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Enterprise Cellular IoT Demands & Opportunities: Healthcare

A Kaleido Intelligence Survey Report

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Introduction

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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.

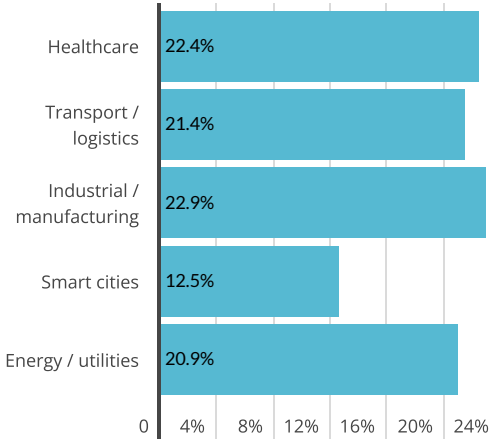
This year's survey has set out to take a deep-dive into where the key pain points in the context of cellular IoT connectivity lie and represents an expansion of the 2022 survey effort. Some 800 enterprises were surveyed during February-April 2023, representing activities in five key IoT industry verticals:

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

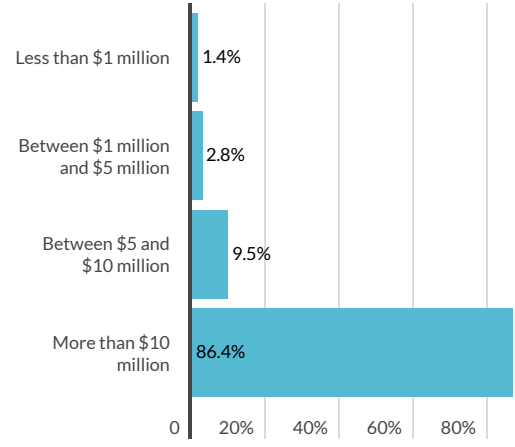
All respondents were all decision-makers at managerial level or higher within their organisation, in addition to having a good knowledge of the cellular IoT ecosystem. In order to understand a broad picture of perceptions, respondents included companies that had adopted cellular connectivity for IoT, 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.

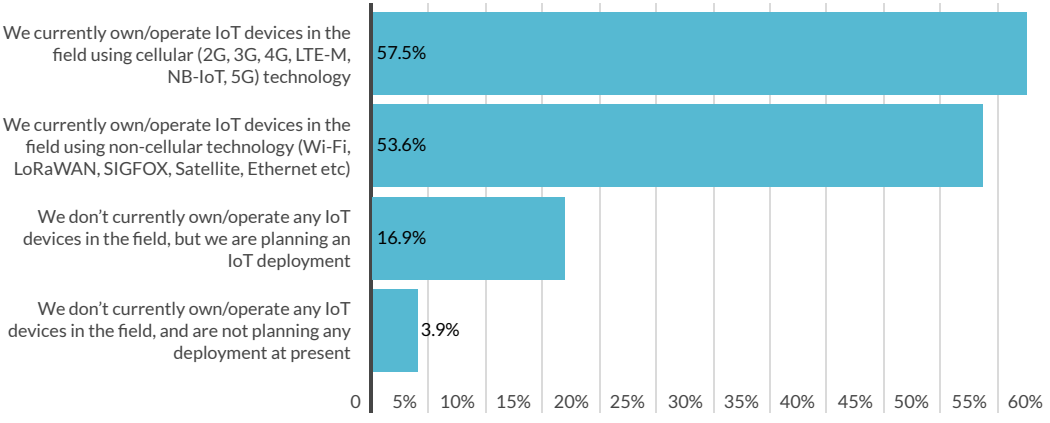
In what market segment does your business unit primarily operate?



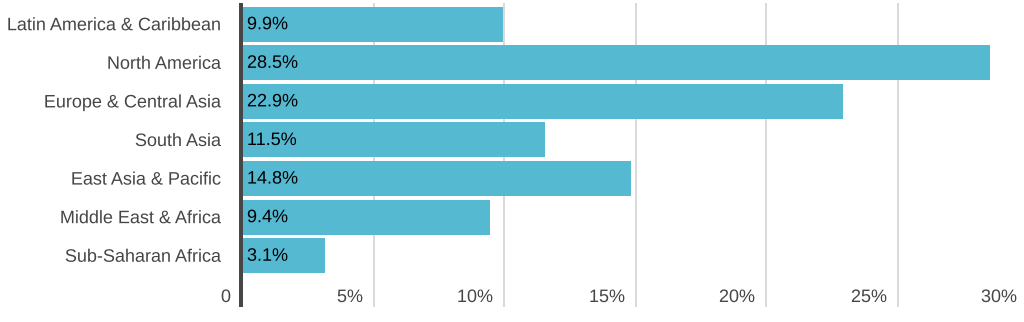
What was your organisation's turnover in 2022?



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



Where is your business unit based?



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Survey Themes

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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:

Healthcare

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State of IoT - Healthcare

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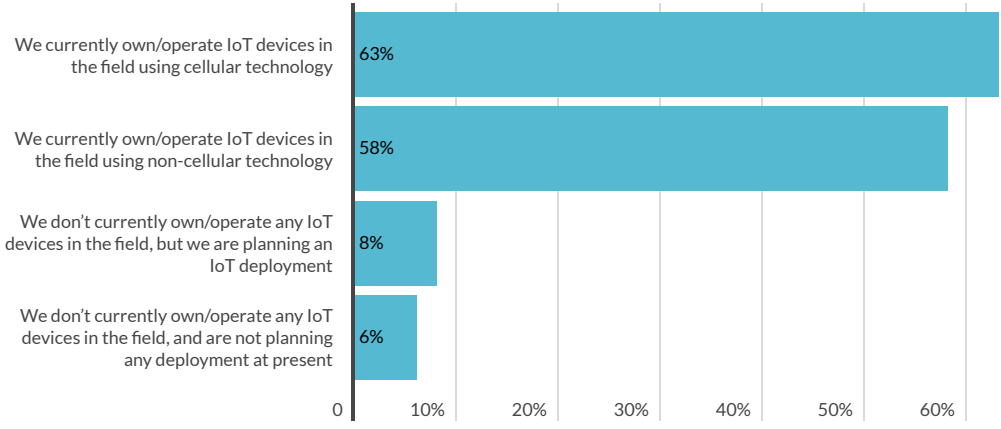
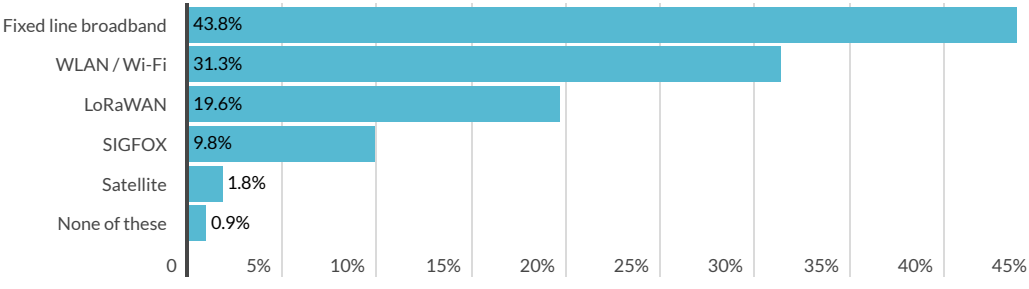
Enterprises in the healthcare vertical reported higher levels of cellular IoT adoption compared to the survey average, with **63% of survey respondents stating they have an active cellular IoT deployment, compared with 58% of enterprises across all verticals.** The results are interesting when positioned against those collected in 2022, where 49% of respondents reported a cellular IoT deployment, in addition to nearly half of the non-adopter cohort stating an intention to deploy cellular IoT in the next 2 years. **Evidently, strong growth has been achieved within the healthcare vertical, undoubtedly due to continuing efforts to digitise caregiving as a result of the COVID-19 pandemic.**

What is your organisation's current status in regard to IoT? (All Respondents)



Use of other communications technologies for IoT is common within the healthcare vertical, with **69% of cellular IoT adopter respondents using additional technologies to support IoT operations.** Most commonly, these implementations leverage fixed-line broadband communications, which, at 44% of respondents, is higher than the 40% seen across all verticals, although lower than transportation and logistics and energy and utilities.

Apart from cellular technology, are you deploying IoT using devices with other communications technologies? (Cellular IoT Adopters)



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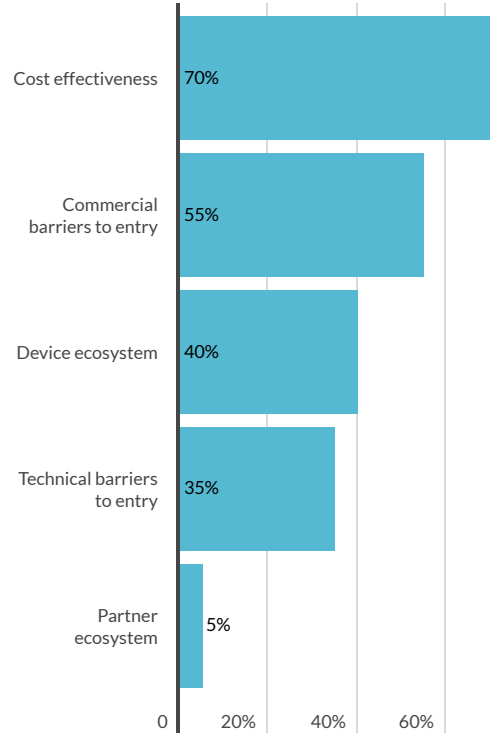
Digital healthcare services have undoubtedly benefitted from the onset of the COVID-19 pandemic, which saw a large proportion of the global population issued with stay-at-home orders and with limited physical access to general healthcare services. Teleconsulting services, which pre-pandemic were limited in scope, are now relatively commonplace across developed regions, while renewed emphasis has been placed on remote patient monitoring solutions for chronic disease and cardiac outpatients, with a plethora of devices using various communications technologies to transmit data to caregivers. In addition to this, the market has seen a drive towards greater efficiency in caregiving locations through asset and worker connectivity.

The survey points to positive sentiments where cellular technology is concerned, acting either as a direct means for connectivity or as an aggregation tool through gateway devices connecting data from non-cellular devices. This is observed first throught the level of cellular IoT adoption witnessed earlier, in addition to perceptions from the non-adopter cohort: 70% of respondents view cellular as a key technology for wide-area digital health connectivity.

However, it should be noted that, **among those that did not select cellular in the survey question displayed above, cost-effectiveness was cited as the main reason for not choosing the technology by 70% of respondents; much higher than the survey average of 58%.** As such, it is important to consider where extraneous costs may exist within the ecosystem and if any mechanisms exist to alleviate those issues. One likely source of unwanted cost is likely to stem from complexity, which is particularly acute in the healthcare industry. This will be examined in the next section.

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



Complexity - Healthcare

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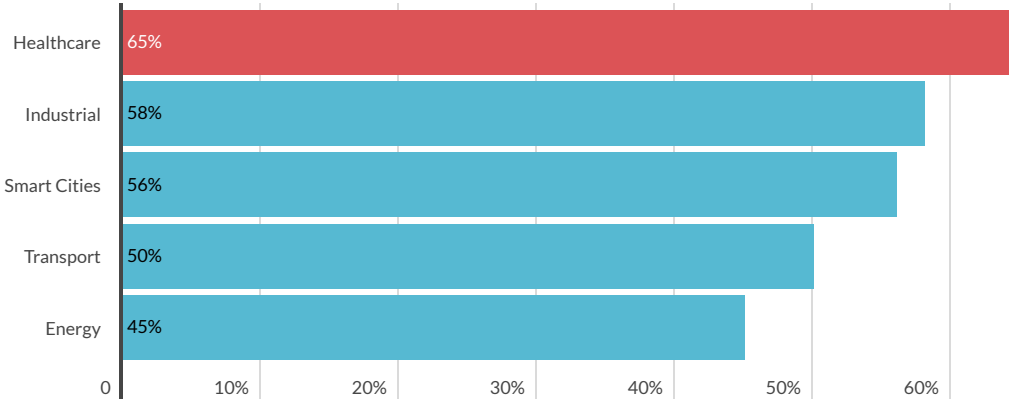
According to the survey, hardware complexity is more evident in the healthcare vertical than others: **65% of cellular IoT adopters reported that hardware experience on the part of a CSP's capabilities is their number one concern when looking for a partner.** This proportion is well above other verticals, and likely for good reason: certifications for medical device use are challenging to say the least, and in many cases, a change in the hardware will require the process to repeat itself. As such, there is a strong desire to optimise from the outset which, as we have seen throughout the survey, is not an easy task for adopters or non-adopters of cellular IoT. **Hardware is of such importance to cellular IoT adopters that the ability to bundle hardware and connectivity was cited as the second highest priority in terms of a CSP's capabilities.**

Device & Hardware Experience Ranked Top Priority for CSP Capabilities (Cellular IoT Adopters)



Simply from the results above, it is apparent that being competitive in the healthcare vertical requires a considerable level of specialisation beyond mere connectivity. For most players, this can only be achieved through M&A activities, which are likely difficult to justify on account of the comparatively small size of the market at present compared to some other verticals. Inevitably, this vertical represents a long-term opportunity for CSPs, although specialisation at this juncture will mean they are well-positioned to capture market share as traction and adoption gather pace.

Further challenges are found through results that healthcare enterprises also suffer from having to engage with multiple CSPs to meet their connectivity requirements; here, 28% of respondents ranked this as their number 2 challenge in scaling IoT deployments up. When one considers the level of specialisation expected from healthcare vertical CSPs, it is apparent that the pool of available CSPs able to meet requirements is diminished when compared to many other verticals, which makes the ability to scale up even more challenging. This relates not only to the issues with hardware described earlier but also to the technical capabilities of the CSP to ensure that devices retain a

high level of security and data privacy. Indeed, end-to-end security was ranked as a top 5 priority for cellular IoT connectivity among cellular IoT adopters.

Challenges in scaling IoT up - Need to engage with multiple CSPs (All Respondents)

Rank 2

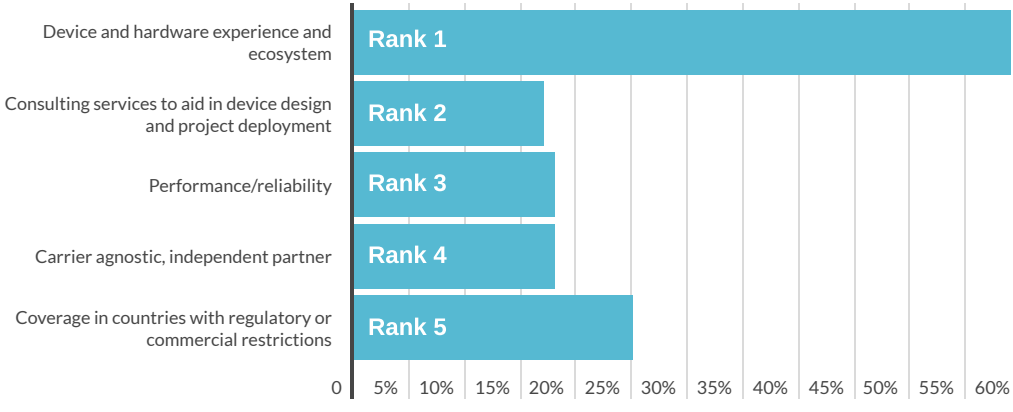
By nature, digital health solutions can have a positive or negative impact on an individual's health, depending on whether the solution is functioning reliably or not. As such, connectivity reliability is perhaps even more important in this vertical when compared to others, given the risks involved with lengthy downtime: revenue may not be the only thing at stake. This is reflected in the survey results, with healthcare respondents ranking connectivity performance and reliability as a top 3 priority where a CSP's capabilities are concerned. This complexity is not necessarily felt at the end-customer level but rather at the service provider level.

Top priorities for IoT connectivity - End-to-end security (Cellular IoT Adopters)

Rank 5

Considerable effort must be made on the part of CSPs to ensure that high-quality, resilient links between the CSP and connectivity partners are established so as to maximise performance and reduce potential downtime. In addition to this, the CSPs must have strong capabilities to identify network issues rapidly. If robust SLAs are struck between the CSP and its connectivity partners, this would undoubtedly prove a strong point of differentiation, given that customers can be assured of reliability. It is notable that other verticals also selected this capability among their top 5 prioirites, albeit lower down the list. This may offer some investment incentive, given the differentiator is not exclusive to the healthcare vertical.

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



Sophistication - Healthcare

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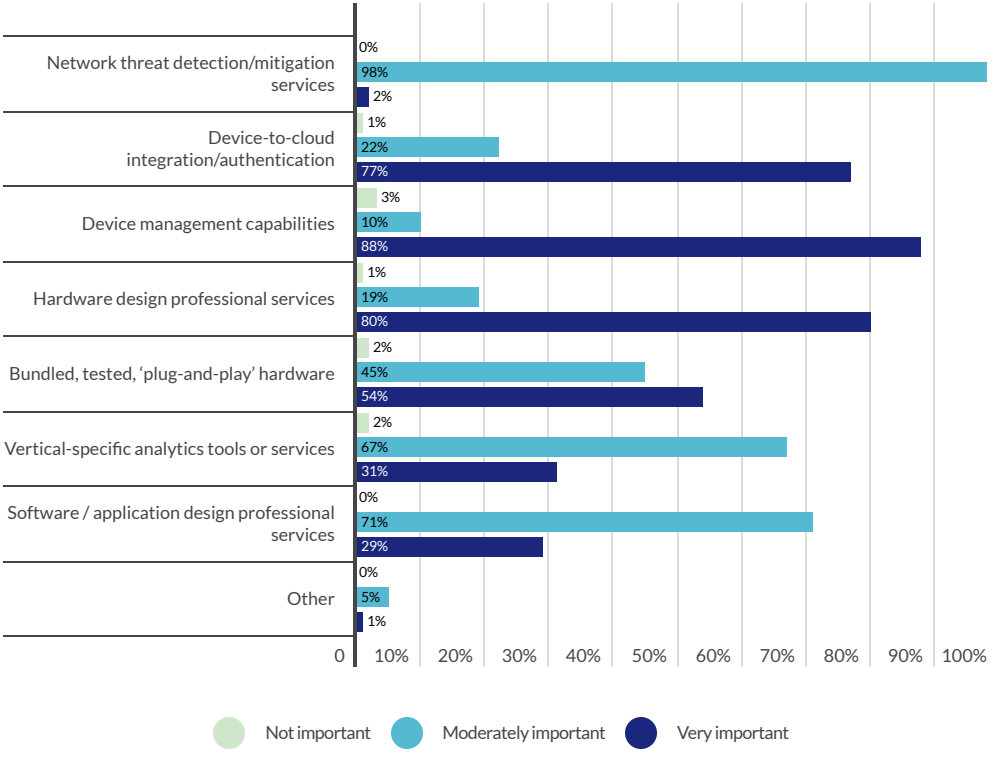
Sophistication in healthcare enterprise vertical demands is not limited to the expertise requirements outlined in the previous section. The ability to deliver VAS components in addition to connectivity appears to be a key factor for existing cellular IoT customers, with **88% of respondents reporting that device management capabilities are of the highest importance.** In part, this is likely liked to a perceived need to simplify IoT deployments by sourcing the capability to manage the connectivity, device firmware and device software from the same provider. However, one can envision how in reality, this might run into trouble: earlier, we observed how customers must frequently source connectivity from more than one provider, which leads to the logical conclusion that device management solutions should be sourced via an agnostic third-party. That said, CSPs with device and hardware portfolios and expertise, which are evidently favoured by healthcare enterprises in principle, will likely offer device management capabilities at some level; this is certainly the case where hardware OEMs are concerned.

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

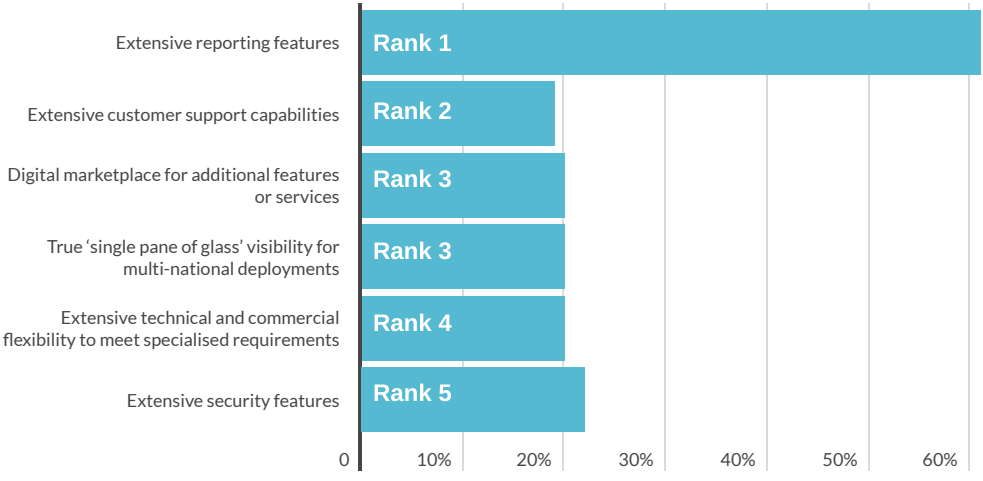


Security services are clearly important in the healthcare domain and are perhaps more so in this vertical due to the nature of activities and data involved. It is interesting to note, however, that security threat detection and mitigation solutions are cited as moderately important for the most part, despite security expectations playing a greater role in the survey results in terms of CSP capabilities. From this perspective, one can infer that typical security solutions, such

as private IP addressing, private APNs and VPN flavours are viewed as broadly sufficient in terms of how CSPs should present the offering. It is likely that many enterprises in this vertical are unaware that compromised devices using cellular technology may not necessarily be detected as such by traditional enterprise detection and response tools, which focus on data gathering from cloud services or enterprise data centres. Tools to enable visibility into device activity within the cellular network itself will undoubtedly be beneficial, but education is clearly required at this stage to help enterprises better understand the potential risk profile.

This is perhaps in part reflected in enterprise sentiments regarding CSP product capabilities, where reporting tools were ranked as the number one feature most important in the context of CSPs' products. These types of capabilities not only involve enterprises' ability to gather metrics that help them understand the root cause of potential issues with SIM cards, but also to gather information that can be leveraged for further business intelligence, particularly when device management capabilities and associated reporting metrics can be combined with connectivity data.

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



Although such capabilities may not be available in typical out-of-the-box offerings, the rankings highlight that enterprises are open to adding new services to the solution on a case-by-case basis. Here, digital marketplace models are desirable, given the sales and implementation simplification offered by a purely digital self-service approach. Naturally, this will rely on the CMP having been developed in a modular, rather than monolithic approach, which offers some advantage to CSPs in control of their own CMP development rather than relying on a third-party supplier. Further emphasis on this is found in the fact that enterprises demand a highly flexible technical and commercial approach to services, which ranked as a top 4 priority for CSPs' products. Older platforms are certainly at a distinct disadvantage here, owing to protracted roadmap development times and heavy emphasis on developing features that are likely to be adopted by all customers rather than opening services to specific niches.

Roaming - Healthcare

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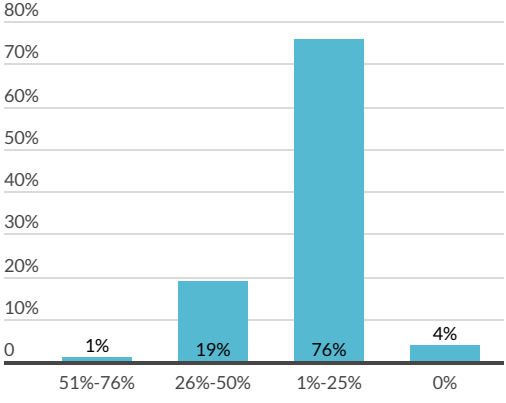
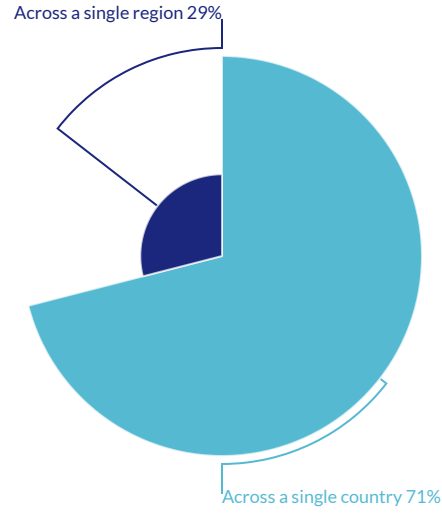
Alongside the industrial and manufacturing vertical, healthcare showed the highest demand for international connectivity support, with **only 4% of cellular IoT adopter respondents reporting they require domestic connectivity only. This is in stark contrast to those who have not yet adopted cellular IoT, where 71% of respondents reported that their future deployment will only require connectivity in a single country.** This may be a case of 'start small' for those who have not yet adopted, but it is clear from those already in the ecosystem that connectivity needs have spread beyond what was originally envisioned.

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

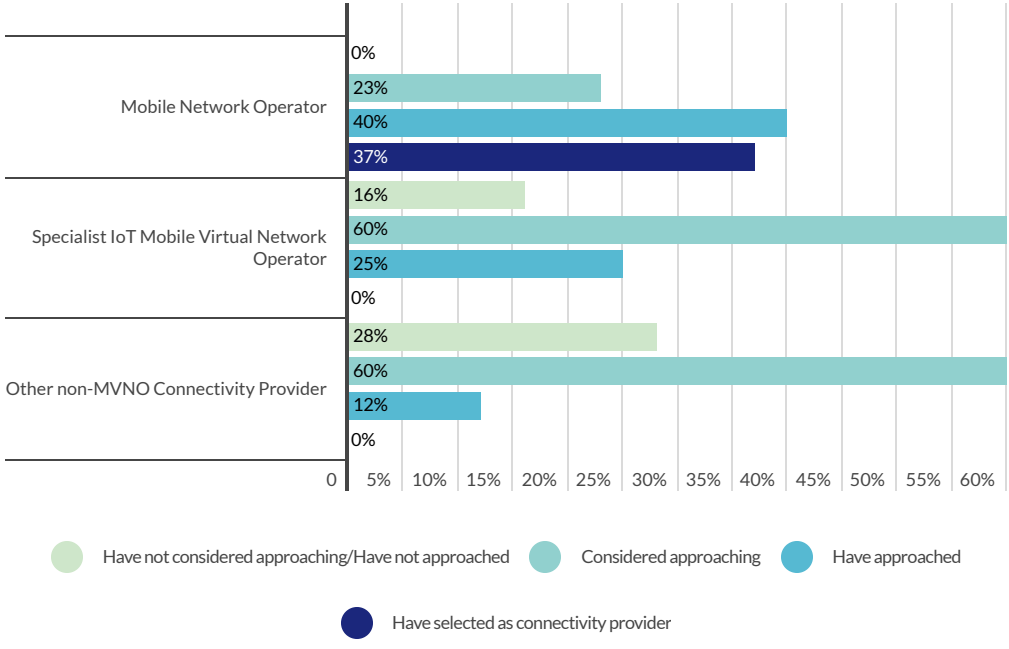


In part, this desire among non-adopters for single-country connectivity helps explain the high prevalence of respondents preferring the MNO market over aggregator specialists, with **77% of respondents either having approached or engaged an MNO for connectivity requirements, compared with 37% of respondents that have considered approaching alternative service providers.**

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

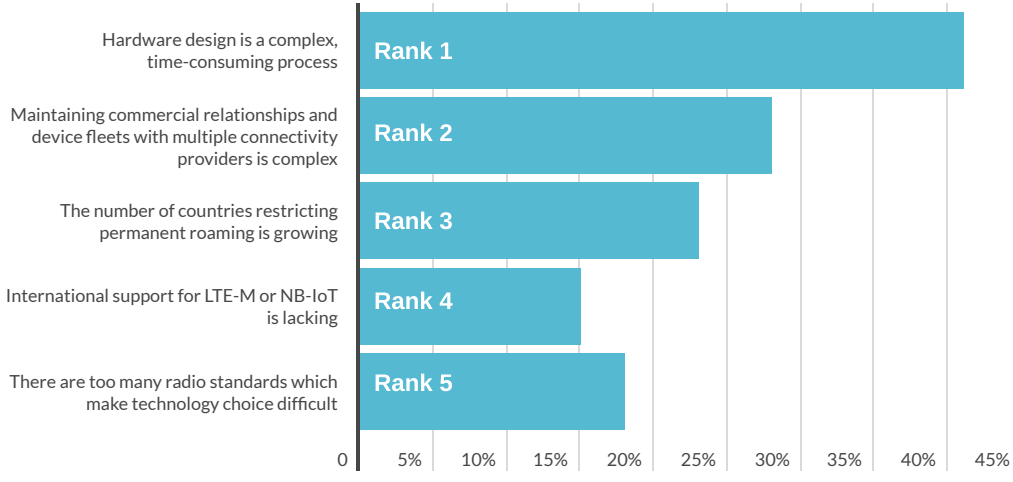


What types of organisations are you considering approaching or have you approached for your IoT connectivity needs? (Cellular IoT Non-Adopters)



Roaming challenges rank highly in terms of the ability to scale deployments up: permanent roaming concerns were cited as the third-highest challenge here, with a lack of support for cellular LPWAN connectivity ranked as the fourth-highest challenge. **Meanwhile, the ability to safeguard a solution from regulatory or commercial restrictions was in turn, ranked as a top priority by respondents.**

What do you perceive to be the top 5 challenges where scaling up cellular IoT connectivity deployments is concerned? (All Respondents)



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Regional presence is evidently essential to go about addressing some of these concerns, particularly due to the more stringent regulations for healthcare data cross-border data flows. Control over data routing must form a part of the CSP's capabilities, while mechanisms to localise connectivity through multi-IMSI or eSIM technology will likely prove as a differentiator. At the commercial level, efforts to secure roaming connectivity for NB-IoT or LTE-M should be made for all verticals, but healthcare is evidently one of the verticals more impacted by the current status quo; notably, **robust coverage for international deployments was cited as the fourth most important factor for IoT connectivity,** which only increases pressure on CSPs where cellular LPWAN is concerned. Here, agreements with roaming hub providers may prove beneficial, owing to the one-to-many access model applied by such hubs for roaming connectivity; often, such players have relatively strong commercial market power, enabling them to sign permanent roaming agreements with operators and thus avoiding risk.

Top priorities for IoT Connectivity - Assurance against commercial/regulatory restrictions (All Respondents)

Rank 1

Top priorities for IoT connectivity - Robust coverage for international deployments (All Respondents)

Rank 4

eSIM - Healthcare

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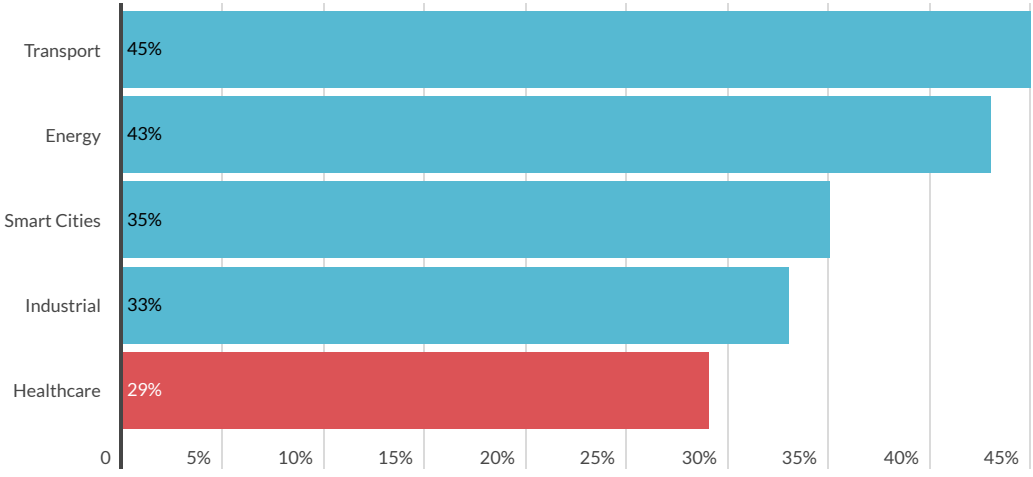
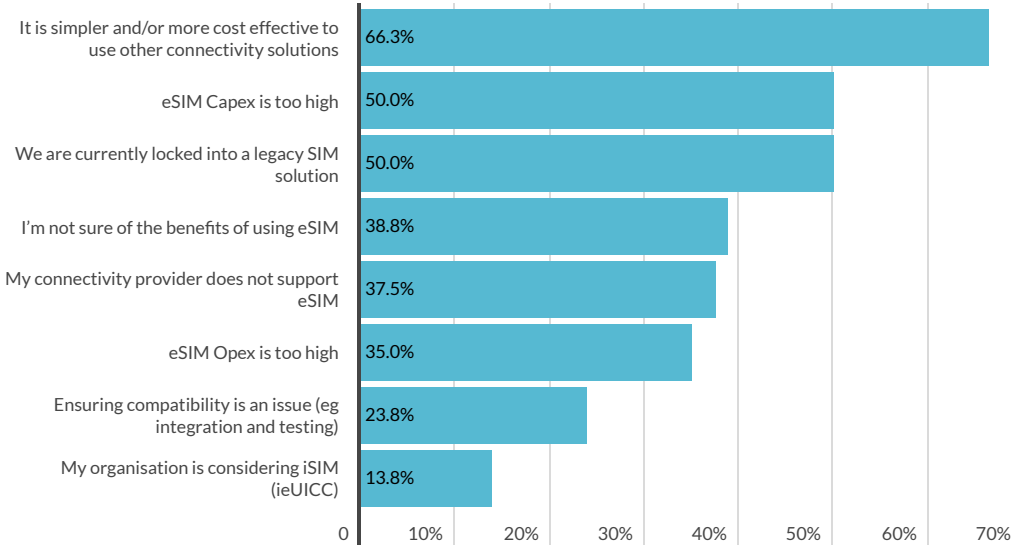
Somewhat surprisingly, eSIM adoption among healthcare enterprises is lower than the survey average, with **only 29% of cellular IoT adopters reporting using the technology, compared to a survey average of 36%.**

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



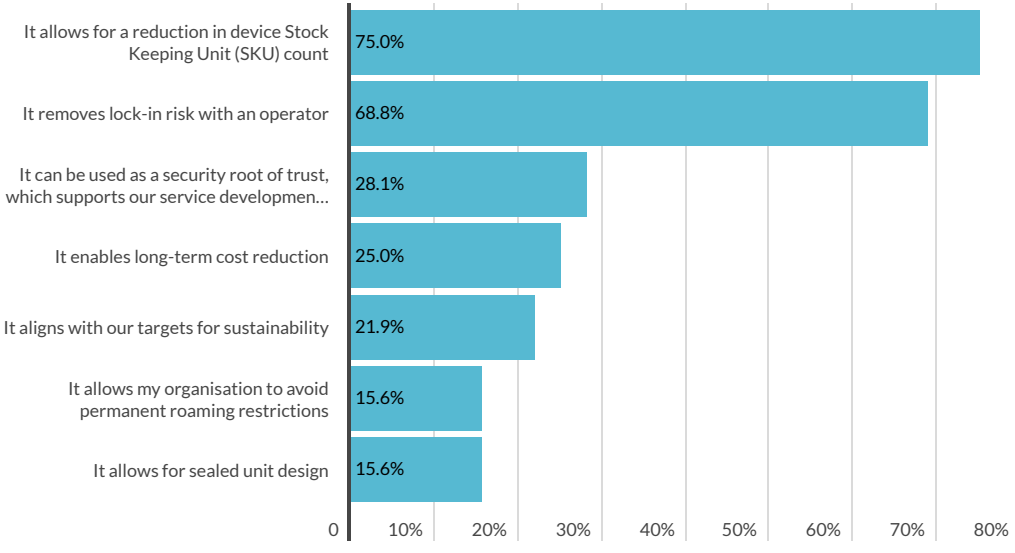
In part, this lower adoption can be linked to issues concerning eSIM Capex, where the price of the eSIM itself is higher than a traditional SIM card, while the acquisition of a digital eSIM profile may incur additional costs. When the fact that the complexity of hardware design in this particular vertical is higher than in most other verticals, it is evident that additional entry costs imposed by eSIM present a barrier for enterprises. On the other hand, healthcare is a highly regulated industry, with many risks and challenges, as we have observed in earlier sections. While other SIM solutions might well lower the entry barrier to cellular IoT, in the long-term these may prove to be more costly if changing to a new connectivity provider is required for any reason. Industry education is critical if only to help enterprises understand how eSIM can reduce risk; meanwhile, alternative business models for eSIM deployment could be considered, such as bundling the cost of eSIM into the overall connectivity package.

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



The hypothesis that cost reduction is top-of-mind is confirmed by the fact that **75% of those that have adopted eSIM cited the potential reduction in SKU count as a key reason for leveraging the technology. Once again, this represents a hardware concern, and the ability of eSIM to minimise complexity at some level is clearly appreciated by those that have absorbed the additional costs of moving away from traditional SIM solutions.** The survey response average for this benefit, at 59%, is much lower than in the healthcare vertical, underlining the link between hardware and cost sensitivity.

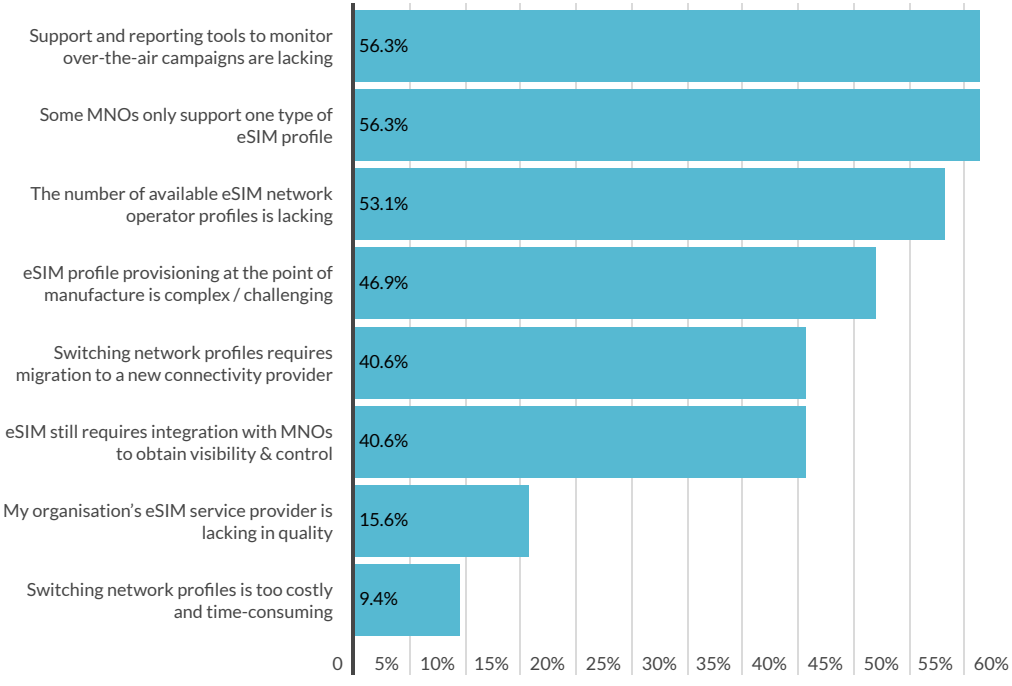
What factors made you choose eSIM (eUICC)? (Cellular IoT Adopters)



Earlier, we observed how enterprises in this vertical would like to see improved reporting features, enabling business intelligence and diagnostics capabilities to be opened up. This sentiment carries over to the eSIM domain, with **56% of eSIM adopters citing a lack of support and reporting tools for OTA campaigns. This is felt more acutely in this vertical, with 51% of respondents citing the same issue when all verticals are considered.** In part, this can be attributed to requirements revealed earlier, where connectivity reliability and uptime factored strongly among enterprise needs. Clearly, the risk of OTA campaigns failing and leaving devices without connectivity is unacceptable among enterprises, and as such, tools are demanded in order to ensure that campaigns are run smoothly.

Meanwhile, a high level of concern was also cited regarding operators' support for eSIM profile types, with **56% of the respondent base reporting that operators often only support one of the consumer or M2M profile types.** Given the range of devices involved in healthcare connectivity, support for both profile types will, historically, have been a benefit. With the forthcoming publication of the IoT specification in summer 2023 however, these issues will gradually be overcome, given the fact that the new specification reuses many components of the consumer eSIM specification. As such, devices using the consumer or IoT specifications can be supported with a relatively marginal additional investment on the part of the operator rather than the large sums involved with establishing support for consumer and M2M specifications.

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



Private LTE/5G - Healthcare

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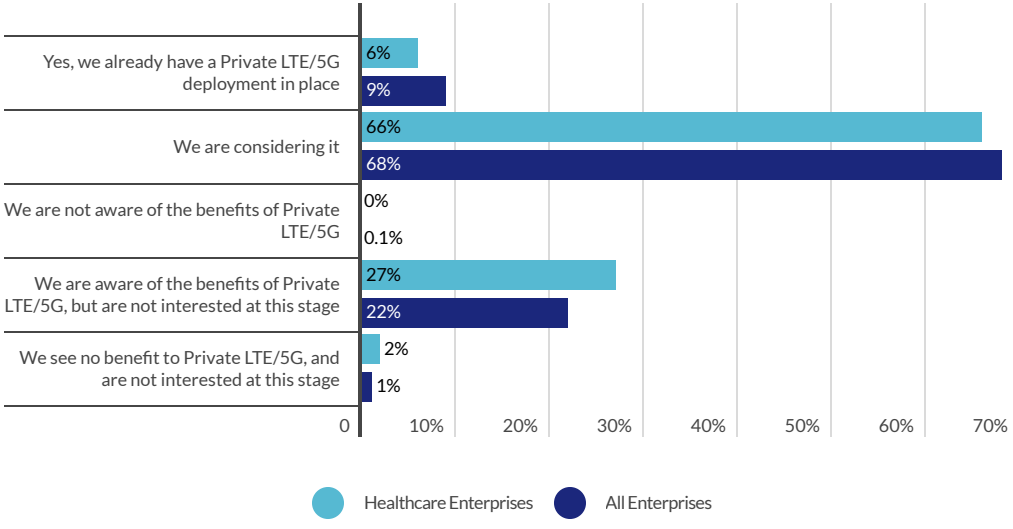
Enterprises in the healthcare domain reported the second lowest adoption levels of private LTE or 5G solutions, with **only 6% of respondents reporting an active deployment, compared to a survey average of 9%.** Meanwhile, the level of respondents **that are aware of the benefits, but are not interested in a private cellular solution, at 27%, is notably higher than the 22% identified in the cross-vertical analysis.** While it is certainly the case that private LTE or 5G speaks strongly to the high security and privacy requirements in the healthcare vertical, challenges evidently exist that means that a large proportion of the market is not yet ready to enter the ecosystem.

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

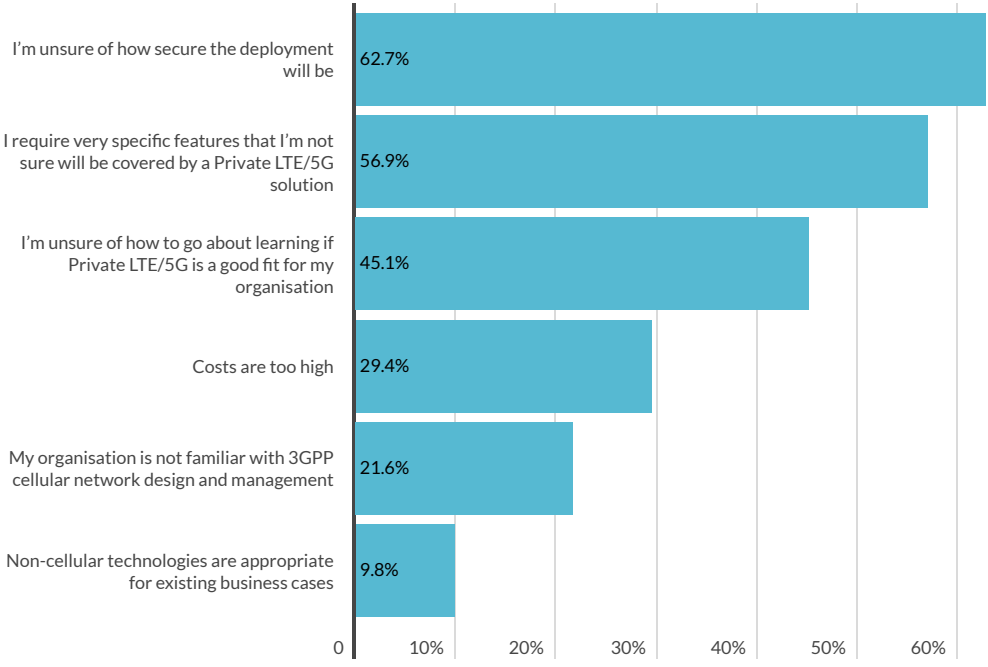


When examining only the cohort that is not considering a private cellular deployment, the reasons for eschewing the market become clearer. Here, **security concerns continue to be top-of-mind, in line with results seen in other verticals. Importantly, 57% of the respondent base reported being unsure if the features they need will be enabled by a private LTE or 5G solution, while 45% of respondents reported being unsure of how to educate themselves on the suitability of a private cellular deployment.**

This raises a similar theme observed in 2022's survey results, which highlighted a lack of education among enterprises regarding the deployment and benefits of private LTE or 5G. It appears as though little has changed in the interim in terms of demystifying the market, and highlights that opportunities, particularly in the healthcare vertical, remain at a nascent stage. This presents an interesting dilemma for service providers, given that 5G features such as network slicing, which can potentially offer similar benefits in terms of QoS and performance, will eventually make it to market, albeit in around 3 years. Without a doubt, fixed healthcare locations will benefit to a greater degree using private LTE or 5G, on account of security and privacy benefits, particularly where the core

network is located on-site. Nevertheless, entry costs for private networks are likely to be higher and, as we have seen earlier, this is a cost-sensitive vertical.

What are your main concerns over a potential Private LTE/5G deployment? (No interest in a solution)



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Afterword

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About the authors

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