CELLULAR CONNECTIVITY

CAN CELLULAR TECHNOLOGY BECOME THE BASIS FOR INDUSTRIAL IoT?

IoT NOW ANALYST REPORT

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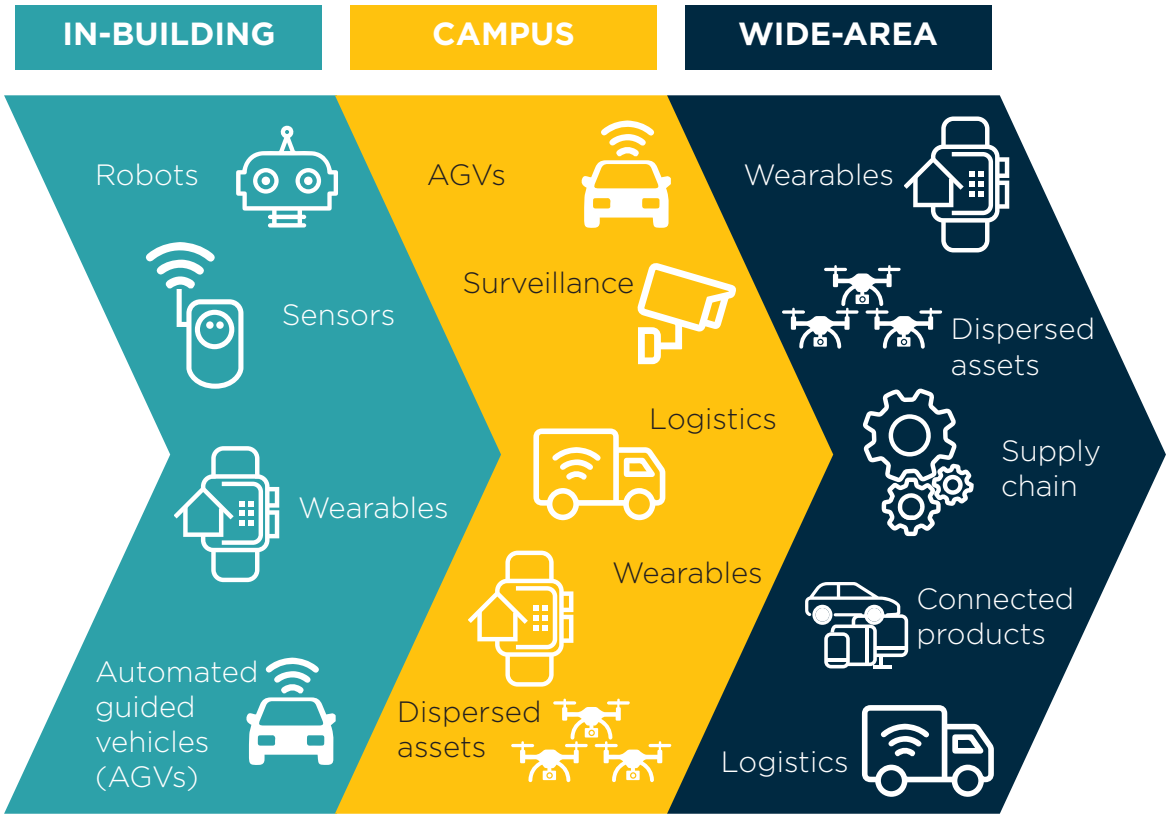
Cellular connectivity will build a role across the three domains of industrial IoT

Cellular networks have had limited success in addressing the needs of the industrial sector. While they have been relatively successful in supporting wide-area use cases such as fleet management and asset-tracking they have not penetrated the in-building or campus domains. The telecoms industry is promoting 5G as a networking solution that will unify the three domains - in-building, campus and wide area - of the industrial sector and support diverse asset requirements. Indeed, the telecoms industry is developing 5G with new industrial use cases in mind. However, the challenges of addressing the industrial sector extend beyond the technical issues. This report, authored by Michele Mackenzie, the principal analyst for the IoT Services research programme at Analysys Mason, and Caroline Chappell, the lead analyst for Digital Infrastructure Strategies at Analysys Mason, discusses some of the challenges that the industry faces and how they are being overcome ▶

Figure.1: The three domains in the industrial IoT sector [Source: Analysys Mason, 2020]



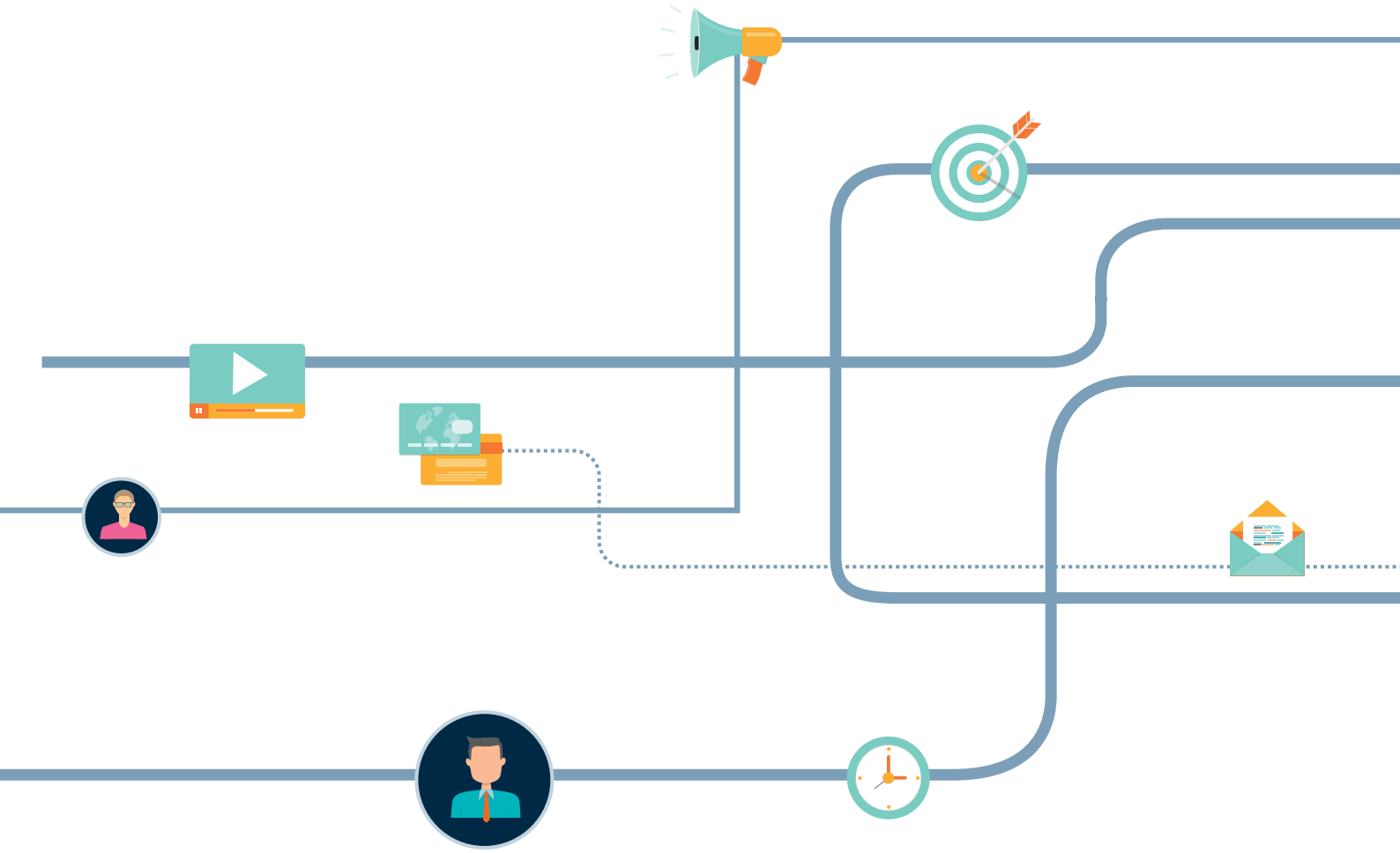
Cellular technologies are not widely deployed across the three domains of the industrial sector. Enterprises currently deploy – multiple - networks within three domains to connect their assets. The three domains are illustrated in **Figure 1** and include:

- The **in-building domain** that comprises a single building such as a factory where local area network (LAN) technologies are deployed, such as Ethernet, as well as Wi-Fi, Zigbee and LoRa.
- The **campus domain** that requires connectivity between buildings and where a mix of LAN and wide area network (WAN) solutions are deployed.
- The **wide-area domain** that covers areas outside of the campus. To cover these areas, enterprises deploy fibre-to-the-x (FTTX), cellular and satellite solutions, among others, to support static and mobile assets.

Cellular networks have not been successful in addressing the network requirements in two of the three domains - in-building and campus – because of the technical and commercial constraints of cellular connectivity.

Why have cellular technologies not been widely adopted by the sector to date?
Until recently there has been a significant mismatch between industrial sector requirements and the cellular network proposition. Analysys Mason's research across different sectors including manufacturing and utilities has highlighted this. For example:

- Requirements of propagation, resilience and latency have not been met by existing cellular networks to support in-building and mission critical applications, for example.
- Geographic coverage can be an issue in the wide area domain for supporting remote assets.
- Cost and the traditional cellular business model, which requires a monthly subscription per subscriber identification module (SIM), are often cited as a key barrier to adoption.



- The public network model is not always viewed as fit for purpose for industrial networking requirements. The perception is that a private network model will facilitate greater control and assurances over data privacy.

However, digital transformation initiatives in the industrial sector, especially among large enterprises, are opening up opportunities for new networking capabilities.

Digital drives the need for new networking capabilities

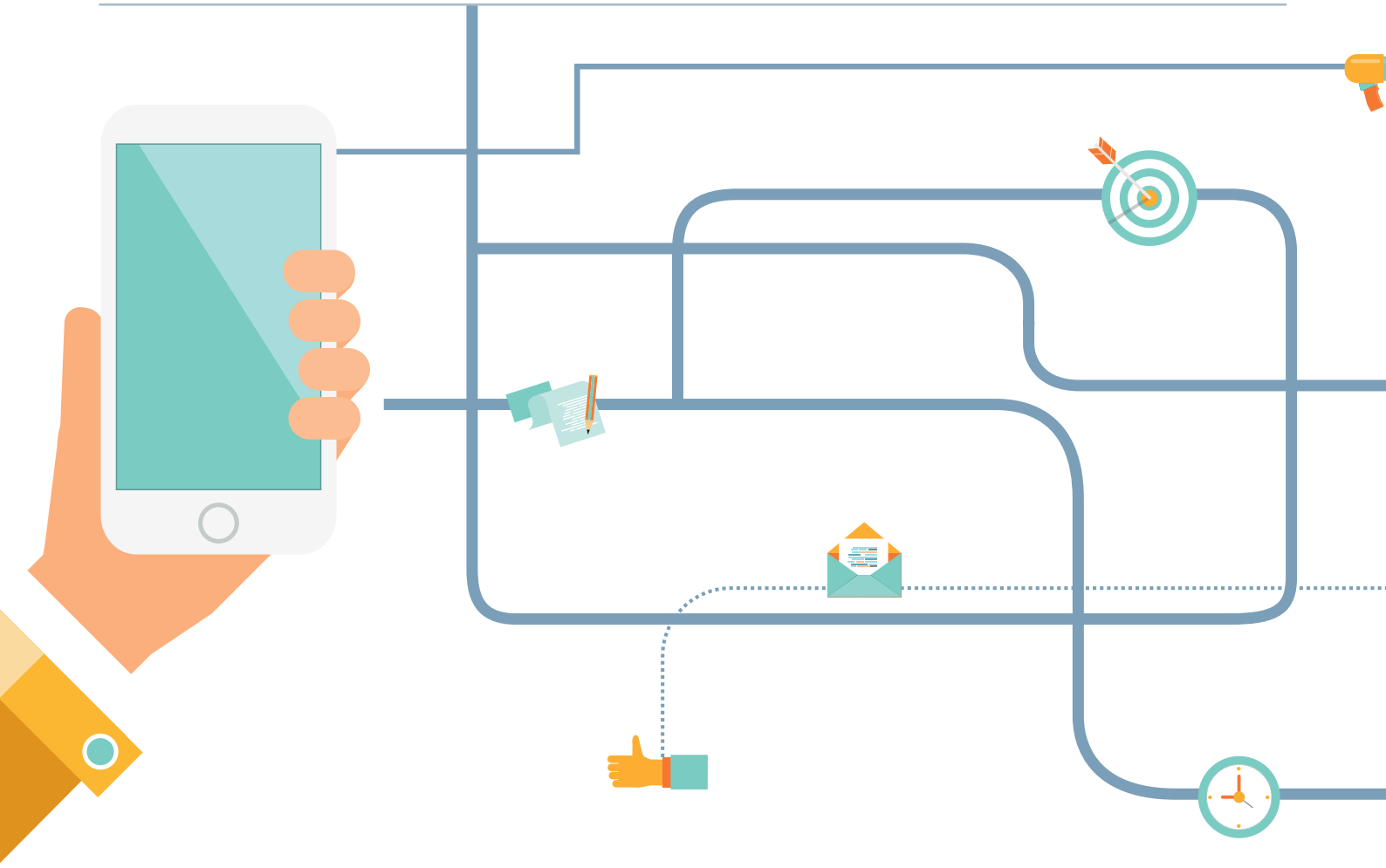
Digital transformation projects will drive the adoption of emerging technologies such as 5G and edge computing. Key motivations for the adoption of digital technologies include increased productivity, reduced costs and quality assurance, resulting in customer retention and the creation of new revenue streams. Enterprises are introducing new digital use cases that could radically change industry practices, including the deployment of autonomous guided vehicles, widespread adoption of robotics and digital twin capabilities.

The deployment of digital use cases will result in the collection of more electronic data from diverse locations. This data will need to be collected, harmonised and transported cost-effectively to support new business models. Companies will seek to transition from product-based, transactional business models to service-based, relational business models – often called servitisation. This will require persistent connectivity between enterprises' own systems and customers' and reducing the cost of such connectivity is a key concern for enterprises. The convergence of operational technology (OT) and information technology (IT) systems to bring manufacturing and business systems together will be a key enabler for digital transformation.

There are potential benefits to deploying a single network to cover in-building, campus and wide area domains, and to make this shift to a single network as part of the broader digital transformation process. This process opens opportunities for cellular networks especially with the advent of 5G.

The 5G vision for industrial IoT is ambitious

The first stage of 5G deployments are heavily focused on expanding capacity in the access network in order to support urban mobile and fixed wireless use cases. But a far greater variety of use cases including industrial IoT (IIoT) will be enabled by the next steps. ▶



The most important of these are the future releases of the 3GPP 5G standards, Releases 16 and 17, which will introduce support for IoT-related capabilities such as very low latency and very high device density. Release 16 will also start to introduce support for unlicensed or shared spectrum, which will be critical for lowering the barriers to entry for alternative network deployers such as private network operators or neutral hosts.

In addition, the cloud-native core, which we refer to as the 5G core, but in reality, will often be converged, supporting multiple access technologies will be an important future component of 5G. The logical extension of the cloud core model is full end-to-end, dynamic network slicing, which will enable operators to carve out a virtual network slice, optimised for the needs of a specific industry or use case.

Many operators will not reach this stage in the journey which means they will not offer dynamic network slices, but those who do will be able to support large numbers of enterprise and IoT services with greater flexibility and quality of service. All of these attributes will be supported by emerging technologies such as edge computing and automation for which 5G will enable better capabilities.
The strategic and economic rationale for 5G in industrial IoT hinges on the industry's vision to enable a homogenous network across the three domains of the IIoT. 5G is positioned as a solution to a large number of networking challenges that enterprises in the industrial sector encounter. For example:

- **Network complexity** 5G has been developed as a suitable substitute for short- and long-range, wireless and fixed networks, replacing Wi-Fi and Ethernet, for example, although it is likely to co-exist with many of these technologies.
- **Cost** Reduced complexity in the form of the consolidation of multiple network technologies is expected to result in reduced operating costs following an initial outlay.
- **Futureproofing** An overarching 5G architecture should permit greater agility and flexibility when connecting new devices and applications to the network.
- **Heterogenous devices** 5G is designed to support a heterogenous device landscape, ranging from high-bandwidth, low-latency devices to power- or bandwidth-constrained devices, with support for massive IoT.
- **Spectrum** The 5G standard will support licensed, shared and unlicensed spectrum, expanding the options available to enterprises deploying 5G network infrastructure. ▶

Challenge	Comment
Entrenched suppliers	Some enterprises have deployed proprietary industrial automation solutions. It may be difficult for other stakeholders to enter this market because legacy systems create barriers to entry.
Substitute networks	Fixed networks based on proprietary solutions as well as Wi-Fi, Bluetooth, Zigbee and other technologies are already widely used in the in-building and campus domains. These networking technologies are also evolving and improving, for example Wi-Fi 6.
Negative perception of cellular networks	Cellular networks are not well-perceived for some wide-area use cases, and the perception is even worse for the in-building and campus domains. The industry's view is somewhat based on its experience of connectivity for smartphones which is not considered to be of high enough quality for industrial operations.
Business model	Enterprises do not typically pay recurring monthly connectivity costs for networks in the in-building and campus domains.
Lifecycle and culture	Replacement cycles are long - often ten years or longer - and cultural issues such as resistance to change are slowing the pace of digital transformation in the sector.
Ecosystem breadth	The ecosystem of providers for hardware and software solutions is broad and differs significantly from that in other sectors. Telecoms operators and vendors do not typically work with companies in the industrial ecosystem.

Figure 2: Barriers to the adoption of 5G in IIoT [Source: Analysys Mason, 2020]

Other strengths of 5G, which are not necessarily differentiators when comparing with alternative technologies but are important considerations when combined with those mentioned above, include the 3GPP standardisation process to ensure that the technology is fit for purpose, the large ecosystem that supports the cellular industry, the platform model - the converged core - and the role of 5G as a key enabler for other technologies such as edge computing. This is a solid vision for 5G in IIoT, but challenges remain as outlined in **Figure 2**.

Operators with ambitions for IIoT should start put the building blocks in place

Operators with ambitions to target the industrial sector should start to build a connectivity offering that is predicated on:

- Demonstrating the ability of cellular connectivity to address networking requirements across all three domains of industrial IoT.
- Implementing private long-term evolution (LTE) networks as a precursor to 5G to provide a consistent service across private and public networks.

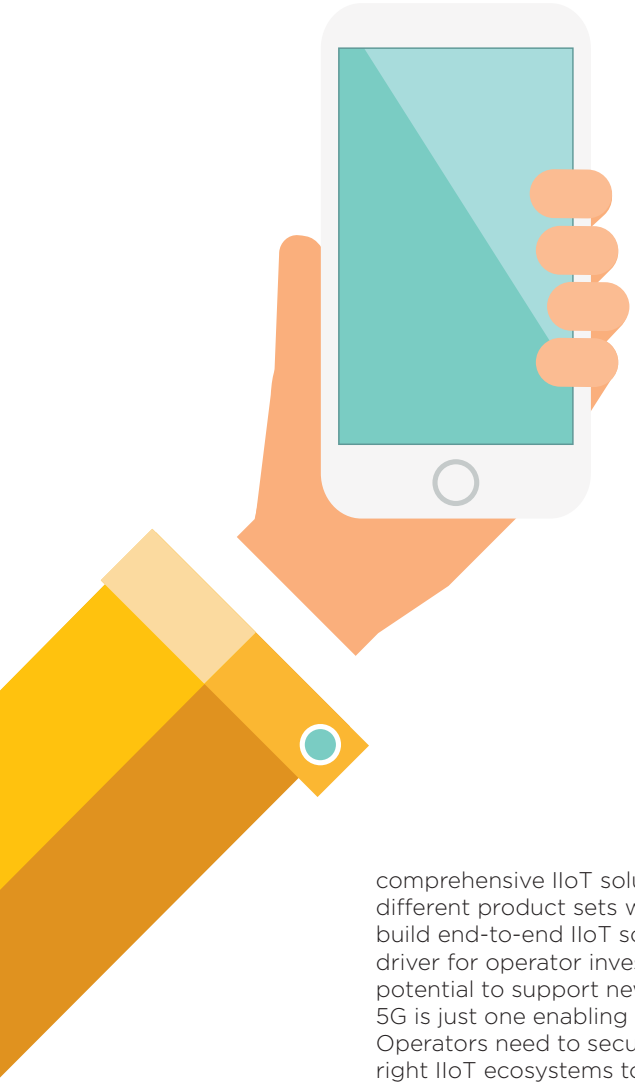
In the early phase of market development, operators should focus on connectivity. A private wireless proposition will be critical to address the in-building and campus domains, but operators should support a broad portfolio of network technologies. Private LTE will be an important precursor to high-bandwidth 5G use cases, and technologies such as narrowband IoT (NB-IoT) will be important for simple indoor tracking use cases. Support for non-cellular networking technologies could also be a differentiator.

Operators with existing capabilities will be better placed for IIoT

Operators with existing IoT and ICT business units are more likely to have invested in building vertical sector expertise than those without. They will be aware of the general challenges involved in entering new sectors, including the need for partnerships and visibility in the industrial ecosystem, as well as investment in direct sales and channels to market. Establishing an early foothold in IIoT will provide operators with the opportunity to assess and quantify the benefits of implementing 5G. It will allow them to internally evaluate the revenue opportunity of 5G in IIoT, and to assess what investment is required to implement 5G capabilities such as the core network in the longer term.

Operators and vendors alike will need to understand the IIoT ecosystem

5G networks are not themselves a ▶



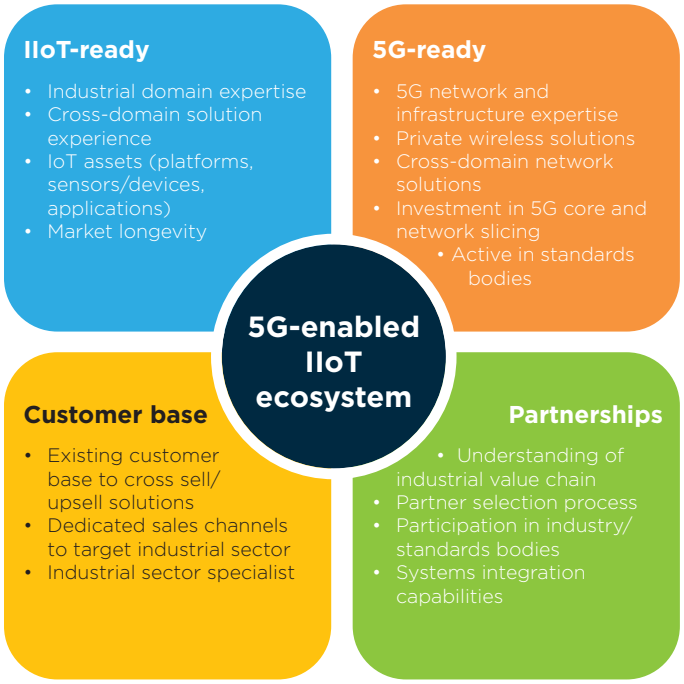


Figure 3: Key requirements for a 5G-enabled IIoT ecosystem
[Source: Analysys Mason, 2020]

comprehensive IIoT solution; companies with different product sets will need to partner to build end-to-end IIoT solutions. An important driver for operator investment in 5G is its potential to support new IIoT use cases, but 5G is just one enabling element of IIoT. Operators need to secure their positions in the right IIoT ecosystems to gain access to valuable customers and innovative capabilities. They must also demonstrate the additional value that 5G brings over alternative types of connectivity.

Industrial IoT propositions are complex; most suppliers will struggle to deliver components outside of their core competencies. Most companies will be open to partnerships but all will need to undertake a rigorous partner selection process. They will need to select influential partners and compare their readiness for IIoT and 5G, as well as their existing industrial customer base and ecosystem presence. **Figure 3** illustrates some of the key selection criteria that IIoT players need to consider.

The IIoT is challenging and requires a different approach

In sectors such as automotive and fleet management where cellular technology is obviously a good fit in supporting wide area coverage for mobile assets the mobile industry has been relatively successful. There are also few competing technologies. The industrial sector has a different set of requirements. Mobile operators have a long path ahead to demonstrate the role of cellular networks, build credibility and the ecosystem of partners to be successful.