Physical Security	11%
Global Collaboration	56%
Infrastructure Security	34%
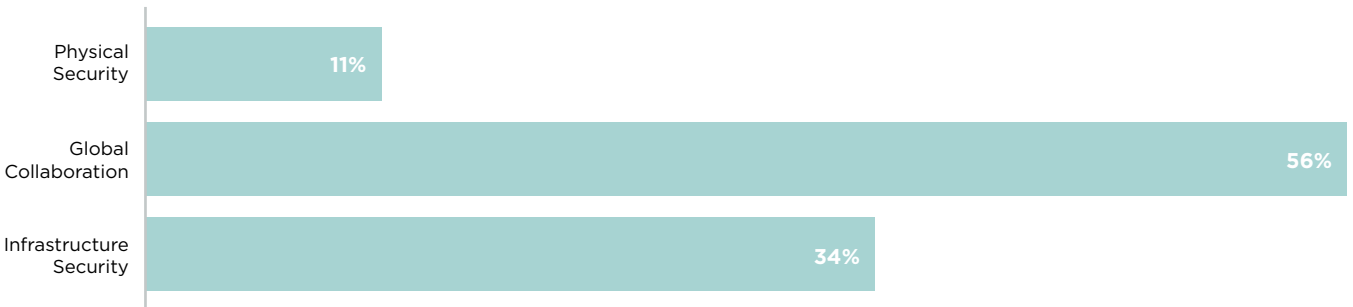
At this early stage, NTN is of keen interest to governments and the military. These are the sectors with the strategic need and the available budget to explore the tech. So we asked **what is the biggest challenge in adopting NTN in tactical/military environments**. There was a fairly even spread of answers, with resilience and redundancy top (40 per cent) followed by signal delay/latency (31 per cent) and spectrum management (29 per cent).

What is the biggest challenge in adopting NTN in tactical/military environments?

|	
Resilience and Redundancy	40%
Spectrum Management	29%
Latency and Signal Delay	31%

As set out in the introduction, there is as yet no fixed launch date for 6G. Still, we can speculate. We asked **how many years before operators start to roll out 3GPP 6G networks** and 66 per cent opted for five-to-ten years. Some 25 per cent believe 6G is one-to-five-years away and 12 per cent think the upgrade will not happen for a decade.

Future Networks (NTN and 6G) How many years before operators start to roll out 3GPP 6G networks?

1-5 years	23%
5-10 years	65%
>10years	12%
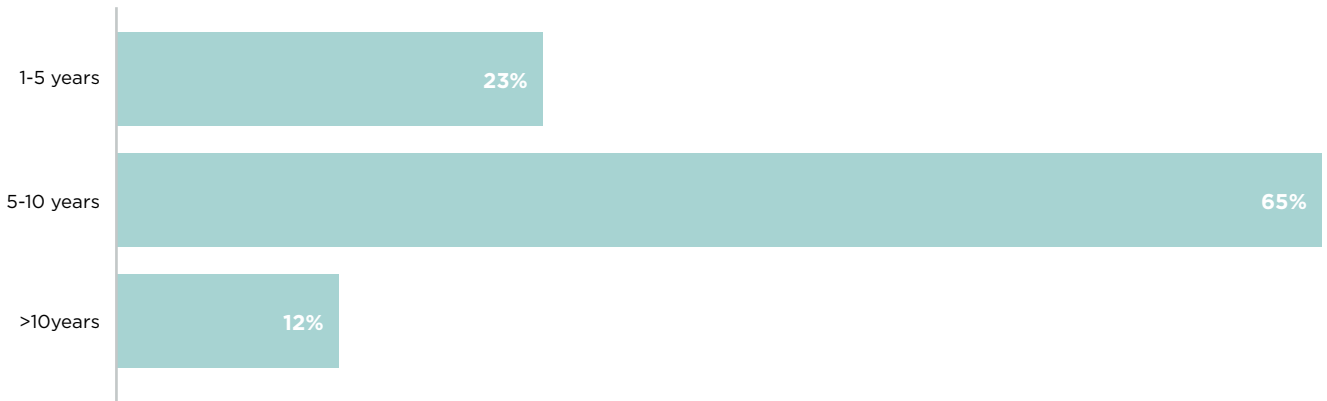
There is a similar degree of uncertainty around 6G's technical composition. Much of this centres on spectrum questions. So we asked **what percentage of the 6G standard do you expect to utilise new spectrum (7-15GHz, sub-THz).** Nearly 60 per cent think less than 40 per cent; 33 per cent say 50 per cent to 80 per cent; and around 8.3 per cent expect more than 80 per cent.

What percentage of the 6G standard do you expect to utilise new spectrum (7-15GHz, sub-THz)?

40% or less	58%
50%-80%	35%
80% or more	8%
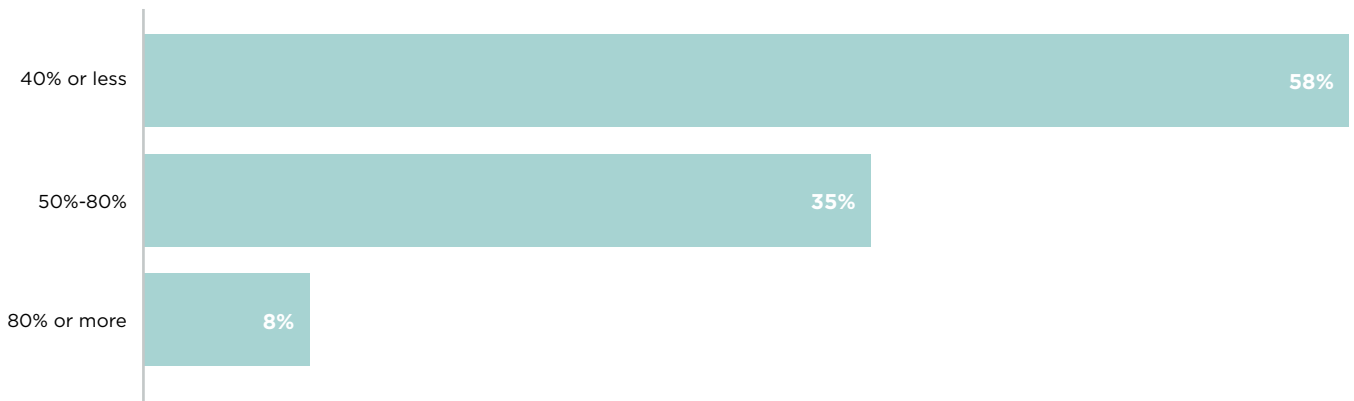
Sponsor comment:

In the drive towards enhanced connectivity and efficiency, non-terrestrial networks (NTNs) are set to play a pivotal role. NTNs can deliver truly global connectivity, characterised by unified and standardised wireless solutions. In parallel, the Open Radio Access Network (O-RAN) ecosystem is now transitioning from hype to adoption as V-RAN systems become commercially deployable. This will increase the demands placed on physical layer processing, particularly as we advance towards 6G.

AccelerComm is working hard to accelerate these next-gen technologies. We have extensive experience in both terrestrial and non-terrestrial PHY layer products, and this puts us in a unique position to understand the future requirements and how best to address them. Our platform-independent IP is designed to seamlessly integrate a configurable mix of standard compute, programmable silicon and advanced vector processing.

This approach is poised to deliver unprecedented throughput, coverage and enhanced spectral efficiency. These are key objectives for an industry that is committed to the prompt, profitable and effective delivery of communication services.

AccelerComm is driving advancements that not only meet current industry needs but also adapt to the future challenges associated with 6G and beyond. Our dedication to excellence positions us as a reliable partner for stakeholders seeking cutting-edge solutions in the rapidly transforming world of telecommunications.

MOBILE WORLD LIVE

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