PRIVATE 5G – TRENDS AND OUTLOOK

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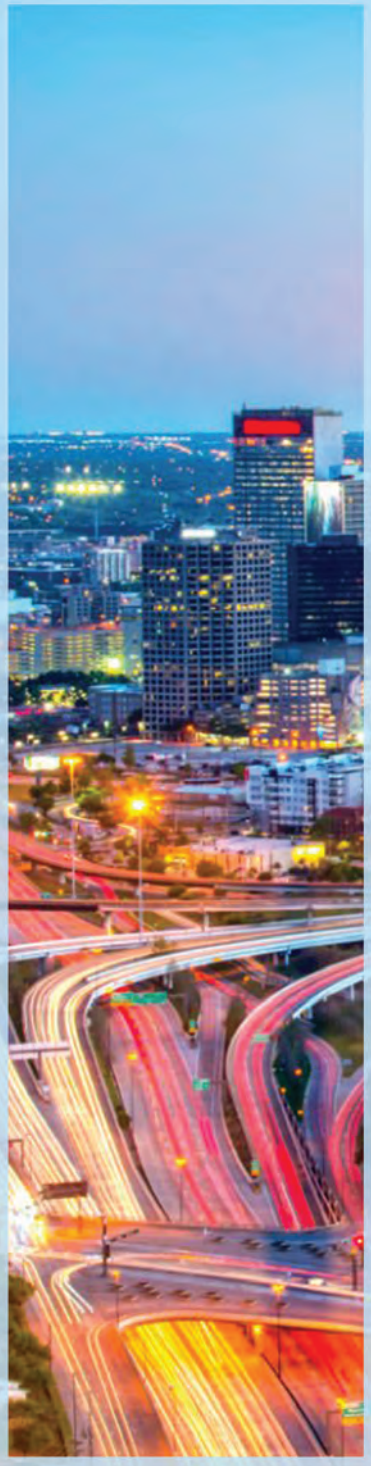

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EXECUTIVE SUMMARY

As enterprises accelerate digital transformation, the demand for secure, high-performance connectivity is driving increased interest in private networks. Unlike public 5G, private networks offer greater control, reliability, and customization — making them ideal for mission-critical operations in industries such as manufacturing, mining, and utilities.

Regulatory advancements, shared spectrum models like the Citizens Broadband Radio Service (CBRS), and standards set by the 3rd Generation Partnership Project (3GPP) are easing barriers to entry. Meanwhile, equipment providers and system integrators are simplifying network deployment. Mid-sized enterprises — often referred to as mid-market organizations — are becoming key drivers of growth, alongside emerging use cases in education, retail, and smart campuses. The rise of generative artificial intelligence (AI) and edge computing is further fueling demand for low-latency, high-capacity networks that private 5G can support.

Although adoption has been slower than initially predicted, momentum is building. Organizations are weighing the higher upfront infrastructure costs against long-term operational benefits such as enhanced cybersecurity, reduced downtime, and support for automation and internet of things (IoT) ecosystems. While challenges remain — including device costs, skill shortages, and regulatory complexity — solutions like 5G as

a service (5GaaS) and network outsourcing are improving accessibility.

With a projected compound annual growth rate (CAGR) of 42% over the next five years, private 5G is positioned to become a foundational enabler for enterprise innovation — especially in environments where reliability, performance, and network independence are critical.

THE RISE OF 5G

Each generation of mobile networks has advanced to meet growing demands for speed, reliability, and connectivity. However, 5G is more than just a speed upgrade over 4G — especially for enterprises, where it enables new ways of operating. While carriers initially focused on consumer mobile adoption for 5G, its enterprise potential became evident through IoT applications in manufacturing, education, autonomous vehicles, and remote healthcare. The rise of AI and generative AI has further underscored 5G's ability to support large data transfers with high speed and low latency, prompting both businesses and carriers to pursue enterprise-level deployments.

PRIVATE 5G VERSUS PUBLIC 5G

Public 5G offers key advantages — carriers manage the infrastructure, maintenance, and data security, while providing broad coverage and easy scalability. It enables enterprises to expand connectivity without major capital investment. In contrast, private 5G requires higher upfront costs, greater technical expertise, and ongoing operational oversight. This raises the question: Why choose a private network when public 5G is readily available?

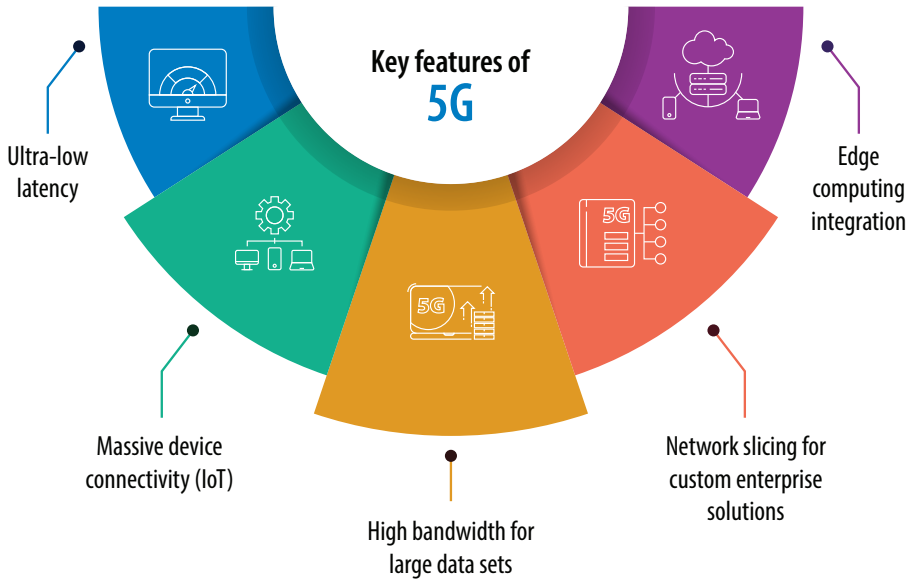
The answer is control, reliability, and customization.

Public networks are shared with millions of users, limiting visibility, increasing security risks, and reducing opportunities for customization. Service quality can also vary widely, especially in high-density or congested areas, making public 5G less reliable for mission-critical operations. In many cases, a private network's upfront cost is more economical than ongoing carrier fees, especially where carriers lack coverage and require enterprises to co-fund infrastructure. Key reasons organizations choose private 5G include:

- Unavailability of public 5G coverage
- Enhanced security requirements and more data control
- Low-latency requirements
- Minimized downtime for critical operations
- Cost efficiency in long-term network investments

Public and private 5G networks serve distinct roles in telecom. Public 5G, managed by mobile network operators, offers broad, high-speed connectivity as a public utility. In contrast, private 5G caters to enterprise-specific needs, like low latency and secure, localized data processing, using licensed or unlicensed spectrum. Vikram Meghal, senior vice president, global head of engineering for networks, media, and technology, says: "Private 5G is fast becoming a strategic asset for enterprises seeking greater control, reliability, and performance, especially in high-stakes environments like manufacturing, utilities, and mining. As both public and private 5G ecosystems evolve, we see them complementing each other to unlock new levels of automation, safety, and real-time intelligence."

Figure 1. 5G is more than a speed upgrade from previous generations



Source: Infosys Knowledge Institute

Private 5G is fast becoming a strategic asset for enterprises seeking greater control, reliability, and performance, especially in high-stakes environments like manufacturing, utilities, and mining.

Vikram Meghal

Senior vice president, global head of engineering for networks, media, and technology

FACTORS DRIVING PRIVATE 5G IN 2025

The AI-IoT-edge trio

The synergy between AI, IoT, and edge computing is driving the demand for private 5G by enabling real-time, high-performance data processing. IoT devices generate massive amounts of data that need to be analyzed quickly, which AI facilitates. Edge computing processes this data locally, reducing latency and improving efficiency. Private 5G here provides fast, secure, and reliable communication between devices and edge servers.

Industry standards

By providing a framework for interoperability and innovation, 3GPP, a global collaboration between telecoms that develops technical specifications for mobile networks — ensures that 5G deployments can scale, evolve, and integrate across sectors such as manufacturing, logistics, healthcare, and smart infrastructure. Nearly half of 5G operators have adopted 5G-Advanced, a new 3GPP standard that introduces machine learning (ML), edge computing, and industrial IoT. This shift enables intelligent network management, with AI-driven optimization reducing downtime.

Spectrum availability

Private 5G networks rely on dedicated spectrum to provide secure, high-performance communication tailored to enterprise needs. Regulatory bodies worldwide, such as the US Federal Communications Commission (FCC), have streamlined access to licensed spectrum,

facilitating the deployment of these networks. The FCC's tiered spectrum system includes both licensed and unlicensed portions, offering flexibility for enterprises based on their needs for control and interference protection.

A popular band for private 5G is the 3.5 GHz CBRS, balancing coverage and capacity. Globally, countries are also making strides in spectrum allocation. For example, the Netherlands and the UK offer portions of the 3.5 GHz band for private 5G, while Germany has allocated 100 MHz at 3.7 GHz. Other countries like Japan and Bahrain have similarly allocated specific frequency ranges. This global trend toward providing dedicated spectrum is helping enterprises adopt private 5G solutions more easily and efficiently.

Simplified deployment models

Equipment providers and service integrators are making it easier to deploy private 5G networks. A key solution is the network-in-a-box (NIAB) — a compact, mobile system that combines the 5G core, which manages data and network functions, and the radio access network (RAN), which connects user devices to the network, into a single plug-and-play unit. This approach eliminates the need to integrate multiple components from various carriers, hardware vendors, and security providers, making deployment faster and simpler.

Both established players, such as Verizon and HCL, and new entrants, like Celona and Ataya, provide NIAB solutions tailored for various industries, including manufacturing, defense, and disaster management.

5G as a service

5G as a service (5GaaS) removes the complexity of owning and managing network infrastructure by bundling essential components, including radio units, 5G core, edge computing, and built-in security, compliance, and data governance.

Enterprises manage and configure their private 5G networks via a centralized portal or application programming interface, typically offered by telecom providers or cloud hyperscalers. System integrators play a critical role in customizing deployments, integrating enterprise applications, and ensuring end-to-end service alignment with business needs. This approach enables dynamic scaling, remote updates, and seamless orchestration of services.

Enhanced security

Private 5G networks enhance security by providing isolated, enterprise-controlled environments that reduce exposure to threats from public networks. This isolation keeps sensitive data and critical operations within a secure perimeter, lowering the risk of unauthorized access. Additionally, encryption protects data in transit, making it harder for malicious actors to intercept information. Industries such as manufacturing, logistics, and energy, where operational integrity and confidentiality are crucial, are especially motivated to adopt private 5G for its robust security features.

CASE STUDIES

Manufacturing

In large manufacturing facilities with thousands of IoT devices and mission-critical applications, reliable, low-latency connectivity is crucial for maintaining operational efficiency. However, physical obstructions and interference within these environments can make robust communication a challenge. This is where private 5G networks come into play, providing connectivity that ensures smooth and efficient operations across manufacturing systems. Technologies like IoT, connected robotics, automation, and digital twins are key enablers of this transformation, helping reduce downtime and optimize performance across operations.

Benefits of private 5G networks for manufacturing:

- Dedicated bandwidth: Ensures no fluctuations in data transmission, providing stable and reliable connectivity.
- Reliable throughput: Enables seamless communication between millions of connected devices, such as sensors, robots, and automated guided vehicles (AGVs).
- Supports Industry 4.0: Enhances the capabilities of IoT devices and systems, particularly as AI and ML improve automation and system integration.

An example is the partnership between Betacom and Siemens, which combines

their strengths to support manufacturers. Betacom supplies the complete 5G stack, including all software components for private 5G networks. Siemens provides the user equipment that connects to the network, enabling manufacturers to use the solution effectively.

Mining

The mining industry faces specific challenges, including inefficiency, safety concerns, and limited connectivity in remote areas. Traditional methods, which rely heavily on manual labor, often expose workers to hazardous conditions.

To address these issues, the sector is adopting private 5G networks as part of its shift toward smart mining. With reliable, high-speed connectivity, the mining industry can use IoT, AI, robotics, and data analytics to remotely monitor equipment, track materials, and assess environmental conditions, reducing human exposure to dangerous environments. For example, private 5G provides ultrareliable low latency communications to enable millisecond response time and real-time control for critical mining machinery such as autonomous vehicles.

Given the remote locations of many mining sites, private 5G networks ensure uninterrupted communication across vast areas, with enhanced security and reliability, supporting real-time decision-making and automating critical operations. Deploying private 5G has enabled Chinese mining corporations to reduce worker accidents by 20%, cut caustic gas emissions by 30%, and reduce the number of people needed for underground operations by 50%.

Australian mining company Newmont has deployed a private 5G network at its Cadia Copper-Gold Mine in New South Wales to enhance the efficiency of its dozer fleet and improve worker safety. The new 5G solution, provided by Ericsson, overcomes the limitations of the existing Wi-Fi, which could only connect two machines within a 100-meter range, causing frequent downtime. The private 5G network enables connections across 2.5 kilometers, allowing up to 12 dozers to operate simultaneously with high-speed data transfer.

Utilities industry

Utilities companies in the US are increasingly using private networks for robust communication, which is essential for managing grids, especially during extreme weather or cyberattacks. Know how private 5G addresses key challenges in the utilities industry in the below Figure 2.

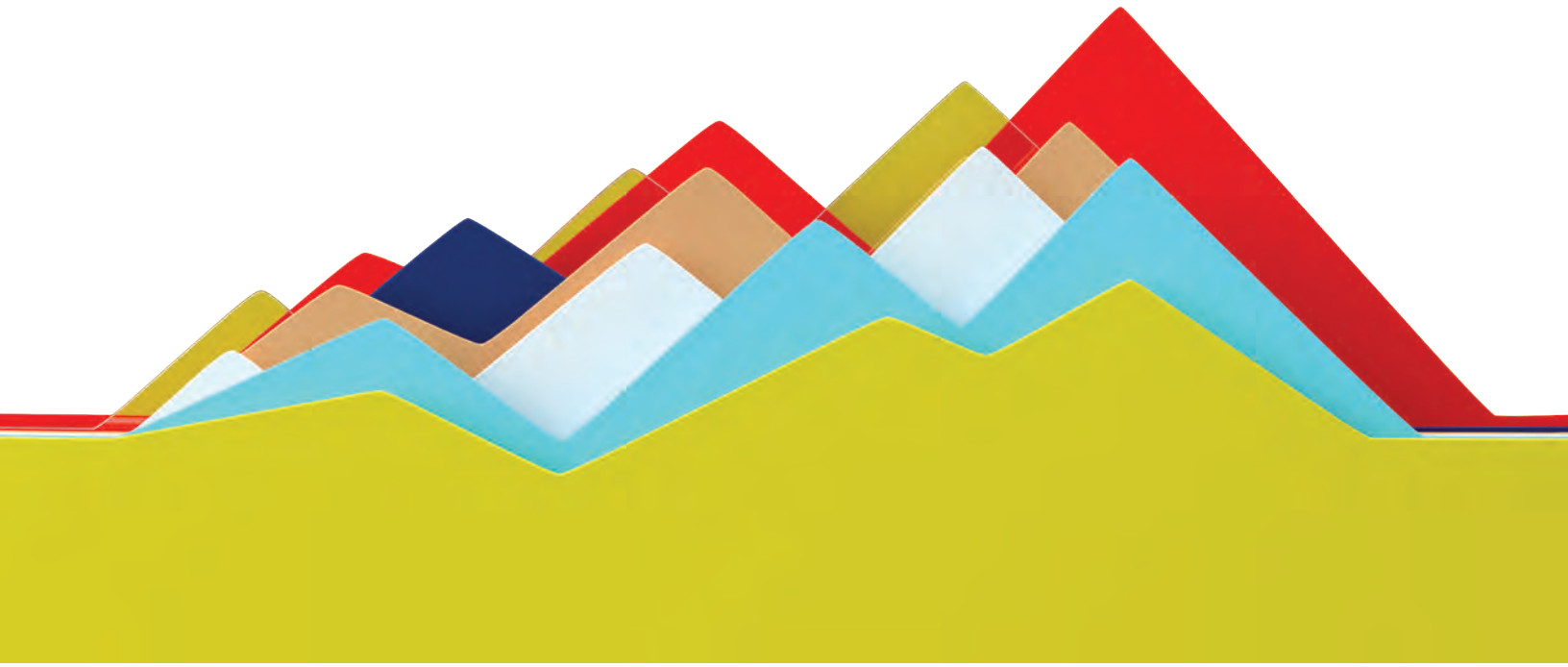
A recent example of a utility company adopting private 5G is Southern California Edison (SCE). In partnership with Nokia, SCE has deployed a private 5G network utilizing the Citizens Broadband Radio Service (CBRS) spectrum. This secure, high-performance network supports real-time grid monitoring, remote asset management, and automated control of distributed energy resources. It enables critical operations with enhanced reliability — making the deployment a major step in grid modernization.

Figure 2. Annual revenue 2024 and net profit margin for carmakers

Challenge	Solution offered by private 5G
Security (protection against cyberattacks)	Enhanced security features protect critical infrastructure and data from cyberattacks — including ransomware.
Resilience (managing power distribution during extreme weather)	Private 5G enables real-time monitoring and control to maintain grid stability during extreme weather events.
Real-time control (adjusting supply and demand)	Provides low-latency communication for real-time management of fluctuating electricity supply and demand.
Field communication (mission-critical push-to-talk)	Delivers reliable communication for field workers in remote areas lacking public network coverage, even during emergencies.
Asset monitoring and management	Enables efficient monitoring of assets like meters, transformers, and substations across large areas.
Grid modernization and automation	Supports high-speed, low-latency communication for automating grid operations and integrating renewable energy sources.
IoT and advanced metering infrastructure (AMI)	Facilitates the deployment and management of smart meters and IoT devices for real-time data processing and optimization.

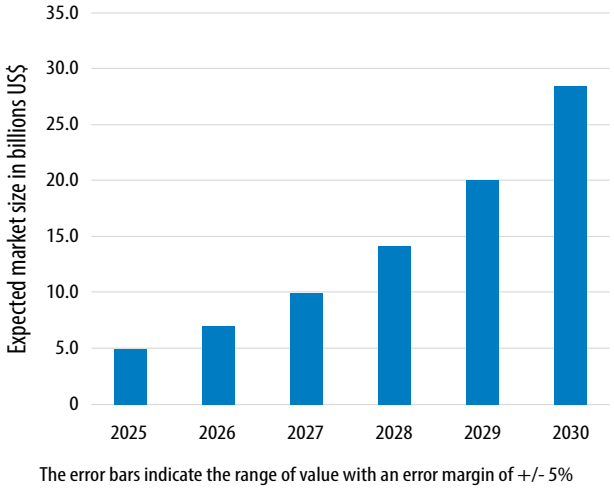
Source: Infosys Knowledge Institute

PRIVATE 5G OUTLOOK — 2025 AND BEYOND



Multiple sources (Figure 3) project the private 5G market to grow at a CAGR of 39.8% to 44%, averaging 41.9% over the next six years — reaching approximately $30 billion by 2030.

Figure 3. Expected market growth of private 5G over the next five years



The error bars indicate the range of value with an error margin of +/- 5%

Source: Customer Market Insights, Mordor intelligence, Grandview research, Research nester, Markets and Markets

This momentum is propelling more than 50 suppliers and system integrators to invest in private 5G solutions, anticipating long-term returns. Leading players such as Huawei, Nokia, and Ericsson are actively expanding their private network portfolios, with Ericsson driving significant growth in this space.

The growth stems from:

1. **Rising demand from mid-market enterprises:** Mid-market enterprises, including regional retail chains, mid-sized logistics companies, or local healthcare networks which are increasingly seeking solutions to challenges like network coverage, reliability, and isolation.

2. **Expansion into nontraditional sectors:** Beyond traditional sectors like mining, warehouses, and logistics hubs, new industries such as golf courses, retailers, universities, and even retirement communities are beginning to explore the advantages private 5G can offer to their operations.

3. **Growing needs driven by generative AI applications:** Industrial sectors are rapidly adopting traditional AI in tandem with generative AI for tasks like predictive maintenance, quality inspection, and design simulation, all of which require ultra-low latency and reliable connectivity. Private 5G enables real-time AI inference at the edge, avoiding cloud delays. This has driven over 2,700 private 5G deployments globally, as of 2024 end.

Though 2025 looks promising for private 5G, several significant hurdles still hinder its widespread adoption:

1. **Cost of 5G devices:** 5G-enabled devices like AGVs, drones, and surveillance systems are expensive, making it harder for small and mid-sized enterprises to justify the upfront investment in private 5G.

2. **High deployment and operational costs:** Deploying private cellular networks is costly due to the need for dedicated on-premises infrastructure, which involves both capital expenditures (CapEx) and operational expenditures (OpEx). Emerging OpEx-only or network-as-a-service pricing models are attracting small and medium-sized enterprises, as they allow businesses to pay only for network operations while vendors absorb the upfront costs of infrastructure, deployment, and ongoing maintenance. But most enterprises feel they are not as cost-effective as existing Wi-Fi solutions.

3. **Regulatory challenges:** Despite governments easing spectrum allocation for private networks, the process of obtaining and managing spectrum access, including navigating regulatory approvals, licensing conditions, and coordination with national authorities, remains time-consuming and can slow or prevent private 5G deployments. Telecom operators also face growing demands around data protection and governance, such as compliance with the EU's General Data Protection Regulation (GDPR), which require significant investment to ensure secure and responsible data handling. Additionally, AI regulations, such as the proposed EU AI Act, aim to balance innovation with consumer protection by emphasizing privacy, transparency, and ethical use. However, navigating these complex regulations, while essential, can lead to time-to-market delays and increase the cost of deploying private 5G networks.

4. **Skill shortage:** Building and maintaining 5G networks is more complex than previous generations, requiring specialized skills in network construction and cybersecurity. The telecom industry faces a significant skills gap — but many organizations opting to outsource network setup and management to external experts is helping to ease the skill shortage.

KEY CONSIDERATIONS FOR ADOPTING PRIVATE 5G

1. **Evaluate your network's spread and coverage:** If you need a network that covers a large area, such as a campus or industrial site, private 5G can offer better coverage than Wi-Fi, especially in areas where Wi-Fi's range is limited. However, for smaller or more localized coverage, Wi-Fi 6 or public 5G might be sufficient.

2. **Consider privacy and security needs:** If your enterprise handles sensitive communications, private 5G could provide better security and privacy than public networks. However, if you don't have stringent privacy requirements, encrypted communication over Wi-Fi or public 5G might be adequate.

3. **Determine your mission and future needs:** Private 5G can support more advanced use cases — like automation, IoT, and large-scale data processing — but if your current network is already meeting your needs, ensure you have a clear reason for switching to private 5G and consider the long-term benefits.

4. **Analyze the total cost of ownership:** If the cost of maintaining public carrier services (such as data fees) exceeds the cost of building and maintaining a private 5G network, investing in a private network might be more cost-effective in the long run. Evaluate both CapEx and OpEx before deciding.

5. **Plan ahead and use simulation:** To ensure private 5G provides the robust and reliable connectivity it's designed for, thorough network planning and coverage simulations are essential. Advanced design tools allow engineers to model and precisely simulate how wireless signals behave in different environments.

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