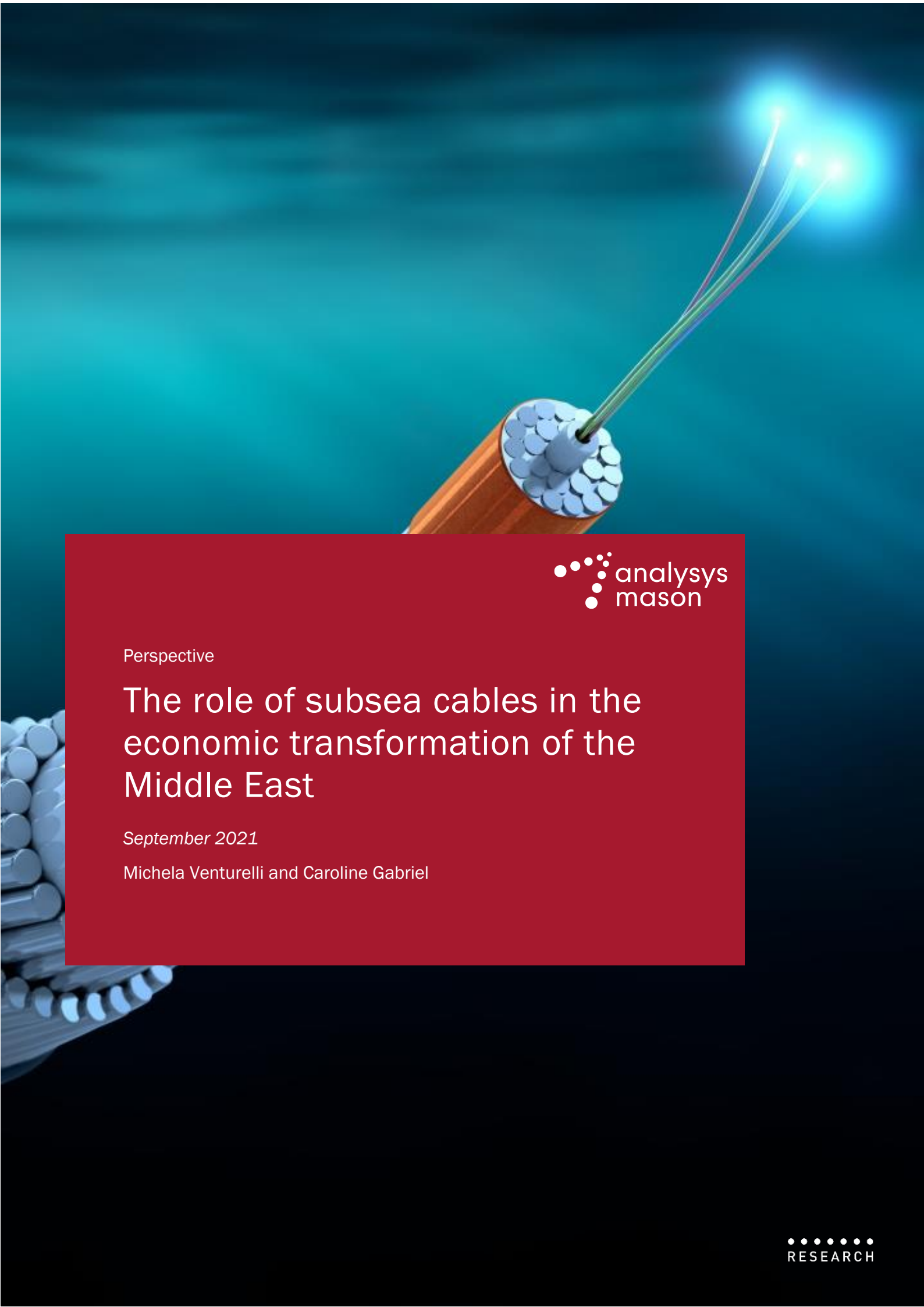

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Perspective

The role of subsea cables in the economic transformation of the Middle East

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RESEARCH

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1. Executive summary

Individuals and businesses worldwide are consuming increasingly more digital content and services, and a high-quality network infrastructure is required to support this growing demand for international connectivity. The deployment of subsea cables is helping to meet this demand, and new technologies have been developed to improve the capacity and latency performance that these systems can provide. A remarkable amount of recent development of subsea cable networks has been taking place globally, including in the Middle East, which has become a hub for international connectivity because of its strategic geographical position.

The rising use of technologies such as cloud computing and mobile broadband in every aspect of business and personal life is creating a fully connected digital society, for which access to reliable connectivity is essential. This has made coverage and capacity expansion – enabled by subsea cables – essential. However, modern services have more-advanced requirements. The introduction of 5G network technology, and the advanced use cases that it supports, is leading to a shift in the role that subsea cables play: formerly seen as the foundation of universal broadband access, they are now also becoming the enabler of business-critical services. The investment in submarine cables, which was previously driven by the need to improve access to low-cost, high-bandwidth international connectivity, is now driven by the demand for high-quality connectivity.

The submarine fibre market will continue to grow through the 2020s, which means that the role of subsea cables is more important than ever. Huge technological improvements have enabled cable system owners to improve the performance of the transport network, both in terms of capacity and latency. This is a key enabler of new applications, and new technologies provide a range of business opportunities for both wholesalers and enterprises. In particular, the availability of low-latency connectivity is critical for enabling wholesalers to provide innovative, differentiated and specialised services to consumers and businesses. Examples of such services include advanced gaming, as well as emerging applications such as augmented reality (AR) and virtual reality (VR), which are critically dependent on low latency. The importance of low-latency connectivity will increase in conjunction with enterprises' growing reliance on connectivity services for achieving critical business goals.

The investments being made in subsea cables are having a positive impact on the connectivity ecosystem across the Middle East. Wholesalers in the Middle East must understand how they can maximise the benefits of the new generation of subsea cables, including making preparations to support a huge diversity of potential use cases, each with its own connectivity requirements, its own ecosystem and its own challenges. This will enable wholesalers to develop new business models and create new revenue streams, and by expanding their offerings and targeting new customers and verticals, they can ultimately win a larger share of the connectivity market.

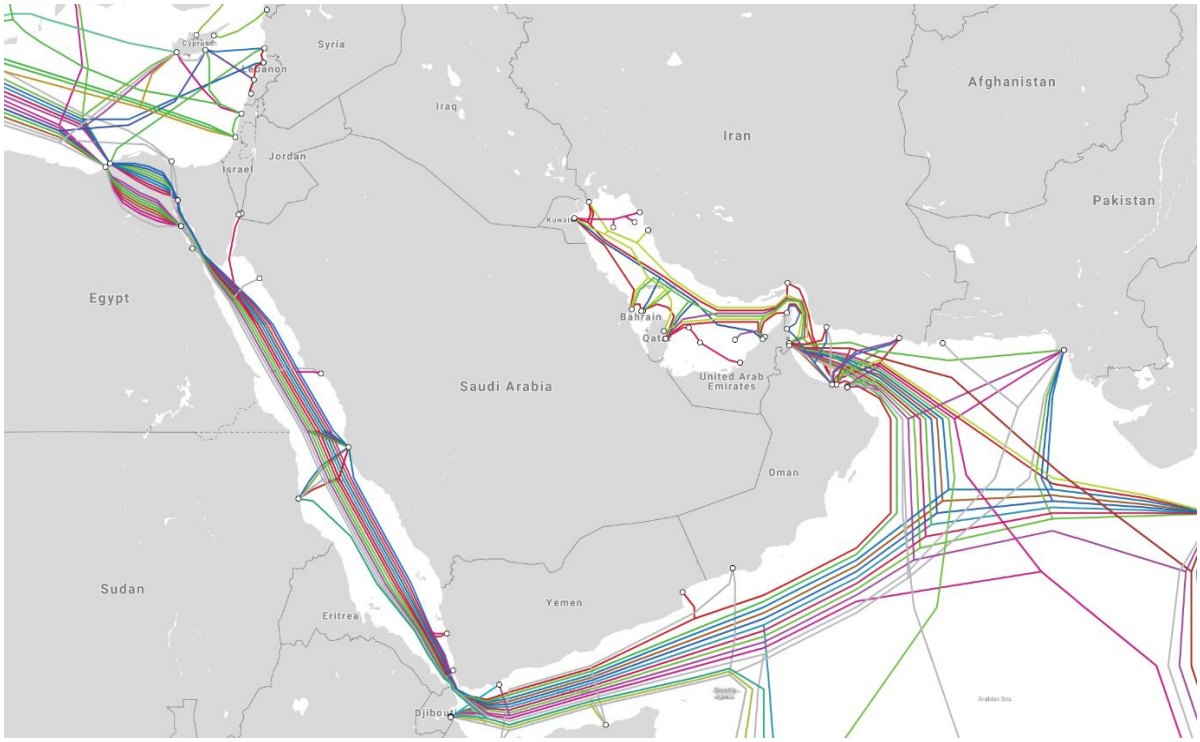
Connectivity improvements have a significant economic impact on every sector of the economy. The value of subsea cable connectivity has been demonstrated in numerous socioeconomic studies, which have shown how this technology has been a catalyst for economic growth and globalisation. Subsea networks facilitate affordable, good-quality internet access and are therefore identified as an enabler of ICT diffusion, higher investment in mobile broadband infrastructure and datacentre and, more generally, long term economic and social development. In developed regions, such as the Gulf Co-operation Council (GCC) states, new opportunities can arise from high-quality connectivity delivered via subsea cables. These include a strong base for start-ups focused on new use cases and the creation of a digital hub and ecosystem, that can enable advanced services for larger neighbouring economies. The latter will be essential for the development of the region and the consolidation of its role as global connectivity hub.

2. Introduction

Subsea cables form the backbone of modern communication and are of vital importance to economies across the world. They carry most of the data and voice transmissions globally and the impact that they have had on social and economic development has been demonstrated in many studies, highlighting the important relationship between high-quality connectivity and economic growth.

In the Middle East, the need for reliable internet connectivity and widespread infrastructure has driven the regional deployment of a robust submarine cable network, which has become a connectivity route between Europe, Asia–Pacific and Africa, an area of critical importance in terms of network redundancy.

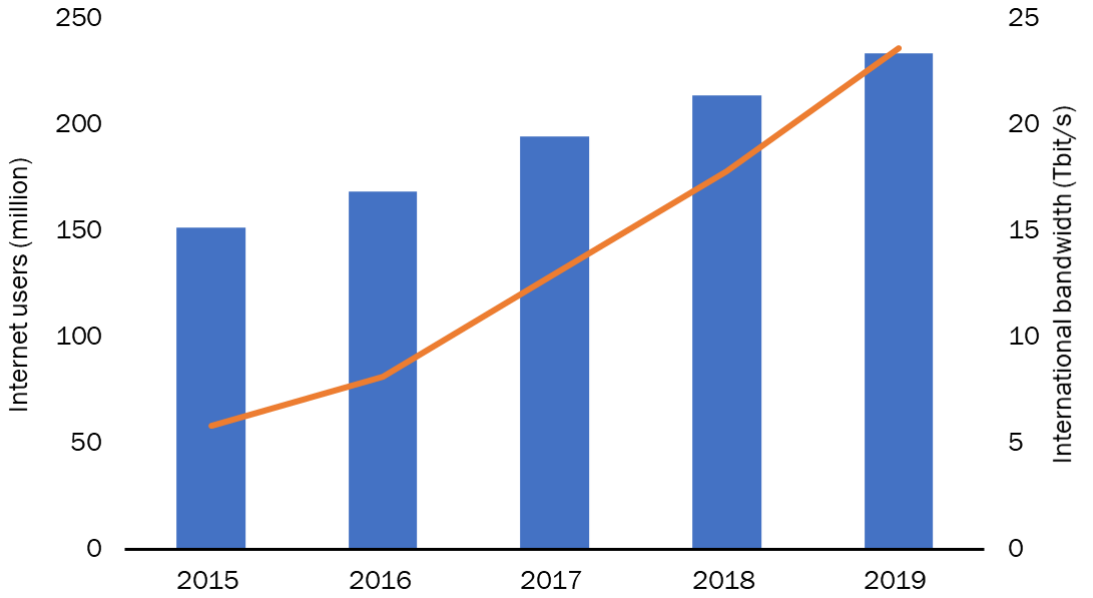
Figure 2.1: Subsea cables map in the Middle East



Source: TeleGeography, 2021'

In the member states of the Gulf Cooperation Council (GCC), the estimated number of individuals using internet grew at a CAGR of 8% from 38 million in 2014 to 56 million in 2019, while in the same period, the use of international bandwidth increased at a CAGR of 46%, which indicates the rising user demand for more capacity. Fulfilling this expanding flow in cross-border data are currently more than 30 undersea cables in service in the Middle East and North Africa (MENA) region, and more than 390 globally.

Figure 2.2: International bandwidth and number of individuals using internet in the GCC region



Source: Analysys Mason

The number of submarine cables per country varies considerably across different economies in the Gulf, depending on the size and population of the country, but all members states of the GCC are currently connected with at least four international submarine cables. UAE is currently connected to 16 cables, while Saudi Arabia and Oman have 12 cables. Bahrain, Kuwait and Qatar, the three smaller and less populous member states of the GCC, have fewer cables landing on their coasts: four cables landing in Bahrain and Kuwait, and six in Qatar.

The number of landing points in the GCC is expected to increase in the next 5 years as new subsea cables are under construction. For example, one more subsea cable will land in UAE and Oman (Africa-1 by the end of 2023 and 2Africa in 2023/2024, respectively), while two more will land in Saudi Arabia.

Most international submarine cables have been deployed primarily to provide connectivity between individual countries in the Middle East, Europe and Asia. The following are examples of the subsea cable networks that stretches from Europe to Asia.

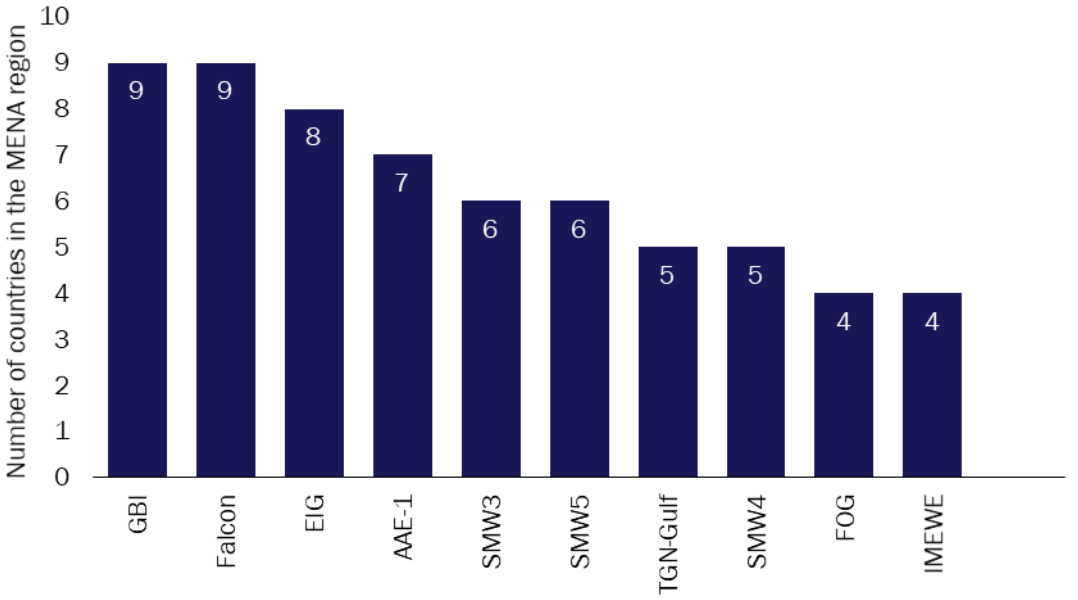
- **GBI** is a fibre optic submarine cable system that links Europe with India via Egypt and the Persian Gulf.
- **Asia Africa Europe-1** is a 25 000 km cable system that connects Southeast Asia to Europe via Egypt, connecting 19 countries.
- **Europe India Gateway (EIG)** is a 15 000 km fibre optic submarine cable system that links the United Kingdom with India via the Mediterranean Sea.
- **India–Middle East–Western Europe (IMEWE):** this submarine cable is an ultra-high-capacity system that links India with Europe via the Middle East. Its total length is approximately 12 091 km.

Few systems, such as Falcon, Fiber Optic Gulf (FOG) and GBI, account for the majority of landing points in MENA countries (see Figure 2.3).

The Middle East is also home to a number of terrestrial fibre optic networks that offer lower latency and provide diverse routes to traditional subsea cables, which reduces the risk of connectivity outages. Examples of

terrestrial cables in the region include the GBI North Route (completed in 2013), the Middle East–Europe terrestrial system (MEETS) and Regional Cable Network (RCN).

Figure 2.3: Number of countries in the MENA region connected by subsea cables, 2021



Further investments in cable systems are expected in future years to meet data usage growth. New investments will be driven both by the need to cover underserved geographical regions and to deliver high-quality connectivity to key routes, either by adding capacity and lowering latency to existing systems or by deploying new cables.

Large investments are expected in geographies that have yet to experience the growth in internet usage observed in other parts of the world. Africa is a good example, although cable systems have been deployed along the west and east coasts already, more are currently under construction (including Equiano, Africa-1 and 2Africa).

Investment in new submarine cables leads to an increase in the supply of international bandwidth and will deliver higher-quality connectivity, both in terms of latency and reliability. This increased supply leads to reduced prices for buyers of international bandwidth, as well as to improvements in the quality of users' experience of the internet, which stimulates new use cases (such as the adoption of cloud services) and a higher level of use of existing services.

The access to high-quality, reliable connectivity is critical for fostering economic development as supports the development of data centre industries, facilitates improvements in mobile and fixed technology and increases data consumption, which in turn drive significant revenue. For example, according to a GSMA study,[1] mobile technologies and services accounted for 5.7% of MENA's GDP in 2019, or USD244 billion. The mobile industry in MENA also supported almost a million jobs (directly and indirectly) and contributed to the funding of the public sector, with almost USD20 billion raised through taxation in 2019.

[1] GSMA (2020), *The Mobile Economy: Middle East & North Africa 2020*. Available at: https://www.gsma.com/mobileeconomy/wp-content/uploads/2020/11/GSMA_MobileEconomy2020_MENA.pdf.

A study by the European Commission established that the value of the data market in the European Union was almost USD365 billion in 2019, which represents 2.6 % of the area's GDP. The same study predicts that this market will grow to over USD617 billion by 2025, or 4% of the area's overall GDP.[2]

3. Technological progress has had a significant impact on the capacity and latency performance of subsea cables

Subsea cables' primary functions are to carry international connectivity and to expand internet access worldwide, but their role is expanding. New technologies are enhancing the capacity and latency performance of subsea cables, which are key enablers of new applications and advanced services.

Submarine cable technology has significantly improved. For example, new cables can provide more than fifty times the capacity per fibre pair compared with cables deployed 20–25 years ago, and new burial technology enables cables to be deployed through more direct routes, which reduces latency.

The introduction of coherent technology to existing dispersion-managed submarine cables represented a substantial leap forward. The successful adoption of coherent technology, which maximises the transport of data by modulating the light's amplitude, phase and polarisation, enabled existing systems to achieve more than 100 Gbit/s, up from 10 Gbit/s for old-generation cables. The benefits of coherent modulation are further increased if combined with improved digital signal processing (DSP) technology, which can support greater spectral efficiency and hence deliver higher capacity.

In addition to improvements in the optical transport technology, optimisation of the network architecture and of the design of fibres (for example, support of additional bands and a larger cross-section of the core) are among the features that can improve capacity and expand the distance reached by the cables. New technologies (such as ROADM), alongside achieving the optimal trade-off between the number of fibres deployed and the capacity per fibre, also play an important role in the overall performance and efficiency of the cable.

Remarkable progress has also been made in submarine cable design in terms of minimising the cable latency. From the perspective of the network design, lower latency has been achieved by developing transparent optical network elements, such as switching, and by introducing coherent technology. This technology not only increases capacity, as previously discussed, but also has a huge impact on latency performance. Submarine cables that rely on coherent technology do not require dispersion compensating systems (which can add up to one-fifth of the length to the fibre, which corresponds to few milliseconds of delay for long-distance fibre systems). This allows the signal to travel along a shorter optical path, which ultimately is the main factor in determining the latency of a link.

New burial technologies have been explored to improve the number and diversity of paths used to carry traffic between regions and to find direct routes for minimising the latency of a connection and for providing URLL connectivity for critical services.

[2] European Commission, *Building a data economy*. Available at: https://digital-strategy.ec.europa.eu/en/library/building-data-economy-brochure.

Advancements in transport technology have been driven by cable owners' need to improve the performance of their assets to meet increasing global data demand while maximising the monetisation of existing cables. Improvements in signal processing also mean that the typical lifetime of a cable (20 to 25 years) can be extended to operate for up to 30 years, which improves ROI for existing subsea cables.

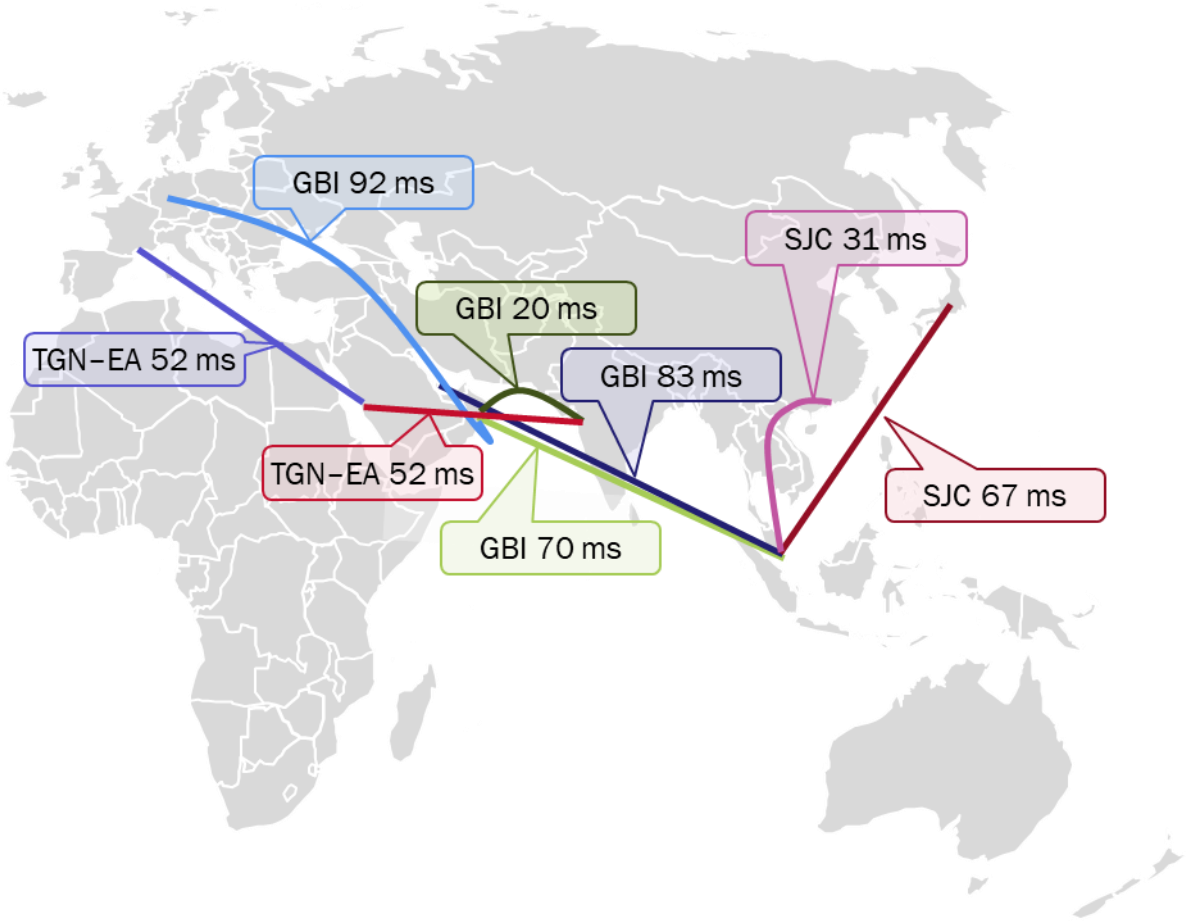
Advances in subsea cable technologies have also been driven by the entry of web giants in this sector, and their capacity needs are leading today's infrastructure growth. Cloud and content providers such as Amazon, Facebook, Google and Microsoft are major investors in new cables, which are deployed with the prospect of supporting ongoing massive bandwidth growth.

We expect changes in the market as existing systems are upgraded with new technologies and new cables replace older systems. Advanced subsea cables will play a central role in supporting mission-critical services and will provide competitive differentiation for service providers. This will lead to several shifts in the market, including some subsea cable connectivity hubs specialising in advanced connectivity (with the potential to attract more customers) or new customers and end users gravitating to specific subsea cable ecosystems, which will affect the geographical distribution of the customer base.

4. Low latency is increasingly important in the evolving subsea cable business model

The role of latency is becoming more critical with the emergence of 5G networks, where latency has been an integral part of the development of the technology, and a priority for customers. This is well understood by cable providers, which are continuously making efforts to improve latency.

Figure 4.1: Latency of selected subsea cable, 2021



Source: Analysys Mason

The most-effective way to reduce latency is to reduce the distance between endpoints. This can be done either by routing subsea cables along the most-direct path or, where possible, by using a combination of terrestrial and subsea cables to establish a shorter path.

For example, the most-recent SEA–ME–WE cable system (SEA–ME–WE 5) continues the heritage started by the consortium in 1985 but offers lower latency than its predecessors. The new cable has been designed with the latest 100 Git/s technology, which enables an initial system capacity of 24 Tbit/s. This will provide a round trip delay (RTD) between Singapore and France of 140 milliseconds (ms). This is 23 ms and 39 ms quicker than SEA–ME–WE 4 and SEA–ME–WE 3, a breakthrough achieved by optimising the deployment path across the traditional Red Sea route.

Figure 4.2: Details of SEA–ME–WE cable deployments

SEA–ME-WE cables	Singapore–France route RTD (ms)	Singapore–Palermo route, RTD (ms)	RFS	Length (km)	Design capacity (Tbit/s)	Number of owners
SEA–ME–WE 3	179 ms	N/A	1999	39 000	8 x 2.5 Gbit/s	92
SEA–ME–WE 4	163 ms	148	2005	20 000	64 x 2 x 10 Gbit/s	16

SEA–ME-WE cables	Singapore–France route RTD (ms)	Singapore–Palermo route, RTD (ms)	RFS	Length (km)	Design capacity (Tbit/s)	Number of owners
SEA–ME–WE 5	140 ms	124	2016	20 000	24 Tbit/s	18

Source: Analysys Mason, 2021

An alternative approach has been adopted by GBI, which offers its North route option (combining submarine and terrestrial networks) as an alternative to its South route for achieving a lower RTD figure. GBI North route connects the Gulf region to Europe with 20 ms less latency than its South route.

The Middle East has a total of 6 terrestrial cables combined with 105 cable landings. This provides geographical diversity and avoids submarine route constriction.

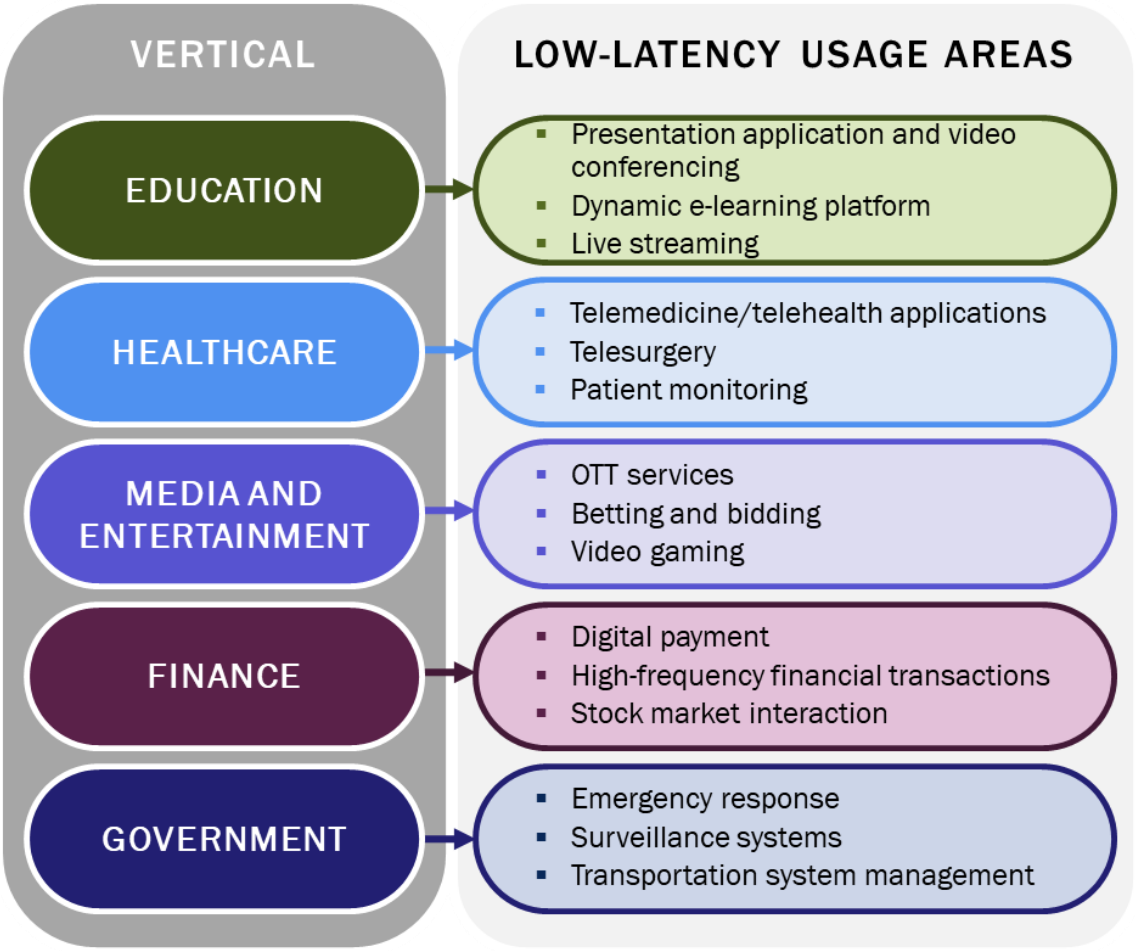
4.1 Low latency is a key enabler of new services and applications

Access to low-latency connectivity is one of the most-critical factors for improving network performance. Reducing latency not only enhances the delivery of existing services (such as two-way voice and video communications, where user experience degrades rapidly above 100 ms latency) but can also support a wide and diverse mix of completely new solutions and use cases, such as modern video games, which demand latencies of 10–20ms.[3]

Latency has become a critical performance factor for many verticals including finance, education, and entertainment. Figure 4.3 below illustrates selected applications and services for which very low latency is critical or desirable across different sectors.

[3]For more information on gaming requirements, please see Analysys Mason's *Cloud gaming requires 'game ready' 5G networks and industry co-operation*.

Figure 4.3: Selected examples of applications and services that rely on low-latency connectivity



Source: Analysys Mason

Access to low-latency can deliver a multitude of benefits, both in terms of business profitability and efficiency.

- For financial enterprises, latency performance has a huge impact on the profitability of trading operations: being able to react to market events faster than the competition is of critical importance in high-frequency trading (HFT), which relies on trading algorithms characterised by high turnover rates and high speeds. Financial firms are now seeking to measure predictable latency down to the nanosecond to increase profitability.

- In the healthcare sector, ultra-reliable and low-latency connectivity will improve the accuracy and reliability of products and services (for example, real-time patient diagnosis and monitoring, which can be combined with AR/VR or AI for remote diagnosis and remote surgery).

- Low-latency connectivity is essential in the critical communications networks domain. A critical infrastructure communications network must be reliable, and therefore its performance must be enhanced. Public safety networks include first responders such as police, ambulance and rescue services, along with utilities and railway companies. Applying low-latency connectivity to deliver these services can deliver a superior level of safety through more-efficient operations.

- Low latency is of paramount importance for consumers of any networked services, where a responsive performance is essential for keeping users engaged. Network performance can impact users' experience and

ultimately their willingness to interact with websites and complete online transactions. This is critical for the online retail sector and content providers. Web-scalers and content delivery networks (such as Akamai and Google) have reported that the higher the latency, the more likely users are to move to a competitor's website, which directly impacts the success of their businesses. A 100-millisecond delay in website load time can hurt conversion rates by 7%,[4] whereas a loading time delay of up to 6 seconds will increase the probability of users clicking away by 106%.[5]

5. Both enterprises and wholesale customers are well-positioned to take advantage of modern subsea cables

Advanced subsea cables can support digital enterprise applications with many different performance requirements, from multi-gigabit speeds to sub-millisecond response times, to guaranteed availability levels. This can attract the interest of new industries that want to take advantage of enhanced connectivity, and can benefit existing customers that want to exploit modern links between the Middle East and other key economic regions to achieve any of the following goals:

- Facilitate highly efficient trade and communications with customers, suppliers and ecosystems internationally, especially in Europe, helping businesses to operate globally in a more-effective way and to access a global marketplace for expanding their supply chains and customer base.
- Improve connectivity and advanced data processing to enable growth in productivity, with subsequent operational efficiencies and an ensuing competitive edge over competitors.
- Enable businesses to cloudify their systems rapidly and to access data sets in global clouds.
- Facilitate the adoption of new processes and services that require mission-critical response times, extremely high-performance and reliable connectivity (for instance, ultra-low-latency response and redundant back-up).

5.1 Wholesale customers in GCC countries are ideally positioned to benefit from improved connectivity delivered by modern subsea cables

A new generation of capacity, reliability and performance in subsea cables can deliver improved capabilities across many industry verticals in the Middle East region. This can create new opportunities for wholesale customers (such as telecoms operators, OTT providers and enterprise service providers), which have the option of upselling premium connectivity either to enhance existing services, or to attract new business from enterprises and other customers that are eager to exploit new services enabled by high-quality connectivity.

[4] Akamai (19 April 2017), *Akamai Online Retail Performance Report: Milliseconds Are Critical*. Available at: https://www.akamai.com/uk/en/about/news/press/2017-press/akamai-releases-spring-2017-state-of-online-retail-performance-report.jsp.

[5] Google (February 2018), *Find out how you stack up to new industry benchmarks for mobile page speed*. Available at: https://www.thinkwithgoogle.com/marketing-strategies/app-and-mobile/mobile-page-speed-new-industry-benchmarks/.

A whole range of new use cases will emerge with the introduction of low-latency and high reliability. This includes the use of AR and VR, gaming, finance services and medical applications. Enabling these use cases will mean that wholesalers can monetise the growing consumer interest in low latency and increased capacity. Each will provide a different revenue opportunity.

For example, the AR/VR market (which includes a wider group of VR applications as well as AR and mixed reality (MR) applications that depend on network performance) is expected to grow considerably in the next few years. Consistent high-speed and low-latency assurance for the duration of the service provision will be of paramount importance to the success of AR/VR-based applications. The VR video market is nascent, but the use of VR headsets (which are essential if VR video is to become popular) is increasing. 146 million people worldwide used VR in 2020 and we expect this to grow to 339 million by 2025, reaching a worldwide population penetration of 3.7%. Mobile VR video services, and the associated demand for VR headsets, will generate around USD28 billion worldwide in retail revenue by 2025, of which more than USD500 million is connectivity-related. In the GCC region, we expect a larger-than-average take-up of VR headsets, with a population penetration in 2026 of 9.2%.

Such patterns of demand in the region open up new opportunities for wholesalers to expand their business models. This is important because connectivity prices are declining (the weighted median 10 Gbit/s and 100 Gbit/s prices have fallen at an average CAGR of 14% and 23%, respectively, since 2016[6]) and the international connectivity market is being threatened by the recent investment of global cloud providers.

Therefore, wholesalers that rely solely on the international carrier economy are at risk of limiting their future growth in revenue or market share. Wholesalers need to understand how they can benefit from improved connectivity and must create a strategy to improve pricing and margins by offering added-value capabilities and services. They can do this through different channels, such as those below.

- Wholesalers should deliver new propositions to the market by offering premium connectivity through more-flexible business models, such as revenue sharing, pay-as-you go and value-based pricing. This would meet new enterprises' buying requirements that are focused on generating more-dynamic commercial engagement and avoiding the traditional provider 'lock-in' model. A more dynamic, asset-light offering would be more palatable for enterprises that are cost-conscious. This can also reduce the barrier to entry for new players in the enterprise ICT ecosystem, which increases the customer base for wholesalers.

- Wholesalers can cost-effectively enable new revenue streams based on advanced data analytics services that they can provide to customers. Providing advanced analytics based on AI and machine learning (ML) on top of premium connectivity is critical for customers that want to gain an insight into the performance of their services. This would enable customers to gain better control of their assets and resources and deliver an improved customer experience.

- Wholesalers can facilitate adoption of new processes and services that will add further value for their customers. For instance, they can develop relevant capabilities to play a part in emerging cloud-driven processes. By leveraging these capabilities, they have the potential to create further value to enrich enterprise offerings and to take a broader service portfolio to market, as well as support additional monetisation of advanced applications. Driven by digital transformation, wholesalers could potentially play a broader enablement role by providing edge cloud services and by expanding their role in the connectivity stack by offering solutions such as hybrid cloud, managed networks and security.

[6] TeleGeography (5 May 2020), *Global Bandwidth Prices Are Converging. Somewhat.* Available at: https://blog.telegeography.com/global-bandwidth-prices-are-converging-somewhat.

- Wholesalers can gain a key competitive advantage by providing ultra-reliable connectivity, which is now a business-critical parameter for enterprises. Network downtime is deeply disruptive, not only for the main services enabled by the link (such as data or voice services) but also for the underlying business model that revolves around internet usage: for example, network downtime can lead to large losses in terms of advertising business. This highlights the important role that network infrastructure plays for users' experiences and the underlying business model.

- Wholesalers need to understand the increasing complexity of use cases, often with individual requirements, if they want to target specific sectors that will benefit from improved connectivity. As business needs are becoming more specific, wholesalers will need to create sales, marketing and technical teams within their organisations that are dedicated to these verticals if they want to position themselves as specialist providers. They should also build industry partnerships to gain a market advantage and to facilitate the success of specific use cases. This, in turn, may stimulate demand for high-performance connectivity.

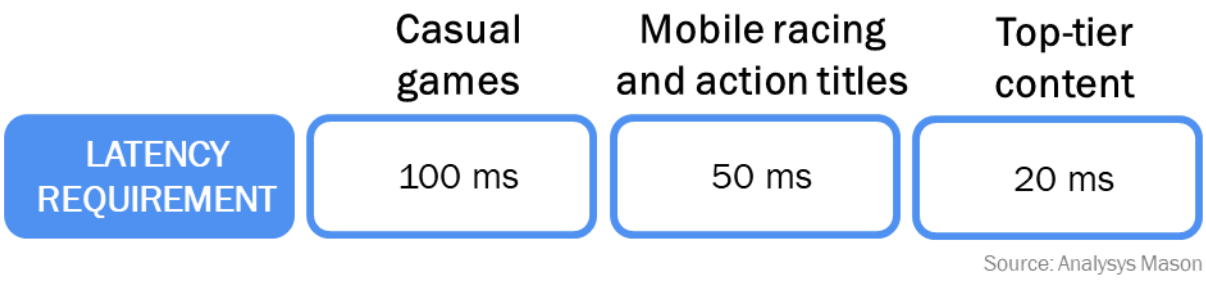
5.2 Wholesalers should consider the potential roles that they can play in use cases that require high-quality connectivity and meet their revenue growth strategies

Low-latency connectivity can offer an important advantage in implementing any combination of the strategies outlined above. Wholesalers and services providers should consider low-latency connectivity to be a key differentiator because the quality of connectivity (not just the speed) is an important factor for customers. To address this opportunity, wholesalers need to consider the verticals where low latency is most critical and offers added-value services to specific customers (for example, to those seeking efficient low-latency connectivity to enable business critical media applications).

Gaming is an example of a low-latency business model. Gaming is one of the fastest growing entertainment markets. More than 3.8 billion people worldwide played a digital game at least once per month in 2020, spending a total of USD147 billion. This is forecast to grow to 5 billion people worldwide and USD241 billion by 2025,[7] Cloud-gaming services will contribute to this growth because these services will both extend the customer base and improve the experience of existing gamers. In fact, cloud gaming is expected to become the dominant form of digital gaming in the next 5–10 years: global consumer spending on cloud-gaming is expected to account for USD14.5 billion by 2024; in the MENA region, this will be USD214 million.

All cloud-based gaming services need low latency throughout the entire session of play: from 100 ms for simple titles to 20 ms for top-tier content. Consistent high-speed and low-latency assurance for the duration of the service provision makes network performance central to the success of cloud gaming-based applications.

Figure 5.1: Latency requirements for different categories of gaming titles



Source: Analysys Mason

[7] For more information, see Analysys Mason's *Consumer 5G use cases: operator strategies for mobile gaming*.

Wholesalers can therefore maintain control over key assets of the cloud-gaming value chain. This creates a unique opportunity to build a profitable position in the gaming value chain. For example, wholesalers with digital service and content ambitions could play the role of sales channel partners for cloud-gaming service providers.

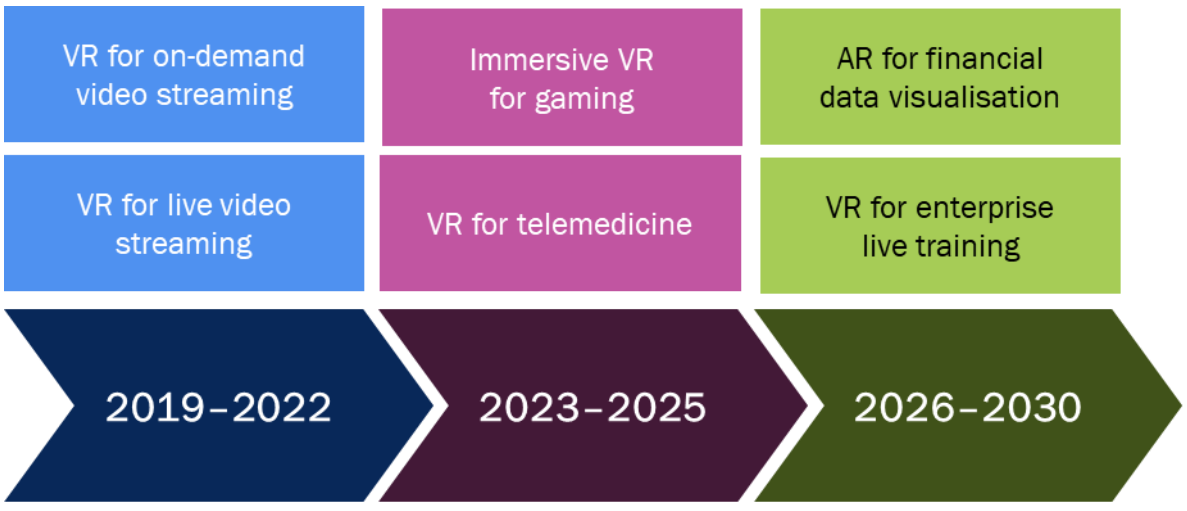
To do this, they need to build a deep understanding of the market requirements and the different consumer segments. They should develop plans to stimulate the demand for, and adoption of, the next-generation gaming services that require high-performance connectivity. Strategies for success in this market may include forming the right partnerships with content creators, lowering barriers to market development and assuring connectivity performance via edge computing and end-to-end network management, which can stimulate the demand for low-latency connectivity.

However, wholesalers should not look for a single 'killer' low-latency use case. Instead, they need agility to benefit from multiple digital services, which they can achieve through new partnerships and business models. Many low-latency applications are still developing so wholesalers in the Middle East should focus on high-quality, connectivity-enabled use cases that will deliver the greatest benefits in the short term that also enable them to develop expertise for future use cases. Wholesalers must take a long-term view and consider the opportunity that these use cases, and relative technologies, will generate in the future.

For example, wholesalers should consider extended reality (XR) as a technology that will revolutionise the gaming market and other verticals. These include communications (for example, live translation and information overlay), education, tourism, healthcare, retail (such as the creation of AR-based, store-like experiences), real estate (such as interior design and virtual property tours), manufacturing and automotive (designing and virtual prototyping). Therefore, XR-based applications have the potential to stimulate demand for high-performance connectivity across different sectors in the long term. New formats such as AR/VR are, for the moment, considered niche, but they have the potential to drive upsell and generate future revenue. If wholesalers facilitate the take-up of these XR services (for example, by discounting headsets or bundling them into connectivity tariffs) in the short term, the potential reward is a larger share of the revenue growth once there is mass take-up.

It is therefore important that wholesalers proactively choose their role in the high-connectivity services value chain before the ecosystem is fully mature.

Figure 5.2: Evolution of VR/AR applications and use cases



Source: Analysys Mason

5.3 The strategic geographical position of subsea cables in the Middle East presents wholesalers in the region with unique business opportunities

Wholesalers in the Middle East have the opportunity to take advantage of their strategic geographical position as a connectivity hub for Europe, Asia–Pacific and Africa, and to benefit from the growth in international connectivity expected across these regions. In the MENA region alone, 93 million new mobile subscribers are expected to become internet users by 2025, representing a CAGR of 5.1% between 2019 and 2025. North Africa alone will account for more than a third of these new mobile internet users in 2025.[8].

As a result, wholesalers can play a prominent role as connectivity providers for existing and upcoming multinational enterprises. It is important that they capture this opportunity while investment from web-scalers is still limited. The Europe–Middle East and Egypt route has, so far, been less used by large content providers compared to major interconnection routes (for example, in 2018, content providers accounted for 85% of used capacity on the Atlantic route but just 5% on the Europe–Middle East and Egypt route).[9]

Local cable owners and wholesalers have a competitive advantage over global web-scalers because of their deep understanding of regional regulatory processes and local business needs. To succeed in this market, wholesalers will need to rely on the local cable owners that work closely with regulatory bodies across different landing points and with backhaul and service providers if they are to ensure the smooth delivery of services that maintain regulatory regional compliance.

6. The commercial impact of advanced subsea cables on the wider economy

As in other parts of the world, extended access to international connectivity in the Middle East can actively support a large increase in internet usage and can have a significant impact on digital transformation.

For consumers, the digitalisation of the economy has already significantly transformed the way that people access and consume products and entertainment services, while also providing increased choices and access to information, as well as saving time. Further digitalisation offers the promise of more-ubiquitous, convenient and personalised access to these services, while fostering innovation and the development of new products (such as AR- and VR-based entertainment, consumer drones and robots).

For individual consumers, digitalisation is expected to generate economic growth and the development of human skills that will have a positive impact on productivity in multiple sectors of the economy.

There is significant potential for further economic growth in the Middle East, supported by the increased availability and penetration of high-speed broadband, the adoption of connected devices and the already-prevalent use of digital economy services (such as e-commerce, media and mobile payments). High-quality connectivity can contribute to the region's economic development in the following ways:

[8] GSMA (2020), *The Mobile Economy - Middle East & North Africa 2020.* Available at: https://www.gsma.com/mobileeconomy/wp-content/uploads/2020/11/GSMA_MobileEconomy2020_MENA.pdf.

[9] TeleGeography (2020), *The state of the network 2020 edition.* Available at: https://www2.telegeography.com/hubfs/assets/Ebooks/state-of-the-network-2020.pdf.

- supporting the development of the domestic information and communications technology (ICT) industry and stimulating the use of new technologies, such as cloud solutions.

- stimulating the development of a national infrastructure (including backhaul), which will lead to improved access to affordable healthcare and education and, more generally, better access to public services and information.

- increasing competition in the data centre industry, which will spur lower prices and encourage better customer services. A strong data centre sector will be needed to develop a 5G strategy for the Middle East and, once in place, will make the region a digital connectivity hub for Europe and Asia–Pacific, where latency and edge computing are required to support the adoption of new use cases. This can enable the Middle East region to exploit its geographical advantages and to improve its global position in the connectivity market.

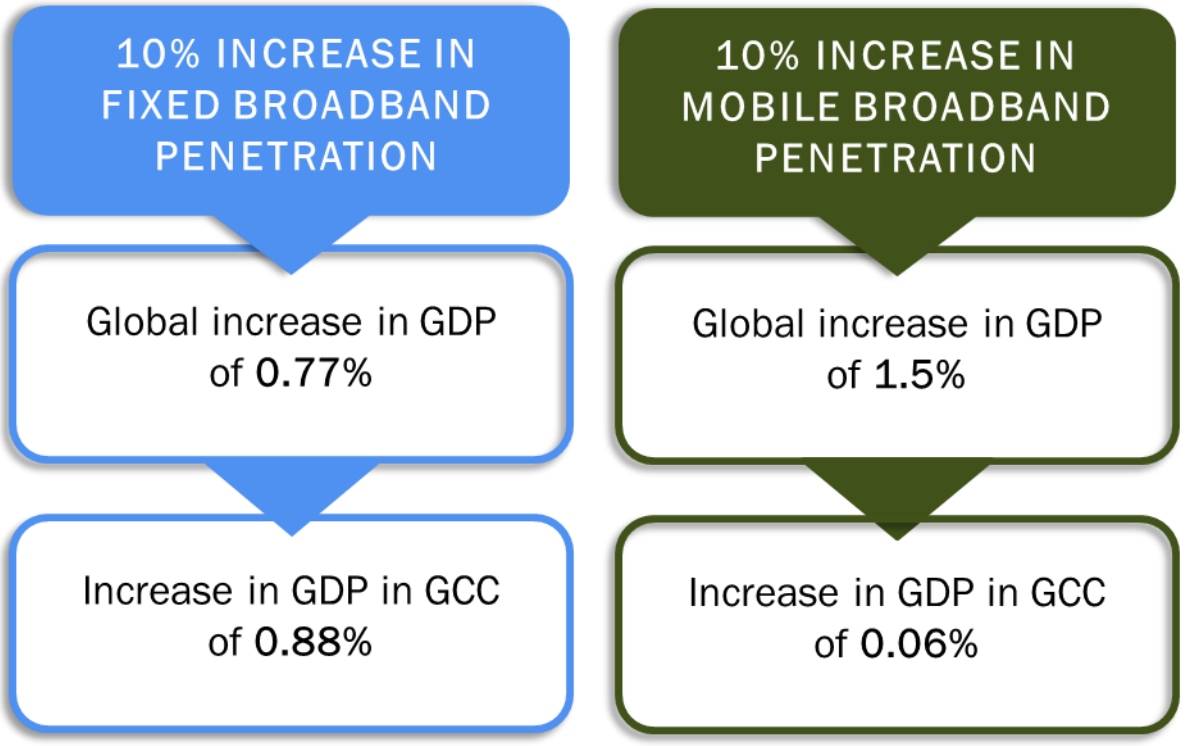
6.1 Investment in submarine cable improves connectivity and has a significant impact on GDP growth in MENA

Investments in upgrading the performance of existing submarine cables and in deploying new systems increase the supply of international bandwidth. This growth in supply and competition erodes bandwidth prices and makes access to high-quality international connectivity more affordable. For example, the increase in submarine cable supply is estimated to result in prices that are 74% lower on average in strongly connected countries compared to less connected APAC economies.[10] The combined effects of lower connectivity prices and improvements in latency and internet speed stimulate the adoption of new service, and drive increases in the volume of traffic and the number of internet users.

These benefits also generate positive outcomes in other sectors of the economy including stimulating ICT diffusion and encouraging higher investment in mobile broadband infrastructure and data centres. This creates a cycle that supports higher adoption of broadband, which ultimately will lead to economic and social development (see Figure 6.1).

[10] For more information, see Analysys Mason's Economic *impact of Google's APAC network infrastructure*. Available at: https://www.analysysmason.com/contentassets/b8e0ea70205243c6ad4084a6d81a8aa8/impact-of-googles-network-investments-in-apac---september.pdf.

Figure 6.1: The impact of fixed and mobile broadband penetration on GDP, GCC member states and worldwide



Source: International Telecommunications Union and Analysys Mason

In developed regions such as the GCC states, improvements in connectivity can lead to the following benefits.

- Improved network resilience and customer experience, which will lead to higher consumer spending in the Middle East
- wider foreign direct investment that benefits local wholesalers, service providers and the region's overall business sector
- the emergence of new technologies that require high-quality connectivity, such as low-latency and high-capacity.

Other benefits of network infrastructure investments include job creation, which can either be direct (for example, jobs in the telecoms sectors) or indirect (for example, jobs associated with the improvement of broadband connectivity across the broader economy, particularly in services industries such as IT, financial services and manufacturing). The latter category includes the creation of start-ups based on new use cases, and the creation of a digital hub and ecosystem that leverage advanced services for larger neighbouring economies, which will be essential for the region's economic development and the consolidation of its role as connectivity hub.

Submarine cables play an integral role in the modern world's digitalisation. A study conducted in 2016 by the World Economic Forum estimated that the potential value associated with the digitalisation of society and industry could exceed USD100 trillion worldwide in 2025 with the majority of this value benefiting societies and individuals.[11]

[11] World Economic Forum (January 2016), *Digital Transformation of Industries Demystifying Digital and Securing $100 Trillion for Society and Industry by 2025*. Available at: http://reports.weforum.org/digital-transformation/wp-content/blogs.dir/94/mp/files/pages/files/wef-digital-transformation-2016-exec-summary.pdf.

7. Conclusion

The growing demand for international bandwidth usage has driven investment in network infrastructures in the Middle East, including in subsea cables networks.

The deployment of subsea cables, which was historically driven by the need for affordable international connectivity, is now propelled by the demand for high-quality connectivity, characterised by higher capacity and lower latency. This is causing a shift in the role of this infrastructure: subsea cables with improved capacity, reliability and latency are becoming key enablers of new applications and advanced services.

Access to low-latency connectivity, in particular, is becoming a critical factor for improving network performance. Reducing latency not only can enhance the delivery of existing services (such as two-way voice and video communications) but can also support a diverse mix of completely new solutions and use cases, including modern video games.

This can create new opportunities for wholesale customers, such as telecoms operators, OTT providers and enterprise service providers. Wholesale customers have the option to upsell premium connectivity either to enhance existing services or to attract new business from enterprises and other customers that are eager to exploit new services enabled by high-quality connectivity. They should seek to address this opportunity and differentiate themselves by:

- becoming providers for selected industry verticals and by offering value-added services to specific customers
- taking advantage of the business opportunities associated with the strategic geographical position of the GCC region, including benefits arising from neighbouring growing economies.

Access to reliable and affordable high-quality connectivity also creates socio-economic benefits for consumers and enterprises throughout the Middle East. Wholesale customers and enterprises should therefore prioritise the selection of connectivity providers (such as GBI) that can offer alternative, low-latency connectivity routes. Individuals benefit from increased access to information and services that low-latency connectivity offers, including improved quality of life, health, education and income, whereas enterprises benefit from easily reaching and communicating with customers while expanding their market share and portfolio through newly accessible international links and technologies.

These investments create a positive impact on the connectivity ecosystem across the Middle East: the increased supply of high-quality international bandwidth helps to reduce the price of bandwidth while also improving the quality of experience for end customers. These benefits have a positive impact on other sectors of the economy, including stimulating ICT diffusion, encouraging higher investment in mobile broadband infrastructure and data centres and creating a virtuous cycle that supports higher adoption of broadband. This will ultimately lead to economic and social development.

8. About the authors

Michela Venturelli (Analyst) is a member of the Networks research team in London, and contributes to various research programmes, focusing on Operator Investment Strategies and Wireless Infrastructure Strategies. Michela holds a PhD and an MSc in Physics from University College London and Statale di Milano university, respectively.

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