



Kaleido Intelligence

Enterprise Cellular IoT Demands & Opportunities: Transport & Logistics

A Kaleido Intelligence
Survey Report

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Introduction to the Survey



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Over the past decade or more, considerable interest has risen around the concept of IoT and what it might mean for businesses and end-users impacted by the digitisation strategies applied using IoT technologies. In turn, a plethora of IoT survey reports have been published that typically cover a broad range of topics. In 2022, Kaleido Intelligence recognised the need for a more focused understanding of specific areas of IoT implementation and, as a result, undertook one of the largest survey fieldwork efforts of its kind, examining enterprise perceptions around cellular IoT connectivity in detail.

Despite the fact that much of the revenue and user experience is impacted by the applications and services that are applied in the context of IoT, connectivity remains the bedrock for any deployment. Therefore, it is imperative that the ecosystem serving IoT customers understands where challenges exist, where improvements could be made, and how customers perceive the IoT ecosystem in the context of connectivity. As we shall see later in this report, cellular technology is well-understood as an important enabler of IoT connectivity, albeit with several challenges associated with it.

The end of 2022 saw some 2.5 billion cellular connections deployed globally for IoT programmes, with connections having increased by 26% over 2021. In contrast, the end of 2020 saw only a 12% increased in connection volume, and as a result, it is evident that the overall ecosystem for cellular IoT connectivity is on the path to recovery following the pandemic. Nevertheless, this strong growth highlights that meeting the challenge of 'scaling up': supporting higher volumes of

connections from a technical, service and commercial standpoint is ever more critical for service providers if the ecosystem is to be sustainable. Meanwhile, the introduction of new radio technologies, such as 5G, support for converged cellular-satellite communications systems and private cellular networks, in addition to a vast ecosystem of connectivity service providers, hardware vendors and differentiated regulatory and commercial requirements has meant that cellular IoT is more complex than ever for enterprises to navigate.

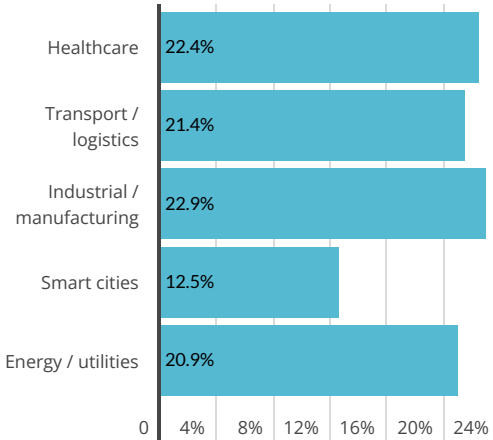
This year's survey has set out to take a deep-dive into where the key pain points in the context of cellular IoT connectivity lie and represents an expansion of the 2022 survey effort. Some 800 enterprises were surveyed during February-April 2023, representing activities in five key IoT industry verticals:

- Transportation & Logistics
- Industrial & Manufacturing
- Healthcare
- Energy & Utilities
- Smart Cities

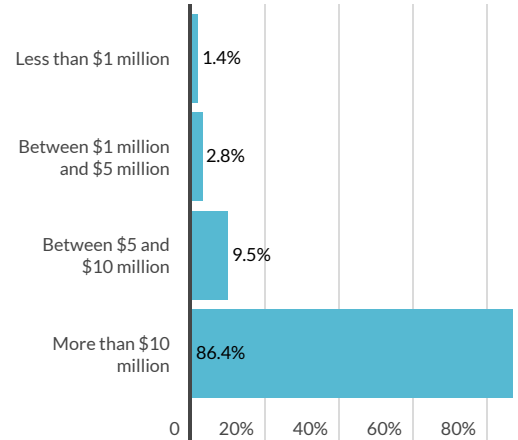
All respondents were all decision-makers at managerial level or higher within their organisation, in addition to having a good knowledge of the cellular IoT ecosystem. In order to understand a broad picture of perceptions, respondents included companies that had adopted cellular connectivity for IoT, in addition to those that had not. The differences, as well as the and consensuses in perceptions among these groups and industry verticals, are among the key goals of the study in terms of understanding where the industry can improve and where opportunities to accelerate

the adoption of cellular technology for IoT lie.

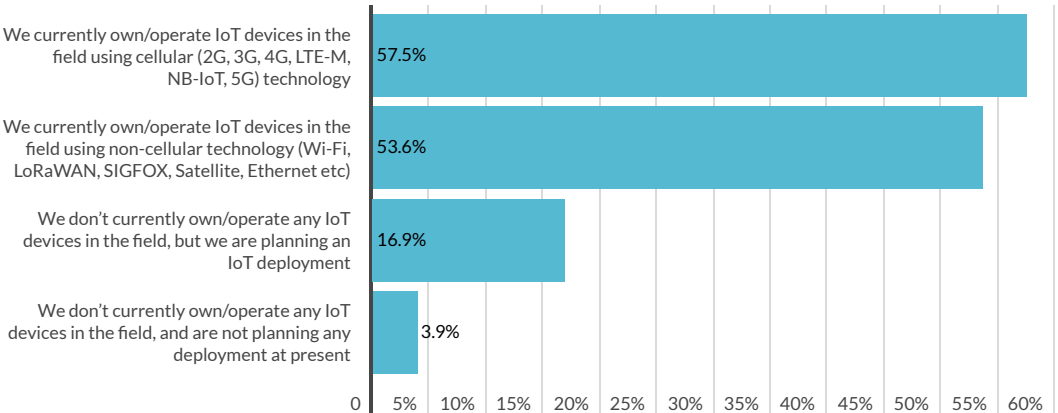
In what market segment does your business unit primarily operate?



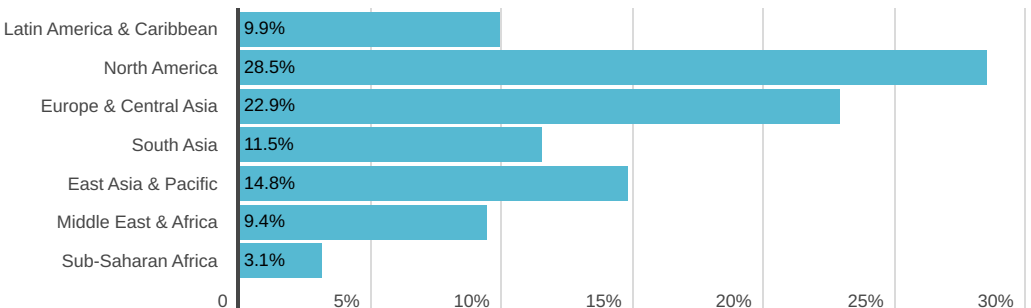
What was your organisation's turnover in 2022?



What is your organisation's current status in regard to IoT?



Where is your business unit based?



The survey analysis allows us to identify several themes among the respondent base, which will be examined in the following sections.



Complexity

Costs, time-to-market, commercial and regulatory barriers, in addition to enterprise understanding of IoT requirements and goals all play a role in the success of IoT projects. Service providers must position themselves as both problem solvers as well as experts in the field here in order to help enterprise customers launch and maintain successful IoT deployments.



Sophistication

Enterprises are becoming increasingly aware of IoT risks, while simultaneously becoming more demanding in what they expect from connectivity providers. This means that service providers must become more sophisticated in how they approach the market.



Roaming

IoT devices provisioned with cellular connectivity often operate across several countries worldwide. Inevitably, this means that roaming, the technical and commercial arrangement that allows cellular devices to access networks in visited countries, is required. Coverage, costs, performance and support are of fundamental concern to enterprises here.



eSIM

eSIM enables a paradigm shift in how cellular connectivity can be provisioned and managed. Its reprogrammability over-the-air makes it a highly flexible solution to achieve various goals, and is increasingly considered a must-have for cellular IoT connectivity.



Private LTE/5G

Private cellular networks offer enterprises significant enhancements over traditional communications solutions, and suffer from few technical compromises. The ecosystem is complex, however, and a significant level of expertise is required to aid in choosing an appropriate deployment.



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IoT Connectivity Challenges & Opportunities:

Transport and Logistics



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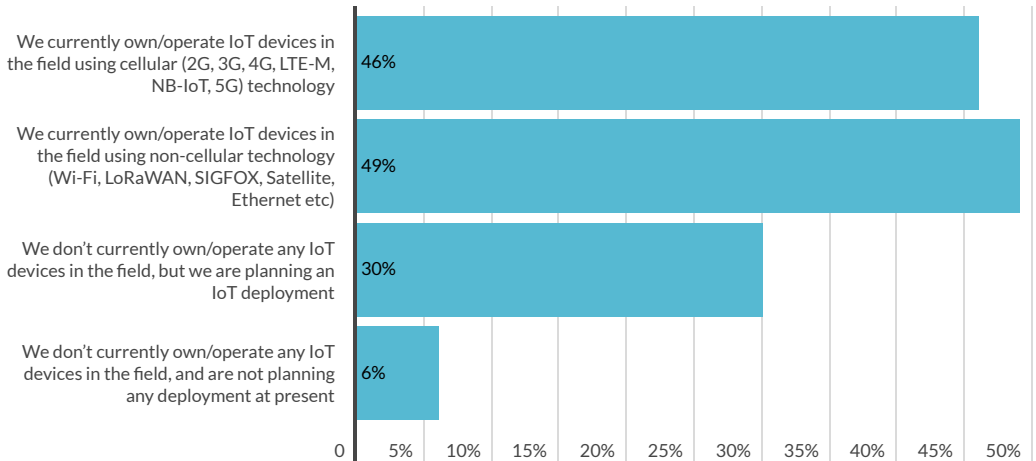
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State of IoT - Transport/Logistics



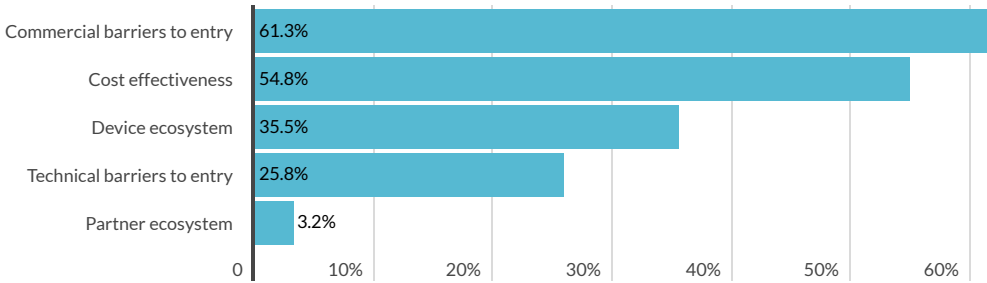
The transport industry has huge potential as a market for cellular IoT, with highly mobile assets that need a ubiquitous infrastructure. However, the vertical shows the least amount of cellular IoT adoption among those surveyed – **46% of transport respondents report they currently operate a cellular IoT deployment, slightly less than report owning and operating non-cellular IoT devices.** Both technologies are likely to grow together in this industry, as similar proportions consider at least one form of unlicensed wide-area connectivity suitable for their needs.

Does your business unit currently have an IoT deployment or proof-of-concept underway that uses 3GPP cellular radio technology (2G/3G/LTE/5G)? (All Respondents)



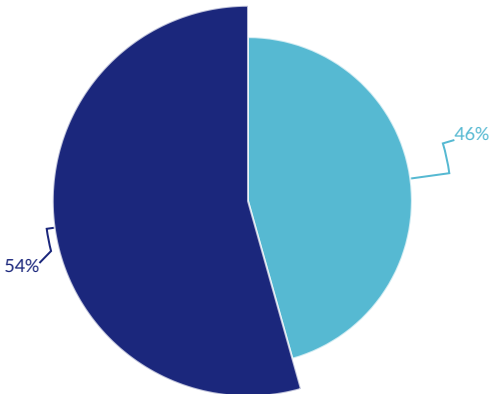
The technologies will also coexist, as **41% of current cellular IoT adopters indicate that they use at least one form of unlicensed LPWAN, and 45% indicate they also use fixed-line communications.** Meanwhile, **55% of future adopters report that they consider both cellular and unlicensed technologies suitable for their IoT deployments.** Service providers need to be able to offer multiple forms of connectivity if they are to cover all of a client's potential use cases, particularly in the low-power arena. However, **the biggest challenge for cellular connectivity may be commercial rather than technical. 61% of those who consider cellular technology unsuitable for IoT deployments consider commercial barriers a reason, while only 26% think the same of technical barriers.** It is, therefore, clear that there are some business model issues discouraging usage by this sector rather than the technical difficulties of implementation.

Why do you perceive cellular connectivity as unsuitable for IoT deployments? (Cellular IoT Non-Adopters)

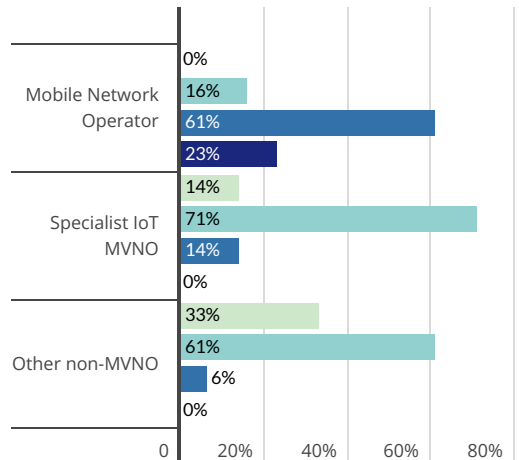


In terms of service providers, MVNOs are the most common type of service provider among current users by a slim margin (56% of adopters in the transport industry). However, while only 14% of respondents planning a cellular IoT deployment have not approached MVNOs for their connectivity, 23% have already chosen an MNO as their provider, while none have firmed up relationships with MVNOs in the same way. MNO service providers are primed to make a comeback in the IoT space in the coming years.

What type of connectivity service provider have you chosen to engage with for your cellular IoT deployment? (Cellular IoT Adopters)



What types of organisations are you considering approaching or have you approached for your IoT connectivity needs? (Cellular IoT Non-Adopters)

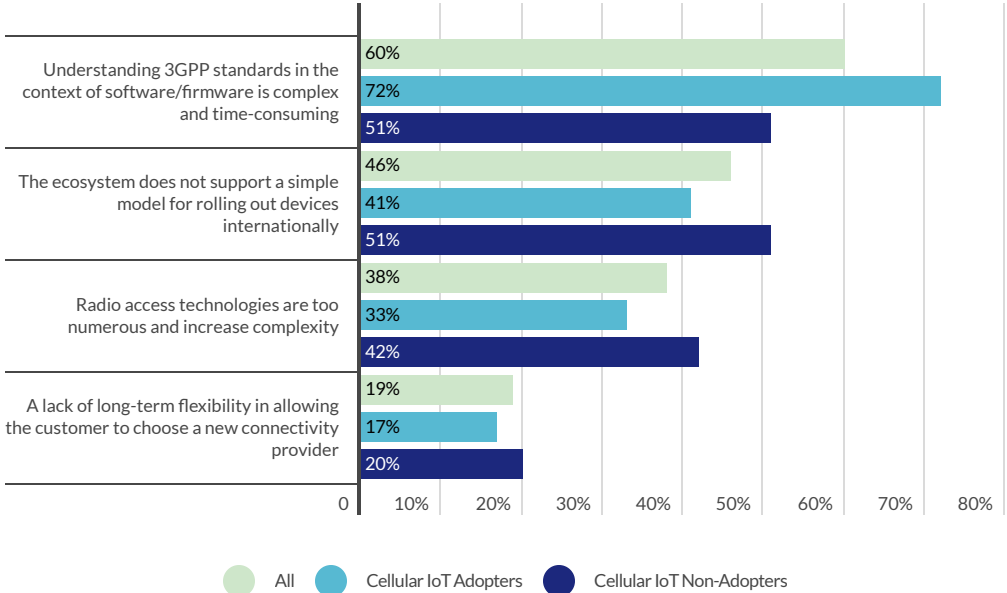


- A mobile network operator(s)
- A mobile virtual network operator(s)
- Have not considered approaching/Not approached
- Considered approaching
- Have approached
- Have selected as connectivity provider

Complexity - Transport/Logistics

Different forms of radio technology are only one part of the complexity of the IoT for transport and logistics companies and not the biggest concern. Only 38% of respondents perceived the number of RATs available for cellular deployments to be one of the main challenges to using the technology in the first instance. Instead, they reported that 3GPP standards implementations through software as the biggest challenge.

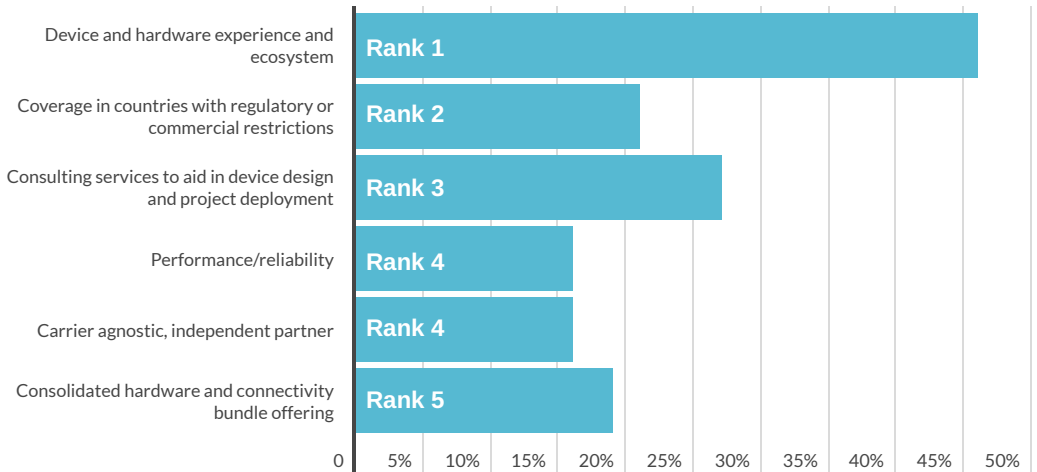
What do you perceive as the main challenges for organisations wishing to leverage cellular technology for IoT connectivity for the first time? (All Respondents)



This is mirrored in the hardware space, with the challenge of hardware design being the biggest in the cellular IoT space for manufacturers, although felt more acutely in his space, with 60% of respondents naming it the number 1 scaling challenge.

As a result, logistics providers want hardware assistance in their deployments after the basic connectivity needs are met. Consultative device design and capabilities rank number 3 in what respondents look for in a connectivity partner’s capabilities, and hardware and software bundling features in the top 5 capabilities that 50% of respondents look for, although it only ranks highest at number 5. This indicates the desire for a more customised solution rather than off-the-shelf products, a fact reinforced by 54% of current users and 47% of future users noting that vertical-specific solutions are one of the main non-technical influences in selecting a connectivity provider.

What are the top 5 factors that you look for/would look for in an IoT connectivity partner's capabilities? (All Respondents)



Cellular IoT Adopters: Ability to provide vertical-specific solutions importance in choosing a connectivity provider



This industry also wants general ongoing support to deal with the complexity; customer support ranks second in product features transport and logistics professionals look for in a connectivity product, while **62% believe that adequate expertise to simplify the IoT development process is lacking.** This is closely followed by an absence of global connectivity customer support, and a simplified technical model for global integrations.

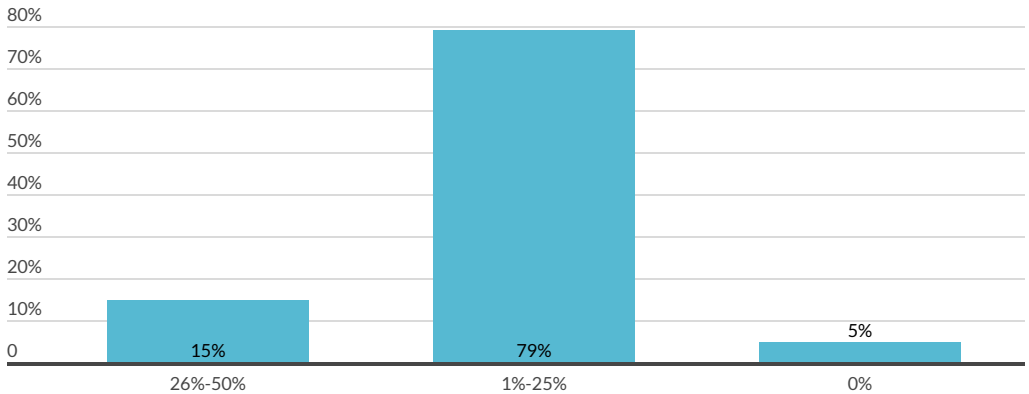
Several respondents may be resolving this complexity themselves; maintaining relationships with multiple connectivity providers is ranked the 2nd biggest challenge for scaling cellular IoT, but only 5th by adopters.

Cellular IoT Non-Adopters: Ability to provide vertical-specific solutions importance in choosing a connectivity provider

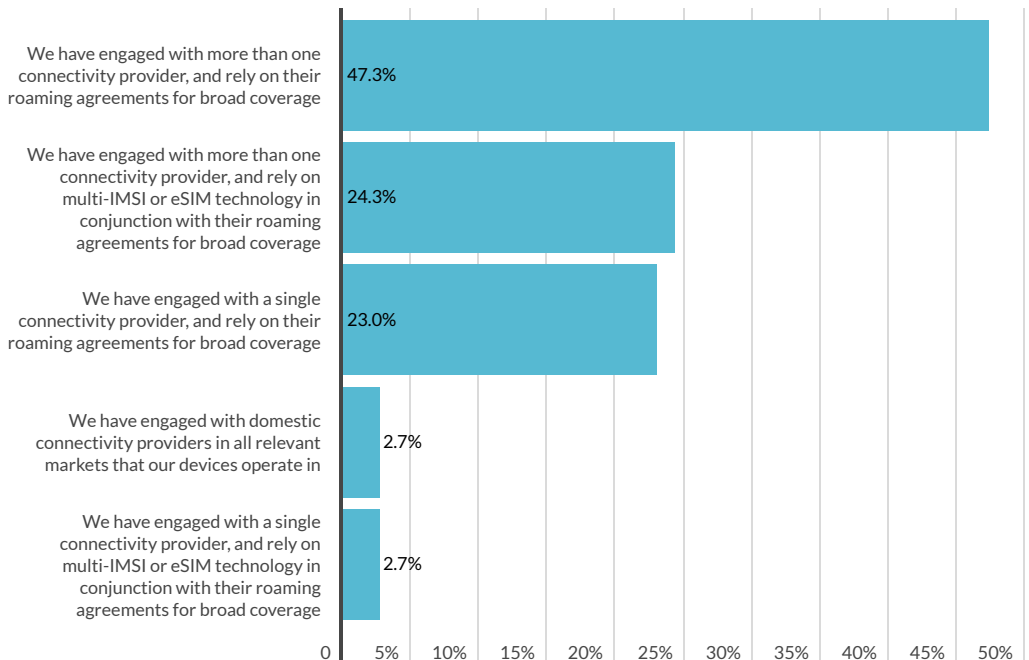


This is because companies with a larger proportion of their device fleet operating internationally are actually less likely to engage multiple providers, with 42% of respondents with more than a quarter of their devices operating internationally reporting that they only engage a single provider, while only 22% of those with a smaller multinational commitment say the same. However, these smaller-scale multinational commitments are far more common, with **72% of all respondents using more than one connectivity provider in some way to cover their international connectivity requirements.**

What proportion of your organisation's cellular IoT device fleet requires international or multi-regional connectivity (Cellular IoT Adopters)



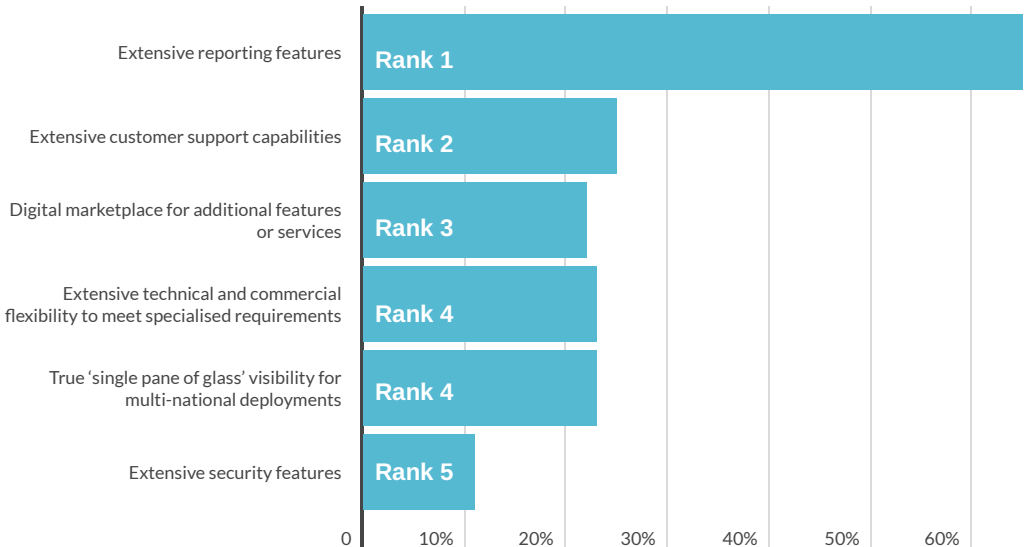
How has your organisation addressed this international cellular IoT connectivity requirement? (Cellular IoT Adopters)



Sophistication - Transport/Logistics

The level of desire for customer support and custom solutions noted in the previous section means that connectivity providers need to offer increasingly sophisticated services, with the need for ongoing support increasingly important. This customisation need is also reflected in the desire for a range of services, with **22% of respondents ranking a digital marketplace at number 3 in factors they look for in a connectivity partner's product** and 39% listing it in their top 5 important factors overall. However, it should be noted that only 35% of cellular IoT adopters who put a digital marketplace in their top 5 features actually expect their connectivity VAS portfolio delivered in that manner. The important thing here is clearly that there are multiple options available to deal with complex needs, not the marketplace in itself.

What are the top 5 factors that you look for/would look for in an IoT connectivity partner's product? (All Respondents)



What respondents actually want in a product is detail and the ability to ask more questions if required – extensive reporting capabilities are the clear first choice, being one of only 2 factors to score more than 10% for rank one in what factors respondents consider most important. The other top scorer, extensive self-service, is only in the top 5 factors for under half of respondents, and so while these are strongly desired by

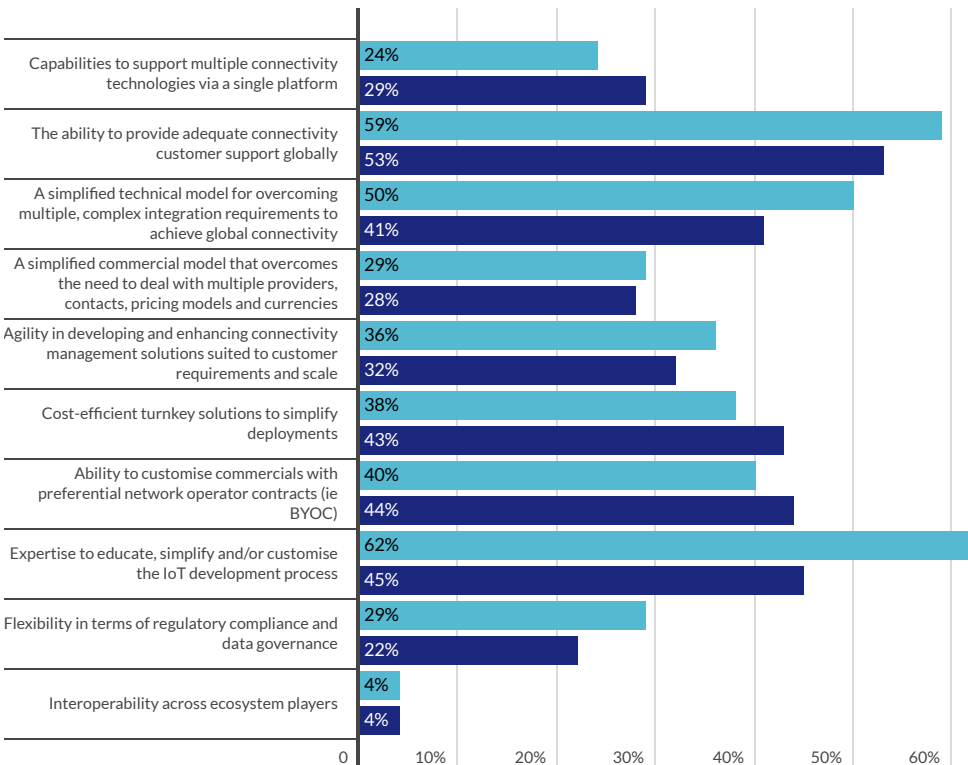
a particular subset of respondents and there is a potential market for this, it is not the majority of transport and logistics professionals that feel this way.

By contrast, technical and commercial flexibility is somewhat important to most respondents, with 87% placing it in their top 5 product features overall, although it only comes top at rank 4.

Tied with it in that position is single-pane-of-glass visibility, reiterating that tools available to the end user are some of the most important aspects of the product overall. Single pane of glass will, however, be difficult to achieve given the landscape – cellular to non-cellular in the first instance, as **65% of respondents use both cellular and non-cellular modes of connectivity**. These integrations will be relatively simple compared to the cellular integrations that will be necessary for single-pane visibility. With 74% of respondents engaging more than one connectivity provider, achieving single-pane visibility will require many back-end integrations between connectivity providers to ensure a smooth service.

This may be contributing to the perception of complexity in the ecosystem, as 60% of respondents note software complexity as the main challenge for first-time cellular IoT users. It will also be a strong differentiator for those who can produce a reliable integration service, with 45% reporting that simple ways to overcome the integration requirements are currently lacking within the IoT ecosystem overall. It is also worth noting that the thing most seen as missing is consistent international connectivity customer service, also noted as the second highest thing that respondents look for in an IoT product. Having a responsive and competent customer support team is an asset that will be appreciated by the logistics industry.

How has your organisation addressed this international cellular IoT connectivity requirement? (All Respondents)

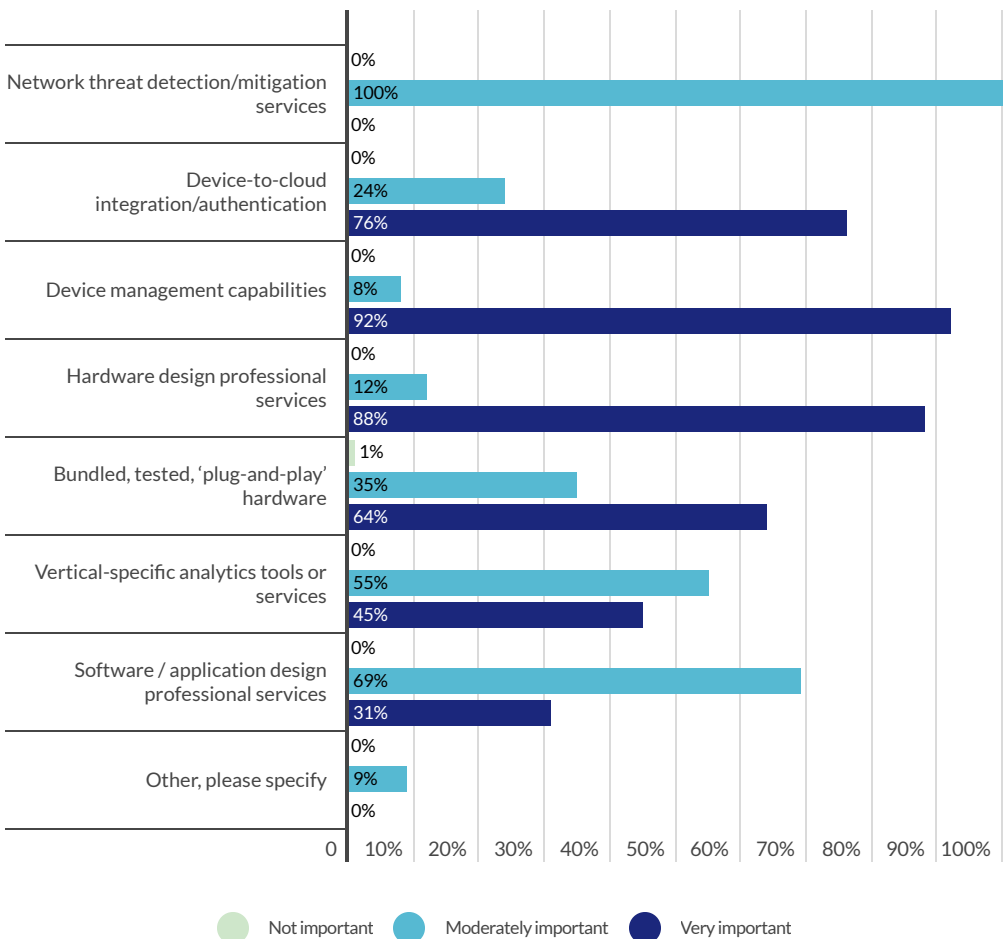


● Cellular IoT Adopters ● Cellular IoT Non-Adopters

Building any simplified integration would require CSPs to integrate with other providers, as well as potentially non-cellular connectivity. Transport professionals already acknowledge this, as 42% noted an extensive set of ecosystem partners as the top capability they look for in a connectivity partner. 46% said the same for having device and ecosystem experience in general; however, with hardware continuing to be a strong focus overall. It is one of the most important things for service

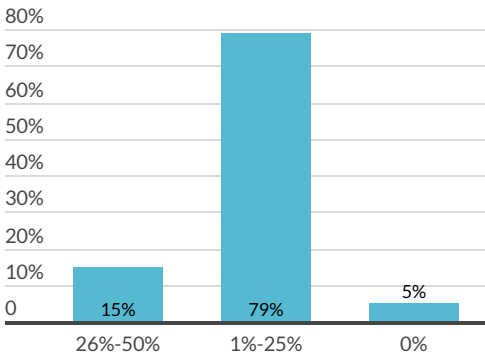
providers; as already noted, it is a key challenge for the logistics industry, and when it comes to VAS, the 3 top-scoring services are all device-related. Most particularly, 92% of current cellular IoT users consider device management capabilities very important, and only slightly fewer respondents say the same about hardware design. Interestingly, vertical-specific features are less relevant than device management, with only 45% of adopters reporting these as very important.

Beyond connectivity, what are the most important value-added services you expect your cellular IoT connectivity service provider to offer? (Cellular IoT Adopters)



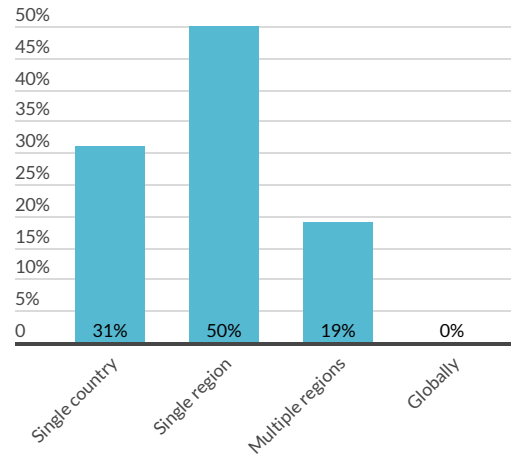
Roaming is a key part of the connectivity ecosystem for transport and logistics, thanks to the mobile nature of many of the industry's assets; international connectivity is required by 95% of respondents, and 69% of future users will need it. Additionally, 56% of respondents put robust international coverage as one of their top 5 most important factors, although it is not scored highly. Roaming agreements are the most common way of dealing with international connectivity requirements, with 70% relying purely on roaming agreements for their international connectivity. Future respondents will be similarly focused, if not more so; 84% of those report they will rely on multiple connectivity providers and leverage their roaming agreements to do so. However, this also needs to be paired with some domestic connectivity, with no respondents reporting that over 50% of their devices would need international connectivity and most only requiring it for 25% or less. This will need to be rectified in conventional ways, typically; while 45% of cellular IoT users report using eSIMs (see in the next section), only 11% report using them to alleviate roaming concerns. In addition, switching profiles may complicate matters, particularly as 42% of respondents wish for simpler BYOC frameworks, which eSIM profiles will make more complex to deploy.

What proportion of your organisation's cellular IoT device fleet requires international or multi-regional connectivity? (Cellular IoT Adopters)



Concerns about roaming could be holding the space back, with 63% of respondents see growing roaming restrictions as one of their top 5 concerns in scaling IoT, with it coming in as the third-ranked concern overall. 60% of respondents also report that keeping a multinational solution safe from regulatory or

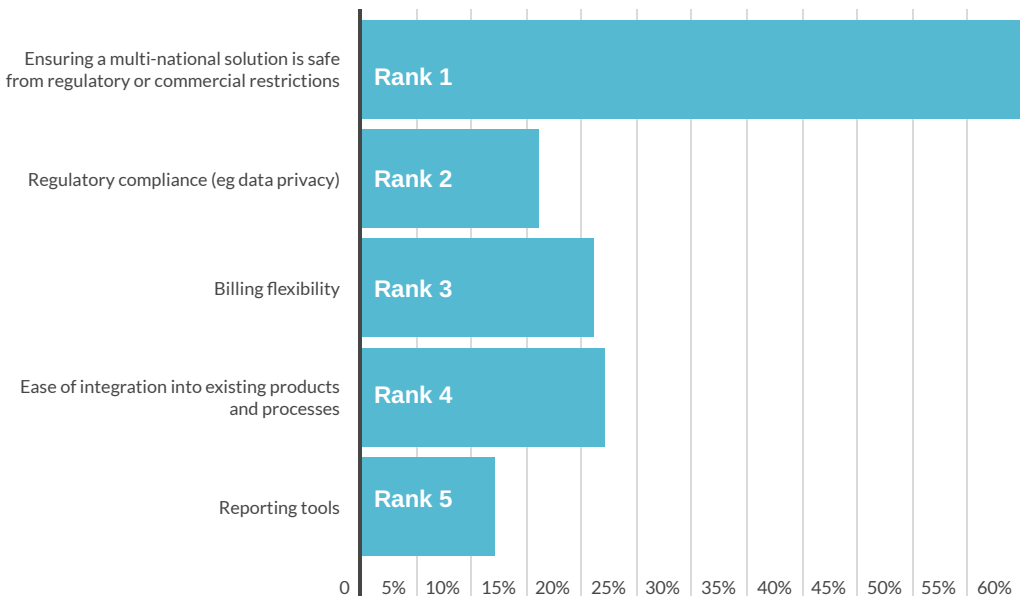
How do you expect your organisation's forthcoming IoT devices to be distributed? (Cellular IoT Non-Adopters)



commercial restrictions is their top most important factor for IoT connectivity, while ensuring coverage in countries with roaming restrictions is ranked second overall in a connectivity partner's desired capabilities. However, robust international coverage is a logical corollary of this, and that factor did not make it into the

top 5 most important factors. This suggests that logistics companies simply expect robust international connectivity, rather than it being fully top-of-mind until it comes under regulatory threat.

What are your top 5 factors that are most important where IoT connectivity is concerned? (All Respondents)

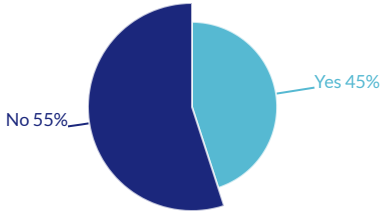


That said, there is still a long way to go with its implementation; 45% of respondents think that a simplified technical model for integrations is lacking in the current ecosystem, and 42% say the same about the use of preferential operator contracts and BYOC arrangements. International connectivity itself may not be the primary concern in some circumstances, but the ability to simplify roaming and accommodate alternative connectivity is something that a sizeable minority of respondents want. There is also a desire for connectivity partners to be seen as independent, with a carrier-agnostic partner being ranked as a top 4 capability that respondents look for and selected by 47% of respondents to be in their top 5 capabilities. This is, however, moderately less important for those who would consider using or do use an MNO directly for their connectivity requirement, possibly because they

rely on that MNO's existing roaming agreements. Above all else, respondents want high-quality connectivity, noted as the top technical feature adopters reported influenced their choice of connectivity provider. This, coupled with the requirements for carrier-agnostic partners, would potentially require a degree of sophistication in roaming steering based on use case-dependent criteria, such as low latency or signal strength, in order to minimise the required transmit power. This makes it important for roaming providers to be able to gauge connectivity requirements not just on availability and agreements but use case-specific criteria. In the long run, this should put MVNx players at an advantage, as these providers are more likely to be able to negotiate more flexible terms with their roaming partners than MNOs, who will have more restrictive peer agreements in place.

eSIMs are an increasingly common solution to many of the problems of international connectivity, and the logistics industry has enthusiastically adopted them. **45% of transport and logistics respondents with a current cellular IoT deployment reported they use eSIM**, the most highly adopted vertical of all the survey.

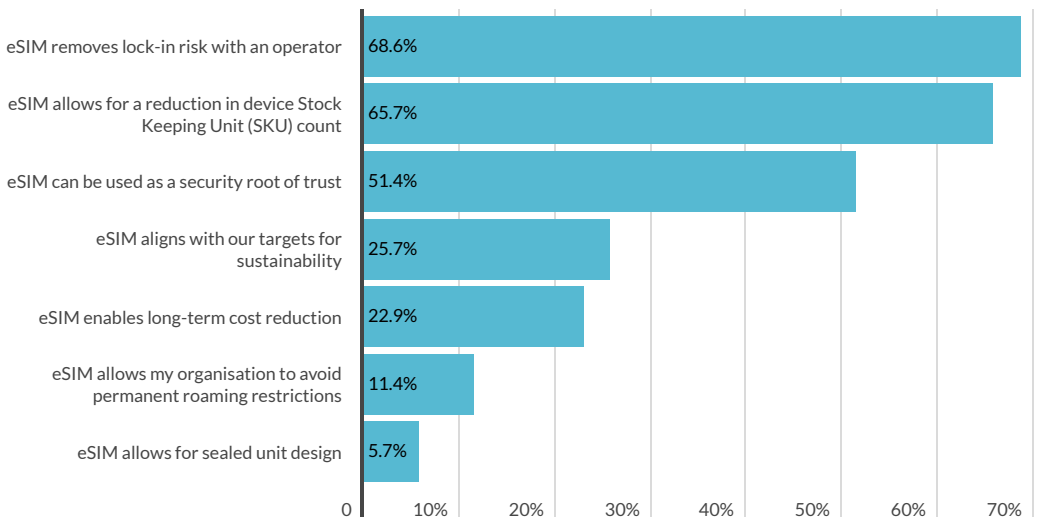
Have you decided to use eSIM (eUICC) as part of your IoT deployment? (Cellular IoT Adopters)



The main driving force for this is to **avoid operator lock-in**, with **69% of users reporting this as the reason for their usage**. A **reduction in SKU count is close behind at 66%**. These measures are intended both as a security policy and as a way to simplify international deployments, which it seems to be doing; non-eSIM users are significantly more likely to rank the complexity of managing multiple providers higher than those who use eSIM.

However, this reduction in complexity is unlikely to be related directly to roaming, with **only 11% of users reporting they use it to avoid permanent roaming restrictions**. It is likely to be used to provide a handful of global connectivity providers that can then be switched to local profiles as required, rather than local profiles being a consistent use pattern wherever devices are located. In the context of logistics, this is also more cost-effective, as international mobile assets may need to change profiles several times if they are aiming for local usage, whereas a single international profile will require less switching, lowering both management time and profile costs.

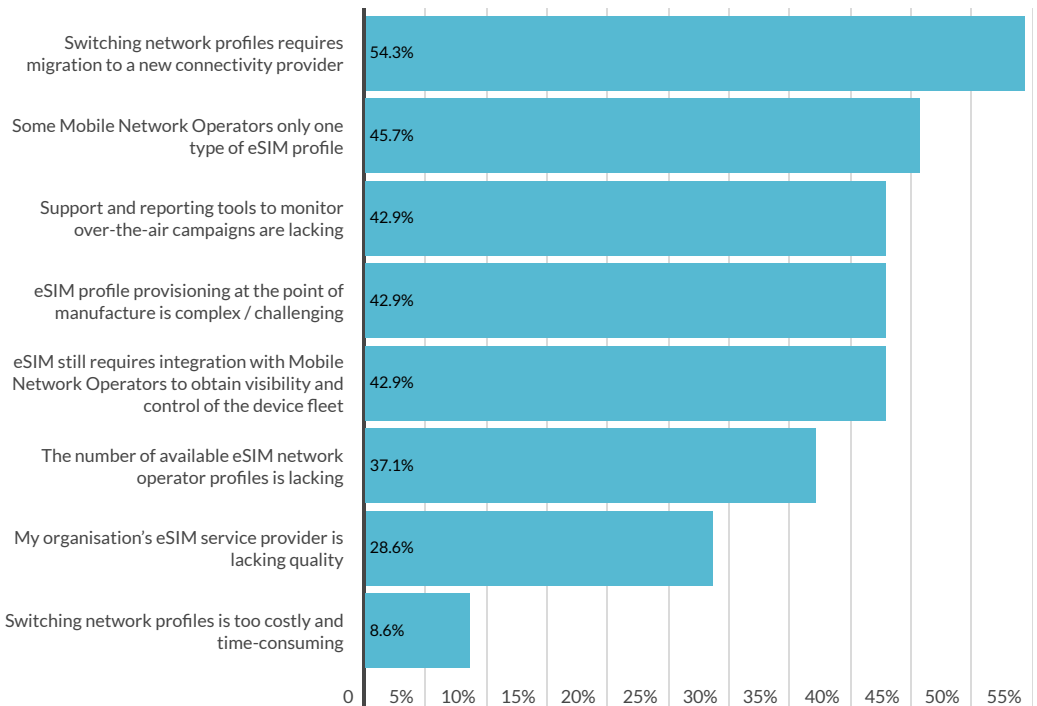
What factors made you choose eSIM (eUICC)? (Cellular IoT Adopters)



Indeed, there is likely to be a pervasive hesitancy from end users around profile switching; **54% of eSIM users reported that changing profile meant changing provider, negating the biggest benefit to using the technology to a large extent.** More profile flexibility is needed in general as well, with **46% of eSIM users reporting that there is limited support for the whole range of eSIM profile types.** With logistics covering a wide variety of device types, eSIM providers need to make a broader range of profile types available to match the needs of their end users.

These profiles also may not be delivering what end users need, with 43% noting that they cannot get full visibility without more integrations with local MNOs. This also makes switching MNOs challenging, as there will be a reluctance to change MNOs without guarantees of that fuller integration. Making sure that the profiles offered are full-featured should be a priority for eSIM providers.

What are your main issues with your current eSIM (eUICC) solution? (Cellular IoT Adopters)

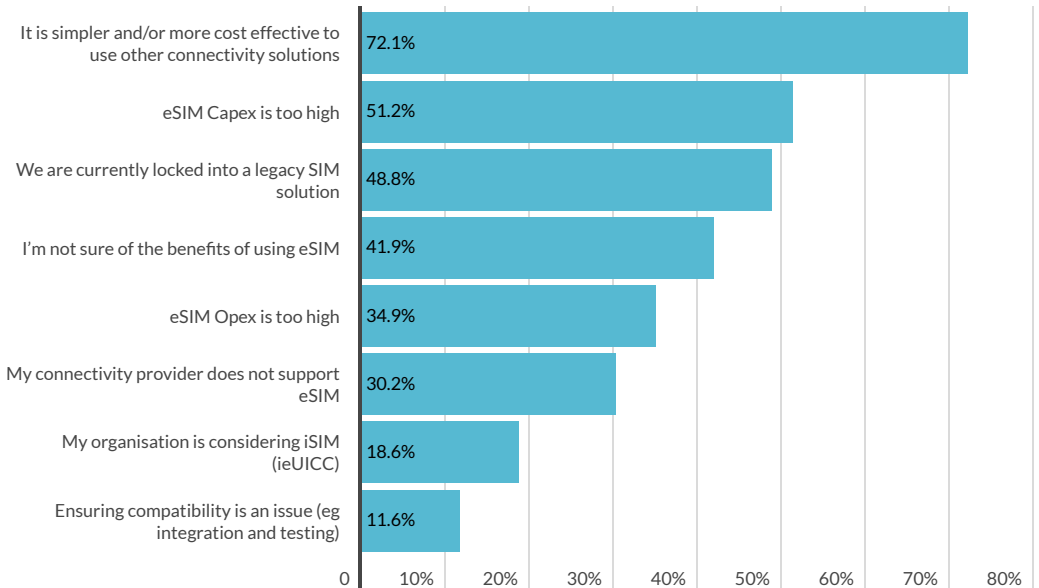


eSIMs' operational complexity is putting off potential users – **72% of non-users report that they believe other connectivity solutions are simpler.** However, even with the perception of complexity reduced it is unlikely to increase adoption by much. On average, non-users are reporting more than 3 reasons they do not want to use eSIM, and almost half are locked into a legacy SIM solution, and, therefore, unlikely to move unless the switch to eSIM happens as part of a broader hardware refresh.

iSIM can potentially help with some of these issues, although not all. Most particularly, the note that eSIM Capex is high can potentially be reduced by using iSIM over eSIM; with a reduced bill of materials, the expenditure on connectivity can potentially be reduced to more acceptable levels. More broadly, it should be emphasised that there is still a lot of uncertainty in the market about eSIMs, with 42% of non-users reporting that they are not sure of the benefits of using eSIM. Working with enterprises to clarify where it can be useful would be a good start

towards increasing their adoption, particularly for those who are committed to legacy solutions – establishing a relationship before the need to replace devices would give connectivity providers time to make the benefits of eSIM clearer to potential users.

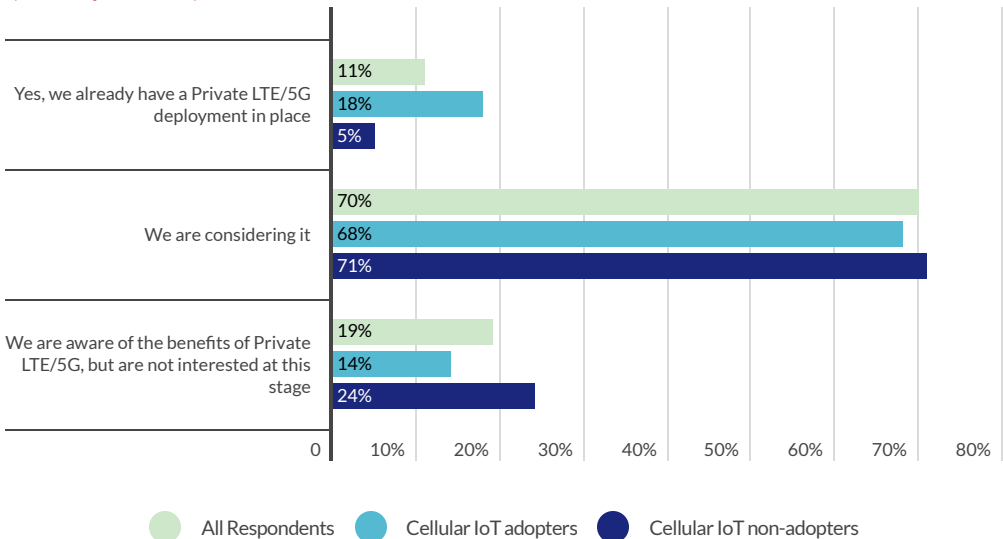
Why have you chosen not to use eSIM (eUICC)? (Cellular IoT Adopters)



Private LTE/5G - Transport/Logistics

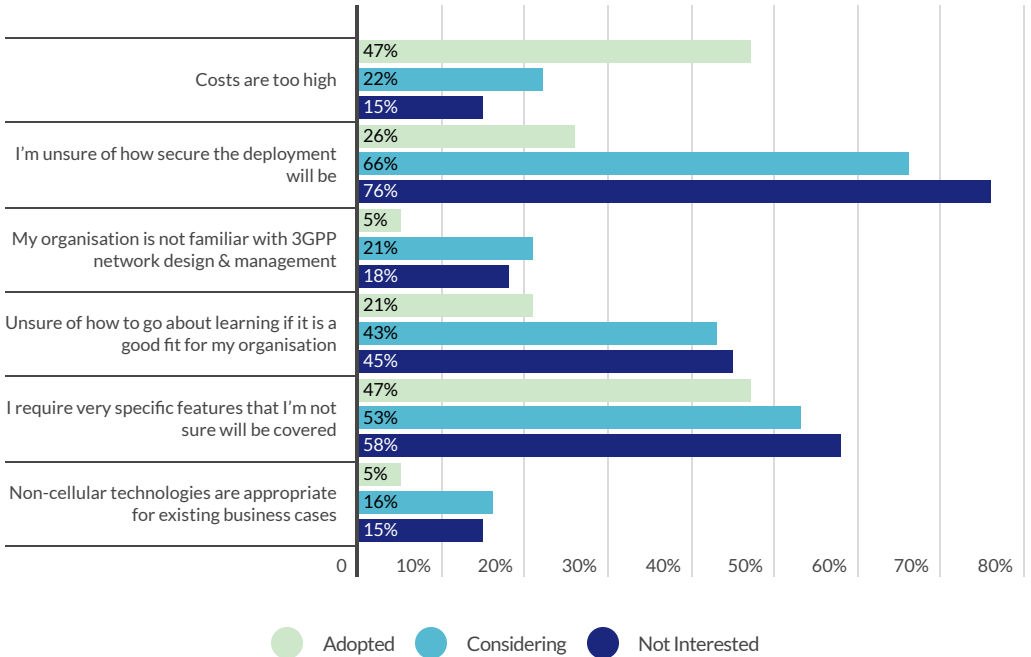
Private networks are one of the hottest topics in connectivity at present, and the logistics sector is no exception, with **11% of respondents reporting having already deployed a private network and a further 70% considering it as a possibility.** Of the verticals surveyed, only the energy and utilities sector have higher adoption and interest in the technology.

Does your business unit have an interest in Private LTE/5G to enhance business operations? (All Respondents)



However, current adopters in transport and logistics have had a different set of drivers compared to the broader set of those who are thinking about using the technology. Current users are more likely to highlight privacy as one of the core benefits than those considering, who instead focus on a broader range of possible benefits, including the reliability of connections and their potential to support a guaranteed QoS for connected assets. There is little difference between those considering and even those who are not interested in private networks, however, with the benefits mostly clear to all the industry at this point.

What are your main concerns over a potential Private LTE/5G deployment? (All Respondents)

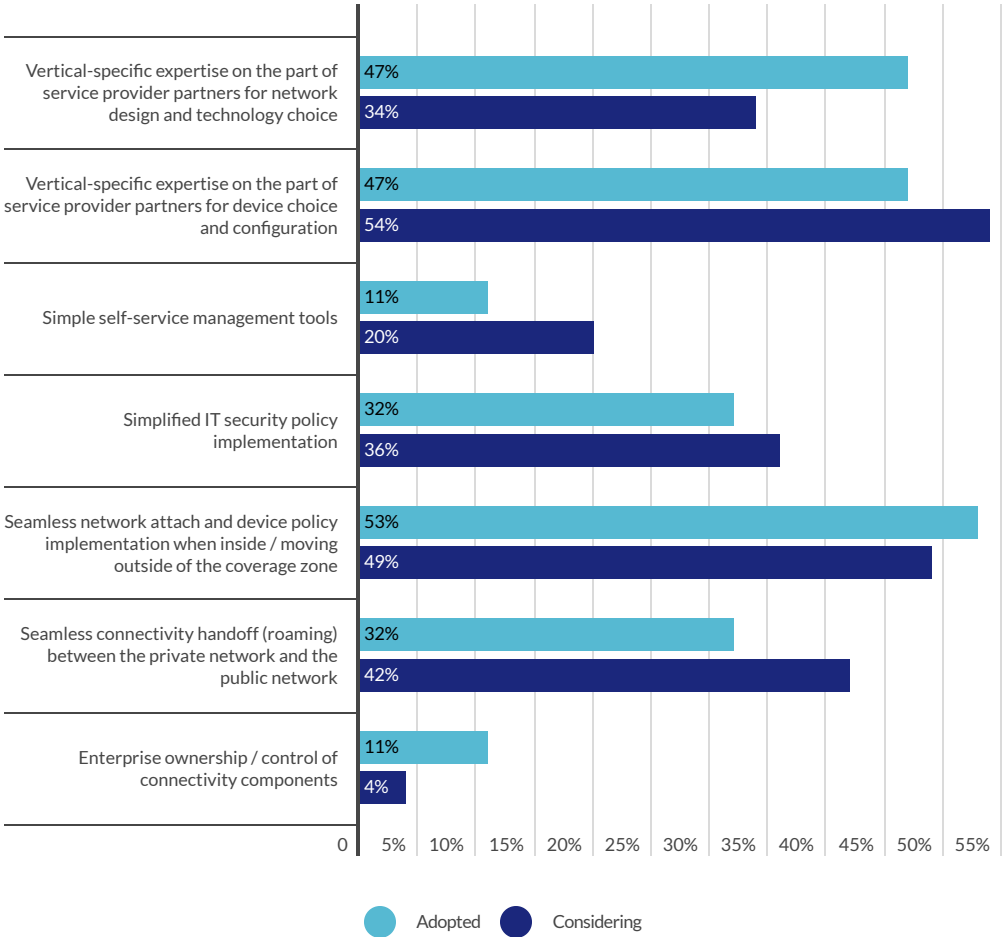


In terms of barriers to adoption, perceived security is the clear barrier, with **76% of those who are not interested saying they are unsure of the security of private networks**. This is even true of many respondents who consider security to be one of the benefits of private networks. There is clearly an awareness of how private networks can improve security but a level of mistrust around how that works in practice. This is emphasised by how many respondents are unsure whether private networks will meet their specific requirements; over 50% of both those not interested and those considering. There is an awareness that private networks are useful in general, but connectivity providers need to be able to show how that applies in specific circumstances and use cases to win over clients.

Part of this will be instruction on cellular network management, which 19% of respondents reported as a concern. Adopters are far more confident in their ability to manage cellular networks, as well as being less likely to consider non-cellular networks suitable for their business cases. Private network providers need to focus on the unique benefits of private cellular over non-cellular to make a case for them. This would also clear up the uncertainty of the **42% of those considering who do not know how to assess if private networks will be a good fit for them**. As with the rest of the cellular IoT, hardware plays a part in what respondents wish for; **51% consider vertical-specific expertise in device choice and configuration to be important for private networks, while 37% think similarly for vertical-specific network design**, although both private network adopters and those not interested show higher results here.

Similarly, 50% want seamless device policy implementation for movement between the private network and public networks, with elevated importance given to these by current adopters and those not interested. In fact, adopters and those not interested have a similar order of priorities for private networks. This indicates that many of those who have dismissed them may have done so prematurely, without full comprehension of what private networks can offer.

**What are the most important factors for consideration where Private LTE/5G is concerned?
(Solution Adopters & Considering Adopting)**





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About the authors



This survey report would not be possible without the support of its sponsors. Kaleido wishes to thank the sponsors of this study, who, along with Kaleido and IoT Now, are supporting our vision of enabling business decisions across the enterprise sector through inspiring, educational and accessible insights.



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Kaleido covers industry-leading market intelligence and publications on IoT Roaming, eSIM, Connectivity Management Platforms, Private Cellular Networks and Mobile Telecoms Fraud & Security. Research is led by expert analysts, each with significant experience delivering insights that matter.

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For more information on this market study or if you have further requirements, please contact:

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