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CONTENTS

Digital inclusion and the European Accessibility Act: both a necessity and an opportunity for TMT players

Maria Tunberg, Principal

The transition to a more-digital world provides many new opportunities that can affect our everyday lives. However, the digital world is not accessible to all. Indeed, 8% of 16–74 year olds in the EU did not use the internet at all in 2021.[1] The digital divide is even greater on a global level: more than a third of the world's population (that is, 2.9 billion people) did not use the internet in 2021.[2]

The European Accessibility Act aims to improve digital inclusion

People with disabilities and the elderly are the most likely to be excluded from the digital world. Here, we take Sweden as an example, even though the country had one of the highest levels of internet usage in the EU in 2021.[1] Internet usage among various user groups in Sweden differs significantly. Only 6% of Swedish people aged 16 and above did not use the internet in 2021.[3] This figure grew to 20% among people with disabilities (of all ages) and to 33% among people aged 76 and above (Figure 1).

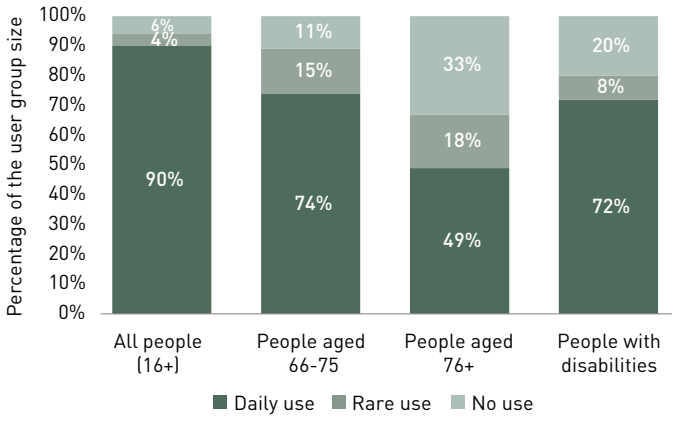

Figure 1: Internet usage among various user groups, Sweden, 2021[3]
[Source: Internetstiftelsen, 2021]

> Analysys Mason can provide TMT players with guidance about how to improve the digital accessibility of their products and services in order to adhere to the EAA

The European Accessibility Act (EAA) addresses the digital divide by aiming to improve the internal market in the EU for accessible products and services.[4] Improved accessibility will increase digital inclusion by helping people with disabilities to participate in our ever more digitalised society. The EAA is therefore a step forward in reducing the barriers for people with disabilities in the EU. The act will come into force in 2025 and will cover a range of products and services in the TMT sector, including computers and operating systems, smartphones, telephony services, TV equipment related to digital television services and e-commerce. The affected products and services must be designed and produced to fulfil a range of requirements with regards to accessibility, including the use of text-to-speech technology, the availability of instructions via more than one sensory channel and the provision of software and hardware for interfacing with the assistive technologies.

TMT players must start preparing now in order to be able to comply with the new act.

TMT players currently have a relatively limited understanding of the consequences of the European Accessibility Act

TMT players will face several challenges when integrating digital accessibility and inclusion into their businesses. The level of readiness varies, but in many cases, it needs to improve. Analysys Mason performed a study in 2021 on behalf of the Swedish Post and Telecom Authority covering the biggest telecoms operators in Sweden. The results show that operators' knowledge of the specific requirements of the EAA is still relatively limited. The results further highlight the importance of co-ordination and collaboration between different departments because complying with the EAA will involve legal/compliance expertise as well as technical and commercial knowledge. The costs and benefits of adhering to the EAA from a business perspective have proved to be difficult to estimate, thereby further complicating the planning and preparation process. However, our interview-based study that examined the consequences of EAA in Sweden concluded that there will be material costs.

Nonetheless, complying with the act is also expected to benefit TMT players. Improving the accessibility of products and services may bring additional revenue because more people will be able to make use of them. Expanding the customer base and improving the customer experience across the board provides TMT actors with further incentives to embrace digital inclusion.

Analysys Mason supports TMT players in improving their digital accessibility

Analysys Mason has performed a number of projects in the area of digital inclusion and accessibility and can provide TMT players with guidance about how to improve the digital accessibility of their products and services in order to adhere to the EAA. We have experience in supporting clients to integrate a user perspective throughout the development process, including methods such as usability testing. We have also developed a framework to perform cost/benefit calculations based upon our study of the costs and benefits of the EAA in Sweden.

Questions? Please feel free to contact Maria Tunberg, Principal, at maria.tunberg@analysysmason.com

[1] Eurostat (2021), Digital economy and society statistics – households and individuals. Available at: https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Digital_economy_and_society_statistics_-_households_and_individuals#Internet_usage.

[2] International Telecommunication Union (2021), Measuring digital development. Facts and figures. Available at: https://www.itu.int/en/ITU-D/Statistics/Documents/facts/FactsFigures2021.pdf.

[3] Internetstiftelsen (2021), Svenskarna och internet. Available at: https://svenskarnaochinternet.se/rapporter/svenskarna-och-internet-2021/.

[4] European Commission, European Accessibility Act. Available at: https://ec.europa.eu/social/main.jsp?catId=1202#navItem-1. European Commission, European Accessibility Act – Improving the accessibility of products and services in the single market. Available at: https://ec.europa.eu/social/BlobServlet?docId=14869&langId=en.

3b or not 3b: ex-ante regulation of wholesale FTTH in Denmark

James Allen, Partner

Background to ex-ante regulation of FTTH

In the EU regulatory framework for electronic communications (known as the European Electronic Communications Code or, more simply, the Code), national regulatory authorities (NRAs) have to define and review relevant markets susceptible to ex-ante regulation. They then have to impose one or more proportionate remedies on operators that are found to have significant market power (SMP). The European Commission provides a Recommendation on relevant markets; the latest iteration is from December 2020 and includes market 1, the market for "wholesale local access at a fixed location". However, many NRAs are still applying regulation from reviews undertaken according to the 2014 Recommendation on relevant markets, or have only just finished such reviews. The 2014 Recommendation contains (among others):

- market 3a, the market for "wholesale local access at a fixed location", where local access means interconnection at the main distribution frame (MDF) or optical distribution frame (ODF) and includes, for example, copper local-loop unbundling
- market 3b, the market for "wholesale central access at a fixed location for mass-market products" (that is, access via a more centralised, regional or national point of interconnection), which includes many bitstream services.

We are currently part way through a generational shift from copper to fibre services; as a result, the extent to which copper (xDSL) services and fibre services can be considered to be part of the same relevant market is changing over time. Indeed, it appears that where FTTH is available, many broadband customers in leading markets do not consider xDSL to be a substitute. When conducting their market reviews, NRAs are trying to safely navigate this tricky change in the market.

As part of their market reviews, NRAs in the EU are allowed to deviate from the Recommendation on relevant markets by proposing a different market definition, as long as they can show that the proposed relevant market will pass all parts of a so-called 'three-criteria test'. This requires that:

- there are high and non-transitory barriers to entry
- the market structure does not tend towards effective competition
- ex-post competition law would not be sufficient to address the market failure.

The recent DBA review regarding high-capacity services in Denmark has provided some interesting results

A market review process that has recently completed in Denmark concluded that the market definition for market 3 of the 2014 Recommendation should instead separate high-capacity services (FTTH and cable) from low-capacity services (copper, including DSL), and should not differentiate between local (3a) and central access (3b). The latter decision was based on the fact that in Denmark LLU has been largely superseded with (central) VULA services and that wholesale access to cable (which does exist in the Danish market) is only provided centrally. So, the answer to our Hamlet-inspired question is perhaps: "3b, but not as we know it".

This review has led to the following results.

- The Danish NRA, the Danish Business Authority (DBA), defined 21 sub-national markets for wholesale high-speed services based on the (mutually exclusive) electricity distribution areas of the regional electricity distribution utilities (many of which have built very extensive FTTH networks in their territory).
- The DBA found that an operator had SMP in 17 of the 21 sub-national markets; this was TDC in only 4 of these cases.
- The European Commission issued a 'serious doubts' letter relating to 5 of the 17 geographic markets in which SMP was found on the grounds that the so-called three-criteria test was not passed (mostly because there was considerable overlap with a competing high-capacity network) and/or that it disagreed with the finding of SMP. The DBA withdrew four of the decisions but defended the fifth; the Commission allowed this decision to stand after BEREC agreed with the DBA.
- There has been a mix of approaches in terms of remedies. Binding commitments (a new option under the Code) have been agreed for some of the SMP operators, while ex-ante remedies have been imposed for the others.
- Wholesale-only operators have been subject to slightly lighter remedies (access, non-discrimination and "fair and reasonable" prices), as is allowed under the Code.

> "Appropriate definition of the relevant market can separate declining copper services (in which the former incumbent is still likely to be the dominant player) from FTTH and cable

As a result, we will see ex-ante ('asymmetric') regulation of an altnet in many areas of Denmark. By contrast, and contrary to many years of regulation in fixed markets, the former incumbent TDC is the SMP operator in this wholesale high-capacity market in only 4 of the 21 geographic areas in the country. This ex-ante regulation of altnets is specific to Denmark and will not necessarily be adopted in other countries, where the facts are likely to differ (for example, as regards wholesale access, competing network coverage and perhaps consumer behaviour). Nevertheless, the DBA's decision shows that:

- operators with very high wholesale market shares of FTTH in discrete regions can be, and will be, regulated under the Code in certain circumstances, whether or not they were the monopolist pre-liberalisation (often called the 'former incumbent')
- appropriate definition of the relevant market can separate declining copper services (in which the former incumbent is still likely to be the dominant player) from FTTH and cable.

Similar cases are likely to occur in the next round of market reviews in other Member States, and operators and investors will need to understand the risks and implications.

Questions? Please feel free to contact James Allen, Head of Regulation, at james.allen@analysysmason.com

The Digital Markets Act proposes messaging interoperability, but this is easier said than done

Andrew Daly, Principal

The European Commission (EC) recently announced a provisional political agreement on the Digital Markets Act (DMA).[1] The act is expected to mandate interoperability between the online messaging services of large firms (known as 'gatekeepers').

Messaging is important in today's world: it has become a huge part of our everyday lives. For example, parents worldwide benefit from the collective insight of other parents via such messaging to know if their child needs a sports kit/costume/prop on a particular day. However, the devil is in the detail when requiring interoperability between messaging services, and the current (fragmented, non-interoperable) market for messaging may not be such a bad thing.

NIICS messaging has been more popular than SMS messaging for some time

The EC defines Number Independent Interpersonal Communications Services (NIICS) as interpersonal communications services that do not connect with publicly assigned numbering resources.[2] WhatsApp, iMessage, Facebook Messenger, Telegram and Signal are all examples of NIICS. These services offer a range of forms of communication (including voice and video calls), but the dominant mode of use, especially on mobile devices, is messaging. NIICS messaging has long overtaken traditional SMS messaging in terms of volume. Indeed, we forecast that the number of NIICS messages sent worldwide will be 40 times the number sent via SMS by 2025.[3] This difference in volume is driven by the following factors.

- NIICS offers better functionality than SMS (messages are not limited to 160 characters and rich characters such as emojis can be included).
- Group messages contribute significantly to traffic levels.
- Demographics play a key role: younger users have a preference for NIICS over traditional services.

'Multi-homing' is another dynamic that is prevalent in the NIICS market. Users will typically be active on more than one of these services and will hold accounts for multiple services on a single device. Our illustration of this dynamic for some major NIICS is shown in Figure 1.

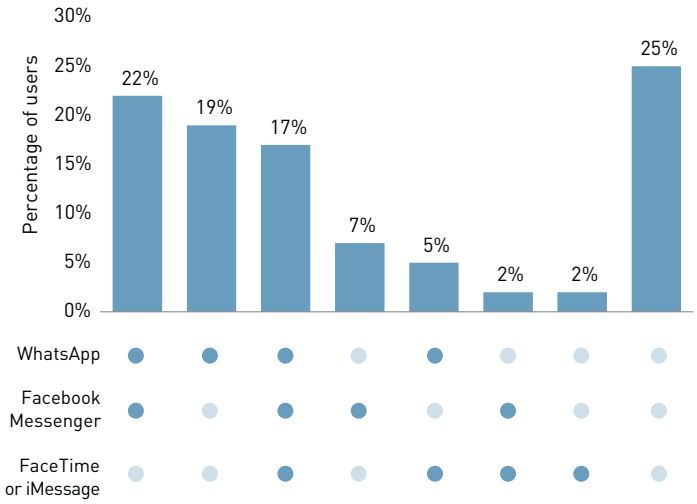

Figure 1: Use of the major NIICS, UK, 2021
[Source: Analysys Mason, 2022]

> It is interesting to consider whether the current structure of the messaging market is actually creating harm for consumers

Group network effects have a significant impact on preserving market share

Data on the market share of message volumes for each of the NIICS is not publicly available, but we know from our primary research that WhatsApp has the largest share of user accounts in the UK. The 'network effects' that are prevalent on these types of platforms are a major driver of WhatsApp's success. The classic definition of network effects is that the value to an individual user is increased with a greater number of users taking the service. Network effects in NIICS take an additional form relating to the dynamics of group chat. Once in a group (which may itself be quite small), a user is likely to face substantial inconvenience to move to another service (since all members of the group would also have to move). Group chats therefore encourage users to stay with a particular NIICS provider. Nonetheless, conventional network effects are still relevant: the larger the user base on a particular messaging service, the more likely it is that potential group members will already have an account with a particular NIICS provider when the group is set up.

WhatsApp does face competition from other NIICS platforms, but so far, this competition has not been sufficient to affect its market position. WhatsApp has been able to implement features that are similar to those offered by rival services ('feature parity'), and this has been sufficient to avoid any mass migration away from the platform. Indeed, even previous concerns over changes to the WhatsApp privacy policy did not appear to do much to dent WhatsApp's lead.

The DMA is expected to require interoperability between NIICS

The DMA is expected to require interoperability between NIICS. In particular, according to the European Commission press release, "the largest messaging services (such as WhatsApp, Facebook Messenger or iMessage) will have to open up and interoperate with smaller messaging platforms, if they so request". This proposal would seem to be a simple solution to the high market share of certain NIICS, but the implementation could come with some challenges.

- The nature of the interconnection between NIICS is critical. It is expected that the act will initially only require interoperability for one-to-one messages; the interoperability of group chats is likely to be required at a later date. As such, the act is unlikely to materially affect the current 'group-based' dynamic in the market straight away. It also remains to be seen whether the requirement for one-to-one interoperability will usefully contribute towards group interoperability. One-to-one interoperability could possibly be addressed using a simple forwarding function, but group interoperability could be a more complex issue to solve.
- End-to-end encryption is part of the appeal (and marketing) of some NIICS. As has been reported,[4] there could be some complexity in achieving end-to-end encryption between groups of users across multiple applications, which implies a degree of risk that this encryption may be more easily subverted. Interoperability could require encryption keys to be shared outside of an individual app, which at the very least would require standards for sharing keys. This could also raise questions about which apps are qualified to gain access to the keys and whether hackers could use this procedure to gain access to message content.
- It is also important to assess how considerations around privacy will play out in a world with interconnecting messaging services. For example, a user may become unhappy with the privacy policy of large messaging provider A (because even with end-to-end encryption, they can see who is being messaged and when). The user may then change over to small messaging provider B. The change can be done easily because interoperability means that the user can still be part of the same groups (once interoperable groups are implemented). However, messages are now moving between platforms A and B, so can the user be confident that provider A cannot see any information about the traffic? Even if this could be solved technically, would the user trust that it was solved, or would they try to persuade their contacts to also move to platform B (thus defeating the need for interoperability)?
- There are other considerations around new features and differentiation. Would all features be in the scope of interoperability? For example, if one platform allows unicorn emojis in three different shades of pink, do all platforms need to render the same three shades? If large platforms effectively have to share any innovations they deploy, could this reduce their ability and incentive to innovate, and would this be a better outcome for consumers overall?

It is not clear at this stage the extent to which the above points will transpire to be material issues, or whether the industry can find pragmatic solutions in each case. However, it is interesting to consider whether the current structure of the NIICS market is actually creating harm for consumers. Services such as WhatsApp and iMessage provide end users with easy, secure and feature-rich communications. Multi-homing and feature parity keep the large operators 'in check', and many services are free to use with no likelihood of that changing. Ultimately, if there was a material reduction in service quality or privacy from a current messaging provider, users could choose to migrate to another platform.

The requirement to offer interoperability between messaging services creates a range of complex issues. This will require service providers and regulators to work closely together to make sure that a positive outcome overall is delivered for consumers.

Analysys Mason has wide-ranging expertise in supporting stakeholders across the internet value chain. For further details and to discuss any aspect of the technology and economics of digital communications, please contact Andrew Daly, Principal.

Questions? Please feel free to contact Andrew Daly, Principal, at andrew.daly@analysysmason.com

[1] European Parliament (2022), Deal on Digital Markets Act: EU rules to ensure fair competition and more choice for users. Available at: https://www.europarl.europa.eu/news/en/press-room/20220315IPR25504/deal-on-digital-markets-act-ensuring-fair-competition-and-more-choice-for-users.

[2] European Union (2018), Directive (EU) 2018/1972 of the European Parliament and of the Council of 11 December 2018 establishing the European Electronic Communications Code (Recast)Text with EEA relevance. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32018L1972.

[3] For more information, see Analysys Mason's DataHub.

[4] The Verge (2022), Security experts say new EU rules will damage WhatsApp encryption. Available at: https://www.theverge.com/2022/3/28/23000148/eu-dma-damage-whatsapp-encryption-privacy.

Robust contractual agreements underpin the success of telecoms infrastructure carve-outs

Makram Chehayeb, Manager

The number of telecoms infrastructure carve-outs (either of existing infrastructure to an infraco or similar deals relating to financing of future roll-outs by an infraco) has increased recently. Operators are seeking to create additional value for their shareholders and infrastructure investors are seeking to invest in projects with predictable long-term returns. The success of these transactions relies on a robust review of the market and technical and business plans and also depends on the negotiation of numerous contracts between infracos, operators and suppliers. It is crucial that these contracts and the key clauses are reviewed by expert advisers with the appropriate commercial and technical knowledge. Analysys Mason has considerable experience in this area.

Multiple contracts define the relationship between the infraco, the operator and their suppliers. The set of key contracts is similar across the asset classes that are being carved out (mobile towers, fibre assets, data centres), but some contracts are specific to brownfield transactions whereas others are specific to greenfield transactions (Figure 1).

Contract	Type of transaction	Parties to the contract
Shareholder agreement	Brownfield and greenfield	Infrastructure investors and operator
Share purchase agreement	Brownfield	Infraco and operator
Asset purchase agreement	Brownfield	Infraco and operator
Master service agreement	Brownfield and greenfield	Infraco and operator
Roll-out/deployment agreement	Greenfield	Infraco and operator or infraco and supplier or tripartite agreement
Maintenance agreement	Brownfield and greenfield	Infraco and operator or infraco and supplier or tripartite agreement

Figure 1: Non-exhaustive list of key contractual agreements relevant to carve-out transactions [Source: Analysys Mason, 2022]

> At Analysys Mason, we help clients to critically review the commercial and technical clauses of the contracts that can make or break infrastructure carve-out transactions

Shareholder agreement. This agreement defines the rights and obligations of an infraco's shareholders, the issue and distribution of shares, minority shareholder protections and the constraints (if any) regarding future changes in the shareholding structure. This agreement typically does not require material inputs from commercial/technical advisers.

Share purchase agreement. This agreement defines the transfer of all, or part of, the shares of the carved-out infraco to the infrastructure investor. The agreement includes the legal definitions of terms (some of which relate to the assets being transferred) and could include appendices that enumerate the assets included within the infraco's perimeter and the remainder of the carve-out plan that is envisaged (if the carve-out is not completed yet). The technical/commercial adviser should play a key role in reviewing the consistency of relevant legal definitions in the contract and ensuring that the asset and carve-out plan schedules are in line with the agreed transaction perimeter.

Asset purchase agreement. In situations where the carve-out plan is not expected to be completed when the infrastructure investor and the operator sign the agreement, an asset purchase agreement is required to define the terms of the transfer of the remaining assets. The clauses and schedules in the contract that are particularly important for the technical/commercial adviser to review relate to the perimeter of assets being transferred. It is crucial that the asset perimeter is defined correctly, in line with the agreed transaction perimeter, and that the definition does not omit important assets that would be required for the operations of the infraco (for example, fibrecos would need to know if ducts and poles are partially included or fully included in the perimeter, or towercos would need to know if shelters are included etc.)

Master service agreement. This agreement defines the services offered by the infraco to the anchor tenant operator and the terms on which such services are offered. Key clauses in the master service agreement that require the technical/commercial adviser's review include the duration and renewal terms of the agreement, the volume commitments by the operator, the scope and prices of the different services, the potential indexation mechanism, the sharing of regulatory risks (where applicable), service-level agreements (SLAs) and contractual penalties. Typically, infracos aim to maintain a lean structure and hence tend to outsource most of their operations to the operator or other suppliers. In that context, it is also critical to review the infraco's obligations (SLAs) that are defined in the master service agreement and ensure that these are appropriately transferred to other contracts with the providers to which those services will be outsourced.

Roll-out/deployment agreement. This agreement defines the terms that govern the deployment of physical infrastructure. The deployment agreement could be an agreement between an infraco and the anchor tenant operator, whereby the operator subcontracts the deployment to one or more suppliers and provides the services on a turnkey basis to an infraco. Alternatively, the contract could be signed between an infraco and the supplier(s) directly or in some cases the agreement could be a tripartite agreement between an infraco, the operator and the supplier(s). In all cases, the agreement will contain key clauses that the technical/commercial adviser should review. These include:

- the volume commitments to assess the risk relating to the pace of roll-out as defined in the business plan
- the price mechanism (for example, fixed price per premises for FTTH or per base station type for towercos, or a variable price structure) to assess the risk of cost overruns
- the SLAs by which the supplying party should abide (and relevant contractual penalties)
- the process by which a roll-out target is defined, and the high- and low-level design processes.

Maintenance agreement. Maintenance is one of the key services that the infraco generally outsources. The maintenance agreement typically includes clauses relating to the scope of the maintenance services, the prices at which these are offered and the pricing mechanism (fixed or variable) and the indexation of these prices. The agreement also includes SLAs and contractual penalties. This is another contract that should be critically reviewed by the technical/commercial adviser to ensure that the scope of services is properly defined, the prices are in line with what has been assumed in the business plan and that the SLAs and contractual penalties are in line with industry best practices and allow for the successful operations of the infraco.

In all carve-out transactions, contractual negotiations are a key component of the binding offer proposal submitted by bidders. They can make or break a deal. At Analysys Mason, we can complement our unmatched experience of commercial and technical due diligence projects in the telecoms industry with an in-depth contractual review. We have, in fact, helped many clients to critically review and successfully negotiate commercial and technical clauses in all of these key contract types, paving the way for a fruitful and successful long-term relationship between the operator and the infraco.

Questions? Please feel free to contact Makram Chehayeb, Manager, at makram.chehayeb@analysysmason.com

Active sharing: a way of delivering 5G ROI, or a technological and operational hazard?

Rohan Dhamija, Managing Partner, Nick Edwards, Principal and Vishesh Sinha, Associate Consultant

The challenge of achieving a return on investments in 5G technology and services

In developing markets, low ARPU leads to challenges for operators that want to realise a reasonable return on investment (ROI) in 5G. Even in developed markets with more-favourable customer economics and relatively earlier adoption of newer technologies, the case for 5G remains challenging.

The 5G business case is difficult to justify in many countries for several reasons. On the cost side, 5G spectrum can be expensive, with as much as 100MHz required to achieve optimal network performance. Furthermore, 5G involves high network equipment capex and opex. On the revenue side, ARPU uplift is limited and add-on revenue use cases will be rare in the near-to-medium term. As a result, the 5G business case is anchored to defending market share until demand increases network capacity requirements to the point that 5G becomes the only cost-effective network solution.

Active sharing can lead to significant savings for MNOs, if done right

Active sharing can nearly halve the number of physical sites required for sharing operators to deploy an equivalent number of PoPs. In a 5G-only sharing scenario, our estimates suggest that the aggregate savings potential from launching 5G via active sharing, range between 18% and 35% (compared with a no-sharing scenario). Further, if the full technology stack is shared (that is, all technologies, not just 5G, are actively shared), then the savings could be more than 40% compared with a non-sharing scenario (although these savings depend on the state of the existing legacy networks).

Active sharing can be done in a variety of ways

Key dimensions for active sharing include geography, depth of sharing and 5G technology.

Operators can share full national networks, or limit sharing to particular geographies

Sharing the network across an entire nation enables operators to achieve maximum savings by minimising duplication on network and operation and maintenance (O&M) services. On the other hand, limiting the network sharing to non-dense-urban areas can help operators to maintain their ability to differentiate on coverage and quality of service in the more-lucrative dense-urban areas, while still benefiting from reduced cost in less-lucrative non-dense-urban areas (where the business case for 5G is the most debatable). In addition, traffic density is typically higher in dense-urban areas, where spectrum and equipment can be more-efficiently utilised, and the savings from sharing are therefore reduced; at most, instead of two sites shared 50:50, there could be one site for each operator providing the same total capacity.

> Active sharing could help operators to increase the pace and extent of 5G deployments by reducing the capex and opex requirements associated with launching 5G

Possible network sharing arrangements depend on the preferred depth of sharing

Different possible modes of network sharing include the following.

- **Multi-operator RAN (MORAN)** entails sharing the RAN equipment and the passive infrastructure; spectrum is not shared or pooled. Of all the active sharing modes, MORAN gives operators the best opportunity to differentiate on QoS
- **Multi-operator core network (MOCN)** goes a step further; operators run their network on a common RAN and a shared pool of spectrum. Spectrum pooling can be efficient and have benefits for operators but the implementation of a MOCN arrangement depends on the regulations around spectrum sharing.
- **Gateway core network (GWCN)** involves operators sharing the core network. However, the incremental savings from sharing core networks are limited and, as a result, GWCN is generally not preferred by operators.

Choosing between these three options does not typically have a large impact on savings, but is rather a decision based on preferred level of integration between operators as well as the regulators acceptance of deeper integration.

The mode of 5G deployment –non-standalone (NSA) or standalone (SA) – is a key design decision for a shared network

5G NSA involves the use of a shared core (4G ePC or 5GC) to connect both the 4G (LTE) and 5G (NR) radio networks and for the LTE and NR radio networks to connect with each other; 5G SA features an NR network that is independent of a 4G network and in all likelihood relies on a 5GC. Operators inmost countries are using the more incremental 5G NSA approach, given that it can support more extensive coverage, the most common 5G use cases such as eMBB and FWA, and can be deployed more rapidly than 5G SA. However, in the context of active sharing, 5G NSA poses a major challenge. Launching 5G NSA with active sharing requires operators to use the same vendor in their 4G and 5G cores, which is a major constraint in most countries (Figure 1). However, operators in Norway, South Korea and Sweden have launched 5G NSA via active sharing arrangements.

In cases where the 4G vendor mismatch between operators is limited to a small number of sites, there are some possible workarounds such as deploying an anchor LTE layer and using open X2 interfaces, which can enable the operators to launch 5G NSA with active sharing with minimal investment.

However, if the scale of vendor mismatch on the operators' 4G networks is high, then the operators are better off opting to launch 5G SA with active sharing. The X2 interface is not needed in 5G SA, removing the need for vendor interoperability. As of 2021, 93 operators in 52 countries have begun investing in building 5G SA networks and 22 operators in 17 countries, including China and Singapore, have launched 5G SA networks.[1]

Active sharing depends on trust and transparency between operators to address operational challenges

A reduction in the required number of sites per operator and sharing opex increases the viability of the 5G business case. The reduced upfront investment and improved business case can lead to quicker and more extensive 5G network deployments While there are some complexities associated with active sharing, there are feasible work arounds with slightly reduced, but still very positive potential savings, as evident from the solutions around the vendor interoperability issue with 5G NSA.

Despite the benefits, it is crucial to note that active sharing involves major operational co-ordination between the participating operators. As a result, apart from the decisions on the various dimensions of launching 5G via active sharing, the level of trust and transparency between the operators will play a pivotal role in deciding the success of such an agreement.

Analysys Mason has assisted operators in many countries to assess active sharing in the context of 5G deployment and we are well-equipped to support operators in overcoming any barriers and realising the full potential of the 5G business case.

Questions? Please feel free to contact Rohan Dhamija, Managing Partner, at rohan.dhamija@analysysmason.com, Nick Edwards, Principal, at nick.edwards@analysysmason.com or Vishesh Sinha, Associate Consultant, at vishesh.sinha@analysysmason.com

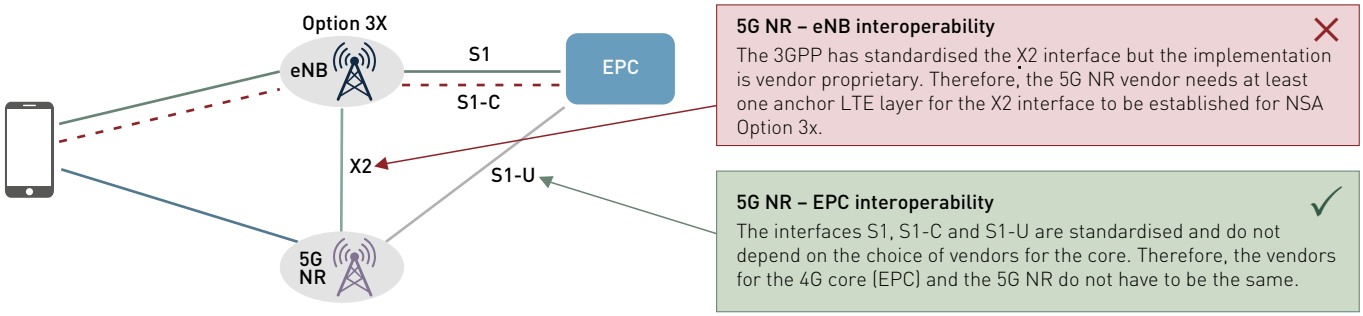

Figure 1: Vendor interoperability constraints in 5G NSA [Source: 3GPP, Parallel Wireless and Analysys Mason © 2019 - 3GPP™ deliverables and material are the property of ARIB, ATIS, CCSA, ETSI, TSDSI, TTA and TTC who jointly own the copyright in them. They may be subject to further modifications and are therefore provided to you "as is" for information purposes only. Further use is strictly prohibited.]

[1] GSACOM.

Open RAN vendors have an opportunity with private networks, regardless of their success with public 5G

Caroline Gabriel, Research Director

Emerging Open RAN platforms promise to provide a standards-based way to implement virtualised, multi-vendor mobile networks. This could open up the close-knit RAN supply chain and provide operators with a wider choice of vendors, architecture and price points. In this article, we examine the first markets in which Open RAN is likely to gain large-scale adoption, and explain why the biggest near-term opportunities lie in the private wireless space.

Open RAN promises to provide a path to virtualised networks and could also end vendor lock-in

Organisations such as the O-RAN Alliance have defined the Open RAN architecture to provide a unified way for operators to deploy disaggregated networks. In these networks, the tightly integrated base station is broken apart. Digital baseband functions are run in software, which is disaggregated from the underlying hardware. The baseband is also disaggregated from the radio/antenna equipment; this equipment remains on the cell site, while the baseband can be located remotely and can be further split into a centralised unit in the cloud and a distributed unit that handles low-latency functions.

In Open RAN, the interfaces between all these different elements are standardised. This means that hardware and software from different suppliers can interoperate and that operators can select the best solution for each individual function.

This could enable a wide variety of hardware and software suppliers to enter the mobile infrastructure market for the first time, thereby releasing operators from vendor lock-ins and easing their path to the agile cloud-native RANs that can support the diversity of 5G use cases. However, the disaggregation of network functions increases complexity in areas such as performance validation and assurance testing, which are currently exacerbated by the immaturity of solutions.

Open RAN-related challenges in 5G macro networks will take years to address

Open RAN architecture is very immature, so there are several reasons why it will not be widely adopted in mobile operators' macro networks for at least 3–4 years.

- Most commercially available solutions currently focus on one interface only: the open fronthaul connection between the radio unit and the baseband. Solutions that can support the full architecture without significant customisation or integration are limited in number, and most operators will wait for greater choice.

- Many operators have only recently invested in conventional 4G network expansion or 5G network roll-outs. This reduces their motivation to invest rapidly in Open RAN, especially because interworking with conventional RANs remains challenging.

- Several technical challenges need to be addressed before the Open RAN will be able to support the most-demanding 5G use cases without significant systems integration effort and cost. For instance, the processor-intensive Layer 1 functions of the network are very difficult to implement on standard open servers.

Open RAN vendors will find near-term opportunities in private cellular deployments, and may create their own ecosystem

Some operators (mainly greenfield operators such as Rakuten Mobile) are prepared to invest significantly in a customised solution in the short term. However, these operators are not sufficient in number to enable all the vendors targeting Open RAN to build strong revenue streams. There is therefore a risk that many smaller innovators will not survive the wait for the platform to catch up with the needs of other large MNOs, which is a further risk to future adoption.

> Open RAN solutions for private networks may be ready for commercial deployment in 2022, rather than 2025 or later

As such, most Open RAN vendors will focus on areas where there is pent-up demand, and where first-generation Open RAN solutions will be capable of supporting most of the use cases. These include rural coverage projects and, more significantly in terms of commercial potential, private cellular deployments. Doing this can also mitigate the risk identified above of smaller innovators leaving the market before the challenges of wider adoption are addressed.

Our private LTE/5G networks forecast highlights the revenue growth potential in the enterprise 4G and 5G space. Open RAN, especially when combined with shared or industrial spectrum, can help to enable a diversity of private wireless deployers, which will be important to meet the varying use cases and roll-out scenarios of different enterprises. Open RAN deployment in private networks also promises to make private cellular networks more easily deployable and manageable due to open reference designs that are akin to those used in enterprise Wi-Fi. Opening up the ecosystem to new vendors means that a wide range of solutions can emerge that are optimised for various price points, physical environments and use cases, so those deploying networks can select the best price/performance characteristics for their customers.

Open RAN solutions for private networks may be ready for commercial deployment in 2022, rather than 2025 or later. Nearly all enterprise networks have lower and more predictable traffic loads than 5G urban public networks, and are geographically constrained. The network is critical to enterprises' business, but it will rarely need to support the same density of devices using high-bandwidth applications in a given location as a public network would, so the processing burden on the platform will be considerably lower than that in the macro RAN.

The private cellular network market, then, provides two advantages for Open RAN developers.

- There are signs of rising demand for cellular networks from organisations that will want a lower-cost, simpler solution than the more complex and customised private networks commissioned by the largest enterprises, which could be addressed by Open RAN. Assuming this demand materialises, it will provide a greenfield market with no incumbency for traditional cellular equipment vendors.

- Most of the current performance requirements for private cellular networks can be met by first-generation Open RAN designs, thereby generating near-term revenue for new Open RAN players.

The private cellular opportunity mitigates the risk for vendors that Open RAN will miss its chance entirely in the macro network market (either because performance and other challenges take too long to address, or because most MNOs feel safer with their established vendors). Some alternative suppliers could build a profitable business in the private cellular sector alone. Indeed, we forecast that Open RAN will account for 71% of all small cells deployed in the private enterprise sector in 2026, and 91% of the virtualised small cells (Figure 1). There is no particular reason why the private enterprise network market and the public macro network market should share the same architecture and ecosystems, given their contrasting requirements and economics. Open RAN, regardless of its fortunes in non-greenfield public 5G networks, may prove to be the catalyst for a parallel ecosystem to emerge to support private cellular platforms and operators, which may bear a stronger resemblance to the Wi-Fi industry than to the conventional 5G RAN ecosystem.

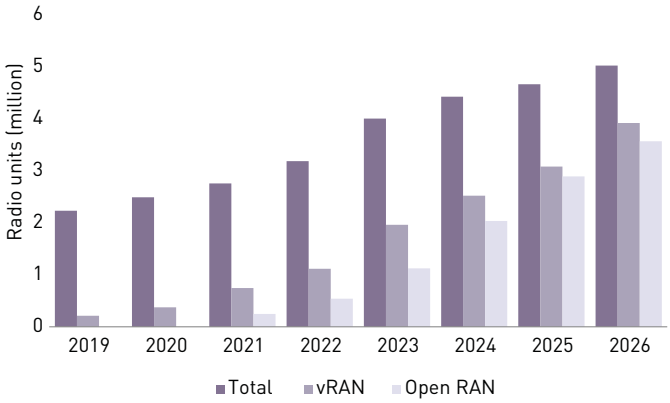

Figure 1: Forecast deployment of radio units in private enterprise networks by network architecture, worldwide, 2019–2026
[Source: Analysys Mason, 2022]

Analysys Mason offers consulting and research on the wireless market, including Open RAN.

Questions? Please feel free to contact Caroline Gabriel, Research Director, at caroline.gabriel@analysysmason.com or Janette Stewart, Partner, at janette.stewart@analysysmason.com

Northern Sky Research (NSR) to become part of Analysys Mason

Analysys Mason, a world-leading management consultancy focused on telecoms, media and technology (TMT), today announced the acquisition of Northern Sky Research (NSR), a specialist satellite and space research and consulting firm.

Founded in 2000, NSR is a prominent global provider of satellite and space market research and consulting services specialising in the analysis of growth opportunities across four core industry sectors: satellite communications, satellite & space applications, financial analysis and satellite & space infrastructure.

The combination of NSR's industry-leading satellite and space expertise and Analysys Mason's strong international market position in the TMT sector will provide an exceptional breadth of services to new and existing clients worldwide, underpinned by a unique knowledge base spanning 5G, fibre and satellite platforms.

"We have long admired Christopher and the NSR team for their world-class analysis and insights in the satellite and space industry and are delighted to welcome them to Analysys Mason." says Bram Moerman, Executive Vice Chair, Analysys Mason. "At a time when 5G and satellite technologies and investment models are converging with disruptive effect, this acquisition couldn't be more timely, and puts us in a unique position to advise our clients on these important developments."

Christopher Baugh, founder and CEO of NSR said, "We are very excited to be joining Analysys Mason. Against a backdrop of accelerating integration of terrestrial and satellite networks, as well as the rapid expansion of space activities worldwide, our combined knowledge and track record provides a tremendous opportunity to enhance our position globally as a satellite and space research and consulting provider."

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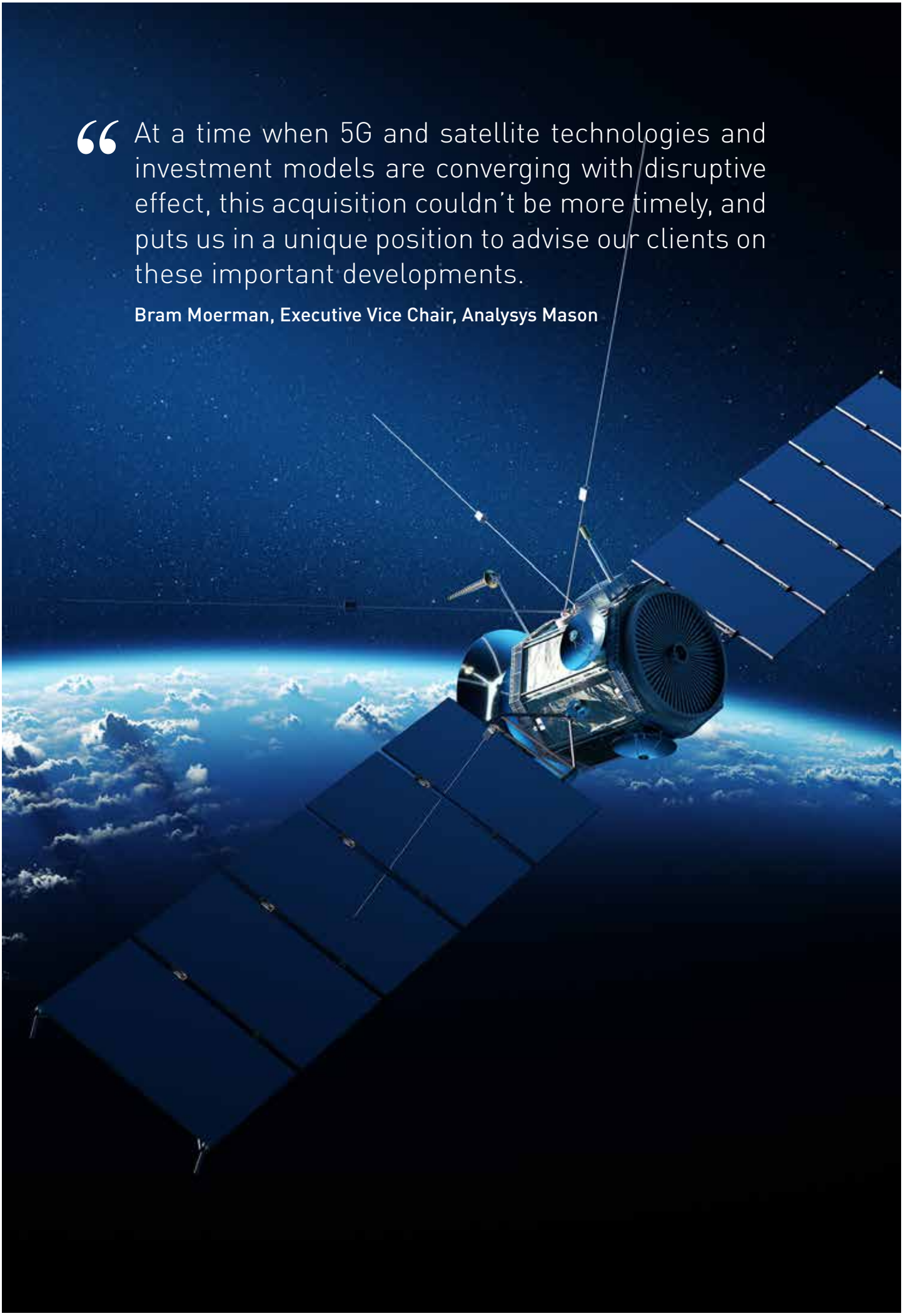
> **Christopher Baugh, founder and CEO of NSR**



> At a time when 5G and satellite technologies and investment models are converging with disruptive effect, this acquisition couldn't be more timely, and puts us in a unique position to advise our clients on these important developments.
>
> **Bram Moerman, Executive Vice Chair, Analysys Mason**

Global leaders in TMT management consulting

Analysys Mason is the world's leading management consultancy focused on telecoms, media and technology (TMT). We give clarity and confidence in answering our clients' biggest commercial questions: What strategy will best enhance value? What implementation plan will be most successful? What is the optimal positioning for five years' time?

We bring together commercial and technical expertise across four interconnected consultancy practices strengthened by globally respected research:

- **Strategy**

  We cover all aspects of strategy development and review based on a highly analytical and data-driven approach. Our propositions include corporate growth strategy (organic and inorganic), business unit strategy (including consumer and enterprise products), and infrastructure strategy (including capex optimisation through data analytics).

- **Transaction support**

  We provide robust commercial and technical due diligence support for TMT debt and equity financing, M&A and IPO processes. We support the full M&A cycle from opportunity scouting through to post-merger integration.

- **Transformation**

  We help structure and operate major IT, digital and business transformation programmes. We also have deep expertise around what it takes to avoid the pitfalls of and maximise the success of complex change programmes.

- **Regulation and policy**

  We play a leading role in helping to formulate and examine policy and regulation related to TMT. We support governments, regulators and the whole telecoms sector in a rapidly changing world increasingly shaped by digitalisation.

- **Subscription research**

  We evaluate the key topics driving the TMT industry and quantify the impact on operators and vendors worldwide. Clients rely on our research as an essential resource for strategic planning, investment and benchmarking.

Global reach, local insight

Our advice is rooted in deep domain knowledge that combines global reach and local insight into markets to help our clients achieve their goals. Our service offerings are fully integrated across all five key strengths. This allows us to make sense of a complex TMT landscape and create valuable insights in ways that cannot be matched by narrower domain specialists or generalist consultants that lack our depth of experience.

Working with private- and public-sector clients in 140+ countries, we are committed to advancing TMT's role as a critical enabler of global economic, environmental and social transformation – and to contributing to a world where technology delivers for all.

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